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REMEDIAL ACTION PLAN

65-69 Woodlark St, Lismore NSW

Job Number: 218078

For:

Balanced Earth Building

By:

ENV Services Pty Ltd

Date:

April 2024

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SCOPE OF ENGAGEMENT AND LIMITATIONS

This report has been prepared by ENV Services at the request of Balanced Earth Building for the purpose of a Remedial Action Plan. No other parties may rely on the contents of this report for any purposes except those stated.

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ENV declares that it does not have, nor expects to have, a beneficial interest in the subject project.

To avoid this advice being used inappropriately, it is recommended that you consult with ENV before conveying the information to another who may not fully understand the objectives of the report. This report is meant only for the subject site/project and should not be applied to any other.

ENV staff are appropriately experienced and qualified to undertake the works described in the scope of this investigation and have adequate professional indemnity (PI) insurance for the work undertaken.

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LIST OF ACRONYMS

Below is a list of commonly used acronyms in this report:

ACM	Asbestos Containing Material
BGL	Below ground level
COC	Chain of Custody
CSM	Conceptual Site Model
COPC	Chemical of Potential Concern
EILs	Ecological Investigation Levels
ENV	ENV Solutions
ESLs	Ecological Screening Levels
FA/AF	Fibrous Asbestos/Asbestos Fines
HILs	Health Investigation Levels
HSLs	Health Screening Levels
LTSMP	Long Term Site Management Plan
NEPC	National Environment Protection Council
NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)
NSW EPA	New South Wales Environment Protection Authority
ppm	Parts Per Million (by volume)
QA/QC	Quality Assurance and Quality Control
RAP	Remedial Action Plan
UCL	Upper Confidence Limit

1 INTRODUCTION

1.1 Background and Purpose

ENV Services Pty Ltd (ENV) has been engaged by Balanced Earth Building (the client), to prepare a Remediation Action Plan (RAP) for the proposed development at 65-69 Woodlark St, Lismore NSW 2480, (Lot 1 DP780375; Lot A DP397258, Lot 1 DP341873, Lot 1 DP341874) (hereafter referred to as the 'Site'). The site location and layout are shown in Figure 1 and 2, Appendix A.

The site is currently undergoing rectification after flood damage to the buildings, with the site previously being utilised as both a retail and educational facility. An area of the redevelopment will include a rainforest, which has been the subject of contamination investigations to date.

A Soil Contamination Assessment (SCA) that comprised of surface soil sampling was performed at the site by ENV in August 2023 at the request of the Lismore City Council as part of a Development Application for a proposed education facility. This investigation identified Lead and Benzo(a)pyrene TEQ (BAP TEQ) concentrations in excess of the adopted National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) (the 'NEPM') Health-based Investigation Levels (HILs) in three collected soil samples and Total PAHs concentrations in excess of the adopted NEPM HILs in one collected soil sample.

Further Test Pitting activities were undertaken in May 2024 to investigate the sub-surface conditions at the site, identifying further lead and BAP concentrations in excess of the adopted NEPM HILs and Ecological screening levels (ESLs) in four and three collected soil samples (consecutively), while a single soil sample returned zinc concentrations above the Site-Specific Ecological investigation levels (EILs). A further collected fragment was laboratory analysed and reported to contain asbestos material (chrysotile).

This Remedial Action Plan (RAP) has been produced in response to the results of the SCA and Test Pitting activities to outline the remediation strategy and management of the identified chemical contamination within the site in relation to the proposed future land use.

1.2 Objective

The primary objective of this RAP is to document the procedures and standards to be followed in order to manage the contamination identified at the site, ensuring the protection of human health and the surrounding environment, such that contamination can be remediated/managed in a manner that allows the site to be made suitable for the proposed future land use.

1.3 Scope of Works

This RAP includes the following:

- Findings of SCA (ENV, 2023), 2024 Test Pitting activities and a refined conceptual site model (CSM).
- Remediation objectives.
- Remediation criteria, procedures and schedule.
- Site management measures.

- Health, safety and environmental requirements for remediation works.
- Contingencies and unexpected finds protocols.
- Validation methodology and reporting.

1.4 Technical and Regulatory Framework

The following technical and regulatory framework has been considered in preparing this RAP.

1.4.1 State Environmental Planning Policy (Resilience and Hazards) 2021 – Remediation of Land

State Environmental Planning Policy (Resilience and Hazards) 2021 aims to 'promote the remediation of contaminated land for the purpose of reducing risk of harm to human health or any other aspect of the environment'. The relevant regulatory requirements pertaining to this investigation are considered to be:

Clause (4.6) Contamination and remediation to be considered in determining development application.

The consent authority, being Lismore City Council, will need to consider the contaminated status of the land in assessing any development application submitted for the land, and whether remediation of any known contamination is required.

Clause (4.7) Remediation work permissible

Clause 4.7 describes that remediation works must be carried out in accordance with State Environmental Planning Policy (Resilience and Hazards) 2021. Additionally, Clause 4.7 describes that Category 1 remediation works must not be undertaken without consent from a consent authority, and that Category 2 remediation works can be undertaken without consent from a consent authority.

ENV understands that due to the site's proximity to the Wilsons River and its location within a flood planning area as shown in Figure 1, Appendix A (Lismore City Council Flood Study Overlay 2024), the remediation work may be considered to be Category 1 remediation work on the basis of the subclause 4.8.a.vi under Clause 4.8 relating to Category 1 remediation work, which states:

Jus *a category 1 remediation work is a remediation work […] that is –*

> *(e) carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument –*
>
> *(vi) floodway*

Consent for works outlined in this RAP will be required to be given by the consent authority (Council) prior to the commencement of any remedial works, as outlined in *Clause 4.9.1.b.i Consent authority in relation to remediation works* which states:

(1) T*he consent authority in relation to a development application for consent to carry out remediation work is –*

> *(b) in default of any such provision –*
>
> *(i) the council for the local government area in which the land is situated.*

It is noted that the final determination of whether or not the site is located within a floodway (and therefore whether the proposed remediation works are category 1 or 2) will be made by Lismore City Council.

1.4.2 Water Management Act 2000 No 92

The aim of the Water Management Act 2000 No 92 is to 'provide for the sustainable and integrated management of water sources of the State for the benefit of both present and future generations'. Within this Act, 'waterfront land' is defined as *the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance (40 metres) inland of, the highest bank of the river'.* Due to the site's location, it is not considered to be 'waterfront land' as defined by the Act.

1.4.3 Protection of the Environment Operations Act 1997 (POEO Act)

The proposed remediation/validation activities are not required to be licensed under the POEO Act since the works do not involve any activities listed in Schedule 1 of the Act. In particular, Schedule 1 of the Act includes Scheduled activities, Part 1 – Premises based activities, Clause 15 – Contaminated soil treatment, which states the following:

15. Contaminated soil treatment

(2) The activity to which this clause applies is declared to be a scheduled activity if –

(b) where it treats contaminated soil originating exclusively on site, it has a capacity –

(i) to incinerate more than 1,000 cubic metres per year of contaminated soil, or

(ii) to treat (otherwise than by incineration) and store more than 30,000 cubic metres of contaminated soil, or

(iii) to disturb more than an aggregate area of 3 hectares of contaminated soil.

The remedial actions proposed within this RAP do not meet any of the criteria specified above.

1.4.4 Protection of the Environment Operations (Waste) Regulation 2014

This Regulation stipulates requirements relating to non-licensed waste activities and waste transporting. The proposed works on the site will not be required to be licensed.

Section 42 of this Regulation stipulates special transportation, reporting, re-use and recycling requirements relating to asbestos waste and must be complied with regardless of whether the activity is licensed.

The requirements for the transportation of asbestos waste include:

- Bonded asbestos material must be securely packaged at all times.
- Friable asbestos material must be kept in a sealed container.
- Asbestos-contaminated soils must be wetted down.

- All asbestos waste must be transported in a covered, leak-proof vehicle.

The transporter of asbestos waste must provide the following information to the NSW EPA prior to the transportation of asbestos waste loads.

- Source site details including address, name and contact details.
- Date of proposed transportation commencement.
- Name, address and contact details of disposal site.
- Approximate weight of each class of asbestos in each load.

The transporter of asbestos waste must ensure the following information is given to the disposal site before or at delivery:

- Unique consignment code issued by NSW EPA in relation to that load.
- Any other information specified in the NSW EPA Asbestos and Waste Tyres Guidelines.

