



**Environmental Audit Report and Statement
of Environmental Audit
140 to 204 Western Avenue, Westmeadows, Vic
(CARMS 71120-1)**

Report reference: 212173

Prepared for Transpacific Cleanaway Pty Ltd

February 2014

DOCUMENT CONTROL

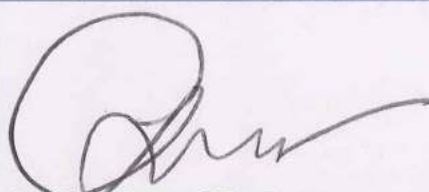
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ENVIRONMENTAL AUDIT REPORT AND STATEMENT OF ENVIRONMENTAL AUDIT

140 to 204 Western Avenue, Westmeadows, Vic (CARMS 71120-1)

EXECUTIVE SUMMARY

This report is in response to a request for a Certificate of Environmental Audit (CoEA) in accordance with Part IXD of the *Environment Protection Act (1970)*. The summary information on this audit is presented in the following table, in accordance with EPA Pub 1147.1:

Table 1: Summary of Audit Information

EPA File Reference No.	71120-1
Auditor	Anthony Lane
Auditor Term of appointment	29 July 2009 to 30 May 2014
Name of Person Requesting Audit	Mr Kieren McDermott
Relationship to Premises/Location	Environmental Specialist – Operations, Transpacific Cleanaway Pty Ltd
Date of Request	9 July 2012
Date EPA Notified of Audit	16 July 2012
Completion Date of Audit	17 February 2014
Reason for Audit	Voluntary for commercial due diligence purposes
Current Land Use Zoning	Farming Zone – Schedule 3 (FZ3) Public Use – Service and Utility (PUZ1)
EPA Region	Metropolitan
Municipality	Hume City Council
Dominant - Lot on title plan	Lot 1 of Title Plan TP512682C (Volume 09667 Folio 677)
Additional - Lot on plan(s)	Lot 2 of Title Plan TP512682C (Volume 09667 Folio 677)
Site / Premises name	
Street / Lot - Lower No.	140
Street / Lot - Upper No.	204
Street Name	Western
Street Type (Road, Court, etc.)	Avenue
Suburb	Westmeadows
Postcode	3049
GIS Coordinate of Site Centroid	
Longitude	144.869714
Latitude	-37.675036

Site Area (hectares)	29 ha
Members and Categories of Support Team Utilised	<ul style="list-style-type: none"> • Jon Bartley – Hydrogeology • Peter Gringinger – Remedial technologies and geotechnology, Hydrogeology, Contamination transport and assessment of exposure pathways and risk. • Brian Eva – Environmental Chemistry and Asbestos • Giorgio De Nola – Environmental Risk Assessment
Outcome of the Audit	Statement of Environmental Audit
Further Work or Requirements	<p>SoEA issued with conditions, including:</p> <ul style="list-style-type: none"> • Groundwater not to be used for Potable Mineral Water, Agricultural, Parks and Gardens (Irrigation), Stock Watering, Industrial and Primary Contact Recreation. • Monitoring bores need to be kept accessible for monitoring by party responsible for the ongoing management of the Closed Tullamarine Landfill.
Nature and Extent of Continuing Risk	<p>Groundwater is locally contaminated with a range of inorganic and organic chemical species including with chlorinated hydrocarbons, originating from the adjacent Closed Tullamarine Landfill. Whilst many of the beneficial uses are unlikely to be realised, the Audit has found that all applicable extractive beneficial uses of groundwater are precluded at the site. A condition is provided in the Statement of Environmental Audit (SoEA) to manage these risks.</p>

Table 2: Physical Site Information

Site Aquifer Information	<p>Older Volcanics Aquifer Werribee Formation Aquifer Silurian Bedrock Aquifer</p>
Average Depth to Groundwater	>25 m
Groundwater Segment	B
Groundwater Flow Direction	East south-east
Past Use / Site History	Open pasture and grazing
Surrounding Land Use	<p>North: Moonee Ponds Creek, semi-rural undeveloped farmland. South: Tullamarine Freeway. Airport parking and undeveloped airport land. East: Low-density residential on the east side of Wright St and farm land on the west side of Wright Street. West: Victoria Street Road reserve. Transpacific Cleanaway Depot and Closed Tullamarine Landfill, Tullamarine International Airport.</p>
Proposed Future Use	Commercial/Industrial - rezone to Commercial Zone 2 (CZ2)

Site Definition and History

The Audit Site comprises Lots 1 and 2 at 140 to 204 Western Avenue, West Meadows, Vic (hereafter referred to as “the site”). It is bisected by Western Avenue in the south which runs through the site from the south-east corner to the western boundary. For the purposes of auditing and preparation of a Certificate or Statement of Environmental Audit, Lots 1 and 2 can be treated as a single site as shown in Figure 1, Appendix A.

The site is 17 km north-west of the Melbourne Central Business District (CBD) and located within the fringes of the Melbourne (Tullamarine) International Airport precinct (airport terminal buildings commence approximately 1,200 m to the west). Abutting the site to the west is the Victoria Street road reserve followed by the Transpacific Cleanaway Depot and then further west is the Closed Tullamarine Landfill (CTL). The edge of the nearest landfill cell is about 120 m from the audit site. Wright Street and two vacant land plots define the site to the east which is followed by contiguous low-density residential properties that form the suburb of Westmeadows. The Moonee Ponds Creek (Melbourne Water land) defines the irregular northern site boundary and the Tullamarine Freeway and areas of airport parking form the southern boundary.

The Tullamarine Landfill was operated as an industrial waste landfill between 1973 and 2008. It occupies a former basalt quarry and it is reported (Kleinfelder 2013b) that the total mass of waste disposed of at the site during operation was 3,710,000 tonnes. The landfill was partially lined with a curtain wall of clay against the Brighton Group formation (founded on the Older Volcanics) since 1976.

The landfill initially operated as a solid and liquid industrial waste co-disposal site. Liquid was disposed of into pits prepared in the solid wastes, and leachate was collected and partially evaporated on site (Shugg, 1999) in historical leachate ponds. Kleinfelder (2013b) report that the majority of waste (80%) accepted in the 1970s was solid inert and the remaining 20% was industrial.

Proposed Future Use

Golder Associates (2012b) reported that Transpacific have applied to Hume City Council (HCC) for a planning scheme amendment to rezone the land for a proposed future commercial and industrial use. The current application with Hume Council is for a proposed amendment to the planning scheme from Farming Zone – Schedule 3 (FZ3) to Commercial Zone 2 (CZ2). The majority of the site is zoned FZ3, with a portion of the site that is adjacent to Moonee Ponds Creek zoned as Public Use Zone – Service and Utility (PUZ1).

Site Assessments

Investigation of the site was commenced in 2012 by Golder Associates, and included a quantitative human health risk assessment, and preliminary contamination risk and geotechnical assessment.

Kleinfelder commenced as assessor for the site in 2012 and have completed a number of Environmental Site Assessments (ESAs) including investigation of groundwater (multiple events), soil vapour, landfill gas (multiple events) and soil. The minor remedial work undertaken includes the removal of oversize rubble as well as asbestos containing material (ACM) and lead impacted soils localised around the farmhouse ruins.

Land Contamination and Risks

Following a review of the data provided and having regard to the *SEPP Prevention and Management of Contaminated Land*, the Auditor is of the opinion that none of the protected beneficial uses of the land are precluded by contamination assuming the future land use was commercial / industrial, public open space or residential.

Groundwater Contamination and Risks

Groundwater quality was reviewed with respect to all beneficial uses protected in Segment B, in accordance with *SEPP Groundwaters of Victoria*. Groundwater is contaminated by metals, inorganic and organic compounds derived from the CTL.

The following beneficial uses of groundwater at the site are precluded by this contamination:

- Agriculture, parks and gardens
- Stock watering
- Industrial water use
- Primary contact recreation

These uses of groundwater are not currently occurring and are considered very unlikely to occur at the site in the future.

It is understood, following consultation with EPA, that upon receiving this information relating to presumed groundwater pollution at the site, EPA may identify a Groundwater Quality Restricted Use Zone (GQRUZ) in accordance with Clause 19 of the SEPP (GoV).

Audit Outcome

The audit site located at 140 to 204 Western Avenue, Westmeadows, Vic (CARMS 71120-1) qualifies for a Statement of Environmental Audit (SoEA) to be issued as part of this report. The statement is attached to the Executive Summary. A SoEA implies that the site is suitable for a restricted range of uses subject to the implementation of one or more conditions set out in the Statement. In this case, the site is suitable for the following land uses (subject to conditions discussed in Section 11.2.2):

- Agricultural
- Sensitive Use (High Density and "Other", including low density)
- Recreation/Open Space
- Commercial
- Industrial

The conditions to be included in the SoEA for these uses are developed in Section 11.2.2.

Conditions of the Statement of Environmental Audit

Given the risks identified, the conditions considered relevant to the protection of the beneficial uses at the site are outlined below:

Condition 1 *The groundwater is contaminated and unsuitable for the extractive beneficial uses: Potable Mineral Water Supply, Agricultural, Parks and Gardens, Stock Watering, Industrial and Primary Contact Recreation. Consequently, no groundwater shall be extracted at this site for such uses.*

Condition 2 *Groundwater Monitoring Wells (MB13, MB14, MB15, MB16, MB1, MB55U/L, MB56, MB57, MB57A, MB61, MB61L, MB69, MB72, MB73, MB74, MB75, MB76, MB80, MB83, MB85, MB86U/L, BH 1, BH2, BH3) must be maintained and remain accessible for the purpose of ongoing monitoring by the party responsible for the aftercare of the Closed Tullamarine Landfill.*

Conditions for Issue of a Certificate of Environmental Audit

Section 53Z Part 2(c) of the Environment Protection Act 1970 requires an audit report to specify the “terms and conditions” that need to be complied with before a Certificate of Environmental Audit (CoEA) may be issued. It should be noted that the site is currently suitable for the beneficial uses listed in the Statement of Environmental Audit (SoEA) (subject to the conditions of the statement), and the specification of requirements for issue of a CoEA are for information purposes only, given existence of the SoEA.

If a CoEA were requested, the terms and conditions that need to be complied with before a CoEA could be issued include:

- *Groundwater would need to be cleaned up such that all protected beneficial uses are restored.*

Other Related Information

Other related information on the SoEA for the site includes:

- *A Certificate of Environmental Audit was not issued due to the presence of polluted groundwater derived from sources off-site, which precludes the extractive beneficial uses of Potable Mineral Water Supply, Agricultural, Parks and Gardens, Stock Watering, Industrial and Primary Contact Recreation.*
- *In accordance with section 13.7 of EPA Publication 759.2, the Auditor has concluded that polluted groundwater has been cleaned up to the extent practicable due to it being from an off-site source, the precluded beneficial uses are not relevant and it does not present an unacceptable risk to the use of the land.*
- *Upon receiving this information relating to presumed groundwater pollution at the site, EPA may identify a Groundwater Quality Restricted Use Zone (GQRUZ) in accordance with Clause 19 of the SEPP (GoV).*
- *The party responsible for the aftercare of the Closed Tullamarine Landfill will require access to the site in order to carry out the ongoing monitoring of groundwater monitoring bores (listed in Condition 2 of this statement).*

Read in Conjunction with Audit Report

While this Executive Summary has endeavoured to accurately summarise the key points of the Audit Report, the latter shall take precedence and the Executive Summary must be read in conjunction with the full report of the Auditor (Cardno Lane Piper document ref. 212173Report01.3), and the Statement of Environmental Audit, attached to this Executive Summary.

The full Audit Report and appendices are presented in electronic format on CD-ROM. Summary Information comprising a copy of the SoEA, a plan of the site and the Executive Summary of the Report are provided separately in paper copies.

About this Environmental Audit Report

While this Environmental Audit has been undertaken in accordance with the EPA Auditor Guidelines and current industry practice, there may be some limitations on the meaning and use of this report. The reader is advised to read this report in conjunction with the attached document *About Site Contamination / Environmental Audits and Reports* (Appendix K).

In December 2012 EPA issued updated guidance to Auditors (Publication 1147.1) which included the need to insert an information document in all audit reports. This document is titled *Information Regarding Environmental Audit Reports* and is included as Appendix J of this report.

Anthony P. Lane

Environmental Auditor

(appointed pursuant to the Environment Protection Act 1970)

Cardno Lane Piper

February 2014

ENVIRONMENT PROTECTION ACT 1970

STATEMENT OF ENVIRONMENTAL AUDIT

I, *Anthony P. Lane of Cardno Lane Piper Pty Ltd, Building 2, 154 Highbury Rd, Burwood, Victoria*, 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 *Mr Kieren McDermott of Transpacific Cleanaway Pty Ltd* to issue a Certificate of Environmental Audit in relation to the site located at *140 to 204 Western Avenue, Tullamarine, comprising Lots 1 and 2 on Title Plan TP512682C, located in the City of Hume* ("the site") owned/occupied by *Transpacific Cleanaway Pty Ltd* (see attached audit site plan).
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:
 - *SEPP Groundwaters of Victoria*
 - *SEPP Waters of Victoria*
 - *SEPP Prevention and Management of Contamination of Land*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 the following land uses:

- Agricultural
- Sensitive Use (High Density and Other)
- Recreation/Open Space
- Commercial
- Industrial

subject to the following conditions attached thereto:

Condition 1 The groundwater is contaminated and unsuitable for the extractive beneficial uses: Potable Mineral Water Supply, Agricultural, Parks and Gardens, Stock Watering, Industrial and Primary Contact Recreation. Consequently, no groundwater shall be extracted at this site for such uses.

Condition 2 Groundwater Monitoring Wells (MB13, MB14, MB15, MB16, MB1, MB55U/L, MB56, MB57, MB57A, MB61, MB61L, MB69, MB72, MB73, MB74, MB75, MB76, MB80, MB83, MB85, MB86U/L, BH 1, BH2, BH3) must be maintained and remain accessible for the purpose of ongoing monitoring by the party responsible for the aftercare of the Closed Tullamarine Landfill.

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:

- *Groundwater would need to be cleaned up such that all protected beneficial uses are restored.*

Other related information:

- *A Certificate of Environmental Audit was not issued due to the presence of polluted groundwater derived from sources off-site, which precludes the extractive beneficial uses of Potable Mineral Water Supply, Agricultural, Parks and Gardens, Stock Watering, Industrial and Primary Contact Recreation.*
- *In accordance with section 13.7 of EPA Publication 759.2, the Auditor has concluded that polluted groundwater has been cleaned up to the extent practicable due to it being from an off-site source, the precluded beneficial uses are not relevant and it does not present an unacceptable risk to the use of the land.*
- *Upon receiving this information relating to presumed groundwater pollution at the site, EPA may identify a Groundwater Quality Restricted Use Zone (GQRUZ) in accordance with Clause 19 of the SEPP (GoV).*
- *The party responsible for the aftercare of the Closed Tullamarine Landfill will require access to the site in order to carry out the ongoing monitoring of groundwater monitoring bores (listed in Condition 2 of this statement).*

This statement forms part of the environmental audit report (Environmental Audit Report and Statement of Environmental Audit, 140 to 204 Western Avenue, Westmeadows, Vic (CARMS 71120-1), February 2014 - Cardno Lane Piper, Doc. Ref.212173Report01.3). Further details regarding the conditions of the site may be found in the Environmental Audit Report.

DATED: 17 February 2014

Signed:



Anthony P. Lane
Environmental Auditor

Figure A: Audit Site Plan



ENVIRONMENTAL AUDIT REPORT AND STATEMENT OF ENVIRONMENTAL AUDIT)

140 to 204 Western Avenue, Westmeadows, Vic (CARMS 71120-1)

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LIST OF ABBREVIATIONS AND UNITS

Chemical Names

BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
DCE	Dichloroethene
LNAPL	Light Non-Aqueous Phase Liquid
NAPL	Non-Aqueous Phase Liquid
OCP	OrganoChlorine Pesticides
OPP	OrganoPhosphate Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PCB	PolyChlorinated Biphenyls
TCE	Trichloroethene
TDS	Total Dissolved Solids (salinity of water)
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons (= TPH)
VOC	Volatile Organic Compounds

Technical Terms

ACM	Asbestos Containing Material
AF	Attenuation Factor
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
BOM	Bureau of Meteorology
BPEM	Best Practice Environmental Management
CBD	Central Business District
CHM	Conceptual Hydrogeological Model
CoEA	Certificate of Environmental Audit
CoPC	Chemicals of Potential Concern
CSM	Conceptual Site Model
EIL	Environmental Investigation Level
EPA	Environment Protection Authority (Victoria)
ESA	Environmental Site Assessment
ESF	Exposure Scaling Factor
FID	Flame Ionisation Detector (measures in ppm)
GME	Groundwater Monitoring Event
GQMP	Groundwater Quality Management Plan
GQRUZ	Groundwater Quality Restricted Use Zone

GSV	Gas Screening Value
GW	Groundwater
HHRA	Human Health Risk Assessment
HIL	Health Investigation Level
IUR	Inhalation Unit Risk
LOR	Limit of Reporting
LWMP	Liquid Waste Management Plan
N/A	Not Applicable
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Measure – Assessment of Contamination
NEPM	National Environmental Protection Measure
NHMRC	National Health and Medical Research Council
PCPAN	Post-Closure Pollution Abatement Notice
PCR	Primary Contact Recreation
PID	Photo-ionisation detector (measures in ppm)
PSR	Priority Sites Register
QA	Quality Assurance
QC	Quality Control
RBC	Risk Based Criteria
RPD	Relative Percentage Difference
RSC	Risk Screening Level
SEPP	State Environment Protection Policy
SEPP GoV	State Environment Protection Policy - Groundwaters of Victoria
SEPP PMCL	State Environment Protection Policy - Prevention and Management of Contaminated Land
SoEA	Statement of Environmental Audit
TEF	Toxic Equivalency Factor
TEQ	Toxicity Equivalent
USEPA	United States Environment Protection Agency
VIM	Vapour Intrusion Model
WHO	World Health Authority
WQC	Water Quality Criteria

Units

% v/v	Percent volume per volume
ha	Hectares
m AHD	Meters above Australia Height Datum
M bgl	Metres Below Ground Level
mBTOC	Meters Below Top of Casing

mg/kg	Milligram per Kilogram (approximately equivalent to ppm)
mg/L	Milligram per Litre
mg/m ³	Milligram per Metre Cubed
m/s	Metres per Second
ppm	Parts per Million
µg/L	Microgram per Litre
µg/m ³	Microgram per Metre Cubed

Site Specific

BGA	Brighton Group Aquifer
CTL	Closed Tullamarine Landfill
LFG	Landfill Gas
OEB	Outer Eastern Bores
HCC	Hume City Council
HHRA	Human Health Risk Assessment
NVA	Newer Volcanics Aquifer
OVA	Older Volcanics Aquifer
PIW	Prescribed Industrial Waste
SBA	Silurian Bedrock Aquifer
SIW	Solid Inert Waste
WFA	Werribee Formation Aquifer

ENVIRONMENTAL AUDIT REPORT AND STATEMENT OF ENVIRONMENTAL AUDIT)

140 to 204 Western Avenue, Westmeadows, Vic (CARMS 71120-1)

1 INTRODUCTION

1.1 Summary Information

This audit report has been prepared in response to a request by Transpacific Cleanaway Pty Ltd (“Transpacific” or “the client”) for a Certificate of Environmental Audit (CoEA) in accordance with Part IXD of the *Environment Protection Act 1970* (“the Act”). The Audit was conducted in accordance with the scope of work set out in our letter of 25 June 2012 (document ref: 212173Proposal01.1).

Transpacific has engaged Golder Associates and more recently Kleinfelder Australia Pty Ltd (“the Assessor”) as their environmental consultants for the purpose of investigating the site and its environs and for the purpose of providing sufficient information to enable this audit to be completed.

The site is located at 140 to 204 Western Avenue, Tullamarine, Vic and is divided by the road reserve of Western Avenue. The location of the site and Audit Areas is shown in Figure 1 and 2 (Appendix A) and the summary information on this Audit is presented in Table 1-1 below.

Table 1-1: Summary of Audit and Site Information

EPA File Reference Number	71120-1 (CARMS)
Auditor	Anthony Lane
Audit Site Name	Vacant Land
Audit Site Address	140 to 204 Western Avenue, Westmeadows, Vic
Lot and Plan Number	Volume 09667 Folio 677 Lots 1 and 2 on Title Plan 512682C.
Audit Area (hectares)	Approximately 29 ha
Municipality	Hume City Council

1.2 Reason for the Audit

The s.53X environmental audit of the site was initiated voluntarily by Transpacific on 9 July 2012¹ for the purpose of commercial due diligence. Prior to the audit being commissioned the Assessor (Golder Associates) had completed a *Preliminary Contamination Risk and Geotechnical Assessment* (Golder 2012b) and a *Quantitative Human Health Risk Assessment (HHRA) Report* (Golder 2012a).

1.3 Site Definition

The audit site comprises Lots 1 and 2 at 140 to 204 Western Avenue, West Meadows, Vic (hereafter referred to as “the site”). It is bisected by Western Avenue in the south which runs through the site from the south-east corner to the western boundary. For the purposes of auditing and preparation of a Certificate or Statement of Environmental Audit, Lots 1 and 2 can be treated as a single site identified as shown in Figure 1, Appendix A.

The site is 17 km north-west of the Melbourne Central Business District (CBD) and located within the fringes of the Melbourne (Tullamarine) International Airport precinct (airport terminal buildings commence approximately 1,200 m to the west). Abutting the site to the west is the Victoria Street road reserve followed by the Transpacific Cleanaway Depot and then the Closed Tullamarine Landfill (CTL). The edge of the nearest landfill cell is about 120 m from the audit site. Wright Street and two vacant land plots define the site to the east which is followed by contiguous low-density residential properties that form the suburb of Westmeadows. The Moonee Ponds Creek (Melbourne Water land) defines the irregular northern site boundary and the Tullamarine Freeway and areas of airport parking form the southern boundary.

The Victoria Street Road reserve that runs along the western boundary of the site between the site and the Transpacific Cleanaway Depot is not owned by Transpacific and not part of the land audited. The two parcels of undeveloped land known as 47 to 67 Wright Street and 69 to 99 Wright Street that abut the site to the east as can be seen in Figure 1-1 below and Figure 2 (Appendix A) are also not owned by Transpacific and not part of the land audited.

¹ The client provided written instruction to commence the audit through their acceptance of our proposal by providing a letter of engagement on this date (9 July 2012).



Figure 1-1: Aerial Photo of the site – July 2013 (Near Map, 2013)

Surrounding land uses, nearby potential sources of contamination and sensitive receptors in proximity to the site are outlined in Table 1-2. Figure 2 (Appendix A) also shows the site and its surroundings.

Table 1-2: Surrounding Land Uses

Direction	Land Use or Activity
North	<ul style="list-style-type: none"> Moonee Ponds Creek defines the sites northern boundary. Semi-rural undeveloped farm land.
West	<ul style="list-style-type: none"> Victoria Street road reserve is immediately to the west. CTL (approximately 120 m to the nearest landfill cell) Melbourne (Tullamarine) Airport terminal buildings are approximately 1,200 m from the site at the closest point.
East	<ul style="list-style-type: none"> Semi-rural undeveloped farm land including 47 to 67 Wright Street and 69 to 99 Wright Street. Wright Street forms part of the eastern boundary of the site. Low-density residential properties (suburb of Westmeadows) on the east side of Wright St.
South	<ul style="list-style-type: none"> Tullamarine Freeway. Airport parking and undeveloped airport land.

1.4 Proposed Development

Transpacific have applied to Hume City Council (HCC) for a planning scheme amendment to rezone the land for a proposed future commercial and industrial use (Commercial Zone 2). Under the current HCC Planning Scheme, the site is predominantly located within a Farming Zone – Schedule 3 (FZ3) with a portion of the site that is adjacent to Moonee Ponds Creek zoned as Public Use Zone – Service and Utility (PUZ1).

The Auditor has no knowledge of any specific proposed development as none is currently planned. If the site is rezoned, the Auditor understands that it would be likely to have the characteristics of a commercial or industrial development potentially including warehouses, offices and associated infrastructure.

1.5 Audit Activities

Table 1-3 summarises the activities and sequence of events to arrive at an assessment and audit of this site.

Table 1-3: Audit Activities

Date	Activity
May 2012	Quantitative HHRA Report completed by Golder Associates.
June 2012	Preliminary Contamination Risk and Geotechnical Assessment (Phase 1 ESA) completed by Golder Associates.
9 July 2012	Auditor engaged by Transpacific Cleanaway Pty Ltd.
17 July 2012	Notification of environmental audit received by EPA Victoria.
October 2012	Kleinfelder Australia Pty Ltd ¹ engaged by Transpacific as Assessor
17 October 2012	Site inspection by Auditor's assistant. Observation of Assessor soil sampling and collection of Auditor verification soil samples.
18 October 2012	Site inspection by Auditor's assistant. Observation of Kingtech ² groundwater sampling.
13 June 2013	Soil Contamination Assessment completed by the Assessor.
30 July 2013	Site inspection by the Auditor's assistant. Observation of soil vapour monitoring and collection of a verification sample.
28 August 2013	Auditor inspects the site during the asbestos clearance works (the Auditor did not enter the asbestos work zone).
4 September 2013	Auditor's assistant inspects the site and collects verification near-surface soil samples.
21 November 2013	Vehicle Rollover Validation and Waste Removal Report issued by the Assessor.
22 November 2013	Landfill Gas Assessment Report (Outer Eastern Bores) Tullamarine Landfill completed by the Assessor.
22 November 2013	Soil Vapour Report completed by the Assessor.
29 November 2013	Lead and Asbestos Abatement Report completed by the Assessor.
21 December 2013	Draft Audit Report issued to Transpacific.
20 January 2014	Groundwater Condition Report completed by the Assessor.

Date	Activity
31 January 2014	Draft Audit Report issued
17 February 2014	Final Audit Report issued
Notes: 1. Kleinfelder Australia Pty Ltd was previously known as "Kleinfelder Alliance Pty Ltd". 2. Kingtech Pty Ltd was engaged by Transpacific for the purpose of conducting groundwater and LFG monitoring.	

1.6 Auditor and Assessment Team

The Auditor, Anthony Lane has conducted the audit and prepared this report with the assistance of a team of environmental specialists. Table 1-4 identifies the persons assisting in this audit.

Table 1-4: Audit Expert Support Team

Person	Role	Company
Peter Gringinger*	Contaminant transport and assessment of exposure pathways and risk.	Cardno Lane Piper
Jon Bartley*	Hydrogeology	Cardno Lane Piper
Brian Eva*	Environmental Chemistry	Eva and Associates Pty Ltd.
Giorgio De Nola*	Senior Risk Assessor	Cardno Lane Piper
Kris Inkster	Environmental Geoscientist	Cardno Lane Piper
Jonathan Thom	Environmental Geoscientist	Cardno Lane Piper
Colin Stapleton	Environmental Scientist (Project Manager)	Cardno Lane Piper
David Louwrens	Hydrogeology	Cardno Lane Piper
Note: *Indicates a member of the Auditor's expert support team.		

The consultants engaged to undertake the environmental site assessments, remediation and/or other inspection and testing roles are summarised in Table 1-5.

Table 1-5: Assessment Team

Company	Role	Comments
Kleinfelder Australia Pty Ltd ("Kleinfelder") ¹	Environmental Assessor	Engaged by Transpacific to conduct environmental investigations (including soil and asbestos sampling and assessment, soil vapour sampling, landfill gas assessment and groundwater condition assessment).
Golder Associates Pty Ltd ("Golder Associates")	Environmental Assessor	Engaged by Transpacific to conduct preliminary environmental investigations (including soil sampling and risk assessment).
EnviroProtect Services Pty Ltd.	Asbestos Clearance Contractor	Engaged by Kleinfelder
Kingtech Services Pty Ltd	Groundwater Monitoring Contractor Landfill Gas Monitoring	Engaged by Transpacific.

Company	Role	Comments
	Contractor (CTL)	
SGS Leeder Consulting	Primary Laboratory for groundwater analysis.	Engaged by Transpacific.
ALS Laboratory Group	Primary Laboratory for: <ul style="list-style-type: none"> ● Soil analysis (Kleinfelder). Secondary Laboratory for: <ul style="list-style-type: none"> ● Soil analysis (Golder Associates). ● Groundwater (Transpacific). 	Engaged by: <ul style="list-style-type: none"> ● Golder Associates. ● Transpacific. ● Kleinfelder.
Eurofins Air Toxics	Primary laboratory for soil vapour analysis	Engaged by Kleinfelder.
Envirolab Services	Secondary laboratory for soil vapour analysis.	Engaged by Kleinfelder.
Eurofins MGT Laboratory ²	Primary laboratory for: <ul style="list-style-type: none"> ● Soil analysis (Golder Associates). Secondary Laboratory for: <ul style="list-style-type: none"> ● Soil Analysis (Kleinfelder). 	Engaged by: <ul style="list-style-type: none"> ● Golder Associates. ● Kleinfelder.
Notes:		
1. Kleinfelder Australia Pty Ltd was previously known as "Kleinfelder Alliance Pty Ltd".		
2. Eurofins MGT Pty Ltd were previously known as "MGT-LabMark Consulting"		

1.7 The Audit Process and "Standards of Certification"

Environmental Audits of contaminated land provide certification that a site is suitable for one or more uses. This certification is in the form of either a *Certificate of Environmental Audit* (CoEA) or a *Statement of Environmental Audit* (SoEA).

The Environmental Audit has been performed in accordance with the *Environmental Auditor (Contaminated Land) Guidelines for Issue of Certificates and Statements of Environmental Audit*, EPA Publication 759.1, September 2007.

A CoEA is issued if the contamination status of the site is not detrimental to any beneficial use of the site. A SoEA is issued where the contamination makes the site suitable for a restricted range of uses. In cases where SoEA are issued, they are generally conditional upon measures being taken to maintain the site as suitable for the nominated uses. Further detail on the audit process and the limitations on the meaning and uses of audit reports are contained in the appended document titled "Information Regarding Environmental Audit Reports" EPA September 2007 (Appendix J), and in the Cardno Lane Piper document "About Site Contamination / Environmental Audits and Reports" (Appendix K).

2 SITE HISTORY

2.1 Audit Site History

A site history review was conducted by the Golder Associates as part of the *Preliminary Contamination Risk Assessment* (Golder 2012b). This was supplemented with additional information gleaned by Kleinfelder during preparation of the *Soil Contamination Assessment* (Kleinfelder 2013f), notably through review of the following additional documents:

- Clark (2008) *Transpac Tullamarine Due Diligence Assessment*. Report to Ecology Partners Pty Ltd, November 2008.
- Tardis (2011) *Historical Cultural Heritage Assessment Industrial Development & Subdivision, Western Avenue, Tullamarine*. Report to Commercial & Industrial Property Pty Ltd, July 2011.

Historical information for the site and surrounding areas is available from approximately 1850 onward with information being obtained from the following sources:

- Historical aerial photography;
- Current and historical certificates of title;
- Previous site assessment reports (associated with adjacent CTL site);
- EPA priority sites register and Certificate or Statement of Environmental Audit database.

Kleinfelder (2014) suggests that the site has been used for grazing as early as the 1850s although no grazing has occurred on-site following purchase of the site by Transpacific. The site history summary in Table 2-1 is based on information provided within the following Assessors reports:

- *Preliminary Contamination Risk and Geotechnical Assessment, Buffer Land, 140-204 Western Avenue, Tullamarine* (Golder 2012b); and
- *Soil Contamination Assessment, 140 – 204 Western Avenue, Westmeadows Victoria* (Kleinfelder 2013e).

Table 2-1: Site History Summary (Golder 2012b and Kleinfelder 2013e)

Year(s)	Information Source	Owner/Activity
1850s	Kleinfelder (2013e)	Pastoral grazing and agricultural uses.
1921	Historical certificates of title	Charles Nash owns the land. Janet Murray and Alexander Murray (quarryman) own the land incorporating the site or parts of the site.
1923	Historical certificates of title	Ellen Eliza Nash and Alexander Murphy own the land.
1945 to 1966	Historical aerial photography review (Golder 2012b)	The site comprises pasture / agricultural land. Several small on-site structures (inferred to be a residential dwelling and sheds) are located mid-point and within the southern portion of the western site boundary.
1962	Historical certificates of title	Henry Alexander Nash and David John Drever own the land.
1964	Historical certificates of title	Olive Nash owns the land.
1976 to 1979	Historical aerial photography review (Golder 2012b)	A Dam is present in the south-west corner of the northern portion of the site.

Year(s)	Information Source	Owner/Activity
1985	Historical certificates of title	Land transferred to Brambles Holdings Limited (the former owner of the Cleanaway waste business).
1997	Historical aerial photography review (Golder 2012b)	Dam in south-west corner of the site is now vegetated and a number of the buildings in the west of the site are no longer present. An inferred shed (immediately north of the dam) and an inferred shed (further north of the dam) are still visible.
2003	Historical aerial photography review (Golder 2012b)	Shed structure (further north of the dam) no longer present. Horse pen is present in the eastern portion of the site. A billboard is present in the southern portion of the site adjacent to the Tullamarine freeway.
2011	Historical aerial photography review (Golder 2012b)	Shed (immediately north of the dam) and horse pen are no longer present.

In summary, the site appears to have been used predominantly for agricultural pasture from at least the 1850s onward with a number of small buildings (including a homestead and sheds) being constructed and removed in the west of the site at various times since at least 1945.

2.2 Tullamarine Landfill History

The audit site forms a portion of the amenity buffer for the now CTL; as part of the Auditor's review of on-site conditions, the potential impacts of the adjacent landfill (and the work that has been completed in the post-closure phase to rehabilitate and manage it) has been considered.

2.2.1 Landfill Operational History

The Tullamarine Landfill was operated as an industrial waste landfill between 1973 and 2008. It occupies a former basalt quarry and it is reported (Kleinfelder 2013b) that the total mass of waste disposed of at the site during operation was approximately 3,710,000 tonnes. The landfill was partially lined since 1976 with a curtain wall of clay against the Brighton Group formation (founded on the Older Volcanics).

The landfill initially operated as a solid and liquid industrial waste co-disposal site. Liquid was disposed of into pits or craters prepared in the solid wastes, and leachate was collected and partially evaporated on site (Shugg, 1999) in a leachate pond. Kleinfelder (2013b) report that the majority of waste (80%) accepted in the 1970s was inert and the remaining 20% was industrial.

The disposal of liquid wastes at the site was discontinued in 1987. Leachate has been collected, treated in the leachate treatment ponds constructed in about 1982 in the north eastern corner of the CTL site (Golder, 2007) and disposed to sewer since 1987 (Cardno, 2012). Prior to that, leachate had been recirculated at the landfill after aeration in a lagoon formerly located in the area of the present Mound 3 Landfill (i.e. former Leachate Evaporation Ponds, which area was later excavated and the area used for landfilling from the 1990s). This was the accepted leachate management practice at the time.

The site was formally closed on 15 May 2008 and capped with an engineered landfill cap in accordance with EPA requirements. Leachate collection then ceased in 2011 (*pers. comm.* Transpacific, 6 January 2014). CTL is currently regulated by EPA under a Post-Closure Pollution Abatement Notice (PCPAN).

2.2.2 Tullamarine Landfill Groundwater Contamination

An assessment of risks posed by the CTL, known as the “Secondary Risk Assessment” was completed by Golder Associates in 2007 (Golder, 2007) as was an s53V Environmental Audit based on those data (Lane Piper, 2007). The Secondary Risk Assessment indicated that the CTL is a source of contamination due to its operation as a licensed prescribed industrial waste landfill between 1972 and 2008. Sources of groundwater contamination are from the disposed liquid waste (until 1987) and solid wastes in the landfill cells, plus additional potential sources like historic leachate evaporation ponds and historically the operation of a liquid waste treatment plant and an oil recovery plant.

Secondary sources of groundwater contamination are probably related to the landfill leachate within the landfill cells, LNAPL within the landfill cells and seepage into the ground of contaminated liquids from old liquid waste treatment and oil recovery plants and leachate evaporation ponds.

Groundwater contamination from the landfill has been observed particularly through elevated levels of salinity (TDS), with a ‘halo’ of elevated salinity groundwater surrounding the landfill and plumes of highly saline water from the landfill towards the north and south from the landfill cells. Elevated concentrations of inorganic and organic contaminants were found in groundwater around the landfill, particularly of nitrogen compounds (i.e. ammonia and nitrate) and heavy metals (particularly barium, boron, cobalt, chromium (total), copper, iron, manganese (total), nickel and zinc) and a much lower occurrence of elevated (above water quality criteria) of some organic compounds (e.g. PAHs, phthalates, phenols, chlorinated hydrocarbons etc.).

Historical data (particularly for salinity) indicate that migration of highly saline groundwater from the landfill cells occurred from at least the early 1980s, with peak salinity concentrations observed in the late 1980s to early 1990s and a continuous decline in overall salinity levels since then. This is related to a significant drop in water levels in the landfill cells and surrounding groundwater (of up to 6 m) from maximum levels during the operation of leachate evaporation ponds in the past.

A Groundwater Quality Management Plan (GQMP) and Liquid Waste Management Plan (LWMP) are in place to address groundwater contamination at, and beyond the Landfill. This includes maintaining a monitoring network at, and beyond the CTL, of in excess of 100 groundwater monitoring bores and 9 surface water locations. As part of the implementation of the GQMP and LWMP, it is understood that Transpacific are soon to commence remediation trials in an effort to further reduce the impacts of contamination in groundwater at, and beyond CTL.

2.2.3 Auditor Involvement with Tullamarine Landfill

The Auditor (Anthony Lane) has also completed the following environmental audits and independent reviews at the Closed Tullamarine Closed Landfill:

- Cardno Lane Piper (2012) *Environmental Auditor Review – Groundwater Quality Management Plan Implementation and Liquid Waste Management Plan, Tullamarine Landfill, Western Avenue, Tullamarine Vic*. Document ref: 208013Report01.6, June 2012, Cardno Lane Piper Pty Ltd.
- Lane Piper (2007) *Environmental Audit Report (Secondary Risk Assessment), Tullamarine Landfill, Western Avenue, Tullamarine Vic*. Document ref: 0693CReport02.4, December 2007, Lane Piper Pty Ltd.

- Lane Consulting (May 2004) *Environmental Audit Report, Preliminary Groundwater Risk Assessment, Cleanaway Tullamarine Landfill.*

The Auditor is currently engaged by Transpacific to lead a panel of independent reviewers to peer review the ongoing LNAPL or Liquid Waste Extraction Trial at the CTL. EPA has been notified of all requests for input by the Auditor on the CTL, at the time of each request.

2.3 Review of Audit Reports for Nearby Sites

The Assessor reports that twenty s.53X environmental audits are recorded on the EPA register of certificate or statement of environmental audits for the City of Hume however none of the audits were completed within one kilometre and were therefore not considered as part of the environmental site assessment.

The Assessor has also completed a review of the EPA Priority Sites Register² (PSR) (dated 9 November 2012 that identified one site on the register, the adjacent CTL, within one km of the site. A search of the Priority Sites Register (search undertaken on 17 February 2014, register dated 31 January 2014) by the Auditor confirms two entries on the PSR in the vicinity of the Audit Site as:

- Notice ID: 0090003661 (206 Western Avenue) *“Former landfill. Requires assessment and/or clean up”.*
- Notice ID: 0090003530 (Western AV) *“Former Landfill. Requires ongoing management”.*

Transpacific has confirmed that both entries relate to the CTL site.

² The Priority Sites Register (PSR) is a list of all sites for which EPA requires active management to clean up, monitor, or prevent pollution of land and/or groundwater. A site is listed on the PSR when EPA issues a clean up notice or a pollution abatement notice (relevant to land and groundwater) (EPA Publication 735.2, Nov. 2011).

3 REVIEW OF ASSESSMENTS

3.1 Documents Reviewed

The key reports prepared by the Assessors which have been relied upon by the Auditor for the purpose of completing the audit are presented in Table 3-1.

Table 3-1: Documents Reviewed and Relied Upon

Author	Date	Document Title	Presented in
Kleinfelder Australia	January 2014	Groundwater Condition Report, 140-204 Western Avenue, Tullamarine VIC.	Appendix E
Kleinfelder Australia	November 2013	Lead and Asbestos Abatement Report	Appendix E
Kleinfelder Australia	November 2013	Vehicle Rollover Validation and Waste Removal Report, Westmeadows Victoria 3043	Appendix E
Kleinfelder Australia	November 2013	Landfill Gas Risk Assessment Outer Eastern Bores, Tullamarine Landfill, Western Avenue	Appendix E
Kleinfelder Australia	November 2013	Soil Vapour Assessment, 140-204 Western Avenue, Tullamarine VIC.	Appendix E
Kleinfelder Australia	June 2013	Soil Contamination Assessment, 140-204 Western Avenue, Tullamarine VIC.	Appendix E
Golder Associates	June 2012	Preliminary Contamination Risk and Geotechnical Assessment, Buffer Land, 140-204 Western Avenue, Tullamarine.	Appendix E
Golder Associates	May 2012	Quantitative HHRA ¹ Report, Buffer Land, 140-204 Western Avenue, Tullamarine.	Appendix E
Note:			
1. HHRA = Human Health Risk Assessment.			

3.2 Environmental Investigations

3.2.1 Soil Investigations

The field investigations were conducted as a multiple event program commencing in January 2012 by Golder Associates followed by Kleinfelder in October 2012. The Assessors' soil sampling locations (Golder 2012b and Kleinfelder 2013e) are presented in Figure 3, Appendix A. The field investigations undertaken are discussed in the following stages:

- Stage 1: Preliminary Contamination Risk and Geotechnical Assessment (Golder 2012b) including site definition, background information, compilation and review of historical data, preliminary soil investigations and risk assessment.
- Stage 2: Soil Contamination Assessment (Kleinfelder, 2013e) including further grid-based and targeted soil sampling and assessment.
- Stage 3: Asbestos clearance, lead abatement and waste removal (Kleinfelder 2013a and 2013d).

Stage 1: Preliminary Contamination Risk and Geotechnical Assessment (Golder 2012b)

This preliminary assessment of soil contamination was conducted in January 2012 prior to the Auditor's engagement. The objectives of this assessment were to undertake a preliminary assessment of, and identify the key potential contamination risks that may exist at the site in relation to potential soil and groundwater contamination (including an assessment of risk posed by vapours emanating from impacted groundwater to the land surface). The preliminary assessment identified two potential on-site sources of contamination, based on the previous uses of the site, which are summarised in Table 3-2.

The assessment also included a preliminary geotechnical investigation which has not been part of the auditor's review.

Table 3-2: Summary of Potential On-site Contamination Sources (Golder, 2012b)

Potential Contamination Sources	Potential Contaminants
Agricultural Pasture	<ul style="list-style-type: none"> • Fertilisers: Ammonia, nitrogen and metals. • Pesticides: Organochlorine pesticides (OCP) and organophosphorus pesticides (OPP).
Former and disused sheds	<ul style="list-style-type: none"> • Building Materials: Asbestos. • Fertilisers: Ammonia, nitrogen and metals. • Pesticides: OCP and OPP.

Golder conducted intrusive soil investigations in response to the potential for contamination to be present. Soil investigations at the site comprised:

- Excavation of 30 test pits on an approximate 100 m grid across the site.
- Excavation of 4 test pits targeting the former and disused sheds and the dam in the western portion of the site.
- Soil samples collected at the following depth intervals:
 - 0.1 m
 - 0.5 m
 - 1.0 m
 - Every metre thereafter until refusal on rock or target pit depth reached.

A total of 40 primary samples were submitted for laboratory analysis. The results of the contamination investigations undertaken by Golder (2012b) are discussed below in combination with the results of the further (Stage 2) investigations by Kleinfelder (2013e).

Stage 2: Soil Contamination Assessment (Kleinfelder 2013e)

In October 2012, following the Auditor's engagement, the Assessor conducted further contamination assessment of the site which included review and supplementation of Golder's previous investigations. Additional intrusive soil investigations were completed at the site, which comprised:

- Excavation of 26 test pits at grid-based locations positioned to fill data gaps identified in Golder (2012b) investigations.
- Excavation of 8 test pits at targeted at locations around the former infrastructure and in areas of sparse vegetation or surface disturbance. The targeted locations were chosen to complement the previous investigations.
- Soil samples collected at the following depth intervals:

- Site surface 0.0 m to 0.1 mbgl.
- 0.5 mbgl.
- 1.0 mbgl.
- Each 1 m interval thereafter.
- Additional samples collected if site observations indicated the need.

A total of 44 primary soil samples were collected during the investigations (26 samples from the grid locations and 8 from the targeted locations). 10 soil samples were also collected from surface soils (0.0 to 0.1 m bgl) at locations adjacent to samples collected by Golder for the purpose of analysing for potential surface related contaminants, associated with possible fertiliser and pesticide use (Kleinfelder, 2013e).

Including the preliminary investigations by Golder (2012b), a total of 84 soil samples were collected over the two stages of soil investigation. The results of the soil analysis is summarised in Table 3-3.

Table 3-3: Summary of Soil Analytical Results¹

Parameter	Concentration Range	Comments
MAH and Halogenated Benzenes	<ul style="list-style-type: none"> • Below laboratory limit of reporting (LOR) 	41 samples analysed (28 Samples analysed for halogenated benzenes).
TPH	<ul style="list-style-type: none"> • TPH C6 – C9: Below LOR • TPH C10 – C36: highest concentration of 270 mg/kg in TP107_0.05 (16 samples detected). 	45 samples analysed
PAH	<ul style="list-style-type: none"> • Detected in 2 samples BL-TP004/1001 and TP117_0.05), all other samples were below laboratory detection limit. • Benzo(a)pyrene: 0.8 mg/kg (BL-TP004/1001) and 0.6 mg/kg (TP117_0.05) • Total PAH: 9.3 mg/kg (BL-TP004/1001) and 4.1 mg/kg (TP117_0.05). 	-
Phenols	<ul style="list-style-type: none"> • All samples below LOR 	20 samples analysed
OCPs, OPPs and Herbicides	<ul style="list-style-type: none"> • All samples below LOR 	-
Metals	<ul style="list-style-type: none"> • Arsenic: 2.2 mg/kg to 14 mg/kg (38 samples detected). • Barium: 10 mg/kg to 730 mg/kg (34 samples detected). • Beryllium: 1 mg/kg to 3 mg/kg (18 samples detected). • Boron: 11 mg/kg to 26 mg/kg (5 samples detected). • Cadmium: 0.4 mg/kg (1 sample detected). • Chromium; 9 mg/kg to 115 mg/kg (74 samples detected). • Cobalt: 2 mg/kg to 51 mg/kg (65 samples detected). • Copper: 5.2 mg/kg to 43 mg/kg (70 samples detected). • Lead: 5.1 mg/kg to 440 mg/kg (59 samples detected). • Manganese: 31 mg/kg to 1,200 mg/kg (74 samples detected). • Mercury: 0.1 mg/kg to 0.3 mg/kg (5 samples detected). 	74 samples analysed

Parameter	Concentration Range	Comments
	<ul style="list-style-type: none"> Nickel: 3 mg/kg to 110 mg/kg (72 samples detected). Vanadium: 19 mg/kg to 190 mg/kg (74 samples detected). Zinc: 6.6 mg/kg to 194 mg/kg (71 samples detected). 	
PCBs	<ul style="list-style-type: none"> All samples below LOR 	20 samples analysed
Nutrients	<ul style="list-style-type: none"> Total Phosphorus: 136 mg/kg to 711 mg/kg (17 samples detected). Total Nitrogen: 110 mg/kg to 5,560 mg/kg (13 samples detected). Total Kjeldahl Nitrogen (TKN): 110 mg/kg to 6,930 mg/kg (17 samples detected). Total Sulphur: 0.02 mg/kg to 0.05 mg/kg (15 samples detected). Nitrate and Nitrite as N: 0.1 mg/kg to 16.1 mg/kg (16 samples detected). 	-
Cations	<ul style="list-style-type: none"> Calcium: 20 mg/kg to 70 mg/kg (15 samples detected). Magnesium - 20 mg/kg to 160 mg/kg (15 samples detected). Potassium: 10 mg/kg to 100 mg/kg (16 samples detected). 	-
pH and Sulphate	<ul style="list-style-type: none"> pH: 6.4 (BL-TP021/1001) to 9.7 (BL-TP003/1002). Sulphate: 12 mg/kg (1 sample detected). 	-
Cyanide	<ul style="list-style-type: none"> Free Cyanide: 1 mg/kg to 3 mg/kg (15 samples detected). Total Cyanide: 1 mg/kg to 7 mg/kg (15 samples detected). 	-
Asbestos	<ul style="list-style-type: none"> Not detected in any samples analysed. 	-
Note: 1. Summarised from Section 7 "Soil Analytical Results" of <i>Soil Contamination Assessment, 140 – 204 Western Avenue, Westmeadows, Victoria</i> (Kleinfelder, 2013e).		

The adequacy of sampling is generally assessed against the guidance provided in the Australian Standard AS4482.1 (2005) *Guide to Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds*. It should be noted that the standard provides a range of guidance in addition to tabulation (Table E1 of AS4482.1) of a grid spacing required to detect a circular "hotspot" of arbitrary diameters. The standard also stresses the need for using knowledge of site history to plan the sampling strategy. Reliance on Table E1 of AS4482.1 as the key guidance for specifying a soil sampling strategy is therefore misleading. The Auditor reviewed the locations of samples collected by the Assessors and considers them satisfactory for the purposes of assessing contamination at the site.

Stage 3: Asbestos Clearance, Lead Abatement and Waste Removal Works

During August, September and October 2013, the Assessor has completed the following discrete remediation and verification works pursuant to the completion of the audit:

- 2 rounds of asbestos (cement bonded sheeting) clearance from within the vicinity of the farm ruins.
- Soil hotspot (lead contamination) removal and verification sampling from within the vicinity of the farm ruins.

- Removal of discrete site debris (including various solid inert wastes and deposited soil mound).
- Removal of an abandoned vehicle (including associated parts, broken glass and oil stained soil) and verification sampling.

The remediation and verification works are documented within the Lead and Asbestos Abatement Report (Kleinfelder 2013a) and the Vehicle Rollover and Waste Removal Report (Kleinfelder 2013d) reproduced in Appendix E.

Remediation and verification works are discussed in greater detail in Section 7.

3.2.2 Groundwater Investigations

The Auditor has assessed four groundwater monitoring events (GMEs) during 2013. The monitoring rounds, and bores sampled, are summarised as follows:

- Round 1 (February to April 2013): all 24 bores sampled; bores BH1 and MB57A were dry
- Round 2 (22-26 July 2013): MB61, MB61L, MB72-74, MB83, MB85, MB86U, MB86L
- Round 3 (11-18 September 2013): MB61, MB61L, MB72-74, MB80, MB83, MB85, MB86U, MB86L
- Round 4 (21-23 October 2013): MB55U, MB55L, MB61, MB61L, MB83

Previous groundwater assessment work was undertaken by Golder Associates during 2007 and 2011 as part of the assessment of CTL.

The locations of the groundwater monitoring bores on the site are shown in Figure 4, Appendix A. Groundwater flow has been assessed to be in an easterly to south-easterly direction, and therefore the bores close to Victoria Street (near western site boundary) are considered to be up-gradient bores.

