Information sheet for environmental audits and preliminary risk screen assessments (PRSAs)

Publication 2009 June 2021

Victoria's audit system

An environmental audit system has operated in Victoria since 1989. The *Environment Protection Act 2017* (the Act) provides for the appointment of environmental auditors. It also provides for Environment Protection Authority (EPA or the Authority) to have a system of preliminary risk screen assessments (PRSAs) and environmental audits. These are used in the planning, approval, regulation and management of activities, and in protection of human health and the environment.

Under the Act, the functions of an environmental auditor include to:

- conduct PRSAs and environmental audits
- prepare and issue PRSA statements and reports, and environmental audit statements and reports.

The purpose of a PRSA is to:

- assess the likelihood of the presence of contaminated land
- determine if an environmental audit is required
- recommend a scope for the environmental audit if an environmental audit is required.

The purpose of an environmental audit is to:

- assess the nature and extent of the risk of harm to human health or the environment from contaminated land, waste, pollution, or any activity
- recommend measures to manage the risk of harm to human health or the environment from contaminated land, waste, pollution, or any activity
- make recommendations to manage any contaminated land, waste, pollution or activity.

Upon completion, all PRSAs and environmental audits require preparation of either a PRSA statement, accompanied by a PRSA report, or an environmental audit statement, accompanied by an environmental audit report.

A person may engage an environmental auditor to conduct a PRSA or an environmental audit.

EPA administers the environmental audit system and ensures an acceptable quality of environmental auditing is maintained. This is achieved by assessing auditor applications and conducting a quality assurance program. These measures ensure that PRSAs and environmental audits that environmental auditors undertake are completed in accordance with the relevant sections of the Act or any other Act, and with the guidelines the Authority or other government agencies have published.

Environment Protection Authority Victoria
GPO BOX 4395 Melbourne VIC 3001
1300 372 842 (1300 EPA VIC) **epa.vic.gov.au**

File structures

EPA stores digital statements and reports from PRSAs and environmental audits in three parts:

- Part A, the PRSA or environmental audit report
- Part B, report appendices
- Part C, the PRSA statement and executive summary or environmental audit statement and executive summary.

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

Currency of PRSAs and environmental audits

PRSAs and environmental audits are based on the conditions encountered and information reviewed at the time of preparation. They don't represent any changes that may have occurred since the completion date. As it's not possible for the PRSA or audit report 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 about the site changes from what was available at the time the PRSA or environmental audit was completed, or where an administrative error is identified, an environmental auditor may amend or withdraw PRSA or environmental audit statements and/or reports. Users are advised to check EPA's website to ensure documents' currency.

PDF searchability and printing

EPA can only provide PRSAs and environmental audit statements, reports and appendices that the environmental auditor provided to EPA via the EPA portal on the EPA website.

All statements and reports should be in a Portable Document Format (PDF) and searchable; however at times some appendices may be provided as image-only PDFs, which can affect searchability.

The PDF is compatible with Adobe Acrobat Reader, 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

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

EPA VICTORIA

Preliminary risk screen assessment statement

Under Part 8.3 of the *Environment Protection Act 2017*

Publication F1031 published September 2021

This statement is a summary of the findings of a preliminary risk screen assessment conducted under Part 8.3 of the *Environment Protection Act 2017* for:

327 Yan Yean Road, Plenty, VIC

Further details are provided in the preliminary risk screen assessment report that accompanies this statement.

Section 1: Preliminary risk screen assessment overview

Environmental auditor details

Name:	Mark Stuckey
Company:	Environmental Earth Sciences VIC
Address:	98 Maribyrnong St., Footscray 3011
Phone:	9687 1844
Email:	mstuckey@eesigroup.com

Site owner/occupant

Name:	D. Bolzonello, K&A Strange (No. 16 and 19)
Company:	-

Environmental auditor engaged by

Name:	Nick Bradley
Company:	HWL Ebsworth Lawyers
Relationship to site owner:	Lawyer

Reason for preliminary risk screen assessment

Planning scheme:	Nillumbik Council – Environmental audit overlay
Other:	

Preliminary risk screen assessment statement

Section 2: Assessment scope

Site details

Address:	327 Yan Yean Road, Plenty, Victoria with properties now referred to as numbers 12, 15, 16, 17, 19 Thornbill Drive, Plenty, Victoria
Title details:	11659/983 to 11659/989 (formerly 9507/749)
Area (hectares):	23979 m^2 / 2.4 hectares

☒ a plan of the site is attached

Use or proposed use assessed

☒ Sensitive use (including land used for residential use, a child care centre, pre-school, or primary school) or secondary school or children's playground
- ☐ high density
- ☒ other (lower density)

☐ Recreation/open space
☐ Parks and reserves
☐ Agricultural
☐ Commercial
☐ Industrial
☐ Other

Environmental elements assessed

☐ Ambient air
- ☐ all environmental values were considered **OR**
- ☐ all environmental values other than the following were considered:

☐ Ambient sound
- ☐ all environmental values were considered **OR**
- ☐ all environmental values other than the following were considered:

☒ Land
- ☒ all environmental values that apply to the land use category were considered **OR**
- ☐ all environmental values that apply to the land use category, other than the following, were considered:

☒ Water
- ☐ Surface water
  - ☐ all environmental values that apply to the applicable segment were considered **OR**
  - ☐ all environmental values that apply to the applicable segment, other than the following, were considered:
- ☒ Groundwater
  - ☒ all environmental values that apply to the applicable segment were considered **OR**
  - ☐ all environmental values that apply to the applicable segment, other than the following, were considered:

Preliminary risk screen assessment statement

Standards considered

Environment Reference Standard 2021
National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)

Assumptions made during the assessment or any limitations

Exclusions from the assessment and the rationale for these

This statement is accompanied by the following preliminary risk screen assessment report

Title:	Preliminary Risk Screen Assessment at 327 Yan Yean Road, Plenty, VIC
Report no:	221086_PRSA_V
Date:	10/12/2021

Section 3: Assessment outcome

Based on my assessment, I am of the opinion that an environmental audit is **not required** for the following land uses, **including** the use or proposed use for which the site has been assessed:

(Tick as appropriate and strike out those uses not assessed and for which the need for an audit has not been determined)

- ☒ Sensitive use (including land used for residential use, a child care centre, pre-school, or primary school) or secondary school or children's playground
  - ☐ high density
  - ☒ other (lower density)
- ☐ Recreation/open space
- ☐ Parks and reserves
- ☐ Agricultural
- ☐ Commercial
- ☐ Industrial
- ☐ Other

Section 4: Environmental auditor's declaration

I state that:

- I am appointed as an environmental auditor by the Environment Protection Authority Victoria under the *Environment Protection Act 2017*.
- The findings contained in this statement represents a true and accurate summary of the findings of the preliminary risk screen assessment that I have completed.

Date: 10 December 2021

Signed:

Name: Mark Stuckey

Environmental Auditor

Former 327 Yan Yean Rd, Plenty

Plan of subdivision

64 0 32 64 Meters

GDA_1994_VICGRID94

Map Created on 10-Dec-2021

Scale 1:1,250

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PRELIMINARY RISK SCREEN ASSESSMENT AT 327 YAN YEAN ROAD, PLENTY, VICTORIA

HWL EBSWORTH LAWYERS

10 DECEMBER 2021
221086
VERSION 1

ENVIRONMENTAL EARTH SCIENCES
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10 December 2021

HWL Ebsworth Lawyers
Level 8, 447 Collins Street
Melbourne VIC 3000

Attention: **Nick Bradley**
Associate

Dear Nick

Preliminary Risk Screen Assessment at 327 Yay Yean Road, Plenty, Victoria

Please find enclosed a copy of our report entitled as above. Thank you for the opportunity to undertake this work.

Should you have any queries, please do not hesitate to contact us on (03) 96871666.

For and on behalf of
Environmental Earth Sciences VIC

Project Manager
Ann-Marie O'Brien
Senior Environmental Scientist

Author
Mark Stuckey
Environmental Auditor (Contaminated Land)
appointed pursuant to the *Environment Protection Act 2017*

221086_PRSA_V1

ENVIRONMENTAL EARTH SCIENCES
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EXECUTIVE SUMMARY

Table 1: Summary of PRSA information

Item	Details
Auditor	Mark Stuckey
Auditor account number	EXT001139
Name of person requesting audit or PRSA	Nick Bradley of HWL Ebsworth Lawyers
Relationship of person requesting audit or PRSA to site	Lawyer
Name of site owner	D. Bolzonello, K&A Strange
Date of auditor engagement	21 October 2021
Completion date of the audit or PRSA	10 December 2021
Reason for audit or PRSA	Environmental audit overlay
Elements of the environment assessed	Ambient Air, Soil
Planning permit number or requirement detail if applicable	-
EPA Region	Northern Metro Region
Municipality	Nillumbik
Dominant — Lot on plan	Lot 1, PS705379
Additional — Lot on plan(s)	Lots R1, 2, 4 and 5 PS705379 and Lot 51 PS827184
Site/premises name	327 Yan Yean Road
Street/Lot — Lower No.	12
Street/Lot — Upper No	19
Street Name	Thornbill
Street type (For example, road, court)	Drive
Street suffix (For example, North, South)	---
Suburb	Plenty
Postcode	3090
Site area (in square metres)	23,979 m^2 / 2.4 hectares
Plan of site/ premises/ location showing the audit site boundary attached	Figure 1
Members and categories of support team utilised	Ann-Marie O'Brien – Senior Environmental Consultant – Environmental Earth Sciences
Further work or requirements	-
Nature and extent of continuing risk of harm	-

Item	Details
Outcome of the PRSA report	No Audit required

Table 2: Physical site information

Item	Details
Historical land use	Rural farmland with stables or poultry sheds, agriculture. Small area of northern portion was crossed by an oval training track
Current land use	Vacant land, and Low Density Residential
Proposed land use	Low Density Residential
Current land use zoning	Low Density Residential Zone
Proposed land use zoning	Low Density Residential Zone
Surrounding land use – north	Low Density Residential
Surrounding land use – south	Low Density Residential
Surrounding land use – east	Yan Yean Road
Surrounding land use – west	Low Density Residential
Has EPA been notified about the site under Section 40 of the Environment Protection Act 2017?	No
Nearest surface water receptor – name	Plenty River
Nearest surface water receptor – direction	West
Site aquifer formation	Melbourne Formation, Anderson Creek Formation
Groundwater segment	Segment B

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1 INTRODUCTION

On 21 October 2021, HWL Ebsworth Lawyers on behalf of the landowners (D. Bolzonello, K&A Strange) engaged Mark Stuckey of Environmental Earth Sciences VIC to complete a Preliminary Risk Screen Assessment (PRSA) of the property formerly known as 327 Yan Yean Road, which has been subdivided and is now Numbers 12, 15, 16, 17, 19 Thornbill Drive, Plenty, Victoria ('the site).

The site is subject to an Environmental Audit Overlay (EAO) as outlined in the Nillumbik Shire Council Statutory Planning Unit Report on application delegated to Council officers pursuant to Section 188 (1) of the *Planning & Environment Act 1987*.