The requirements relating to the off-site disposal of asbestos waste are as follows:

- Asbestos waste in any form must be disposed of only at a landfill site that may lawfully receive the waste.
- When asbestos waste is delivered to a landfill site, the occupier of the landfill site must be informed by the person delivering the waste that the waste contains asbestos.
- When unloading and disposing of asbestos waste at a landfill site, the waste must be unloaded and disposed of in such a manner as to prevent the generation of dust or the stirring up of dust.
- Asbestos waste disposed of at a landfill site must be covered with virgin excavated natural material or other material as approved in the facility's environment protection licence.

Section 48 of the Regulation requires that wastes are stored in an environmentally safe manner. It also stipulates that vehicles used to transport waste must be covered when loaded.

It is noted that the above requirements of the waste regulatory framework apply when waste materials leave a site. As detailed in **Section 6.4.1** of this RAP, impacted materials will be removed from the site to a suitably licensed disposal facility, with current analytical results for Lead, Benzo(a)pyrene and PAHs indicating the chemically impacted material likely being classified as CT2 – Restricted Waste, and ACM contaminated material likely being classified as "Special Waste".

1.4.5 Contaminated Land Management Act 1997 (CLM Act)

The *Contaminated Land Management Act 1997* (CLM Act) provides various definitions relevant to the subject remedial works, including such terms as 'contaminate, contamination and environment', as well as other terms such as 'remediation' and 'local authority'.

In accordance with the *Duty to Report Guidelines* (NSW EPA 2015) and Section 60 of the *Contaminated Land Management Act 1997*, there is a duty on polluters and owners to notify EPA if contamination is either above prescribed levels and a person has or could be exposed to a contaminant, and/or the contamination has or will foreseeably enter neighbouring lands.

The EPA 2015 guidelines also present notification triggers specific to asbestos in, or on, soil. However, it is understood that there have been no detections of FA/AF during previous investigations and soil

disturbance activities at the site. Based on the current data, it is considered that there is not a requirement for notification of the site to the EPA for asbestos contamination.

1.4.6 Environmental Planning and Assessment Act 1979 (EP&A Act)

The *Environmental Planning and Assessment Act 1979* (EP&A Act) facilitates and promotes sustainable development in NSW. Of particular relevance to the subject remedial works is the provision of State Environmental Planning Policy (Resilience and Hazards) 2021 – Remediation of Land, which is made under the EP&A Act.

Other environmental planning instruments relevant to the subject remedial works are included under the EP&A Act, including the Lismore Local Environmental Plan 2012 (LLEP 2012). The LLEP presents the land zoning relevant to the site as well as a range of other provisions that require consideration in terms of determining items such as whether the remediation works will be considered Category 1 or Category 2 works.

Of further relevance is Part 1, Section 1.6, Consent Authority. ENV understands that in accordance with Section 1.6, Lismore City Council is the consent authority for the subject remedial works.

1.4.7 Asbestos Removal Regulations and Codes of Practice

The remediation of fill containing asbestos will be managed in accordance with the Work Health and Safety Act (2011), WHS Regulation (2017), SafeWork NSW guidelines, '*Code of Practice: How to Safely Remove Asbestos* (SWA 2020a), '*Code of Practice: How to Manage and Control Asbestos in the Workplace'* (SWA 2020b) and the NSW EPA (2014) Waste Classification Guidelines.

Excavation, onsite remediation and removal of friable asbestos contaminated soils are required to be conducted by a Class A licensed Asbestos Removal contractor, with the removal of non-friable asbestos material required to be conducted by a Class B licensed Asbestos Removal contractor.

All airborne asbestos fibre monitoring works must be undertaken by a Licenced Asbestos Assessor (LAA), in accordance with SafeWork NSW requirements.

Before starting the subject works, the Contractor is required to obtain a site-specific permit approving the asbestos works from SafeWork NSW. A permit will not be granted without evidence of a current licence and the permit application must be made at least seven days before the work is due to commence.

1.4.8 Other Technical and Regulatory Framework

The following other technical and regulatory framework has been considered in preparing this RAP:

- *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (as amended 2013)* (NEPC, 2013).
- *Consultants Reporting on Contaminated Land - Contaminated Land Guidelines* (NSW EPA, 2020).
- *Contaminated Sites – Sampling Design Guidelines; Parts 1 and 2* (NSW EPA, 2022).
- *NSW Waste Classification Guidelines* (NSW EPA, 2014).

- *AS 4482.1-2005 (withdrawn) Guide to the sampling and investigation of potentially contaminated soil – Non-volatile and semi-volatile compounds* (Standards Australia, 2005).

2 SITE CONDITIONS

2.1 Previous Assessments

Two previous environmental investigations were conducted at the site by ENV, with information from these investigations, which was considered relevant for the RAP, discussed below.

2.1.1 Soil Contamination Assessment (ENV 2023)

The Soil Contamination Assessment (SCA) included the following components.

- Identification of past and present potential chemicals of potential concern (COPC).
- An inspection of the site and subject area.
- Collection of soil samples from eight discrete sampling locations within the proposed rainforest area on the ground level covering a total area of approximately 100 m^2.
- Assessment of the soil analytical results against relevant Tier 1 investigation levels detailed in the NEPM.
- Assessment of the environmental suitability of the site for the proposed land use.

A site inspection and soil sampling program were undertaken on 8 August 2023, with visible signs of building materials, concrete and bitumen within surface soils observed. Targeted soil samples were collected from the surface soils of the proposed indoor forest at eight discrete locations.

This investigation identified Lead and Benzo(a)pyrene TEQ (BAP TEQ) concentrations in excess of the adopted NEPM Health-based Investigation Levels (HILs) in three collected soil samples and Total PAHs concentrations in excess of the adopted HILs in one collected soil sample. The remaining returned analyte concentrations were either below the adopted soil criteria or below the laboratory Limit of Reporting (LOR).

Based on the SCA findings, further delineation of contaminants was recommended within the inaccessible areas to develop a Remedial Action Plan for the site to facilitate the excavation and disposal of impacted soils and replacement with suitable growing media.

2.1.2 Test Pitting Investigation (ENV 2024)

Further Test Pitting activities were undertaken by ENV in May 2024 to investigate the sub-surface conditions at the site, identifying further lead and BAP concentrations in excess of the adopted HILs and Ecological screening levels (ESLs) in four and three collected soil samples (consecutively), while a single soil sample returned zinc concentrations above the Site-Specific Ecological investigation levels (EILs). A further collected fragment was laboratory analysed and reported to contain asbestos material (chrysotile).

3 SITE DESCRIPTION AND CHARACTERISTICS

The site is located within the Lismore CBD precinct. It is understood that the site was previously used as commercial retail and an education facility. The building was submerged in the floods that occurred in 2022 and the site is currently undergoing internal flood rectification works.

Table 1 provides an overview of relevant identification details for the site. The site location and sampling plan is depicted in Appendix A.

Table 1: Site Details

Site Address	65-69 Woodlark St Lismore NSW
Real Property Description	Previously a retail centre within building fronting Woodlark St. Educational centre in building fronting Larkin Lane/Carrington St
Site Area	~2,392 m^2
Investigation Area	Ground level, approximately 440 m^2
Height (AHD)	25 m
Site Layout	Two buildings connected with a bridge over Larkin Lane from Level one. Investigation area located on ground floor of north-eastern section of southern building.
Local Government Area	Lismore City Council
Land Zoning	3 (a) Business
Proposed Land Use	Educational centre with indoor forest feature

3.1 Topography and Drainage

Topography of the Lismore CBD is generally flat with a gentle slope toward the Wilson River to the west of Woodlark Street. Drainage is to the west towards the Wilson River.

Surface soils within the investigation area comprise of surficial sandy clays with various fill materials including glass, bitumen blue metal, bricks and timber.

3.2 Geology and Soils

A search of the Soil Landscape Series – Sheet 9540-9640 soil landscape map indicates the site is mapped as lying within the Leycester soil landscape. This is characterised by level to gently undulating broad to extensive (500 > 1500m) alluvial plains of extremely low relief, draining the Mackellar Hills. Extensively cleared closed and open forest.

Soil landscapes are described as deep (>200cm), poorly to moderately well drained alluvial Black Earths (Ug5.15, Ug5.17) and structured Clays (Uf6.42) occur throughout the floodplain. Wetter areas, such as ox-bow floors, have deep (>200cm), poorly drained Weisenbodens (Ug5.15, Ug5.17), while deep (>200cm) well-drained Earthy Sands (Uc5.21) line channels.

Limitations of the Leycester soil landscape are summarised as moderately erodible, moderately plastic soils with low wet-bearing strength, moderate shrink-swell and localised waterlogging, flooding and streambank erosion.