Of the 26 bores at the site, 17 are screened in the Older Volcanics Aquifer (OVA), five are screened in the Silurian Bedrock Aquifer (SBA), one is screened in the Brighton Group Aquifer (BGA) and one is screened in the Werribee Formation Aquifer (WFA). One bore is screened across the WFA and the SBA, and one is screened across the BGA and OVA. It is noted that bores MB61 and MB61L are both screened in the OVA, with MB61L screened near the base of the OVA. Table 3-4 presents a list of the on-site bores, the aquifer(s) in which each bore is screened, and the standing water levels recorded during the Round 1 and Round 4 monitoring events. It is noted that standing water levels varied only slightly during these GMEs, with the most significant difference recorded in bore MB75, which reported an increase of 0.71 m from Round 1 to Round 4. The next highest was bore MB69 which reported an increase of 0.39 m for this period.

Table 3-4: On-site Groundwater Bores and Standing Water Levels

Bore ID	Aquifer Monitored	SWL (m bTOC) Feb-Apr 13	SWL (m AHD) Feb-Apr 13	SWL (m bTOC) 21 Oct 13	SWL (m AHD) 21 Oct 13
BH1	OVA	DRY			
BH2	OVA	24.23	86.17	24.30	86.10
BH3 ¹	WFA / SBA	13.45	87.95	13.37	88.03
MB13	OVA	26.41	88.48	26.51	88.38
MB14	SBA	26.42	88.47	26.52	88.37
MB15	BGA / OVA	29.50	84.69	Damaged	
MB16	BGA	32.12	82.37	32.10	82.39
MB17	OVA	32.09	82.26	32.08	82.27
MB55U	OVA	30.89	80.51	30.88	81.72
MB55L	SBA	30.50	81.80	30.46	81.84
MB56	OVA	30.33	81.77	30.32	81.78
MB57	OVA	28.01	82.07	28.04	82.04
MB57A	OVA	DRY			
MB61	OVA	25.66	88.77	25.77	88.68
MB61L	OVA	26.49	88.18	26.57	88.10
MB69	SBA	5.86	83.77	5.47	84.16
MB72	OVA	25.59	89.73	25.68	89.64
MB73	OVA	30.64	82.33	30.65	82.32
MB74	OVA	30.44	82.71	30.45	82.70
MB75	SBA	8.49	81.67	7.78	82.38
MB76	OVA	21.71	82.04	21.80	81.95
MB80	SBA	15.59	78.18	15.60	78.17
MB83	OVA	29.13	81.88	29.13	81.88
MB85	OVA	29.17	82.03	29.17	82.04
MB86U	OVA	28.68	81.82	29.17	81.84
MB86L	WFA	28.67	81.81	28.61	81.87

Note:
 1. Following discussions with Transpacific, it was confirmed that bore BH3 was incorrectly logged; with the log suggesting that the monitored aquifers are the NVA and BGA. The Auditor has reviewed the log in the context of the site geology and agrees that the aquifers monitored include the WFA and SBA.

Groundwater laboratory results from the four GMEs conducted during 2013 reported analyte concentrations above the adopted assessment criteria, summarised as follows:

February to April 2013:

- Inorganics: total nitrogen, nitrate, sulphate (as SO₄²⁻);
- Metals: aluminium, barium, boron, chromium, cobalt, copper, total iron, manganese, mercury, molybdenum, nickel, selenium and zinc; and

- Organics: 1,2-Dichloroethane, Vinyl chloride, Trichloroethene (TCE).

22 to 26 July 2013:

- Inorganics: total nitrogen, nitrate, sulphate (as SO_4^{2-});
- Metals: boron, chromium, cobalt, copper, total iron, manganese, mercury, molybdenum, nickel, selenium and zinc; and
- Organics: 1,2-Dichloroethane, Vinyl chloride, Trichloroethene (TCE).

11 to 18 September 2013:

- Inorganics: total nitrogen, nitrate, sulphate (as SO_4^{2-});
- Metals: boron, chromium, cobalt, copper, total iron, manganese, mercury, molybdenum, nickel, selenium and zinc; and
- Organics: 1,2-Dichloroethane, Vinyl chloride, Trichloroethene (TCE).

21 to 23 October 2013:

- Inorganics: total nitrogen, nitrate, sulphate (as SO_4^{2-});
- Metals: boron, chromium, cobalt, copper, total iron, manganese, nickel, selenium and zinc; and
- Organics: 1,2-Dichloroethane, Vinyl chloride, Trichloroethene (TCE).

Details of the groundwater analytical results and the relevant adopted assessment criteria for the GME are provided in spreadsheet tables in Appendix B of the Assessor's report (Kleinfelder, 2014). The results are also summarised in tabulated format in Section 10 of this report. The bores reporting organics concentrations above adopted assessment criteria, and above laboratory detection limits, are shown in Figure 4, Appendix A.

Inorganics

A number of bores (in all aquifers) reported concentrations of nitrate (as N) and total nitrogen that exceeded the adopted assessment criteria for Ecosystems Maintenance. Bore BH3, near the north-west corner of the site and screened across the WFA and SBA, reported the highest nitrate (N) concentration of 26 mg/L (cf. criterion of 2 mg/L). Sulphate (as SO_4^{2-}) reported concentrations exceeding one or more of the adopted assessment criteria in all aquifers at the site.

Metals

A number of bores reported metals concentrations that exceeded one or more of the adopted assessment criteria at the site. The metals that exceeded assessment criteria included aluminium, barium, boron, chromium, cobalt, copper, total iron, manganese, mercury, molybdenum, nickel, selenium and zinc). The chromium, cobalt, copper, molybdenum, selenium and zinc concentrations are for the most part not significantly elevated and may be attributed to background concentrations in the groundwater aquifers at the site.

Round 1 laboratory results reported anomalously high aluminium and total iron concentrations (above adopted assessment criteria) in bores MB85, MB86L and MB86U. However, the results of additional sampling (Rounds 2 and 3) were significantly lower (mostly below LOR), possibly indicating spurious Round 1 laboratory results.

Organics

Groundwater bores that reported concentrations of organics exceeding adopted assessment criteria included:

- MB61, MB61L, MB72, MB74, MB85 and MB86L

These bores are all located along a clearly defined north-west to south-east trend that follows the line of the cross-section presented in Figure 3-1 below. The trace of the section line is shown in Figure 5, Appendix A, and the detailed legend for the cross-section is included in Figure 5-2, Section 5. Bores MB36 and MB84 shown in this figure are off-site to the west of the Audit Site. Bore MB61L is not shown on this figure, but is understood to be screened in the OVA. Bore MB83 is the only bore on the cross-section which does not report chlorinated solvents exceeding assessment criteria and all chlorinated solvent concentrations are, in fact, below LOR for bore MB83.

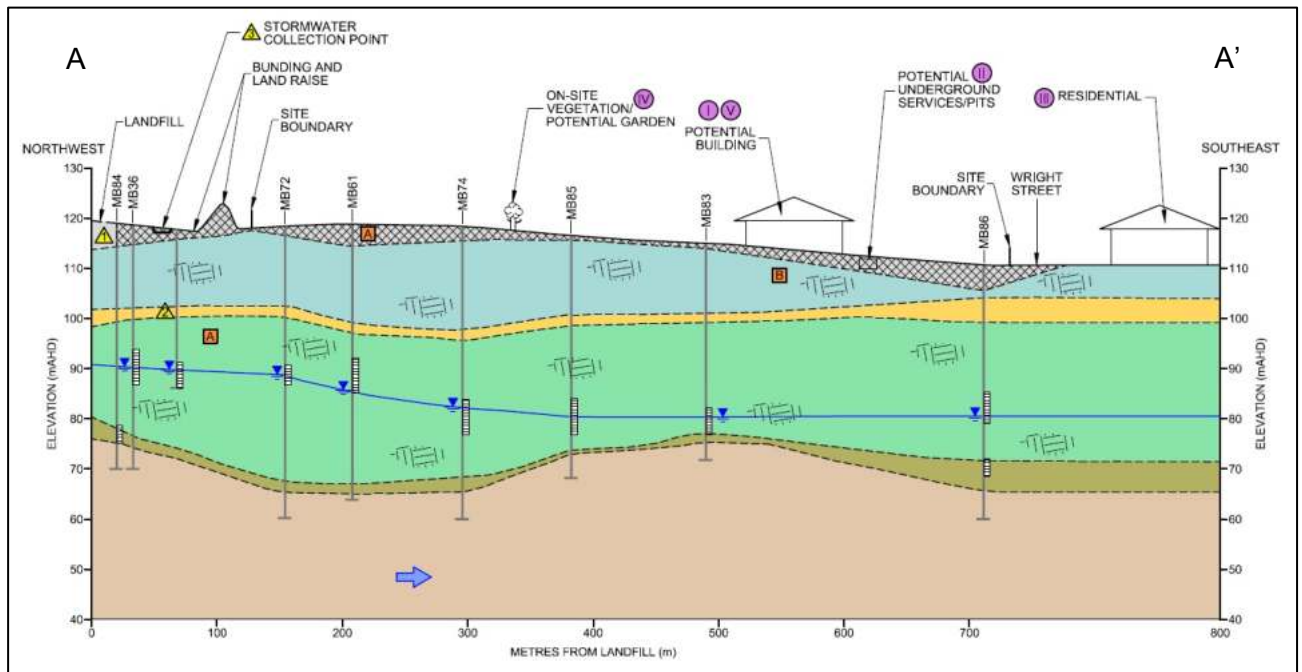


Figure 3-1: Section of Contaminated Plume (Kleinfelder, Jan. 2014)

Bore MB61L, installed in the OVA, reported concentrations of 1,2 DCE (cis) and 1,2 DCA exceeding the assessment criteria, and increasing concentrations of TCE (slightly below criterion). Furthermore, bore MB86L (installed in the WFA) reported concentrations of vinyl chloride and 1,2 DCA above adopted assessment criteria.

3.2.3 Boundary Landfill Gas Investigations CTL

The potential for Landfill Gas (LFG) migration beneath the site must be considered as part of this audit. LFG monitoring is undertaken at the adjacent CTL to comply with the Site Post-Closure Pollution Abatement Notice (PCPAN). The locations of the OEBs are shown in Figure 6, Appendix A. The risks associated with potential LFG migration are discussed further in Section 9.

Most recently the Assessor has undertaken an assessment of LFG Assessment (Kleinfelder 2013b) in the outer eastern boundary bores (OEBs) within the landfill facility that are adjacent to the audit site. The purpose of the LFG Assessment is to identify potential risks posed by LFG at the landfill eastern boundary OEBs.

The results of this assessment form an important aspect of the Auditor's investigations given that the closed landfill facility would present the most likely potential source of LFG within the immediate vicinity of the site.

LFG monitoring from 10 LFG bore installations (at 4 locations spanning multiple geological horizons along the eastern boundary of the CTL site) is reported for a 6-month period between October 2012 and April 2013. Bores have been monitored for the presence of methane, carbon dioxide and oxygen. Parameters such as barometric pressure, differential bore pressure and flow were also recorded during the monitoring.

LFG monitoring results from the OEBs for the reported period indicated no methane present in the ground at the boundary between the CTL site and the Audit Site. However, there are some elevated carbon dioxide concentrations including a number of in excess of 5% v/v (maximum recorded was 7.4 % v/v). The LFG Assessment has also used field data from soil vapour bores at the site (discussed further in Section 3.2.4 below) for the purposes of assessing potential LFG risks at the site. Five bores installed to a depth of 3 m bgl were monitored on up to 4 occasions and found no methane. Carbon dioxide was present in low concentrations (between 0 % v/v and 1.6 % v/v) in the soil vapour bores.

3.2.4 Soil Vapour Investigations

The Assessor has completed a *Soil Vapour Assessment* (Kleinfelder 2013c) at the site for the purpose of understanding the potential soil vapour issues arising from groundwater impact beneath the site. The assessment comprised installation and monitoring of two nested (multiple depth) and three single depth soil vapour implants installed at five locations across the site. Details of the bore monitoring network are shown in Table 3-5.

Initially two rounds of monitoring were specified (in November 2012 and January 2013); in consultation with the Auditor a third round was completed (July 2013) and then a fourth round of monitoring at a reduced number of locations (all bores at SV01 and the deep bore at SV02 only) was completed in October 2013. The four rounds of soil vapour monitoring comprised:

- Monitoring of sub-surface gases (oxygen, carbon dioxide, methane and hydrogen sulfide) using a landfill gas meter.
- Screening for volatile organic compounds (VOCs) with photo-ionisation detector (PID).
- Collection of soil vapours (in summa canisters) and laboratory analysis for VOCs and total petroleum hydrocarbons (TPHs).

Table 3-5: Soil Vapour Implant Construction Summary (Kleinfelder, 2013c)

Soil Vapour Probe ID	Soil Vapour Implant ID	Implant Depth (m)	Implant Screen Interval (m bgl)	Encountered Geology
V01	V01-3.0	3.0	2.8 – 3.0	Silty clay
	V01-14.5	14.5	14.3 – 14.5	Newer Volcanics
	V01-23.0	23.0	22.8 – 23.0	Older Volcanics
V02	V02-3.0	3.0	2.8 – 3.0	Silty clay / Newer Volcanics
	V02-15.0	15.0	14.8 – 15.0	Newer Volcanics
	V02-25.0	25.0	24.8 – 25.0	Brighton Group Sediments / Older Volcanics
V03	V03-3.0	3.0	2.8 – 3.0	Sandy clay / Newer Volcanics
V04	V04-3.0	3.0	2.8 – 3.0	Newer Volcanics
V05	V05-3.0	3.0	2.8 - 3.0	Silty clay / Newer Volcanics

A total of 31 soil-vapour samples and 7 quality control samples were collected and analysed over the 4 rounds of sampling. A summary of the analytical results is provided below in Table 3-6.

The locations of the soil vapour bores are shown in Figure 6, Appendix A.

Table 3-6: Summary of Soil-Vapour Analytical Results¹

Parameter	Concentration Range	Comments
BTEX and Naphthalene	<ul style="list-style-type: none"> Benzene: A maximum concentration of 5.4 mg/m³ from a shallow implant at SV04. A single detect of 0.17 mg/m³ was identified in 8 samples taken from deep implants. Toluene: Detected in most samples ranging from 0.01 mg/m³ to 1 mg/m³. Higher concentrations from implants at shallow depths. Ethylbenzene: Not detected in any sample. Xylenes: Predominantly non-detects with the highest concentration of 0.014 mg/m³ at shallow depth in SV04. Naphthalene: Non-detect in all samples except a single QC sample from the deep implant at V02 during the first round of testing. 	BTEX were predominantly non-detect in most samples. When detected the highest concentrations were reported at shallow depths and more often during the second monitoring event. These results do not appear to be related to groundwater impacts beneath the site.
TPH	TPH fractions: Non-detects in all samples except for the deep implant at V01 in the latest sampling round.	Potentially related to groundwater.
Chlorinated Hydrocarbons	Multiple chlorinated hydrocarbons detected in soil-vapour samples from deep (just above water table) implants at V01 and V02. The highest concentrations were reported in the latest round of sampling from V02 for: <ul style="list-style-type: none"> 1,1-dichloroethene (19 mg/m³) Trichloroethene (51 mg/m³); trans-1,2-dichloroethene(1.8 mg/m³); Freon (0.345 mg/m³); 	Impacts in soil-vapour from most of these chlorinated hydrocarbons are directly related to contaminated groundwater from the adjoining landfill site.

Parameter	Concentration Range	Comments
	<ul style="list-style-type: none"> • cis-1,2-dichloroethene(0.48 mg/m³); • 1,2-dichloroethane (1.3 mg/m³); • 1,1,2-Trichloroethane (2.5 mg/m³); and • Tetrachloroethylene (15 mg/m³). Other chlorinated were also detected such as vinyl chloride (0.021 mg/m ³), bromodichloromethane (0.16 mg/m ³), and chloroform (0.14 mg/m ³).	
Other Volatile Hydrocarbons	A number of compounds associated with petroleum hydrocarbons (e.g. trimethylbenzenes, hexane and cyclohexane) were detected in some samples. These compounds are likely in concentrations reported for the TPH fractions above therefore not considered separately. A number of other volatile hydrocarbons were identified in earlier rounds of sampling and include; <ul style="list-style-type: none"> • Alcohols (ethanol, isopropanol and t-butanol); • Ketones (acetone, butanone and methyl pentanone); • Carbon Disulfide; and • Tetrahydrofuran. 	These compounds were detected at low concentrations (<1 mg/m ³) and mostly non-detect for the aromatic compounds.

Field monitoring of sub-surface gases reported the following results across the 3 rounds of monitoring:

- Concentrations of carbon dioxide were detected in the range of 0.0 to 1.7 % v/v.
- Concentrations of oxygen were detected in the range of 18.2 to 22.3 % v/v.
- Methane was not detected during the three rounds of monitoring.
- Field screening of VOCs saw concentrations in the range of 0.0 to 37.5 ppm.

The Assessor has compared the field-monitored concentrations of carbon dioxide and oxygen to the laboratory data from the third round of monitoring and they were generally found to correlate. Generally field-monitored carbon dioxide concentrations were higher than laboratory concentrations in the range of 0.07 to 0.2% higher. Oxygen concentrations differed in the range of 0.0 to 0.8 % v/v with neither sampling method trending higher or lower than the other. This data is presented as Table 8 within the *Soil Vapour Assessment* (Kleinfelder, 2013c) reproduced in Appendix E.

3.3 Data Quality Review

This section reviews the Quality Assurance (QA) and Quality Control (QC) documentation. QA encompasses the actions, procedures, checks and decisions undertaken to ensure sample integrity and representativeness, and the reliability and accuracy of analysis results. The QA documentation should also include an indication of the Data Quality Objectives sought in relation to each significant action, test or process involved in the assessment.

QC activities measure the effectiveness of the QA procedures by undertaking testing, and then comparing results to previously established objectives. QC work will include the internal laboratory testing as well as results of QC samples submitted by the Assessor such as trip blanks and duplicates. The quality of the information and/or data is deemed satisfactory when the QC results demonstrate that agreed objectives have been met.

The Auditor has completed a review of the Assessor's QA/QC as part of the data validation exercise. The findings of the review are summarised in the Auditor's data quality Report which is included as Appendix D. The data quality review has noted the following:

- The scope of work undertaken was generally consistent with that required to characterise the site as set out in the Assessor's Work Plan.
- Chain of custody information and laboratory certificates indicates that all holding times for samples are in conformance with Appendix B of EPA Publication IWRG701 (2009) *Sampling and Analysis of Waters, Wastewaters, Soils and Wastes*.
- A number of exceedances in relative percentage difference (RPDs) calculations were identified although the Auditor concluded that the exceedances were generally minor and likely to be related to sample heterogeneity and the low analyte concentrations of analyte pairs.
- Laboratory reports indicate the method detection limits for soil and groundwater analysis were generally lower than the respective assessment criteria, with the following exceptions relating to groundwater:
 - LOR for 1,3-dichloropropene was 0.001 mg/L, which is above the adopted ecosystem criteria of 0.0001 mg/L.
 - LOR for hexachlorobenzene was 0.0001 mg/L, which is above the adopted ecosystem criteria of 0.00005 mg/L.

As no results were reported above the LOR, the Auditor does not consider these to significantly affect the outcome of the groundwater assessment.

- Rinsate blanks analysed did not return concentrations above the laboratory LOR.
- All trip blanks analysed to assess the potential for sample contamination during transport returned results below the laboratory LOR for TPH C6 – C9 and BTEX.
- Laboratory certificates are stamped with NATA endorsement and carry signature.
- Chain of custody information is provided within the Assessor reports.
- Fieldwork procedures are documented in the Assessor's reports and are comparable for each phase of assessment.

In summary, the Auditor has concluded that the dataset used as the basis for the soil and groundwater assessment is considered to be valid and complete.

3.4 Auditor's Assessment of Adequacy

The Auditor considers that the scope of works, methodology of the site investigations and laboratory analytical program undertaken by the Assessor have been appropriate in order to characterise the nature and extent of contamination at the site. Hence, the field assessment and data is considered to be of an acceptable quality as the basis for the Audit.

4 AUDITOR'S VERIFICATION OF SITE CONDITION

4.1 Verification Tasks Summary

The Auditor has undertaken work to verify that the environmental quality of the site is as reported by the Assessor. Tasks undertaken by the Auditor and his audit team in verifying the site conditions are summarised in Table 4-1.

Table 4-1: Auditor's Verification Activities

Date	Activity	Comment	Verification Sampling
17 October 2012	Ste inspection by Auditor's assistant	Observe soil sampling	3 verification soil samples
18 October 2012	Ste inspection by Auditor's assistant	Observe groundwater monitoring	None
30 July 2013	Ste inspection by Auditor's assistant	Observe soil vapour sampling	1 verification soil vapour sample
28 August 2013	Site inspection by Auditor	Observe asbestos clearance work and conduct a site-walkover	None
4 September 2013	Ste inspection by Auditor's assistant	Observe asbestos clearance area	4 verification soil samples

4.2 Observations from Site Inspections

4.2.1 Site Inspection (17 October 2012)

The Auditor's assistant attended the site for the purpose of observing test-pitting works by the Assessor. No issues were observed during the test-pitting by the Assessor. Three verification soil samples were collected by the Auditor's assistant; refer to Section 4.3 for further details of the sampling and results.

4.2.2 Site Inspection (18 October 2012)

The Auditor's assistant attended the site for the purpose of observing groundwater sampling by the groundwater monitoring contractor. No issues were observed with the equipment, sampling methodology or collection of the sample by the Assessor. Verification samples were not collected during this exercise.

4.2.3 Site Inspection (30 July 2013)

The Auditor's assistant attended the site for the purpose of observing soil vapour sampling being completed by the Assessor. No issues were observed with the equipment, sampling methodology or collection of the sample by the Assessor. One verification soil vapour sample was collected; refer to Section 4.3 for further details of the sampling and results.

4.2.4 Auditor Site Inspection (28 August 2013)

The Auditor conducted an inspection of the Site on 28 August 2013. The Auditor made the following key observations during the inspection:

- Asbestos clearance works were being conducted in the vicinity of the demolished homestead. The portion of the site subject to the asbestos clearance was controlled and the Auditor did not enter the exclusion zone.
- Some boxthorn hedges had been removed although a large volume remained at site.
- The paddocks at the north and north-east of the site had no visible evidence of fill or rubble; the Auditor also notes that the boxthorn hedgerows in this area are impenetrable to persons on foot.
- An earthen mound (vegetated and approximately 20 m³ in volume) was observed along the eastern boundary of the site with Wright Street. A small volume of solid inert waste (SIW) including bricks and rubble was observed beneath boxthorn hedges that were in the vicinity of the mound.
- A small circular water body was observed in the south-east of the site; the water body contained a minor amount of SIW which appeared to be recently deposited. Bricks, soil, scoria and mulch were also observed.
- 2 backfilled test-pit locations (one in the south-east corner and the other along the boundary with Western Avenue in the northern portion of the site) were observed to have subsided to approximate depths of 0.5 m potentially posing a potential trip hazard (notified to site owner).
- A small water-hole (approximately 2 x 2 m in area) was observed along the eastern boundary with Wright Street. SIW was noted in a surrounding mound and frogs were heard in the vicinity.
- The area of a recently removed wreckage of an abandoned and burnt-out motor vehicle was observed. Wreckage including broken glass, rubber seals, a fibreglass roof and oil staining on the grass were all observed.
- The excavated dam at the western boundary of the site was observed.

Photographs taken during the site inspection are presented in Appendix C.

4.2.5 Site Inspection (4 September 2013)

The Auditor's assistant and the Audit Project Manager attended the site for the purpose of viewing the completed asbestos clearance works and observing the Assessor excavate a number of test-pits in this area. During the inspection of this area the Auditor's assistant noted the presence of black bituminous material (apparently used for lining of roofs at the site) which had the potential to contain asbestos. The Assessor arranged to collect a sample of this material for asbestos analysis.

The Auditor's assistant and Project Manager attended the areas of the earthen mound and the area of removed car wreckage. Both areas had been removed and cover soil had been applied to the area of the car wreckage. Soil had also been placed in the areas of the subsided former test-pit locations and they were ready to be backfilled.

Verification samples were collected from the excavated test-pits and from the vehicle rollover area; refer to Section 4.3 for further details of the sampling and results. Photographs taken during this site inspection are presented in Appendix C.

4.3 Verification Testing and Results

Table 4-2 summarises the scope and method of work performed by the Auditor and/or his representatives of his audit team in obtaining verification samples.

Table 4-2: Auditor Verification Sampling Information

Activity	Comment
Date of sampling	Soil sampling: 17 October 2012 and 4 September 2013 Soil vapour sampling: 30 July 2013
Person(s) undertaking sampling	Soil sampling: Kris Inkster (Environmental Geoscientist), Garry Masur (Associate Hydrogeologist) Soil vapour sampling: Jonathan Thom (Associate Environmental Geoscientist)
Number of sample locations	Soil sampling: 7 locations (total) Soil vapour sampling: 1 location (V04)
Number of samples taken	Soil sampling: 7 (total) Soil vapour sampling: 1
Media sampled	Soil sampling: Near surface soils Soil vapour sampling: vapour
Depth of sampling	Soil sampling: 0.1 mbgl (near surface) Soil vapour sampling: not applicable
Sampling method	Soil sampling: Soil Grab Soil vapour sampling: Entech silonite "MiniCan" (1400 ml) connecting to the Assessor's sampling equipment.
NATA certified testing laboratory	Soil sampling: Eurofins MGT Soil vapour sampling: ALS Group

4.3.1 Sample Locations and Description

Soil Samples

The following verification soil samples were collected from the site on 17 October 2012:

- TP116_0.01: Collected at the near surface (0.1 mbgl) from the sidewall of the Assessor's test-pit location TP116. This sample was submitted to the laboratory for analysis of TRH, Phenols, PCBs, organochlorine pesticides, heavy metals and PAHs.
- TP122_0.01: Collected at the near surface (0.1 mbgl) from the sidewall of the Assessor's test-pit location TP122. This sample was submitted to the laboratory for analysis of TRH, Phenols, PCBs, organochlorine pesticides, heavy metals and PAHs.
- TP131_0.01: Collected at the near surface (0.1 mbgl) from the sidewall of the Assessor's test-pit location TP131. This sample was submitted to the laboratory for analysis of TRH, Phenols, PCBs, organochlorine pesticides, heavy metals and PAHs.

The following verification soil samples were collected from the site on 4 September 2013:

- AV01: Collected at the near surface (0.1 mbgl) from the sidewall of the Assessor's test-pit location TP146. This sample was submitted to the laboratory for analysis of heavy metals and PAHs.

- AV02: Collected at the near surface (0.1 mbgl) from the sidewall of the Assessor’s test-pit location TP147. This sample was submitted to the laboratory for analysis of heavy metals and PAHs.
- AV03: Collected at the near surface (0.1 mbgl) from the sidewall of the Assessor’s test-pit location TP148. This sample was submitted to the laboratory for analysis of heavy metals and PAHs.
- AV04 was taken from the cleared vehicle rollover area. This sample corresponds to the Assessor’s sample V1_01. This sample was submitted to the laboratory for analysis of TRH and BTEX compounds only.

Soil Vapour Samples

The following verification soil vapour samples were collected from the site on 30 July 2013:

- V04: Sample collected from soil vapour bore V04 in an Entech silonite “MiniCan” (of 1400 ml volume) that was connected to the Assessor’s sampling equipment. This sample was submitted to the laboratory for analysis of VOC and TPH compounds.

4.3.2 Laboratory Test Results

The findings of the verification analyses are summarised below in Table 4-3. Laboratory reports and chain of custody documents are shown in Appendix H. In the main the results from the Auditor’s verification samples were equivalent to results from the Assessor’s samples. One exception was a high result for lead (AV02, 1,700 mg/kg).

Table 4-3: Summary of Verification Analysis

Analyte	Results
Soil	
Metals (Bo, As, Ba, Be, Cd, Cr, Co, Cu, Hg, Mn, Ni, Pb, Va, Zn)	The results from six samples for metals were screened against relevant criteria for human health, i.e. NEPM HIL ‘D’. All results except for lead in AV02 were below the relevant criteria. A sample from location AV02 was not taken by the assessor. NB: The sample from AV04 was not analysed for metals.
BTEX	BTEX was only reported in one sample, AV04. These compounds were below limits of reporting (LOR) and therefore are below the adopted reference criteria.
TPHs	TPH results for sample AV04 in the crash site area are all below the limit of reporting (LOR).
PAHs	Concentrations of PAHs in 6 samples (except AV04) are below the laboratory LOR for all compounds analysed.
Other Compounds	Other groups of compounds that were reported to be below laboratory LOR were the Organochlorine pesticides, polychlorinated biphenyls, phenols and halogenated phenols
Soil Vapour	
VOCs including BTEX and TPH fractions	All volatile organic compounds (including BTEX and TPH fractions) were below laboratory LOR. This sample was taken from a shallow soil-vapour implant at SV04. Results from samples (for the same location and taken by the Assessor over 4 rounds) were typically below laboratory LOR for this soil-vapour bore location.

4.4 Review of Verification Results and Site Inspections

4.4.1 Soil Sampling

A comparison of soil results taken from locations TP116 and TP131 is provided in Table 4-4. The results appear to be generally comparable with the differences likely a result of inter-laboratory variability. The Auditor's verification samples taken at other locations (e.g. TP122) were also comparable to those reported in Table 4-4 except for an elevated lead concentration in one sample (1,700 mg/kg recorded in Auditor verification sample AV02).

Table 4-4: Summary of Verification Results for Metals in Soil Samples

Metal	Limit of Reporting		TP116		TP122	TP131	
	Auditor	Assessor	Auditor	Assessor	Auditor	Auditor	Assessor
Boron	10	50	< 10	<50	< 10	< 10	<50
Arsenic	2	5	< 2	<5	2.8	6.6	6
Barium	10	10	140	180	180	200	260
Beryllium	2	1	< 2	1	< 2	< 2	2
Cadmium	0.4	1	< 0.4	<1	< 0.4	0.5	<1
Chromium	5	2	42	52	17	46	53
Cobalt	5	2	18	23	< 5	20	28
Copper	5	5	21	21	10	27	30
Lead	5	5	56	54	< 5	13	12
Manganese	5	5	1100	803	160	720	778
Mercury	0.1	0.1	< 0.1	<0.1	< 0.1	< 0.1	<0.1
Nickel	5	2	26	35	7.8	36	44
Vanadium	10	5	49	59	26	77	96
Zinc	5	5	82	80	29	51	56

The elevated lead concentration was communicated to the Client and the Assessor at a meeting held with the Auditor on 24 September 2013. A Lead Abatement Program was subsequently undertaken by the Assessor (Kleinfelder 2013a) to delineate the extent of lead impacts (discussed further in Section 7 and Section 9.3.1). High Lead concentrations were reported in a number of additional samples taken by the Assessor to the east and south of TP147. The Lead impacts at TP147 were:

- Delineated laterally to be within the footprint of the former homestead (5 m x 3 m); and
- Delineated vertically (less than 1 m) below ground with Lead impacts restricted to shallow soils.

4.4.2 Soil Vapour Sampling

The results of the verification soil-vapour sample collected by the Auditor at soil-vapour bore SV04 were less than LOR for all compounds. The same result was achieved by the Assessor for their sample taken at the same time, as shown in Figure 4-1. It is noted that the verification sample was taken from a shallow soil-vapour implant (3 m depth) at SV04. Results from samples (for the same location and taken by the Assessor over 3 rounds) were typically below laboratory LOR for this soil-vapour bore.

The laboratory certificate for the analysis of the soil vapour verification sample collected by the Auditor's assistant is provided as Appendix H.



Figure 4-1: Soil Vapour Sampling (Primary Sample and Auditor Verification Sample)

4.4.3 Verification Results Summary

Generally the Auditor considers that the observations of the site conditions and laboratory analytical results collected by the Auditor's assistants are consistent with the Assessor's results and observations.

5 CONCEPTUAL HYDROGEOLOGICAL MODEL

This chapter has been written with the assistance of the Auditor's EPA Victoria approved expert support team member, Jon Bartley.

5.1 Geographic setting

5.1.1 Climate

The Bureau of Meteorology (BOM) website provides representative longer term climate data for the site. Annual precipitation data recorded at the Melbourne Airport weather station (station number 86282) located approximately one km west of the site is shown in Table 5-1. Information from BOM website also suggests that the region has an average annual evaporation³ of between 1,200 and 1,400 mm.

Table 5-1: Total Annual Precipitation (Melbourne Airport¹) 2009 to 2013

Annual Precipitation (mm)				
2009	2010	2011	2012	2013 ²
397.8	727.4	678.4	482.8	358.6

Notes:
1. Data sourced from www.bom.gov.au (accessed 19 September 2013), Melbourne Airport Weather Station (number: 86282).
2. Data available for January to August 2013.

5.1.2 Topography and Drainage

The site is located approximately 17 km north-west of the Melbourne CBD. The natural topography of the site slopes in a north to north-easterly direction from an elevation approximately 114 m AHD near the south-western site boundary to approximately 84 m AHD near the north-eastern corner of the site. The southern and central part of the site has a gentle to moderate slope, while the northern portion has a steep slope, with a fall of approximately 30 m over 200 m.

The northern boundary of the site is defined by Moonee Ponds Creek which is deeply incised into the Silurian bedrock, as shown in Figure 5-1. Apart from the steep slope in the northern part of the site, there are no significant topographic features on the site, and the surface of the land is generally level and grass-covered.

Surface water run-off is expected to be north to north-easterly, following the contours of the land.

³ Annual average pan evaporation data is based on at least 10 years of records from 1975 to 2005. Data obtained from: <http://www.bom.gov.au/watl/evaporation/> accessed on 19 September 2013.

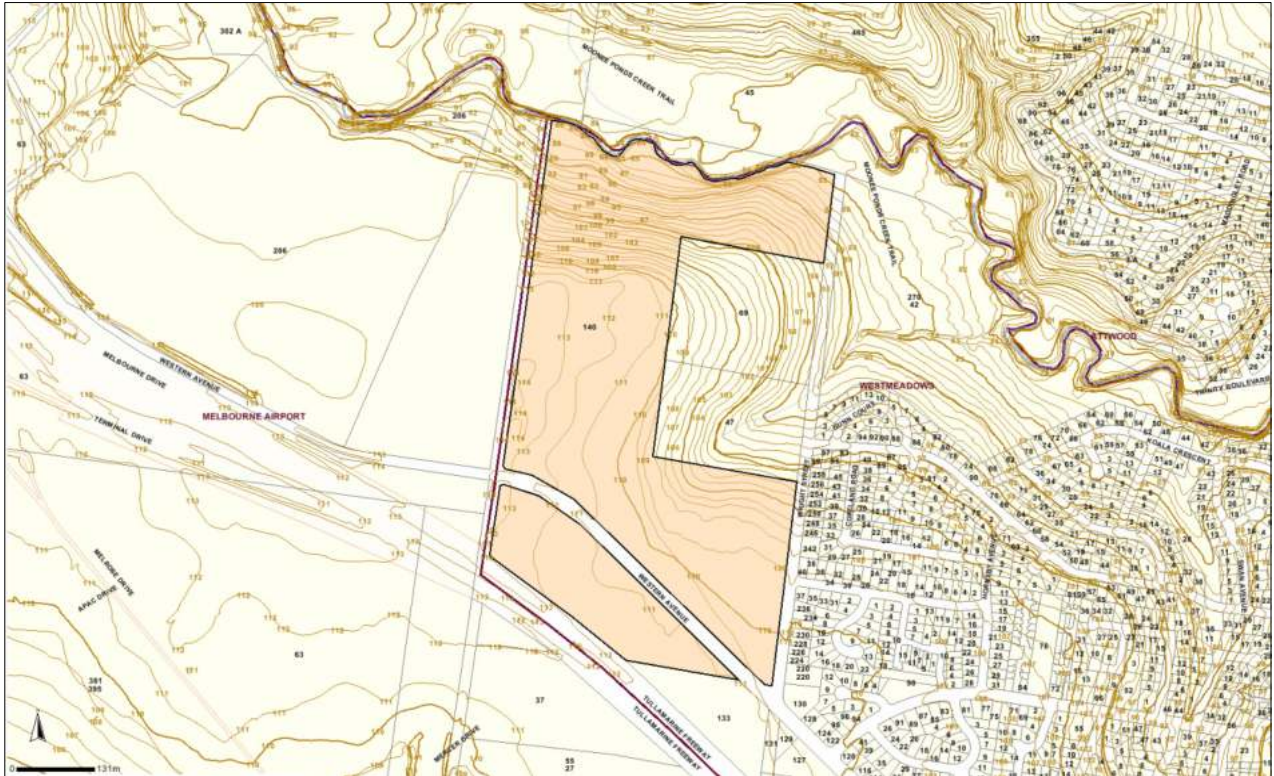


Figure 5-1: Local Topography (Landata 2013)

5.2 Geology and Aquifers

The geology in the vicinity of the site is shown in Figure 7, Appendix A. Geological units at, and in the vicinity of the site, include the following (from youngest to oldest):

- Quaternary age alluvium and colluvium occurring as surficial, unconsolidated deposits along watercourses
- Quaternary age basalts of the Newer Volcanics forming extensive, lava flow plateaus in the region. These basalts outcrop to the south and west of Moonee Ponds Creek in the vicinity of the site. The Newer Volcanics occur as the youngest 'hard rock' stratigraphic unit in the region.
- Tertiary age clays and sands of the Brighton Group which form a thin sedimentary unit between the Newer Volcanics and the underlying Older Volcanics. Where the Older Volcanics is absent, the Brighton Group is located between the Newer Volcanics and the Silurian bedrock.
- Tertiary age basalts of the Older Volcanics, located stratigraphically between the Brighton Group and the Silurian bedrock. Where the Brighton Group is absent, the Older Volcanics occurs between the Newer Volcanics and the underlying Silurian bedrock.
- The Tertiary age Werribee Formation forms as a thin sedimentary horizon between the Older Volcanics and Silurian bedrock. It does not appear to 'visibly' outcrop in the vicinity of the site, probably due to the fact that is a thin interval and largely unconsolidated. At depth at the site, the Werribee Formation consists silt and sand intervals, and is thickest near the south-east corner of the site where it is approximately 8 m thick (bore MB86L). Elsewhere, it is either absent or less than 1 m thick, or may be representative of core loss intervals immediately below the Older Volcanics.

- The Devonian age Bulla Granodiorite outcrops over large areas to the north of the site, forming a topographic high at Gellibrand Hill. The granodiorite is igneous rock that has intruded into the Silurian bedrock.
- The Silurian age Dargile Formation occurs as the bedrock unit in the region, outcropping on the northern portion of the site. Structurally, the Dargile Formation forms an “inlier”, in that it is a geologically older unit that is surrounded by younger units. The Dargile Formation consists of interbedded shale, mudstone and greywacke.

The principal aquifers at the site include the following:

- Older Volcanics Aquifer (OVA): Fractured basalt, water table aquifer with highly variable permeability (but generally low) and usually providing low bore yields.
- Silurian Bedrock Aquifer (SBA): Fractured mudstone/shale, water table aquifer, outcropping on the northern part of the site, providing low to moderate bore yields.

The Brighton Group Aquifer (BGA) is dry for the most part, with the exception of an area near the south-western corner of the site (groundwater was noted to be present in bore MB16) where significant structural thickening of the Brighton Group is evident. The BGA is a porous, intergranular, water table aquifer with low bore yield.

Figure 5-2 presents a conceptual site model (Kleinfelder, 2014) of the site, shown as a hydrogeological cross-section, orientated from south-west to north-east across the site, and extending to the adjacent landfill and across Moonee Ponds Creek. The section line for this figure is shown in Figure 5, Appendix A.

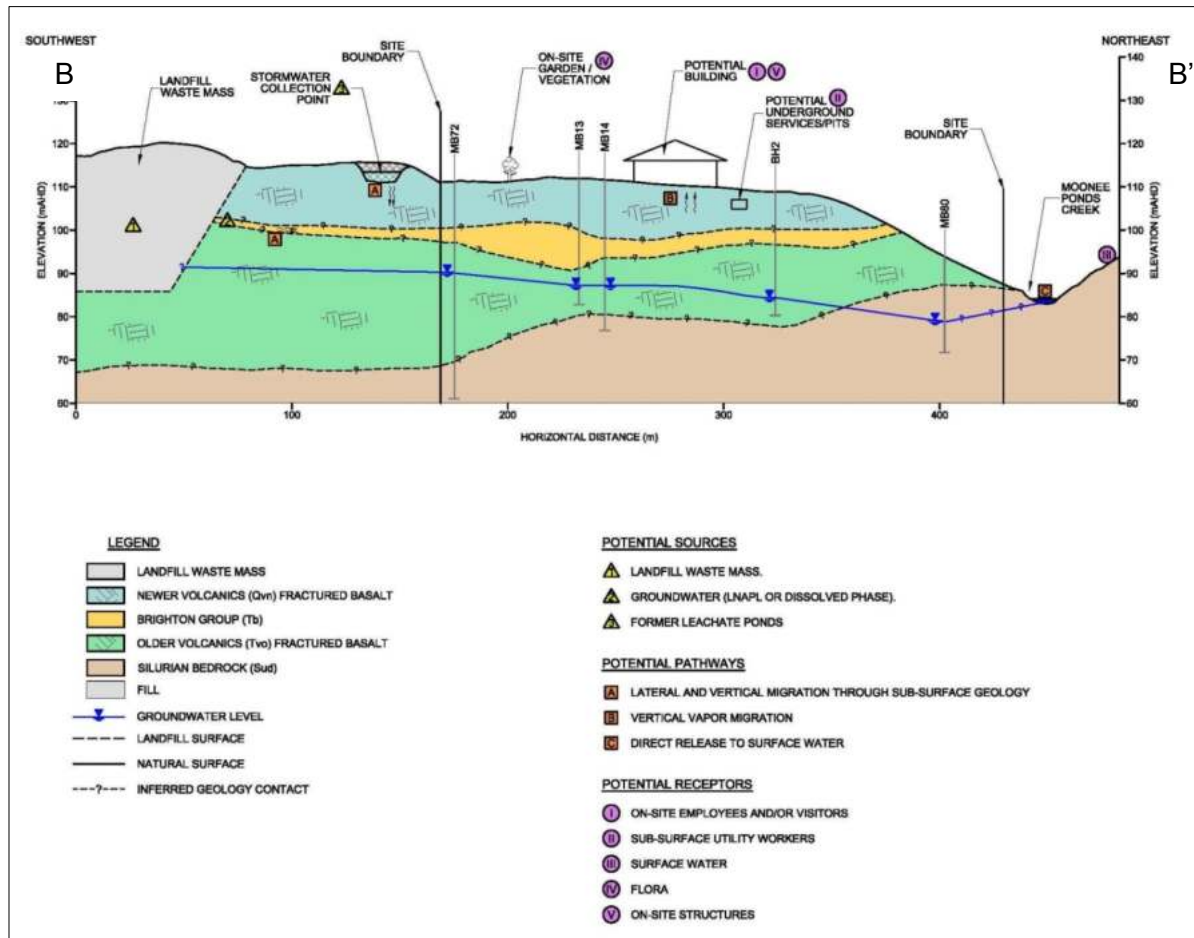


Figure 5-2: Conceptual Site Model (Kleinfelder, 2014)

5.3 Groundwater Occurrence and Flow Systems

Groundwater at the site is relatively deep, with standing water levels mostly at depths greater than 25 m below ground level (bgl). Most of the bores are screened in the Older Volcanics, with the overlying aquifers generally unsaturated. An exception includes an area in the south-western part of the site where there appears to be structural thickening of the geology, and where bore MB16 is screened in the Brighton Group Aquifer.

The three bores that are nearest to Moonee Ponds Creek (where the overlying Older Volcanics basalts have been completely eroded), and one deep bore (MB55L) in south of the site, were screened in the SBA. The OVA was dry in bore MB55U (nested with MB55L). Bore MB86L, near the south-east corner of the site, was screened in the Werribee Formation Aquifer, nested bore MB86U was screened in the Older Volcanics at this location.

Standing groundwater occurs at depths ranging from approximately 6 m bgl in bore MB69 near Moonee Ponds Creek, to 32 m bgl in bores MB16 and MB17 near the south-west corner of the site. The groundwater flow direction, as shown in Figure 5, Appendix A (after Kleinfelder 2014), is partly consistent with the site topography, with groundwater generally flowing from areas of high elevation, in the south and west of the site, towards Moonee Ponds Creek to the north-east and east. However, it is noted that the groundwater contours were drawn irrespective of the fact that bores were screened in different aquifers. Given that the bores are screened across the water table this is a realistic representation of the water table shape.

It is noted that that the standing water levels (potentiometric surface) occurred at similar levels in nested pairs at the site (bores MB13 and MB14, MB16 and 17 and MB86U and MB86L), despite the fact that screened depths were different in the respective pairs. This indicates a lack of vertical hydraulic gradient at these locations.

Kleinfelder (2014) reported that mounding of the water table has occurred as a result of the landfill to the west of the site, and that the groundwater flow direction is approximately radial, away from the landfill, as a consequence.

5.4 Groundwater Quality and Protected Beneficial Use

The Victorian Groundwater Beneficial Uses Map Series (1995) shows the groundwater in the vicinity of the site to have a salinity ranging from 3,501 to 13,000 mg/L TDS, and is therefore classified as Segment C according to the State Environmental Protection Policy (SEPP) *Groundwaters of Victoria* (1997).

Data obtained from the most recent groundwater monitoring event (February to April 2013) reported groundwater salinity for the individual aquifers monitored at the site. The aquifers for which the most data were collected include the OVA and the SBA. The salinity for the OVA (14 bores) ranged from 2,900 to 8,800 mg/L TDS, which is generally consistent with the Beneficial Uses Map (1995). Only one of the 14 bores screened in the OVA reported a salinity of < 3,500 mg/L. The salinity for the SBA (six bores) ranged from 3,000 to 12,000 mg/L TDS, including three bores < 3,500 mg/L and three bores >3,500 mg/L (i.e. Segments B and C).

The average salinity of the main groundwater aquifer at the site, the OVA, is 5,900 mg/L.

A study of groundwater salinity in the Older Volcanics Aquifer (OVA), which is the principal aquifer at the site, was completed as part of the 2007 Environmental Audit of the adjacent CTL site. This study found that groundwater quality in the vicinity of the landfill had been impacted by landfill leachate, with salinity reported at elevations above the natural/background concentrations of the OVA. It was determined that the background groundwater quality in the OVA should be classified as Segment B in accordance with *SEPP Groundwaters of Victoria*.

Therefore, the same would apply to the Audit Site and groundwater would be classified Segment B. The following beneficial uses of groundwater are protected under Segment B of *SEPP Groundwaters of Victoria* (1997):

- Maintenance of ecosystems
- Potable mineral water supply
- Agriculture, parks and gardens
- Stock watering
- Industrial water use
- Primary contact recreation
- Buildings and structures.

5.5 Groundwater Resources and Utilisation

The principal aquifers in the vicinity of the site include the Older Volcanics Aquifer and the Silurian Bedrock Aquifer, as discussed in Section 5.2. These aquifers are generally not widely used as a source of water supply in the Melbourne region.

A search of the Victorian Groundwater Management System database, conducted by the Assessor on 15 November 2013, identified a total of 47 registered groundwater bores within a 2 km radius of the site. Figure 4 in Kleinfelder (2014) provides an illustration of the locations of the registered groundwater bores, though it should be noted that this figure does not cover the full 2 km radius, as the registered bores are within approximately 1 km of the site.

Table 5-2 summarises the details of registered bores within 1 km of the site, which are off-site and not on the adjacent landfill site. According to database search presented in Table 5-2, there are no registered bores that are listed as domestic and/or stock, and irrigation, which could potentially be used for groundwater extraction. However, the bores listed as “unknown” may be used as extraction bores. Of the unknown bores, only the bore to the south-east of the site may potentially be impacted by contaminated groundwater from the site. However, it is a significant distance (775 m) from the site. It should also be noted that groundwater may be utilised by persons with unregistered bores not appearing on the database.

It is the Auditor’s opinion that groundwater use in the vicinity of the site is unlikely, given that bore yields are typically low in the shallow aquifers in Melbourne. While the Werribee Formation Aquifer has greater yield potential, the Werribee Formation is very thin at the site, and does not form a significant water supply aquifer.

Table 5-2: Nearby Registered Groundwater Bores

Bore Use	No. of Bores	Bore Depth (m)	Approximate Distance from Site (m)	Approximate Direction from Site (m)
Investigation	8	13.0	150	North
		31.5	200	South
		18.0	275	North
		11.5	300	North
		12.0	350	North-west
		19.5	520	North
		43.6	1,000	East
		43.6	1,000	East
Observation	3	31.5	200	South
		40.0	200	South
		48.0	375	South
Not known	4	-	300	North-west
		25.0	340	North-west
		60.0	400	North-west
		30.0	775	South-east

6 CONCEPTUAL SITE MODEL

This chapter has been written with the assistance of the Auditor's EPA Victoria approved expert support team member, Peter Gringinger.

6.1 CSM Concepts and Background

Prior to discussing findings in relation to the assessment of contamination and associated risks, an outline of the Auditor's understanding of the site contamination and conceptual site model (CSM) of the occurrence of contamination and potential for impact on the environment is provided.

A CSM is a testable representation of environmental processes on a site and in its vicinity. Its purpose is to identify potential contamination sources, pathways, and receptors with a view to identifying potential and significant pollution linkages. Conceptual Site Models (CSMs) as described in this section to assist in the assessment of risk and provide a rational basis for design of remedial solutions to contamination (if required). The CSM development process is also used to identify data gaps, uncertainty and to define the risk assessment approach. The CSM is a blueprint (a working hypothesis) for the understanding of site contamination and is updated as new information is obtained.

The CSM generally includes the following aspects:

- Hydrogeology (documented in the CHM presented in Section 5).
- Primary and secondary sources (i.e. Release areas and source zones).
- Known contaminant distribution.
- Migration mechanisms.
- Known and/or potential contaminant migration pathways (natural and man-made).
- Fate and transport bio-geochemistry of site contaminants (for each media – soil and groundwater) including partitioning, plume migration and retardation (i.e. Natural attenuation).
- Contaminant sinks⁴.
- An initial qualitative risk assessment.

This CSM is based on environmental works completed by the Assessors in Golder (2012b) and Kleinfelder (2013e). Information from Lane Piper (2007) and Cardno Lane Piper (2012) has also been relied upon.

6.2 Potential Contamination Sources

Primary sources (i.e. release areas) are those sections of the site where contaminants have leaked or been spilled. Secondary sources (e.g. deep soil impacts, NAPL source zones and/or release of vapours) are subsurface impacts resulting from the primary source.

⁴ For example, the Newer Volcanics may contain low permeability portions of the aquifer as palaeosoils, which may enable matrix diffusion and sorption of contaminants from groundwater (and the related partitioning and subsequent diffusion of soil vapour).

6.2.1 Primary Sources

There are several potential primary sources of contamination at the site which have been identified through review of the site (and adjacent landfill's) history and the Assessor's investigations. Based on the known site history, the principal potential contaminants of concern identified by the Assessor and summarised by the Auditor are shown in Table 6-1.