Planning Permit 608/2013/14P is dated 19 December 2013 related to the proposed subdivision of the land. The proposal required assessment against the decision guidelines of the Development Plan Overlay (Schedule 4), Environmental Significance Overlay (Schedule 1), Public Acquisition Overlay (Schedule 1), Clause 52.17, Clause 52.29, Plenty Low Density Area Development Plan, Sub-Catchment E Development Plan, and any other relevant policy with Nillumbik Planning Scheme. Potential Contamination of the Site is mentioned as one of the key planning issues in relation to the assessment of the then planning application.

Connolly Environmental was engaged to conduct a Phase 1 Contamination Assessment (August 2014), and a Phase 2 Soil Assessment (April 2015) at the site to respond to Clause 6a of the planning permit 608/2013/14P following which the site was approved for subdivision. However, an EAO remains for the resultant individual parcels, and two of these (No. 16 and 19 owned by the landowners) now require completion of a PRSA to assess whether an Audit is required to permit development of the properties.

The regional location and PRSA boundary are shown in **Figure 1**, and the proposed development plans provided in **Appendix A**.

2 OBJECTIVES

The objective of the PRSA is to:

- Assess the potential for contamination to be present at the site;
- Conclude whether an Audit of the site will be required to determine that the land is suitable for the proposed residential use; and
- If an Audit is considered by the Auditor to be required, an outline scope for Audit will be provided.

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3 SCOPE OF WORK

The scope of work undertaken comprised the following:

- A desktop review of site history and environmental setting to assess potential contaminating activities at or surrounding the site.
- A site inspection.
- Boreholes were advanced using hand auger to a maximum depth of 1 m below ground level (bgl). Locations are shown on **Figure 2**.
- Soil profiles were logged by a suitably qualified scientist with colour, odour, texture, and material type were noted. Borelogs are provided in **Appendix F**.
- Limited soil sampling was conducted to compare with historical sampling results available for the site. The analytical suite was based on the findings of the desktop review and field observations (see **Appendix G** for transcripts and **Table 16** in the Tables section at the rear of this report).
    - Heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg), and in particular arsenic (As), which was identified as a chemical of concern in previous assessments.
    - Total Iron and cations were also analysed to assist with derivation of site-specific ecological investigation levels (EILs).
    - Quality assurance procedures were followed, including the collection of additional samples for these purposes.
- Limited surface gas monitoring was conducted due the proximity of an existing landfill to the site (see **Table 11** below for results).
    - The site was walked across while monitoring for methane with an Inspectra Laser. Existing service pits (communications, stormwater and sewer) were located and monitored.
- Development of a conceptual site model (CSM) and assessment of the likelihood of the land being contaminated land and, if so, the need for an environmental audit considering the environmental values that apply to the site (taking into account the use or proposed use).
- Preparation of a PRSA report summarising the details and findings of the investigation and basis for conclusions as to whether or not an Audit is required.
- Preparation of a PRSA Statement in accordance with Section 206 of the Act including, if one is recommended, a scope for the Audit.
- Submission of the PRSA report and Statement to EPA within five business days of completion, as per Section 205 of the Act.

4 PHYSICAL SITE INFORMATION

4.1 Site location and identification

4.1.1 Site land use

The site is formerly known as 327 Yan Yean Road, which now consists of 5 lots (No. 12, 15, 16, 17, 19) and Thornbill Drive. The site is currently subdivided with houses on No 16 and 19; No. 12, 15, and 17 are undeveloped. The site identification details are summarised in **Table 3 below** and the site locality and layout are presented in **Figure 1** (Figures Appendix).

Table 3: Site Identification

Item	Details
Site Address	327 Yan Yean Road
Site Owners	D. Bolzonello, K&A Strange
Lot & Plan number	Lots R1, 1, 2, 4 and 5 PS705379 and Lot 51 PS827184
Area	23,979 m^2 / 2.4 hectares
Current Zoning	Low Density Residential Zone
Planning Overlays	BMO, DCPO4, DPO4, EAO, ESO1, PAO1
Current land use	Vacant land, Low Density Residential Zone
Local Government Authority	Nillumbik
Site locality and layout	See **Figure 1**

4.1.2 Surrounding land uses

The surrounding land uses to the site are presented below in **Table 4**.

Table 4: Surrounding land uses

Direction	Description
East	Bound by Yan Yean Road. Southeast and across Yan Yean Road is the Nillumbik Recycling and Recovery Centre and closed Landfill.
West	Low Density Residential
North	Low Density Residential. North east and across Yan Yean Road is a forested area which is in planning zone RCZ3 (Rural Conservation Zone-Schedule 3).
South	Low Density Residential

4.1.3 Sensitive receptors

The nearest sensitive receptors to the site include those listed in **Table 5**.

Table 5: Sensitive Receptors

Receptor	Onsite	Offsite
Human	Site users (present and future) including residents, visitors	Surrounding site users (present and future) including residents, visitors
Ecological	Flora and fauna with access to site soil	Flora and fauna at the location of groundwater discharge.

4.1.4 Proposed site use

The site currently has approved developments for subdivision and the construction of a low density residential housing. The key features of the proposal include:

- Subdivide the site into five lots, consisting of approximately 4,000 to 4,200 square metres each.
- Access to all of the lots is proposed via a road (Road Zone, Category 1) that extends from Thornbill Drive that was created as part of the subdivision to the west of the site.

Development plans are presented in **Appendix A**.

4.2 Regional geology

A review of Yan Yean 1:63,600 geological map (Geological Survey of Victoria, 1981) and Geology Data Custodian: State Government Victoria, indicates the surface geology at the site consists of the Melbourne Formation to the northeast portion of the site and the Anderson Creek Formation to the southwest portion of the site.

The Melbourne Formation consists of Silurian Period (420-445 million year old) sedimentary rock consisting of sandstones and siltstones, that are mainly thin-bedded (Sxm). The Anderson Creek Formation (Sxa) is also Silurian aged (Llandovery to Wenlock Epochs) sedimentary rock that consists of siltstone, with thick to thin bedded sandstone with and minor conglomerates.

4.3 Soil and acid sulfate soils

Victorian Soil Type Mapping Data Source indicates that Brown Sodosols is the type of soil on site (SOAB). A review of The Digital Atlas of Australian Soils also indicates the soils at the site are classified as Sodosols.

A review of the Digital Atlas of Australian Acid Sulfate Soils indicates there is a low probability for acid sulfate soils to occur at the site (Class B, 6-70% chance of occurrence). This is confirmed by DNRE (2002).

4.4 Topography and hydrology

The approximate surface elevation of the site is from 158 – 174 mAHD (DELWP 2021c). The highest elevation is observed to be at the northeast corner of the lot and the lowest elevation is at the southwest corner, with an elevation drop towards the southeast corner. Surface water would drain to the southwest and south, and to stormwater infrastructure along Thornbill Drive. Plenty River is the closest surface water body and is located approximately 900 m to the west of the site.

4.5 Hydrogeology

According to DELWP groundwater data, groundwater is present in the range 10-50 m bgs beneath the site. The water bearing aquifers at the site are inferred to be associated with the Melbourne and Anderson Creek Formations.

Groundwater flow direction is inferred to be west in the direction of Plenty River.

Groundwater salinity from digital DELWP groundwater data is 1,000 to 3,500 mg/L as total dissolved salts (TDS), placing groundwater within Segment B (Victorian Government, 2021).

4.6 Registered groundwater bores

A search of DELWP WMIS registered groundwater users was undertaken. Three (3) bores were identified within a 2 km radius of the site. Below is summary of surrounding groundwater uses and aquifer details:

- One bore is registered for domestic use and is 841 m to the northeast of the site. The bore was drilled to a depth of 147 m bgl, however, screened interval is not provided.
- The use type and construction of other two registered bores are not described. They are located approximately 1,593 m and 1,887 m from the site to the southeast. The screened depth is not noted.

4.7 Groundwater dependent ecosystems

A review of the Digital Groundwater Dependent Ecosystems Atlas indicates that the site is terrestrial and has a low potential for groundwater dependent ecosystems (GDE) due to the presence of dissected high plateaus on various resistant rocks, with isolated high plains. The nearest aquatic GDE is the Plenty River (BOM, 2021).

5 HISTORICAL REVIEW

The site historical review included a review of the following documents and information sources:

- Previous investigations;
- Sands and McDougall directories;

- Historical aerial imagery dating from 1945 – 2021;
- EPA completed environmental audits;
- EPA priority site register;
- EPA Groundwater Quality Restricted Use Zones Map; and
- EPA Victoria List of former landfill sites.

5.1 Summary of Previous Investigations

Previous investigations are summarized in the following section. Previous investigation reports (Connolly 2014, and April and July 2015) are presented in **Appendix B**.

- In 1999, Golder reviewed a SKM desktop study conducted in 1998. SKM classified sites depending on whether they had been associated with historical gold mining activities. SKM identified multiple mine locations within the region. The site was located with the Greys Reef mining lease which operated a battery plant. Although the site was reported to be within the mining lease area it was unknown whether mining operations were conducted on the site (Connolly, 2014).
- Golder conducted a preliminary contamination assessment in 1999. Further investigation was recommended to define the contaminated area for risk assessment and contaminant management or remedial action (Connolly, 2014).
- Connolly (August 2014):
    - The site history review indicated uses of the site were associated with farming-related activities. The buildings/ sheds observed in the historical aerial photographs were consistent with stables for animals. The large circular track evident in the 1972 aerial photography was consistent with this use.
    - No current or historical onsite land uses were identified with significant potential to have contaminated the site.
    - Surrounding land uses comprised rural residential properties, orchards, likely horse training facilities, open farmland, and the Nillumbik Shire Council operations depot and former landfill.
    - Arsenic concentrations were slightly at one location, and it was concluded that the identified exceedance may have been the result of deposition of mining spoil from adjacent properties.
    - It was concluded that a statutory audit is not required, and that the site can be cleaned up in accordance with EPA guidelines in order to make it safe for a sensitive use.
    - The clean-up would be conducted prior to commencement of subdivisional work and would be reported to the satisfaction of Council. It would be conducted in

conformance with all relevant ecological and health-based criteria and EPA guidelines, and would be based on a work plan prepared following up-to-date sampling across the site.

- Connolly (April 2015):
    - Soil boring and sampling at 37 bores in an approximate grid pattern across the site (see **Figure 3** for locations).
    - Laboratory analysis of selected soil samples, and interpretation and review of results with respect to relevant criteria (see **Table 16** for metals results).
    - With the exception of soil at sampling location B29 (see **Figure 3** for location), soil at the site met the criteria relevant to low density residential land-use.
    - While the soil at sampling location B29 was not considered suitable for retention within a residential allotment (based on comparison to Tier 1 criteria), it was considered suitable for retention beneath the roadway within the subdivision, where it would not be accessible for direct contact.
- Connolly (July 2015):
    - Inspection and selection of the area of roadway to receive the excavated soil.
    - Supervision of excavation of the soil from the borehole B29 'hotspot' which exceeded the adopted Tier 1 assessment criteria for low density residential land use.
    - Collection of validation samples from the borehole B29 'hotspot' excavation, to confirm removal of the soil which exceeded the adopted Tier 1 assessment criteria for low density residential land use.
    - Analysis of validation samples for arsenic.
    - Supervision of placement of the excavated soil into an area beneath the sub base of the proposed roadway.
    - Preparation of a letter documenting the conduct and outcomes of remediation.
    - Soil remaining at the former location of the arsenic hotspot was not considered to pose a significant risk to human health or the terrestrial ecosystem, and was suitable to remain *in-situ*.
    - Soil excavated from the former location of the arsenic hotspot and placed beneath the sub-base of the proposed roadway met the NEPC (2013) HIL D criterion for arsenic (3,000 mg/kg) and was concluded to be suitable for retention on-site in this location.
    - The soil remediation work reported above was concluded to satisfy Condition 3 of Clause 6a of the planning permit.