3.3 Surface Water Bodies and Flooding

The Wilson River is located 200 m to the west of the site. The site and surrounding areas have been subject to flooding in 1954, 1974, 2017 and 2022; with the 2022 flood event resulting in the total inundation of the site, reaching a height equivalent to the second level of the structure.

3.4 Hydrogeology and Groundwater Use

A search of the Water NSW real time database on 9 April 2024 indicated a total of four (4) licensed groundwater bores within 500m of the site, described as follows:

- GW307167 – approximately 320m to the northeast of the site, monitoring bore.
- GW307166 - approximately 330m to the northeast of the site, monitoring bore.
- GW307168 - approximately 340m to the northeast of the site, monitoring bore.
- GW071090 - approximately 450m to the east of the site, with a purpose listed as recreation.

Based on the location of the nearest major surface water receptor (Wilsons River), local groundwater is expected to be flowing in a general west direction (i.e. from the site, away from the licensed bores).

3.5 Contaminated Land Record and Record of Notices

The NSW EPA Contaminated Land Record (EPA Notifications) contains a list of sites which have been notified to the NSW EPA under the Contaminated Land Management Act 1997 (CLM Act). Upon receiving the notification, the EPA then assesses the contamination status of the site and decides whether the contamination is significant enough to warrant formal regulation by the EPA in accordance with the provisions of the CLM Act. The NSW EPA Record of Notices contains selected information about sites which have been issued with a Regulatory Notice by the NSW EPA under the CLM Act.

The NSW EPA Contaminated Land Record and Record of Notices were searched on 10 April 2024 for the suburb of Lismore. The search identified that the Lismore Gasworks – located on the corner of John Street & Keen Street approximately 1.5 km to the southwest of the site – received a Notice of a ‘Declaration of Significantly Contaminated Land’.

3.6 POEO Act Public Register Search

The Protection of the Environment Operations Act 1997 (POEO Act) Public Register contains information about environment protection licences, licence applications, notices issued under the POEO Act, and pollution studies and reduction programs. The POEO Act Public Register was searched on 9 April 2024 with no records identified within a 1 km radius of the site.

3.7 Historic and Surrounding Land Use

Aerial photographs dating from 1971 to 1997 were reviewed from the NSW Government Historical Imagery Database. Relevant observations from this review are summarised in **Table 2**. Copies of the aerial photographs are provided in ENV (2022a).

Table 2: Summary of Notable Observations from Historic Aerial Images

Date	Summary of Key Site Observations
1971	The subject site appears to have been constructed prior to 1971 – with the surrounding commercial/industrial tenancies also already established.
1979	No observable change within the subject site or surrounding tenancies.
1987	No observable change within the subject site or surrounding tenancies.
1991	No observable change within the subject site or surrounding tenancies.
1997	No observable change within the subject site or surrounding tenancies.

Historical aerial photographs indicate that site usage has been commercial since the date of the earliest accessed aerial photograph in 1971. There is a minor possibility that, prior to development as a commercial precinct, the area was under agricultural usage.

4 PREVIOUSLY IDENTIFIED CONTAMINATION WITHIN REMEDIATION AREAS

Previous investigations at the site referenced in **Section 2.1** of this report have identified several contamination issues within the remediation area. These issues and their relevance to remedial works which are the subject of this report, are summarised below.

4.1 Proposed Rainforest Area

Initial works to investigate the potential for surface contamination within the proposed rainforest area was undertaken, with surface soil samples collected from locations SS03 and SS08 reporting both lead and zinc concentrations exceeding the HIL and EIL assessment criteria. Surface sample SS05 reported hydrocarbon concentrations exceeding the ESLs (Urban Residential Fine Soils) and PAH concentrations exceeding the HIL, while both surface soil samples SS05 and QA1 (duplicate sample of location SS02) returned Benzo(a)pyrene (BaP) concentrations exceeding the ESLs. The soil sampling locations are outlined within Appendix B, reported contaminant exceedance locations are outlined within Appendix D, with the analytical results included within the previous report in Appendix E.

From the results of this investigation, a subsequent sampling event was performed to determine the vertical extent of the identified contamination, with subsurface (0.4m BGS) soil samples collected from locations TP02, TP04, TP05 and TP08 reported lead concentrations exceeding the HILs, with sample TP04 also returning zinc concentrations exceeding the HILs. Further, subsurface soil samples collected from locations TP02, TP06 and TP07 returned Benzo(a)pyrene (BaP) concentrations exceeding the ESLs (Urban Residential Fine Soils). Finally, a single fragment was collected from the location of TP02, reporting the presence of non-friable asbestos (chrysotile). The test pitting locations are outlined within Appendix C, reported contaminant exceedance locations are outlined within Appendix D, with the laboratory analytical tables included within Appendix E.

5 CONCEPTUAL SITE MODEL

The information presented in the previous sections pertaining to the site characteristics, history and surrounding environment, has been used to identify plausible receptors of contamination at the site and in off-site areas, and exposure pathways linking the contamination sources and receptors. This information is brought together in what is known as a Conceptual Site Model (CSM), as outlined below.

5.1 Contamination Sources

Historical and current land use of the site includes potential agricultural use prior to the establishment of retail and commercial activities, with a machinery workshop being currently located within the building footprint. The primary potential source of soil contamination from land usage is lead from painted building surfaces, Organochlorine Pesticides (OCPs) from the potential historical site usage as agricultural land and/or application of termiticides beneath structures, Total Recoverable Hydrocarbons (TRH) and Polycyclic Aromatic Hydrocarbons (PAHs) from oil/fuel storage due to heating and ancillary machinery on site.

Further, floodwater ingress is an additional, likely source of contamination. Floodwaters are known to transport hydrocarbons and other contaminants from compromised fuel storage facilities and chemical storage depots, as well as other industrial facilities.

5.2 Chemicals of Potential Concern

The Chemicals of Potential Concern (COPC) associated with the identified contamination sources include the following.

- Metals (e.g. lead).
- OCPs.
- PAHs.
- BTEX/TRH.

5.3 Potentially Affected Environmental Media

Potentially affected environmental media include surface soils within the subject site. While other environmental media may be affected by the contamination sources described above, surface soils are considered the most likely media to be directly impacted by the presence of potential contamination sources. If the surface soils at the site are contaminated, it is possible that further environmental media have been impacted, which will then require further investigation.

5.4 Potential Migration and Exposure Pathways

Potential migration pathways depend on a number of factors including the chemical properties of the contaminant, soil texture, topography, and hydraulic gradient of shallow groundwater etc.

In consideration of the above, potential migration pathways for identified COPC include:

- Fugitive dusts; and

- Plant uptake and bioaccumulation.

Subsequently, potential exposure pathways include:

- Direct contact (ingestion or dermal) with contaminated environmental media;
- Inhalation of dust;
- Ingestion of food grown in contaminated soils; and
- Direct toxicity for plants and terrestrial ecosystems.

5.5 Potential Receptors of Contamination

Potential receptors of contamination have been identified as:

- Staff and students on-site.
- Visitors to the site.
- Workers planting and maintaining the forest area.
- Terrestrial ecosystems on the site.

It is noted that the potential for off-site receptors to be exposed to contamination originating from the site depends on the nature and extent of the contamination, soil properties, local surface water and groundwater hydrology, and distance to the receptors. If contamination is identified on-site, additional investigations may be required to identify and assess the risk to potential off-site receptors.

6 REMEDIATION OPTIONS ASSESSMENT AND REMEDIATION STRATEGY

6.1 Remediation Objectives

The primary remedial objective is the removal of unacceptable risks to human health and the environment from the identified chemical and asbestos contaminated soil such that the site is made suitable for the proposed land uses. This will include the spot excavation and removal of the impacted soils in selected areas, and also the management of impacted soils in placing the contaminated materials beneath the proposed development.

The remediation will be carried out in a manner that does not cause any environmental harm or expose site workers or the public to any risks posed by the remediation works. As a part of this process, the remedial contractor will validate the remedial works in accordance with the relevant guidelines and with reference to the adopted site criteria and document the validation process in a validation report.

6.2 Guidance in Considering Remedial Options

6.2.1 National Environment Protection Council (NEPC 2021) Guidance

The rationale for the selection of remediation options is provided below. The approach adopted in this RAP is consistent with the hierarchy of site remediation and/or management set out in Key Principles for the Remediation & Management of Contaminated Sites (NEPC, 2021) which is listed as follows.