Table 6-1: Site Activities, Sources and Potential Contaminants of Concern

Activity/Use/Event	Contaminants of Potential Concern	Comments
On-Site Sources		
Former agricultural uses	Fertilisers (Ammonia, nitrogen and metals) and pesticides (OCP and OPP).	The assessor reports that there were no signs of chemical storage at the site; the Auditor similarly did not note the presence of chemicals at the site during his inspection.
Imported fill, stockpiles	Metals and PAHs	Minor amounts of possible fill were noted in the test-pits and evidence of disturbed ground in the vicinity of the dams.
Illegal waste dumping	Metals, PAHs and TPH	An area of an abandoned vehicle exhibited signs of oil staining on the ground. Most dumped materials observed by the Auditor appeared to be Solid Inert Waste.
Dwelling, current and former sheds and outhouses.	Asbestos containing building materials.	Asbestos was confirmed to be present during the site inspections.
	Storage of fertilisers (Ammonia, nitrogen and metals) and pesticides (OCP and OPP)	The assessor reports that there were no signs of chemical storage at the site; the Auditor similarly did not note the presence of chemicals at the site during his inspection.
Off-Site Sources		
CTL - Prescribed Industrial Waste Landfill (adjacent land-use).	LNAPL and dissolved phase plume in groundwater containing a range of contaminants including salt, nitrogen oxides, metals, chlorinated hydrocarbons	Environmental Audit (s53V) on the landfill and environs reports contamination of groundwater with dissolved phase plumes that have migrated beyond the boundary of the landfill.
	Landfill gas (methane, carbon dioxide and trace gases).	Landfill gas is monitored regularly at the boundary of the landfill. The presence of landfill gas was also investigated during the soil vapour testing.

Further detailed information on site history and uses and potential areas of environmental concern and related contaminants of concern can be found in the Golder (2012b) and Kleinfelder (2013e).

6.2.2 Secondary Sources

Secondary sources for the current condition of the site are likely to include:

- Affected surface soils (<1m depth) by contaminants in soil
- Dissolved groundwater plume (emanating from sources off-site)
- Soil vapours emanating from impacted groundwater.

Relevant off-site (i.e. at closed PIW landfill) secondary sources for the current condition of the site are likely to include:

- Residual and free product held in soil “reservoirs”, such as pores and voids in the landfill cells and fractures or voids in the Older Volcanics rock, in the unsaturated zone.
- Residual and free product in the smear zone.
- LNAPL plume at the capillary fringe/water table.
- Soil vapours emanating from impacted groundwater.

6.3 Potential Migration Pathways

An assessment of the migration mechanisms and pathways for contaminants in each phase and media is required in order to evaluate the adequacy of the current state of knowledge. Potential migration mechanisms noted below are conditions (historic and/or current) that may promote the movement of groundwater, and/or soil vapour beneath the site.

Potential migration mechanisms include:

- Wind Erosion and atmospheric dispersion of affected surface soils
- Leaching of contaminants in surface soils and migration through unsaturated zone into groundwater and transport in groundwater
- Deeper migration of impacted groundwater (i.e. deeper aquifers).
- Transport in groundwater from off-site sources (i.e. closed PIW landfill)
- Soil vapour in unsaturated soil following partitioning from groundwater and migration through unsaturated soil to the surface.

The following types of migration pathways have been identified at the site.

Natural

- Root and borrow holes from vegetation or animals, likely found within surface fill or in surface weathered soil horizon.
- Desiccation cracks in clay rich surface soil are a possible pathway of contaminants from the surface
- Fractures, joints and contiguous voids in Newer and Older Volcanics (NV and OV) basalts identified in bore logs as discussed in Kleinfelder (2013e) and summarised here in Section 5.2.
- Clay lenses (paleosols) commonly occurring in the NV and OV represent discontinuities between multiple volcanic flows.
- Discontinuities between sediment layers from deposition (e.g. bedding planes) in the Brighton Group and Werribee Formation sediments
- Fractures, joints and bedding planes in the Silurian Bedrock.

Anthropogenic

- Underground utilities. The potential for this pathway is most likely insignificant as the site has primarily been used for agricultural purposes. There is a former Victoria Street Homestead however underground utilities there are likely to be limited.
- Monitoring wells and boreholes (providing vertical interconnection between separate aquifer units or between the surface and the aquifer).
- Surface drainage features. These are considered to be unlikely migration pathway as there have not been any documented spills at the site.

6.4 Potential Exposure Pathways and Receptors

6.4.1 Exposure Routes

Potential exposure routes for receptors at the site include:

- Dermal contact.
- Ingestion.
- Inhalation.

Dissolved phase impacted groundwater has migrated from an off-site source (i.e. closed PIW landfill) and is migrating upwards vertically as a vapour through the soil profile.

6.4.2 Human Receptors

Direct Contact with Soil

Potential receptors and exposure routes from *soil contamination* are:

- **Commercial Workers and Site Visitors:** Visitors or workers at the site including maintenance workers (dermal contact, incidental ingestion and inhalation of dust).
- **Intrusive Workers:** Workers engaged in excavation or maintenance/intrusive work often associated with underground services or construction (dermal contact, incidental ingestion and inhalation of dust).

Direct Contact with Groundwater

Potential receptors and exposure routes from *groundwater contamination* are:

- **Bore Users:** extracting groundwater from bores installed in the local aquifer due to the known migration of contamination. The assessment has shown that there are no water supply bores located within 2 km of the site.

Inhalation of Soil Vapour and Ground Gases

Potential receptors and exposure routes from *impacted soil vapour/ground gas*:

- **Current Workers and Site Visitors:** Adults working or visiting the site (inhalation, asphyxiation and explosion).
- **Commercial and Maintenance Workers or Visitors of Future buildings:** Adults visiting or working in business or commercial buildings to be constructed (pathways: inhalation, asphyxiation and explosion).
- **Excavation and Maintenance Workers:** Workers engaged in excavation or maintenance/intrusive work often associated with underground services or construction (pathways include inhalation, asphyxiation and explosion).

6.4.3 Ecological Receptors

Potential ecological receptors and exposure routes from *groundwater contamination*:

- Aquatic ecosystems (invertebrates, fish, plants and other ecological receptors) in nearest surface water body (i.e. Moonee Ponds Creek) via contact with or ingestion of contaminated groundwater.

6.4.4 Summary of Exposure Pathways and Receptor

In the Auditor's opinion, commercial/industrial workers and intrusive workers on-site are the most likely exposure group relevant to any assessment of risk. The relevant exposure pathway is associated with inhalation of vapours migrating from impacted groundwater.

Other pathways to be considered are:

- Inhalation of soil through dust/particulates.
- Ingestion of soil or groundwater through handling/use.
- Dermal absorption through handling (soil and groundwater).
- Inhalation of landfill gas (for example carbon dioxide component), from off-site contamination migrating onto the site.

6.5 Soil Contamination

The assessment of soil contamination was completed in several stages between 2012 and 2013 (see Section 3.2.1). Additional investigations, discussed separately below, have been undertaken to investigate the presence of asbestos, lead, two stockpiles of soil and an area where a vehicle was abandoned.

The range in sample concentrations reported for compounds detected in the soil is shown in Table 6-2. Soil contamination at the site is considered to be limited based on a total of 84 soil samples collected over two separate field programs by Golder and subsequently Kleinfelder.

Table 6-2: Soil Results for Detects from 2 Separate Field Sampling Events.

Compound	Number of Samples	Number of Detects	Minimum	Maximum
TPH C10-C34	45 (34)	16	50	270
Polyaromatic Hydrocarbons		2	4.1	9.3
Benzo(a)Pyrene		2	0.6	0.8
Arsenic	74 (34)	38	2.2	14
Barium		34	10	730
Beryllium		18	1	3
Boron		5	11	26
Cadmium		1	0.4	0.4
Total Chromium		74	9	115
Cobalt		65	2	51
Copper		70	5.2	43

Compound	Number of Samples	Number of Detects	Minimum	Maximum
Lead		59	5.1	440
Manganese		74	31	1200
Mercury		5	0.1	0.3
Nickel		72	3	110
Vanadium		74	19	190
Zinc		71	6.6	194
Notes:				
1. Values in brackets represent the number of samples collected and analysed for the compound by Kleinfelder (2013e).				
2. Results for polychlorinated biphenyls were not identified in Appendix B of Kleinfelder (2013e).				

It was reported that Human Health Investigation Levels (HIL) for commercial/industrial workers (HIL-F) were not exceeded for either organic or inorganic compounds (Kleinfelder 2013e). Ecological Investigation Levels (EIL) were exceeded for four metals, however these exceedances were attributed to background levels and is discussed further below.

The Auditor's views of risks from land contamination are considered in Section 9.

6.5.1 Organic Compounds

The majority of organic compounds were reported at levels less than the limit of reporting including monoaromatic hydrocarbons, polychlorinated biphenyls, chlorinated volatile hydrocarbons, phenolic compounds, organochloride and organophosphate pesticides, herbicides and the TPH C₆-C₉ fraction.

The following organic compounds were reported at levels greater than the limits of reporting:

- TPH C₁₀-C₃₄ fraction; and
- Poly Aromatic Hydrocarbons (PAH) including benzo(a)pyrene (BaP).

The TPH C₁₀-C₃₄ fraction was identified in 16 of 45 natural soil samples and considered by (2013e) to be "*reflective of naturally occurring organic content in topsoils*". This is based on a correlation between the Total Kjeldahl Nitrogen (TKN) values and organic content as well as observing a large reduction in Total Recoverable Hydrocarbons (TRH) following silica gel clean-up of sample extracts in the laboratory.

TPH C₁₀-C₃₄ fraction and Polyaromatic Hydrocarbons (PAH) were also identified in a sample of soil identified as "fill" from TP117. It is generally expected that the Toxicity Equivalent Factor (TEF) approach would be used to calculate a Toxicity Equivalent (TEQ) for Benzo(a)pyrene, however this has not been conducted by the Assessor as the assessment was carried out in accordance with the NEPM (1999) which applies until mid May 2104 when the NEPM amendment of 2013 applies; this calculation and comparison has been completed in the Auditor's assessment of risks from Land Contamination in Section 9.3.2.

6.5.2 Inorganic Compounds

Three metals (manganese, nickel and vanadium) were reported at levels that exceeded EILs according to the Assessor (Kleinfelder 2013e, Section 7.6). It is noted that a fourth metal, Barium, was identified by Kleinfelder (2013e, Table 9 Section 8.2) to also exceed EILs.

Kleinfelder (2013e) has concluded that beneficial uses associated with ecological use are unlikely to be precluded as these metals are present within the background range for these compounds. The maximum manganese concentration (1200 mg/kg) exceeded both the EIL (500 mg/kg) and typical background concentrations from NEPC (1999, 500 mg/L) however it is less than manganese concentrations in basalt rock (2,200 mg/kg) from which the site soil is derived. The average manganese concentration (272 mg/kg) is below the EIL for this compound.

Further investigation of lead in soil was conducted by the Assessor following the identification of elevated lead in an Auditor verification sample. Lead concentrations from subsequent sampling by the Assessor continued to exceed criteria to the east and south of TP147 with a maximum concentration reported at 1780 mg/kg. The lead impacts at TP147 were delineated laterally to be within the footprint of the former homestead (an area of approximately 5 m x 3 m) and restricted vertically to shallow soils (<1m). This soil was remediated by excavating 12 m³ of soil which was disposed to landfill as waste Category C contaminated soil. Soil classified as Fill Material from an on-site stockpile (see Section 6.5.5) was used as backfill.

6.5.3 ACM Site Investigation

Asbestos containing material (ACM) in the form of cement bonded sheeting was identified at the ground surface in the vicinity of the former homestead and shed (Kleinfelder 2013a). The source of the ACM is attributed to wall cladding of the shed with additional (unused or spare) sheeting also present. Cement-bonded material (100m²), fibro-cement sheet (7m²) and vinyl wall covering also containing ACM were removed from the site and disposed of to an EPA licensed landfill.

The Assessor reports that fill identified in an in-ground brick-lined well was also found to contain ACM as it included materials from demolition of the homestead (such as bricks and rubble). This fill was removed, disposed off-site to a licensed EPA facility and replaced with soil classified as clean fill from an on-site stockpile (see Section 6.5.5).

6.5.4 Vehicle Crash Site

A small amount of oil staining was identified in soils following the removal of an overturned vehicle which was abandoned on the site in September 2013 (Kleinfelder 2013d). There were no detectable levels of monocyclic aromatic hydrocarbons (MAH), PAH or TPH fractions in the single sample taken.

6.5.5 Stockpiles

A stockpile (60 m³) of silty clay soil located on the eastern boundary is the remnants of material used for a land fill cap completed at the adjacent CTL (Kleinfelder 2013d, Appendix G). This stockpile was characterised (3 samples) as "fill material" for the purpose of backfilling at the site and disposal of remaining soil. Soil from this stockpile was used as backfill at the following locations:

- The site of Lead contamination (Section 6.5.2).
- In-ground brick-lined well/cistern (Section 6.5.3).
- The vehicle crash site soil due to staining of soils (see Section 6.5.4).
- Two former test pit locations TP112 and TP124 where the surface (previously backfilled) has sunk (Kleinfelder 2013d).

6.5.6 Summary of Soil Contamination

In summary soil contamination is associated with the following compounds. The extent of soil contamination is discussed in Section 9:

- TPH (C₁₀ to C₃₆).
- PAH (benzo(a)pyrene and total PAHs).
- Metals: barium, lead, manganese, nickel and vanadium.

6.6 Groundwater Contamination

The assessment of groundwater contamination was completed in several stages between 2012 and 2013 (see Section 3.2.2).

The groundwater bores that are most significantly impacted by organics (i.e. chlorinated solvents) are located along a south-east trend-line, as shown in Figure 4, Appendix A. This trend extends from the western boundary (adjacent to Closed Tullamarine Landfill site) to the eastern site boundary, consistent with the interpreted groundwater flow direction. The distribution of contaminants has been evaluated with respect to the site geology, as well as migration potential and pathways. Most of the organics contamination is in the Older Volcanics Aquifer (OVA), screened approximately 30 m below ground surface. It is anticipated that the OVA has relatively low permeability, allowing only a slow groundwater flow rate.

Groundwater contamination and risks are discussed further in Section 10, including results that exceeded the relevant criteria.

6.6.1 Plume Extent and Stability

The plume extent appears to be generally stable with some bores showing decreasing contaminant concentrations and others slightly increased concentrations. This plume is subject to on-going monitoring by the party responsible for the aftercare of the CTL (Transpacific Cleanaway Pty Ltd) which provides an opportunity for periodic review of the stability of the plume.

6.6.2 Evidence of Degradation

Degradation of TCE appears to be occurring, with daughter breakdown products (VC, DCE and DCA) present in the groundwater at the site. TCE is present in concentrations exceeding the assessment criterion in bores near the landfill site, but decreasing in the direction of groundwater flow to the east. Similarly, concentrations in the daughter products decrease in the down-gradient bores.

6.7 Landfill Gas Contamination

The assessment of landfill gas at the site was completed as part of works completed for the adjacent Closed Tullamarine Landfill and was also monitored on-site as part of soil vapour investigations completed by the Assessor (see Section 3.2.3).

Given that the adjacent CTL is only partially lined and received bio-degradable wastes, there is some potential for LFG generation and migration of LFG beyond the landfill boundary.

The CTL no longer receives waste, has been rehabilitated and is in the aftercare management phase (including the extraction and destruction of LFG). Kleinfelder (2013b, after Transpacific,

2012) reports that peak LFG generation occurred between 1990 and 1994 with gas generation during this period to be approximately 3,000 tonnes per year.

Kleinfelder (2013b) further reports that site specific data suggests that the site in “late stage 4” of gas generation (assumed to be the equivalent of “phase 4” of Farquhar and Rovers (1973) diagram of LFG production phases reproduced in Figure 6-1) and therefore LFG generation will continue to decrease over time. The LFG extraction system (installed in 2011) recovered 662 tonnes of LFG in 2011 and 616 tonnes in 2012 (equivalent to 225 and 209 m³/hr, respectively) (Kleinfelder, 2013b). This is considered to be a low LFG generation rate for a landfill of this size when considered in the context of Table 6.5 of the EPA Publication 788.2 Best Practice Environmental Management *Siting Design, Operation and Rehabilitation of Landfills* (“the BPEM”) (reproduced as Table 6-3 below) which discusses LFG treatment options for landfill gas generation over a range of generation rates.

Table 6-3: Potential LFG Treatment Technologies (EPA, 2010)

Landfill gas generation rate	Potentially suitable landfill gas treatment technologies
> 1000 m ³ /hr	<ul style="list-style-type: none"> ● Combined heat and power generation ● Substitute fuel ● Power generation ● Intermittent use and off-time flaring ● High-temperature flaring
> 250 m ³ /hr – < 1000 m ³ /hr	<ul style="list-style-type: none"> ● Power generation ● Intermittent use and off-time flaring ● High-temperature flaring ● Low-calorific flaring
> 100 m ³ /hr – < 250 m ³ /hr	<ul style="list-style-type: none"> ● Power generation ● High-temperature flaring ● Low-calorific flaring ● Other oxidation and discharge (e.g. passive flares, bio-filters, bio-cover)
< 100 m ³ /hr	<ul style="list-style-type: none"> ● Other oxidation technology and discharge (e.g. passive flares, bio-filters, bio-cover)
Note: Table adapted from EPA Victoria Best Practice Environmental Management (BPEM) Publication 788.2 Siting, Design, Operation and Rehabilitation of Landfills	

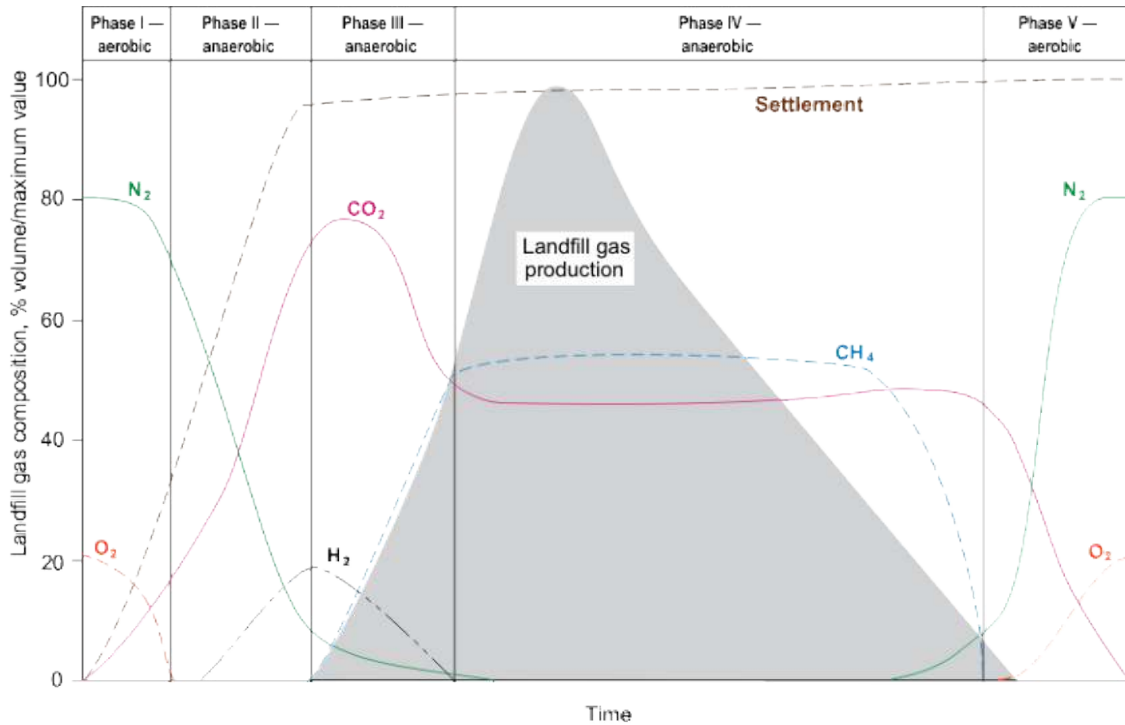


Figure 6-1: LFG Production Phases (Farquhar and Rovers, 1973)

The LFG Assessment (Kleinfelder 2013b) completed at the area of the eastern boundary bores (OEBs) did not indicate the presence of methane during the monitoring period. Concentrations of carbon dioxide were detected up to 7.4 % v/v with both negative and positive flow recorded from the bores; the highest positive flow was 10 L/hr.

The Assessor suggests that the observed fluctuations between positive and negative flow rates may be driven by operational variations of the on-site LFG extraction system (Kleinfelder 2013b).

The data would suggest that there is a potential for LFG to migrate beyond the boundary however monitoring of the soil vapour bores at the site did not indicate the presence of methane with carbon dioxide present in the range of 0.0 to 1.6 % v/v with low rates of flow (-2.5 to 1.4 L/hr).

Transpacific has also conducted fugitive emissions assessments on the landfill and in infrastructure (buildings, stormwater and service pits) within the Landfill boundary as recently as May 2013 which also did not indicate the presence of any methane. The surface emissions assessments are presented within the Assessor's *LFG Risk Assessment* report which is provided in Appendix E of this Audit report.

The risk posed by LFG is discussed further in Section 9.

6.8 Soil Vapour Contamination

The assessment of soil vapour contamination was completed in several stages between 2012 and 2013 (see Section 3.2.4).

As a result of groundwater contamination (see Section 6.6) an investigation was undertaken to identify the potential presence of volatile organic hydrocarbons in soil-vapour (see Section

3.2.4). The maximum concentration for compounds detected in soil-vapour taken from nine implants at five soil vapour bore locations (V01 to V05) is shown in Table 6-4. The contaminants identified are discussed here in the following groups:

- **Mono Aromatic Hydrocarbons:** Benzene, Toluene and Xylene were identified in implants at each soil-vapour bore location but it was not correlated with depth hence their presence is unlikely to be associated with groundwater contamination beneath the site. Trimethyl benzene was also reported in one result from a shallow implant.
- **Petroleum Hydrocarbon Fractions:** The maximum TPH C₆-C₁₀ fraction was reported (59.6 mg/m³) in the deep implant (23 m) of soil-vapour bore V01. This fraction was below levels of reporting (0.17 mg/m³) in shallower implants of this bore indicating significant attenuation of soil-vapour. The maximum TPH C₁₀ - C₁₂ fraction was identified in most implants at similar concentrations (up to 2.1 mg/m³) also indicating a source other than groundwater. Note that a number of compounds from this fraction (such as hexane, cyclohexane and heptane) were reported separately from this fraction but are not shown in Table 6-4).
- **Chlorinated Hydrocarbons:** A number of chlorinated hydrocarbons (CHC) including trichloroethylene and vinyl chloride were identified at their maximum concentrations in the deep implant of soil-vapour bore V01. Attenuation of one to two orders of magnitude is seen for most CHC in soil-vapour bore V01 from the deep implant (at 23m depth) to the middle implant (at 14m depth). This indicates groundwater to be the source of the CHCs, as the deep implant sits immediately above the water table. Most chlorinated compounds are below levels of reporting in the shallow implants (at 3 m depth) indicating attenuation of multiple orders of magnitude.
- **Other Hydrocarbons:** A variety of other compounds including ketones (acetone, 2-butanone, 4-methyl-2-pentanone) and alcohols (Ethanol, t-butyl alcohol) were also identified in soil-vapour. Data from soil vapour bore V01 appears to show attenuation up to one order of magnitude from the deep implant (at 23 m depth) to the shallow implant (3 m depth) however it was the opposite in soil-vapour bore V02 implants. The source of these contaminants is uncertain.

Table 6-4: Maximum Soil-Vapour Concentrations (mg/m³)

Compound	V01			V02			V03	V04	V05
	3	14	23	3	14	25	3	3	3
<i>Petroleum Hydrocarbons</i>									
Benzene	3.4	<LOR	0.173	0.41	0.024	0.12	0.013	5.4	0.98
Toluene	0.77	0.09	0.13	0.11	0.03	0.09	0.08	1	0.24
Xylenes	0.058	<LOR	<LOR	<LOR	<LOR	0.0066	0.0076	<LOR	0.0067
1,2,4-Trimethylbenzene	0.0096	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
TPH C ₆ - C ₁₀ Aliphatic ¹	<LOR	<LOR	59.6	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
TPH C ₁₀ - C ₁₂ Aliphatic	1.5	<LOR	1.4	<LOR	1.7	1.3	2.1	1	2.1
<i>Chlorinated Hydrocarbons</i>									
Bromodichloromethane	<LOR	<LOR	<LOR	<LOR	0.016	<LOR	<LOR	<LOR	<LOR
1,1-dichloroethene	<LOR	0.725	18.9	<LOR	<LOR	0.094	<LOR	<LOR	<LOR
Vinyl Chloride	<LOR	0.021	<LOR	<LOR	<LOR	0.0048	<LOR	<LOR	<LOR
Chloroform	0.019	0.05	<LOR	0.016	0.14	0.018	0.012	<LOR	0.092

Compound	V01			V02			V03	V04	V05
1,3-dichlorobenzene	0.15	<LOR	0.076	<LOR	0.056	0.04	0.13	0.13	0.088
Trichloroethene	<LOR	0.972	50.9	<LOR	<LOR	0.186	<LOR	<LOR	<LOR
trans-1,2 Dichloroethene	<LOR	0.04	1.78	<LOR	<LOR	0.064	<LOR	<LOR	<LOR
Freon 12 (Dichlorodifluoromethane)	<LOR	0.055	0.345	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
1,1-dichloroethane	<LOR	<LOR	0.13	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
cis-1,2-dichloroethene	<LOR	<LOR	0.48	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
1,2-dichloroethane	<LOR	<LOR	1.28	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
1,1,2-trichloroethane	<LOR	<LOR	2.45	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
Tetrachloroethylene	<LOR	0.515	14.8	<LOR	<LOR	0.009	<LOR	<LOR	<LOR
<i>Other Hydrocarbons</i>									
4-methyl-2pentanone	0.012	<LOR	<LOR	<LOR	<LOR	<LOR	0.012	0.019	<LOR
Acetone	0.098	0.26	0.6	0.094	0.082	0.96	0.1	0.083	0.09
Carbon disulfide	<LOR	<LOR	<LOR	0.059	0.1	0.019	<LOR	<LOR	<LOR
2-Propanol	<LOR	0.15	0.46	0.065	0.54	0.082	0.016	0.076	0.03
2-butanone	<LOR	<LOR	<LOR	0.022	0.028	<LOR	<LOR	0.028	<LOR
Ethanol	0.22	0.072	0.31	0.16	0.087	0.1	0.08	0.19	0.14
t-Butyl Alcohol	0.018	0.074	0.19	<LOR	0.02	<LOR	0.019	0.032	<LOR
Tetrahydrofuran	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.0041
Note:									
1. A number of compounds from this fraction (hexane, cyclohexane, heptane etc. were reported separately however they are not shown in this table.									

In summary, a number of volatile organic compounds have been identified in soil-vapour at the site. The source of these vapours is:

- Groundwater contamination for TPH C6-C10 fraction and the majority of the chlorinated hydrocarbons including trichloroethylene, tetrachloroethylene, dichloroethanes, dichloroethenes and trichloroethanes.
- Uncertain for the monoaromatic hydrocarbons and other volatile organic hydrocarbons such as ketones and alcohols. There are no potential sources of contamination on-site (based on site history and investigations) that have been identified to explain the presence of these compounds.

The results of the soil vapour sampling are shown in Table B1, Appendix B.

A screening assessment of risk is conducted for all these compounds in Section 8 (human health) and Section 9 (beneficial uses and ecosystems) of this Audit report.

6.9 Receptors Potentially Exposed

Receptors potentially exposed to contamination located on or sourced from the site are summarised in Table 6-5. These receptors are based on the conceptual site model prepared by the Assessor and shown in this Audit report in Figure 3-1 and Figure 5-2. Sections 8, 9 and 10 assess the risk to each receptor.

Table 6-5: Receptors Potentially Exposed to the Identified Contamination

Source	Transport Mechanisms	Exposure Route	Resident		Open Space User	Commercial Workers, Visitors and Maintenance Workers		Intrusive Worker	
			On-site	Off-site	On-site	On-site	Off-site	On-site	Off-site
Affected surface soils (<1 m depth)	Wind, erosion and atmospheric dispersion	Inhalation of dust							
		Oral ingestion							
		Dermal contact							
		Uptake via plants							
	Volatilisation and enclosed space accumulation	Inhalation of vapours							
Affected subsurface soils (>1 m depth)	Volatilisation and enclosed space accumulation	Inhalation of vapours							
Dissolved phase groundwater plume	Extraction of groundwater for use	Inhalation of vapour			○	○	○	○	○
		Oral ingestion			○	○	○	○	○
		Dermal contact			○	○	○	○	○
	Volatilisation and enclosed space accumulation	Inhalation of vapours			○	✓	✓	✓	✓
Phase Separated Hydrocarbons (i.e. LNAPL)	Extraction of groundwater for use	Inhalation of vapour			○	○	○	○	○
		Oral ingestion			○	○	○	○	○
		Dermal contact			○	○	○	○	○
	Volatilisation and enclosed space accumulation	Inhalation of vapours			○	○	○	○	○

✓: Complete or major pathway, ○: Partially complete or minor pathway, **Blank Cell**: No pathway or negligible pathway

7 SITE REMEDIATION WORKS

Minor remedial works at the site occurred in September 2013 (Kleinfelder 2013a, 2013d) and are described here as a single phase split in to six sections, summarised in Table 7-1. Soil from two on-site stockpiles, classified as fill (Kleinfelder 2013d), was used to backfill during site remediation works where required.

Table 7-1: Summary of Remedial Works

Phase	Description	Reference
1A	Asbestos clearance	Kleinfelder (2013a)
1B	Lead Clearance	
1C	Vehicle Crash Site clearance	Kleinfelder (2013d)
1D	Inert Waste clearance	
1E	Test Pit Backfill	
1F	Stockpile clearance	

7.1 Phase 1 Remediation

7.1.1 Remediation of Asbestos

Cement bonded asbestos containing material (ACM), identified at the surface in the vicinity of the former homestead and shed infrastructure, was cleared from the site by a Class A licenced asbestos removalist and disposed of to an EPA licenced landfill. This included cement-bonded material (100m²), fibro-cement sheet (7m²) and vinyl wall covering. Fill containing ACM (along with building rubble from the homestead) identified in an in-ground brick cistern was also removed and disposed of. This cistern was backfilled with soil from an on-site stockpile (see Section 6.5.5).

7.1.2 Remediation of Lead

A lead abatement program was undertaken in a limited area of the site after lead was identified by the Auditor to exceed criteria in a limited area of the site (TP147). Lead impacts were delineated and 12m³ of soil was disposed of to landfill as Category C contaminated soil. Soil from an on-site stockpile (see Section 6.5.5) was used as backfill.

The location of the lead-excavation and verification sampling is shown in Figure 8, Appendix A.

7.1.3 Remediation of Vehicle Crash Site

An abandoned vehicle was identified and removed from the site in September 2013. Soil staining as a result of the rolled over vehicle resulted in 1 m³ of soil being removed from an area of 5 m x 2 m to a depth of 0.1 m. The soil was characterised based on a single soil sample and disposed of as fill material. The Auditor notes that soil characterisation was not performed in accordance with Industrial Waste Resources Guidelines (See IWRG702 Soil Sampling) as a minimum of 3 samples should be taken. Soil from a stockpile located on the Eastern boundary of the site (see Section 6.5.5) was used as backfill.

7.1.4 Removal of Solid Inert Waste

Following the Auditor's inspection of the site in which bricks, concrete rubble and timber were identified at two locations in the eastern portion of the site; these materials were removed by the contractor and disposed of to landfill.

7.1.5 Test Pit backfill

Two former test pits (TP112 and TP124) were identified to have sunken and considered, by the Auditor, needed to be backfilled. These former test pits were backfilled with soil from on-site stockpiles and compacted with an excavator.

7.1.6 Removal of Stockpiles

Soil from two stockpiles located on the eastern boundary, classified as clean fill, was used for backfilling operations at the site. This included for the minor remediation works described in this section (e.g. in-ground brick-lined cistern and lead abatement works). It is understood that soil leftover was disposed of to a licensed facility.

8 RISK ASSESSMENT

This section summarises the Auditor's assessment of the risks at the site as documented by the Assessor's reports and additional risk characterisation completed by the Auditor; the Auditor's risk full assessment report is included as Appendix F.

8.1 Drivers for Risk Assessment

The environmental policies in Victoria relevant to any consideration of risk assessment or remediation planning are:

- SEPP *Prevention and Management of Contamination of Land* (2002) ("SEPP PMCL").
- SEPP *Groundwaters of Victoria* (1997) ("SEPP GoV").

SEPP PMCL states in Clause 21(a) that "*where contamination at a site is of a level which precludes a protected beneficial use of the relevant land use, a state of pollution exists and the land must be cleaned up and/or managed so that there is no immediate threat to human health on-site or off-site*".

SEPP GoV characterises groundwater pollution in terms of the beneficial uses of water measured against water quality criteria for various uses of groundwater. The SEPP GoV does not explicitly refer to the possible human health risks arising from inhalation of vapours from contaminated groundwater or LNAPL; the Auditor has therefore considered the potential for harm to human health via this exposure pathway as a component of risk to land and has conducted an assessment of risks accordingly.

8.2 Risk Assessment Process

The Auditor has completed the following steps in forming a view on risks from vapour intrusion at the site:

- Review the Assessor's findings on risk by review of the "*Quantitative HHRA Report, Buffer Land, 140-204 Western Avenue, Tullamarine*" (Golder 2012).
- Additional risk characterisation by the Auditor comprising:
 - Identification of Chemicals of Potential Concern (CoPC).
 - Characterisation of risks for these CoPC.

The methodology employed by the Golder HHRA and Appendix F are consistent with the guidelines of the Australian enHealth Council, and the Australian National Environmental Protection Measure for contaminated sites (NEPC 1999).

8.3 Auditor's Review of the Human Health Risk Assessment

8.3.1 HHRA findings on Human Health Risk from Vapour

A Human Health Risk Assessment (HHRA) was prepared by Golder (2012a) to assess potential health risk for future occupants of commercial/industrial buildings that may be exposure to vapours emanating from groundwater contamination. The future occupants were

assumed to be industrial site workers (indoor and outdoor), site visitors, maintenance personnel and construction personnel⁵.

The Chemicals of Potential Concern (CoPC) identified as potentially contributing to vapour risk from groundwater (see Golder 2012) included the following compounds:

- BTEX
- PAHs
- Chlorinated solvents
- Pesticides
- Fire retardants
- Other solvents

The risks were characterised in the HHRA in terms of whether the adopted guideline values for the CoPC exceeded estimated exposure concentrations. It was concluded in the HHRA that the *“concentrations of chemicals of interest in groundwater were not indicated to generate vapour levels that would exceed generic screening guidelines for ambient air as adjusted for a commercial or industrial land”* (Golder, 2012a).

8.3.2 Auditors findings on the HHRA

The Auditor reviewed the HHRA and was of the view that site-specific soil vapour data would be required to address uncertainties associated with the presence of multiple carcinogens in groundwater and the potential for preferential pathways in fractured basalt beneath the site. Further work was recommended including the installation of soil-vapour bores to confirm the findings of the HHRA.

8.4 Soil Vapour Assessment

Four (4) rounds of soil vapour data was collected at the site by the Assessor and the results provided to the Auditor in Soil Vapour Assessment. 140-204 Western Avenue, Westmeadows Victoria. Kleinfelder (2013c). See Section 3.2.4 for further details of the Assessor’s Soil Vapour Assessment of the site.

An assessment of the soil-vapour data was performed by the Auditor using the following two-step process:

1. Identification of CoPC in soil-vapour
2. Characterisation of risks for CoPC

Consideration was also given by the Auditor to more sensitive land uses for the site in compliance with auditing guidelines.

8.4.1 Identification of CoPC

The Auditor conducted an assessment of risk based on soil-vapour results collected. A screening process was used to identify CoPC in soil-vapour using concentrations from very deep bores (>24 mbgl)⁶. The following chlorinated hydrocarbons were identified as CoPC:

- Chloroform;

⁵ Workers in deep or narrow excavations were assumed to be protected by *“additional occupational health and safety controls regardless of any potential contamination issues”*. (Golder 2012a)

⁶ This is a conservative measure consistent with a screening assessment used to identify CoPC present just above the groundwater level (water table).

- 1,3-dichlorobenzene;
- Trichloroethene;
- 1,2-dichloroethane;
- 1,1,2-trichloroethane; and
- Tetrachloroethene.

It is noted that the maximum concentrations of compounds identified in soil vapour from bores at 24m depth are used in this screening level assessment. In many cases this did not reflect the lower concentrations of the compounds screened in soil-vapour near the surface.

8.4.2 Assessment of Compounds of Potential Concern.

The Auditor has estimated risks associated with potential exposure to these CoPC as set out in the latest enHealth guidelines (enHealth 2012). The risks calculated for the potential future commercial workers are considered negligible.

Risks calculated are based on soil-vapour concentrations at 24 mbgl. The CoPC were not detected at shallow depth (approximately 3 mbgl) therefore it is most likely that indoor air concentrations in a hypothetical building on the site would be lower than modelled using a vapour intrusion model and potentially zero, i.e. not measurable in the indoor environment. Therefore, risks are considered negligible for commercial workers that may occupy buildings. Similarly, the risk due to potential vapour intrusion would be negligible or non-existent for more sensitive receptors such as residents off-site to the east and the occupants of a hypothetical residence on-site.

8.4.3 Consideration of More Sensitive Site Uses.

In accordance with the auditing guidelines, the Auditor has also considered the possibility that the site may be used for a more sensitive use, such as residential (albeit unlikely due to the proposed zoning). The calculated risks for a hypothetical resident could increase by as much as a factor of 10, however would continue to be below levels of risk considered acceptable (assuming worst case exposure scenario). Therefore the vapour intrusion risks are considered acceptable and negligible for a hypothetical resident who is assumed to occupy a residential building if constructed on the site. Further, risks are most likely considerably lower than estimated here due to the conservative nature of the assessment.

8.5 Auditor's Findings on Risk

The potential for risk from soil vapour, and direct contact with groundwater and soil to commercial workers has been estimated and it is concluded that the site does not present a risk to occupants of the site inside or outside of buildings potentially proposed for land uses permitted at this site, i.e. commercial industrial. An assessment has also been included for potential risks to a hypothetical occupant of a residential building if constructed at the site, despite this more sensitive land use not being permitted at the site. This assessment also indicates that current occupants of residential properties to the east of the site do not have any unacceptable risks due to vapour intrusion from contamination identified in groundwater. Contamination in groundwater beneath the Audit Site which originates from the CTL is subject to on-going monitoring and management by the parties responsible for aftercare of the CTL.

9 LAND CONTAMINATION AND RISKS

This section summarises the Auditor's assessment of the significance of the contamination documented by the Assessor's reports, and justifies the level of certification provided in this case.

This chapter has been written with the assistance of the Auditor's EPA Victoria approved expert support team member, Peter Gringinger.

9.1 Beneficial Uses to be Protected

The beneficial uses considered during this audit were those which were conducive to the use of the land for public benefit, welfare, safety, health and aesthetic enjoyment, and include all those listed in the SEPP *Prevention and Management of Contamination of Land* (2002) incorporating Variation G 39 (26 September 2013) "SEPP PMCL". They are:

- Maintenance of Ecosystems (Natural, Modified and Highly Modified Ecosystems).
- Human Health.
- Buildings and Structures.
- Aesthetics.
- Production of Food, Flora and Fibre.

The land uses that may be relevant to the protection of all or some of those beneficial uses are:

- Parks and Reserves.
- Agricultural.
- Sensitive Use (High Density)⁷.
- Sensitive Use ("Other")^{7,8}.
- Recreation/Open Space.
- Commercial.
- Industrial.

Table 9-1 summarises the protected beneficial uses and relevant land uses defined in the SEPP PMCL. The "ticks" in the table mean that the respective beneficial use is protected for each land use under the policy.

⁷ While high density can be defined as a setting in which there is "minimised access to soil" by occupants, "other" residential settings may include medium and low density residential settings in which there may be more frequent access to soil in private garden areas. (See EPA Publication 759.1, August 2007, Appendix 4).

⁸ Sensitive Use as defined in the SEPP *Prevention and Management of Contamination of Land* (June 2002) means "a residential use, a child care centre, a pre-school centre or a primary school as defined in Minister's Direction no. 1 as amended from time to time under section 12(2)(a) of the Planning and Environment Act 1987"

Table 9-1: Protected Beneficial Uses of Land

Beneficial Use	Land Use							Explanation
	Parks & Reserves	Agricultural	Sensitive Use (High density residential)	Sensitive Use (Other)	Recreation / Open space	Commercial	Industrial	
Maintenance of Natural Ecosystems	✓							Contamination must not adversely affect the maintenance of relevant ecosystems. Natural ecosystems include parks and forested areas. These are generally undisturbed by human activity and mainly occur in non-urban areas.
Maintenance of Modified Ecosystems	✓	✓		✓	✓			These land uses may contain ecosystems disturbed by human activity but with significant ecosystems remaining. Includes public open space and low density residential allotments.
Maintenance of Highly Modified Ecosystems		✓	✓	✓	✓	✓	✓	These land use areas may contain ecosystems highly modified by human disturbance. These would be expected in any residential, public open space or commercial/industrial area where there are landscaped garden and lawn areas.
Human Health	✓	✓	✓	✓	✓	✓	✓	If persons are exposed directly to soil then their health must be protected. Exposure might occur to residents digging in gardens, workers engaged in excavations for construction or maintenance of underground services. Exposure can also occur from volatile organic vapours migrating through the soil and structures.
Buildings and Structures	✓	✓	✓	✓	✓	✓	✓	Contamination must not cause the land to be corrosive to or adversely affect the integrity of structures or building materials.
Aesthetics	✓		✓	✓	✓	✓		Contamination must not cause the land to be offensive to the senses of human beings.
Production of Food, Flora and Fibre	✓	✓		✓				Contamination of the soil in these land use areas should not affect the quality or yield of produce, or affect the level of an indicator in the food, fibre or flora such that it exceeds the Australian and New Zealand Food Authority Standards Code.

9.2 Contamination Assessment Criteria – Soil

9.2.1 Soil Assessment Guidelines

Table 2 of the SEPP PMCL specifies the “Indicators and Objectives” to be applied to the assessment of land contamination. These objectives refer to the (NEPM) *National Environment Protection (Assessment of Site Contamination) Measure* issued in December 1999 by the National Environment Protection Council (NEPC)⁹.

The NEPM presents guidelines for soil and groundwater in the assessment of site contamination and specifies Investigation Levels at which further assessment of human or ecological risks or management of contamination is required. The human health levels are referred to as HILs, and the ecological levels as EILs. The NEPM EILs are equivalent to the ANZECC B criteria, with the following exceptions:

- The NEPM EIL includes criteria for two additional metals (barium and vanadium) and specifies methyl mercury separately from total mercury;
- ANZECC B specifies criteria for antimony and tin, not included in NEPM;
- The criteria for chromium, copper and lead in the NEPM-EIL are higher than the more conservative ANZECC B levels, and;
- The NEPM also specifies separate criteria for Chromium III and Chromium VI.

The initial screening levels for determining the issue of a CoEA, and therefore, generally the most conservative of these levels, are the EILs, with the exception of lead where HIL ‘A’ is lower than the EIL.

Where these levels do not offer a value for a particular parameter, alternate and equivalent sources of investigation levels are used including:

- ANZECC B (1992);
- Dutch Soil Remediation Circular (2009) (referred to as Dutch criteria), and;
- NSW EPA Guidelines for Assessing Service Station Sites (1994).

“Investigation levels” are not intended to be interpreted as “maximum permissible levels”, “clean up levels” or “safe levels”, rather, they are levels at which further investigation or assessment should be undertaken to provide assurance that unacceptable contamination does not occur. Subsequent assessment on a site-specific basis often results in higher levels being acceptable. However, since the “investigation levels” are generally set at conservatively low levels, they are often taken to be the acceptable levels.

In accordance with NEPM, the assessment against the criteria differs between ecological and human receptors. For ecological receptors, the data for each point of observation is compared against EIL criteria, whereas for human health, the average for the site (or domain of interest) is compared against criteria. This is justified on the basis that “plants do not move” whereas animals can move and be exposed to average conditions. The assessment for human health also requires the standard deviation be less than 50% of the HIL criterion, and that the data at any location does not exceed 2.5 times the HIL criterion. If this is exceeded then a “hot spot” of contamination is suspected and requires further investigation.

⁹ This Audit project commenced and had been substantially progressed prior to the release of the NEPM 2013 Amendment (released on 11 April 2013). This Audit is scheduled for completion prior to 16 May 2014 (end date of EPA Victoria 12-month transition period) and therefore the Auditor has continued to reference the NEPM (1999) for the purposes of assessing the risk posed by contaminated land at the site.

The SEPP PMCL (Table 2) specifies the NEPM EILs and HILs as objectives to be met unless a site-specific assessment of risk yields alternative values.

Where results in excess of NEPM EILs (or equivalent criteria) are noted, these are compared with the NEPM Health Investigation Levels (HILs). The site may not qualify for a CoEA if a significant amount of soil at the site exceeds the NEPM EIL criteria, in the absence of a suitable risk assessment. A CoEA is less likely to result where soil exceeds NEPM HIL criteria.

In cases where excess contamination occurs and where further remediation may not occur, a risk assessment to determine site specific criteria or a regime of management of contamination may be required, and may result in the issue of a CoEA or SoEA depending on site-specific situation.

As it is the Auditors' duty to first consider whether a CoEA can be issued, it follows that the assessment must be for all beneficial uses and all land uses.

9.2.2 Site-specific Land Use and Criteria

The current land use of the site is vacant pasture (agricultural). It is proposed to develop the site for commercial/Industrial use following completion of this environmental audit. However, all beneficial uses need to be assessed in this audit.

Therefore, the beneficial uses and assessment criteria commensurate with these uses are:

- NEPM EIL
- NEPM HIL A (residential, including childcare centre)
- NEPM HIL-D (residential with minimal soil access i.e. high-rise apartments)
- NEPM HIL-E (parks, recreational open space and playing fields, includes secondary schools)
- NEPM HIL F (commercial/industrial)

The following sections provide a summary of soil analytical results that exceed NEPM criteria or equivalent.

9.3 Protection of Ecosystems – Land

The intended land use of the site is commercial/industrial use. Therefore, the soil remaining on the site may reasonably be expected to sustain “highly modified” ecosystems in compliance with the SEPP PMCL. It is also noted that the soil condition is such that “modified” ecosystems could also be supported, consistent with more sensitive uses, including residential.

Soil analytical results exceeding the NEPM EIL criteria are shown in Table 9-2 including background levels as provided in NEPC (1999). The results indicate that manganese and vanadium exceeded EILs at the majority of locations listed. Barium, lead, and nickel were also reported at levels above the EIL's. The Auditor agrees with the conclusions provided by Kleinfelder (2013e) in that:

- There is no association between fill and EIL exceedances.
- Barium, nickel and vanadium are well within background ranges of these metals.
- Manganese is also present at background levels. Background level for manganese is given as 850 mg/kg in NEPC (1999) which is lower than the maximum value of

2,500 mg/kg (AV01). The Assessor has argued that manganese is elevated due to the presence of basalt in soil lithology. The Auditor agrees with this assessment and further notes that WHO (2004) provides a range of naturally occurring levels for manganese from <1 to up to 4,000 mg/kg.

- Lead has exceeded EILs in the vicinity of TP147. This impact has been delineated vertically and laterally, removed (and disposed) and backfilled with clean fill (see Section 6.5.2).

Table 9-2: Soil Analytical Results Exceeding Protection of Ecosystems Criteria

Sample ID	Strata	Analyte and NEPM EIL Criteria (mg/kg)				
		Barium	Lead	Manganese	Nickel	Vanadium
		300	600	500	60	50
Background Levels (NEPC 1999)	-	100-3000	2 - 200	850	5 – 500	20 - 500
TP101_0.05	Silty Clay	80	22	363	24	71
TP102_0.05	Silty Clay	80	12	590	74	105
TP103_0.05	Sandy Silt	130	16	227	38	104
TP104_0.05	Silty Clay	210	16	586	80	98
TP105_0.05	Sandy Silt	180	24	792	32	66
TP106_0.05	Silty Clay	60	15	689	39	76
TP107_0.05	Sandy Silt	50	45	305	23	64
TP108_0.05	Sandy Silt	40	52	237	18	51
TP116_0.05	Silty Clay	180	54	803	35	59
TP120_0.05	Sandy Silt	70	104	191	21	54
TP123_0.05	Sandy Silt	160	20	420	30	61
TP129_0.05	Sandy Silt	30	23	253	20	51
TP130_0.05	Silty Clay	190	23	528	52	81
TP131_0.05	Silty Clay	260	12	778	44	96
TP132_0.05	Silty Clay	140	19	532	36	67
TP134_0.05	Silty Clay	230	13	656	80	118
BL-TP001/1001	Fill (Silty Clay)	94	87	590	20	41
BL-TP001/1002	Clay	120	8	640	31	38
BL-TP002/1001	Fill (Silty Clay)	190	11	810	31	47
BL-TP002/1002	Fill (Silty Clay)	140	7.3	750	25	42
BL-TP003/1002	Clay	34	<5	180	52	78
BL-TP004/1001	Fill (Silty Clay)	96	440	680	24	43
BL-TP004/1002	Clay	85	88	630	35	41
BL-TP005/1001	Silty Clay	140	11	1,200	28	39
BL-TP006/1001	Silty Clay	59	<5	560	30	50
BL-TP007/1001	Silty Clay	68	<5	570	71	66
BL-TP008/1001	Silty Clay	94	8.5	640	36	55
BL-TP009/1001	Silty Clay	55	<5	590	56	59
BL-TP010/1001	Clayey silt	69	<5	900	110	45
BL-TP011/1001	Silty Clay	190	5.7	1,100	53	61
BL-TP012/1001	Silty Clay	190	<5	230	41	56
BL-TP013/1001	Silty Clay	250	<25	79	52	190
BL-TP014/1001	Silty Clay	36	12	100	15	85
BL-TP015/1001	Silty Clay	30	15	590	19	44
BL-TP017/1001	Silty Clay	180	11	630	29	39
BL-TP019/1001	Silty Clay	<50	<25	320	37	59
BL-TP020/1001	Silty Clay	83	<5	560	30	47
BL-TP021/1001	Silty Clay	89	7.1	470	31	54
BL-TP027/1001	Silty Sand	340	<5	190	11	36
BL-TP028/1001	Silty Clay	29	11	160	33	53
BL-TP030/1001	Fill (Silty Clay)	730	<5	160	44	49
BL-TP031/1001	Silty Clay	25	8.1	670	27	45
BL-TP032/1001	Silty Clay	<50	<25	340	40	64
AV01	-	570	21	2500	42	48

The NEPM EIL criteria for metals are considered conservative and do not reflect the range of sensitivities between different types of plants expected to be grown in different land uses. As the level of metals in soil are considered to be at background levels (as discussed and shown Table 9-2) then these exceedances in soil are not considered to constitute a 'precluded beneficial use'. This applies to the site which is zoned as commercial/industrial land as well as more sensitive beneficial uses (e.g. low density residential with a garden).

Based on the points mentioned above, the protected beneficial use of unmodified, modified and highly modified ecosystems are considered to be not precluded. Protection of Human Health

9.3.1 Soil Results – Inorganics

Lead is the only compound that has been reported at levels greater than NEPM-HIL-F. These exceedances were reported in sample TP147 collected by the Auditor and additional soil samples collected by Kleinfelder (2013a) and used to delineate the lead impacts. The impacted area has been removed, soil disposed of and then backfilled with clean fill (see Section 6.5.2).