5.2 Sands and McDougall Directory

Based on a search of the Sands and McDougall database records, there were no businesses specifically linked to the site at 327 Yan Yean Road. However, for the years 1977 and 1980, there was a butcher located along Yan Yean Road, but there was no address is associated with this business. Directories database search found no records for former gasworks, liquid fuel facilities, dry cleaners, motor garages, service stations.

5.3 Aerial photographs

Presented below in **Table 6** is a review of available historical aerial imagery. Historical aerial imagery was located, dating from 1945 through 2021. The aerial photographs reviewed are included in **Appendix C**.

Table 6: Aerial photograph summary

Year	Onsite	Offsite
1945	Site shows 6 rectangular structures, and 4 small square structures at the north and north west portion of the property. Probably associated with the farm to the north. The southeast quadrant of the site is bushland with a dirt road that branches, running from Yan Yean road, NE to SW. Black and white.	Due north, there is a house, just north of the defined property boundary at Yan Yean Road. This looks to be a farm with associated structures for animals, orchards, agricultural fields. Due south of the property is vegetated bushland, with a dirt road running from the site, across the centre of the site from northeast to southwest. The western section is unforested. Due east is Yan Yean Road, bush land and an orchard. Due west is another farming property with a dam, agricultural fields, orchards, and rectangular structures for housing animals.
1951	Looks very similar to the 1945 image.	Looks very similar to the 1945 image.
1956	Looks very similar to the 1945 image.	Looks very similar to the 1945 image. Due east is Yan Yean Road, bush land but orchard looks overgrown.
1962	Looks very similar to the 1945 image.	The farm at the northwest, looks very similar to the 1956 image. Due west, the orchards are not as defined. Northeast across Yan Yean Road, there looks to be a new cleared area.
1974	The agricultural fields have been replaced by a large “Training Track,” that crosses into the northern portion of the site. The house from the 1945 image is still in the same location. The associated rectangular buildings have been removed and other buildings have been constructed.	Due south of the property, this area continues to be vegetated bushland, the dirt road has faded. The western section is unforested. Due west there is a new road going to the northeast from Yan Yean Road and buildings, where the orchard used to be. Northeast across Yan Yean Road, this area has a house build on and has revegetated. Yan Yean Road has been improved and moved east, there is still an access road to the Training Track.

Year	Onsite	Offsite
1979	Similar to 1974 photo. Training track present. Three buildings on northeast side of site.	Due west this area is getting more built up.
1982	Similar to 1974 photo. Training track present. Four buildings on northeast side of site. Historical Map from 1982 has “Training Tracks” written and shows 4 ovals in dashed lines near the site.	An oval track has appeared to the southwest of the property. Otherwise surrounding properties look similar to 1979 image.
1990	Similar to 1982 photo, however the training track is not as defined. First colour image.	Surrounding properties look similar to 1979 image
2009	Training track is becoming overgrown. Four buildings on northeast side of site still present. There is a rectangular patch of green at the centre of the site and structure to the southwest of this. Access road from Yan Yean Road still present at east side of site.	To the north west, see subdivision development of rural residential, where training track was located. On property to south see dirt tracks, cars, piles of wood.
2016	Training track no longer visible. The buildings on the site have been removed. Thornbill Drive and the associated driveways of the 5 lots, have been constructed. No. #12 Thornbill has vegetation. The centre lot (No. #16) is barren. No. #15 is barren with a fresh dirt patch at centre. #17 has vegetation and trees present. No. #19 is similar. Power lines have been constructed on the old access road to Yan Yean Road.	To the west, see additional subdivision development of rural residential housing, where orchards were located.
2021	Houses have been built at #16 and #19 Thornbill Drive. The western lot, No. #12 is vegetated and undeveloped. The northern lot, No. #15 has a dirt track across it and eastern half of it has items placed on it. The central lot, No. #17 is vegetated and undeveloped.	Yan Yean Road has been improved. Additional subdivision development continues to the west of the site. Thornbill Drive has been continued to the south, brush has been cleared, and additional houses are being constructed on the property to the south.

5.4 EPA Victoria records and searches

5.4.1 Completed audit reports

A search of completed EPA audits within 500m identified the below listed sites in **Table 7** below, with a map and further details provided in **Appendix C**.

CARMS No 36194-2 is an Environmental Audit Report for “Lot 1, 323-325 Yan Yean Road, Yarrambat Vic” (GHD, June 2000). This Lot is located due south of 327 Yan Yean Road, and shows the inferred Greys Reef Mine Area and associated soil sampling locations. GHD also reviewed “Final Environmental Assessment Report, Low Density Residential Development, Lot 1, 323-325 Yan Yean Road, Yarrambat,” completed by GeoPollution Management in June 2000.

Arsenic concentrations were detected up to a maximum of 1,100 mg/kg in mullock heaps, and as such it was concluded that the site was suitable for low density residential land-use outside the area of the mullock heaps. It was also concluded that there is no risk to groundwater and as such a groundwater assessment was not considered necessary.

Table 7: Nearby completed audit reports

CARMS	Address	Distance/ direction	Date completed	Former land use	Soil	Groundwater
36194-2	Lot 1, 323-325 Yan Yean Road	0 m Adjacent, south	13/07/2000	Residential, farming, grazing, business, (since 1938), gold mining (mid to late 1800s)	As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, BTEX, TPH, OC OP Pesticides, PCB, Phenolics, Cyanide	NA
42626-1	344-368 Yan Yean Rd	23 m, north east	24/10/2000	Rural residential, gold mining (mid to late 1800s)	Metals, Cyanide, Fluoride, OCP, PAH, TPH, MAH, Phenols, Cresols	NA
31365-1	Lots 1 & 2, Kurrak Road Yarrambat Vic 3091	48 m north	23/06/1997	Vacant land, agriculture, rural	Asbestos, As, Cr, Ni, Zn	NA
68515-9	Forest audit program. Cannot obtain the specific location of the coupes being assessed.	233 m east	11/02/2015	Forestry	NA	NA

CARMS No 31365-1 is located 50m north of the site, and a Certificate of Environmental Audit was issued as concentrations of all chemicals assessed in soil (including arsenic) complied with all land-use guideline levels.

CARMS No 42626-1 is located 25m north-east of the site. A small section of the north-eastern portion of the site contained elevated arsenic (naturally enriched from the local geology) in fill material, and it was concluded the site was suitable for sensitive land-use so long as a 0.5m clean soil cap was maintained over the fill material in the north-east corner of the site.

5.4.2 Priority site register

A search of completed EPA priority sites register within 500m identified the following and is presented below in **Table 8**, with a map and further details provided in **Appendix C**.

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Table 8: EPA Priority Site Register

Notice No	Notice Type	Company	Address	Issue	Date Issued	Distance and direction
900007767	Not described.	Nillumbik Shire Council (Yarrambat)	290-304 Yan Yean Road	Former Landfill requires ongoing management.	Current	277 m, East
90003407	Hydrogeological Assessment PAN	Nillumbik Shire Council (Yarrambat)	290-304 Yan Yean Road		19/11/2014	277 m, East
90003408	Monitoring, Rehab & Aftercare PAN	Nillumbik Shire Council (Yarrambat)	290-304 Yan Yean Road		19/11/2014	277 m, East
90006073	Previous Priority Notice		290 Yan Yean Road		24/05/2013	277 m, East

5.4.3 Waste Management Facilities and Landfills

A search of EPA Victoria List of former landfill sites found nearby landfills and waste management sites within 500m, and is presented below in **Table 9**, with a map and further details provided in **Appendix C**.

Table 9: Landfill and Waste Management

Site ID	Description	Owner	Address	Distance and direction	Operational/ Closed	Waste Type
1212	Landfill	Nillumbik Shire Council	Yan Yean Road	277 m, East	Operational	Municipal Waste
344	Municipal Waste Transfer Station	Nillumbik Recycling and Recovery Centre	Yan Yean Road	277 m, East	Operational	Municipal Waste
11086	Landfill	Nillumbik Shire Council	Heard Avenue Reserve, 290-304 Yan Yean Road, Plenty Vic	277 m, East	Closed 2007	Solid inert waste, putrescible waste, PIW, low level contaminated soil, asbestos

5.4.4 Groundwater quality restricted use zones (GQRUZ)

A search of completed EPA audits identified no records for GQRUZ within 500m and is presented below in **Table 10**, with a map and further details provided in **Appendix C**.

Table 10: GQRUZ details

CARMs No	EPA ID	Site history	Address	Distance and direction	Restricted use
NA	NA	NA	NA	NA	No restricted uses within 500m

5.5 Site history summary

Based on the historical documents reviewed, the site history is as understood to be as follows.

SKM conducted a desktop study in 1998. SKM classified sites depending on whether they had been associated with historical gold mining activities, and identified multiple mine locations within the region. The SKM report indicated that the site was located within the Greys Reef mining lease which operated a battery plant. Although the site was reported to be within the mining lease area it was unknown whether mining operations were conducted on the site (Connolly, 2014).

Golder Associates conducted a preliminary contamination assessment in 1999, and recommended that further investigation and assessment to define the contaminated area for risk assessment and contaminant management or remedial action (Connolly, 2014).

Connolly Environmental conducted Phase 1 and Phase 2 investigations and remediated an arsenic 'hotspot' in 2015 (Connolly, April and August 2015). Following remediation, Connolly concluded that soil at the site met the criteria relevant to low density residential land-use.

Connolly (April 2015) identified arsenic concentrations at one location exceeding NEPM (2013) criteria, and concluded that the identified exceedance may have been the result of deposition of mining spoil from adjacent properties. This arsenic 'hotspot' was removed, the pit validated and the soil was relocated to be beneath Thornbill Drive. See **Figure 3** for these features.

A review of the site history review and aerial photographs is consistent with previous works. Historical uses of the site were associated with agriculture and farming related activities. The buildings/sheds observed in the historical aerial photographs were consistent with stables and/or animals. The large oval training track evident in the 1972 aerial photography was consistent with this use.

Surrounding land uses comprised rural residential properties, agriculture, orchards, probably horse training facilities, farmland, bushland, and the Nillumbik Shire Council operations depot and former landfill.

Aerial photographs from 1945 through to 2009 show the rural site and surrounding agricultural land changing over time. The photos show the changing uses on rural residential properties, bushland, orchards, horse training facilities, open farmland, and the Nillumbik Shire Council operations depot and former landfill. Aerial photos in 2009, 2016, and 2021 show the development of rural subdivisions. Aerial photos from 1990, 2009, and 2021 show improvements to Yan Yean Road.