1. On-site treatment to either destroy the contaminant, or reduce the associated hazards, to an acceptable level.
2. Off-site treatment to either destroy the contaminant or reduce the associated hazards to an acceptable level so that the soil can be returned to the site.

If neither of these options is possible, then further options for consideration include:

3. Removal of contaminated soil to an approved site/facility, and replacement (as necessary) with clean fill.
4. Isolation of contamination on-site in an appropriately designed and managed containment facility (i.e., cap and contain).
5. Adopt a less sensitive land use (to reduce risk associated with contamination) or undertake partial remediation.
6. If there is no immediate risk to the environment or community, and the site has appropriate management controls in place, it may be possible to leave contamination *in situ*.

In addition, it is also a requirement that remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the site undisturbed. In addition, where there are large quantities of soil with low levels of contamination, alternative strategies are required to be considered

or developed (EPA, 2017). In addition, sustainability should be considered by the consultant when deciding which remediation option to choose, in terms of achieving an appropriate balance between the benefits and adverse effects of undertaking the option.

Consideration of each of the available remedial options is presented in **Section 6.3** below.

6.2.2 Western Australian Department of Health (WA DoH 2009) Guidance

WA DoH (2009) provides specific guidance on the remediation and management of asbestos.

WA DoH (2009) notes the following considerations as important when assessing the acceptability of any remediation strategy.

- Minimisation of public risk.
- Minimisation of contaminated soil disturbance.
- Minimisation of contaminated material/soil to landfill.

Consideration of each of these items from the WA DoH (2009) guidance is presented in **Section 6.3** below.

6.3 Assessment of Remedial Options

Possible remedial options for contamination at the site are presented and discussed in a remedial options matrix included as Table 3Error! Reference source not found. below.

Table 3: Remedial options matrix for impacted soil

Remedial Option	Discussion	Conclusion
Option 1: On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level.	Asbestos fibres contained within a bonded matrix can be removed from impacted soils by hand-picking. Hand picking of ACM within fill material is labour intensive and can be costly and time consuming. The success of this remediation method is highly dependent on soil type, quantity of building rubble present within the soil and also on the adopted validation criteria. The more clayey the soil, or the more road base/building material present, the more difficult it is to remove all ACM. Further, in-situ treatment strategies for the presence of metals (lead and zinc), PAHs, hydrocarbons and BaP concentrations in excess of the applicable guideline criterion can be excessively costly – if achievable – and time consuming.	**Less preferred remedial option due to time constraints, expense and soil type (clay), however can be considered for areas of soil exclusively impacted by bonded ACM if other remedial options are unviable**
Option 2: Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site.	Offsite treatment of soils is not seen as a viable option as typically the costs of removing soil and returning it to the site are similar to that of landfill disposal. Whilst it is noted that this method would result in a reduction of noise and dust emissions when compared with onsite treatment, these benefits would be offset by increased truck movements. This is not considered a suitable remediation option.	Not a suitable option
Option 3: Consolidation and isolation of the soil on-site by containment within a properly designed barrier	Onsite containment of soil contaminated with bonded ACM fragments and the identified chemical contaminants is considered a suitable remedial option due to the difficulties associated with on-site remediation of impacted soils. Given that site observations indicate the impacted soil contains road base/building material and consist of identified clays, it would be commercially unviable to remediate the material for on-site reuse. For this remedial option, soil impacted with bonded ACM fragments and the identified chemical contaminants can be retained on site and would be managed as a single unit and homogeneously be considered as 'asbestos and chemical impacted soil'. The management strategies discussed for this material, including the implementation of a Long Term Site Management Plan (LTSMP), would be adopted for all impacted soil in the vicinity of the planned raised planter beds – where barrier layers can be installed and clean growing media be imported to site – or the remainder of the site that will have hard-stand reinstated at the completion of flood rectification works.	**A suitable remedial option for the portions of the site where material can be contained and isolated.**

Remedial Option	Discussion	Conclusion
Option 4: Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill.	Offsite disposal is a suitable remedial option for areas where ACM and chemically impacted soils have potential contaminant transfer pathways and/or where tree health may be impacted by soil contamination. For this site, where trees are proposed to be planted within the proposed rainforest area, with the roots of these trees potentially acting as a contaminant transfer pathway. Contaminants in the soils in these areas may also have adverse effects on tree health. Therefore, the offsite disposal of contaminated material from any proposed tree locations is required, following which installation of an impermeable barrier would be required prior to planting. However, the costs associated with offsite disposal make this method the most expensive of the remedial options. It is also noted that the remedial strategy for asbestos management at landfills in NSW is to contain the material in an area of the site which is managed under an LTSMP. If the majority of the impacted soil that does not pose a potential contaminant transfer pathway can be successfully remediated on site in the same way as a landfill facility would in an offsite location, this would significantly reduce the potential receptors of contamination and adhere to the WA DoH 2009 consideration of minimising waste to landfill facilities.	**A suitable remedial option if material is unable to be retained and managed onsite due to the potential establishment of a contaminant transfer pathway**

6.4 Preferred Remedial Strategy

6.4.1 Option 3: Consolidation, Isolation and Containment & Option 4: Removal of contaminated soil to an approved site or facility

A number of potential remedial options have been outlined in Table 3: Remedial options matrix for impacted soil. A mixture of two preferred remedial options for the site have been determined.

- Option 3 – Containment of asbestos and chemically contaminated soils on site within the vicinity of the planned raised planter beds – where barrier layers can be installed and clean growing media be imported to site – or the remainder of the site that will have hard-stand reinstated at the completion of flood rectification works, subject to space constraints and geotechnical and engineering suitability of soils for the proposed development. The additional installation of a marker layer, capping layer, implementation of a LTSMP and notation on the Title Record for the land will also be undertaken.
- Option 4 – The removal of ACM and chemically contaminated soils from any proposed tree locations within the proposed rainforest area. Once the impacted material is removed, a marker and barrier layer is to be installed to prevent the tree root structure from entering the remaining impacted material, with clean growing media to be imported for the trees to be planted in.

6.4.2 Remediation Principles

The following remediation principles must be implemented during remedial works:

- Minimise the area and extent of disturbance of the impacted soils; and
- Minimise off-site disposal of the impacted soils.

7 REMEDIATION WORKS

7.1 Approvals, Licences and Notifications

Section 1.4.3 provides information relevant to deciding whether a remedial activity is a scheduled activity under the POEO Act and requires licensing as such. The information presented in the POEO Act is for the on-site treatment of contaminated soil.

Based on the findings of previous investigations, the total volume of known contaminated material is less than 30,000 m^3. According to client supplied design drawings, Figure 6 within Appendix D, the total area of identified impacted material to remain in-situ at the site (or otherwise managed) will be approximately 700 m^2. The total number of trees to be planted has yet to be determined, however due to the size of the proposed rainforest area (Figure 6, Appendix D) the anticipated total volume of impacted soils to be disposed off-site is less than 20 m^3. On the basis of these volumes, but principally how they will be managed (i.e. no treatment is proposed), no licensing is required under the POEO Act for disturbing these materials.

The total site area is less than 3 hectares, with remedial excavations to be limited to areas of known contamination. On the basis of the area of land disturbance required, licensing under the POEO Act is not required.

Asbestos remedial excavations are required on land which may be designated as 'floodway' under the State Environmental Planning Policy (Resilience and Hazards) 2021 and would therefore be classifiable as category 1 remediation works. Consent is required for category 1 remediation works by a consent authority (in this case, Lismore City Council), which is anticipated to be provided in the form of Development Application (DA) consent. It is noted that the final determination of whether or not the site is located within a floodway (and therefore whether the proposed remediation works are category 1 or 2) will be made by Lismore City Council. Further discussion of the conditions and legislation required for remedial works by State Environmental Planning Policy (Resilience and Hazards) 2021 is available in **Section 1.4.1**.

The aim of the Water Management Act 2000 No 92 is to 'provide for the sustainable and integrated management of water sources of the State for the benefit of both present and future generations'. Within this Act, 'waterfront land' is defined as *the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance (40 metres) inland of, the highest bank of the river'.* Due to the site's location, it is not considered to be 'waterfront land' as defined by the Act.

An appropriately experienced and licensed Remediation Contractor (Contractor) is required to undertake the works, under the supervision of an appropriately qualified and experienced Remediation Consultant. As it is considered that non-friable asbestos impacted soils will be encountered, the works must be conducted by a Class B (non-friable) licensed contractor who has obtained a site-specific permit approving the asbestos works from SafeWork NSW. This permit application must be made at least seven working days before removal work is commenced.