Concentrations of lead (one sample) and manganese (one sample) above criteria for residential beneficial uses (NEPM-HIL-A) remain on site, as shown in Table 9-2. The results of statistical analysis are shown in Table 9-3. The average concentrations for both lead and manganese are well below NEPM-HIL-A criteria. Other conditions that need to be met in accordance with guidance from NEPC (1999) are that the standard deviation be less than 50% of the relevant criterion value and that no single value exceeds the relevant criterion by 2.5 times. These conditions have been met therefore concentrations of lead, manganese and other inorganic compounds in soil do not preclude beneficial uses at this site based on human health considerations.

Table 9-3: Statistical Data for Lead and Manganese results in Soil

Analyte	NEPM-HIL-A	Number of Results	Number Exceeded NEPM HIL-A	Max. Conc. (mg/kg)	Mean Conc. (mg/kg)	Median Conc. (mg/kg)	Standard Deviation (mg/kg)
Lead	300	74	2	440 ¹	34	13	68
Manganese	1500	74	1	2,500	408	330	364
1. Concentrations from Lead associated with contamination identified at TP147 are not included. This contamination was remediated (Section 6.5.2).							

9.3.2 Soil Results – Organics

TPH C₁₀-C₃₄ fraction and PAH were reported in soil at levels below NEPM-HIL-F criteria. It is noted that some concentrations of TPH C₁₅ – C₃₄ (maximum 270 mg/kg) have exceeded NEPM-HIL-A criterion of 90 mg/kg for >C₁₆ – C₃₅ aromatic hydrocarbons. Diesel fuels typically contain more than 80% aliphatic hydrocarbons (ATSDR 1995) for which the NEPM-HIL-A criterion is 5,600 mg/kg. Therefore the presence of detectable concentrations of TPH fractions is not considered to exceed criteria for residential beneficial uses.

9.3.3 Asbestos

ACM was observed at the site during the Assessor's and Auditor's investigations in surface soils in a restricted area of the site near the former homestead and shed infrastructure

(Kleinfelder 2013a). The source of the ACM is attributed to building materials (wall cladding) used at the site. ACM was removed and disposed of to an EPA licenced landfill. The presence of ACM was not identified in other areas and was not associated with the presence of fill at the site. Test pit works were conducted following removal of ACM and no further cement bonded ACM was identified indicating it was limited to surface soils only. A hygienist provided a clearance letter for 'no visible asbestos' in the remediation area.

9.3.4 Conclusions for Human Health

Soil contamination identified at the site is minimal and restricted to localised areas. The maximum concentrations for some contaminants (lead and manganese) exceeded the adopted human health criteria for the most sensitive land uses (i.e. residential). Asbestos was also identified in surface soils. Other contaminants identified in soil include TPH C₁₀-C₃₄ and polyaromatic hydrocarbons however these contaminants were present at concentrations below adopted criteria.

The potential risks to human health from these contaminants in soil are considered negligible as:

- Lead and ACM impacts have been removed and validated.
- Exceedances for manganese was considered insignificant based on a statistical assessment.

Considering this, the beneficial use of human health is not precluded at the site for any land use.

9.3.5 Protection of Buildings and Structures

Australian Standard AS3600 (2009) *Concrete Structures*, prescribes a pH guideline of 4 for soils and NEPM (1999) sets a sulphate level of 2,000 mg/kg for protecting building and structures. Table 6.4.2 of Australian Standard AS2159-2009 *Piling – Design and Installation* shows the severity of soil sulphate concentrations and pH on concrete.

The pH of the soils at the site was found to range from 6.4 to 9.7. Soil of this pH is not likely to present a corrosion hazard to buildings and structures. Four samples were analysed for Sulphate (as sulphur) by Golders in the preliminary assessment of contamination. The maximum concentration recorded was 12 mg/kg in TP003_0.2-0.3; the three others samples were below the LOR (10 mg/kg).

Acid sulphate soils were not suspected at this site due to the geological and geomorphological characteristics of the site. Therefore, testing was not performed for acid sulphate soil at the site. Based on the above and in consideration of sulphate concentrations identified at the site the Auditor considers that soil characteristics are unlikely to impact buildings and structures and this beneficial use is not precluded.

The protection of buildings and structures from LFG is addressed separately in Section 9.9.

9.4 Protection of Aesthetics

The objective for "Aesthetics" in the SEPP *Prevention and Management of Contamination of Land* (2002) is that "contamination must not cause the land to be offensive to the senses of human beings." The beneficial use of aesthetics is protected for commercial land uses (but not industrial land uses) therefore the Auditor has included this beneficial use in his assessment.

The Assessor reports that fill was recorded at two main locations at the site:

- Five test-pits, TP116 to TP121 in the vicinity of the former site infrastructure at the western side of the site.
- Test-pit TP030 in the northern part of the site.

Shallow rubble and brick was reported in five test-pits excavated by Golder (2912b) located in the vicinity of the former farm infrastructure in the west of the site. The Assessor reports that the fill comprised of disturbed silt and clay materials ranging from 0.2 to 0.7 depth which appears to confirm the scattered nature of minor amounts of other building demolition debris observed on the surface at the site.

The majority of the site has been for agricultural and grazing purposes only. The Auditor conducted an inspection of the site and observed areas of debris (mostly solid inert wastes) at discrete locations around the site, which, as reported in the (Kleinfelder 2013a and 2013d) *Asbestos and Lead Abatement Report* and *Vehicle Rollover Validation and Waste Removal Report*, have now been removed. The Assessor concludes that the impact of scattered material and debris at the site to be low.

The Assessor also reports that no soil staining or contaminant odours were recorded in test pits and field screening of surface soil samples with a PID reported volatile organic compounds (VOCs) at less than 10 ppm (Kleinfelder, 2013e). Staining in soil was identified due to the recent abandoning of a vehicle. Soil at this location was characterised and removed as fill material (Kleinfelder 2013d). Two rounds of asbestos clearance work has been completed which has been discussed in further detail in Section 7.

Based on the information provided and the clearance and remediation work that has been completed, the Auditor is generally satisfied that the beneficial use for aesthetics is not precluded at the site.

9.5 Production of Food, Flora and Fibre

The SEPP *Prevention and Management of Contamination of Land* (2002) indicates that contamination of land must neither adversely affect produce quality or yield, nor affect the level of an indicator in food, flora and fibre.

Hypothetical, more sensitive uses of the site could include a vegetable garden. Although an unlikely use, soil contamination at the site is negligible and it is unlikely that there would be a detrimental effect on vegetable and/or plants grown on this site.

This beneficial use is not precluded for any land use including commercial and industrial uses,

9.6 Surface Water Impacts

The Auditor must also consider the relevance of potential impacts on surface water bodies (not connected to groundwater) potentially protected by SEPP Waters of Victoria located within the audit area. The Auditor observed a number of small shallow water bodies (shown as Plates 11, 13 and 17 in Photolog01, Appendix C) during the site inspection of 28 August 2013. These would not be protected by the SEPP due to being small scale artificial pondages. The contamination status of the soil and the hydrology of the site indicate that there are no aspects of surface water protection requiring further discussion in this audit report.

9.7 Landfill Gas Risks

The Assessor has considered the potential impacts of LFG from the CCTL on the site in the *LFG Assessment Report* (Kleinfelder, 2013b). The assessment considered LFG monitoring from the OEBs along the eastern boundary of the CTL and soil vapour bores installed at five locations within the site.

The Assessor has opted to screen risks using a 2-stage approach as follows which is generally consistent with industry guidelines:

- **Preliminary Risk Assessment** comprising a qualitative assessment of risks. The Assessor has followed a process to identify the potential sources, pathways and receptors that may influence the risk of landfill gas migration to the site, including the gas generation regime of the Landfill.
- **Generic Quantitative Risk Assessment** comprising calculation of Gas Screening Values (GSVs) based on monitored gas concentrations and flow rates and comparison with minimum standards for the purpose of assessing the need for, and level of, gas protection measures in new buildings. Generally GSVs were calculated assuming the “worst-case” gas scenario.

The Assessor has prepared a summary of the LFG pollutant linkages for the site which are reproduced below in Table 9-4.

Table 9-4: LFG Pollutant Linkages (Kleinfelder, 2013b)

Source Constituents	Source	Exposure Pathways	Receptors
Methane (flammable, explosive)	Landfill Waste Mass	<ul style="list-style-type: none"> • Lateral and vertical migration through sub-surface geology • Accumulation in enclosed spaces off-site (sub floor voids, wall cavities, rooms) 	<ul style="list-style-type: none"> • Offsite residents • Flora • Off-site workers (sub-surface / utility workers)
Carbon dioxide (toxic, asphyxiant)			

The results of the LFG monitoring from the OEBs for the reported period (October 2012 to April 2013) are summarised in Table 9-5.

Table 9-5: LFG Bore Monitoring Summary (Oct. 2012 to Apr. 2013) (Kleinfelder, 2013b)

Implant ID	Screen Location (m)	Screen Formation	Worst-Case Flow Rate (l/hr)	Worst Case Concentration (% v/v) ¹	GSV	Risk Classification
SG01A	2.0 – 8.0	Engineered Fill	5.0	4.3	0.22	Very Low Risk
SG02A	8.5 – 5.5	Newer Volcanics	-19.0	7.4	1.41	Low Risk
SG03A	4.0 – 9.0		-12.6	4.7	0.59	Low Risk
SG04A	3.0 – 6.0		-33.0	6.6	2.18	Low Risk
SG02B	9.5 – 11.5	Brighton Group	-25.0	4.9	1.23	Low Risk
SG03B	12.5 – 14.0		-17.1	6.9	1.18	Low Risk
SG04B	21.0 – 26.0		10.6	1.6	0.17	Low Risk
SG01B	11.0 – 20.0	Older Volcanics	-24.9	4.9	1.22	Low Risk
SG02C	12.9 – 21.9		-30.7	2.1	0.64	Low Risk

Implant ID	Screen Location (m)	Screen Formation	Worst-Case Flow Rate (l/hr)	Worst Case Concentration (% v/v) ¹	GSV	Risk Classification
SG03C	16.0 – 20.0		-21.2	6.8	1.44	Low Risk
Note 1. All results are carbon dioxide concentrations.						

The high variability in flow rates is noted by the Auditor which the Assessor indicates may be driven by operational variations in of the on-site LFG extraction system. GSVs calculated for the OEBs indicate a generally low risk profile at the Landfill boundary.

LFG parameters collected during the soil vapour sampling indicated the highest concentration of carbon dioxide to be 1.6 % v/v. As discussed in Section 3.2.3, no methane was observed during monitoring of both the OEBs and the soil vapour bores.

The LFG monitoring data collected during soil vapour monitoring has also been assessed in the same manner as the OEBs. A “worst-case” GSV of 0.03 for LFG data collected from the soil vapour bores at the site indicates a “very low risk” profile. The LFG Assessment (Kleinfelder 2013b) concludes, in relation to the Audit Site that, *the sub-surface lateral migration of LFG is likely to be restricted by the characteristics of the strata surrounding the landfill. The current risk regime identified at the OEBs does not, therefore, preclude development of land immediately adjacent to the eastern boundary of the site.*

In relation to the potential need for protective measures in buildings, the Assessor makes the following recommendation: *“Given the calculated GSV for off-site soil vapour bores the concentration of CO₂ within the OEB is not considered to pose a risk to off-site receptors and therefore gas protection measures are not required.”*

Based on the data provided, the Auditor is in general agreement with the method of assessment undertaken by the assessor and considers that the monitoring results appear to be representative of site conditions. Given this, the Auditor concludes that there is no significant risk arising to the occupants or property of the audit site arising from LFG on the CTL and no specific management measure are required on the Audit Site.

It is noted that the parties responsible for the aftercare of the CTL are also responsible for on-going monitoring of LFG on the site boundary (between the CTL and the Audit Site) and period assessment of risks to the environment including the Audit Site.

9.8 Soil Vapour Intrusion

The potential risks associated with soil-vapour intrusion are considered negligible for both commercial/industrial workers and more sensitive hypothetical residents (see Section 8 of this Audit Report). This finding was based on consideration of all impacts (soil and groundwater) that influence soil-vapour. Contaminants identified in soil-vapour (mainly chlorinated hydrocarbons) are not a result of impacts in soil which are minimal. Instead, groundwater contamination from the up gradient CTL migrating with the prevailing groundwater flow under the site is the source responsible for vapours detected at depth but sufficiently attenuated at the surface.

9.9 Summary of Auditor's Opinion on Land Contamination

Following a review of the data provided, and having regard to the SEPP *Prevention and Management of Contaminated Land (2002)*, the Auditor is of the opinion that there are no beneficial uses of the land precluded. This includes all the beneficial uses protected in the land use settings for commercial industrial, public open space and residential uses.

10 GROUNDWATER CONTAMINATION AND RISKS

10.1 Beneficial Uses to be Protected – Groundwater

Table 10-1 presents the classification of beneficial uses of groundwater protected in accordance with SEPP *Groundwaters of Victoria*.

Table 10-1: Protected Beneficial Uses of Groundwater Segments

Beneficial Uses	Segments (mg/L TDS)				
	A1 (0-500)	A2 (501- 1,000)	B (1,001- 3,500)	C (3,501- 13,000)	D (greater than 13,000)
1. Maintenance of ecosystems	✓	✓	✓	✓	✓
2. Potable water supply					
Desirable	✓				
Acceptable		✓			
3. Potable mineral water supply	✓	✓	✓		
4. Agriculture, parks and gardens	✓	✓	✓		
5. Stock watering	✓	✓	✓	✓	
5. Industrial water use	✓	✓	✓	✓	✓
6. Primary contact recreation (e.g. bathing, swimming)	✓	✓	✓	✓	
7. Buildings and structures	✓	✓	✓	✓	✓

Based on the results of groundwater sampling and analysis at the site and the findings in the 2007 Environmental Audit of the adjacent CTL, the groundwater in the water table aquifers at this site is classified as **Segment B** under *SEPP Groundwaters of Victoria*.

Therefore the Beneficial Uses for Segment B, as shown in Table 10-1, are protected at this site.

10.2 Contamination Assessment Criteria – Groundwater

The water quality guidelines applying to the assessment of groundwater contamination in Victoria are those specified in Table 3 of the *SEPP Groundwaters of Victoria* (1997). These are presented in Table 10-2.

Table 10-2: Water Quality Criteria for Groundwater

Beneficial Use Category	Applicable Water Quality Criteria (WQC)
Maintenance of Aquatic Ecosystems	Those applicable under the relevant SEPP for receiving waters. In this case the SEPP <i>Waters of Victoria</i> applies and the water quality guidelines are found in Chapter 2 of the ANZECC (2000) <i>Australian Water Quality Guidelines for Fresh and Marine Waters</i> .
Potable Water Supply	Chapter 4 of the ANZECC (1992) <i>Australian Water Quality</i>

Beneficial Use Category	Applicable Water Quality Criteria (WQC)
	<i>Guidelines for Fresh and Marine Waters</i>
Agriculture, Parks and Gardens	Chapter 5 of the ANZECC (1992) <i>Australian Water Quality Guidelines for Fresh and Marine Waters</i>
Stock Watering	Chapter 5 of the ANZECC (1992) <i>Australian Water Quality Guidelines for Fresh and Marine Waters</i>
Industrial Water use	Chapter 6 of the ANZECC (1992) <i>Australian Water Quality Guidelines for Fresh and Marine Waters</i>
Primary Contact Recreation	Chapter 3 of the ANZECC (1992) <i>Australian Water Quality Guidelines for Fresh and Marine Waters</i>
Potable Mineral Water	Australian Food Standards Code (1987) – <i>Standard 08 Mineral Water</i>
Buildings and Structures	No criteria – “shall not be corrosive to structures”.

It is noted that more recent guidelines are available including:

- NHMRC/NRMCANZ (2011) *Australian Drinking Water Guidelines*. National Water Quality Management Strategy
- ANZECC/ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. National Water Quality Management Strategy.
- NHMRC (2008) *Guidelines for Managing Risks in Recreational Water*.

The EPA has not adopted these at this time, except in the case for Maintenance of Aquatic Ecosystems whereby the guidelines refer to ANZECC/ARMCANZ (2000). Additionally, EPA’s guidance has included advice to the effect that ANZECC/ARMCANZ (2000) can be used if it represents “better science”.

10.3 Groundwater Pollution Assessment Protocol

In assessing the protection/pollution status of groundwater, all beneficial uses protected under this segment must be considered. The following is the Auditor’s assessment of the protection status of the groundwater with regard to each beneficial use relative to the relevant water quality criteria.

In conducting this assessment the Auditor has referred to Section 13 of the *Environmental Auditor (Contaminated Land) Guidelines for Issue of Certificates and Statements of Environmental Audit*, September 2007 (EPA Publication 759.1) and has addressed the key questions posed by the guidelines.

Is Groundwater Likely to be Polluted?

That is to say - is there any significant risk that groundwater at the site is contaminated to the extent it may be polluted from sources on-site or off-site?

The former use of the adjoining site as an industrial waste landfill (CTL), hydraulically up-gradient of the subject site, indicates such a risk. Therefore, the groundwater investigation was justified on the basis of off-site contaminating activities.

Is Groundwater Polluted?

That is to say, does any groundwater contamination found at the site constitute pollution of groundwater in accordance with the definition in SEPP *Groundwaters of Victoria*?

The discussion in the following sections presents the Auditor’s analysis of the degree of compliance with the objectives in SEPP *Groundwaters of Victoria*.

Table 10-13 summarises the findings of this assessment and identifies the beneficial uses that are considered to be polluted and whether these are relevant uses, including ‘existing’, ‘likely’ and ‘unlikely’ beneficial uses of groundwater at this site and its vicinity.

The Auditor has concluded that the off-site CTL, to the immediate west of the Audit Site, is the source of the contamination identified in groundwater at the site.

Is NAPL Present?

Clause 18 of SEPP *Groundwaters of Victoria* requires NAPL to be removed to the satisfaction of EPA. If NAPL is found in the course of an audit, EPA must be notified. LNAPL has not been reported in groundwater bores at the site.

10.4 Maintenance of Aquatic Ecosystems

10.4.1 Results Exceeding Water Quality Criteria (WQC)

Groundwater analytical results for organics which exceeded the adopted assessment criteria for Ecosystems Maintenance are presented in Table 10-3.

Table 10-3: Groundwater Results (Organics) Exceeding Maintenance of Aquatic Ecosystem Criteria

Analyte	Adopted Criteria (mg/L)	Date	MB61	MB72	MB85	MB86L
Vinyl Chloride	0.1	Feb-Apr 13	1.6	0.1	0.47	0.16
		Sep-13	1.4	0.07	0.42	0.12
		Oct 13	3.0	NS	NS	NS
Trichloroethylene	0.33	Feb-Apr 13	0.38	0.40	0.10	0.16
		Sep-13	1.40	0.33	0.10	0.12
		Oct 13	0.51	NS	NS	NS

Notes: NS = not sampled

A number of groundwater bores also reported nitrate (as NO₃), total nitrogen (as N) and several metals that exceeded the adopted assessment criteria for Ecosystem Maintenance, as summarised in Table 10-4. The February to April 2013 monitoring round was the only round where all on-site bores were sampled and tested. While the above analytes were tested in selected bores during subsequent monitoring rounds, the results were largely the same as the February to April 2013 round, and no further significant exceedances were reported.

Table 10-4: Groundwater Results (Inorganics) Exceeding Maintenance of Aquatic Ecosystem Criteria (February to April 2013)

Analytes	Adopted Criteria (mg/L)	Max. Conc (mg/L)	No. Analytical Results	No. Results Above Adopted Criteria
Metals				
Aluminium	0.055	6.5	24	2
Barium	0.22	0.52		2
Boron	0.37	0.62		5
Chromium (Total)	0.001	0.057		24
Cobalt	0.0014	0.016		9
Copper	0.0014	0.009		19
Iron (Total)	0.05	4.6		6
Manganese (Total)	1.9	2.9		1
Mercury	0.0006	0.01		4
Molybdenum	0.034	0.07		2
Nickel	0.011	1.2		7
Selenium	0.011	0.049		9
Zinc	0.008	0.14		19
Inorganic				
Nitrate (NO ₃)	0.01	26	24	13
Total Nitrogen (N)	0.1	6		15
Note: Results are "adopted ecosystem protection criteria" (after Kleinfelder, 2013e)				

10.4.2 Background/Regional

As shown in Table 10-4, a total of 13 metals, as well as nitrate (as NO₃) and total nitrogen (as N) reported concentrations that exceeded the adopted criteria for Ecosystem Maintenance. For the most part, the exceedances are minor, with exceptions including aluminium, iron (total), mercury, nickel and zinc which reported concentrations of more than an order of magnitude above the assessment criteria in one to four bores at the site.

The elevated nitrate (as NO₃) and total nitrogen (as N) are consistently high, particularly in the OVA. While it is possible that the OVA may have elevated background concentrations, it was reported in the Tullamarine Landfill Audit (Lane Piper, 2007) that groundwater concentrations of nitrogen species had increased as a result of the landfill.

10.4.3 Source of Contamination

The chlorinated hydrocarbons (vinyl chloride and trichloroethylene) which reported concentrations above adopted assessment criteria occur in bores along the trend of the contaminated groundwater plume, and are concluded to be sourced from the hydraulically up-gradient CTL.

Some of the metals reporting exceedances occur in bores in which chlorinated hydrocarbons are present (along the contaminated groundwater plume) and may therefore represent contamination sourced from the CTL. The Tullamarine Landfill Audit (Lane Piper, 2007) reported that concentrations of barium, boron, chromium (total), copper, iron, manganese (total), nickel and zinc had increased in the groundwater as a result of the landfill.

10.4.4 Relevance of the Beneficial Use

This beneficial use is almost always considered relevant as groundwater commonly discharges to surface waters containing aquatic ecosystems. Given the proximity of Moonee Ponds Creek to the immediate north of the site, it is likely that groundwater beneath the site may discharge to the creek; therefore the beneficial use is relevant. Groundwater flowing in a southerly direction in this region would ultimately discharge towards the Maribyrnong River and tributaries and therefore this beneficial use needs to be considered.

10.4.5 Conclusion – Maintenance of Aquatic Ecosystems

This beneficial use is protected by policy and is relevant when considering groundwater at the site. Chlorinated hydrocarbons (vinyl chloride and trichloroethene), nitrate as (NO₃), total nitrogen (as N) and a number of metals reported concentrations exceeding the adopted criteria for the protection of Ecosystems Maintenance. The Auditor considers that the CTL site to be the source of the chlorinated hydrocarbons and certain metals in the groundwater beneath the site.

While groundwater from the north-eastern part of the CTL site can flow towards the creek, examination of the groundwater flow system pattern (reflected in the groundwater elevation contours and flow directions) suggest that the most contaminated groundwater flows to the south-east away from the creek. In addition, monitoring suggests that the chlorinated hydrocarbon plume has not impacted the creek given bores MB69, MB75 and MB80 screened in the SBA near the creek did not report chlorinated hydrocarbons.

In addition, the ongoing monitoring of Moonee Ponds Creek and adjacent groundwater, as part of the GQMP and LWMP for the CTL, provides some assurance of the ongoing surveillance of risk to the creek which was assessed by the Auditor (Cardno 2012) to be presenting a low risk to the aquatic ecosystem and primary contact recreation users, subject to the rigorous implementation of ongoing long term monitoring and management (i.e. triggers and contingency process) through the aftercare management program (including contingency measures) and the LWMP. Therefore, the beneficial use of groundwater for Maintenance of Aquatic Ecosystems is not precluded by contamination at the audit site.

10.5 Potable Water Supply

This use is characterised as groundwater used for drinking by humans. This is not a protected beneficial use for groundwater of this salinity (Segment B). Therefore, this beneficial use is not required to be assessed for this audit.

10.6 Potable Mineral Water

The groundwater beneath the site does not conform to the definition of mineral water (*potable groundwater which in its natural state contains carbon dioxide and other soluble matter in sufficient concentrations to cause effervescence or impart a distinctive taste, SEPP Groundwaters of Victoria*), nor is the site in a recognised mineral water province as envisaged

in EPA Publication 592 Policy Impact Assessment of *SEPP Groundwaters of Victoria*. Therefore, this beneficial use is not considered relevant and has not been assessed for this audit. However, if it was relevant it is apparent that the contamination present would preclude this use.

10.7 Agriculture, Parks and Gardens (Irrigation)

This use is generally characterised as groundwater used for irrigation of crops or parks and gardens (including domestic gardens) and is considered to be a protected beneficial use of groundwater in the study area.

10.7.1 Results Exceeding WQC

The groundwater has elevated salinity considered to be associated with leachate contamination from the CTL which precludes the beneficial use of Agriculture, Parks and Gardens. Groundwater salinity has been recorded at concentrations of up to 63,000 mg/L TDS at the closed CTL, with concentrations within the contaminated plume of the CTL typically ranging from 5,000 to 13,000 mg/L TDS. Background salinity, based on the recorded TDS in bores outside the interpreted contaminated plume extent, was reported to range from 1,000 mg/L to 3,300 mg/L TDS (Lane Piper 2007).

Further, a number of groundwater bores reported metals that exceeded the adopted assessment criteria for Agriculture, Parks and Gardens, as summarised in Table 10-5. The February to April 2013 monitoring round was the only round where all on-site bores were sampled and tested and is therefore the only round included in the table. The Assessor has not reported on the significance of chlorinated hydrocarbon impacts for this beneficial use. The Auditor has undertaken a limited assessment of the potential impacts in Table 10-6.

Table 10-5: Groundwater Results Exceeding Agriculture, Parks and Gardens Criteria (February to April 2013)

Analytes	Adopted Criteria (mg/L)	Max. Conc (mg/L)	No. Analytical Results	No. Results Above Adopted Criteria
<i>Metals</i>				
Barium	0.5	0.61	24	3
Iron (Total)	1	4.6		3
Manganese (Total)	2	2.9		1
Mercury	0.002	0.01		3
Molybdenum	0.01	0.07		8
Nickel	0.2	1.2		3
Selenium	0.02	0.049		7

There are currently no water quality criteria for the chlorinated organic compounds identified in groundwater for Irrigation use. Therefore, the potential for these compounds to impact this beneficial use is considered by comparing with Primary Contact Recreation exposure.

Exposure via irrigation is considered to be incidental exposure that is akin to secondary contact recreation exposure. Therefore, it is expected that the actual exposure during

irrigation will be considerably lower than during swimming (i.e. primary contact recreation). As such, the risk based criteria used for swimming (see Section 10.10, Moonee Ponds Creek¹⁰) are adopted here as a conservative measure multiplied by a factor of 10 to account for lesser exposure. While a higher factor could be applied, there is also potential for an additional inhalation pathway of spray drift not accounted for in the swimming scenario.

It can be seen in Table 10-6 that Trichloroethylene does not exceed adopted criterion, whereas 1,2-dichloroethane does exceed the adopted criterion. Neither of these compounds are considered to preclude the beneficial use, as exposure during irrigation is likely to be considerably less than one tenth the exposure during swimming. Vinyl Chloride exceeds the adopted criterion by more than an order of magnitude.

Table 10-6: Summary of Chlorinated Hydrocarbons Exceeding Criteria (All Data)

Analyte	PCR Criterion (mg/L)	Adopted Criterion (mg/L)	Maximum Concentration (mg/L)
Vinyl Chloride	0.01	0.1	0.5
1,2-Dichloroethane	0.03	0.3	0.67
Trichloroethylene	0.13	1.3	0.61

10.7.2 Background/Regional

Barium, total iron, total manganese, mercury, molybdenum, nickel and selenium reported concentrations that exceeded the adopted assessment criteria for Agriculture, Parks and Gardens. However, for the most part, the exceedances are minor. It is possible that some of these metals represent background concentrations in the groundwater although there is insufficient data available in the current study to demonstrate this.

10.7.3 Source of Contamination

Elevated groundwater salinity and metal concentrations reported in a number of bores at the site are believed to be sourced from the adjacent CTL.

10.7.4 Relevance of the Beneficial Use

This beneficial use is considered unlikely at the site, given the proposed land use. It is recognised that there are no registered bores used for this purpose in the vicinity of the site, as none of the aquifers encountered would provide a bore yield sufficient for commercial irrigation.

10.7.5 Conclusion – Agriculture, Parks and Gardens

While this beneficial use of groundwater is considered to be precluded at the site by contamination from an off-site source, the beneficial use is unlikely.

¹⁰ The risk based criteria for swimming in the Moonee Ponds Creek are adopted ahead of these for the swimming pool because there is limited time for evaporation of volatiles from groundwater used in irrigation (assuming it is not stored) as is the case for water in a swimming pool.

10.8 Stock Watering

10.8.1 Results Exceeding WQC

This is a protected beneficial use for this segment, meaning that stock could be sustained by drinking water supplies drawn from bores with pumps or windmills.

The groundwater has elevated salinity considered to be associated with leachate contamination from the CTL which precludes the beneficial use of Stock Watering. As discussed in Section 10.7.1, the salinity of contaminated groundwater at the CTL typically ranges from 5,000 mg/L to 13,000 mg/L, with concentrations recorded up to 63,000 mg/L. Table 10-7 below lists the analytes reported in exceedance of the adopted criteria for livestock watering. The salinity of the groundwater beneath and within the vicinity of the site may further restrict its use for this purpose. ANZECC (1992) guidelines recommend that the guidelines set for raw drinking water for humans are applied in the case of organic contaminants. In this case, the chlorinated solvents, including vinyl chloride, trichloroethylene and dichloroethane compounds exceed adopted drinking water criteria.

Table 10-7: Groundwater Results Exceeding Stock Watering Criteria (February to April 2013)

Bore ID	Aluminium	Molybdenum	Mercury	Nickel	Selenium	Sulphate (as SO ₄ ²⁻)
	Assessment Criteria (mg/L)					
	5.0	0.01	0.002	1.0	0.02	1,000
BH2	-	-	0.01	-	-	-
MB13	-	0.02	-	-	-	-
MB14	-	0.02	-	-	-	-
MB15	-	-	-	-	0.043	1,100
MB16	-	-	-	-	0.049	1,000
MB55U	-	-	-	-	0.022	-
MB56	-	0.03	-	-	0.046	-
MB57	-	-	-	-	0.028	1,500
MB61L	-	-	-	1.2	-	1,200
MB72	-	0.02	-	-	-	-
MB74	-	0.07	-	-	-	-
MB76	-	-	-	-	0.020	-
MB83	-	0.02	-	-	-	-
MB85	-	0.02	0.04	-	-	-
MB86U	6.5	0.05	-	-	0.021	-
MB86L	-	-	0.0048	-	0.014	-

While the analytes were tested in selected bores during subsequent monitoring rounds during 2013, the results were largely the same as the February to April 2013 round, and no significant

exceedances were reported. Therefore, it is considered unnecessary to tabulate the July, September and October 2013 laboratory results.

10.8.2 Background/Regional

As shown in Table 10-7, aluminium, molybdenum, mercury, nickel and selenium reported concentrations that exceeded the adopted criteria for stock watering. However, for the most part, the exceedances are not significant, with only mercury exceeding the adopted assessment criterion by an order of magnitude in two bores. It is possible that several of these metals are a result of background concentrations in the groundwater.

While the anomalous aluminium and nickel (separate single bores) and mercury (three bores) are not indicative of background concentrations, the bore locations suggest that they are not sourced from the landfill.

10.8.3 Source of Contamination

The chlorinated solvents and several metals reported in a number of bores at the site are believed to be sourced from the CTL to the west. As discussed previously, a plume containing chlorinated solvents above adopted assessment criteria can be traced from the central western site boundary to the south-eastern corner of the audit site.

Groundwater bores that reported concentrations of organics exceeding adopted assessment criteria included bores MB61, MB61L, MB72, MB74, MB85 and MB86L.

These bores are all located along a clearly defined north-west to south-east trend that follows the line of the cross-section presented in Figure 3-1. The trace of the section line is shown in Figure 5, Appendix A, and the detailed legend for the cross-section is included in Figure 5-2, Section 5. Bores MB36 and MB84 shown in this figure are off-site to the west of the Audit Site. Bore MB61L is not shown on this figure, but is understood to be screened in the Lower OVA. Bore MB83 is the only bore on the cross-section which does not report chlorinated solvents exceeding adopted assessment criteria, and in fact all chlorinated solvent concentrations are below LOR for bore MB83.

Bore MB61L is the only bore along the line of the plume that is installed in the SBA, and this bore reported concentrations of 1,2 DCA above the assessment criteria, and increasing concentrations of TCE (slightly below criterion). Furthermore, bore MB86L (installed in the WFA) reported concentrations of vinyl chloride and 1,2 DCA above adopted assessment criteria.

10.8.4 Relevance of the Beneficial Use

Kleinfelder (2014) advised that the nearest groundwater bore listed for domestic/stock purposes is located approximately 2.2 km to the east of the site, on the other side of Moonee Ponds Creek.

The proposed zoning of the site for commercial/industrial (planning Zone CZ2) use suggests that this beneficial use is most unlikely.

10.8.5 Conclusion – Stock Watering

Concentrations of aluminium, molybdenum, mercury, nickel and selenium and chlorinated solvents in groundwater monitoring bores at the site exceed the adopted criteria for stock

watering. The elevated salinity, chlorinated solvents and several metals are considered to be sourced from the adjacent CTL site.

Therefore, this beneficial use of groundwater is considered to be precluded at the site due to contamination from an off-site source. This beneficial use is unlikely to be realised.

10.9 Industrial Water Use

Industrial water uses defined in the ANZECC 1992 (Chapter 6 Industrial Water Quality) relevant to groundwater extractive use are generic processes (heating and cooling), textile industry, chemical and allied industry, food and beverage industry, iron and steel industry, tanning and leather industry, pulp and paper industry and the petroleum industry).

Table 10-8: TDS of Industrial Water Uses

Industrial Water Use	TDS
Once through cooling and make-up water systems for fresh water	<1000 and <500, respectively
Textile industry	<100 mg/L
Food and beverage industry	<850 mg/L
Iron and steel industry	<1000 mg/L
Pulp and paper industry	<500 m/L
Petroleum industry	<750 mg/L

The groundwater cannot be used for the industries listed in Table 10-8, as the TDS required is less than the background water quality from the site. However, the groundwater may be used for more generic commercial/industrial purposes, like wash down water or for dust suppression.

The concentrations of chlorinated solvents in the groundwater would also impact on the suitability of the groundwater for industrial use.

10.9.1 Relevance of the Beneficial Use

This beneficial use is considered unlikely at the site due to the expected low bore yields achievable in these aquifers. It is noted that the availability of a reticulated water supply, and the costs associated with a groundwater supply system, reduce the attractiveness of groundwater supply. However, potential restrictions on reticulated water use may increase the likelihood of groundwater for this use.

10.9.2 Conclusion – Industrial Water Use

This beneficial use of groundwater is considered to be precluded by contamination from an off-site source. The natural salinity of the groundwater also represents constraints for its use for industrial purposes. This beneficial use is considered unlikely to be realised at the site.

10.10 Primary Contact Recreation (PCR)

This PCR beneficial use relates to the use of groundwater to fill swimming pools, or in cases where a water body occurs on a site, where it receives groundwater discharge and may be used for swimming. While there are no surface water bodies on the site itself, Moonee Ponds Creek is located a short distance to the north of the site.

Water quality criteria for toxicants for PCR are the same as for drinking water. The criteria adopted for PCR by Kleinfelder (2014) are attributed to a technical report prepared for the CTL (Golder 2011). The Auditor notes that the criteria adopted for PCR are in some cases higher than from more recent guidelines (NHMRC 2011) however as WQC have been exceeded (see Table 10-9 and Table 10-10) then the use of these higher criteria (see below) do not affect the audit outcome.

10.10.1 Results Exceeding WQC

Table 10-9 presents the contaminants which exceed the assessment criteria for PCR in a surface water body or swimming pool where the water may be ingested by humans. In this case, Moonee Ponds Creek is the nearest surface water body where this beneficial use is likely to be realised. However, the possible use of extracted water for filling swimming pools and PCR associated with this, has also been considered.

Table 10-9: Groundwater Results Exceeding PCR Criteria – Surface Water (February to April 2013)

Analyte	Adopted Criteria (mg/L)	MB61	MB61L	MB72	MB74	MB85	MB86U	MB86L
Vinyl Chloride	0.01	1.6	0.01	0.10	0.02	0.47	-	0.16
1,2-Dichloroethane	0.03	0.35	0.090	0.35	0.037	0.085	-	0.043
Trichloroethylene	0.13	0.38	-	0.40	-	-	-	-
Aluminium	0.20	-	-	-	-	2.0	6.5	4.0
Molybdenum	0.05	-	-	-	0.07	-	0.05	-

Table 10-10 below presents a comparison for monitoring Rounds 3 and 4, and includes Round 2 (July 2013) where the bores were not tested for these analytes during September and October 2013. The most significant analyte increases were noted in the results for bore MB61L.

Table 10-10: Groundwater Results Exceeding PCR Criteria – Surface Water (September to October 2013)

Analyte	Adopted Criteria (mg/L)	MB61	MB61L	MB72	MB74	MB85	MB86L
Vinyl Chloride	0.01	3.0	0.01	0.09	0.02	0.042	0.12
1,2-Dichloroethane	0.03	0.46	0.13	0.27	0.029	0.067	0.038
Trichloroethylene	0.13	0.51	0.16	0.48	-	-	-
Molybdenum	0.05	-	-	-	0.06	-	-

Analyte	Adopted Criteria (mg/L)	MB61	MB61L	MB72	MB74	MB85	MB86L
Note: Shaded cell represents analyte increase to next order of magnitude.							

Table 10-11 presents the contaminants which exceed the assessment criteria for the extraction of groundwater from on-site bores for the filling of swimming pools, and where the water may be ingested by humans. The criteria for surface water body PCR and swimming pool PCR differ slightly due to the assumptions made in relation to the manner of operation of a swimming pool system (i.e. water being stored in a pool over time and resultant volatilisation of volatiles).

Table 10-11: Groundwater Results Exceeding PCR Criteria – Swimming Pool (2013)

Analyte	Adopted Criteria (mg/L)	Date	MB61	MB72	MB74	MB85	MB86U	MB86L
Vinyl Chloride	0.02	Feb-Apr	1.6	0.10	0.02	0.47	-	0.16
		Sep-Oct	3.0	0.07	0.02	0.42	-	0.12
Aluminium	0.20	Feb-Apr	-	-	-	2.0	6.5	4.0
		Sep	-	-	-	-	-	-
Molybdenum	0.05	Feb-Apr	-	-	0.07	-	0.05	-
		Sep	-	-	0.06	-	-	-

10.10.2 Background/Regional

As discussed above, with respect to maintenance of aquatic ecosystems and stock watering, the concentrations of molybdenum are regarded as slightly exceeding background levels in the groundwater. While the elevated aluminium concentrations in two bores do not represent background levels, the location of the bores (central and south-east parts of the site) indicates that the aluminium is unlikely to be sourced from the landfill. Further, the aluminium, and to a lesser extent molybdenum, decreased significantly during later monitoring events.

10.10.3 Source of Contamination

As discussed above, the chlorinated solvents and several metals are believed to be sourced from the CTL to the west of the site.

10.10.4 Relevance of the Beneficial Use

PCR is of relevance at this site to the extent that the groundwater or surface water is used to provide for primary contact recreation such as swimming. This can occur during recreational activities in Moonee Ponds Creek, or where a swimming pool is filled using groundwater pumped from a bore at the site, the latter a rare but possible occurrence in Melbourne.

As discussed in Section 10.4 in relation to maintenance of aquatic ecosystems, groundwater from the north-eastern part of the CTL site can flow to the creek. However, the more contaminated groundwater emanating from the eastern boundary of the CTL site flows in an east to south-easterly direction away from the creek. Groundwater discharge from the

beneath the site to the Moonee Ponds Creek is not likely to cause PCR to be precluded and the creek environment is monitored by TPI as part of post-closure monitoring of the CTL.

The nearest registered bore that may be used for domestic purposes is located 2.2 km to the east of the site, and is considered highly unlikely to be impacted by contamination sourced from the site. There is also potential for unregistered bores to be located in adjacent residential properties and it is possible but unlikely that one or more of these unregistered bores may be used to fill swimming pools.

10.10.5 Conclusion – Primary Contact Recreation

This beneficial use is protected by the policy. Several analytes measured in groundwater at the site were found to exceed the adopted criteria for protecting PCR beneficial uses. While this beneficial use for filling of swimming pools is considered unlikely to be realised, it cannot be ruled out.

This beneficial use is considered to be precluded (for filling swimming pools from a bore) by contamination derived from the closed landfill to the east.

10.11 Buildings and Structures

Groundwater should not be corrosive to building elements due to contamination. Table 6.4.2 of Australian Standard (2009) AS2159-2009 *Piling – Design and Installation* shows the severity of groundwater sulphate and chloride concentrations and pH on concrete and it is summarised in Table 10-12 below.

Table 10-12: Exposure Classification for Concrete Piles (After AS2159-2009)

Sulphate (SO ₄ /S)	pH	Chloride	Soil Conditions	
			<i>High permeability (sands and gravels), below groundwater</i>	<i>Low Permeability (silts and clays) below GW & all soils above groundwater</i>
<360/120	>6.5	<2000	Non-aggressive	Non-aggressive
360/120 to 1,200/400	5 - 6	2,000 to 6,000	Mild	Non-aggressive
1,200/400 to 3,000/1,000	4.5 - 5	6,000 to 12,000	Moderate	Mild
3,000/1,000 to 6,000/2,000	4 - 4.5	12,000 to 30,000	Severe	Moderate
>6,000/2,000	<4	>30,000	Very Severe	Severe

10.11.1 Results Exceeding WQC

Sulphate, chloride and pH results from the groundwater monitoring were compared to the guidance in AS2159-2009.

The groundwater pH, as measured in the field, was recorded in the range of 6.7 to 7.8, and may therefore be non-aggressive with regard to concrete structures.

Chloride and sulphate (as SO₄) concentrations were reported to range from 1,100 and 6,000 mg/L, and 190 to 1,500 mg/L, respectively. Thus, groundwater is considered to range from “non-aggressive” to “mild” to concrete structures.

10.11.2 Relevance of the Beneficial Use

The three bores closest to Moonee Ponds Creek (MB69, MB75 and MB80) recorded standing groundwater levels ranging from approximately 6 to 15 m below ground surface. All the other bores recorded standing groundwater levels greater than 20 m below ground surface.

It is considered unlikely that buildings or structures with foundations deep enough to intersect groundwater will be constructed on the site.

10.11.3 Conclusion – Buildings and Structures

This beneficial use of groundwater is not precluded by contamination at the site.

10.12 Summary of Auditor’s Opinion on Groundwater Contamination

Pollution was reviewed with respect to all beneficial uses in Segment B in accordance with Section 13 of EPA Publication 759.1, given the classification of the groundwater salinity (measured as TDS) in the aquifer. Table 10-13 summarises these findings.

It is noted that the conclusions in this audit report in relation to the ‘relevance’ of groundwater use appear to be different to those in the Tullamarine Landfill Audit Report (Lane Piper, 2007) which concluded all beneficial uses to be relevant or likely to be realised. This difference arises due the necessity in the s53V audit to consider all possible locations of groundwater use down-gradient of the landfill site. Therefore, the possibility of some future groundwater use could not be ruled out. However, in the case of the current s53X audit, the only location where this assessment needs to be made is at the Audit Site. Given the proposed commercial/industrial use of the Audit Site, it is very unlikely that any extractive use of groundwater will occur there in the foreseeable future.

It is understood, following consultation with EPA, that upon receiving this information relating to presumed groundwater pollution at the site, EPA may identify a Groundwater Quality Restricted Use Zone (GQRUZ) in accordance with Clause 19 of the SEPP (GoV).

Table 10-13: Summary of Groundwater Pollution Assessment

Beneficial Use Category	Protected Beneficial Uses of this Segment of Groundwater	Precluded	Existing Use	Likely Use	Un-likely Use
Maintenance of Aquatic Ecosystem	✓	No	✓		
Potable Water Supply	✗				
Potable Mineral Water	✗	Yes			✓
Agriculture, Parks & Gardens	✓	Yes			✓
Stock Watering	✓	Yes			✓
Industrial Water use	✓	Yes			✓
Primary Contact Recreation	✓	Yes			✓
Buildings & Structures	✓	No			✓

11 AUDITOR OUTCOME AND “CERTIFICATION”

11.1 Summary of Outcome

The audit site located at 140 to 204 Western Avenue, Westmeadows, Vic (CARMS 71120-1) qualifies for a Statement of Environmental Audit (SoEA) to be issued. The statement for each Audit Area is attached to the Executive Summary. A SoEA implies that the site is suitable for a restricted range of uses subject to the implementation of one or more conditions set out in the Statement. In this case, the site is suitable for the following land uses (subject to conditions discussed in Section 11.2.2):

- Agricultural
- Sensitive Use (High Density and Other)
- Recreation/Open Space
- Commercial
- Industrial

The conditions to be included in the SoEA for these uses are developed in Section 11.2.2.

11.2 Contamination Risk Management

11.2.1 Future Land Use Activities

Given the findings on land contamination in the previous section, and the proposed or possible land use for the site, the Auditor has considered the need for further management of contamination for the purpose of defining the conditions of the Statement of Environmental Audit. This is achieved by examination of the likely land use and possible activities associated with that land use.

11.2.2 Conditions of the Statement of Environmental Audit

Given the risks identified, the conditions considered relevant to the protection of the beneficial uses at the site are outlined below:

- Condition 1 The groundwater is contaminated and unsuitable for the extractive beneficial uses: Potable Mineral Water, Agricultural, Parks and Gardens, Stock Watering, Industrial and Primary Contact Recreation. Consequently, no groundwater shall be extracted at this site for such uses.*
- Condition 2 Groundwater Monitoring Wells (MB13, MB14, MB15, MB16, MB17, MB55U/L, MB56, MB57, MB57A, MB61, MB61, MB69, MB72, MB73, MB74, MB75, MB76, MB80, MB83, MB85, MB86U/L, BH 1, BH2, BH3) must be maintained and remain accessible for the purpose of ongoing monitoring by the party responsible for the aftercare of the Closed Tullamarine Landfill.*

11.2.3 Conditions for Issue of Certificate of Environmental Audit

Section 53Z Part 2(c) of the Environment Protection Act 1970 requires an audit report to specify the “terms and conditions” that need to be complied with before a Certificate of Environmental Audit (CoEA) may be issued. It should be noted that the site is currently suitable for the beneficial uses listed in the Statement of Environmental Audit (SoEA) (subject

to the conditions of the statement), and the specification of requirements for issue of a CoEA are for information purposes only given existence of the statement (SoEA).

If a CoEA were requested, the terms and conditions that need to be complied with before a CoEA could be issued include:

- *Groundwater would need to be cleaned up such that all protected beneficial uses are restored.*

11.3 Other Related Information

Related environmental issues arising during the course of an environmental audit, but which do not affect issue of a CoEA or SoEA, must be noted by the Auditor and included in the CoEA or SoEA in the section titled "Other Related Information". Other related information on the SoEA for the site is:

- *A Certificate of Environmental Audit was not issued due to the presence of polluted groundwater derived from sources off-site, which precludes the extractive beneficial uses of Potable Mineral Water Supply, Agricultural, Parks and Gardens, Stock Watering, Industrial and Primary Contact Recreation.*
- *In accordance with section 13.7 of EPA Publication 759.2, the Auditor has concluded that polluted groundwater has been cleaned up to the extent practicable due to it being from an off-site source, the precluded beneficial uses are not relevant and it does not present an unacceptable risk to the use of the land.*
- *Upon receiving this information relating to presumed groundwater pollution at the site, EPA may identify a Groundwater Quality Restricted Use Zone (GQRUZ) in accordance with Clause 19 of the SEPP (GoV).*
- *The party responsible for the aftercare of the Closed Tullamarine Landfill will require access to the site in order to carry out the ongoing monitoring of groundwater monitoring bores (listed in Condition 2 of this statement).*

11.4 About Your Environmental Audit Report

While this Environmental Audit has been undertaken in accordance with the EPA Auditor Guidelines and current industry practice, there may be some limitations on the meaning and use of this report. The reader is advised to read this report in conjunction with the attached document *About Site Contamination / Environmental Audits and Reports* (Appendix K).

In December 2012 EPA issued updated guidance to Auditors (Publication 1147.1) which included the need to insert an information document in all audit reports. This document is titled *Information Regarding Environmental Audit Reports* and is included as Appendix J of this report.