Based on our site history review, no current or historical onsite land uses were identified with significant potential to have contaminated the site.

6 CONCEPTUAL SITE MODEL DEVELOPMENT

A conceptual site model (CSM) of the site can be formed by considering the geophysical characteristics at play at the site, the contaminant source, potential receptors, and the pathways to the receptors. The development of a CSM is an iterative process, constantly being updated during the investigation process as more information becomes available.

6.1 Chemicals of potential concern

Based on the site history and sampling undertaken to date, chemicals of potential concern (CoPC) are considered to be associated with an area located at borehole BH29, which was subsequently removed. CoPC previously identified by Conolly is arsenic associated with natural enrichment I the local geology and landscape. In addition to arsenic, there is a perceived potential for the migration of landfill gases associated with Nillumbik Shire Council's closed landfill located at 290-304 Yan Yean Road, Plenty.

6.2 Source to receptor pathway analysis

6.2.1 Sources

Following a review of the site history and reviewing Connolly (2014 and April 2015), sources of potential contamination were considered to be limited to the following:

- Potential of remaining elevated arsenic levels in the area of borehole BH29 and associated with the former Greys Reef mining lease to the south of the site; and
- Migration of landfill gases associated with Nillumbik Shire Council's closed landfill located at 290-304 Yan Yean Road, Plenty; while
- Activities at 327 Yan Yean Road are not likely to have contaminated groundwater, so groundwater was not investigated.

6.2.2 Pathways

The potential pathways between the sources and receptors include:

- Soil: direct contact, inhalation, ingestion, and consumption of home-grown produce (HGP).

6.2.3 Receptors

The potential human receptors include the future users of the site (residents, maintenance workers and visitors).

7 FIELD PROGRAM

A site walkover, methane gas monitoring and a limited soil sampling program was conducted by Environmental Earth Sciences on 12 and 13 November 2021.

7.1 Site inspections

A site inspection was conducted on 12 November 2021 by a suitably qualified environmental scientist. Photographs was taken and selected photos are presented in **Appendix D**. The following observations were made during the site inspection (refer to Figure 2 for property numbers):

- 327 Yan Yean Road has been subdivided into 5 lots, consisting of No. #12, #16, #15, #17, and #19 and the street, Thornbill Drive. Thornbill Drive makes a right angle turn through the centre of the property. No.s #12 and #16 are located respectively, at the west side of the property, with Thornbill Drive to the north. While No.s #15, #17, and #19 (situated north to south respectively) are between Thornbill Drive (on the west) and Yan Yean Road, which runs along the east side of the property.

- No. #12 is fenced, vacant, and covered with a dense ground cover of grasses and vegetation. No #12 is topographically the lowest elevated lot.

- No. #15 had a container, some concrete barricades, some stacked bricks and tiles, tubing, wood, and other miscellaneous construction materials stored on it. No. #15 was also covered with a dense ground cover of grasses and vegetation, except for the dirt road. Brush and trees cover the west side of the property screening out Yan Yean Road. No. #15 is the topographically highest lot.

- No. #16 has a house constructed on it, with planted gardens.

- No. #17 is fenced and vacant, and covered with a dense ground cover of grasses and vegetation. Brush and trees cover the west side of the property, screening out Yan Yean Road.

- No.#19 has a house constructed on it. Brush and trees cover the west side of the property screening out Yan Yean Road.

- At all the lots there were no signs of surface staining, soil piles, odours, or unusual vegetation apparent during the inspection.

- The site topography and surrounds has the highest elevation at the northeast corner and the lowest elevation at the southwest corner, with an elevation drop towards the southeast corner.

7.2 Landfill Gas Monitoring

Following the site walk over on 12 November 2021, monitoring for possible landfill gas was conducted. Landfill gas monitoring for methane was conducted because the closest southeast corner of 327 Yan Yean Road (19 Thornbill Dr.) is approximately 277 metres from

Nillumbik Shire Council's landfill located at 290-304 Yan Yean Road (see **Figure 1** and **Appendix C**).

The property was walked over and an Inspectra Laser was used to monitor methane levels across the site, in accordance with EPA Victoria (2018). During walking, the wand was held near ground level (within 5 cm) to monitor for methane levels, while the readout was monitored and recorded. Four stormwater grates were also located along Thornbill Drive, and each was monitored above the grate and within the enclosure.

Weather was overcast at the beginning of monitoring but then it began to rain and continued to rain for the rest of the inspection.

The location (refer to **Figure 2**) with the highest level recorded (3.0 ppm) was at the boundary of No. #12 and No. #16, along #16's retaining wall, at the northwest corner of the tennis court. Observed along this location were white PVC pipes to vent air from #16's sewer system. No. #12 is the lowest elevated property and there is a sewer lid at its southwest corner.

No. #19 is the portion of subdivided 327 Yan Yean Road, located closest to the closed landfill. A fresh exposure of siltstone rock was monitored on No. #19 and the result was 0.9 ppm. The corner closest to the landfill (southeast corner) was monitored and returned a result of 1.8 ppm. This location was also close to Yan Yean Road.

It is noted that EPA Victoria (2018, Sections 7.4 and 8.4) notes that the "average global background methane concentration is ~1.8 ppm".

A summary of landfill gas monitoring is presented in the following **Table 11**. Equipment calibration certificates provided in **Appendix E**.

Table 11: Landfill Gas Monitoring Results

Location	Range	High Reading (ppm)
#12	1.6 – 3.0 ppm	3.0 ppm
#12, above sewer lid at southwest corner	NA	2.0 ppm
#15	0.9 – 1.9 ppm	1.9 ppm
#16	1.1 – 2.0 ppm	2.0 ppm
#17	1.4 – 2.0 ppm	2.0 ppm
#19	0.9 – 1.8 ppm	1.8 ppm
#19 at exposure of fresh siltstone	NA	0.9 ppm
#19 at southeast corner, closest to closed landfill	NA	1.8 ppm
Thornbill Drive Storm Sewer, across from No. #12, north side	2.1 ppm – above 2.1 ppm – inside	2.1 ppm
Thornbill Drive Storm Sewer across from No. #12, south side	2.0 ppm – above 2.0 ppm – inside	2.0 ppm

Location	Range	High Reading (ppm)
Thornbill Drive Storm Sewer, near No. #16, west side	1.3 ppm – above, 1.3 ppm – inside	1.3 ppm
Thornbill Drive Storm Sewer, near No. #19, east side	1.1 ppm – above, 1.3 ppm – inside	1.3 ppm
No. #12, southwest corner above sewer lid	2.0 ppm	2.0 ppm

7.3 Soil investigation

7.3.1 Rationale for sampling locations

Soil sampling locations were chosen based on a review of previous investigations. Connolly (April 2015) sampled at 37 locations in an approximate grid pattern across the site (see **Figure 3** for locations). With the exception of soil at sampling location B29, soil at the site met the criteria relevant to low density residential land use. This arsenic hotspot was subsequently remediated in 2015 and the excavated soil was placed in a suitable sized excavation beneath the sub-base level of the proposed roadway (Connolly, July 2015).

Up to 4 hand auger locations were proposed to target the area of borehole B29 for arsenic. Limited soil sampling was conducted to compare with the historical sampling results available for the site. The chosen analytical suite was based on the findings of the desktop review and field observations.

- Heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg), and in particular arsenic, which was identified as a chemical of concern in previous assessments.
- Total Iron and cations were also analysed to assist with derivation of site-specific ecological investigation levels (EILs).
- Quality assurance procedures were followed, including the collection of additional samples for these purposes.

The borehole locations from the November 2021 investigation are shown in **Figure 2**.

7.3.2 Soil sampling methodology

Due to encountering refusal at a shallow depth, 7 locations were hand augered in order to collect soil samples at required depths.

Soil profiles were logged by a suitably qualified environmental scientist, with information including soil classification, moisture, texture, visual/ olfactory indicators of contamination and water ingress.

Soil samples were collected at targeted depth intervals similar to the samples collected during the Phase 2 investigation. The soil samples were collected from the decontaminated hand auger using a clean spatula. All samples were placed in laboratory prepared containers, labelled with the location number, depth of discrete sample collection, site

reference and date before being placed into a chilled container. The container was dispatched to the laboratory with a chain of custody form.

Geological borelogs are included in **Appendix F**.

7.3.3 Soil sampling observations

Two hand auger locations HA01 and HA02 were in areas of vacant land on No. #15, in order to target near the arsenic hot spot (see **Figure 3** for reference). Hand auger locations HA03 and HA04, near No. #16 and No. #19 were selected to investigate arsenic levels at these locations.

Hand augers were advanced to a maximum depth of 1.0 m (at HA01, HA02 and HA04). Dark brown top soil ranged from surface to 0.2 m, which was generally underlain by orange-brown silty clays, with grey and orange to red mottling. Some carbonized material was found in HA01 between the depths of 0.5 and 0.6 m. All locations encountered natural material from surface, other than HA04 adjacent to Thornbill Drive.

HA03 encountered grey siltstone from surface, hence HA04 was augered in the nature strip and advanced to 1.0 m. HA04 encountered a dark grey, gravelly fill material from 0.8 m to nearly 1.0 m. Duplicate sample HA06 1.0 was collected at HA04, and so there is no boring called HA06.

As with HA03, HA05 and HA07 had refusal on the siltstone at 0.2 m, and HA08 was able to be advanced to 0.5 m, in order to collect a sample at this depth, prior to refusal.

No odour, staining, or man-made debris was observed at any bore location, although carbonized fragments were seen in HA01 from 0.5 to 0.6 m, and at HA04 at 0.6 m, along with a gravel layer from 0.8 to nearly 1.0 m.

8 LABORATORY ANALYSIS

8.1 Soil

Samples were analysed by ALS Environmental (ALS), which is accredited with the National Association of Testing Authorities (NATA) for the methods used. A duplicate laboratory sample was submitted as part of our Quality Assurance and Quality Control (QA/QC) procedure.

Samples were analysed for the following:

- Heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg), and in particular arsenic, which was identified as a chemical of concern in previous assessments.
- Total Iron and cations were also analysed to assist with derivation of site-specific ecological investigation levels (EILs).

- Quality assurance procedures were followed, including the collection of additional samples for these purposes.

Laboratory transcripts are provided in **Appendix G**.

8.2 Procedures for quality control and quality assurance

Quality control (QC) is achieved by using NATA registered laboratories using ASTM standard methods supported by internal duplicates, the checking of high, abnormal, or otherwise anomalous results against background and other chemical results for the sample concerned.

Quality assurance (QA) is achieved by confirming that field results, or anticipated results based upon comparison with field observations, are consistent with laboratory results. Also, that sampling methods are uniform, and that decontamination of sampling equipment is thorough. In addition to their internal QA/QC, the laboratory undertakes additional duplicate analysis as part of their internal quality assurance program on the basis of one duplicate analysis for every 20 samples analysed.

Field observations were compared with laboratory results when they are not as expected. Confirmation, re-sampling and re-analysis of a sample are undertaken if the results are not consistent with field observations and/or measurements. In addition, field duplicate sample results have to be within the acceptable range of reproducibility.