Remediation works shall not commence until all required approvals and licences have been granted and/or received. In summary, these include:

- DA consent from Lismore City Council for Category 1 remediation works in a 'floodway', noting that the final determination of whether or not the site is located within a floodway will be made by Lismore City Council.
- Site-specific permit from SafeWork NSW approving the asbestos-related works.

7.2 Extent of Remediation

The extent of the Remediation Area is based on both the client-provided design drawings, within Appendix D, and the known extent of asbestos and chemical contamination at the site established through previous investigations (ENV, 2023 and 2024).

7.3 Site Establishment

The Contractor shall secure the remediation areas to ensure that all safety and environmental controls are implemented. These controls will include, but may not be limited to, the following:

- Locate and isolate all required utilities in the proximity of the works.
- Assess need for, and implement any necessary traffic controls.
- Work area security fencing.
- Site signage and contact numbers.
- Stabilised site entry gate.
- Appropriate decontamination areas for personnel and plant.
- Sediment fencing (attached to security fencing) where necessary.
- Stormwater runoff and sediment controls (e.g. silt fences and hay bales) where necessary.

7.4 Remediation Preliminaries

Preliminary works will be required at the site prior to the remediation commencing. These will include, but may not be limited to, the following.

7.4.1 Notification to Council and Adjoining Landowners

- Notification to the consenting authority prior to commencement of works, as outlined in the DA consent conditions to be issued by Lismore City Council.
- Notification of the adjacent residents and businesses to the site.

Notification of adjacent businesses and residents should occur prior to commencing the remedial program. While efforts will be made to prevent adverse effects on neighbouring properties and surrounding environments during the program (refer to **Section 8.2**), the proposed works have the potential to affect all surrounding neighbouring retail/commercial tenancies. Notification should be

given to the occupiers of adjoining properties (as a minimum), at least 14 days prior to commencing the remedial works. Notification should occur in writing, with the following details included as a minimum.

- Brief description of proposed activities.
- Anticipated start and end dates for the activities.
- Contact details for the principal contractor on-site (email address, mobile phone number and office phone number).

Contact details for the principal contractor on-site should also be posted on signage at site fence lines, such that other persons (who may not have received prior written notification of the works) have an opportunity to contact the contractor for further details or to make a complaint.

7.5 Remediation Works

7.5.1 Excavation of Impacted Material

In order to meet client design plans (education facility) an anticipated volume of no more than 20 m^3 of impacted material from the proposed rainforest area is proposed to be excavated and transported from the site to a suitably licensed disposal facility.

For soil disposal in NSW, current analytical results for Lead, Benzo(a)pyrene and PAHs indicate the chemically impacted material would be classifiable as CT2 – Restricted Waste, and ACM contaminated material being classifiable as “Special Waste”.

For soil disposal in QLD, the current analytical results indicate that the chemically impacted material would be classifiable as Regulated Waste (Category 1) and ACM contaminated material classifiable as Regulated Waste (Category 2).

This material is anticipated to be excavated to a depth of approximately 1.0 metres below ground surface, with the soil to be stockpiled to allow for sampling and waste classification. Once the waste has been classified, the material will be loaded onto trucks and transported with applicable tracking documentation to a suitably licensed waste disposal facility.

Due to the confirmed presence of a non-friable asbestos fragment, if the location where this fragment was identified is to be excavated as part of the remediation works, these works will be performed by a Class B licensed Asbestos Removal contractor (including all required Site-specific permit), with accompanying airborne asbestos fibre monitoring works to be undertaken by a COH/LAA, in accordance with SafeWork NSW requirements.

The details of such monitoring must be included in documentation prepared by the Contractor for the remediation program, and must be prepared by an appropriately qualified occupational hygienist.

7.5.2 Offsite Disposal of Materials

Any material requiring disposal shall be classified prior to removal by the Remediation Consultant in accordance with *Waste Classification Guidelines Part 1: Classifying Waste,* NSW EPA (2014) and relevant waste regulations. Disposal of waste to licensed waste facilities in accordance with relevant

waste regulations will be undertaken by the Contractor. All waste tracking documentation including disposal dockets must be maintained by the Contractor and must be provided to the Principal and the Remediation Consultant for inclusion in the validation report. Should waste be transported and disposed to a landfill in south-east QLD, all relevant waste classification guidelines and permits applicable in QLD must be adopted.

Soils requiring off-site disposal will be excavated and stockpiled, then sampled by the Remediation Consultant as per the sampling density for stockpiled materials in NEPC (2013) for chemicals of concern.

It is a requirement under the *Protection of the Environment Operations (Waste) Regulation 2014* (POEO Waste Regulation) to record the movement of all loads of more than 100 kg of asbestos waste or more than 10 m^2 of asbestos sheeting. Each load will be assigned a unique consignment code to allow NSW EPA to monitor their movement from site of generation to disposal. Any asbestos waste exceeding 100 kilograms or more than 10 m^2 of bonded ACM in one load disposed off-site must be tracked using the NSW EPA Integrated Waste Tracking Solution (IWTS).

In addition, the *proximity principle*, under the POEO Waste Regulation (2019), makes it an offence to transport waste generated in NSW by motor vehicle for disposal more than 150 kilometres from the place of generation, unless the waste is transported to one of the two nearest lawful disposal facilities to the place of generation. Currently (without stockpiling and waste classification), the chemically impacted materials are classifiable as Restricted Solid Waste. The nearest landfill facility licensed to receive this material in NSW is in Sydney, which means that disposal of these soils in (south-east) QLD would be lawful under the POEO Waste Regulation.

The Contractor must be aware of and conduct all waste disposal in accordance with all relevant regulations.

7.6 Containment of Impacted Fill

Asbestos and chemically impacted material that is not excavated and removed from site is proposed to be managed in-situ, eliminating any potential future inhalation exposure pathway for airborne asbestos fibres and direct contact exposure pathways for chemical contaminants. This will create a physical separation barrier between the contaminant and the possible receptors, with the minimum requirements for the physical separation outlined as follows:

- A minimum soil cover thickness of 0.5 m in turfed areas, 0.5 m in mass planting/shallow landscaped areas and 1.0 m in tree pit zones which is underlain by a “marker layer” in unpaved areas, i.e., parks, gardens and open spaces etc. (this is not expected, as the material is proposed to be placed beneath the ground level concrete slab); or
- Permanent concrete floor/ground/wall slabs or asphaltic concrete surfaced pavement and underlain by a “marker layer”, i.e., underlying buildings, roads, pathways; or
- Top (concrete) of pile foundations (no marker layer required below pile foundations).

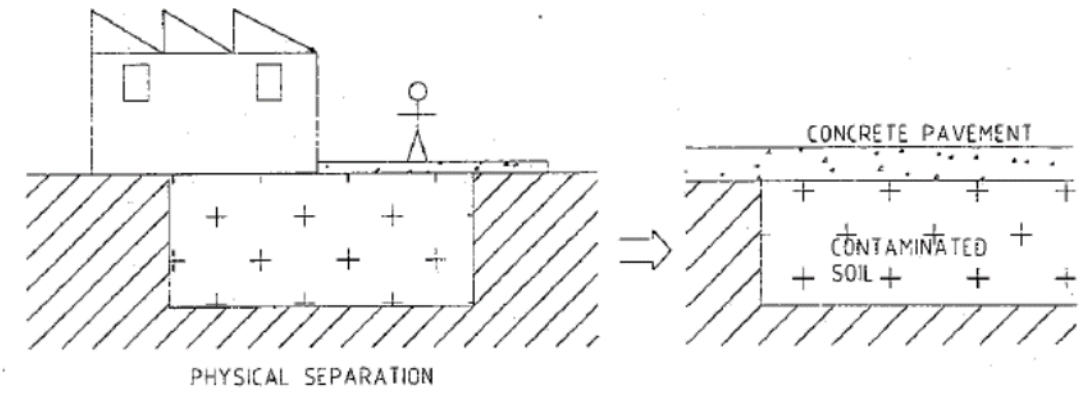
7.6.1 Proposed rainforest

In the proposed rainforest area, impacted material is to be excavated from any proposed locations planting locations. Once the impacted material has been removed, the remaining excavation is proposed to be lined with both a marker layer, as well as with a root barrier layer (a rigid plastic sheet made from high density polyethylene) prior to the importation of any growing media. The excavation will be extended to a depth and width sufficient to allow at least 500mm of imported growth media both laterally and vertically between the plant roots and the root barrier layer.