Cardno Lane Piper

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Appendix A

8 Pages

Figures

Figure 1: Site Locality Plan

Figure 2: Site Layout Plan

Figure 3: Soil Investigation Locations

Figure 4: Groundwater Bore Locations and Contaminants

Figure 5: Groundwater Elevation and Section Lines

Figure 6: Landfill Gas Bore and Soil Vapour Bore Locations

Figure 7: Regional Geology

Figure 8: Lead Abatement Sampling Locations



Base image after NearMap (2013)



PROJECT: Environmental Audit Report
 Tullamarine Landfill Buffer Zone
 140 to 204 Western Avenue, Tullamarine, Vic

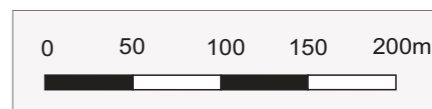
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DATE: January 2014
 JOB No: 212173

TITLE: Site Locality Plan
 REV: 2
 FIG: 1



SCALE





After: Kleinfelder 2013f



PROJECT: Environmental Audit Report
 Tullamarine Landfill Buffer Zone
 140 to 204 Western Avenue, Tullamarine, Vic

SCALE: Not to scale

DATE: December 2013

TITLE:

Soil Investigation Locations

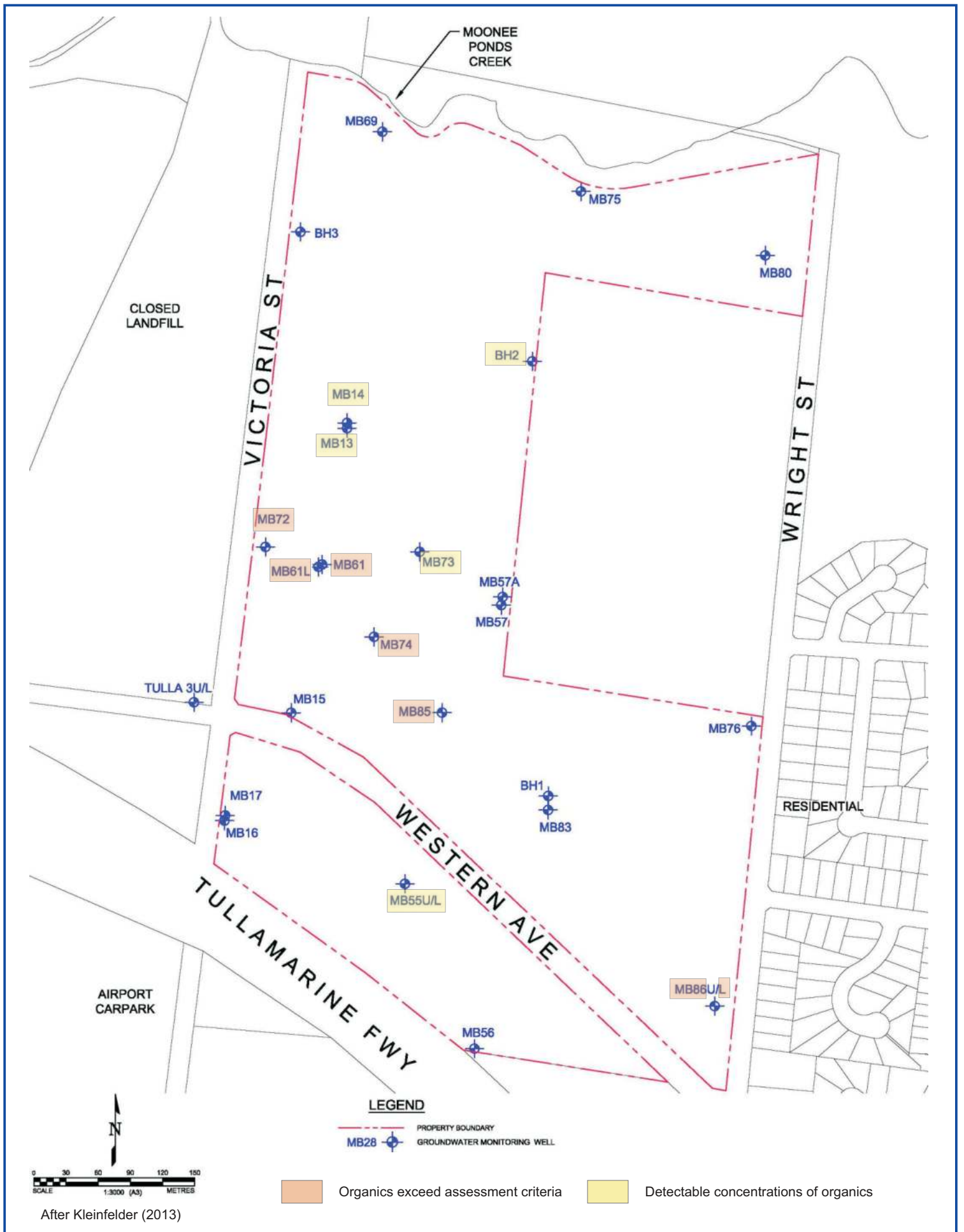
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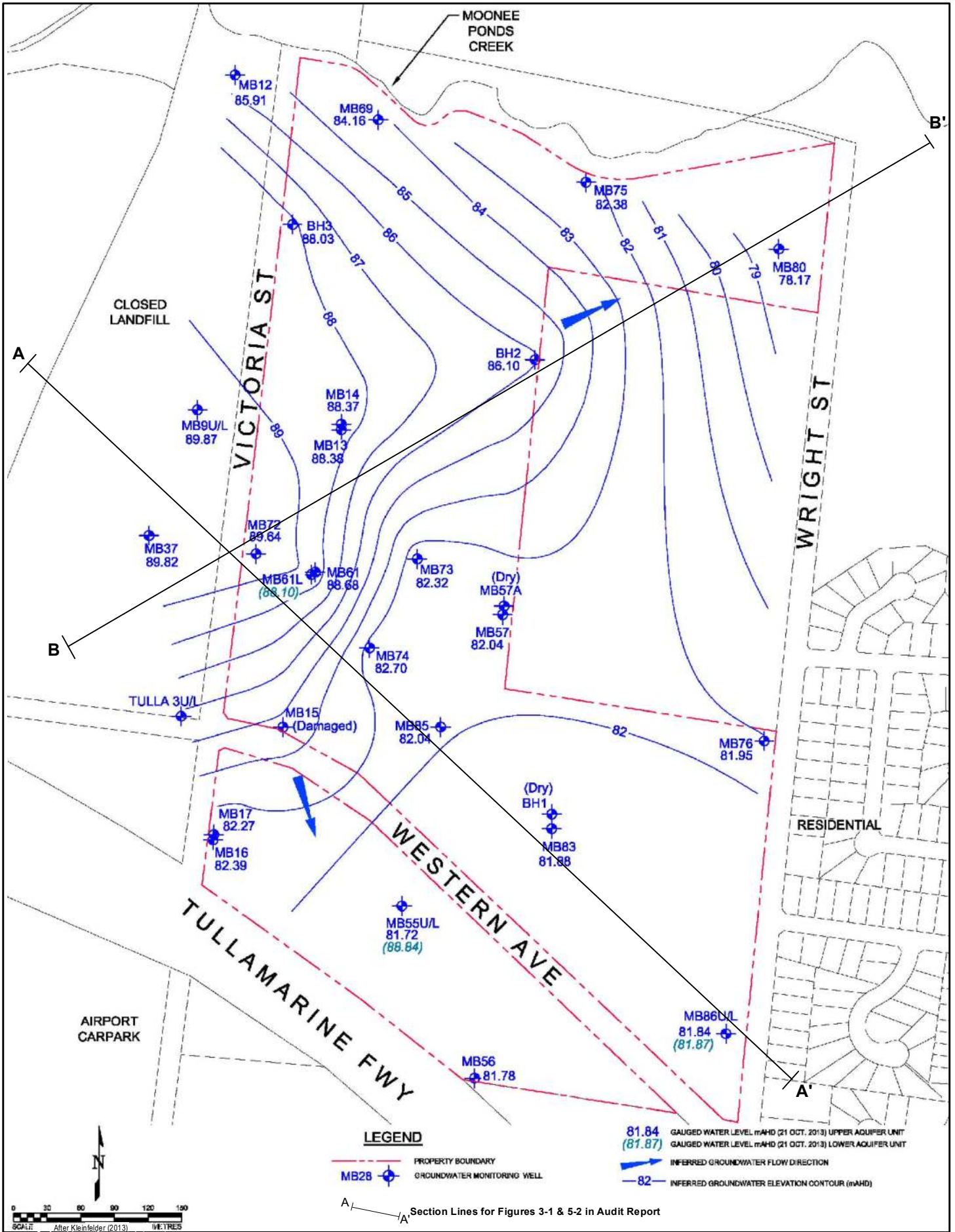
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REV: 1

FIG: 3





	PROJECT: Environmental Audit Report Tullamarine Landfill Buffer Zone 140 to 204 Western Ave, Tullamarine, Vic		TITLE: Bore Locations & Groundwater Contaminants	
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	REF: Figure4.cdr		REV: 1	FIG: 4



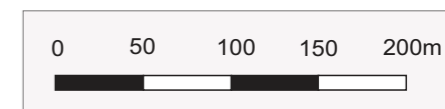
	PROJECT: Environmental Audit Report Tullamarine Landfill Buffer Zone 140 to 204 Western Ave. Tullamarine, Vic	TITLE: Groundwater Elevation & Interpreted Flow Direction		
	SCALE (A4): See scale bar	DRAWN: PXT	DATE: 22 JANUARY 2014	JOB NO. 212173
	REF: Figure5.mxd		REV. NO. 1	FIG. NO. 5



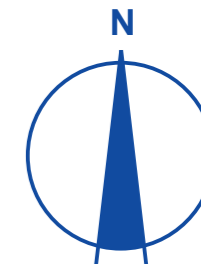
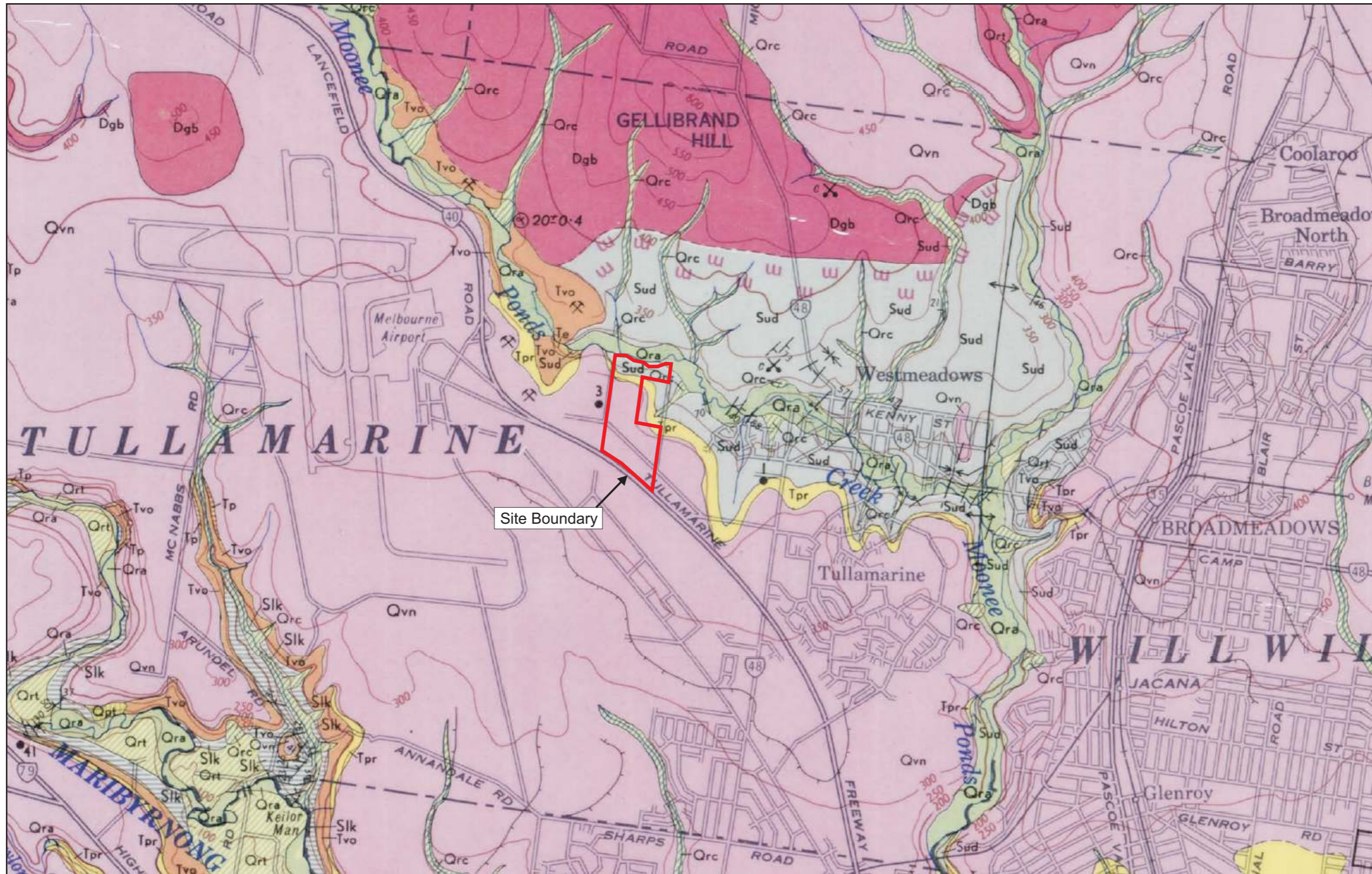
LEGEND

-  V03 Soil Vapour Bore (on-site)
-  SG01a/b Soil Vapour Bore (off-site)

SCALE



Base image after NearMap (2013)



After: Geological Survey of Victoria, Sunbury 1:63,360 scale map (1973)

LEGEND

Qra: Quaternary - Alluvial Deposits
Qrt: Quaternary - Swamp Deposits
Qrc: Quaternary - Colluvial Deposits

Qvn: Newer Volcanics (Quaternary age basalt)
Tp: Brighton Group (quartzite, gravel, sand)
Tvo: Older Volcanics (Tertiary age basalt)

Dgb: Bulla Granodiorite (Devonian age)
Sud: Dargile Formation (Silurian age shale, mudstone)
Slk: Keilor Group (Silurian age shale, mudstone)

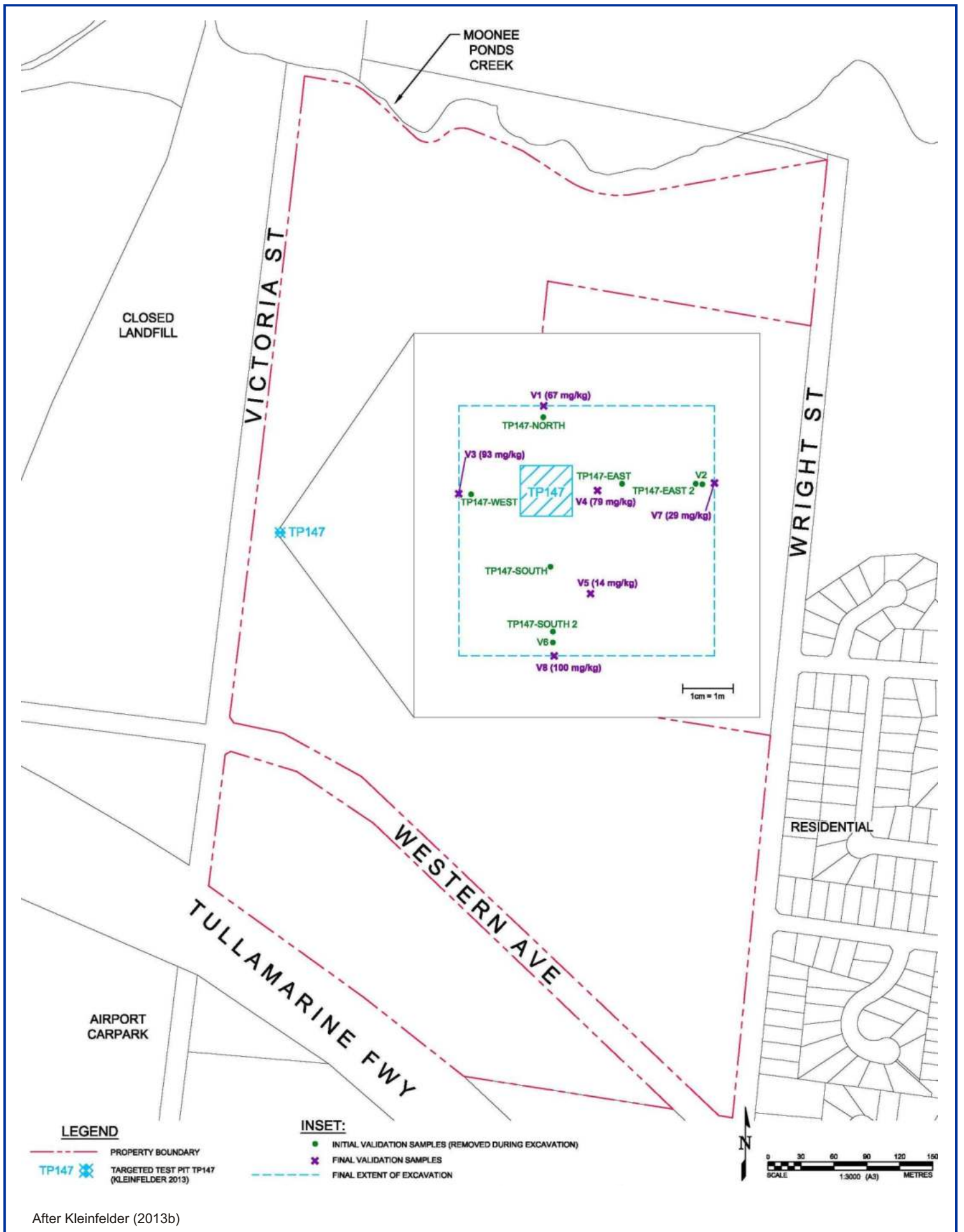
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PROJECT: Environmental Audit Report
 Tullamarine Landfill Buffer Zone
 140 to 204 Western Avenue, Tullamarine, Vic

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 DATE: October 2013
 DRAWN: DJL
 JOB No: 212173
 REF: Figure7.cdr

TITLE: Regional Geology
 REV: 1
 FIG: 7



After Kleinfelder (2013b)



PROJECT: Environmental Audit Report
Tullamarine Landfill Buffer Zone
140 to 204 Western Ave, Tullamarine, Vic

TITLE: Lead Abatement
Sampling Locations

SCALE: See scale bar

DRAWN: DJL

DATE: Dec. 2013

JOB No: 212173

REF: Figure8.cdr

REV: 1

FIG: 8

Appendix B

1 Page

Tables

Table B1: Soil Vapour Data

Table B1: Soil Vapour Data

Sample ID	SV01-3.0m				SV01-14.0m				SV01-23m				SV02-3.0m				SV02-14.0m				SV02-25m				SV03-3.0m				SV04-3.0m				SV05-3.0m			
	28/11/2012	15/01/2013	30/07/2013	22/10/2013	28/11/2012	15/01/2013	30/07/2013	22/10/2013	28/11/2012	15/01/2013	30/07/2013	22/10/2013	28/11/2012	15/01/2013	30/07/2013	22/10/2013	28/11/2012	15/01/2013	30/07/2013	22/10/2013	28/11/2012	15/01/2013	30/07/2013	22/10/2013	28/11/2012	15/01/2013	30/07/2013	22/10/2013	28/11/2012	15/01/2013	30/07/2013	22/10/2013	28/11/2012	15/01/2013	30/07/2013	22/10/2013

	LOR*																																						
BTEXN	LOR*																																						
Benzene	0.0048	nd	3.4	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.026	nd	0.173 ^A	nd	0.41	nd	-	0.005	0.024	nd	-	nd	0.12	nd	nd	nd	0.013	nd	-	nd	5.4	nd	-	nd	0.98	nd	-
Toluene	0.0041	0.17	0.77	0.0067	nd	0.09	0.02	nd	nd	0.11	0.13	nd	nd	0.0076	0.11	nd	-	0.02	0.03	nd	-	0.0097	0.09	nd	nd	0.024	0.08	nd	-	0.91	1.0	nd	-	0.006	0.24	nd	-		
Ethylbenzene	0.0063	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-	
Meta- & Para- Xylene	0.0058	nd	nd	0.0058	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	0.014 ^A	0.0066	nd	nd	nd	0.0076	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Ortho-Xylene	0.0063	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	0.0071 ^A	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Total Xylenes	0.0063	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-	nd	nd	-	-	nd	nd	-	nd	nd	nd	-	-	nd	nd	-	nd	nd	-	nd	nd	-		
Naphthalene	0.0063	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	0.0063 ^A	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Total Petroleum Hydrocarbons	LOR*																																						
C5-C6 Aliphatic	0.081	-	nd	nd	nd	-	nd	nd	nd	-	nd	nd	9.5	-	nd	nd	-	-	nd	nd	-	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
>C6-C8 Aliphatic	0.1	-	nd	nd	nd	-	nd	nd	nd	-	1.2	nd	36.3	-	nd	nd	-	-	nd	nd	-	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
>C8-C10 Aliphatic	0.14	-	nd	nd	nd	-	nd	nd	nd	-	nd	nd	13.8	-	nd	nd	-	-	nd	nd	-	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
>C10-C12 Aliphatic	0.17	-	1.5	nd	nd	-	nd	nd	nd	-	1.4	nd	nd	-	nd	nd	-	-	1.7	nd	-	-	1.3	nd	nd	nd	2.1	nd	-	nd	1.0	nd	-	nd	2.1	nd	-		
>C5-C7 Aromatic	0.05	-	-	-	nd	-	-	-	nd	-	-	-	0.138 ^A	-	-	-	-	-	-	-	-	-	-	-	nd	-	-	-	-	-	-	-	-	-	-	-	-		
>C7-C8 Aromatic	0.0016	-	-	-	0.0981	-	-	-	nd	-	-	-	0.102 ^A	-	-	-	-	-	-	-	-	-	-	nd	-	-	-	-	-	-	-	-	-	-	-	-	-		
>C8-C10 Aromatic	0.12	-	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-	nd	nd	-	-	nd	nd	-	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
>C10-C12 Aromatic	0.14	-	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-	nd	nd	-	-	nd	nd	-	-	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Volatile Organic Compounds	LOR*																																						
4-Methyl-2-pentanone	0.0045	0.012	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	nd	0.012	nd	nd	-	0.019	nd	nd	-	nd	nd	nd	-		
Acetone	0.025	0.098	nd	nd	nd	0.26	nd	0.032	nd	0.6	0.17	nd	nd	0.078	0.094	nd	-	0.082	0.068	nd	-	0.064	0.96	nd	nd	0.1	0.061	nd	-	0.083	nd	nd	-	nd	nd	nd	-		
Bromodichloromethane	0.0073	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	0.016	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Carbon disulfide	0.014	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.033	0.059	nd	-	0.1	0.035	nd	-	0.019	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
1,1-Dichloroethene	0.0042	nd	nd	nd	nd	nd	0.61	0.725	0.095	nd	17.0	18.9	nd	nd	nd	nd	-	nd	nd	nd	-	0.069	0.063	0.094	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Vinyl Chloride	0.0027	nd	nd	nd	nd	nd	0.021	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	0.0048	0.0034	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Chloroform	0.0053	0.019	nd	nd	nd	nd	0.05	nd	nd	nd	nd	nd	nd	0.016	nd	nd	-	0.14	0.054	0.036	-	0.013	0.01	0.018	nd	0.012	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Cyclohexane	0.0038	nd	nd	nd	nd	nd	0.006	nd	nd	0.036	0.160	0.182 ^A	nd	nd	nd	nd	-	0.0057	nd	nd	-	0.0048 ^A	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Heptane	0.0045	0.019	nd	nd	nd	0.025	nd	nd	nd	nd	0.074	nd	nd	nd	nd	nd	-	nd	nd	nd	-	0.075 ^A	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Hexane	0.0038	0.016	0.018	nd	nd	0.015	nd	nd	nd	nd	0.025	nd	0.514 ^A	nd	nd	nd	-	0.024	0.0056	nd	-	0.0091	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
1,3-Dichlorobenzene	0.0066	nd	0.15	nd	nd	nd	nd	nd	nd	nd	0.076	nd	nd	nd	nd	nd	-	nd	0.056	nd	-	nd	0.04	nd	nd	nd	0.13	nd	-	nd	0.13	nd	-	nd	0.088	nd	-		
2-Propanol	0.011	nd	nd	nd	nd	nd	0.15	nd	nd	nd	0.46	nd	nd	nd	0.065	0.021	nd	-	0.54	0.016	nd	-	0.082	0.019	nd	nd	nd	0.016	nd	-	0.076	nd	nd	-	nd	0.03	nd	-	
2-Butanone (MEK)	0.013	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.022	nd	nd	-	0.028	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	-	0.028	nd	nd	-	nd	nd	nd	-		
Ethanol	0.011	0.021	0.22	nd	nd	0.072	nd	nd	nd	0.12	0.31	nd	nd	0.039	0.16	nd	-	0.024	0.087	nd	-	0.017	0.1	nd	nd	nd	0.08	nd	-	0.019	0.19	nd	-	0.013	0.14	nd	-		
tert-Butyl alcohol	0.018	0.018	-	nd	nd	0.074	-	nd	nd	0.19	-	nd	nd	nd	-	nd	-	0.02	-	nd	-	nd	-	nd	0.019	-	nd	-	0.032	-	nd	-	nd	-	nd	-			
Tetrahydrofuran	0.0041	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	0.0041	nd	-		
Trichloroethene	0.0076	nd	nd	nd	nd	nd	0.46	0.972	nd	nd	29.0	50.9	nd	nd	nd	nd	-	nd	nd	nd	-	0.038	0.038	0.12	0.186	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
1,3,5-Trimethylbenzene	0.0025	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	0.0031 ^A	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
1,2,4-Trimethylbenzene	0.0071	0.0096	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
trans 1,2 dichloroethene	0.002	nd	nd	nd	nd	nd	0.04	nd	nd	nd	1.2	1.78	nd	nd	nd	nd	-	nd	nd	nd	-	0.003 ^A	nd	0.0064	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Freon 12	0.0025	nd	nd	nd	nd	nd	0.055	nd	nd	nd	0.22	0.345 ^A	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
1,1-Dichloroethane	0.002	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.13	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Cis-1,2-Dichloroethene	0.002	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.48	0.476	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
1,2-Dichloroethane	0.002	nd	nd	nd	nd	nd	nd	nd	nd	nd	1.0	1.28	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
1,1,2-Trichloroethane	0.0027	nd	nd	nd	nd	nd	nd	nd	nd	nd	1.6	2.45	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		
Tetrachloroethene	0.0034	nd	nd	nd	nd	nd	0.18	0.515	nd	nd	7.7	14.8	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	0.009 ^A	nd	nd	nd	nd	-	nd	nd	nd	-	nd	nd	nd	-		

Notes:
 All concentrations are listed in mg/m 3. nd Denotes Non Detect
 "-" Denotes sample not analysed/ analyte not reported
 "LOR" Denotes Laboratory Limit of Reporting
 "*" Denotes the lowest reported LOR
 "A" Denotes QC sample concentration reported due to RPD exceedence
 Round 1-4 SV Results.xlsx

Appendix C

16 Pages

Site Photographs

Appendix C1: Auditor Site Inspection (28 August 2013)

Appendix C2: Auditor's Assistant Site Inspection (4 September 2013)

Site Inspection Photographs (28 August 2013)
140-204 Western Avenue, Tullamarine, VIC



PLATE 1 Looking East over the area of former farm buildings (now removed).



PLATE 2 Looking north-east over the "exclusion zone" area of asbestos clearance.



PLATE 3 Looking east into the "exclusion zone" area, bricks and rubble visible.



PLATE 4 Looking north-west. Asbestos clearance works progressing.



PLATE 5 Double bagged asbestos awaiting removal from site.



PLATE 6 Looking east. Boxthorn hedges denoting the site boundary with Wright Street land parcels.



PLATE 7 Looking south-east, groundwater monitoring bore visible. Airport parking visible in the distance.



PLATE 8 Looking south-east, groundwater monitoring bores visible and boxthorn hedges present.



PLATE 9 Looking west from along the eastern boundary. Solid inert wastes present at the site.



PLATE 10 Looking east to Wright Street. Vegetated mound present along the boundary.



PLATE 11 Looking south-west. Shallow surface water body present.



PLATE 12 Previous test-pit that has been backfilled and subsided.



PLATE 13 Shallow surface water body present along eastern boundary with Wright Street.



PLATE 14 Looking west along boundary with Western Avenue. Backfilled test-pit that has subsided.



PLATE 15 Looking north-west. Area of an abandoned vehicle (removed although vehicle parts still remain).



PLATE 16 Close up of remaining vehicle parts.



PLATE 17 Looking north-west along western boundary with Victoria Avenue. Dam present.



PLATE 18 Looking east, view across the site.



PLATE 19 Looking east along Western Avenue. Airport parking visible in the distance.



PLATE 20 Area of solid inert waste near dam area in south-west corner of the site.

Site Inspection Photographs (4 September 2013)
140-204 Western Avenue, Tullamarine, VIC



PLATE 1 Looking north at the area of removed farm buildings along the western boundary.



PLATE 2 Looking west at the area of removed farm buildings along the western boundary.



PLATE 3. Bituminous roofing material found to contain asbestos.



PLATE 4 Test-pitting within the cleared asbestos area.



PLATE 5 test-pit spoil



PLATE 6 Excavated test-pit.



PLATE 7 Looking north-west over asbestos clearance area.



PLATE 8 Test-pitting within the vicinity of the former farm buildings. Building remains present.



PLATE 9 Area of the abandoned vehicle (since removed) and soil scraped. Topsoil brought to site to be laid over the area.



PLATE 10 Topsoil brought to the location of the previous test-pit and awaiting filling.



PLATE 11 Topsoil brought to the location of the previous test-pit and awaiting filling.



PLATE 12 Area of previous earthen mound along eastern boundary with Wright Street (since removed).

Appendix D

4 Pages

Auditor's Data Quality Review Report

Data Quality Review 140-204 Western Avenue, Tullamarine, Vic

This appendix reviews the Quality Assurance (QA) and Quality Control (QC) documentation. Quality assurance encompasses the actions, procedures, checks and decisions undertaken to ensure sample integrity and representativeness, and the reliability and accuracy of analysis results. The QA documentation should also include an indication of the Data Quality Objectives sought in relation to each significant action, test or process involved in the assessment.

QC activities measure the effectiveness of the QA procedures by undertaking testing, and then comparing results to previously established objectives. QC work will include the internal laboratory testing as well as results of QC samples submitted by the Assessor such as trip blanks and duplicates. The quality of the information and/or data is deemed satisfactory when the QC results demonstrate that agreed objectives have been met.

The Auditor undertook a review of the Assessor's QA/QC as part of the data validation exercise. The findings are summarised in the table below.

QA/QC Aspects	Evidence & Evaluation
QA Documentation	
Project Quality Plan/Work Plan and Data Quality Objectives	<p>The Auditor was engaged by Transpacific Cleanaway Pty Ltd (the Client) in June 2012. This Data Quality review encompasses soil sampling works carried out by Kleinfelder (the Assessor) between 16-22 October 2012, and groundwater sampling works carried out by KingTech Services Pty Ltd (KingTech) on behalf of Kleinfelder between January and October 2013. Previous sampling events are not under consideration in this review.</p> <p>The Assessor provided a quality control program to KingTech during the Investigation, documented in the following reports:</p> <ul style="list-style-type: none"> ● Kleinfelder (2013) <i>Soil Contamination Assessment</i>, 140-204 Western Avenue, Westmeadows, VIC (ref. P001318-003) ● Golder (2012), <i>Sampling and Analysis Quality Plan</i> (ref. 077613139-119-R-Rev0) ● TCL (2011), <i>Post Closure Management Plan, Transpacific Tullamarine Closed Landfill, Groundwater Quality Management Plan</i> (GQMP), December 2011, Revision 006. <p>The quality assurance procedures used were developed in consultation with the Auditor, and have been reiterated in the Assessor's reports. A health and safety plan was also included as part of the ESA report.</p> <p>The Assessor's soil and groundwater investigations were carried out in accordance with the work scopes detailed in <i>Soil Contamination Assessment</i> (Kleinfelder, 2013) and <i>Groundwater Condition Report</i> (Kleinfelder, 2013).</p> <p>The Data Quality Objectives were expressed in terms of the purpose of the assessment and the relevant assessment criteria.</p>
Data Validation Report	<p>Kleinfelder provided soil and groundwater data validation reports within the <i>Soil Contamination Assessment</i> report and draft <i>Groundwater Condition Report</i>, respectively. Kleinfelder concluded that the overall soil and groundwater data quality was sufficient for interpretive use.</p>

QA/QC Aspects	Evidence & Evaluation
Data Representativeness	
Use of Composites	No composite soil samples were collected.
Holding Times	<p>Soil: Chain of custody and laboratory reports provide evidence of holding times. All holding times were in conformance with Appendix B in EPA Publication IWRG701 'Sampling and Analysis of Waters, Wastewaters, Soils and Wastes (June 2009).</p> <p>Groundwater: All holding times for groundwater samples were in conformance with Appendix A in EPA Publication IWRG701.</p>
Background samples	<p>Soil: No offsite soil samples were collected as part of this program.</p> <p>Groundwater: No offsite groundwater bores were sampled as part of this program.</p>
Verification of field procedures	<p>The Assessor states that soil samples were collected from grid based and targeted test pits using a hand trowel either directly from the test pit walls or from the excavator bucket. The Assessor documents adequate decontamination procedures in the body of the report.</p> <p>Groundwater gauging was completed using an oil/water interface probe, and samples were collected using the micropurge low flow technique. It is noted that dedicated tubing is reused at each bore. Decontamination procedures are documented in the body of the Assessor's report.</p>
Data Precision & Accuracy	
QC Testing – Blind Replicates (Primary Lab)	<p style="text-align: center;">Soil</p> <ul style="list-style-type: none"> ● Acceptance Criteria: RPD < 50% ● Soil Samples Analysed: 44 ● Blind Replicate Samples Analysed: 6 ● Blind Replicate Analyte Pairs: 260 ● Number of Analyte Pairs Exceeding Criteria: 10 ● Percentage of Analyte Pairs Exceeding Criteria: 3.8% <p>The RPD exceedances are confined to TRH fractions and metals (beryllium). The Auditor notes that the levels of exceedance are generally minor and probably related to sample heterogeneity and the low analyte concentrations of analyte pairs. RPD calculations were not calculated by the Assessor for a large number of analyte pairs as either or both of the pairs were less than the limit of reporting. The Assessor's RPD calculations are present in Table 17 of the report.</p> <p style="text-align: center;">Groundwater</p> <ul style="list-style-type: none"> ● Acceptance Criteria: RPD < 50% ● Groundwater Samples Analysed: 24 ● Blind Replicate Samples Analysed: 1 ● Blind Replicate Analyte Pairs: 40 ● Number of Analyte Pairs Exceeding Criteria: 2 ● Percentage of Analyte Pairs Exceeding Criteria: 5% <p>RPD exceedances are identified in the following analytes: 1,1, di-chloroethane and 1,1 di-chloroethane. The Assessor adopted the highest QC concentration for interpretive use.</p> <p>The Auditor notes that the level of exceedance is generally minor and probably related to the low analyte concentrations of analyte pairs. RPD calculations were not calculated by the Assessor for a large number of analyte pairs as either or both of the pairs were less than the limit of reporting. The Assessor's RPD calculations are present in Table 13 of the</p>

QA/QC Aspects	Evidence & Evaluation
	report.
QC Testing – Field Splits (Secondary Lab)	<p style="text-align: center;">Soil</p> <ul style="list-style-type: none"> ● Acceptance Criteria: RPD < 50% ● Soil Samples Analysed: 44 ● Field Split Samples Analysed: 6 ● Field Split Analyte Pairs: 260 ● Number of Analyte Pairs Exceeding Criteria: 7 ● Percentage of Analyte Pairs Exceeding Criteria: 2.7% <p>The RPD exceedances are confined to TRH fractions and metals (manganese and lead). The Auditor notes that the levels of exceedance are generally minor and probably related to sample heterogeneity and the low analyte concentrations of analyte pairs. RPD calculations were not calculated by the Assessor for a large number of analyte pairs as either or both of the pairs were less than the limit of reporting. The Assessor's RPD calculations are present in Table 17 of the report.</p> <p style="text-align: center;">Groundwater</p> <ul style="list-style-type: none"> ● Acceptance Criteria: RPD < 50% ● Groundwater Samples Analysed: 24 ● Field Split Samples Analysed: 1 ● Field Split Analyte Pairs: 40 ● Number of Analyte Pairs Exceeding Criteria: 7 ● Percentage of Analyte Pairs Exceeding Criteria: 17.5% <p>RPD exceedances are identified in the following analytes: chromium, cobalt, total iron, zinc ammonia (as N), 1,2 di-chlorobenzene and 1,1 di-chloroethane. The Assessor adopted the highest QC concentration for interpretive use.</p> <p>The Auditor notes that the level of exceedance is generally minor and probably related to the low analyte concentrations of analyte pairs. RPD calculations were not calculated by the Assessor for a large number of analyte pairs as either or both of the pairs were less than the limit of reporting. The Assessor's RPD calculations are presented in Table 13 of the report.</p>
Trip Blanks	<p>Soil: Three trip blanks were collected and analysed to assess the potential for sample cross contamination during transport. All trip blanks returned results below the laboratory LOR for TPH C₆-C₉ and BTEX.</p> <p>Groundwater: Six trip blanks were collected and analysed. All trip blanks returned results below the laboratory LOR for TPH C₆-C₉ and BTEX.</p>
Laboratory Internal QC	<p>Evidence of the laboratories internal QC testing is present and complete in the Assessor's reports. Both ALS (Primary) and MGT (Secondary) performed internal QC with generally adequate testing and satisfactory results for matrix spikes, method blanks and laboratory duplicates.</p> <p>Outliers in the laboratory internal QC testing for soils include:</p> <ul style="list-style-type: none"> - Matrix spike (MS) recoveries for seven samples, wherein the background level was greater or equal to 4x spike level. In one sample, the MS recovery was not determined due to sample matrix interference. - Duplicate RPDs for one sample, where RPD exceeded LOR based limits. <p>The Auditor does not consider these to significantly affect the outcome of the soil assessment.</p>

QA/QC Aspects	Evidence & Evaluation
	<p>Outliers in the laboratory internal QC testing for groundwater include:</p> <ul style="list-style-type: none"> - Matrix spike (MS) recoveries for one sample, wherein the background level was greater or equal to 4x spike level. - Laboratory control spike (LCS) recoveries for two samples, wherein recovery was less than the lower control limit. <p>The Auditor does not consider these to significantly affect the outcome of the groundwater assessment.</p>
Laboratory Method Detection Limit	<p>Laboratory reports indicate the method detection limits for soil analysis were generally lower than the respective assessment criteria.</p> <p>Laboratory reports indicate the method detection limits for groundwater analysis were generally lower than the respective assessment criteria, with the following exception(s).</p> <ul style="list-style-type: none"> - LOR for 1,3-dichloropropene was 0.001 mg/L, which is above the adopted ecosystem criteria of 0.0001 mg/L. - LOR for hexachlorobenzene was 0.0001 mg/L, which is above the adopted ecosystem criteria of 0.00005 mg/L. <p>As no results were reported above the LOR, the Auditor does not consider these to significantly affect the outcome of the groundwater assessment.</p>
NATA endorsement of laboratory reports	All laboratory reports from Leeder Consulting, ALS, and MGT were stamped with the NATA endorsement stamp and signature.
Calibration of Field Equipment	<p>Soil: A calibration certificate for the PID used during soil sampling works is provided in Appendix J of the Assessor's report.</p> <p>Groundwater: KingTech documented the calibration of the water quality meter on the field sampling record sheets. Documentation was not provided on the calibration of the oil/water interface probe.</p>
Decontamination and Equipment Blanks	<p>Three rinsate blanks from the hand trowel were collected and analysed for TRH/BTEX and metals during the soil sampling program. No results were reported above the laboratory LOR.</p> <p>Four rinsate blanks were collected and analysed during the groundwater sampling program. No results were reported above the laboratory LOR.</p>
Data Comparability	
Standard Procedures	Fieldwork procedures are detailed in the Assessor's reports and are comparable for each phase of assessment.
Qualified Personnel	The Assessor's reports have indicated that the staff involved in managing and reviewing the project and those involved in fieldwork are qualified personnel.
Volatile Losses	There is no evidence of significant volatile losses.
Sample Integrity	Field Chain of Custody/Laboratory request forms can be found in the Assessor's reports.
Data Completeness	
Completeness of test program	The scope of work undertaken was generally consistent with that required to characterise the site as set out in the Assessor's Work Plan.
Validity of Data Set	The data quality review indicates no significant systematic errors in the data collection process for soil and groundwater and therefore, the data set used as the basis for the soil and groundwater assessment is considered valid and complete.

Appendix E

5338 Pages

Assessor's Reports

Appendix E1: Groundwater Condition Report (January 2014, Kleinfelder).

Appendix E2: Lead and Asbestos Abatement Report (November 2013, Kleinfelder).

Appendix E3: Vehicle Rollover Validation and Waste Removal Report (November 2013, Kleinfelder).

Appendix E4: Landfill Gas Risk Assessment, Outer Eastern Bores, Tullamarine Landfill (November 2013, Kleinfelder).

Appendix E5: Soil Vapour Assessment, 140-204 Western Avenue, Tullamarine Vic (November 2013, Kleinfelder).

Appendix E6: Soil Contamination Assessment, 140-204 Western Avenue, Tullamarine Vic (June 2013, Kleinfelder).

Appendix E7: Preliminary Contamination Risk and Geotechnical Assessment, Buffer Land, 140-204 Western Avenue, Tullamarine (June 2012, Golder Associates).

Appendix E8: Quantitative HHRA Report, Buffer Land, 140-204 Western Avenue, Tullamarine (May 2012, Golder Associates).

Appendix F

10 Pages

Risk Assessment

Environmental Audit Report and Statement of Environmental Audit 140 to 204 Western Avenue, Westmeadows, Vic

Appendix F Risk Assessment

1 RISK ASSESSMENT

This appendix provides the Auditor's assessment of the risks at the site as documented by the Assessor's reports and additional risk characterisation completed by the Auditor. This was prepared with the assistance of the Auditor's Support Team risk assessor Giorgio De Nola.

1.1 Drivers for Risk Assessment

The environmental policies in Victoria relevant to any consideration of risk assessment or remediation planning are:

- SEPP *Prevention and Management of Contamination of Land* (2002) ("SEPP PMCL").
- SEPP *Groundwaters of Victoria* (1997) ("SEPP GoV").

SEPP PMCL states in Clause 21(a) that "*where contamination at a site is of a level which precludes a protected beneficial use of the relevant land use, a state of pollution exists and the land must be cleaned up and/or managed so that there is no immediate threat to human health on-site or off-site*".

SEPP GoV characterises groundwater pollution in terms of the beneficial uses of water measured against water quality criteria for various uses of groundwater. The SEPP GoV does not explicitly refer to the possible human health risks arising from inhalation of vapours from contaminated groundwater or LNAPL; the Auditor has therefore considered the potential for harm to human health via this exposure pathway as a component of risk to land and has conducted an assessment of risks accordingly.

1.2 Summary of Soil and Groundwater Findings

Golder Associates (Golder 2012b) and Kleinfelder (2013e) have undertaken a series of soil investigations at the site with the aim of characterising soil quality. With the exception of concentrations of some metals (barium, nickel and vanadium), the soil samples analysed reported concentrations of the selected analytes below the Laboratory Limit of Reporting (LOR). The concentrations of barium, nickel and vanadium reported were found to be consistent with typical background concentrations in soil associated with the geological profile. It has been concluded that the soil quality at the site was suitable for Commercial/Industrial use and that the relevant beneficial uses were not precluded.

A number of groundwater investigations have been conducted for the site or the adjoining landfill. These assessments have identified contaminated groundwater beneath the site with the potential to affect human health risk due to a vapour intrusion pathway. The works performed to address potential risks from vapour intrusion, including further assessment by the Auditor, are presented below.

1.3 Past Findings on Human Health Risk from vapour

Transpacific commissioned Golder Associates to prepare a Human Health Risk Assessment (HHRA) in 2012 (Golder 2012a). This HHRA focussed on assessing health risk associated with the potential exposure of people to vapours emanating from groundwater contamination. The people assumed to be exposed in the HHRA are future occupants of commercial/industrial buildings following proposed redevelopment of the site. The HHRA findings summarised here are based on report dated May 2012 and titled:

- *Quantitative HHRA Report, Buffer Land, 140-204 Western Avenue, Tullamarine, Golder Report Number 117616015.*

In the HHRA, the site was considered to be used as a commercial/industrial site therefore commercial or industrial site workers in indoor and outdoor environments are assumed to be potentially exposed to vapour emanating from groundwater are¹. It was considered that these workers are the most sensitive group and that assessment of risks posed to these site occupants are considered protective of other people with assumed lesser exposure (e.g. visitors, maintenance personnel and construction personnel). Workers in deep or narrow excavations were assumed to be protected by “*additional occupational health and safety controls regardless of any potential contamination issues*”.

The Chemicals of Potential Concern (CoPC) identified as potentially contributing to vapour risk from groundwater (see Golder 2012) included the following compounds:

- BTEX
- PAHs
- Chlorinated solvents
- Pesticides
- Fire retardants
- Other solvents

An exposure air concentration was estimated by:

- Identifying the maximum recorded concentration of CoPC in groundwater and estimating a soil-vapour concentration using Henry's law.
- Selecting generic parameter values for soil properties and assumed future buildings.
- Incorporating soil-vapour concentrations and generic parameters in to Vapour Intrusion model (VIM) to estimate an ambient air concentration in a hypothetical commercial/industrial building.
- Applying an exposure duration scaling factor of 0.09 to the estimated ambient air concentration based on reasonable maximum exposure of people assumed to be exposed (i.e. a commercial/industrial worker).

The risks were characterised in the HHRA in terms of whether the adopted guideline values for the CoPC exceeded the estimated exposure concentration. A summary of the results is shown in Table 1. The calculated exposure concentrations are below the guideline values adopted by Golder (2012a).

¹ Note that the Auditor has considered a more sensitive land use later in this section, i.e. residential land use.

Table 1: Summary of Risk Calculations (Golder 2012a)

Receptors	Calculated Exposure Concentration (mg/m ³)	Guideline Value (mg/m ³)
Benzene	6.89E-06	1.70E-03
Toluene	1.73E-06	2.60E-01
Xylenes	6.21E-07	8.70E-01
Dichloromethane	7.41E-07	4.50E-01
Chloroform	9.03E-07	1.10E-04
1,1-dichloroethane	2.11E-06	1.50E-03
1,2-dichloroethane	2.95E-05	7.00E-01
1,1,2-trichloroethane	1.49E-05	1.50E-04
Vinyl chloride	4.85E-03	1.00E-02
1,1-dichloroethene	2.25E-04	2.10E-01
cis-1,2-dichloroethene	4.94E-05	3.70E-02
trans-1,2-dichloroethene	4.88E-05	6.30E-02
Trichloroethene	1.58E-04	2.30E-03
Tetrachloroethene	3.79E-05	4.10E-04
Bromodichloromethane	2.47E-08	6.60E-05
Acetone	1.57E-07	3.20E+01
Chlorobenzene	2.57E-06	5.20E-02
1,2-dichlorobenzene	1.07E-06	2.10E-01
1,4-dichlorobenzene	4.61E-07	2.20E-04
Formaldehyde	1.94E-08	1.90E-04
Benzo(a)anthracene	1.77E-11	8.70E-06
Benzo(a)pyrene	3.65E-12	1.20E-07
Benzo(b)fluoranthene	1.24E-10	8.70E-06
Indeno(123cd)pyrene	1.36E-12	8.70E-06
Naphthalene	4.91E-07	7.20E-05

It was concluded in the HHRA that the “concentrations of chemicals of interest in groundwater were not indicated to generate vapour levels that would exceed generic screening guidelines for ambient air as adjusted for a commercial or industrial land” (Golder, 2012a).

2 AUDITOR’S REVIEW OF THE HUMAN HEALTH RISK ASSESSMENT

The Auditor reviewed the HHRA (Golder, 2012a) and communicated the findings to Transpacific on 12 September 2012. The Auditor was of the view that site-specific soil vapour data would be required to address uncertainties associated with the presence of multiple

carcinogens in groundwater and the potential for preferential pathways in fractured basalt beneath the site. These uncertainties were not addressed in the HHRA (Golder 2012a) therefore further work was recommended, i.e. the installation of soil-vapour bores to confirm the findings from the HHRA. These issues are discussed further here.

Given the multiple carcinogens in groundwater, the process for adopting the guideline values was not clear in the HHRA. It appears that the guideline values for carcinogens were derived from inhalation unit risk (IUR) values assuming a risk level of 10^{-5} although this was not always the case. It is noted that a risk level of 10^{-6} is considered more appropriate for carcinogens in a screening level of risk to account for additive effects as a conservative measure.

Further, in some instances the derivation of guideline values was not consistent for carcinogens. For example a Reference Concentration (RfC) derived by the World Health Organisation (WHO) was selected as the guideline value for 1,2-dichloroethane even though an IUR is available in USEPA RSL tables. In contrast, an IUR for Tetrachloroethylene was used from USEPA RSL tables to derive a guideline value even though an RfC was available from WHO.

There is also uncertainty in vapour intrusion modelling performed for the HHRA (Golder, 2012a). The selected porosity value of $35 \text{ cm}^3/\text{cm}^3$ for a weathered lens zone² (assumed to be silty clay) was based on the average moisture content (22%) from a subset of moisture data for soil below 1.5m. The justification for using the sub-set of data is insufficient. It is noted that the average moisture content from all depths is 17% which would result in a water filled porosity of $27 \text{ cm}^3/\text{cm}^3$.

Further, the soil porosity values for basalt have not been adequately justified; the values selected are based on “*an estimation*” made in a 2007 HHRA (Golder 2007). Basalt may have air-filled porosity ranging from $3 \text{ cm}^3/\text{cm}^3$ to $33 \text{ cm}^3/\text{cm}^3$ with an average of $17 \text{ cm}^3/\text{cm}^3$ with water filled porosity approaching zero. Therefore, where basalt is fractured, the soil porosity values may potentially be quite different to those estimated in Golder (2012a), i.e. the basalt may be more or less porous which could lead to an increase or decrease in exposure concentrations.

Cardno Lane Piper performed an exercise to re-calculate the exposure concentration using soil porosity values for silty clay from CRC Care (2011) and default soil porosity values in modelling software for a porous substrate (USEPA sand porosity values). The recalculated exposure concentrations were compared with the guidelines values adopted by Golder (2012a) and adapted to take into account a level of risk more appropriate for a screening level risk assessment, see Table 2.

Although this comparison is quite conservative it is evident that there are exceedances of guideline values including for Vinyl Chloride and 1,1,2-trichloroethane and that these compounds require further assessment.

² This was based on an assumed specific density of 1.6 for soil however this calculation was not provided by Golder in the report.

Table 2: Remodelled Exposure Concentrations for a Comparison with Guideline Values based on Different Risk Levels.

Compound	Air Guideline Value		Exposure Concentrations		
	Adopted by Golder (2012a)	10 ⁻⁶ risk	As Modelled	CRC Soil Properties for silty clay	USPEA Soil Properties for a porous substrate (sand)
Benzene	1.70E-03	1.7E-04	6.9E-06	1.4E-05	3.7E-05
1,1,2-trichloroethane	1.50E-04	6.3E-05	1.5E-05	2.9E-05	7.2E-05
Vinyl Chloride	1.00E-02	1.0E-03	4.9E-03	1.1E-02	2.7E-02
Trichloroethene	2.30E-03	2.3E-03	1.6E-04	2.9E-05	7.2E-05
Tetrachloroethene	4.10E-04	3.8E-03	3.8E-05	8.3E-05	2.1E-04
1,2-dichloroethane	0.7	-	3.0E-05	not modelled but likely to increase over modelled value	
	-	3.8E-05			
Notes: Bold values exceed the air guideline value based on risk of 10 ⁻⁶ .					

It should also be noted that an inappropriate averaging time was used in calculation of the exposure scaling factor (ESF) for CoPC with non-carcinogenic endpoints. The exposure duration (in years) should equal the averaging time (also in years) as guideline values selected (RfC) are based on annual averages.

3 SOIL VAPOUR ASSESSMENT

An assessment of risk, based on soil-vapour results collected following review of the HHRA, was completed by Cardno Lane Piper in this Audit report. This assessment follows the methodology set out in the HHRA conducted by Golder (2012a) with minor modifications where necessary. The assessment was conducted in two parts, comprising;

- Identifying CoPC: Identification of CoPC in soil-vapour by estimating indoor air concentrations using generic attenuation factors.
- Further assessment of CoPC: The conduct of an assessment of risks associated with CoPC identified. This is based on exposure concentrations in indoor air that are calculated using vapour intrusion modelling.

Where necessary the methodology was adapted to take in to account uncertainties identified as part of the Audit process (as previously discussed in Section 1.4).

3.1 Identifying Compounds of Potential Concern

CoPC were identified in the following manner:

- The maximum soil-vapour concentrations for all detected compounds were selected. In most cases the maximum concentration was identified in the deep soil vapour bore at 24m depth³;
- Identification of the relevant guideline screening values for soil vapour, selected from:
 - Health Screening Levels (HSLs) from CRC (2011);
 - Health Investigation Levels (HIL) where available as provided in NEPC (1999);
 - Regional Screening Levels from USEPA (2012); and
 - Concentration of No Toxicological Concern as outlined in enHealth (2012) and WA DoH (2010).
- Estimation of an indoor air concentration. Indoor air concentrations of a compound in a building can be considerably than the concentration of that compound in soil-vapour (assuming there are no other sources in the building). There are various process will lead to loss of the compound including attenuation (reduction) across the slab of a building, i.e. the slab of a building will act as a semi-permeable barrier. This is accounted for using attenuation factors (AF). Hence indoor air concentrations were estimated using AF (median values) from sub-slab to indoor air as reported in USEPA databases (USEPA 2008, USEPA 2012b). AF for soil-vapour to indoor air AF factors are not used as they are not considered representative of the contribution from source concentrations (USEPA 2008, USEPA 2012b). The AF used for screening are:
 - 0.003 for chlorinated hydrocarbons;
 - 0.005 for all other hydrocarbons; and
 - 1 for Carbon Disulfide.
- Comparison of the estimated indoor air concentration with the adopted guideline value for commercial and residential receptors.
- Selection of CoPC where the estimated indoor air guideline exceeds the adopted guideline value.