The overall assessment of the data quality is as follows:

- No analysis holding time breaches were present;
- RPDs between HA04 1.0 and HA06 1.0 (duplicate sample) range between 12 and 51%.
- Field observations and measurements were generally comparable to laboratory data;
- Internal laboratory quality data is considered acceptable;
- The dataset as a whole is considered reliable.

9 ENVIRONMENTAL QUALITY OBJECTIVES AND CRITERIA

The Victorian Government has prepared an *Environmental Reference Standard* (ERS) in accordance with Clause 93 of the *Environment Protection Act* 2017. The ERS provides the framework for the assessment and reporting on environmental conditions in Victoria. It sets out the environmental values (EVs) of the ambient air, ambient sound, land, and water environments that are sought to be achieved or maintained in Victoria and standards to support those values.

Standards for the EVs are comprised of objectives for supporting different uses of the environment and indicators that can be measured to determine whether those objectives are

being met. The ERS is not a compliance standard, but the indicators and objectives provide a basis for assessment and reporting on environmental conditions in Victoria and the ERS is required to be considered by Auditors when carrying out their functions under the Act, including conducting Audits.

The PRSA process requires that the levels of contamination reported be assessed in the context of the future land use. The applicable sections of the environment which need to be considered, such as soil, groundwater, surface water and air, are discussed in more detail below.

9.1 Land environmental values

Part 4 of the ERS sets out EVs applicable to various land use categories. These are summarised in **Table 12**.

Table 12: Land Environmental Values

Environmental Values		Land use						
		Parks and reserves	Agricultural	Sensitive use		Recreation/ open space	Commercial	Industrial
				High Density	Other (lower density)			
Land dependant ecosystems and species	Natural ecosystems	✓						
	Modified ecosystems	✓	✓		✓	✓		
	Highly modified ecosystems	✓	✓	✓	✓	✓	✓	✓
Human Health		✓	✓	✓	✓	✓	✓	✓
Building and structures		✓	✓	✓	✓	✓	✓	✓
Aesthetics		✓		✓	✓	✓	✓	
Production of food, flora, and fibre		✓	✓		✓			

The site is proposed for low density residential use, for which EVs are:

- Modified ecosystems
- Highly modified ecosystems
- Human Health
- Buildings and Structures
- Aesthetics

- Production of food, flora, and fibre.

9.2 Soil assessment criteria

The environmental quality indicators and objectives applicable to the assessment of the relevant EVs for the proposed land uses are detailed in **Table 13**.

Table 13: Indicators and objectives for relevant land environmental values

Environmental Values	Indicators	Objectives
Human health	Chemicals specified in Appendix A of Schedule B2 of the NEPM or other chemicals, as identified from current or historical site use.	Health investigation or screening levels (HIL/ HSL) specified in the NEPM or other such levels (where no guidelines are available) or where more appropriate, levels derived in accordance with risk-based methodologies specified in the NEPM or background levels established in accordance with the Act.
Maintenance of ecosystems	Concentration of chemicals.	Contamination must not adversely affect the maintenance of relevant ecosystems and the level of any indicator must not be greater than any ecological investigation/ screening level (EIL/ ESL) developed in accordance with the NEPM or levels approved by EPA Victoria.
Aesthetics	Any chemical substance or waste that may be offensive to the senses.	Contamination must not cause the land to be offensive to the senses of human beings.
Buildings and structures	pH; sulfate; ORP; salinity; other substance or waste that may have a detrimental impact on the structural integrity of buildings and other structures.	Contamination must not cause the land to be corrosive to or adversely affect the integrity of structures or building materials.
Production of food, flora and fibre	Concentration of contaminants.	Contamination must not adversely affect produce quality or yield; and affect the level of an indicator in the food, fibre or flora produced at the site (or that may be produced) such that the level of that indicator is greater than that specified in the Australian and New Zealand Food Authority Standards Codes. NEPM 2013 EIL/ ESLs have been adopted as a conservative measure.

The following section discusses the specific assessment criteria adopted for the protection of relevant land EVs at site.

9.2.1 Human health

Schedule B(1) of NEPC (2013) provides a range of investigation levels for the protection of human health, referred to as health investigation levels (HILs), and provides health screening levels (HSLs) for BTEXN and petroleum hydrocarbons.

HILs and HSLs are provided for four generic land use settings:

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

The adopted HIL level for the site is HILs Res A soil (low density residential) based on the most sensitive use undertaken as per the provided development plans for the site (**Appendix A**).

9.2.2 Maintenance of ecosystems

The ERS states that the contamination must not adversely affect the maintenance of relevant ecosystems (i.e. natural, modified and highly modified ecosystems). As stated in **Table 13** above, any soil contamination must not adversely affect the maintenance of relevant ecosystems and the level of any indicator must not be greater than any ecological investigation levels (EILs) and ecological screening levels (ESLs) developed in accordance with NEPC (2013).

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

- Areas of ecological significance (AES);
- Urban residential/ public open space (UR/POS); and
- Commercial/ industrial (C/I).

The methodology has been developed to protect soil processes, soil biota (flora and fauna) and terrestrial invertebrates and vertebrates. As the proposed use for both of the lots onsite is low density residential, the UR/POS EIL has been adopted for the assessment.

The EILs provided in the ASC NEPM are calculated from summing the added contaminant limit (ACL) to the ambient background concentration (ABC) to derive the site-specific soil quality guideline taking into account the effect caused by pH, exchangeable cations, iron and total organic carbon in soil that can affect concentration toxicity data.

The values presented for zinc, chromium (III), copper and lead are based on derivation of ACLs. Values presented for lead, arsenic, naphthalene and DDT are generic EILs based on total concentrations of aged (arsenic) and fresh contaminants.

A summary of the EILs for aged contamination in soil (>2 years) for the adopted proposed land use is presented in **Table 14**.

Table 14: Site specific EILs

Analyte	Ambient background concentration (ABC, mg/kg)[1]	EIL (mg/kg) – UR/POS
Arsenic	16	100
Naphthalene	-	170
DDT	-	180
Chromium III	132	550
Copper	25	130
Lead	7	1,100
Nickel	37	70
Zinc	49	180

Notes:
1. ABCs were derived from Hamon et al. (2004);
2. ACL – Added contaminant limit, determined using Tables 1B(1-5), Schedule B1, NEPC (2013)
3. Clay content = 35%, pH = 5 and CEC = 6.9 $cmol_c/kg$ were used to derive specific values

Ecological screening levels (ESLs) listed in Table 1B(5) of NEPC (2013) have been adopted in this assessment for TPH/TRH and BTEXN compounds.

9.2.3 Aesthetics

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

9.2.4 Buildings and structures

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

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

considered to be associated with mild or non-aggressive conditions only where all objectives are met.

9.2.5 Production of food, flora and fibre

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

9.2.6 Considerations

For a chemical in soil to be considered acceptable for the respective land-use, the data set should conform to the following requirements, as outlined in NEPC (2013):

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

10 DISCUSSION OF CHEMICAL RESULTS

The analytical results for soil have been summarised and presented in **Table 16** in the Tables section at the rear of this report and the chain of custody documentation and complete laboratory transcripts are provided in **Appendix G**. Methane in air measurements have been included in **Table 11**, with the calibration certificate for the instrumentation used provided in **Appendix E**.

10.1 Soil analytical results compared to Tier 1 criteria

Exceedances of adopted site criteria (NEPM 2013 Table 1A(1) HILs Res A Soil) of 100 mg/kg (see **Table 16**), were identified within the soil sample collected from:

- HA01 at a depth of 0.5 m at 188 mg/kg, and at a depth of 1.0 m at 248 mg/kg (HA01 at a depth of 0.2 m recorded 45 mg/kg); and
- HA02 at a depth of 0.5 m at 104 mg/kg (HA02 at depths of 0.2 m and 1.0 m recorded 58 and 37 mg/kg, respectively.

The collected data is consistent with the historical data collected for the site (Conolly Environmental April and July 2015), as summarised in **Table 16**, with the statistical summary for the soil population at the site provided in **Table 15**. As can be seen in Table 15, despite minor exceedances of Tier 1 criteria for arsenic, the arsenic concentration in the soil

population at the site (based on a final sample size of 65) complies with the NEPC (2013) requirements for statistical assessment as detailed in Section 9.2.6 above.

In particular for arsenic, the soil population at the site has been determined to have a normally distributed arsenic mean concentration of 43 mg/kg, or 53 mg/kg with a 95% level of confidence, a maximum concentration <2.5 times the Tier 1 criteria, and a standard deviation <0.5 times the criterion.

Table 15: Soil arsenic and metal concentrations statistical summary

Analyte	Criteria		Statistical Summary					
	HIL-A	EIL – UR/POS	Count	Mean	SD	MAX	CV	95% UCL
Arsenic	**100**	**100**	65	43	47	248	1.10	53
Chromium	**100**	**550**	61	23	12	59	0.51	26
Copper	**6,000**	**130**	7	15	7	28	0.49	20
Lead	**300**	**1,100**	10	13	4	20	0.33	16
Nickel	**400**	**70**	9	15	20	53	1.30	28
Zinc	**7,400**	**180**	6	28	17	48	0.61	42

Notes:
1. All results in mg/kg other than count
2. SD – standard deviation; MAX – maximum; CV – coefficient of variation; UCL – upper confidence limit

10.2 Methane readings

All methane readings recorded at the site with a calibrated gas meter reported concentrations within or close to the expected global background methane concentration (after EPA Victoria 2018, Sections 7.4 and 8.4) of 1.8 ppm. The maximum recorded reading was 3.0 ppm adjacent to a potential sewer pipe outlet, and all other readings ≤2.1 ppm (**Table 11**).

10.3 Further considerations on land-use suitability and risk

A further consideration with regards to the arsenic concentrations in soil is the (necessarily) conservative nature of the Tier 1 human health and ecological protection criteria (HIL-A and EIL-UR/POS) values of 100 mg/kg. Even though it has been demonstrated that the site soil arsenic levels comply with this criteria, it is also important to point out that less conservative (but still appropriately so) Tier 2 criteria can be readily derived for protection of both receptor populations (after NEPC 2013 Schedules B4, B5 and B7, and Environmental Earth Sciences 2014).

A Tier 2 allowable concentration in soil can be calculated on a site-specific basis, based on factors such as bio-accessibility (BAC) and ageing and leaching factors (ALFs).

Schedule B7 Appendix A1 Section 1.3.1 of NEPC (2013) details HIL derivation for arsenic, and notes that although the Tier 1 criteria are derived assuming a BAC of 100%, a refined value in the range of 25-70% can readily be applied in Australia given the well documented

low BAC of shallow soil arsenic (in particular that associated with natural mineralisation). It is stated that “it would be reasonable to consider a conservative value of 70% bioavailability as a reasonable upper estimate that adequately addresses arsenic that may be derived from mine sites”.

Further, Schedule B7 Appendix A1 Section 1.3.1 of NEPC (2013) states in direct relevance to this site “data from Bendigo in Victoria suggests that the bioavailability of arsenic in soil derived from mine tailings in this region commonly ranges from 10-20% and is generally less than 30%. The value of 25% that is adopted by the US EPA would be appropriate in these areas.”