7.6.2 In-Situ Contaminated Material

In order to meet the design requirements of the project, and to provide both drainage and a layer of unimpacted soil for services to be installed below the concrete slab, it is proposed that a layer of clean fill, 0.3 m in thickness, will be placed above the marker layer and beneath the concrete slab. This material will consist of site won 'clean fill', ENM, VENM or quarry products which meet the criteria discussed in section **9.3.1**. Materials placed above the marker layer will be subjected to compaction as necessary to meet construction requirements. This material is also proposed to serve as the interim capping layer discussed in section **9.1**.

A conceptual sketch, sourced from ANZECC 1999, is shown below.



The marker layer shall consist of a bright orange coloured non-woven polyester continuous filament or PET (such as nonwoven geotextiles) or similar with a minimum density of approximately 150 grams per square metre (or equivalent). The marker layer must:

- Be easily recognisable within soils (i.e., bright orange in colour);
- Be durable as a long term marker layer (i.e., > 150 grams per square metre); and
- Maintain integrity during remedial/civil works such as capping layer insulation and road/building construction.

Additionally, the marker layer must meet geotechnical and civil specifications where required, i.e., underlying load bearing structures.

The specific details of the marker layer are required to be included in the site validation report and LTSMP documents in addition to surveyed plans showing the extent of capped area within the site.

Material above the marker layer extending to the final finished ground level will be required to be environmentally suitable material for human and/or ecological exposure (as appropriate). This may

include virgin excavated natural material (VENM) sourced from on-site, imported VENM, excavated natural material (ENM) or similar material certified in accordance with an exemption issued by the NSW EPA that also meets site suitability criteria; or imported road making materials comprising fresh quarried material or material covered by a beneficial reuse exemption issued by the NSW EPA.

Additionally, material underlying load bearing structures, should be geotechnically suitable, in accordance with previously prepared geotechnical reports.

Validation of the permanent capping arrangements will be required as outlined in **Section 9.3.2**, including inspections by the remediation consultant, a survey plan prepared by a registered surveyor showing the level and lateral extent of the marker layer and permanent capping in relation to the site boundaries.

7.7 Validation

Validation of the remedial works will be conducted by the Remediation Consultant to demonstrate the remediation objectives have been achieved. Details of the validation program are outlined in **Section 9.3**.

7.8 Site Disestablishment

On completion of the remediation works, all plant/equipment and safety/environmental controls shall be removed from the site by the Contractor. All equipment used during asbestos remediation works will need to be appropriately decontaminated or disposed of as asbestos waste by the contractor, in accordance with SWA and SafeWork NSW guidance, NSW EPA (2014) and relevant waste regulations. All plant used in asbestos containment areas will be decontaminated by the Contractor/suitably qualified persons employed by the Contractor and subject to clearance by a licensed asbestos assessor (LAA) prior to its removal from the containment area.

All equipment used during chemically impacted material remediation works will need to be appropriately decontaminated by the contractor, in accordance with SWA and NSW EPA (2014) and relevant waste regulations. All plant used in the chemically impacted containment areas will be decontaminated by the Contractor/suitably qualified persons employed by the Contractor.

8 CONTINGENCY PLANS

A review of remediation works has been undertaken to identify potential risks to meeting the specified remediation objectives. A number of potential risks have been identified. These are listed in the following sub-sections, with contingencies that will be implemented to ensure that remediation objectives are met.

8.1 Unexpected Finds Protocol

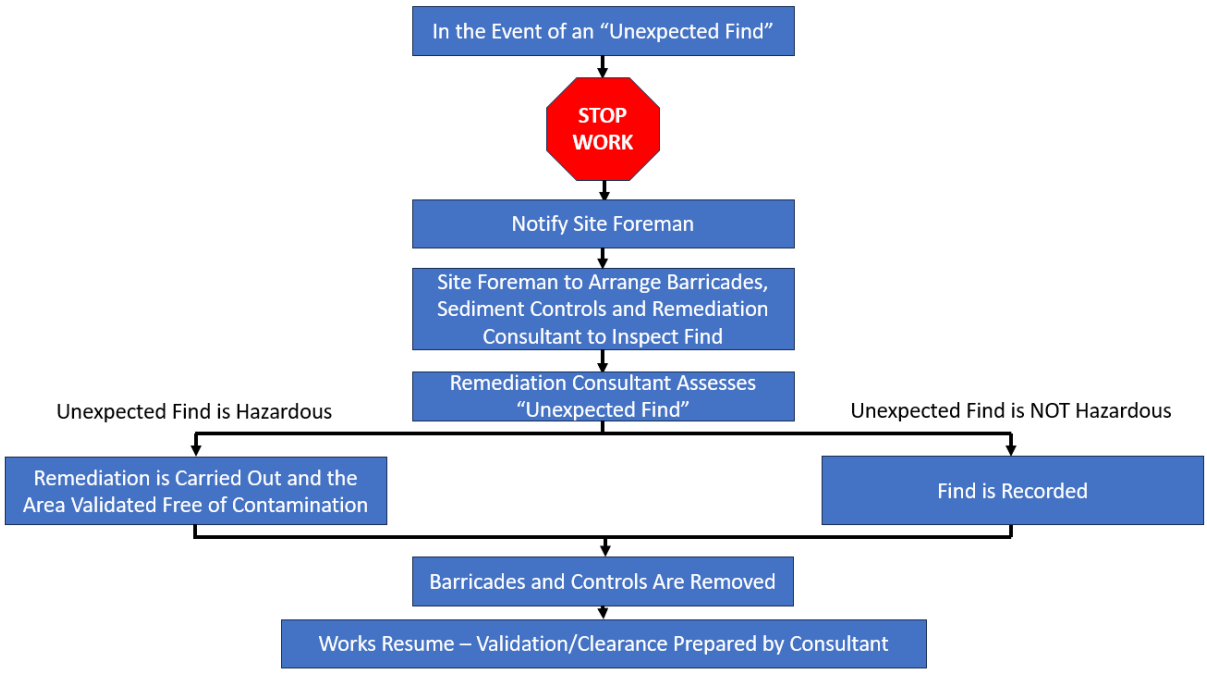
It is acknowledged that previous investigations of the site have been undertaken to assess the identified contaminants of potential concern in selected parts of the site. However, ground conditions between sampling points may vary, and further hazards may arise from unexpected sources and/or in unexpected locations during remediation. The nature of any residual hazards which may be present at the site, are generally detectable through visual or olfactory means, for example:

- Bottles / containers of chemicals (visible).
- Construction / demolition waste (visible).
- Ash and/or slag contaminated soils / fill materials (visible).
- Petroleum contaminated soils (odorous, staining / discolouration visible) beyond the identified impact, or at levels that prevent off-site disposal without treatment.
- Volatile organic compound contaminated soils (odorous).

As a precautionary measure, to ensure the protection of the workforce and surrounding community, should any of the abovementioned substances be identified (or any other unexpected potentially hazardous substance), the procedure summarised in **Flowchart 9.1** is to be followed.

An enlarged version of the unexpected finds protocol, suitable for use on-site, should be posted in the site office and referred to during the site-specific inductions conducted by the Contractor.

Flowchart 9.1 Unexpected Finds Protocol



8.2 Contingency Scenarios

8.2.1 Remedial Strategy Constraints

In the event that the proposed remedial works do meet the validation criteria, or if the selected remedial strategy is not able to proceed, the following actions will be considered to ensure, firstly, the safety and health of people and the environment and, secondly, that the overall project objectives are achieved:

- Reassessment of remedial and validation options for ACM and chemically contaminated soils; and
- Cessation of excavation and relocation of potentially impacted soils, with a view to leave soils in-situ.

8.2.2 Containment Cell Breach

In the event any stockpiled or capped materials escape (or have the potential to escape), then the management controls shall be rectified, and investigations undertaken to review the adequacy of the controls and any improvements implemented.

8.2.3 Complaints

Due to the proximity of the proposed site activities to neighbouring properties and the nature of remedial activities, there is the potential for complaints to be received from neighbours and members of the public relating to environmental emissions, including the following:

- Dust emissions arising from asbestos contaminated soil excavation, material handling, transport, placement and capping.

- Odours from hydrocarbon impacted soils.
- Noise and vibration from excavation.

Monitoring of all environmental emissions shall be undertaken as detailed in **Section 11.1.2** and appropriate actions taken to further control emissions following receipt of a complaint. Such additional controls may include the following actions:

- Disturbance of soils during meteorologically favourable periods only; and/or
- Increasing environmental controls including covering and/or wetting down soils which are generating dust; and/or
- Implementing odour controls to prevent odorous emissions from reaching nearby receptors (refer to **Section 8.2.5** below).