The results of the screening level assessment are shown in Table 3 (see Table F1 for further detail). The CoPC are as follows:

- Chloroform
- 1,3-dichlorobenzene
- Trichloroethene
- 1,2-dichloroethane
- 1,1,2-trichloroethane
- Tetrachloroethene.

It is noted that the maximum concentrations of compounds measured in soil-vapour at 24m depth are used in this screening level assessment. These measured concentrations are unlikely to represent concentrations of compounds in soil-vapour near the surface due to losses from diffusion and biodegradation. This is a normal approach consistent with a screening assessment used to identify CoPC. Exceedence of the screening guideline values preliminary adopted here does not imply a risk is present, only that further assessment of the CoPC identified is required.

³ Soil-vapour data from the deepest bores at 24m were used it is collected from an area close to the source (25m depth) and is unlikely to be affected by biodegradation processes. Soil vapour data from shallower bores may be reduced to due to aerobic biodegradation (in particular petroleum hydrocarbons) Building at the surface with large slabs may restrict the amount of aerobic biodegradation under a site and result in a change in conditions, i.e. increased soil-vapour concentrations for some contaminants.

Table 3: CoPC Identified in Soil-Vapour Data (maximum concentrations).

Compound	Commercial Screening Value	Residential Screening Value	Minimum Soil-gas Value	Maximum Soil-gas Value	Estimated Indoor Air Conc.	Exceeds Commercial Screening Value?	Exceeds Residential Screening Value?
Benzene	230	41	0.005	5.4	0.027	No	No
Toluene	No limit	53000	0.006	1	0.005	No	No
Total Xylenes	No limit	11000	0.0066	0.058	0.00029	No	No
Naphthalene	240	44	0	0	0	No	No
Sum C5 to C10 Aliphatic	55000	9900	0	59.6	0.298	No	No
4-methyl-2pentanone	13	3.1	0.012	0.019	0.000095	No	No
Acetone	140	32	0.032	0.96	0.0048	No	No
Bromodichloromethane	0.00033	0.000066	0.016	0.016	0.000048	No	No
Carbon disulfide	3.1	0.73	0.019	0.1	0.1	No	No
1,1-dichloroethene	0.88	0.21	0.063	18.9	0.0567	No	No
Vinyl Chloride	0.002	0.00016	0.003	0.021	0.000063	No	No
Chloroform	0.00053	0.00011	0.01	0.14	0.00042	Yes	Yes
1,3-dichlorobenzene	0.0002	0.0002	0.04	0.15	0.00045	Yes	Yes
2-Propanol	31	7.3	0.016	0.54	0.0027	No	No
2-butanone	22	5.2	0.022	0.028	0.00014	No	No
Ethanol	0.005	0.005	0.013	0.31	0.00155	No	No
t-Butyl Alcohol	130	31	0.018	0.19	0.00095	No	No
Tetrahydrofuran	8.8	2.1	0.0041	0.0041	0.0000205	No	No
Trichloroethene	0.003	0.00043	0.038	50.9	0.1527	Yes	Yes
Trimethylbenzene	0.031	0.007	0	0.0096	0.000048	No	No
trans-1,2 Dichloroethene	0.26	0.063	0.04	1.78	0.00534	No	No
Freon 12 (Dichlorodifluoro methane)	440	100	0.055	0.345	0.001035	No	No
1,1-dichloroethane	0.0077	0.0015	0.13	0.13	0.00039	No	No
cis-1,2-dichloroethene	0.26	0.063	0.476	0.48	0.00144	No	No
1,2-dichloroethane	0.00047	0.000094	1	1.28	0.00384	Yes	Yes
1,1,2-trichloroethane	0.00077	0.00015	1.6	2.45	0.00735	Yes	Yes
Tetrachloroethylene	0.047	0.0094	0.009	14.8	0.0444	No	Yes

3.2 Assessment of Compounds of Potential Concern.

Further assessment of CoPC identified (in Section 1.5.1) has been conducted as follows:

- Vapour Intrusion Modelling (VIM) was used to model an indoor air concentration using RISC 5 and:
 - The maximum soil-vapour concentrations from 4 rounds of testing. These are predominantly from deep soil vapour bores at 24m depth and in most instances are much greater than levels measured in shallower soil-vapour bores (3m and 15m depth).
 - Building parameters as specified by Golder (2012a).
 - Soil properties as specified by Golder (2012a) however silt clay porosity values were adopted from CRC (2010) and default sand porosity values from VIM software for the basalt lens.
- An Exposure Scaling Factor (ESF) of 0.09 for commercial industrial workers to account for reasonable maximum exposures (see Golder 2012). An ESF of 1 is more appropriate for people in residential premises as some residents are assumed to spend most of their times indoor.
- Adoption of Guideline values for chronic risks and cancer risks, primarily from WHO (2000) and USEPA (2012). The source of guideline values is shown in Table F1 including an assessment of genotoxicity of CoPC.
- Calculation of risks for both chronic risks and cancer risks.

The risks calculated for the potential future commercial workers are considered negligible, as shown in Table 4. The calculated exposure concentration incorporates reasonable maximum exposures for commercial workers using an ESF of 0.09. It is noted that the cancer risks calculated assume exposure is over a lifetime which is likely to overestimate risk for commercial workers who are most likely going to only spend a portion of their lifetime working at the site.

Table 4: Chronic and Cancer Risks for Commercial Workers.

Compound	Chronic Risk (Hazard Quotient)	Cancer Risk (Incremental Lifetime)
1,3-dichlorobenzene	0.00055	-
Chloroform	1.6×10^{-6}	-
1,2-dichloroethane	2.0×10^{-6}	3.7×10^{-9}
Tetrachloroethylene	4.5×10^{-5}	-
1,1,2-trichloroethane	0.01	-
Trichloroethylene	0.021	1.8×10^{-8}
Sum	0.03 (Hazard Index)	2×10^{-8}

Risks calculated are based on soil-vapour concentrations at 24 m depth. The CoPC were not detected at shallow depth (approximately 3 m) therefore it is most likely that indoor air concentrations are lower than modelled using VIM and potentially zero, i.e. not measurable in the indoor environment. Therefore risks are considered negligible and potentially zero for commercial workers that may occupy buildings.

3.3 Consideration of More Sensitive Uses of the Site.

The Auditor has also considered here the possibility (albeit unlikely due to the proposed zoning) that the site may be used for a more sensitive use, i.e. residential. The resultant risks for more sensitive receptors (e.g. a hypothetical resident who would potentially spend all day in a building above the plume) could increase by as much as a factor of 10^4 . This would increase chronic risks to 0.3. Therefore the risks for a hypothetical resident who is assumed to occupy a building if constructed on the site are not considered unacceptable. Further, risks are most likely considerably lower than estimated here. It is expected that risks for current occupants of residential properties to the east of the site are less than for a hypothetical resident on the site, and is most likely zero, as groundwater contamination (emanating from the CLT site) does not extend beneath their properties.

4 UNCERTAINTY IN ASSESSMENTS

A number of uncertainties were identified in previous assessments (Golder 2012a). Uncertainties noted in this assessment include, but are not limited to, the following:

- *Maximum soil-vapour concentrations were adopted for the assessment:* There is significant attenuation in the soil profile as indicated by compounds being predominantly non-detect in the shallow bores and the maximum concentrations identified in the deep bores. An exception to this is benzene which was seen in relatively high concentrations (up to 5.4 mg/m^3) in the shallow bores in the second round of monitoring. Benzene was not considered a CoPC.
- *Soil-vapour concentrations could rise:* A rise in soil vapour concentrations would result in increased risk using soil-vapour data from 24m depth but would need to increase by 2 orders of magnitude before further assessment would be required. A significant increase in the soil-vapour concentration by 2 orders of magnitude has been noted for a number of chlorinated hydrocarbons in the third round of testing in the deep bores only. Although not presented, the maximum concentrations are approaching (one order of magnitude) the theoretical maximum estimated by Golder (2012a) using groundwater results and Henry's Law. It is unlikely that concentrations of CoPC in groundwater will increase to a degree that would trigger the need for further assessment.
- *Biodegradation would continue to occur:* Biodegradation would result in a decrease in air concentration for petroleum hydrocarbons. Biodegradation is likely to be occurring in the deep soil profile as carbon dioxide levels in most bores (>1%) are significantly higher than in ambient air (0.04%) and high oxygen concentrations >15% at all depths.
- *Adopted Guideline Values:* The values adopted are considered conservative as they incorporate multiple uncertainty factors in their derivation.

Cardno Lane Piper
February 2014

⁴ The Exposure Scaling Factor for a resident is slightly less than 1 compared to 0.09 as used for commercial workers.

Table F1 - Summary of Input Values Used in Fate and Transport Model

Model Description:

Source media: Soil Gas
 Johnson and Ettinger Indoor air model
 Volatilization from soil gas source to indoor air (onsite)

Lens Parameters		
Thickness of lens	m	5.0E+00
Total porosity in lens	cm3/cm3	3.8E-01
Water content in lens	cm3/cm3	5.4E-02

Unsaturated Zone Properties Beneath Building		
Total porosity	cm3/cm3	4.8E-01
Water content	cm3/cm3	3.0E-01
Air content	cm3/cm3	1.8E-01
Distance from source to building	m	2.5E+00
Bioattenuation factor	-	1.0E+00

Building Parameters		
Diffusion only case		
Foundation thickness	cm	1.5E+01
Fraction of cracks	-	1.0E-02
Porosity in cracks	cm3/cm3	2.5E-01
Water content in cracks	cm3/cm3	0.0E+00
Enclosed space floor length	m	1.0E+01
Enclosed space floor width	m	1.0E+01
Enclosed space height	m	2.5E+00
Volume of building	m3	2.5E+02
Number of air changes per hour	1/hr	8.0E-01

Soil Gas Source Concentration for Vapor Model		
Chemical	Units	Concentration
1,3-dichlorobenzene	mg/m3	1.5E-01
Bromochloromethane	mg/m3	1.6E-02
Chloroform	mg/m3	1.4E-01
Dichloroethane (1,1)	mg/m3	1.3E-01
Dichloroethane (1,2) (1,2-DCA)	mg/m3	1.3E+00
Dichloroethylene (1,1)	mg/m3	1.7E+01
Dichloroethene (trans 1,2)	mg/m3	1.8E+00
Trichloroethane (1,1,2)	mg/m3	2.5E+00
Trichloroethylene (TCE)	mg/m3	5.1E+01

Chemical Properties	Units	1,3-dichlorobenzene	Bromochloromethane	Chloroform	Dichloroethane (1,1)	Dichloroethane (1,2) (1,2-DCA)	Dichloroethylene (1,1)	Dichloroethene (trans 1,2)	Trichloroethane (1,1,2)	Trichloroethylene (TCE)
Diffusion coefficient in air	cm2/s	6.9E-02	9.7E-02	1.0E-01	7.4E-02	1.0E-01	9.0E-02	7.1E-02	7.8E-02	7.9E-02
Diffusion coefficient in water	cm2/s	7.9E-06	1.1E-05	1.0E-05	1.1E-05	9.9E-06	1.0E-05	1.2E-05	8.8E-06	9.1E-06
Solubility	mg/l	1.3E+02	1.7E+04	7.9E+03	5.1E+03	8.5E+03	2.3E+03	6.3E+03	4.4E+03	1.1E+03
Kd (total soil partition coefficient)	L/kg	ND	2.2E-01	ND	ND	ND	ND	ND	ND	ND
KOC (organic carbon partition coefficient)	L/kg	1.2E+03	2.2E+01	4.0E+01	3.2E+01	1.7E+01	5.9E+01	5.3E+01	5.0E+01	1.7E+02
Henry's Law coefficient	m3-H2O)/(m3-air)	1.2E-01	1.2E-01	1.5E-01	2.3E-01	4.8E-02	1.1E+00	3.9E-01	3.7E-02	4.2E-01
Molecular weight	g/mol	1.5E+02	1.3E+02	1.2E+02	9.9E+01	9.9E+01	9.7E+01	9.7E+01	1.3E+02	1.3E+02
Flux into building	g/s	6.7E-11	1.0E-11	9.4E-11	6.2E-11	8.8E-10	9.9E-09	8.2E-10	1.3E-09	2.6E-08
Indoor Air Concentration	mg/m3	1.2E-06	1.8E-07	1.7E-06	1.1E-06	1.6E-05	1.8E-04	1.5E-05	2.3E-05	4.7E-04
Guidelines Value	mg/m3	2.00E-04	2.7E-05	9.8E-02	6.3E-04	3.8E-05	2.1E-01	6.0E-02	6.3E-05	2.0E-03
Source (Guideline Value)	-	CoNTC	IUR	RfC ¹	IUR	RfC	RfC	RfC	IUR	RfC
Commercial Exposure Scaling Factor	Unitless	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Commercial Exposure Concentrations	mg/m3	1.1E-07	1.6E-08	1.5E-07	1.0E-07	1.4E-06	1.6E-05	1.3E-06	2.1E-06	4.2E-05
Is the Commercial Guideline Value Exceeded?	-	No	No	No	No	No	No	No	No	No
Residential Exposure Scaling Factor	Unitless	1	1	1	1	1	1	1	1	1
Residential Exposure Concentrations	mg/m3	1.2E-06	1.8E-07	1.7E-06	1.1E-06	1.6E-05	1.8E-04	1.5E-05	2.3E-05	4.7E-04
Is the Residential Guideline Value Exceeded?	-	No	No	No	No	No	No	No	No	No

IUR = Based on Inhalation Unit Risk value at a risk level of 10⁻⁶
 RfC = Based on reference concentration (RfC) selected from USEPA Regional Screening Levels (USEPA 2012)
 CoNTC = Concentration of No Toxicological Concern (enmHealth 2012, WADoH 2010)
¹ Chloroform not considered to be a genotoxic carcinogen therefore IUR value was not used.

Appendix G

29 Pages

Site Title Information

Imaged Document Cover Sheet

The document following this cover sheet is an imaged document supplied by LANDATA®, Land Victoria.

Document Type	plan
Document Identification	TP512682C
Number of Pages (excluding this cover sheet)	1
Document Assembled	09/01/2014 10:36

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FIELD PLAN

EDITION 1

TP 5176570

Project Name

Revision

Field No. 100000000

Date

Location

Project No.

Field No.

Field Name

Field No.

Field No.

APPLICABLE REGULATIONS: FEDERAL REGISTER, 40 CFR 1500.101-102

Diagram of Land Parcel Identifier

THESE ARE THE BOUNDARIES FOR THE LAND OF CITY OF ...

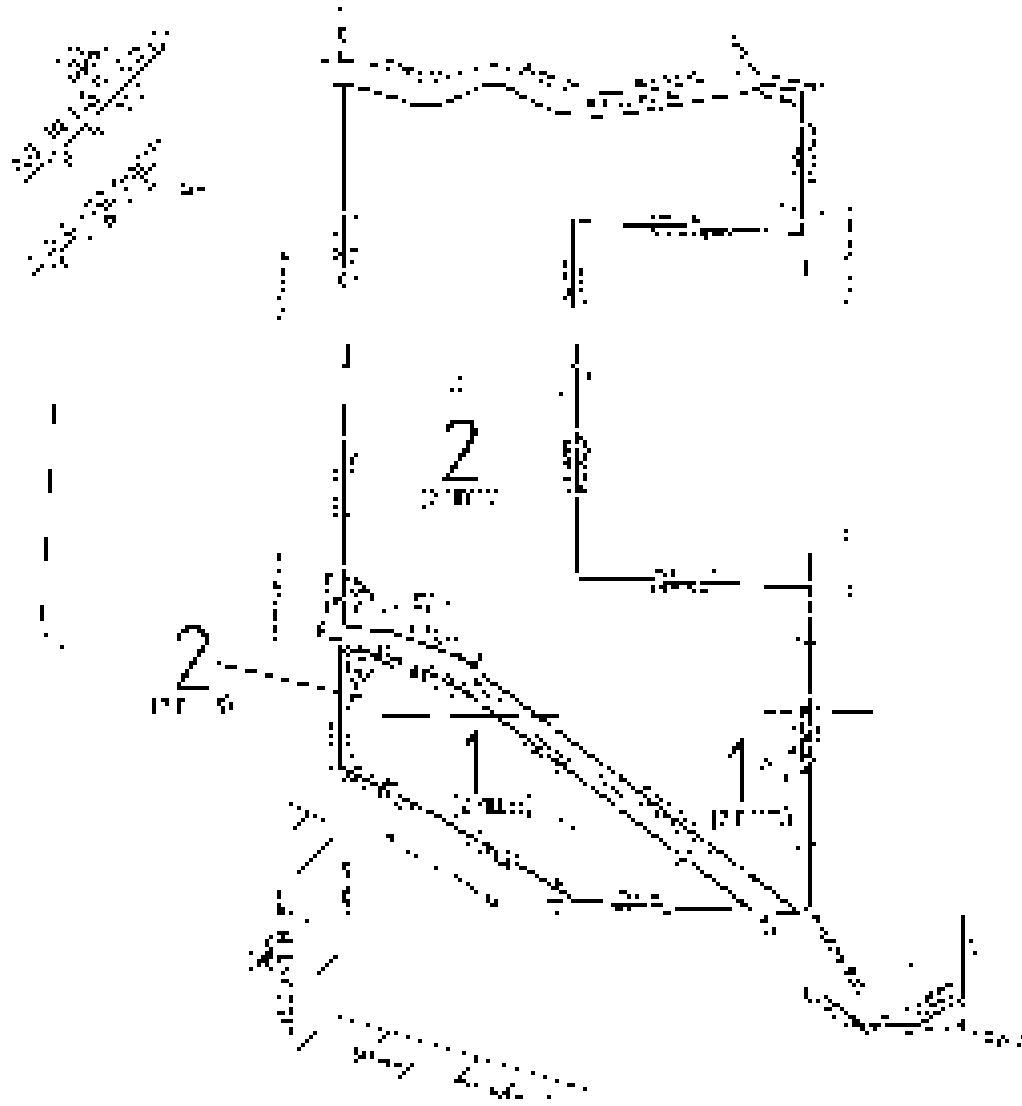


TABLE OF PARCEL IDENTIFIERS

THIS TABLE IS A SUMMARY OF THE PARCEL IDENTIFIERS FOR THE FIELD NO. 100000000. THE IDENTIFIERS ARE LISTED IN THE ORDER IN WHICH THEY APPEAR ON THE FIELD PLAN. THE IDENTIFIERS ARE LISTED IN THE ORDER IN WHICH THEY APPEAR ON THE FIELD PLAN.

PARCEL IDENTIFIER	Area (Acres)	Area (Sq. Ft.)

VOLUME 11379 FOLIO 866

Security no : 124048850107L
Produced 09/01/2014 10:28 am

LAND DESCRIPTION

Lots 1 and 2 on Title Plan 512682C (formerly known as part of Section 6, part of Section 15 Parish of Tullamarine).
PARENT TITLE Volume 09667 Folio 677
Created by instrument AJ919396X 19/09/2012

REGISTERED PROPRIETOR

Estate Fee Simple
Sole Proprietor
TRANSPACIFIC CLEANAWAY PTY LTD of 159 CORONATION DRIVE MILTON QLD 4064
M038790U 11/12/1985

ENCUMBRANCES, CAVEATS AND NOTICES

Any encumbrances created by Section 98 Transfer of Land Act 1958 or Section 24 Subdivision Act 1988 and any other encumbrances shown or entered on the plan set out under DIAGRAM LOCATION below.

DIAGRAM LOCATION

SEE TP512682C FOR FURTHER DETAILS AND BOUNDARIES

ACTIVITY IN THE LAST 125 DAYS

NIL

DOCUMENT END

HISTORICAL SEARCH STATEMENT

Land Victoria

Page 1 of 1

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Volume 11379 Folio 866
Folio Creation: Created as a computer folio
Parent title Volume 09667 Folio 677

STATEMENT END

VOTS Snapshot

VOLUME 11379 FOLIO 866
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LAND DESCRIPTION

Lots 1 and 2 on Title Plan 512682C (formerly known as part of Section 6, part of Section 15 Parish of Tullamarine).
PARENT TITLE Volume 09667 Folio 677
Created by instrument AJ919396X 19/09/2012

REGISTERED PROPRIETOR

Estate Fee Simple
Sole Proprietor
TRANSPACIFIC CLEANAWAY PTY LTD of 159 CORONATION DRIVE MILTON QLD 4064
M038790U 11/12/1985

ENCUMBRANCES, CAVEATS AND NOTICES

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DIAGRAM LOCATION

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HISTORICAL SEARCH STATEMENT

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Page 1 of 6

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Volume 09667 Folio 677
Folio Creation: Created as paper folio continued as computer folio
Parent titles :
Volume 04455 Folio 999
Volume 08496 Folio 620

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RECORD OF ALTS DEALINGS

Date Lodged for Registration	Date Recorded on Register	Dealing	Imaged	Dealing Type and Details
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RECORD OF VOTS DEALINGS

Date Lodged for Registration	Date Recorded on Register	Dealing	Imaged
19/09/2012	02/10/2012	AJ919396X	Y

Cancelled by AJ919396X

STATEMENT END

VOTS Snapshot

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124043340270P
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LAND DESCRIPTION

Lots 1 and 2 on Title Plan 512682C (formerly known as part of Section 6, part of Section 15 Parish of Tullamarine).

PARENT TITLES :
Volume 04455 Folio 999 Volume 08496 Folio 620
Created by instrument M038790U 11/12/1985

REGISTERED PROPRIETOR

Estate Fee Simple
Sole Proprietor
BRAMBLES HOLDINGS LTD of GOLDFIELDS HOUSE 1 ALFRED STREET SYDNEY NEW SOUTH
WALES
M038790U 11/12/1985

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9667/677 - Version 0, Date 24/03/1999

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VICTORIA

FIGURE: 100X

VOL 9667 100.677

Certificate of Title

UNDER THE TRANSFER OF LAND ACT

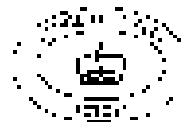
WEAPONS HOLDINGS LIMITED of 601/111-115 House & Alfred Street Sydney New South Wales
is the proprietor of an estate in fee simple subject to the encumbrances specified
hereunder in all those parcels of land in the Parish of Tullahoma County of Victoria
being parts of Crown Lands Nos 5 and 19 which lands are shown as being
used as indicated in the sheet annexed hereto -

FIG.
VOL.

DATE: 11/12/82
DUPED FROM VOL. 4488 PCL 544 411 104 PCL 625 4087801

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11/12/82
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VOL 9667

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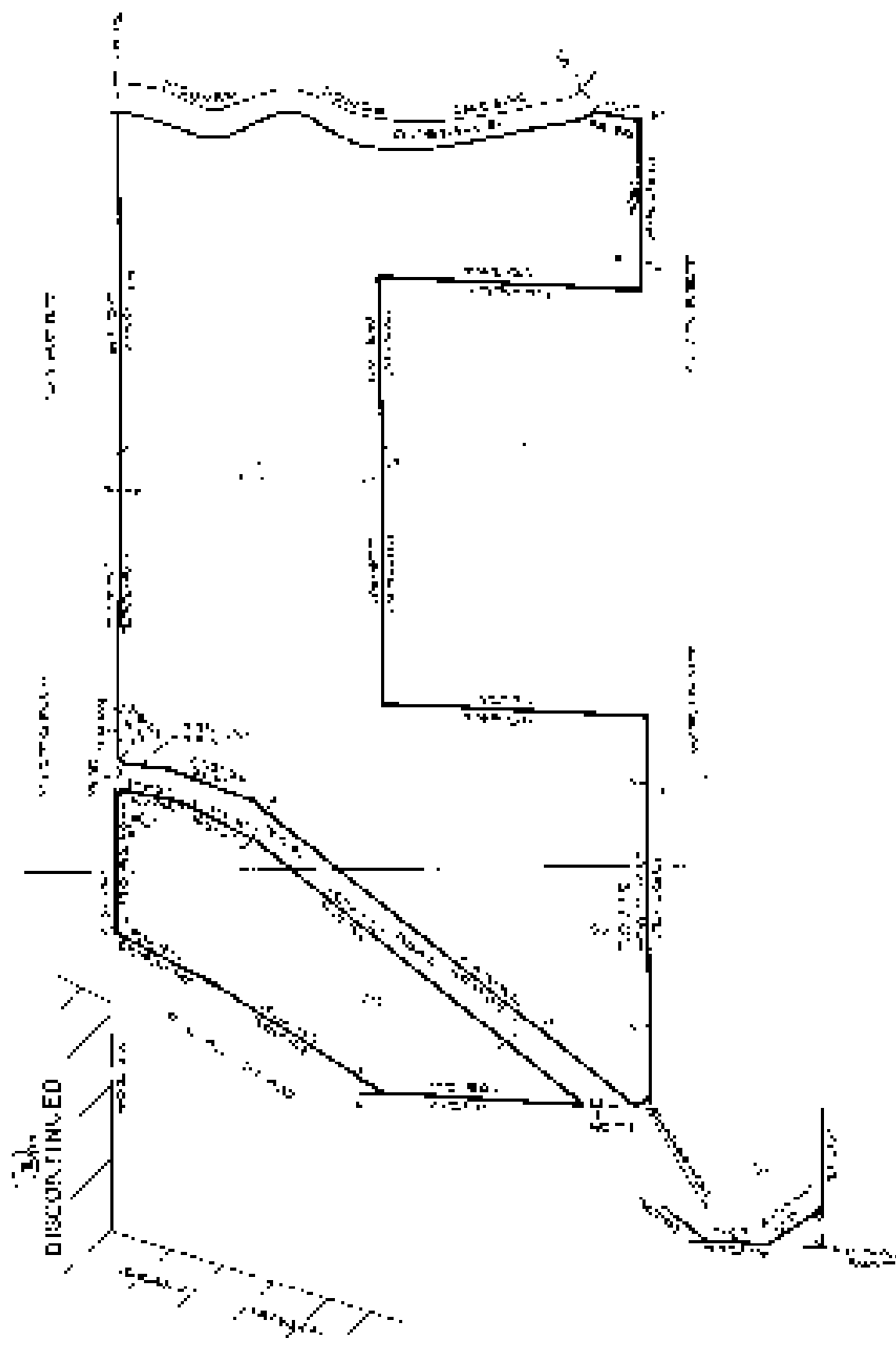


10067 677 0



ANNEXED SHEET REFERRED TO IN
CERTIFICATE OF TITLE VOL. 3657 PGL. 679

John
REGISTERED PROFESSIONAL SURVEYOR



PAID BY CHECK
\$ 100.00
RECEIVED
JAN 10 1968
SURVEYOR

THIS SURVEY WAS MADE IN ACCORDANCE WITH THE REQUIREMENTS OF THE SURVEYING ACT OF 1928 AND THE REGULATIONS THEREUNDER.

World Health Organization
Geneva, Switzerland
INTERNATIONALLY
RECOGNIZED

Vertical text on the right edge of the page, possibly a page number or reference code.

HISTORICAL SEARCH STATEMENT

Land Victoria

Page 1 of 5

Produced 09/01/2014 10:45 AM

Volume 04455 Folio 999
Folio Creation: Details Unknown

STATEMENT END

Paper Title Images

4455/999 - Version 0, Date 04/12/1999

WGS 833975

Entered in Register Book

Vol. 4455 Fol. 800

999 Fol. 999
6/11/11



VICTORIA

Certificate of Title

UNDER THE "TRANSFER OF LAND ACT 1916."

Handwritten mark

Charles Nash of Tullamarine in the County of Bourke Farmer is -----
now the proprietor of an Estate in Fee-simple, subject to the Encumbrances
notified hereunder in All that piece of Land, delineated and coloured
red on the map in the margin containing Seventy-nine acres or thereabouts being---
part of Crown Sections Six and Fifteen Parish of Tullamarine County of Bourke---

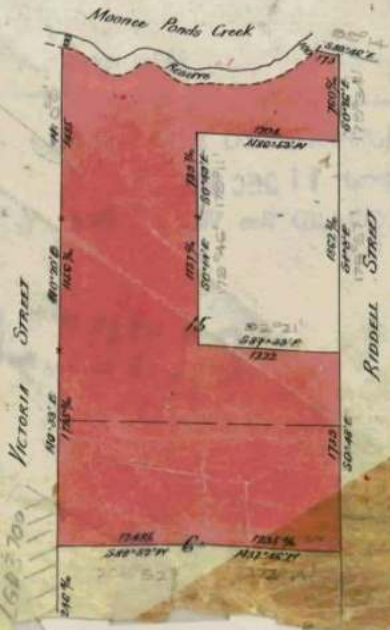
ORIGINAL CERTIFICATE.
Not to be dealt with outside the Titles Office.

Dated the Fourth day of November
thousand nine hundred and twenty-one.

day of November

Alfred H. ...
Assistant Registrar of Titles

ENCUMBRANCES REFER



T04455-999-1-0

Delivered
on-line by
LANDATA®

WARNING
This document provides an image of a cancelled folio of the Register. It is not a statement
from the register of subsisting information in relation to the land to which it refers.

Vol. Fol. Transfer. Application 4361

Nature of Instrument. Time of its Production for Registration. To whom given. Number or Symbol thereon.

2394999
Widow Nash
14 March 1923 Probate has been granted
Elen Eliza Nash of Tullamarine
Widow and Alexander Purphey of 6
Inver Street Tullamarine being Retired
Partner
Thos Gleeson
1 August 1923 Assistant Registrar of Titles
Elyza Nash of Tullamarine
Widow is
Proprietor of the within described estate
from Elen Eliza Nash and
Alexander Purphey
1 August 1923 and numbered
Thos Gleeson
Assistant Registrar of Titles.

ELIZA NASH died on 7th June 1961
Probate of her Will has been granted to HENRY ALEXANDER
NASH of Nash's Lane Tullamarine Farmer and DAVID JOHN
DREVER of 36 Carrington Road Niddrie Retired
Dated 18th December 1962
No. B568515

of 29A Pincock Street
ORCHARD of 1 Genser Street
es and HILDA EMILY DREVER
rie Married Women and
ash's Lane Tullamarine
rs as TENANTS IN COMMON IN

Transfer B68516
Registered 8th December 1962

As to the interest of HENRY ALEXANDER NASH who died on
30th December 1961
Probate of his will has been granted to THE UNION-FIDELITY
TRUSTEE COMPANY OF AUSTRALIA LIMITED of 333 Collins Street
Melbourne and OLIVE NASH of Tullamarine Widow
Dated 12th March 1964
No. M79879

TRANSFER as to the interest formerly held by Henry
Alexander Nash
registered 12th March 1964
CANCELLED as to the said interest
8496 Fol. 620

THE COUNTRY ROADS BOARD
has pursuant to section 57 of Transfer of Land Act
served a Notice of Intention to the compulsory acquisition
of the land comprised herein.
Dated 21 December 1964.
Corres. No. 21986 (plan with letter)

COUNTRY ROADS BOARD
has pursuant to section 57 of Transfer of Land Act
served a Notice of Intention to the compulsory acquisition
of the land comprised herein.
Dated 5 August 1965
Corres. No. 65/13755 (plan with letter)

TRANSFER AS TO PART No. C 811860
registered 23 June 1967
CANCELLED AS TO PART
See Vol. 8681 Fol. 691

TRANSFER AS TO PART No. D 21747
registered 3rd July 1968
CANCELLED AS TO PART
See Vol. 8738 Fol. 114

CAVEAT No. J41105 LODGED 6 APR 1981
CAVEAT WITHDRAWN
25 FEB 1982

CAVEAT No. L817898A LODGED 6 AUG 1985
CAVEAT WILL LAPSE ON
REGISTRATION OF M327904
19 FEB 1986

TRANSFER AS TO BALANCE No. M 387904
registered 11 DEC 1985
CANCELLED See Vol. 9667 Fol. 677

CANCELLED

Does not now affect
9/11/65
Does not now affect
5/8/65



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SCALE: 8 Chains to one inch
Volume 4455 Folio - 999

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WARNING



METRIC MEASUREMENTS SHOWN M 38790u

CONSOL OF INTS. M.038790 U (REM. 3/4 INT. IN LD RE 2 PIECES 28.60 ha)

CONSOL OF INTS CB11850 to C.R.B. (3pts) REM. 3/4 INT. IN PT.

DECLARED G.G. 19/6/74 P 1240 2805 P 9558

CONSOL OF INTS D12,1747 REM 1/2 INT IN PT.

26.7.67

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Natural Resources and Environment
AGRICULTURE - RESOURCES - CONSERVATION - LAND MANAGEMENT
**INTENTIONALLY
BLANK**

HISTORICAL SEARCH STATEMENT

Land Victoria

Page 1 of 5

Produced 09/01/2014 10:48 AM

Volume 08496 Folio 620
Folio Creation: Details Unknown
Parent title Volume 04455 Folio 999

STATEMENT END

Paper Title Images

8496/620 - Version 0, Date 22/12/1999

WCT 833975
D121747

ORIGINAL

REGISTER BOOK

**NOT TO BE TAKEN FROM THE OFFICE
OF TITLES**



VICTORIA

VOL. 8496 FOL. 620

CANCELLED

Certificate of Title

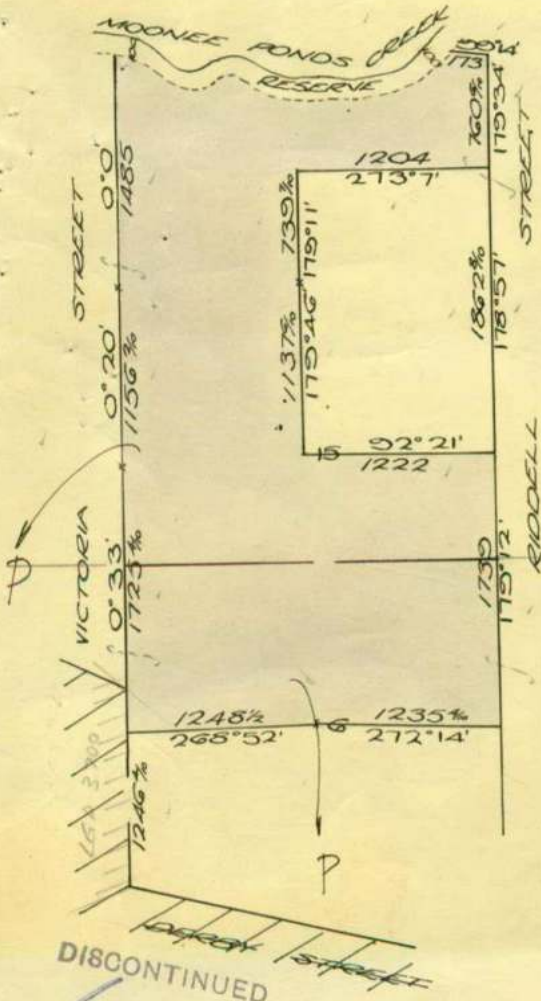
UNDER THE "TRANSFER OF LAND ACT"

OLIVE NASH of Tullamarine Widow is now the proprietor of an estate in fee - -
simple subject to the encumbrances notified hereunder in one equal undivided - -
fourth part or share of ALL THAT piece of land delineated and coloured purple on
the map in the margin containing Seventy-nine acres or thereabouts being part of
Crown Sections 6 and 15 Parish of Tullamarine - - - - -

VOL. 8496 FOL. 620

A.O. IN L.G.D. 3700
8 5 97

DATED the 12th day of March 1964



MEASUREMENTS ARE IN LINKS



W. Hall
Assistant Registrar of Titles

ENCUMBRANCES REFERRED TO

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WARNING

NO DEALING TO BE REGISTERED UNTIL
PLAN IS AMENDED ON DUPLICATE
SEE L.G.D. 3700

Derived from Vol. 4455 Fol. 999

B879880

Section 57 of Transfer of Land Act
compulsory acquisition
land comprised herein

COUNTY ROADS BOARD
Section 57 of Transfer of Land Act
compulsory acquisition
land comprised herein
Dated 5th August 1965
Chancery No. 65/13755

TRANSFER AS TO PART No. *C.P. 11850*
registered *23rd June 1967*
CANCELLED AS TO PART
See Vol. *583* Fol. *601*

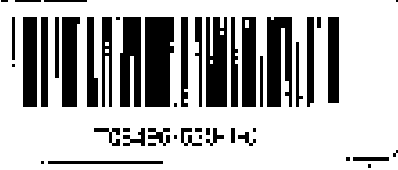
TRANSFER AS TO PART No. *D. 21787*
registered *3rd July 1969*
CANCELLED AS TO PART
See Vol. *5738* Fol. *11*

CAVEAT NO. 100-10001 LODGED 5 APR 1981
CAVEAT WITHDRAWN
20 FEB 1982

CAVEAT NO. 100-10001 A LODGED 5 APR 1981
DORTH MULLI LAPS LK
CANCELLATION OF CAVEAT
15 FEB 1981

TRANSFER AS TO BALANCE No. 10573016
registered 11 DEC 1985
CANCELLED See Vol. *56* Fol. *677*

Handwritten notes and stamps at bottom left



45496 F.620

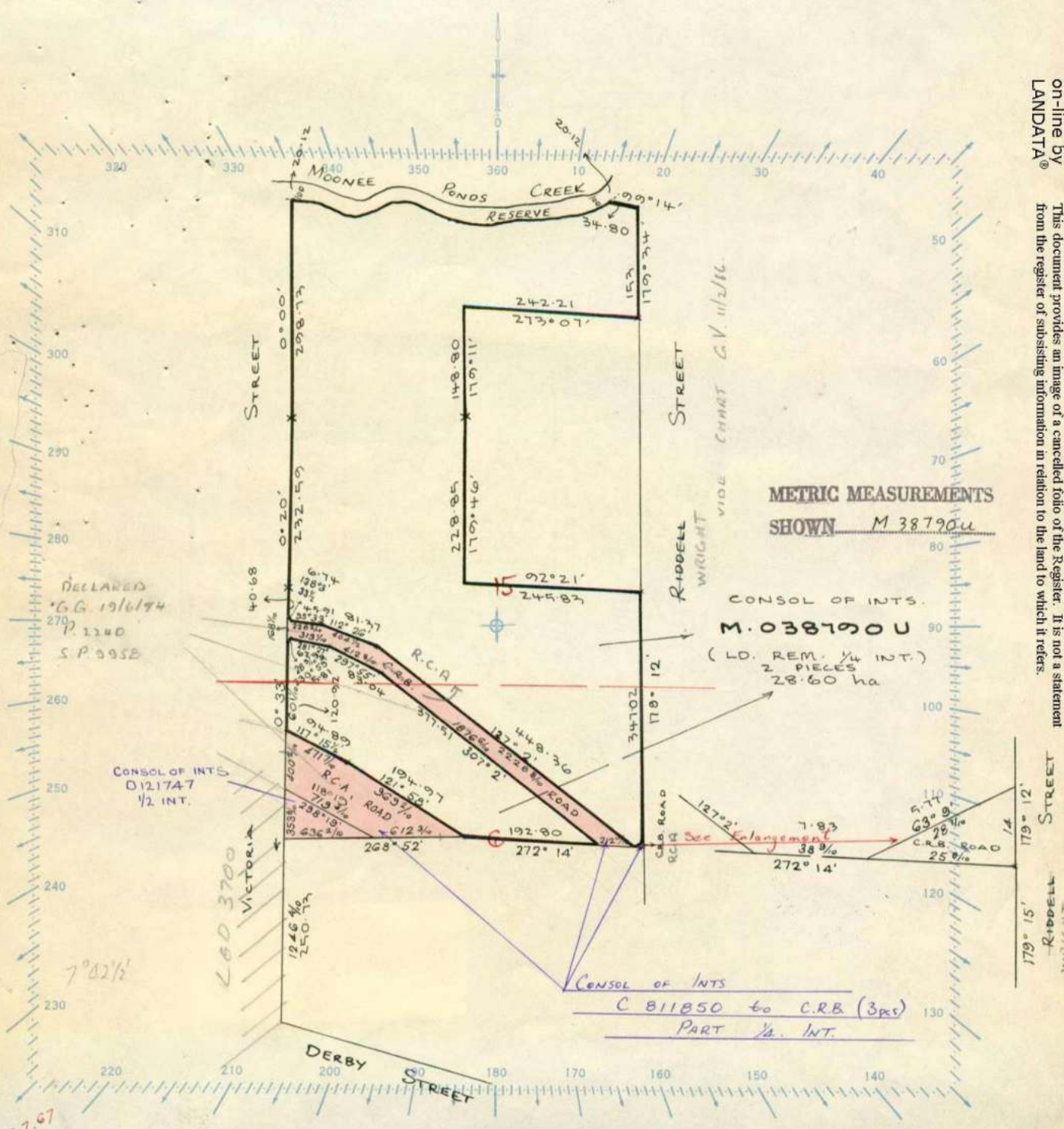
SCALE: 8 Chains to one inch

Volume 8496 Folio 620

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WARNING



X.D. 26.7.67

STATE OF CALIFORNIA
DEPARTMENT OF REVENUE
SALES TAX RECEIPT
NO. 123456789



Property Report

 from www.land.vic.gov.au on 11 July 2012 02:47 PM

Address: 140-204 WESTERN AVENUE WESTMEADOWS 3049

Lot and Plan Number: This site has 2 parcels. See table below.

Standard Parcel Identifier (SPI): See table below.

Local Government (Council): HUME **Council Property Number:** 502521

Directory Reference: Melway 5 F7

**This property is in a designated bushfire prone area.
Special bushfire construction requirements apply.**

Further information about the building control system and building in bushfire prone areas can be found on the Building Commission website www.buildingcommission.com.au

Parcel Details

Lot/Plan or Crown Description	SPI
Lot 1 TP512682	1\TP512682
Lot 2 TP512682	2\TP512682

State Electorates

Legislative Council: WESTERN METROPOLITAN (2005)

Legislative Assembly: YUROKE (2001)

Utilities

Rural Water Business: Southern Rural Water

Metro Water Business: Yarra Valley Water Ltd

Melbourne Water: inside drainage boundary

Power Distributor: JEMENA (Information about [choosing an electricity retailer](#))

Planning Zone Summary

Planning Zones: FARMING ZONE - SCHEDULE 3 (FZ3)
SCHEDULE TO THE FARMING ZONE - SCHEDULE 3
PUBLIC USE ZONE - SERVICE AND UTILITY (PUZ1)
SCHEDULE TO THE PUBLIC USE ZONE - SERVICE AND UTILITY

Planning Overlays: ENVIRONMENTAL AUDIT OVERLAY (EAO)
ENVIRONMENTAL SIGNIFICANCE OVERLAY (ESO)
ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 2 (ESO2)
LAND SUBJECT TO INUNDATION OVERLAY (LSIO)
LAND SUBJECT TO INUNDATION OVERLAY SCHEDULE (LSIO)

Planning scheme data last updated on 6 July 2012.

A **planning scheme** sets out policies and requirements for the use, development and protection of land. This report provides information about the zone and overlay provisions that apply to the selected land. Information about the State, local, particular and general provisions of the local planning scheme that may affect the use of this land can be obtained by contacting the [local council](#) or by visiting [Planning Schemes Online](#)

This report is NOT a **Planning Certificate** issued pursuant to Section 199 of the Planning & Environment Act 1987. It does not include information about exhibited planning scheme amendments, or zonings that may abut the land. To obtain a Planning Certificate go to [Titles and Property Certificates](#)

For details of surrounding properties, use this service to get the Reports for properties of interest

To view planning zones, overlay and heritage information in an interactive format visit [Planning Maps Online](#)

For other information about planning in Victoria visit www.dpcd.vic.gov.au/planning

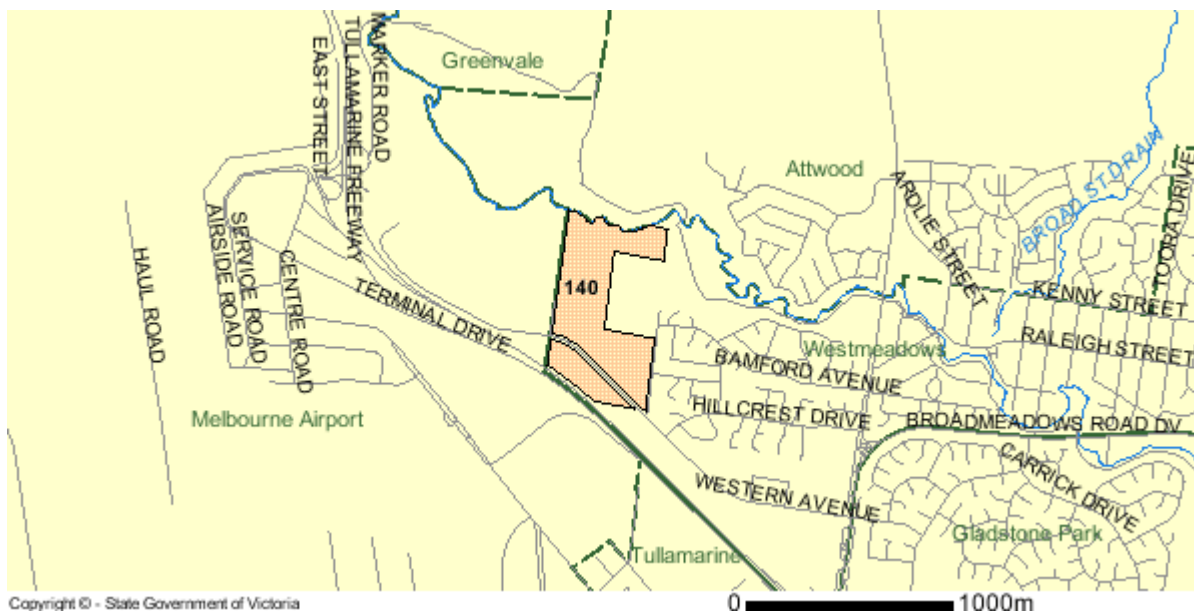
Heritage Register data last updated on 29 June 2012.

This report is NOT a **Heritage Certificate** issued pursuant to Section 50 of the Heritage Act 1995. It does not show places which may be under consideration for inclusion in the Victorian Heritage Register.

For more information on the **Victorian Heritage Register** go to [Victorian Heritage Database](#)

Other information about the heritage status of this property, how to obtain a Heritage Certificate, and any heritage approvals that may be required, may be obtained from [Heritage Victoria](#)

Area Map



Melbourne Airport Environs Overlay Report

from www.land.vic.gov.au on 11 July 2012 02:48 PM

Address: 140-204 WESTERN AVENUE WESTMEADOWS 3049

Lot and Plan Number: Lot 1 TP512682

This property has a total of 2 parcels.

For full parcel details get the free Basic Property report at [Property Reports](#)

Local Government (Council): HUME **Council Property Number:** 502521

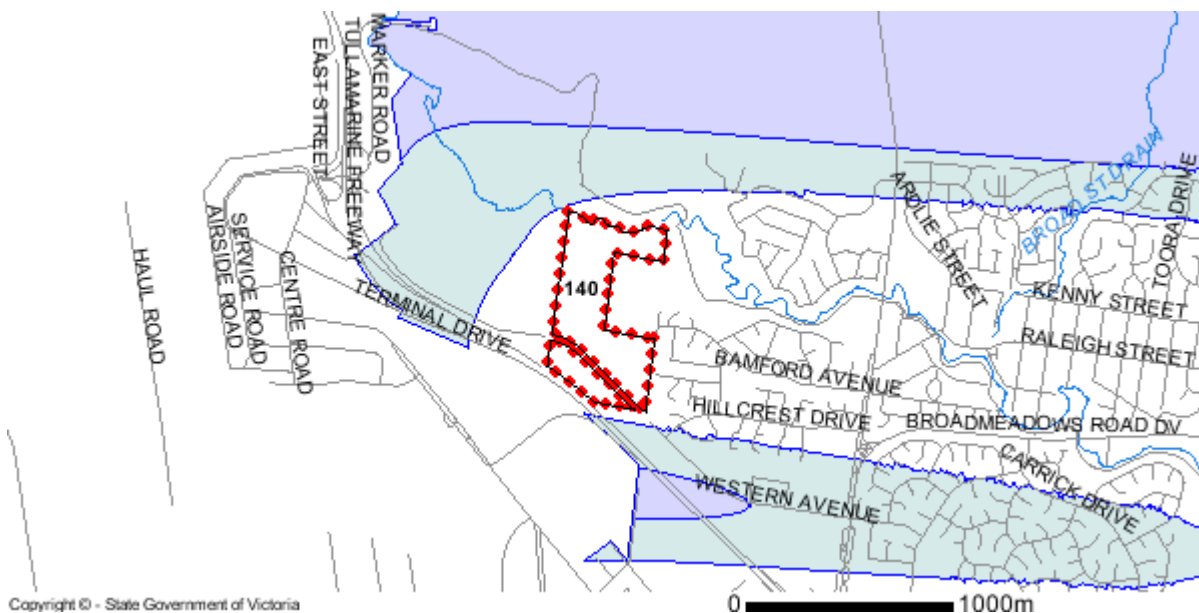
Directory Reference: Melway 5 F7

Planning Zones: [FARMING ZONE - SCHEDULE 3 \(FZ3\)](#)
[SCHEDULE TO THE FARMING ZONE - SCHEDULE 3](#)
[PUBLIC USE ZONE - SERVICE AND UTILITY \(PUZ1\)](#)
[SCHEDULE TO THE PUBLIC USE ZONE - SERVICE AND UTILITY](#)

Airport Overlays: [MELBOURNE AIRPORT ENVIRONS OVERLAY \(MAEO\)](#)

This property is affected by the Melbourne Airport Environs Overlay.

Airport Overlays Map



Airport Overlays Melbourne Airport Environs 1 Melbourne Airport Environs 2

Note - this map shows only the Melbourne Airport Environs Overlays 1 and 2

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Planning Property Report

From www.dpcd.vic.gov.au/planning on 11 July 2012 02:48 PM

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Lot and Plan Number: Lot 1 TP512682

This property has a total of 2 parcels.