Using a conservative worst-case BAC value of 70% results in a Tier 2 HIL-A for arsenic of **200 mg/kg** and using the recommended 25% BAC results in a Tier 2 HIL-A for arsenic of **300 mg/kg**.

Schedule B5b Section 2.4.3 and Schedule B5c Sections 4 and 13.2 of NEPC (2013) detail derivation of Tier 2 EILs for aged (in particular field-aged or natural) arsenic based on toxicity data and incorporation of an ALF which is correlated to between 2-12 years of ageing (Schedule B5c Section 4.7.1, after Song *et al*. 2006).

A Tier 2 EIL of **600 mg/kg** is calculated for arsenic in soil that is at least 12 years old (which is the case at this site as the arsenic is natural).

11 CONCLUSION AND PRSA OUTCOME

The historical investigation and recent complimentary soil sampling and updated desk-top assessment undertaken at the site suggests the following:

- There is a low risk to future onsite or offsite receptors as a result of the site’s soil condition, in particular arsenic concentrations in soil.
- There is no apparent risk or potential for any future risk from the closed landfill located 300 m east of the site.

One the basis of the information presented within this report, the outcome of the PRSA is Outcome 1 as per EPA (2021b):

- Unlikely that contaminated land is present (as per the definition in section 35(1) of the *EP Act 2017*), and no environmental audit is required.

ENVIRONMENTAL EARTH SCIENCES
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12 LIMITATIONS

This report has been prepared by Environmental Earth Sciences VIC ACN 109 404 024 in response to and subject to the following limitations:

1. The specific instructions received from HWL Ebsworth Lawyers;

2. The specific scope of works set out in PO220256 issued by HWL Ebsworth Lawyers for and on behalf of D. Bolzonello, K&A Strange, is included in Section 3 (Scope of Work) of this report;

3. May not be relied upon by any third party not named in this report (other than the applicable Planning Authority) for any purpose except with the prior written consent of Environmental Earth Sciences VIC (which consent may or may not be given at the discretion of Environmental Earth Sciences VIC);

4. This report comprises the formal report, documentation sections, tables, figures and appendices as referred to in the index to this report and must not be released to any third party or copied in part without all the material included in this report for any reason;

5. The report only relates to the site referred to in the scope of works being located at 327 Yan Yean Road (“the site”);

6. The report relates to the site as at the date of the report as conditions may change thereafter due to natural processes and/or site activities;

7. No warranty or guarantee is made in regard to any other use than as specified in the scope of works and only applies to the depth tested and reported in this report;

8. Fill, soil, groundwater and rock to the depth tested on the site may be fit for the use specified in this report. Unless it is expressly stated in this report, the fill, soil and/or rock may not be suitable for classification as clean fill if deposited off site; and

9. Our General Limitations set out at the back of the body of this report.

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ENVIRONMENTAL EARTH SCIENCES GENERAL LIMITATIONS

Scope of services
The work presented in this report is Environmental Earth Sciences response to the specific scope of works requested by, planned with and approved by the client. It cannot be relied on by any other third party for any purpose except with our prior written consent. Client may distribute this report to other parties and in doing so warrants that the report is suitable for the purpose it was intended for. However, any party wishing to rely on this report should contact us to determine the suitability of this report for their specific purpose.

Data should not be separated from the report
A report is provided inclusive of all documentation sections, limitations, tables, figures and appendices and should not be provided or copied in part without all supporting documentation for any reason, because misinterpretation may occur.

Subsurface conditions change
Understanding an environmental study will reduce exposure to the risk of the presence of contaminated soil and or groundwater. However, contaminants may be present in areas that were not investigated, or may migrate to other areas. Analysis cannot cover every type of contaminant that could possibly be present. When combined with field observations, field measurements and professional judgement, this approach increases the probability of identifying contaminated soil and or groundwater. Under no circumstances can it be considered that these findings represent the actual condition of the site at all points.

Environmental studies identify actual sub-surface conditions only at those points where samples are taken, when they are taken. Actual conditions between sampling locations differ from those inferred because no professional, no matter how qualified, and no sub-surface exploration program, no matter how comprehensive, can reveal what is hidden below the ground surface. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from that predicted. Nothing can be done to prevent the unanticipated. However, steps can be taken to help minimize the impact. For this reason, site owners should retain our services.

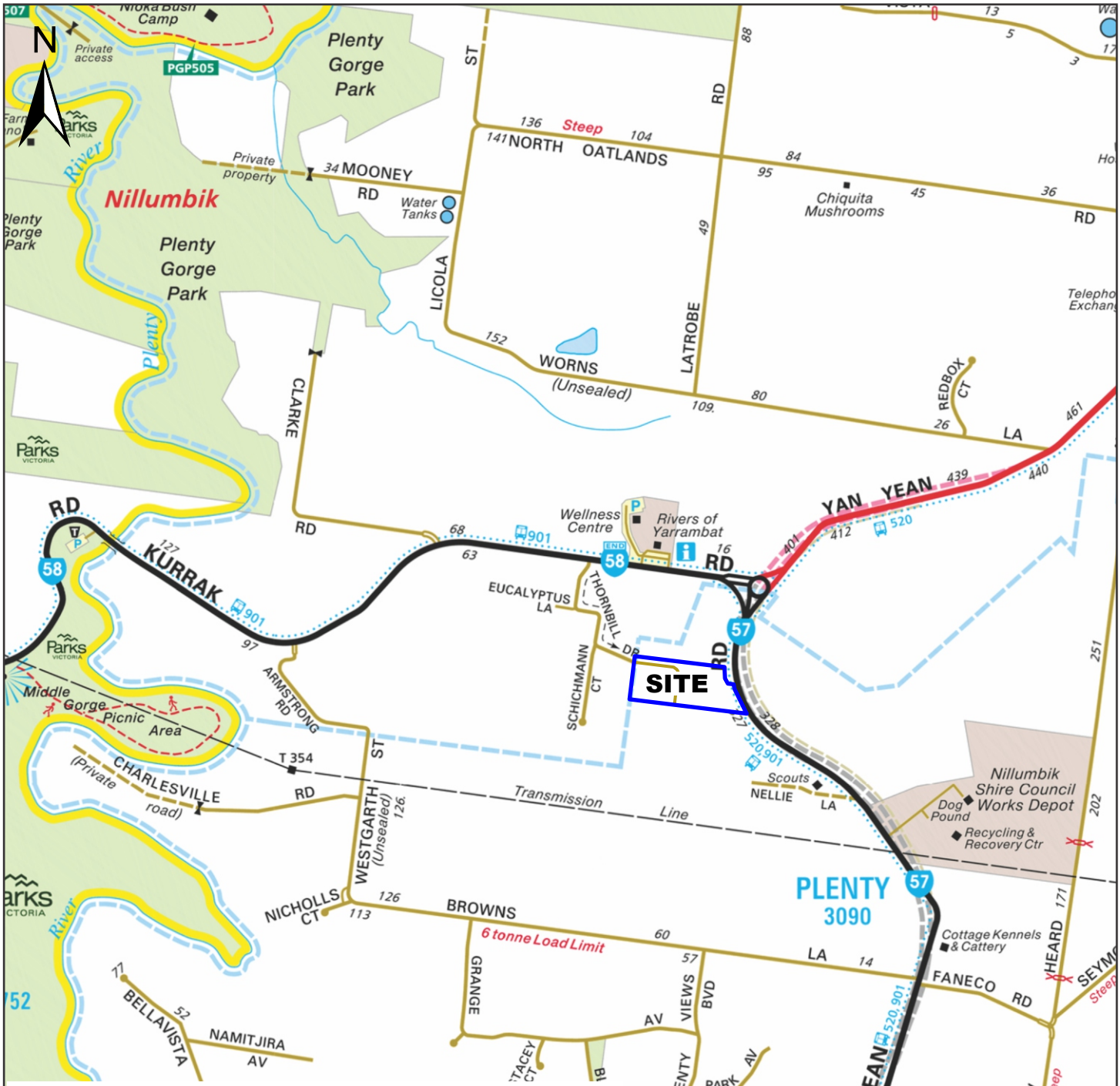
Problems with interpretation by others
Advice and interpretation is provided on the basis that subsequent work will be undertaken by Environmental Earth Sciences VIC. This will identify variances, maintain consistency in how data is interpreted, conduct additional tests that may be necessary and recommend solutions to problems encountered on site. Other parties may misinterpret our work and we cannot be responsible for how the information in this report is used. If further data is collected or comes to light we reserve the right to alter their conclusions.

Obtain regulatory approval
The investigation and remediation of contaminated sites is a field in which legislation and interpretation of legislation is changing rapidly. Our interpretation of the investigation findings should not be taken to be that of any other party. When approval from a statutory authority is required for a project, that approval should be directly sought by the client.

Limit of liability
This study has been carried out to a particular scope of works at a specified site and should not be used for any other purpose. This report is provided on the condition that Environmental Earth Sciences VIC disclaims all liability to any person or entity other than the client in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by any such person in reliance, whether in whole or in part, on the contents of this report. Furthermore, Environmental Earth Sciences VIC disclaims all liability in respect of anything done or omitted to be done and of the consequence of anything done or omitted to be done by the client, or any such person in reliance, whether in whole or any part of the contents of this report of all matters not stated in the brief outlined in Environmental Earth Sciences VIC's proposal number and according to Environmental Earth Sciences general terms and conditions and special terms and conditions for contaminated sites.

To the maximum extent permitted by law, we exclude all liability of whatever nature, whether in contract, tort or otherwise, for the acts, omissions or default, whether negligent or otherwise for any loss or damage whatsoever that may arise in any way in connection with the supply of services. Under circumstances where liability cannot be excluded, such liability is limited to the value of the purchased service.