8.2.4 Severe Weather

Weather will be monitored on a daily basis by the Contractor, via checking the website of an internet-based weather service provider. Should severe weather be forecast, especially strong winds, works will stop until safe to re-commence. All site management controls will be implemented to the extent practicable as outlined in **Section 11.1.2** prior to any severe weather events occurring. Where required, environmental controls such as stormwater retention or retarding devices will also be inspected immediately following the severe weather event, to assess potential damage and the need for repairs, maintenance or replacement.

8.2.5 Odours from Works

Based on the volatile nature of some of the identified contaminants in the material to be excavated, off-site odour complaints are considered unlikely, although possible. Where complaints occur, the following will be undertaken:

- Installation of an odour screening/masking system at the remediation area boundaries; and/or
- Disturbance of soils during meteorologically favourable periods only; and/or
- The use of odour suppressant additives to water used to keep impacted soils/stockpiles moist; and or
- Covering of impacted soils.

9 VALIDATION PLAN

9.1 Overview

Validation data are required to be collected to verify the effectiveness of the remediation works and document the condition of the site as being suitable for the proposed future uses.

Validation activities will be required for the following areas and activities:

- Documentation of installation of containment measures if chosen as the remedial option (both interim and final).
- Validation of imported fill material to demonstrate its suitability for use as a capping layer or in trenching works.
- Movement of all soil and fill material onsite.
- Waste materials requiring offsite disposal.

9.2 Data Quality Objectives

Data Quality Objectives (DQOs) were developed for the validation program, as discussed in the following sections.

9.2.1 State the Problem

The site is proposed to be redeveloped into an educational facility. As was identified in previous investigations at the site (ENV, 2023 and ENV, 2024), and as outlined in **Section 2.1** of this RAP, ACM and chemical contamination has been identified in fill soils within the proposed rainforest area. Therefore, this area of the site designated for planting and the installation of raised planter beds must be remediated of the identified chemical and asbestos impacts, prior to being utilised as an educational facility.

9.2.2 Identify the Decisions

The following decisions must be made during the validation works:

- Have marker and capping layers (where required) been installed appropriately and in accordance with RAP requirements?
- Are imported materials environmentally suitable for their proposed use?
- Have surplus waste materials been suitability classified and lawfully disposed?
- Have the works been completed in accordance with the RAP, or where variations to the works were required, have these met the objectives of the RAP?
- Are analytical data generated by the validation works reliable?
- Is the site suitable for the proposed use?

9.2.3 Identify Inputs to the Decisions

The inputs to the decisions are as follows:

- Previous investigation data.
- Observation and photographic log of marker and capping layer installation.
- Survey of marker and capping layer vertical and lateral extents.
- Field observations, sampling and analytical data for imported materials.
- Field observations, sampling and analytical data for off-site disposal of waste materials.
- Field observations, sampling and analytical data of any unexpected finds.
- Physical observations; including visual, olfactory and photoionisation detector (PID) measurements, where appropriate.
- Documentation of appropriate classification of imported materials.
- Environmental monitoring data to demonstrate that potential airborne pollutants, as generated by the handling of environmentally impacted materials on the site, has not impacted off-site locations.
- Assessment criteria for soils.
- Data quality indicators as assessed by quality assurance/quality control (QA/QC).

9.2.4 Define the Study Boundaries

The geographical study boundaries of the site are defined as follows:

- The lateral extent of the works relevant to this RAP are defined by the proposed extent of the rainforest area within the site. These areas are shown in Figure 6 (Appendix D).
- The vertical extent of the works is defined as follows.
    - 1.0 m in total depth within proposed planting locations.

The temporal boundaries for the remedial program will be dictated by the length of time required to complete each of the required activities. This is anticipated to be over the course of one month.

9.2.5 Decision Rules

The decision rules adopted to answer the decisions identified in **Section 9.2.2** are discussed below.

Have marking and capping layers (where required) been installed appropriately and in accordance with RAP requirements?

The marker and capping layers must be installed across the extent of the material to remain in-situ, as well as within the proposed planting locations, as shown in Figure 6, Appendix D. The marker layer must be installed to the RAP requirements, as well as the manufacturer's installation requirements. The vertical and lateral extents of the marker layer should be surveyed, along with consistent and comprehensive photographic evidence.

Where soil-based material is to be used as a capping layer, placed above the marker layer and readily accessible to human users, this material is required to be validated as meeting the health and ecological validation requirements for the site in addition to aesthetic requirements.

All imported materials to be used as the capping layer must be environmentally suitable, as defined below.

Are imported soils environmentally suitable for their proposed use?

Material required to be imported onto the site as capping, trench backfill (or any other purpose) are required to be demonstrated to be VENM, ENM or material considered suitable for beneficial reuse in accordance with a resource recovery exemption issued by NSW EPA under clauses 51 and 51A of the POEO Waste Regulation.

All imported material must be classified as not containing asbestos as per the definition in SWA (2020a).

All imported materials will be assessed to ensure the entirety of the capping layer from surface to the marker layer is validated upon conclusion of remedial works.

VENM

Laboratory analysis results (if available) will be compared to published background levels (metals) and nominated laboratory LORs (for all man-made chemical constituents) for VENM. The Remediation Consultant may conduct a site inspection of all VENM source sites and will approve any VENM Certificates prior to importation of material. If either the source site or supporting documentation is unsatisfactory in regard to certainty of the material comprising VENM, the Remediation Consultant will undertake additional sampling to confirm chemical characterisation of VENM material and prepare any required documentation.

ENM

ENM will be assessed in accordance with the "Excavated Natural Material Exemption 2014". The Remediation Consultant may conduct a site inspection of all ENM source sites and will approve any ENM material characterisations prior to importation of material. If either the source site or supporting documentation is unsatisfactory in regard to certainty of the material comprising ENM, the

Remediation Consultant will undertake additional sampling to confirm chemical characterisation of ENM material and prepare any required documentation.

Other Resource Recovery Exemptions

Any materials falling under this category will be assessed in accordance with the relevant resource recovery exemption. The Remediation Consultant will undertake additional assessment and reporting if required to ensure compliance with the relevant resource recovery exemption.

Have waste materials been suitability classified and lawfully disposed?

All waste requiring off-site disposal must be suitability characterised and classified in accordance with *Waste Classification Guidelines* (NSW EPA, 2014) or relevant exemptions (such as VENM and ENM).

Additional chemical analysis is required for off-site disposal unless sufficient historical data can be used for waste classification purposes.

Are the data generated by the validation works reliable?

If the analytical data meet the Data Quality Indicators established in **Section 9.2.11,** then the analytical data are considered to be reliable.

All other data, such as visual observations, photographic logs and surveys will be qualitatively assessed to ensure they contain sufficient information to inform the validation report.

Is a Long-Term Site Management Plan Required?

A suitable LTSMP is required at the site if the containment management strategy for the asbestos and chemically impacted fill materials is implemented. The LTSMP will detail the management strategies required to ensure the long-term integrity of the marker and capping layers, such as inspection timetables, accidental penetrations of the marker layer and required controls for scheduled works below the marker layer.

Is the site suitable for the proposed use?

The site will be considered suitable for the proposed use if the following conditions are met:

- Fill materials or natural soils across the site meet the adopted site criteria.
- Marker and capping layers have been appropriately installed and documented.
- Imported soils are considered to be environmentally suitable.
- Waste materials have been suitably characterised and lawfully disposed.
- Analytical data generated are considered reliable.
- A suitable LTSMP will be implemented at the site.

9.2.6 Specify Limits of Decision Errors

A qualitative assessment shall be undertaken of potential decision errors associated with the data, in accordance with the provisions in NEPC (2013).

9.2.7 Optimise the Design for Obtaining Data

The validation sampling design for each specific type of validation works anticipated is discussed in detail in **Section 9.3**. The general sampling methodologies are discussed below.

9.2.8 Soil Sampling Methodology

Soil sampling will be conducted by the Remediation Consultant as required to achieve the remedial objectives. The soil sampling method shall be determined by the Remediation Consultant as consistent with the observations of the site sub-surface and appropriate to generate representative samples. The soil sampling method shall be consistent with the Data Quality Indicators in **Section 9.2.11**.

Where required, soil samples will be recovered directly by hand, or with the assistance of an excavator bucket. Re-usable sampling equipment (hand tools) must be decontaminated between sampling locations.

9.2.9 Soil Sample Containers

During the collection of soil samples, features such as seepage into excavations, soil discolouration, soil staining, odours and other indications of contamination shall be noted on field reporting sheets / field logs.