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Local Government (Council): HUME **Council Property Number:** 502521

Directory Reference: Melway 5 F7

See next page for planning information

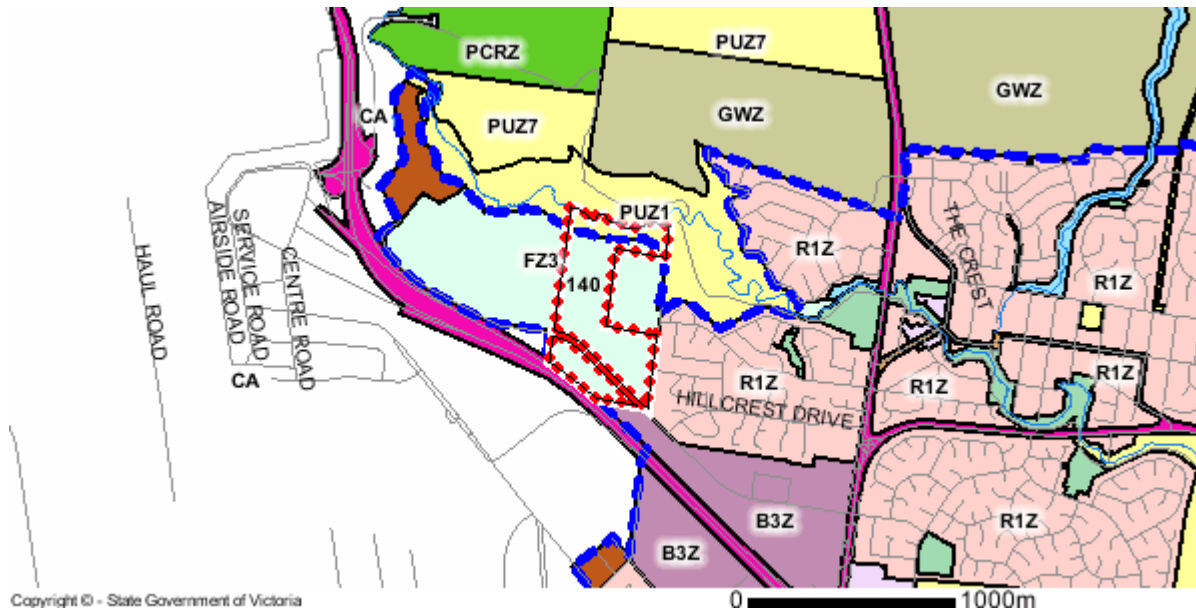
Planning Zones

[FARMING ZONE - SCHEDULE 3 \(FZ3\)](#)

[SCHEDULE TO THE FARMING ZONE - SCHEDULE 3](#)

[PUBLIC USE ZONE - SERVICE AND UTILITY \(PUZ1\)](#)

[SCHEDULE TO THE PUBLIC USE ZONE - SERVICE AND UTILITY](#)



Note: labels for zones may appear outside the actual zone - please compare the labels with the legend.

Zones Legend

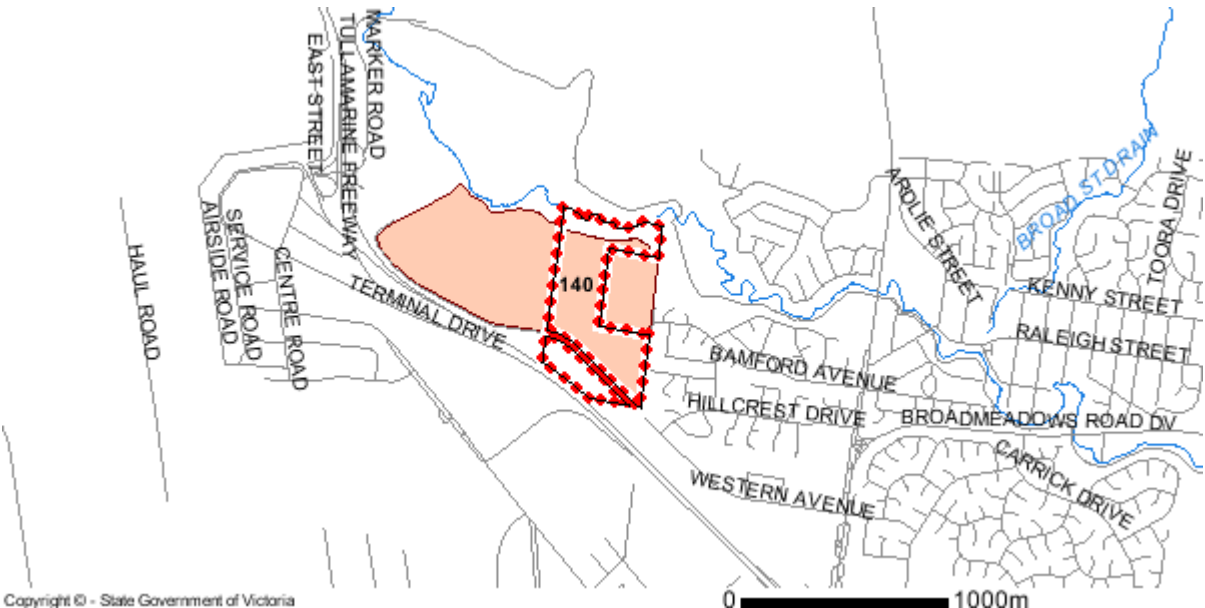
ACZ - Activity Centre	IN1Z - Industrial 1	R1Z - Residential 1
B1Z - Business 1	IN2Z - Industrial 2	R2Z - Residential 2
B2Z - Business 2	IN3Z - Industrial 3	R3Z - Residential 3
B3Z - Business 3	LDRZ - Low Density Residential	RAZ - Rural Activity
B4Z - Business 4	MUZ - Mixed Use	RCZ - Rural Conservation
B5Z - Business 5	PCRZ - Public Conservation & Resource	RDZ1 - Road - Category 1
CA - Commonwealth Land	PDZ - Priority Development	RDZ2 - Road - Category 2
CCZ - Capital City	PPRZ - Public Park & Recreation	RLZ - Rural Living
CDZ - Comprehensive Development	PUZ1 - Public Use - Service & Utility	RUZ - Rural
DZ - Dockland	PUZ2 - Public Use - Education	SUZ - Special Use
ERZ - Environmental Rural	PUZ3 - Public Use - Health Community	TZ - Township
FZ - Farming	PUZ4 - Public Use - Transport	UFZ - Urban Floodway
GWAZ - Green Wedge A	PUZ5 - Public Use - Cemetery/Crematorium	UGZ - Urban Growth
GWZ - Green Wedge	PUZ6 - Public Use - Local Government	Urban Growth Boundary
	PUZ7 - Public Use - Other Public Use	

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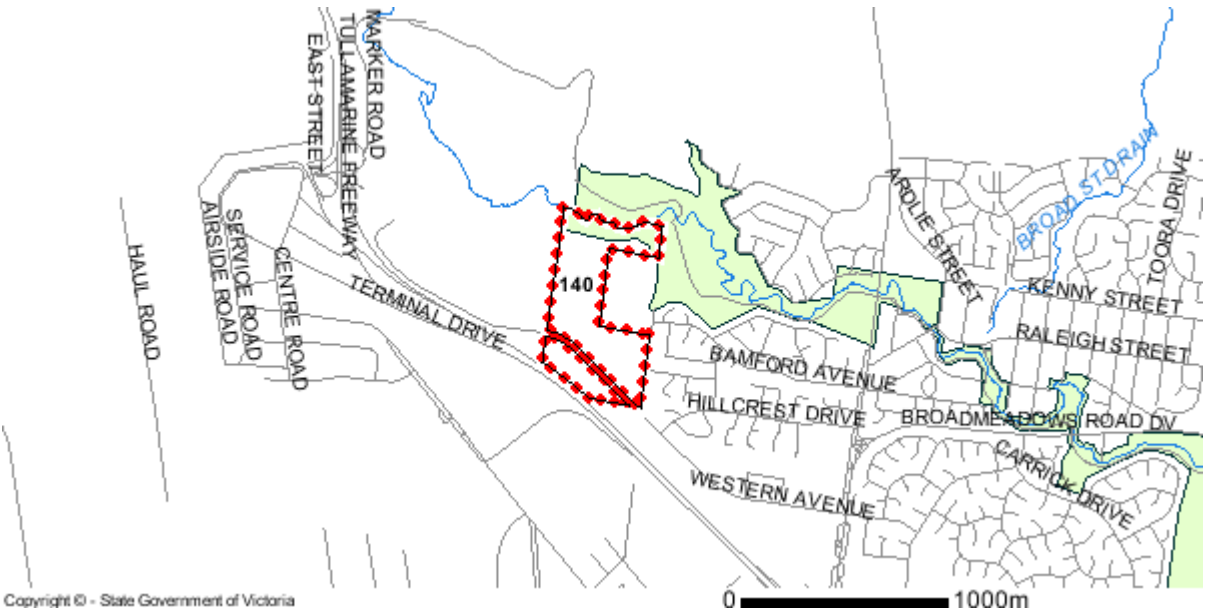
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Planning Overlays

ENVIRONMENTAL AUDIT OVERLAY (EAO)



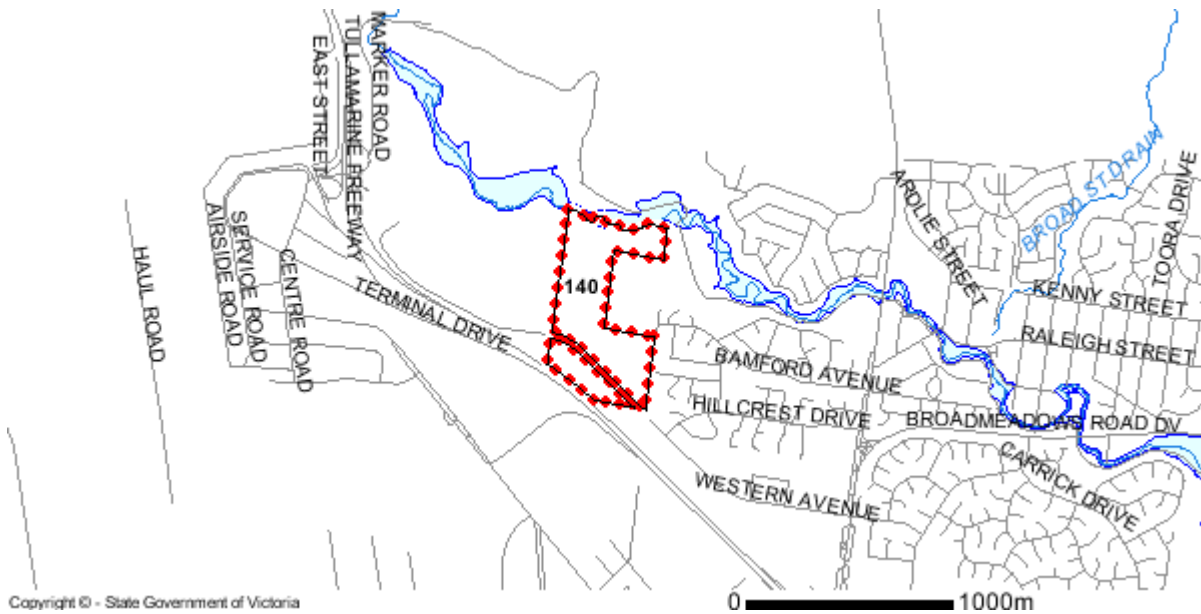
ENVIRONMENTAL SIGNIFICANCE OVERLAY (ESO)
ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 2 (ESO2)



Planning Overlays

[LAND SUBJECT TO INUNDATION OVERLAY \(LSIO\)](#)

[LAND SUBJECT TO INUNDATION OVERLAY SCHEDULE \(LSIO\)](#)



OTHER OVERLAYS

Other overlays in the vicinity not directly affecting this land

[DESIGN AND DEVELOPMENT OVERLAY \(DDO\)](#)

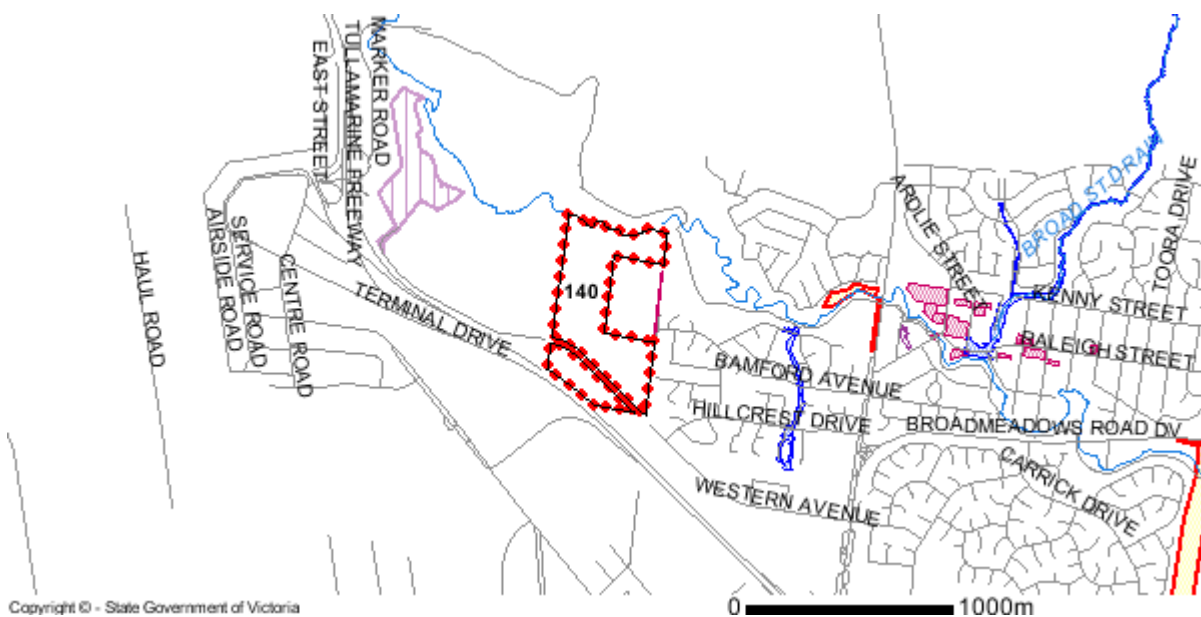
[DEVELOPMENT PLAN OVERLAY \(DPO\)](#)

[HERITAGE OVERLAY \(HO\)](#)

[MELBOURNE AIRPORT ENVIRONS OVERLAY \(MAEO\)](#)

[PUBLIC ACQUISITION OVERLAY \(PAO\)](#)


























[SPECIAL BUILDING OVERLAY \(SBO\)](#)



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Planning Overlays Legend

Overlays Legend					
	Airport Environs		Erosion Management		Public Acquisition
	City Link Project		Environmental Significance		Restructure
	Development Contributions Plan		Floodway		Road Closure
	Design & Development		Heritage		Special Building
	Design & Development Part		Incorporated Plan		Significant Landscape
	Development Plan		Land Subject to Inundation & Floodway		Salinity Management
	Environmental Audit		Melbourne Airport Environs 1		State Resource
			Melbourne Airport Environs 2		Vegetation Protection
			Neighbourhood Character		Bushfire Management - Wildfire Management

Note: due to overlaps some colours on the maps may not match those in the legend.

Further Planning Information

Planning scheme data last updated on 6 July 2012.

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Appendix H

34 Pages

Auditor Verification Sampling Laboratory Certificates

Appendix H1: Soil Sampling (18 October 2012)

Appendix H2: Soil Vapour Sampling (8 August 2013)

Appendix H3: Soil Sampling (4 September 2013)

Cardno Lane Piper Pty Ltd
 Building 2, 154 Highbury Road
 Burwood
 VIC 3125



NATA Accredited
 Accreditation Number 1261
 Site Number 1254

Accredited for compliance with ISO/IEC 17025.
 The results of the tests, calibrations and/or
 measurements included in this document are traceable
 to Australian/national standards.

Attention: Kris Inkster

Report **356096-S**
 Client Reference S53X AUDIT BUFFER LAND WESTERN AVENUE 212173
 Received Date Oct 18, 2012

Client Sample ID			TP116_0-0.1	TP122_0-0.1	TP131_0-0.1
Sample Matrix			Soil	Soil	Soil
mgt-LabMark Sample No.			M12-Oc16999	M12-Oc17000	M12-Oc17001
Date Sampled			Oct 17, 2012	Oct 17, 2012	Oct 17, 2012
Test/Reference	LOR	Unit			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	20	mg/kg	< 20	< 20	< 20
TRH C10-C14	20	mg/kg	< 20	< 20	< 20
TRH C15-C28	50	mg/kg	< 50	< 50	< 50
TRH C29-C36	50	mg/kg	76	< 50	52
TRH C10-36 (Total)	50	mg/kg	76	< 50	52
Total Recoverable Hydrocarbons - Draft 2010 NEPM Fractions *					
Naphthalene ^{N02}	0.5	mg/kg	< 0.5	< 0.5	< 0.5
TRH C6-C10	20	mg/kg	< 20	< 20	< 20
TRH C6-C10 less BTEX (F1) ^{N04}	20	mg/kg	< 20	< 20	< 20
TRH >C10-C16	50	mg/kg	< 50	< 50	< 50
TRH >C10-C16 less Naphthalene (F2) ^{N01}	50	mg/kg	< 50	< 50	< 50
TRH >C16-C34	100	mg/kg	< 100	< 100	< 100
TRH >C34-C40	100	mg/kg	< 100	< 100	< 100
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benzo(b)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Indeno(1,2,3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Total PAH	0.5	mg/kg	< 0.5	< 0.5	< 0.5
p-Terphenyl-d14 (surr.)	1	%	77	84	85
2-Fluorobiphenyl (surr.)	1	%	91	98	96
Organochlorine Pesticides					
4,4'-DDD	0.05	mg/kg	< 0.05	< 0.05	< 0.05
4,4'-DDE	0.05	mg/kg	< 0.05	< 0.05	< 0.05
4,4'-DDT	0.05	mg/kg	< 0.05	< 0.05	< 0.05
a-BHC	0.05	mg/kg	< 0.05	< 0.05	< 0.05

Client Sample ID			TP116_0-0.1	TP122_0-0.1	TP131_0-0.1
Sample Matrix			Soil	Soil	Soil
mgt-LabMark Sample No.			M12-Oc16999	M12-Oc17000	M12-Oc17001
Date Sampled			Oct 17, 2012	Oct 17, 2012	Oct 17, 2012
Test/Reference	LOR	Unit			
Organochlorine Pesticides					
Aldrin	0.05	mg/kg	< 0.05	< 0.05	< 0.05
b-BHC	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Chlordane	0.1	mg/kg	< 0.1	< 0.1	< 0.1
d-BHC	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Endrin	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	< 0.05	< 0.05
g-BHC (Lindane)	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	< 0.05	< 0.05
Toxaphene	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Dibutylchloredate (surr.)	1	%	93	86	86
Tetrachloro-m-xylene (surr.)	1	%	87	86	82
Polychlorinated Biphenyls					
Aroclor-1016	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Total PCB	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Dibutylchloredate (surr.)	1	%	93	86	86
Tetrachloro-m-xylene (surr.)	1	%	87	86	82
Phenols (Halogenated)					
2-Chlorophenol	0.5	mg/kg	< 0.5	< 0.5	< 0.5
2,4-Dichlorophenol	0.5	mg/kg	< 0.5	< 0.5	< 0.5
2,4,5-Trichlorophenol	1.0	mg/kg	< 1	< 1	< 1
2,4,6-Trichlorophenol	1.0	mg/kg	< 1	< 1	< 1
2,6-Dichlorophenol	0.5	mg/kg	< 0.5	< 0.5	< 0.5
4-Chloro-3-methylphenol	1.0	mg/kg	< 1	< 1	< 1
Pentachlorophenol	1.0	mg/kg	< 1	< 1	< 1
Tetrachlorophenols - Total	1.0	mg/kg	< 1	< 1	< 1
Total Halogenated Phenol	1	mg/kg	< 1	< 1	< 1
Phenols (non-Halogenated)					
2-Cyclohexyl-4,6-dinitrophenol	20	mg/kg	< 20	< 20	< 20
2-Methyl-4,6-dinitrophenol	5	mg/kg	< 5	< 5	< 5
2-Methylphenol (o-Cresol)	0.2	mg/kg	< 0.2	< 0.2	< 0.2
2-Nitrophenol	1.0	mg/kg	< 1	< 1	< 1
2,4-Dimethylphenol	0.5	mg/kg	< 0.5	< 0.5	< 0.5
2,4-Dinitrophenol	5	mg/kg	< 5	< 5	< 5
3&4-Methylphenol (m&p-Cresol)	0.4	mg/kg	< 0.4	< 0.4	< 0.4
4-Nitrophenol	5	mg/kg	< 5	< 5	< 5
Dinoseb	20	mg/kg	< 20	< 20	< 20

Client Sample ID			TP116_0-0.1	TP122_0-0.1	TP131_0-0.1
Sample Matrix			Soil	Soil	Soil
mgt-LabMark Sample No.			M12-Oc16999	M12-Oc17000	M12-Oc17001
Date Sampled			Oct 17, 2012	Oct 17, 2012	Oct 17, 2012
Test/Reference	LOR	Unit			
Phenols (non-Halogenated)					
Phenol	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Total Non-Halogenated Phenol	20	mg/kg	< 20	< 20	< 20
Phenol-d6 (surr.)	1	%	87	93	87
Cyanide					
Cyanide (free)	5	mg/kg	< 5	< 5	< 5
Cyanide (total)	5	mg/kg	< 5	< 5	< 5
Phosphate					
Phosphate total (as P)	10	mg/kg	< 10	< 10	< 10
Sulphate					
Sulphate (as S)	10	mg/kg	< 10	< 10	11
Total Sulphur (as S)	100	mg/kg	470	450	390
% Moisture	0.1	%	10	7.2	9.8
NEPM Metals : Metals M15					
Chromium (hexavalent)	1	mg/kg	< 1	< 1	< 1
Chromium (trivalent)	5	mg/kg	42	17	46
Heavy Metals					
Boron	10	mg/kg	< 10	< 10	< 10
Arsenic	2	mg/kg	< 2	2.8	6.6
Barium	10	mg/kg	140	180	200
Beryllium	2	mg/kg	< 2	< 2	< 2
Cadmium	0.4	mg/kg	< 0.4	< 0.4	0.5
Chromium	5	mg/kg	42	17	46
Cobalt	5	mg/kg	18	< 5	20
Copper	5	mg/kg	21	10	27
Lead	5	mg/kg	56	< 5	13
Manganese	5	mg/kg	1100	160	720
Mercury	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Nickel	5	mg/kg	26	7.8	36
Vanadium	10	mg/kg	49	26	77
Zinc	5	mg/kg	82	29	51

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

Description	Testing Site	Extracted	Holding Time
NEPM HIL Screen: 1999 B(1)HIL Table 5A			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions - Method: TRH C6-C36 - MGT 100A	Melbourne	Oct 19, 2012	14 Day
Total Recoverable Hydrocarbons - Draft 2010 NEPM Fractions * - Method: LM-LTM-ORG2010	Melbourne	Oct 19, 2012	14 Day
Polycyclic Aromatic Hydrocarbons - Method: USEPA 8270 Polycyclic Aromatic Hydrocarbons	Melbourne	Oct 19, 2012	14 Day
Organochlorine Pesticides - Method: USEPA 8081 Organochlorine Pesticides	Melbourne	Oct 19, 2012	14 Day
Polychlorinated Biphenyls - Method: USEPA 8082 Polychlorinated Biphenyls	Melbourne	Oct 19, 2012	14 Day
Phenols (Halogenated) - Method: USEPA 8270 Phenols	Melbourne	Oct 19, 2012	14 Day
Phenols (non-Halogenated) - Method: USEPA 8270 Phenols	Melbourne	Oct 19, 2012	14 Day
Cyanide (total) - Method: USEPA 9010 Cyanide	Melbourne	Oct 19, 2012	14 Day
Phosphate total (as P) - Method: APHA 4500-P E. Phosphorous	Melbourne	Oct 19, 2012	14 Day
Sulphate (as S) - Method: APHA 4500-SO4 (SO4 by Discrete Analyser)	Melbourne	Oct 19, 2012	28 Day
Total Sulphur (as S) - Method: Total Sulphur:- NEPM Method 20 - Sodium Bicarbonate FUSION at 550C.	Melbourne	Oct 19, 2012	28 Day
NEPM Metals : Metals M15			
Chromium (hexavalent) - Method: APHA 3500-Cr Hexavalent Chromium- (Extraction:- USEPA3060)	Melbourne	Oct 19, 2012	28 Day
Boron - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Arsenic - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Barium - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Beryllium - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Cadmium - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Chromium - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Cobalt - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Copper - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Lead - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Manganese - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Mercury - Method: USEPA 7470/1 Mercury	Melbourne	Oct 19, 2012	28 Day
Nickel - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Vanadium - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
Zinc - Method: USEPA 6010/6020 Heavy Metals	Melbourne	Oct 19, 2012	6 Month
% Moisture - Method: Method 102 - ANZECC - % Moisture	Melbourne	Oct 19, 2012	14 Day

Company Name: Cardno Lane Piper Pty Ltd
Address: Building 2, 154 Highbury Road
 Burwood
 VIC 3125
Contract Job No.: S53X AUDIT BUFFER LAND WESTERN AVENUE 212173

Order No.:
Report #: 356096
Phone: 9888 0100
Fax: 9808 3511

Received: Oct 18, 2012 6:27 PM
Due: Oct 26, 2012
Priority: 5 Day
Contact Name: Kris Inkster

mgt-LabMark Client Manager: Natalie Krasselt

Sample Detail	% Moisture	NEPM HIL Screen : 1999 B(1)HIL Table 5A
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Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X
Sydney Laboratory - NATA Site # 18217							
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
Sample ID	Sample Date	Sampling Time	Matrix	LAB ID			
116	0-0.1	Oct 17, 2012	3:20PM	Soil	M12-Oc16999	X X	
122	0-0.1	Oct 17, 2012	3:25PM	Soil	M12-Oc17000	X X	
131	0-0.1	Oct 17, 2012	3:15PM	Soil	M12-Oc17001	X X	

mgt-LabMark 2-5 Kingston Town Close, Oakleigh, Victoria, Australia, 3166
 ABN : 50 005 085 521 Telephone: +61 3 8564 5000 Facsimile: +61 3 8564 5080

mgt-LabMark Internal Quality Control Review

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgment.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram	mg/l: milligrams per litre
ug/l: micrograms per litre	ppm: Parts per million
ppb: Parts per billion	%: Percentage
org/100ml: Organisms per 100 millilitres	NTU: Units
MPN/100mL: Most Probable Number of organisms per 100 millilitres	

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environment Protection Authority
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC was performed on samples not pertaining to this report, however QC is representative of the sequence or batch that client samples were analysed within

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions TRH C6-C36 - MGT 100A							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
Total Recoverable Hydrocarbons - Draft 2010 NEPM Fractions * LM-LTM-ORG2010							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons USEPA 8270 Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g,h,i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a,h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Organochlorine Pesticides USEPA 8081 Organochlorine Pesticides							
4,4'-DDD	mg/kg	< 0.05			0.05	Pass	
4,4'-DDE	mg/kg	< 0.05			0.05	Pass	
4,4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-BHC	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-BHC	mg/kg	< 0.05			0.05	Pass	
Chlordane	mg/kg	< 0.1			0.1	Pass	
d-BHC	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-BHC (Lindane)	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	

Test	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Methoxychlor	mg/kg	< 0.05		0.05	Pass	
Toxaphene	mg/kg	< 0.1		0.1	Pass	
Method Blank						
Polychlorinated Biphenyls USEPA 8082 Polychlorinated Biphenyls						
Aroclor-1016	mg/kg	< 0.1		0.1	Pass	
Aroclor-1221	mg/kg	< 0.1		0.1	Pass	
Aroclor-1232	mg/kg	< 0.1		0.1	Pass	
Aroclor-1242	mg/kg	< 0.1		0.1	Pass	
Aroclor-1248	mg/kg	< 0.1		0.1	Pass	
Aroclor-1254	mg/kg	< 0.1		0.1	Pass	
Aroclor-1260	mg/kg	< 0.1		0.1	Pass	
Total PCB	mg/kg	< 0.1		0.1	Pass	
Method Blank						
Phenols (Halogenated) USEPA 8270 Phenols						
2-Chlorophenol	mg/kg	< 0.5		0.5	Pass	
2,4-Dichlorophenol	mg/kg	< 0.5		0.5	Pass	
2,4,5-Trichlorophenol	mg/kg	< 1		1.0	Pass	
2,4,6-Trichlorophenol	mg/kg	< 1		1.0	Pass	
2,6-Dichlorophenol	mg/kg	< 0.5		0.5	Pass	
4-Chloro-3-methylphenol	mg/kg	< 1		1.0	Pass	
Pentachlorophenol	mg/kg	< 1		1.0	Pass	
Tetrachlorophenols - Total	mg/kg	< 1		1.0	Pass	
Method Blank						
Phenols (non-Halogenated) USEPA 8270 Phenols						
2-Cyclohexyl-4,6-dinitrophenol	mg/kg	< 20		20	Pass	
2-Methyl-4,6-dinitrophenol	mg/kg	< 5		5	Pass	
2-Methylphenol (o-Cresol)	mg/kg	< 0.2		0.2	Pass	
2-Nitrophenol	mg/kg	< 1		1.0	Pass	
2,4-Dimethylphenol	mg/kg	< 0.5		0.5	Pass	
2,4-Dinitrophenol	mg/kg	< 5		5	Pass	
3&4-Methylphenol (m&p-Cresol)	mg/kg	< 0.4		0.4	Pass	
4-Nitrophenol	mg/kg	< 5		5	Pass	
Dinoseb	mg/kg	< 20		20	Pass	
Phenol	mg/kg	< 0.5		0.5	Pass	
Method Blank						
Cyanide (total)	mg/kg	< 5		5	Pass	
Phosphate total (as P)	mg/kg	< 10		10	Pass	
Sulphate (as S)	mg/kg	< 10		10	Pass	
Total Sulphur (as S)	mg/kg	< 100		100	Pass	
Method Blank						
NEPM Metals : Metals M15 USEPA 6010/6020 Heavy Metals & USEPA 7470/71 Mercury & APHA 3500-Cr Hexavalent Chromium						
Chromium (hexavalent)	mg/kg	< 1		1	Pass	
Method Blank						
NEPM Metals : Metals M15 USEPA 6010/6020 Heavy Metals & USEPA 7470/71 Mercury & APHA 3500-Cr Hexavalent Chromium						
Boron	mg/kg	< 10		10	Pass	
Arsenic	mg/kg	< 2		2	Pass	
Barium	mg/kg	< 10		10	Pass	
Beryllium	mg/kg	< 2		2	Pass	
Cadmium	mg/kg	< 0.4		0.4	Pass	
Chromium	mg/kg	< 5		5	Pass	
Cobalt	mg/kg	< 5		5	Pass	
Copper	mg/kg	< 5		5	Pass	
Lead	mg/kg	< 5		5	Pass	

Test	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Manganese	mg/kg	< 5		5	Pass	
Mercury	mg/kg	< 0.1		0.1	Pass	
Nickel	mg/kg	< 5		5	Pass	
Vanadium	mg/kg	< 10		10	Pass	
Zinc	mg/kg	< 5		5	Pass	
LCS - % Recovery						
Total Recoverable Hydrocarbons - 1999 NEPM Fractions TRH C6-C36 - MGT 100A						
TRH C6-C9	%	103		70-130	Pass	
TRH C10-C14	%	114		70-130	Pass	
LCS - % Recovery						
Total Recoverable Hydrocarbons - Draft 2010 NEPM Fractions * LM-LTM-ORG2010						
TRH C6-C10	%	103		70-130	Pass	
TRH >C10-C16	%	110		70-130	Pass	
LCS - % Recovery						
Polycyclic Aromatic Hydrocarbons USEPA 8270 Polycyclic Aromatic Hydrocarbons						
Acenaphthene	%	92		70-130	Pass	
Acenaphthylene	%	91		70-130	Pass	
Anthracene	%	96		70-130	Pass	
Benz(a)anthracene	%	90		70-130	Pass	
Benzo(a)pyrene	%	124		70-130	Pass	
Benzo(b)fluoranthene	%	77		70-130	Pass	
Benzo(g,h,i)perylene	%	103		70-130	Pass	
Benzo(k)fluoranthene	%	97		70-130	Pass	
Chrysene	%	85		70-130	Pass	
Dibenz(a,h)anthracene	%	97		70-130	Pass	
Fluoranthene	%	76		70-130	Pass	
Fluorene	%	90		70-130	Pass	
Indeno(1,2,3-cd)pyrene	%	102		70-130	Pass	
Naphthalene	%	88		70-130	Pass	
Phenanthrene	%	93		70-130	Pass	
Pyrene	%	76		70-130	Pass	
LCS - % Recovery						
Organochlorine Pesticides USEPA 8081 Organochlorine Pesticides						
4,4'-DDD	%	128		70-130	Pass	
4,4'-DDE	%	127		70-130	Pass	
4,4'-DDT	%	74		70-130	Pass	
a-BHC	%	125		70-130	Pass	
Aldrin	%	124		70-130	Pass	
b-BHC	%	123		70-130	Pass	
d-BHC	%	129		70-130	Pass	
Dieldrin	%	128		70-130	Pass	
Endosulfan I	%	124		70-130	Pass	
Endosulfan II	%	124		70-130	Pass	
Endosulfan sulphate	%	126		70-130	Pass	
Endrin	%	128		70-130	Pass	
Endrin aldehyde	%	105		70-130	Pass	
Endrin ketone	%	116		70-130	Pass	
g-BHC (Lindane)	%	122		70-130	Pass	
Heptachlor	%	110		70-130	Pass	
Heptachlor epoxide	%	124		70-130	Pass	
Hexachlorobenzene	%	115		70-130	Pass	
Methoxychlor	%	74		70-130	Pass	
LCS - % Recovery						

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code	
Polychlorinated Biphenyls USEPA 8082 Polychlorinated Biphenyls								
Aroclor-1260	%	110			70-130	Pass		
LCS - % Recovery								
Phenols (Halogenated) USEPA 8270 Phenols								
2-Chlorophenol	%	84			30-130	Pass		
2,4-Dichlorophenol	%	87			30-130	Pass		
2,4,5-Trichlorophenol	%	81			30-130	Pass		
2,4,6-Trichlorophenol	%	86			30-130	Pass		
2,6-Dichlorophenol	%	84			30-130	Pass		
4-Chloro-3-methylphenol	%	85			30-130	Pass		
Pentachlorophenol	%	62			30-130	Pass		
LCS - % Recovery								
Phenols (non-Halogenated) USEPA 8270 Phenols								
2-Cyclohexyl-4,6-dinitrophenol	%	40			30-130	Pass		
2-Methyl-4,6-dinitrophenol	%	57			30-130	Pass		
2-Methylphenol (o-Cresol)	%	88			30-130	Pass		
2-Nitrophenol	%	72			30-130	Pass		
2,4-Dimethylphenol	%	119			30-130	Pass		
2,4-Dinitrophenol	%	38			30-130	Pass		
3&4-Methylphenol (m&p-Cresol)	%	86			30-130	Pass		
4-Nitrophenol	%	73			30-130	Pass		
Phenol	%	88			30-130	Pass		
LCS - % Recovery								
Cyanide (total)	%	105			70-130	Pass		
Phosphate total (as P)	%	89			70-130	Pass		
Sulphate (as S)	%	91			70-130	Pass		
LCS - % Recovery								
NEPM Metals : Metals M15 USEPA 6010/6020 Heavy Metals & USEPA 7470/71 Mercury & APHA 3500-Cr Hexavalent Chromium								
Chromium (hexavalent)	%	92			70-130	Pass		
LCS - % Recovery								
NEPM Metals : Metals M15 USEPA 6010/6020 Heavy Metals & USEPA 7470/71 Mercury & APHA 3500-Cr Hexavalent Chromium								
Boron	%	96			80-120	Pass		
Arsenic	%	97			80-120	Pass		
Barium	%	107			80-120	Pass		
Beryllium	%	99			80-120	Pass		
Cadmium	%	90			80-120	Pass		
Chromium	%	102			80-120	Pass		
Cobalt	%	101			80-120	Pass		
Copper	%	97			80-120	Pass		
Lead	%	103			80-120	Pass		
Manganese	%	100			80-120	Pass		
Mercury	%	93			75-125	Pass		
Nickel	%	100			80-120	Pass		
Vanadium	%	98			80-120	Pass		
Zinc	%	99			80-120	Pass		
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery								
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1				
TRH C6-C9	M12-Oc16745	NCP	%	89		70-130	Pass	
TRH C10-C14	M12-Oc16989	NCP	%	116		70-130	Pass	
Spike - % Recovery								
Total Recoverable Hydrocarbons - Draft 2010 NEPM Fractions *				Result 1				

Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
TRH C6-C10	M12-Oc16745	NCP	%	89		70-130	Pass	
TRH >C10-C16	M12-Oc16989	NCP	%	113		70-130	Pass	
Spike - % Recovery								
Polycyclic Aromatic Hydrocarbons				Result 1				
Acenaphthene	M12-Oc16989	NCP	%	76		70-130	Pass	
Acenaphthylene	M12-Oc16989	NCP	%	76		70-130	Pass	
Anthracene	M12-Oc16989	NCP	%	78		70-130	Pass	
Benz(a)anthracene	M12-Oc16989	NCP	%	75		70-130	Pass	
Benzo(a)pyrene	M12-Oc16989	NCP	%	110		70-130	Pass	
Benzo(b)fluoranthene	M12-Oc16989	NCP	%	75		70-130	Pass	
Benzo(g,h,i)perylene	M12-Oc16989	NCP	%	89		70-130	Pass	
Benzo(k)fluoranthene	M12-Oc16989	NCP	%	73		70-130	Pass	
Chrysene	M12-Oc16989	NCP	%	73		70-130	Pass	
Dibenz(a,h)anthracene	M12-Oc16989	NCP	%	83		70-130	Pass	
Fluoranthene	M12-Oc16989	NCP	%	70		70-130	Pass	
Fluorene	M12-Oc16989	NCP	%	76		70-130	Pass	
Indeno(1,2,3-cd)pyrene	M12-Oc16989	NCP	%	89		70-130	Pass	
Naphthalene	M12-Oc16989	NCP	%	74		70-130	Pass	
Phenanthrene	M12-Oc16989	NCP	%	75		70-130	Pass	
Pyrene	M12-Oc16989	NCP	%	71		70-130	Pass	
Spike - % Recovery								
Organochlorine Pesticides				Result 1				
4,4'-DDD	M12-Oc16982	NCP	%	116		70-130	Pass	
4,4'-DDE	M12-Oc16982	NCP	%	110		70-130	Pass	
4,4'-DDT	M12-Oc16982	NCP	%	83		70-130	Pass	
a-BHC	M12-Oc16982	NCP	%	104		70-130	Pass	
Aldrin	M12-Oc16982	NCP	%	101		70-130	Pass	
b-BHC	M12-Oc16982	NCP	%	96		70-130	Pass	
d-BHC	M12-Oc16982	NCP	%	105		70-130	Pass	
Dieldrin	M12-Oc16982	NCP	%	108		70-130	Pass	
Endosulfan I	M12-Oc16982	NCP	%	101		70-130	Pass	
Endosulfan II	M12-Oc16982	NCP	%	101		70-130	Pass	
Endosulfan sulphate	M12-Oc16982	NCP	%	100		70-130	Pass	
Endrin	M12-Oc16982	NCP	%	100		70-130	Pass	
Endrin aldehyde	M12-Oc16982	NCP	%	110		70-130	Pass	
Endrin ketone	M12-Oc16982	NCP	%	95		70-130	Pass	
g-BHC (Lindane)	M12-Oc16982	NCP	%	101		70-130	Pass	
Heptachlor	M12-Oc16982	NCP	%	97		70-130	Pass	
Heptachlor epoxide	M12-Oc16982	NCP	%	101		70-130	Pass	
Hexachlorobenzene	M12-Oc16982	NCP	%	94		70-130	Pass	
Methoxychlor	M12-Oc16982	NCP	%	79		70-130	Pass	
Spike - % Recovery								
Polychlorinated Biphenyls				Result 1				
Aroclor-1260	M12-Oc19051	NCP	%	125		70-130	Pass	
Spike - % Recovery								
Phenols (Halogenated)				Result 1				
2-Chlorophenol	M12-Oc16989	NCP	%	71		30-130	Pass	
2,4-Dichlorophenol	M12-Oc16989	NCP	%	72		30-130	Pass	
2,4,5-Trichlorophenol	M12-Oc16989	NCP	%	70		30-130	Pass	
2,4,6-Trichlorophenol	M12-Oc16989	NCP	%	71		30-130	Pass	
2,6-Dichlorophenol	M12-Oc16989	NCP	%	71		30-130	Pass	
4-Chloro-3-methylphenol	M12-Oc16989	NCP	%	70		30-130	Pass	
Pentachlorophenol	M12-Oc16989	NCP	%	50		30-130	Pass	
Tetrachlorophenols - Total	M12-Oc16989	NCP	%	66		30-130	Pass	
Spike - % Recovery								

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Phenols (non-Halogenated)				Result 1					
2-Cyclohexyl-4,6-dinitrophenol	M12-Oc16989	NCP	%	44			30-130	Pass	
2-Methyl-4,6-dinitrophenol	M12-Oc16989	NCP	%	34			30-130	Pass	
2-Methylphenol (o-Cresol)	M12-Oc16989	NCP	%	73			30-130	Pass	
2-Nitrophenol	M12-Oc16989	NCP	%	60			30-130	Pass	
2,4-Dimethylphenol	M12-Oc16989	NCP	%	119			30-130	Pass	
2,4-Dinitrophenol	M12-Oc16989	NCP	%	38			30-130	Pass	
3&4-Methylphenol (m&p-Cresol)	M12-Oc16989	NCP	%	73			30-130	Pass	
4-Nitrophenol	M12-Oc16989	NCP	%	66			30-130	Pass	
Dinoseb	M12-Oc16989	NCP	%	45			30-130	Pass	
Phenol	M12-Oc16989	NCP	%	73			30-130	Pass	
Spike - % Recovery				Result 1					
Cyanide (total)	M12-Oc17019	NCP	%	105			70-130	Pass	
Sulphate (as S)	M12-Oc18220	NCP	%	97			70-130	Pass	
Spike - % Recovery				Result 1					
NEPM Metals : Metals M15				Result 1					
Chromium (hexavalent)	M12-Oc16729	NCP	%	85			70-130	Pass	
Spike - % Recovery				Result 1					
NEPM Metals : Metals M15				Result 1					
Boron	M12-Oc17392	NCP	%	79			75-125	Pass	
Arsenic	M12-Oc17283	NCP	%	91			75-125	Pass	
Barium	M12-Oc17283	NCP	%	75			75-125	Pass	
Beryllium	M12-Oc17283	NCP	%	83			75-125	Pass	
Cadmium	M12-Oc16715	NCP	%	83			75-125	Pass	
Chromium	M12-Oc17283	NCP	%	76			75-125	Pass	
Cobalt	M12-Oc17283	NCP	%	78			75-125	Pass	
Copper	M12-Oc17283	NCP	%	103			75-125	Pass	
Lead	M12-Oc17283	NCP	%	81			75-125	Pass	
Manganese	M12-Oc17018	NCP	%	83			75-125	Pass	
Mercury	M12-Oc17406	NCP	%	94			70-130	Pass	
Nickel	M12-Oc17392	NCP	%	77			75-125	Pass	
Vanadium	M12-Oc17283	NCP	%	79			75-125	Pass	
Zinc	M12-Oc17392	NCP	%	80			75-125	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M12-Oc16745	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	M12-Oc16989	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M12-Oc16989	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M12-Oc16989	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - Draft 2010 NEPM Fractions *				Result 1	Result 2	RPD			
Naphthalene	M12-Oc16745	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M12-Oc16745	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	M12-Oc16989	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M12-Oc16989	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M12-Oc16989	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

Duplicate								
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD		
Benzo(b)fluoranthene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Benzo(g,h,i)perylene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Benzo(k)fluoranthene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Chrysene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Dibenz(a,h)anthracene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Fluoranthene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Fluorene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Indeno(1,2,3-cd)pyrene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Naphthalene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Phenanthrene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Pyrene	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Duplicate								
Organochlorine Pesticides				Result 1	Result 2	RPD		
4,4'-DDD	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
4,4'-DDE	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
4,4'-DDT	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
a-BHC	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Aldrin	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
b-BHC	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Chlordane	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
d-BHC	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Dieldrin	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endosulfan I	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endosulfan II	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endosulfan sulphate	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endrin	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endrin aldehyde	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Endrin ketone	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
g-BHC (Lindane)	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Heptachlor	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Heptachlor epoxide	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Hexachlorobenzene	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Methoxychlor	M12-Oc16982	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass
Toxaphene	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Duplicate								
Polychlorinated Biphenyls				Result 1	Result 2	RPD		
Aroclor-1016	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Aroclor-1221	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Aroclor-1232	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Aroclor-1242	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Aroclor-1248	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Aroclor-1254	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Aroclor-1260	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Total PCB	M12-Oc16982	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Duplicate								
Phenols (Halogenated)				Result 1	Result 2	RPD		
2-Chlorophenol	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
2,4-Dichlorophenol	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
2,4,5-Trichlorophenol	M12-Oc16989	NCP	mg/kg	< 1	< 1	<1	30%	Pass
2,4,6-Trichlorophenol	M12-Oc16989	NCP	mg/kg	< 1	< 1	<1	30%	Pass
2,6-Dichlorophenol	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
4-Chloro-3-methylphenol	M12-Oc16989	NCP	mg/kg	< 1	< 1	<1	30%	Pass
Pentachlorophenol	M12-Oc16989	NCP	mg/kg	< 1	< 1	<1	30%	Pass
Tetrachlorophenols - Total	M12-Oc16989	NCP	mg/kg	< 1	< 1	<1	30%	Pass

Duplicate								
Phenols (non-Halogenated)				Result 1	Result 2	RPD		
2-Cyclohexyl-4,6-dinitrophenol	M12-Oc16989	NCP	mg/kg	< 20	< 20	<1	30%	Pass
2-Methyl-4,6-dinitrophenol	M12-Oc16989	NCP	mg/kg	< 5	< 5	<1	30%	Pass
2-Methylphenol (o-Cresol)	M12-Oc16989	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass
2-Nitrophenol	M12-Oc16989	NCP	mg/kg	< 1	< 1	<1	30%	Pass
2,4-Dimethylphenol	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
2,4-Dinitrophenol	M12-Oc16989	NCP	mg/kg	< 5	< 5	<1	30%	Pass
3&4-Methylphenol (m&p-Cresol)	M12-Oc16989	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass
4-Nitrophenol	M12-Oc16989	NCP	mg/kg	< 5	< 5	<1	30%	Pass
Dinoseb	M12-Oc16989	NCP	mg/kg	< 20	< 20	<1	30%	Pass
Phenol	M12-Oc16989	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Cyanide (total)	M12-Oc17176	NCP	mg/kg	< 5	< 5	<1	30%	Pass
Sulphate (as S)	A12-Oc17416	NCP	mg/kg	< 10	< 10	43	30%	Fail Q15
Total Sulphur (as S)	A12-Oc17418	NCP	mg/kg	140	150	1.3	30%	Pass
Duplicate								
NEPM Metals : Metals M15				Result 1	Result 2	RPD		
Chromium (hexavalent)	M12-Oc17019	NCP	mg/kg	< 1	< 1	10	30%	Pass
Duplicate								
NEPM Metals : Metals M15				Result 1	Result 2	RPD		
Boron	M12-Oc17392	NCP	mg/kg	< 10	< 10	12	30%	Pass
Arsenic	M12-Oc17283	NCP	mg/kg	2.4	< 2	72	30%	Fail Q15
Barium	M12-Oc17283	NCP	mg/kg	48	44	8.0	30%	Pass
Beryllium	M12-Oc17283	NCP	mg/kg	< 2	< 2	5.0	30%	Pass
Cadmium	M12-Oc16715	NCP	mg/kg	< 0.4	< 0.4	14	30%	Pass
Chromium	M12-Oc17283	NCP	mg/kg	39	33	16	30%	Pass
Cobalt	M12-Oc17283	NCP	mg/kg	7.0	6.2	12	30%	Pass
Copper	M12-Oc17283	NCP	mg/kg	6.8	6.1	10	30%	Pass
Lead	M12-Oc17283	NCP	mg/kg	8.8	8.5	3.0	30%	Pass
Mercury	M12-Oc17406	NCP	mg/kg	0.20	0.20	5.0	30%	Pass
Nickel	M12-Oc17283	NCP	mg/kg	19	16	16	30%	Pass
Vanadium	M12-Oc17283	NCP	mg/kg	35	31	13	30%	Pass
Zinc	M12-Oc17283	NCP	mg/kg	15	13	17	30%	Pass

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q15	The RPD reported passes mgt-LabMark's Acceptance Criteria as stipulated in SOP 05. Refer to Glossary Page of this report for further details

Authorised By

Natalie Krasselt	Client Services
Carroll Lee	Senior Analyst-Volatile (VIC)
Emily Rosenberg	Senior Analyst-Metal (VIC)
Mary Makarios	Senior Analyst-Inorganic (VIC)
Stacey Jenkins	Senior Analyst-Organic (VIC)



Glenn Jackson

Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: EN1302831	Page	: 1 of 9
Client	: CARDNO LANE PIPER PTY LTD	Laboratory	: Environmental Division Newcastle
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Project	: TULLAMARINE BUFFER - 212173	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: 212173	Date Samples Received	: 01-AUG-2013
C-O-C number	: ----	Issue Date	: 08-AUG-2013
Sampler	: JT	No. of samples received	: 1
Site	: ----	No. of samples analysed	: 1
Quote number	: ----		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Daniel Junek	Senior Air Analyst	Newcastle
Daniel Junek	Senior Air Analyst	Newcastle - Organics



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **Canister Sampling QA: Results for Pressure - As Received are expressed as an Absolute Pressure. The Gauge Pressure - As Received is equal to this pressure minus the laboratory pressure at the time of measurement.**
- **EP101, EP103: Results reported in mg/m³ are calculated from PPBV results based on a temperature of 25°C and atmospheric pressure of 101.3 kPa. mg/m³ results may be corrected to account for actual conditions during sampling.**
- **EP101: Sample canisters were received at sub-ambient pressures and required dilution in the laboratory prior to analysis. LOR values have been adjusted accordingly.**
- **EP103: ALS does not hold NATA accreditation for Total Petroleum Hydrocarbons in Air Samples.**



Analytical Results

Sub-Matrix: SOIL GAS (Matrix: AIR)

Client sample ID

Client sampling date / time

				V04	---	---	---	---
				C1127/S043	---	---	---	---
				30-JUL-2013 15:00	---	---	---	---
				EN1302831-001	---	---	---	---
Compound	CAS Number	LOR	Unit					
EP101: VOCs by USEPA Method TO15 (Calculated Concentration)								
^ Freon 12	75-71-8	0.0025	mg/m ³	<0.0099	---	---	---	---
^ Chloromethane	74-87-3	0.0010	mg/m ³	<0.0041	---	---	---	---
^ Freon 114	76-14-2	0.0035	mg/m ³	<0.0140	---	---	---	---
^ Vinyl chloride	75-01-4	0.0013	mg/m ³	<0.0051	---	---	---	---
^ Bromomethane	74-83-9	0.0019	mg/m ³	<0.0078	---	---	---	---
^ Chloroethane	75-00-3	0.0013	mg/m ³	<0.0053	---	---	---	---
^ Freon 11	75-69-4	0.0028	mg/m ³	<0.0112	---	---	---	---
^ 1.1-Dichloroethene	75-35-4	0.0020	mg/m ³	<0.0079	---	---	---	---
^ Dichloromethane	75-09-2	0.0017	mg/m ³	<0.0069	---	---	---	---
^ Freon 113	76-13-1	0.0038	mg/m ³	<0.0153	---	---	---	---
^ 1.1-Dichloroethane	75-34-3	0.0020	mg/m ³	<0.0081	---	---	---	---
^ cis-1.2-Dichloroethene	156-59-2	0.0020	mg/m ³	<0.0079	---	---	---	---
^ Chloroform	67-66-3	0.0024	mg/m ³	<0.0098	---	---	---	---
^ 1.2-Dichloroethane	107-06-2	0.0020	mg/m ³	<0.0081	---	---	---	---
^ 1.1.1-Trichloroethane	71-55-6	0.0027	mg/m ³	<0.0109	---	---	---	---
^ Benzene	71-43-2	0.0016	mg/m ³	<0.0064	---	---	---	---
^ Carbon Tetrachloride	56-23-5	0.0031	mg/m ³	<0.0126	---	---	---	---
^ 1.2-Dichloropropane	78-87-5	0.0023	mg/m ³	<0.0092	---	---	---	---
^ Trichloroethene	79-01-6	0.0027	mg/m ³	<0.0107	---	---	---	---
^ cis-1.3-Dichloropropylene	10061-01-5	0.0023	mg/m ³	<0.0091	---	---	---	---
^ trans-1.3-Dichloropropene	10061-02-6	0.0023	mg/m ³	<0.0091	---	---	---	---
^ 1.1.2-Trichloroethane	79-00-5	0.0027	mg/m ³	<0.0109	---	---	---	---
^ Toluene	108-88-3	0.0019	mg/m ³	<0.0075	---	---	---	---
^ 1.2-Dibromoethane (EDB)	106-93-4	0.0038	mg/m ³	<0.0154	---	---	---	---
^ Tetrachloroethene	127-18-4	0.0034	mg/m ³	<0.0136	---	---	---	---
^ Chlorobenzene	108-90-7	0.0023	mg/m ³	<0.0092	---	---	---	---
^ Ethylbenzene	100-41-4	0.0022	mg/m ³	<0.0087	---	---	---	---
^ meta- & para-Xylene	108-38-3 106-42-3	0.0043	mg/m ³	<0.0174	---	---	---	---
^ Styrene	100-42-5	0.0021	mg/m ³	<0.0085	---	---	---	---
^ 1.1.2.2-Tetrachloroethane	79-34-5	0.0034	mg/m ³	<0.0137	---	---	---	---
^ ortho-Xylene	95-47-6	0.0022	mg/m ³	<0.0087	---	---	---	---
^ 4-Ethyltoluene	622-96-8	0.0025	mg/m ³	<0.0098	---	---	---	---
^ Total Xylenes	1330-20-7	0.0055	mg/m ³	<0.0260	---	---	---	---