FIGURES



ENVIRONMENTAL EARTH SCIENCES CONTAMINATION RESOLVED		Title:	**Site Locality Map**
		Location:	**327 Yan Yean Road, Plenty, Vic.**
Client: **HWL**			Job No: **221086**
Project Man: **AO**	Scale: **As Shown**		**Figure 1**
Drawn By: **LB**	Date: **December 2021**		

Data Source Aerial Imagery: © Aerometrex Pty Ltd

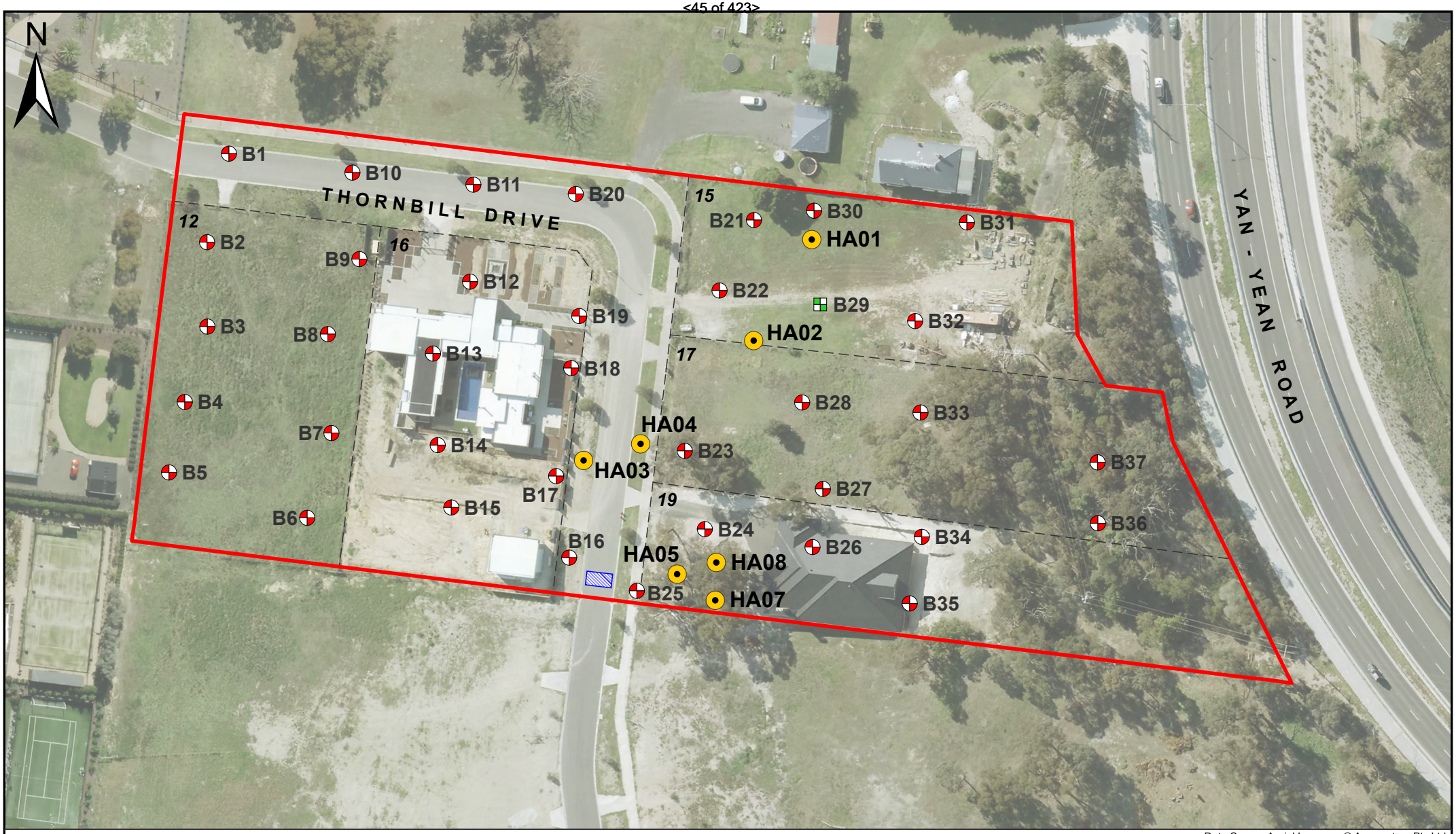
LEGEND:

- Site boundary
- Hand auger location
- Approximate lot boundary
- 12 Property address

0 10 20 30 40 50
Scale in Metres

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Title:	Site Features and Sample Locations		
Location:	327 Yan Yean Road, Plenty, Vic.		
Client:	HWL		Job No: 221086
Project Man:	AO	Scale: As Shown	Figure 2
Drawn By:	LB	Date: December 2021	



Data Source Aerial Imagery: © Aerometrex Pty Ltd

LEGEND:

- Site boundary
- Hand auger location
- Connolly Environmental borehole location (2015)
- Approximate lot boundary
- 12 — Property address
- B29 — Soil removed and validation samples collected
- B29 soil placed here

0 10 20 30 40 50
Scale in Metres

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

Title: **Connolly Environmental Sampling Locations - 2015**

Location: **327 Yan Yean Road, Plenty, Vic.**

Client: **HWL**

Job No: **221086**

Project Man: **AO**

Scale: **As Shown**

Drawn By: **LB**

Date: **December 2021**

Figure 3

ENVIRONMENTAL EARTH SCIENCES
CONTAMINATION RESOLVED

TABLES

221086_soil results with Connollys

EESI sampling results (November 2021)

Chemical Group	Chemical Name	Units	LOR	NEPM 2013 Table 1A(1) HILs Res A Soil	NEPM 2013 Table 1B (1-4) EILs UR/POS	HA010.2	HA010.5	HA011.0	HA020.2	HA020.5	HA021.0	HA040.2	HA040.5	HA041.0	HA061.0 (Duplicate sample)
						0.2	0.5	1.0	0.2	0.5	1.0	0.2	0.5	1.0	1.0
						12/11/2021	12/11/2021	12/11/2021	12/11/2021	12/11/2021	12/11/2021	13/11/2021	13/11/2021	13/11/2021	13/11/2021
Exchangeable cations	Exchangeable Calcium	meq/100g	0.2			4.8	-	-	-	2.4	-	-	-	2.8	-
	Exchangeable Magnesium	meq/100g	0.2			1	-	-	-	2.4	-	-	-	4.1	-
	Exchangeable Potassium	meq/100g	0.2			0.1	-	-	-	0.5	-	-	-	0.3	-
	Exchangeable Sodium	meq/100g	0.2			0.2	-	-	-	0.3	-	-	-	1.7	-
	Cation Exchange Capacity	meq/100g	0.2			6.2	-	-	-	5.5	-	-	-	9	-
Moisture Content	Moisture Content	%	1			17	19.2	17.9	16.7	22.3	15.9	17.9	21.7	15.3	15.9
Metals	Antimony	mg/kg		-		-	-	-	-	-	-	-	-	-	-
	Arsenic	mg/kg	5	100	100	45	188	248	58	104	37	57	33	12	17
	Barium	mg/kg	1	-		-	-	-	-	-	-	-	-	-	-
	Beryllium	mg/kg	1	60		-	-	-	-	-	-	-	-	-	-
	Boron	mg/kg	1	4500		-	-	-	-	-	-	-	-	-	-
	Cadmium	mg/kg	1	20		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Chromium (hexavalient)	mg/kg	2	100		-	-	-	-	-	-	-	-	-	-
	Chromium (III+VI)	mg/kg	2	-	550	10	33	32	15	32	9	25	45	24	31
	Copper	mg/kg	5	6000	130	6	8	13	<5	<5	<5	16	14	28	20
	Lead	mg/kg	5	300	1100	20	15	16	8	11	6	15	17	12	10
	Nickel	mg/kg	2	400	70	6	4	2	5	3	<2	10	8	53	47
	Zinc	mg/kg	5	7400	180	48	<5	<5	6	<5	<5	22	16	47	28
	Iron	mg/kg	50			5660	-	-	-	21,700	-	-	-	37,600	-

221086_soil results with Connollys

Connolly Environmental (April 2015) Metals results from Table 1.

Chemical Group	Chemical Name	Units	LOR	NEPM 2013 Table 1A(1) HILs Res A Soil	NEPM 2013 Table 1B (1-4) EILs UR/POS	B1/0.2	B2/0.5	B2/0.8	B3/0.2	B4/0.5	B5/0.2	B6/0.2	B6/1.0	B7/0.5	B507/0.5 (QA/QC)	B607/0.5 (QA/QC)
						0.2	0.5	0.8	0.2	0.5	0.2	0.2	1.0	0.5	0.5	0.5
						4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	5/03/2015	4/03/2015
Exchangeable cations	Exchangeable Calcium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Magnesium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Potassium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Sodium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Cation Exchange Capacity	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
Moisture Content	Moisture Content	%	1			-	-	-	-	-	-	-	-	-	-	-
Metals	Antimony	mg/kg		-		-	<5	-	-	-	-	<5	-	-	-	-
	Arsenic	mg/kg	5	100	100	6	13	8	7	18	9	8	12	19	17	13
	Barium	mg/kg	1	-		-	59	-	-	-	-	23	-	-	-	-
	Beryllium	mg/kg	1	60		-	<5	-	-	-	-	<5	-	-	-	-
	Boron	mg/kg	1	4500		-	<10	-	-	-	-	<10	-	-	-	-
	Cadmium	mg/kg	1	20		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4
	Chromium (hexavalient)	mg/kg	2	100		-	-	-	-	-	<1	-	-	-	-	-
	Chromium (III+VI)	mg/kg	2	-	550	11	37	33	15	28	20	16	29	37	36	44
	Copper	mg/kg	5	6000	130	-	-	-	-	-	-	-	-	-	-	-
	Lead	mg/kg	5	300	1100	-	-	-	-	-	-	-	-	-	-	-
	Nickel	mg/kg	2	400	70	-	-	-	-	-	-	-	-	-	-	-
	Zinc	mg/kg	5	7400	180	-	-	-	-	-	-	-	-	-	-	-
	Iron	mg/kg	50			-	-	-	-	-	-	-	-	-	-	-

221086_soil results with Connollys

				NEPM 2013 Table 1A(1) HILs Res A Soil	NEPM 2013 Table 1B (1-4) EILs UR/POS	B8/0.5	B9/0.2	B10/0.5	B10/1.0	B11/0.5	B12/0.2	B13/0.2	B14/0.5	B15/0.5	B16/0.2	B16/1.0
						0.5	0.2	0.5	1.0	0.5	0.5	0.2	0.5	0.5	0.2	1.0
Chemical Group	**Chemical Name**	**Units**	**LOR**			4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015
Exchangeable cations	Exchangeable Calcium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Magnesium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Potassium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Sodium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Cation Exchange Capacity	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
Moisture Content	Moisture Content	%	1			-	-	-	-	-	-	-	-	-	-	-
Metals	Antimony	mg/kg		-		-	-	-	-	-	-	-	-	-	-	-
	Arsenic	mg/kg	5	100	100	24	9	-	13	32	16	11	16	13	40	47
	Barium	mg/kg	1	-		-	-	-	-	-	-	-	-	-	-	-
	Beryllium	mg/kg	1	60		-	-	-	-	-	-	-	-	-	-	-
	Boron	mg/kg	1	4500		-	-	-	-	-	-	-	-	-	-	-
	Cadmium	mg/kg	1	20		<0.2	<0.2	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Chromium (hexavalient)	mg/kg	2	100		-	-	-	-	-	-	-	<1	-	-	-
	Chromium (III+VI)	mg/kg	2	-	550	33	16	-	27	45	28	23	34	40	14	30
	Copper	mg/kg	5	6000	130	-	-	-	-	-	-	-	-	-	-	-
	Lead	mg/kg	5	300	1100	-	-	-	-	-	-	-	-	-	-	-
	Nickel	mg/kg	2	400	70	-	-	-	-	-	-	-	-	-	-	-
	Zinc	mg/kg	5	7400	180	-	-	-	-	-	-	-	-	-	-	-
	Iron	mg/kg	50			-	-	-	-	-	-	-	-	-	-	-

221086_soil results with Connollys

				NEPM 2013 Table 1A(1) HILs Res A Soil	NEPM 2013 Table 1B (1-4) EILs UR/POS	B516/1.0 (QA/QC)	B616/1.0 (QA/QC)	B17/0.2	B17/1.0	B18/0.2	B19/0.2	B19/0.5	B20/1.0	B21/0.2	B22/0.2	B22/0.5
						1.0	1.0	0.2	1.0	0.2	0.2	0.5	1.0	0.2	0.2	0.5
Chemical Group	**Chemical Name**	**Units**	**LOR**			5/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015
Exchangeable cations	Exchangeable Calcium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Magnesium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Potassium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Sodium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Cation Exchange Capacity	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
Moisture Content	Moisture Content	%	1			-	-	-	-	-	-	-	-	-	-	-
Metals	Antimony	mg/kg		-		-	-	<5	-	-	<5	-	-	-	-	-
	Arsenic	mg/kg	5	100	100	48	43	32	36	32	8	18	19	45	-	130
	Barium	mg/kg	1	-		-	-	63	-	-	250	-	-	-	-	-
	Beryllium	mg/kg	1	60		-	-	<5	-	-	<5	-	-	-	-	-
	Boron	mg/kg	1	4500		-	-	<10	-	-	<10	-	-	-	-	-
	Cadmium	mg/kg	1	20		<0.2	<0.4	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2
	Chromium (hexavalient)	mg/kg	2	100		-	-	-	-	-	-	-	-	<1	-	-
	Chromium (III+VI)	mg/kg	2	-	550	31	33	10	22	22	59	37	32	22	-	31
	Copper	mg/kg	5	6000	130	-	-	-	-	-	-	-	-	-	-	-
	Lead	mg/kg	5	300	1100	-	-	-	-	-	-	-	-	-	-	-
	Nickel	mg/kg	2	400	70	-	-	-	-	-	-	-	-	-	-	-
	Zinc	mg/kg	5	7400	180	-	-	-	-	-	-	-	-	-	-	-
	Iron	mg/kg	50			-	-	-	-	-	-	-	-	-	-	-

221086_soil results with Connollys

				NEPM 2013 Table 1A(1) HILs Res A Soil	NEPM 2013 Table 1B (1-4) EILs UR/POS	B23/0.2	B23/0.5	B24/0.5	B25/0.2	B25/1.0	B26/0.2	B27/0.5	B28/0.2	B29/0.5	B30/0.2	B30/1.0
						0.2	0.5	0.5	0.2	1.0	0.2	0.5	0.2	0.5	0.2	1.0
Chemical Group	**Chemical Name**	**Units**	**LOR**			4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	4/03/2015	5/03/2015	5/03/2015
Exchangeable cations	Exchangeable Calcium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Magnesium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Potassium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Sodium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Cation Exchange Capacity	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
Moisture Content	Moisture Content	%	1			-	-	-	-	-	-	-	-	-	-	-
Metals	Antimony	mg/kg		-		-	-	-	-	5	-	-	-	-	-	23
	Arsenic	mg/kg	5	100	100	28	94	20	60	25	11	24	7	720	80	150
	Barium	mg/kg	1	-		-	-	-	-	15	-	-	-	-	-	21
	Beryllium	mg/kg	1	60		-	-	-	-	<5	-	-	-	-	-	<0.5
	Boron	mg/kg	1	4500		-	-	-	-	<10	-	-	-	-	-	<10
	Cadmium	mg/kg	1	20		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Chromium (hexavalient)	mg/kg	2	100		<1	-	-	-	-	-	-	-	-	-	-
	Chromium (III+VI)	mg/kg	2	-	550	10	21	18	15	9	7	27	10	8	13	17
	Copper	mg/kg	5	6000	130	-	-	-	-	-	-	-	-	-	-	-
	Lead	mg/kg	5	300	1100	-	-	-	-	-	-	-	-	-	-	-
	Nickel	mg/kg	2	400	70	-	-	-	-	-	-	-	-	-	-	-
	Zinc	mg/kg	5	7400	180	-	-	-	-	-	-	-	-	-	-	-
	Iron	mg/kg	50			-	-	-	-	-	-	-	-	-	-	-

221086_soil results with Connollys

				NEPM 2013 Table 1A(1) HILs Res A Soil	NEPM 2013 Table 1B (1-4) EILs UR/POS	B31/0.2	B32/1.0	B33/0.2	B34/0.2	B34/0.5	B35/0.2	B35/1.0	B36/0.2	B36/0.7	B37/0.2
						0.2	1.0	0.2	0.2	0.5	0.2	1.0	0.2	0.7	0.2
Chemical Group	**Chemical Name**	**Units**	**LOR**			5/03/2015	5/03/2015	5/03/2015	5/03/2015	5/03/2015	5/03/2015	5/03/2015	5/03/2015	5/03/2015	5/03/2015
Exchangeable cations	Exchangeable Calcium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-
	Exchangeable Magnesium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-
	Exchangeable Potassium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-
	Exchangeable Sodium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-
	Cation Exchange Capacity	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-
Moisture Content	Moisture Content	%	1			-	-	-	-	-	-	-	-	-	-
Metals	Antimony	mg/kg		-		-	-	-	-	6	-	-	-	-	-
	Arsenic	mg/kg	5	100	100	9	6	12	16	45	-	34	25	10	37
	Barium	mg/kg	1	-		-	-	-	-	47	-	-	-	-	-
	Beryllium	mg/kg	1	60		-	-	-	-	<5	-	-	-	-	-
	Boron	mg/kg	1	4500		-	-	-	-	<10	-	-	-	-	-
	Cadmium	mg/kg	1	20		<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.2	<0.2
	Chromium (hexavalient)	mg/kg	2	100		-	-	<1	-	-	-	-	-	-	-
	Chromium (III+VI)	mg/kg	2	-	550	14	12	14	9	21	-	12	8	6	8
	Copper	mg/kg	5	6000	130	-	-	-	-	-	-	-	-	-	-
	Lead	mg/kg	5	300	1100	-	-	-	-	-	-	-	-	-	-
	Nickel	mg/kg	2	400	70	-	-	-	-	-	-	-	-	-	-
	Zinc	mg/kg	5	7400	180	-	-	-	-	-	-	-	-	-	-
	Iron	mg/kg	50			-	-	-	-	-	-	-	-	-	-

221086_soil results with Connollys

Connolly Environmental (July 2015) All arsenic results from validation sampling of the B29 'hotspot'.

				NEPM 2013 Table 1A(1) HILs Res A Soil	NEPM 2013 Table 1B (1-4) EILs UR/POS	**SV1/1**	SV1/2	**SV1/3**	SV1/4	SV501/4 (QA/QC Duplicate of SV1/4)	SV1/5	SV2/2	SV2/4	SV2/5	SV3/2	SV3/4
											est. 0.5 m			est. 0.8 m.		
Chemical Group	**Chemical Name**	**Units**	**LOR**			13/05/2015	13/05/2015	13/05/2015	13/05/2015	13/05/2015	13/05/2015	13/05/2015	13/05/2015	13/05/2015	13/05/2015	13/05/2015
Exchangeable cations	Exchangeable Calcium	meq/100g	0.2			**North Wall**	East Wall	**South Wall**	West Wall	West Wall	Floor	East Wall	West Wall	Floor	East Wall	West Wall
	Exchangeable Magnesium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Potassium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Exchangeable Sodium	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
	Cation Exchange Capacity	meq/100g	0.2			-	-	-	-	-	-	-	-	-	-	-
Moisture Content	Moisture Content	%	1			-	-	-	-	-	-	-	-	-	-	-
Metals	Antimony	mg/kg		-		-	-	-	-	-	-	-	-	-	-	-
	Arsenic	mg/kg	5	100	100	100	110	78	250	240	190	160	220	180	150	410
	Barium	mg/kg	1	-		-	-	-	-	-	-	-	-	-	-	-
	Beryllium	mg/kg	1	60		-	-	-	-	-	-	-	-	-	-	-
	Boron	mg/kg	1	4500		-	-	-	-	-	-	-	-	-	-	-
	Cadmium	mg/kg	1	20		-	-	-	-	-	-	-	-	-	-	-
	Chromium (hexavalient)	mg/kg	2	100		-	-	-	-	-	-	-	-	-	-	-
	Chromium (III+VI)	mg/kg	2	-	550	-	-	-	-	-	-	-	-	-	-	-
	Copper	mg/kg	5	6000	130	-	-	-	-	-	-	-	-	-	-	-
	Lead	mg/kg	5	300	1100	-	-	-	-	-	-	-	-	-	-	-
	Nickel	mg/kg	2	400	70	-	-	-	-	-	-	-	-	-	-	-
	Zinc	mg/kg	5	7400	180	-	-	-	-	-	-	-	-	-	-	-
	Iron	mg/kg	50			-	-	-	-	-	-	-	-	-	-	-

Sample locations SV1/1, SV4/2, SV1/3, SV4/4, SV4/5 were the final validation samples shown in Connolly Table 6.1
The final excavation dimensions were approximately 1.5 m by 1.5 m by 1.2.
Sample locations were recorded, but depth of sample was not recorded. Depth of samples (SV1/5, SV2/5, SV3/5, and SV4/5) from floor of validation have been estim

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Chemical Group	Chemical Name	Units	LOR	NEPM 2013 Table 1A(1) HILs Res A Soil	NEPM 2013 Table 1B (1-4) EILs UR/POS	SV3/5	**SV4/2**	**SV4/4**	**SV4/5**	COUNT	MEAN	SD	MAX	CV	95% UCL student's-t
						est. 1.0 m .			est. 1.2 m.						
						13/05/2015	13/05/2015	13/05/2015	13/05/2015						
Exchangeable cations	Exchangeable Calcium	meq/100g	0.2			Floor	**East Wall**	**West Wall**	**Floor**	3	3.3	1.29	4.80	0.39	
	Exchangeable Magnesium	meq/100g	0.2			-	-	-	-	3	2.5	1.55	4.10	0.62	
	Exchangeable Potassium	meq/100g	0.2			-	-	-	-	3	0.3	0.20	0.50	0.67	
	Exchangeable Sodium	meq/100g	0.2			-	-	-	-	3	0.7	0.84	1.70	1.14	
	Cation Exchange Capacity	meq/100g	0.2			-	-	-	-	3	6.9	1.85	9.00	0.27	
Moisture Content	Moisture Content	%	1			-	-	-	-	0					
Metals	Antimony	mg/kg		-		-	-	-	-	3	11	10	23	0.89	
	Arsenic	mg/kg	5	100	100	180	120	120	120	65	43	47	248	1.10	53
	Barium	mg/kg	1	-		-	-	-	-	7	68	82	250	1.21	129
	Beryllium	mg/kg	1	60		-	-	-	-	0					
	Boron	mg/kg	1	4500		-	-	-	-	0					
	Cadmium	mg/kg	1	20		-	-	-	-	1	0.2		0.20	0.00	
	Chromium (hexavalient)	mg/kg	2	100		-	-	-	-	0					
	Chromium (III+VI)	mg/kg	2	-	550	-	-	-	-	61	23	12	59	0.51	26
	Copper	mg/kg	5	6000	130	-	-	-	-	7	15	7	28	0.49	20
	Lead	mg/kg	5	300	1100	-	-	-	-	10	13	4	20	0.33	16
	Nickel	mg/kg	2	400	70	-	-	-	-	9	15	20	53	1.30	28
	Zinc	mg/kg	5	7400	180	-	-	-	-	6	28	17	48	0.61	42
	Iron	mg/kg	50			-	-	-	-	3	21653	15970	37600	0.74	

ated based on fianal total depth reported.