Analytical Results

Sub-Matrix: SOIL GAS (Matrix: AIR)

Client sample ID

Client sampling date / time

V04	---	---	---	---
C1127/S043	---	---	---	---
30-JUL-2013 15:00	---	---	---	---
EN1302831-001	---	---	---	---

Compound	CAS Number	LOR	Unit					
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EP101: VOCs by USEPA Method TO15 (Calculated Concentration) - Continued

^ 1.3.5-Trimethylbenzene	108-67-8	0.0025	mg/m ³	<0.0098	---	---	---	---
^ 1.2.4-Trimethylbenzene	95-63-6	0.0025	mg/m ³	<0.0098	---	---	---	---
^ 1.3-Dichlorobenzene	541-73-1	0.0030	mg/m ³	<0.0120	---	---	---	---
^ Benzylchloride	100-44-7	0.0026	mg/m ³	<0.0103	---	---	---	---
^ 1.4-Dichlorobenzene	106-46-7	0.0030	mg/m ³	<0.0120	---	---	---	---
^ 1.2-Dichlorobenzene	95-50-1	0.0030	mg/m ³	<0.0120	---	---	---	---
^ 1.2.4-Trichlorobenzene	120-82-1	0.0037	mg/m ³	<0.0148	---	---	---	---
^ Hexachlorobutadiene	87-68-3	0.0053	mg/m ³	<0.0213	---	---	---	---
^ Acetone	67-64-1	0.0012	mg/m ³	<0.0047	---	---	---	---
^ Bromodichloromethane	75-27-4	0.0034	mg/m ³	<0.0134	---	---	---	---
^ 1.3-Butadiene	106-99-0	0.0011	mg/m ³	<0.0044	---	---	---	---
^ Carbon disulfide	75-15-0	0.0016	mg/m ³	<0.0062	---	---	---	---
^ 2-Chlorotoluene	95-49-8	0.0026	mg/m ³	<0.0103	---	---	---	---
^ 1-Chloro-2-propene (Allyl chloride)	107-05-1	0.0016	mg/m ³	<0.0062	---	---	---	---
^ Cyclohexane	110-82-7	0.0017	mg/m ³	<0.0069	---	---	---	---
^ Dibromochloromethane	124-48-1	0.0043	mg/m ³	<0.0170	---	---	---	---
^ 1.4-Dioxane	123-91-1	0.0018	mg/m ³	<0.0072	---	---	---	---
^ Ethylacetate	9002-89-5	0.0018	mg/m ³	<0.0072	---	---	---	---
^ trans-1.2-Dichloroethene	156-60-5	0.0020	mg/m ³	<0.0079	---	---	---	---
^ Heptane	142-82-5	0.0020	mg/m ³	<0.0082	---	---	---	---
^ Hexane	110-54-3	0.0018	mg/m ³	<0.0070	---	---	---	---
^ Isooctane	540-84-1	0.0023	mg/m ³	<0.0093	---	---	---	---
^ Isopropyl Alcohol	67-63-0	0.0012	mg/m ³	<0.0049	---	---	---	---
^ 2-Butanone (MEK)	78-93-3	0.0015	mg/m ³	<0.0059	---	---	---	---
^ Methyl iso-Butyl ketone	108-10-1	0.0020	mg/m ³	<0.0082	---	---	---	---
^ 2-Hexanone (MBK)	591-78-6	0.0020	mg/m ³	<0.0082	---	---	---	---
^ Propene	115-07-1	0.0009	mg/m ³	<0.0034	---	---	---	---
^ Methyl tert-Butyl Ether (MTBE)	1634-04-4	0.0018	mg/m ³	<0.0072	---	---	---	---
^ Tetrahydrofuran	109-99-9	0.0015	mg/m ³	<0.0059	---	---	---	---
^ Bromoform	75-25-2	0.0052	mg/m ³	<0.0207	---	---	---	---
^ Vinyl Acetate	108-05-4	0.0018	mg/m ³	<0.0070	---	---	---	---
^ Vinyl bromide	593-60-2	0.0022	mg/m ³	<0.0087	---	---	---	---
^ Ethanol	64-17-5	0.0009	mg/m ³	<0.0038	---	---	---	---



Analytical Results

Sub-Matrix: SOIL GAS (Matrix: AIR)

Client sample ID

				V04	----	----	----	----
				C1127/S043	----	----	----	----
				30-JUL-2013 15:00	----	----	----	----
				EN1302831-001	----	----	----	----

Client sampling date / time

Compound	CAS Number	LOR	Unit					
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EP101: VOCs by USEPA Method TO15 (Calculated Concentration) - Continued

^ Acetonitrile	75-05-8	0.0008	mg/m ³	<0.0034	----	----	----	----
^ Acrolein	107-02-8	0.0011	mg/m ³	<0.0046	----	----	----	----
^ Acrylonitrile	107-13-1	0.0011	mg/m ³	<0.0043	----	----	----	----
^ tert-Butyl alcohol	75-65-0	0.0015	mg/m ³	<0.0060	----	----	----	----
^ 2-Chloro-1.3-butadiene	126-99-8	0.0018	mg/m ³	<0.0072	----	----	----	----
^ Di-isopropyl Ether	108-20-3	0.0021	mg/m ³	<0.0084	----	----	----	----
^ Ethyl tert-Butyl Ether (ETBE)	637-92-3	0.0021	mg/m ³	<0.0084	----	----	----	----
^ tert-Amyl Methyl Ether (TAME)	994-05-8	0.0021	mg/m ³	<0.0084	----	----	----	----
^ Methyl Methacrylate	80-62-6	0.0021	mg/m ³	<0.0083	----	----	----	----
^ 1.1.1.2-Tetrachloroethane	630-20-6	0.0034	mg/m ³	<0.0137	----	----	----	----
^ Isopropylbenzene	98-82-8	0.0025	mg/m ³	<0.0098	----	----	----	----
^ n-Propylbenzene	103-65-1	0.0025	mg/m ³	<0.0098	----	----	----	----
^ tert-Butylbenzene	98-06-6	0.0027	mg/m ³	<0.0110	----	----	----	----
^ sec-Butylbenzene	135-98-8	0.0027	mg/m ³	<0.0110	----	----	----	----
^ 2-isopropyltoluene	----	0.0027	mg/m ³	<0.0110	----	----	----	----
^ n-Butylbenzene	104-51-8	0.0027	mg/m ³	<0.0110	----	----	----	----
^ Naphthalene	91-20-3	0.0026	mg/m ³	<0.0105	----	----	----	----

EP103-S: TPH CWG Aliphatic Hydrocarbon Fractions

Aliphatic >C5-C6	----	50	ppbv	<200	----	----	----	----
Aliphatic >C6-C8	TPHCWG-ALV2	50	ppbv	<200	----	----	----	----
Aliphatic >C8-C10	TPHCWG-ALV3	50	ppbv	<200	----	----	----	----
Aliphatic >C10-C12	TPHCWG-ALE1	50	ppbv	<200	----	----	----	----

EP103-S: TPH CWG Aliphatic Hydrocarbon Fractions (Calc Conc)

^ Aliphatic >C5-C6	----	0.16	mg/m ³	<0.66	----	----	----	----
^ Aliphatic >C6-C8	TPHCWG-ALV2	0.20	mg/m ³	<0.80	----	----	----	----
^ Aliphatic >C8-C10	TPHCWG-ALV3	0.25	mg/m ³	<1.00	----	----	----	----
^ Aliphatic >C10-C12	TPHCWG-ALE1	0.30	mg/m ³	<1.21	----	----	----	----

EP103-S: TPH CWG Aromatic Hydrocarbon Fractions

Aromatic >C5-C7	----	0.5	ppbv	<2.0	----	----	----	----
Aromatic >C7-C8	TPHCWG-ARV2	0.5	ppbv	<2.0	----	----	----	----
Aromatic >C8-C10	TPHCWG-ARV3	2.5	ppbv	<10.0	----	----	----	----
Aromatic >C10-C12	TPHCWG-ARE1	5	ppbv	<20	----	----	----	----

EP103-S: TPH CWG Aromatic Hydrocarbon Fractions (Calc Conc)



Analytical Results

Sub-Matrix: SOIL GAS (Matrix: AIR)

Client sample ID

				V04	---	---	---	---
				C1127/S043	---	---	---	---
				30-JUL-2013 15:00	---	---	---	---
				EN1302831-001	---	---	---	---

Client sampling date / time

Compound	CAS Number	LOR	Unit					
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EP103-S: TPH CWG Aromatic Hydrocarbon Fractions (Calc Conc) - Continued

^ Aromatic >C5-C7	----	0.0016	mg/m ³	<0.0064	----	----	----	----
^ Aromatic >C7-C8	TPHCWG-ARV2	0.0019	mg/m ³	<0.0075	----	----	----	----
^ Aromatic >C8-C10	TPHCWG-ARV3	0.012	mg/m ³	<0.062	----	----	----	----
^ Aromatic >C10-C12	TPHCWG-ARE1	0.025	mg/m ³	<0.101	----	----	----	----

Sampling Quality Assurance

Pressure - As received	----	0.1	kPa	87.4	----	----	----	----
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USEPA Air Toxics Method TO15r

Freon 12	75-71-8	0.5	ppbv	<2.0	----	----	----	----
Chloromethane	74-87-3	0.5	ppbv	<2.0	----	----	----	----
Freon 114	76-14-2	0.5	ppbv	<2.0	----	----	----	----
Vinyl chloride	75-01-4	0.5	ppbv	<2.0	----	----	----	----
Bromomethane	74-83-9	0.5	ppbv	<2.0	----	----	----	----
Chloroethane	75-00-3	0.5	ppbv	<2.0	----	----	----	----
Freon 11	75-69-4	0.5	ppbv	<2.0	----	----	----	----
1.1-Dichloroethene	75-35-4	0.5	ppbv	<2.0	----	----	----	----
Dichloromethane	75-09-2	0.5	ppbv	<2.0	----	----	----	----
Freon 113	76-13-1	0.5	ppbv	<2.0	----	----	----	----
1.1-Dichloroethane	75-34-3	0.5	ppbv	<2.0	----	----	----	----
cis-1.2-Dichloroethene	156-59-2	0.5	ppbv	<2.0	----	----	----	----
Chloroform	67-66-3	0.5	ppbv	<2.0	----	----	----	----
1.2-Dichloroethane	107-06-2	0.5	ppbv	<2.0	----	----	----	----
1.1.1-Trichloroethane	71-55-6	0.5	ppbv	<2.0	----	----	----	----
Benzene	71-43-2	0.5	ppbv	<2.0	----	----	----	----
Carbon Tetrachloride	56-23-5	0.5	ppbv	<2.0	----	----	----	----
1.2-Dichloropropane	78-87-5	0.5	ppbv	<2.0	----	----	----	----
Trichloroethene	79-01-6	0.5	ppbv	<2.0	----	----	----	----
cis-1.3-Dichloropropylene	10061-01-5	0.5	ppbv	<2.0	----	----	----	----
trans-1.3-Dichloropropene	10061-02-6	0.5	ppbv	<2.0	----	----	----	----
1.1.2-Trichloroethane	79-00-5	0.5	ppbv	<2.0	----	----	----	----
Toluene	108-88-3	0.5	ppbv	<2.0	----	----	----	----
1.2-Dibromoethane (EDB)	106-93-4	0.5	ppbv	<2.0	----	----	----	----
Tetrachloroethene	127-18-4	0.5	ppbv	<2.0	----	----	----	----
Chlorobenzene	108-90-7	0.5	ppbv	<2.0	----	----	----	----



Analytical Results

Sub-Matrix: SOIL GAS (Matrix: AIR)

Client sample ID

				V04	---	---	---	---
				C1127/S043	---	---	---	---
				Client sampling date / time	30-JUL-2013 15:00	---	---	---
Compound	CAS Number	LOR	Unit	EN1302831-001	---	---	---	---
USEPA Air Toxics Method TO15r - Continued								
Ethylbenzene	100-41-4	0.5	ppbv	<2.0	---	---	---	---
meta- & para-Xylene	108-38-3 106-42-3	1.0	ppbv	<4.0	---	---	---	---
Styrene	100-42-5	0.5	ppbv	<2.0	---	---	---	---
1.1.2.2-Tetrachloroethane	79-34-5	0.5	ppbv	<2.0	---	---	---	---
ortho-Xylene	95-47-6	0.5	ppbv	<2.0	---	---	---	---
4-Ethyltoluene	622-96-8	0.5	ppbv	<2.0	---	---	---	---
1.3.5-Trimethylbenzene	108-67-8	0.5	ppbv	<2.0	---	---	---	---
1.2.4-Trimethylbenzene	95-63-6	0.5	ppbv	<2.0	---	---	---	---
1.3-Dichlorobenzene	541-73-1	0.5	ppbv	<2.0	---	---	---	---
Benzylchloride	100-44-7	0.5	ppbv	<2.0	---	---	---	---
1.4-Dichlorobenzene	106-46-7	0.5	ppbv	<2.0	---	---	---	---
1.2-Dichlorobenzene	95-50-1	0.5	ppbv	<2.0	---	---	---	---
1.2.4-Trichlorobenzene	120-82-1	0.5	ppbv	<2.0	---	---	---	---
Hexachlorobutadiene	87-68-3	0.5	ppbv	<2.0	---	---	---	---
Acetone	67-64-1	0.5	ppbv	<2.0	---	---	---	---
Bromodichloromethane	75-27-4	0.5	ppbv	<2.0	---	---	---	---
1.3-Butadiene	106-99-0	0.5	ppbv	<2.0	---	---	---	---
Carbon disulfide	75-15-0	0.5	ppbv	<2.0	---	---	---	---
2-Chlorotoluene	95-49-8	0.5	ppbv	<2.0	---	---	---	---
1-Chloro-2-propene (Allyl chloride)	107-05-1	0.5	ppbv	<2.0	---	---	---	---
Cyclohexane	110-82-7	0.5	ppbv	<2.0	---	---	---	---
Dibromochloromethane	124-48-1	0.5	ppbv	<2.0	---	---	---	---
1.4-Dioxane	123-91-1	0.5	ppbv	<2.0	---	---	---	---
Ethylacetate	9002-89-5	0.5	ppbv	<2.0	---	---	---	---
trans-1.2-Dichloroethene	156-60-5	0.5	ppbv	<2.0	---	---	---	---
Heptane	142-82-5	0.5	ppbv	<2.0	---	---	---	---
Hexane	110-54-3	0.5	ppbv	<2.0	---	---	---	---
Isooctane	540-84-1	0.5	ppbv	<2.0	---	---	---	---
Isopropyl Alcohol	67-63-0	0.5	ppbv	<2.0	---	---	---	---
2-Butanone (MEK)	78-93-3	0.5	ppbv	<2.0	---	---	---	---
Methyl iso-Butyl ketone	108-10-1	0.5	ppbv	<2.0	---	---	---	---
2-Hexanone (MBK)	591-78-6	0.5	ppbv	<2.0	---	---	---	---
Propene	115-07-1	0.5	ppbv	<2.0	---	---	---	---



Analytical Results

Sub-Matrix: SOIL GAS (Matrix: AIR)

Client sample ID

V04	---	---	---	---
C1127/S043	---	---	---	---
30-JUL-2013 15:00	---	---	---	---
EN1302831-001	---	---	---	---

Client sampling date / time

Compound	CAS Number	LOR	Unit					
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USEPA Air Toxics Method TO15r - Continued

Methyl tert-Butyl Ether (MTBE)	1634-04-4	0.5	ppbv	<2.0	---	---	---	---
Tetrahydrofuran	109-99-9	0.5	ppbv	<2.0	---	---	---	---
Bromoform	75-25-2	0.5	ppbv	<2.0	---	---	---	---
Vinyl Acetate	108-05-4	0.5	ppbv	<2.0	---	---	---	---
Vinyl bromide	593-60-2	0.5	ppbv	<2.0	---	---	---	---
Ethanol	64-17-5	0.5	ppbv	<2.0	---	---	---	---
Acetonitrile	75-05-8	0.5	ppbv	<2.0	---	---	---	---
Acrolein	107-02-8	0.5	ppbv	<2.0	---	---	---	---
Acrylonitrile	107-13-1	0.5	ppbv	<2.0	---	---	---	---
tert-Butyl alcohol	75-65-0	0.5	ppbv	<2.0	---	---	---	---
2-Chloro-1.3-butadiene	126-99-8	0.5	ppbv	<2.0	---	---	---	---
Di-isopropyl Ether	108-20-3	0.5	ppbv	<2.0	---	---	---	---
Ethyl tert-Butyl Ether (ETBE)	637-92-3	0.5	ppbv	<2.0	---	---	---	---
tert-Amyl Methyl Ether (TAME)	994-05-8	0.5	ppbv	<2.0	---	---	---	---
Methyl Methacrylate	80-62-6	0.5	ppbv	<2.0	---	---	---	---
1.1.1.2-Tetrachloroethane	630-20-6	0.5	ppbv	<2.0	---	---	---	---
Isopropylbenzene	98-82-8	0.5	ppbv	<2.0	---	---	---	---
n-Propylbenzene	103-65-1	0.5	ppbv	<2.0	---	---	---	---
tert-Butylbenzene	98-06-6	0.5	ppbv	<2.0	---	---	---	---
sec-Butylbenzene	135-98-8	0.5	ppbv	<2.0	---	---	---	---
2-isopropyltoluene	----	0.5	ppbv	<2.0	---	---	---	---
n-Butylbenzene	104-51-8	0.5	ppbv	<2.0	---	---	---	---
Naphthalene	91-20-3	0.5	ppbv	<2.0	---	---	---	---

USEPA Air Toxics Method TO15r Surrogates

4-Bromofluorobenzene	460-00-4	0.1	%	87.2	---	---	---	---
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Surrogate Control Limits

Sub-Matrix: SOIL GAS		Recovery Limits (%)	
Compound	CAS Number	Low	High
USEPA Air Toxics Method TO15r Surrogates			
4-Bromofluorobenzene	460-00-4	60	140

Cardno Lane Piper Pty Ltd
Building 2, 154 Highbury Road
Burwood
VIC 3125

Attention: Colin Stapleton

Report 391688-S
Client Reference TULLA BUFFER LAND 212173
Received Date Sep 04, 2013

Certificate of Analysis



NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or
measurements included in this document are traceable
to Australian/national standards.

Client Sample ID			AV01	AV02	AV03	AV04
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M13-Se02934	M13-Se02935	M13-Se02936	M13-Se02937
Date Sampled			Sep 04, 2013	Sep 04, 2013	Sep 04, 2013	Sep 04, 2013
Test/Reference	LOR	Unit				
4-Bromofluorobenzene (surr.)	1	%	-	-	-	99
% Moisture	0.1	%	22	16	13	18
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	20	mg/kg	-	-	-	< 20
TRH C10-C14	20	mg/kg	-	-	-	< 20
TRH C15-C28	50	mg/kg	-	-	-	< 50
TRH C29-C36	50	mg/kg	-	-	-	< 50
TRH C10-36 (Total)	50	mg/kg	-	-	-	< 50
BTEX						
Benzene	0.1	mg/kg	-	-	-	< 0.1
Toluene	0.1	mg/kg	-	-	-	< 0.1
Ethylbenzene	0.1	mg/kg	-	-	-	< 0.1
o-Xylene	0.1	mg/kg	-	-	-	< 0.1
m&p-Xylenes	0.2	mg/kg	-	-	-	< 0.2
Xylenes - Total	0.3	mg/kg	-	-	-	< 0.3
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene ^{N02}	0.5	mg/kg	-	-	-	< 0.5
TRH C6-C10	20	mg/kg	-	-	-	< 20
TRH C6-C10 less BTEX (F1) ^{N04}	20	mg/kg	-	-	-	< 20
TRH >C10-C16	50	mg/kg	-	-	-	< 50
TRH >C10-C16 less Naphthalene (F2) ^{N01}	50	mg/kg	-	-	-	< 50
TRH >C16-C34	100	mg/kg	-	-	-	< 100
TRH >C34-C40	100	mg/kg	-	-	-	< 100
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Benzo(b&j)fluoranthene ^{N07}	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Chrysene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-

Client Sample ID			AV01	AV02	AV03	AV04
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M13-Se02934	M13-Se02935	M13-Se02936	M13-Se02937
Date Sampled			Sep 04, 2013	Sep 04, 2013	Sep 04, 2013	Sep 04, 2013
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Total PAH	0.5	mg/kg	< 0.5	< 0.5	< 0.5	-
Benzo(a)pyrene TEQ*	0.5	mg/kg	0.6	0.6	0.6	-
2-Fluorobiphenyl (surr.)	1	%	112	94	98	-
p-Terphenyl-d14 (surr.)	1	%	117	88	97	-
Heavy Metals						
Arsenic	2	mg/kg	< 2	< 2	< 2	-
Barium	10	mg/kg	570	310	58	-
Beryllium	2	mg/kg	< 2	< 2	< 2	-
Cadmium	0.4	mg/kg	< 0.4	< 0.4	< 0.4	-
Chromium	5	mg/kg	41	28	17	-
Cobalt	5	mg/kg	20	7.9	5.7	-
Copper	5	mg/kg	13	15	7.5	-
Lead	5	mg/kg	21	1700	120	-
Manganese	5	mg/kg	2500	350	110	-
Mercury	0.1	mg/kg	< 0.1	0.6	0.1	-
Nickel	5	mg/kg	42	15	14	-
Vanadium	10	mg/kg	48	39	38	-
Zinc	5	mg/kg	100	130	110	-

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported. A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

Description	Testing Site	Extracted	Holding Time
% Moisture - Method: Method 102 - ANZECC - % Moisture	Melbourne	Sep 05, 2013	14 Day
Polycyclic Aromatic Hydrocarbons - Method: USEPA 8270 Polycyclic Aromatic Hydrocarbons	Melbourne	Sep 05, 2013	14 Day
Metals M13 - Method: USEPA 6010/6020 Heavy Metals & USEPA 7470/71 Mercury	Melbourne	Sep 05, 2013	28 Day
Eurofins mgt Suite 1			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions - Method: TRH C6-C36 - MGT 100A	Melbourne	Sep 05, 2013	14 Day
BTEX - Method: USEPA 8260 - MGT 350A Monocyclic Aromatic Hydrocarbons and MGT 100A	Melbourne	Sep 05, 2013	14 Day
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LM-LTM-ORG2010	Melbourne	Sep 05, 2013	14 Day

Company Name: Cardno Lane Piper Pty Ltd
Address: Building 2, 154 Highbury Road
 Burwood
 VIC 3125
Client Job No.: TULLA BUFFER LAND 212173

Order No.:
Report #: 391688
Phone: 9888 0100
Fax: 9808 3511

Received: Sep 4, 2013 12:54 PM
Due: Sep 11, 2013
Priority: 5 Day
Contact Name: Colin Stapleton

Eurofins | mgt Client Manager: Natalie Krasselt

Sample Detail

% Moisture
 Polycyclic Aromatic Hydrocarbons
 Metals M13
 Eurofins | mgt Suite 1

Laboratory where analysis is conducted

Melbourne Laboratory - NATA Site # 1254 & 14271	X	X	X	X
Geelong Laboratory - NATA Site # 18217				
Widewater Laboratory - NATA Site # 20794				
Internal Laboratory				

Sample ID	Sample Date	Sampling Time	Matrix	LAB ID				
/01	Sep 04, 2013	8:17AM	Soil	M13-Se02934	X	X	X	
/02	Sep 04, 2013	8:51AM	Soil	M13-Se02935	X	X	X	
/03	Sep 04, 2013	9:00AM	Soil	M13-Se02936	X	X	X	
/04	Sep 04, 2013	9:23AM	Soil	M13-Se02937	X			X

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgment.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environment Protection Authority
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions TRH C6-C36 - MGT 100A							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Method Blank							
BTEX USEPA 8260 - MGT 350A Monocyclic Aromatic Hydrocarbons and MGT 100A							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
Xylenes - Total	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions LM-LTM-ORG2010							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons USEPA 8270 Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g,h,i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a,h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Metals M13 USEPA 6010/6020 Heavy Metals & USEPA 7470/71 Mercury							
Arsenic	mg/kg	< 2			2	Pass	
Barium	mg/kg	< 10			10	Pass	
Beryllium	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Cobalt	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Manganese	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	

Test	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Nickel	mg/kg	< 5		5	Pass	
Vanadium	mg/kg	< 10		10	Pass	
Zinc	mg/kg	< 5		5	Pass	
LCS - % Recovery						
Total Recoverable Hydrocarbons - 1999 NEPM Fractions TRH C6-C36 - MGT 100A						
TRH C6-C9	%	112		70-130	Pass	
TRH C10-C14	%	115		70-130	Pass	
LCS - % Recovery						
BTEX USEPA 8260 - MGT 350A Monocyclic Aromatic Hydrocarbons and MGT 100A						
Benzene	%	122		70-130	Pass	
Toluene	%	123		70-130	Pass	
Ethylbenzene	%	116		70-130	Pass	
m&p-Xylenes	%	112		70-130	Pass	
Xylenes - Total	%	112		70-130	Pass	
LCS - % Recovery						
Total Recoverable Hydrocarbons - 2013 NEPM Fractions LM-LTM-ORG2010						
TRH >C10-C16	%	115		70-130	Pass	
LCS - % Recovery						
Polycyclic Aromatic Hydrocarbons USEPA 8270 Polycyclic Aromatic Hydrocarbons						
Acenaphthene	%	100		70-130	Pass	
Acenaphthylene	%	101		70-130	Pass	
Anthracene	%	98		70-130	Pass	
Benz(a)anthracene	%	101		70-130	Pass	
Benzo(a)pyrene	%	102		70-130	Pass	
Benzo(b&j)fluoranthene	%	97		70-130	Pass	
Benzo(g,h,i)perylene	%	91		70-130	Pass	
Benzo(k)fluoranthene	%	92		70-130	Pass	
Chrysene	%	102		70-130	Pass	
Dibenz(a,h)anthracene	%	98		70-130	Pass	
Fluoranthene	%	100		70-130	Pass	
Fluorene	%	96		70-130	Pass	
Indeno(1,2,3-cd)pyrene	%	94		70-130	Pass	
Naphthalene	%	95		70-130	Pass	
Phenanthrene	%	95		70-130	Pass	
Pyrene	%	103		70-130	Pass	
LCS - % Recovery						
Metals M13 USEPA 6010/6020 Heavy Metals & USEPA 7470/71 Mercury						
Arsenic	%	93		80-120	Pass	
Barium	%	114		80-120	Pass	
Beryllium	%	104		80-120	Pass	
Cadmium	%	100		80-120	Pass	
Chromium	%	104		80-120	Pass	
Cobalt	%	102		80-120	Pass	
Copper	%	104		80-120	Pass	
Lead	%	102		80-120	Pass	
Manganese	%	110		80-120	Pass	
Mercury	%	106		75-125	Pass	
Nickel	%	107		80-120	Pass	
Vanadium	%	103		80-120	Pass	
Zinc	%	106		80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	M13-Se02915	NCP	%	102			70-130	Pass	
Acenaphthylene	M13-Se02915	NCP	%	104			70-130	Pass	
Anthracene	M13-Se02915	NCP	%	97			70-130	Pass	
Benz(a)anthracene	M13-Se02915	NCP	%	102			70-130	Pass	
Benzo(a)pyrene	M13-Se02915	NCP	%	103			70-130	Pass	
Benzo(b&j)fluoranthene	M13-Se02915	NCP	%	95			70-130	Pass	
Benzo(g,h,i)perylene	M13-Se02915	NCP	%	89			70-130	Pass	
Benzo(k)fluoranthene	M13-Se02915	NCP	%	102			70-130	Pass	
Chrysene	M13-Se02915	NCP	%	105			70-130	Pass	
Dibenz(a,h)anthracene	M13-Se02915	NCP	%	95			70-130	Pass	
Fluoranthene	M13-Se02915	NCP	%	102			70-130	Pass	
Fluorene	M13-Se02915	NCP	%	98			70-130	Pass	
Indeno(1,2,3-cd)pyrene	M13-Se02915	NCP	%	93			70-130	Pass	
Naphthalene	M13-Se02915	NCP	%	97			70-130	Pass	
Phenanthrene	M13-Se02915	NCP	%	96			70-130	Pass	
Pyrene	M13-Se02915	NCP	%	106			70-130	Pass	
Spike - % Recovery									
Metals M13				Result 1					
Arsenic	M13-Se03166	NCP	%	88			75-125	Pass	
Barium	M13-Se02428	NCP	%	88			75-125	Pass	
Beryllium	M13-Se03166	NCP	%	84			75-125	Pass	
Cadmium	M13-Se03166	NCP	%	87			75-125	Pass	
Chromium	M13-Se03166	NCP	%	85			75-125	Pass	
Cobalt	M13-Se03166	NCP	%	76			75-125	Pass	
Copper	M13-Se03166	NCP	%	100			75-125	Pass	
Lead	M13-Se03166	NCP	%	77			75-125	Pass	
Manganese	M13-Se02346	NCP	%	81			75-125	Pass	
Mercury	M13-Se03568	NCP	%	115			70-130	Pass	
Nickel	M13-Se03166	NCP	%	78			75-125	Pass	
Vanadium	M13-Se03166	NCP	%	91			75-125	Pass	
Zinc	M13-Se03166	NCP	%	78			75-125	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M13-Se02669	NCP	%	108			70-130	Pass	
TRH C10-C14	M13-Se03049	NCP	%	116			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M13-Se02669	NCP	%	120			70-130	Pass	
Toluene	M13-Se02669	NCP	%	122			70-130	Pass	
Ethylbenzene	M13-Se02669	NCP	%	115			70-130	Pass	
o-Xylene	M13-Se02669	NCP	%	113			70-130	Pass	
m&p-Xylenes	M13-Se02669	NCP	%	111			70-130	Pass	
Xylenes - Total	M13-Se02669	NCP	%	112			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH C6-C10	M13-Se02669	NCP	%	124			70-130	Pass	
TRH >C10-C16	M13-Se03049	NCP	%	116			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	

Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Anthracene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g,h,i)perylene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a,h)anthracene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1,2,3-cd)pyrene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	M13-Se02915	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Metals M13				Result 1	Result 2	RPD			
Arsenic	M13-Se03166	NCP	mg/kg	5.5	2.4	78	30%	Fail	Q15
Barium	M13-Se01786	NCP	mg/kg	380	460	18	30%	Pass	
Beryllium	M13-Se03166	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Cadmium	M13-Se03166	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	M13-Se03166	NCP	mg/kg	13	13	3.0	30%	Pass	
Cobalt	M13-Se03166	NCP	mg/kg	5.0	< 5	23	30%	Pass	
Copper	M13-Se03166	NCP	mg/kg	5.1	5.6	10	30%	Pass	
Lead	M13-Se03166	NCP	mg/kg	6.3	< 5	56	30%	Fail	Q15
Manganese	M13-Se03166	NCP	mg/kg	430	470	10	30%	Pass	
Mercury	M13-Se03568	NCP	mg/kg	0.10	0.20	20	30%	Pass	
Nickel	M13-Se03166	NCP	mg/kg	9.5	8.6	10	30%	Pass	
Vanadium	M13-Se03166	NCP	mg/kg	16	15	7.0	30%	Pass	
Zinc	M13-Se03166	NCP	mg/kg	19	19	3.0	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M13-Se02669	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	M13-Se03049	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	M13-Se03049	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	M13-Se03049	NCP	mg/kg	88	99	12	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M13-Se02669	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	M13-Se02669	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	M13-Se02669	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
o-Xylene	M13-Se02669	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	M13-Se02669	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Xylenes - Total	M13-Se02669	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M13-Se02669	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	M13-Se02669	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	M13-Se03049	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	M13-Se03049	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	M13-Se03049	NCP	mg/kg	< 100	< 100	<1	30%	Pass	

Comments
Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q15	The RPD reported passes Eurofins mgt's Acceptance Criteria as stipulated in SOP 05. Refer to Glossary Page of this report for further details

Authorised By

Natalie Krasselt	Client Services
Carroll Lee	Senior Analyst-Volatile (VIC)
Emily Rosenberg	Senior Analyst-Metal (VIC)
Stacey Jenkins	Senior Analyst-Organic (VIC)


Glenn Jackson
Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

Eurofins | mgt shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins | mgt be liable for consequential damages including, but not limited to, lost profits, damages for failure to meet deadlines and lost production arising from this report. This document shall not be reproduced except in full and relates only to the items tested. Unless indicated otherwise, the tests were performed on the samples as received.

Appendix I

3 Pages

Asbestos Reviews (Eva and Associates Pty Ltd)

Appendix H1: Asbestos Removal Works – Tullamarine Buffer Land Audit
(16 September 2013).

Appendix H2: Asbestos and Lead Abatement Program Review – TCL
Westmeadows (21 November 2013).

Eva and Associates Pty Ltd

ACN 005 788 287

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P.O.Box 2163, MALVERN EAST VIC 3145

info@evaandassociates.com.au

Phone: (03) 9509-3370

Fax: (03) 9509-3378



Monday, 16 September 2013

Our Ref: M2327.3

Mr Colin Stapleton
Senior Environmental Scientist
Cardno Lane Piper
150 Oxford Street
Collingwood Victoria 3066

RE: Asbestos Removal Works - Tullamarine Buffer Land Audit

The vinyl wall covering may have an asbestos millboard backing which is friable (the laboratory report was not provided so I'm assuming that this is the case). When removed this material often presents some difficulty as it is bonded to the substrate by adhesive and separates from the sheet vinyl.

Where the material is to be removed, plastic sheeting should be placed on the ground to minimise post removal clean up.

The clearance certificate (Reg 4.3.96 (3)) requires an inspection by an independent person who must state that there is **no visible** asbestos remaining as a result of the asbestos removal work in the area where asbestos removal work was performed or in the area immediately surrounding the area where asbestos work was performed.

There is no requirement for soil sampling.

Should you require any additional information, please do not hesitate to contact me.

Yours faithfully,

EVA AND ASSOCIATES PTY LTD

Brian Eva Certified Occupational Hygienist

Please note that Eva & Associates has a certified Quality Management System, is NATA accredited and all auditors are registered with the RABQSA. All occupational hygienists undertaking monitoring are members of the Australian Institute of Occupational Hygienists (AIOH).



RABQSA - TL
RABQSA - OH



Accreditation No: 14879



Quality
ISO 9001
SAI GLOBAL

LIC 11560
SAI GLOBAL

Thursday, 21 November 2013

Our Ref: M2327.3.1

Mr Colin Stapleton
Senior Environmental Scientist
Cardno Lane Piper
150 Oxford Street
Collingwood Victoria 3066

RE: Asbestos & Lead Abatement Program Review – TCL Westmeadows

A review of the asbestos & lead Abatement program document prepared by Kleinfelder (Project 136162 14th November 2013) for the TCL Westmeadows property, has been completed for the asbestos component only.

The following comments are made:

- The inspection program, including the establishment of test pits and clearing of vegetation to allow inspection of undisturbed surfaces was appropriate for investigative purposes.
- Review of the test pit observations confirms that the ACM debris was as a result of pre-existing structures and not as a result of commercial activities conducted at the site.
- The laboratory results of the deeper test pit, containing deeper fill material, do not indicate the presence of asbestos containing materials.
- The surface scraping and removal of soil (top 100mm within a 5x5m radius of the shed) where a minor quantity of asbestos was identified has been completed.
- There is no evidence in the information provided to suggest that the extent and spread of ACM in this area is wider than that identified in the investigative process.

Inaccuracies in the report

- The report refers to EnviroProtect Services Pty Ltd as providing a qualified industrial hygienist to undertake downwind air monitoring for airborne asbestos fibres (page 9). This statement is incorrect. Persons who conduct atmospheric monitoring do not have to be approved under the regulations, however atmospheric monitoring, and the interpretation of results (including comparison to the asbestos exposure standard), need to be undertaken by a competent person such as an occupational hygienist or safety professional who has the appropriate qualifications, skills and experience. [Compliance Code Removing Asbestos in Workplaces]. The NATA endorsed report relates to the laboratory component only and does not cover field collection. The report signatory may be competent for the purposes of the OHS Regulations, however there is no evidence to support the statement "Qualified Industrial Hygienist". If this statement is to be retained, evidence to this effect should be obtained from EnviroProtect Pty Ltd. A list of Certified Occupational Hygienists is available from the Australian Institute of Occupational Hygienists (AIOH).
- Executive Summary [page iv, page 6], the term qualified industrial hygienist is used in the context of the visual inspection and issue of a clearance certificate. The comments above also apply here. This term should be replaced with inspection by an Independent Person with appropriate knowledge and experience.
- The laboratory analysis report for soil samples obtained from further test pit works [page 10 section 4.3 and included in Appendix D] is not NATA endorsed. The report should be re-issued with NATA endorsement. LRM Global holds accreditation for asbestos in soil.

In conclusion, from the methodology, data and supporting information provided, the asbestos abatement program is appropriate for the specific area and the results can be used for the basis of an opinion for Environmental Audit purposes.

Should you require any additional information, please do not hesitate to contact me.

Yours faithfully,

EVA AND ASSOCIATES PTY LTD



Brian Eva
Certified Occupational Hygienist

Please note that Eva & Associates has a certified Quality Management System, is NATA accredited and all auditors are registered with the RABQSA. All occupational hygienists undertaking monitoring are members of the Australian Institute of Occupational Hygienists (AIOH).



RABQSA – TL
RABQSA - OH



Accreditation No: 14879



Quality
ISO 9001
SAI GLOBAL

LIC 11560
SAI GLOBAL

Appendix J

1 Page

EPA “Information Regarding Environmental Audit Reports”



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.

AUDIT FILES STRUCTURE

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.

PDF SEARCHABILITY AND PRINTING

EPA Victoria can only certify the accuracy and correctness of the audit report and appendices as presented in the hardcopy format. EPA is not responsible for any issues that arise due to problems with PDF files or printing.

Except where PDF normal format is specified, PDF files are scanned and optical character recognised by machine only. Accordingly, while the images are consistent with the scanned original, the searchable hidden text may contain uncorrected recognition errors that can reduce search reliability. Therefore, keyword searches undertaken within the document may not retrieve all references to the queried text.

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This PDF is compatible with Adobe Acrobat Reader Version 4.0 or any later version which is downloadable free from Adobe's Website, www.adobe.com.

FURTHER INFORMATION

For more information on Victoria's environmental audit system, visit EPA's website or contact EPA's Environmental Audit Unit.

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

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

Appendix K

4 Pages

About Site Environmental Audits and Reports

About Site Contamination / Environmental Audits and Reports

1. Introduction

This document explains the Environmental Audit process and the context that applies to the use of Environmental Audit Reports issued by Cardno Lane Piper.

2. What is an Environmental Audit?

Environmental Audits are undertaken in accordance with the provisions of regulations enacted in various states of Australia. They are referred to as Environmental Audits in Victoria, Site Audits in NSW & ACT, Contaminated Site Audits in WA and Site Contamination Audits in SA. In this document, the term Environmental Audit is used to include Site Audit, Contaminated Site Audit and Site Contamination Audit. The details of the regulatory framework applying in each case are explained in the body of the audit report.

The EPA (or equivalent) in each state has delegated the role of auditing contaminated land to a number of experienced contaminated land practitioners known as Environmental Auditors or Site Auditors or similar. Anthony Lane and John Piper of Cardno Lane Piper are such auditors. The roles and responsibilities of the Auditor are described in EPA Guidelines as explained in the text of the report.

Environmental Audits of contaminated land provide certification that a site is suitable for one or more uses.

Please note that this is not legal advice, and if more precise detail is required on the applicable regulations and guidelines in any state jurisdiction, we suggest you consult a specialist environmental legal practitioner.

3. Reasons for Conducting an Environmental Audit

An Audit of Contaminated Land is usually undertaken where there is a statutory requirement – a statutory Audit. This is most commonly as a requirement of the local Planning Authority when a change to a more sensitive use is proposed or where there is a local policy or “overlay” in the planning scheme which calls for a statutory audit. EPA may also require an audit where contaminating activities have resulted in the issue

of a clean up or remediation order or notice. Removal of such notices generally requires an environmental audit to be completed.

The site owner may also undertake audits at other times for due diligence purposes. Such audits (due diligence audits) are undertaken to establish whether the site has been impacted to the extent that some beneficial uses of the site may be precluded. Due diligence audits in many cases may be completed as non-statutory Audits, although in some jurisdictions they can also be statutory audits.

4. The Auditing Process

The Client generally initiates the Audit process (the client must be the owner of the land or be acting with the written authority of the owner) by requesting an Audit. The Auditor notifies EPA of the request and commences the audit.

In most jurisdictions (except Victoria) the Auditor is not permitted to undertake the necessary testing of the soil and groundwater, and this must be by a specialist contaminated land consultant (The Assessor). It is prudent to engage the Auditor and the Assessor at commencement of the audit to allow the Auditor the opportunity of ensuring that the site assessment will be to the required standard and scope.

The Auditor independently reviews the Assessor’s work and forms his own conclusions regarding the contamination status of the site. The Auditor is obliged to ensure that the Assessor has conducted the investigation in accordance with industry standards and guidelines before reaching any conclusion regarding the status of the land and groundwater (and other elements including water and air, where relevant).

A thorough site history assessment (Phase 1 Assessment) is essential to the process of identifying the potential for significant contamination at a site. Where the history is unclear, a broad screening of chemical parameters can be used to test environmental media. This normally includes a broad range of organic and inorganic compounds and elements, often referred to as the EPA Auditor Screen.

The Assessor undertakes sampling of soil at representative locations across the site. A NATA accredited laboratory does the analysis of soil. It is

impractical for all of the soil to be assessed. The Audit is generally based on a statistical method of grid or random sampling, augmented by targeted sampling at locations known or suspected to be contaminated. Guidance on sampling strategy and density is provided in Australian Standard AS4482.1–2005. However, some considerable degree of judgment is still required in the application of any sampling and testing strategy. For example the blanket application of the “hot spot” method is often inappropriate given its limitations and inapplicability to heterogeneous fill.

The field program also investigates the likelihood of contamination below the site surface. Field investigations must sample and test the natural soils. If contamination is found then it is common for further work to be undertaken to characterise, to the extent practical, its vertical and horizontal extent. However, where fill is encountered and testing shows it to be uncontaminated, it must be realised that the heterogeneous nature of the material might mean that not all pockets of contaminated material can be detected using normal sampling regimes.

The auditing guidelines indicate the need in all cases to consider the potential for groundwater contamination in any site Audit. This does not mean all sites need to be drilled to sample groundwater, but it is most often the case. In most hydrogeological conditions, contaminated groundwater conditions are complex and vary in space and time. The condition of groundwater is investigated to identify if any beneficial use or environmental value of groundwater is precluded due to pollution.

As previously stated, all soil and groundwater at the site cannot be tested. The environmental investigations are conducted in accordance with industry standards and guidelines. This provides a level of confidence that a sufficiently comprehensive assessment of the land and groundwater at the site is achieved.

Where an investigation shows that groundwater is polluted, the authorities often require it to be cleaned up such that all beneficial uses are restored or as necessary on a risk-basis. Where this is not practicable due to technical, logistical or financial reasons, the Auditor or EPA (depending on the situation and jurisdiction) may determine that groundwater has been Cleaned Up To the Extent Practicable (Vic), or Remediated To the Extent Necessary (SA). In some jurisdictions only EPA can determine whether clean up has occurred to the extent required, after submission of relevant information by the Auditor. In other

jurisdictions, the Auditor may make this determination.

5. Audit Outcome

If the site contamination is not found to preclude any beneficial uses of the land then an unqualified audit outcome can be obtained. For example, in Victoria a Certificate of Environmental Audit (CoEA) would be issued – in NSW it would be a Site Audit Statement (SAS) without any conditions attached, in WA and SA, a Site (Contamination) Audit Report concluding “unrestricted use”. This generally means the site is suitable for all beneficial uses including sensitive uses such as low and medium density residential.

If the beneficial uses of the site are limited or conditions need to be applied to maintain the beneficial uses, then in Victoria a Statement of Environmental Audit (SoEA) is issued; in NSW a SAS with conditions; in SA and WA a Site (Contamination) Audit Report concluding a “restricted use with conditions”. The statement and Audit Report outline the conditions applying to the management of contamination at the site, necessary to assure the continued suitability of the site for the stated uses.

Where conditions are likely to be included in a report, these are generally discussed, and if necessary, agreed between the Client and the relevant Local Planning Authority, prior to the issue of the Audit Report. It is noted that these conditions may require actions by the Client and/or council subsequent to the issue of the Audit report. In some cases, ongoing management plans to protect people and the environment may be required for an indefinite period.

When complete, the Audit report (containing the certification, either a SoEA, CoEA, SAS or SCAS) is forwarded by the Auditor to the Client, the EPA and the Local Planning Authority. The EPA enters the site into a register of audited sites and in some cases the certification is attached to title. The Local Planning Authority is responsible for ensuring that statement conditions are implemented.

There are generally obligations in each jurisdiction requiring the occupier of the site to provide a copy of any statement (CoEA, SoEA, SAS or SCAS) to any person who proposes to become the occupier of the site.

If significant contamination is encountered (e.g. an Imminent Environmental Hazard [Vic] or a Significant Hazardous Circumstance [SA]) during a statutory audit, then the EPA must be notified by

the Auditor. Under some jurisdictions there is also an obligation on the owner of a site being the source of contamination affecting beneficial uses off site, to inform EPA.

6. Environmental Audit Report

The Environmental Audit Report (or Site Audit Report or Site Contamination Audit Report) details the findings of the Audit. It provides summary information on the site definition, the reasons for the audit and other relevant facts. It reviews the scope and quality of the site investigations, laboratory testing and data analyses undertaken by the Assessor. The report also presents the Auditor's independent review of the contamination status of the site, the need for further clean up, and opinion on the suitability of the site for a range of beneficial uses and land uses such as "residential – low density".

The Audit Report contains the relevant certification being CoEA, SoEA SAS or SCAS, depending on the jurisdiction, as an appendix. In WA the Executive Summary of the Audit Report constitutes the audit statement. The information contained in the certification is the result of conclusions reached by interpretation of the data contained in the Audit Report. It is noted that these statements are brief documents (2 pages) and use the wording prescribed by EPA. They cannot fully explain the conclusions on which they are based or the details of the site contamination. The certification must be read in conjunction with the Audit Report to fully appreciate the site condition.

The Audit Report generally includes a copy of the site assessment report(s) as an appendix. These generally contain more detailed information than the Audit Report. Care should be taken to also read the Assessor's report in full.

Cardno Lane Piper generally issues reports in electronic form (*e-Report*) on CD ROM or by FTP. Audit Reports are issued in this format as Adobe Acrobat™ PDF files. A paper copy of the certification and executive summary of the Audit Report are issued to EPA, council and client, or otherwise as required by regulation.

7. Limitations of Environmental Audit Report

The Environmental Audit Report is prepared in a manner that can be read and understood by a person with a legitimate interest in the site, such as the site owner or occupier, EPA and Local Planning Authority, for determining the

contamination status of the site. The Audit report is not intended for use by other parties or for other purposes. Anyone who uses the Audit report for purposes other than specified in the report, does so at their own risk.

The site should only be used for one or more of the beneficial uses and land uses identified in the certification as suitable.

The conditions applying to the certification in each case are the responsibility of the Client to implement. The Auditor and Cardno Lane Piper are only responsible for the issuing of the Environmental Audit Report and associated certification. The Auditor and Cardno Lane Piper accept no liability for the costs incurred in the implementation of certification conditions. The Audit provides a snapshot of the site conditions at the time of the site investigation. Consequently, the Audit report may not be valid at a later time if there has been any change to the contamination status of the site in that time. Verification of the status of the site may be required in cases where a significant time has elapsed, or site conditions have changed since the assessment and audit.

The Environmental Audit process is necessarily limited by constraints such as time and available information; although normal auditing practice at the time has been applied with all due care to prepare the report. A necessary requirement of this process is the horizontal and vertical interpolation of data from discrete locations. However, site conditions are generally not homogenous and some discrepancies will occur between the actual conditions and those represented by test results or at locations not directly sampled. There is a risk that contamination may occur at the site and not be identified by a competent investigation and assessment. The approach adopted in sampling (a combination of statistically based grid and judgmental sampling) seeks to reduce, but cannot eliminate, this risk.

Where unexpected occurrences of contamination arise, subsequent to the issue of the Audit Report, the Auditor should be permitted to make an interpretation of these facts in relation to the Audit Report. Consequently, the Client should inform the Auditor and seek their opinion. The Auditor and Cardno Lane Piper accept no liability for costs incurred due to such unexpected occurrences, given the inherent uncertainties in the assessment process.

The Auditor uses information provided by the Assessor as the basis for the audit, and reliance on this information is at the Auditor's discretion. This is generally achieved by review of the

Assessors Work Plan/Quality Plan, checking the progress and standard of work, inspecting the site and taking verification samples.

The Audit cannot guarantee any of the facts, findings or conclusions presented by the Assessor but must make a judgment about the validity of information relied upon in the conduct of the Audit. Further, the Auditor will not be liable for the use of information, provided by others that is subsequently found to be intentionally or otherwise misleading.

The Audit Report is not and does not purport to be anything other than a contaminated land audit within the meaning of the legislation. It is not a geotechnical report and bore logs produced (in most cases by the Assessor) are for interpretation of the likely distribution of contamination. They are not intended for geotechnical interpretations and may not be adequate for this purpose.

The Audit Report is not intended to be a comprehensive analysis of the presence and associated risk of asbestos in buildings and services. Where asbestos in buildings and services is known or likely, the report may only caution that an appropriately qualified person be engaged to undertake demolition to avoid contamination of the site.

Cardno Lane Piper

25 February 2013