500 mL samples shall be additionally collected and placed in new zip lock bags where quantitative asbestos analysis is required. Where chemical analysis is required, collected soil samples shall be immediately transferred to sample containers of appropriate composition (glass jars) fitted with Teflon sealed lids. Sample labels shall record sample identification number and date and time of sampling. Sample containers shall be transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form shall be completed and forwarded with the samples to the testing laboratory, containing the following information:

- Sample identification.
- Signature of sampler.
- Date of collection.
- Type of sample.
- Number and type of container.
- Inclusive dates of possession.
- Signature of receiver.

9.2.10 Soil Sample Containers

Where hydrocarbons are present and these soils require sampling, sub-samples of the soil will be screened during field works using a PID to assess the potential presence of VOCs including petroleum hydrocarbons. Samples obtained for PID screening will be placed in a sealed plastic bag for approximately 5 minutes to equilibrate, prior to a PID being attached to the bag. Readings will then be monitored for a period of approximately 30 seconds or until values stabilise and the

stabilised/highest reading will be recorded on the field sample forms. The PID will be calibrated prior to the commencement of field works and then check readings will be completed on a daily basis during the field program using suitable calibration gas. If required, the PID will be re-calibrated during the field program in accordance with manufacturer's instructions.

9.2.11 Quality Assurance/Quality Control

The objective of the project is to remediate the site to a standard suitable for the proposed uses. To demonstrate the effectiveness of the remedial works, validation sampling, inspections and analysis will be conducted. The quality of the validation data must be sufficient to draw conclusions regarding the suitability of the site. Hence, the quality assurance / quality control (QA/QC) program employed as part of the remediation works will involve pre-determined data quality indicators (DQIs).

The DQIs are summarised following and in **Table 4**: Summary of QA/QC Program**:**

- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is normally assessed by calculating the Relative Percent Difference (RPD)[1] between duplicate sample pairs. However, this calculation is not applicable to the subject remedial program due to the presence / absence nature of asbestos, and as such, the agreement between the sample pairs will be assessed instead (ie. duplicate sample pairs both contain asbestos/do not contain asbestos).
- **Accuracy** - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** - expresses the degree to which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** - expresses the confidence with which one data set can be compared to another. This is achieved through maintaining a level of consistency in techniques used to collect samples, ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- **Completeness** - is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study for interpretation of the soil data set(s).

[1] $$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where C_0 is the analyte concentration of the original sample
C_d is the analyte concentration of the duplicate sample

- **Sensitivity** - expresses the appropriateness of the chosen field and laboratory methods, including the limits of reporting, in producing reliable data in relation to the adopted site remediation criteria.

Table 4: Summary of QA/QC Program

Data Quality Indicator	Frequency	Data Quality Acceptance Criteria
Precision		
Blind duplicates (intra laboratory)	1/20 samples	≤ 50% RPD or agreement between asbestos presence/absence
Blind duplicates (inter laboratory)	1/20 samples	≤ 50% RPD or agreement between asbestos presence/absence
Accuracy		
Surrogate spikes	All organic samples	70 – 130%
Matrix spikes	N/A for asbestos Otherwise, 1 per lab batch	70 – 130%
Laboratory control samples	1 per lab batch	70 – 130%
Representativeness		
Sampling appropriate for media and analytes	All samples	All samples
Samples extracted and analysed within holding times	All samples	N/A for asbestos, organics (14 days), inorganics (6 months)
Laboratory blanks	1 per lab batch	
Trip spike	1 per sampling event targeting volatiles	70 – 130%
Trip blank	1 per sampling event targeting volatiles	
Comparability		
Standard operating procedures for sample collection and handling	All samples	All samples
Standard analytical methods used for all analytes	All samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All samples	All samples
Limits of reporting appropriate and consistent	All samples	All samples
Completeness		
Soil description and COCs completed and appropriate	All samples	All samples
Appropriate documentation	All samples	All samples
Satisfactory frequency and result for QA/QC samples	All QA/QC samples	-
Data from critical samples is considered valid	-	Critical samples valid
Sensitivity		

Data Quality Indicator	Frequency	Data Quality Acceptance Criteria
Field and analytical methods and limits of recovery appropriate for media and adopted site assessment criteria	All samples	At least 10 L per field AQ sample LOR, It is noted that gravimetric analysis of soils may not be possible where soil types or inclusions of materials do not allow for material to pass through a sieve.

If the RPD between duplicates is greater than the pre-determined DQI, a judgement will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field. For asbestos agreement, the highest concentration of the primary, duplicate or triplicate samples will be recorded as the result for that sample location, thus eliminating any non-conformance between primary, duplicate and triplicate samples.

9.3 Validation Inspections, Sampling and Analyses

9.3.1 Overview of Validation Sampling

The proposed soil validation sampling, quantification and analytical program is outlined in Table 5:.

Table 5: Validation Sampling and Analytical Plan

Validation Area	Sampling Frequency	Analytes
Imported VENM materials (if required)	VENM report supplied/source site observed by remediation consultant and delivered materials verified to be consistent. **OR** Minimum 5 samples per source site.	As a minimum: Heavy Metals, TPH/BTEXN, PAHs, OCPs, Asbestos WA/NEPM 500 mL
Quarried VENM material (e.g. blue metal, sandstone, shale)	Confirmation that the material is quarried VENM prior to importation (quarry supplied testing/remediation consultant source site inspection) and visual confirmation on receipt of materials	Site inspection/Quarry supplied testing
Imported materials of ENM	As per ENM exemption (NSW EPA, 2014)	Heavy metals, TPH/BTEXN, PAHs, pH, EC, RTA T276 (foreign materials), Asbestos WA/NEPM 500 mL
Waste classification	As per the NSW EPA Waste Classification Guidelines (2014)	Relevant contaminants of concern

9.3.2 Marker and Barrier Layer Inspection

Visual inspection will be undertaken by the Remediation Consultant to verify the installation of the marker layer across the in-situ remediation areas, as well as to verify the installation of the barrier and marker layers within the proposed planting locations. Photographic records and a survey of the marker/barrier layer installation, including vertical and lateral extents by the Contractor, will be retained for inclusion in the validation report.

9.3.3 Interim Capping Layer Inspection

Material to be used as a capping layer must be validated by the Remediation Consultant to be environmentally suitable, consisting of VENM, ENM, suitable on-site materials (i.e. VENM from other portions of the site) or material considered suitable for beneficial reuse via a resource recovery exemption issued by NSW EPA. Additionally, any capping layer material must not exceed the adopted site validation criteria for soils.

The capping layer must be placed at the thicknesses specified for each capping scenario as detailed in **Section 7.6** and presented schematically in **Section 7.6.2.** Photographic records and a survey of the capping layer installation, which details the final thicknesses of the capping layer, including the vertical and lateral extents by the Contractor, will be retained for inclusion in the validation report.

9.4 Validation Criteria Selection

9.4.1 Planting Locations Validation Criteria

The site is proposed to be redeveloped for use as an educational facility, including a proposed rainforest area where the remediation works are to be performed. Within this rainforest area, it is proposed that a number of trees will be planted, a specific number of trees is yet to be confirmed. The validation criteria for these planting locations is the elimination of any potential contaminant pathways between the clean imported material and the tree roots, and the remaining in-situ contaminated material.

The validation criteria will comprise of the installation of both a marker layer, as well as with a root barrier layer (a rigid plastic sheet made from high density polyethylene) prior to the importation of growing media to support any proposed plants. Additionally, excavation is required to be extended to a depth and width sufficient to allow at least 500mm of imported growth media both laterally and vertically between the plant roots and the root barrier layer. No soil sample collection or analysis – aside from those potentially required for the classification of the imported fill – will be required as part of the validation works.

9.4.2 In-Situ Contaminated Soil Validation Criteria

The remaining contaminated material will remain in-situ at the site, with the remediation works to include the placement of a marking layer on top of the in-situ material. To provide both drainage and a layer of unimpacted soil for services to be installed below the concrete slab, it is proposed that a layer of clean fill, 0.3 m in thickness, will be placed above the marker layer and beneath the concrete

slab. For the areas where the raised planter beds are to be located, a marker and barrier layer will be installed, and clean growing media is to be imported.

The validation criteria for the raised planter bed locations will comprise of the installation of both a marker layer, as well as a root barrier layer (a rigid plastic sheet made from high density polyethylene) prior to the construction of the raised planter beds and importation of clean growing media. No soil sample collection or analysis – aside from those potentially required for the classification of the imported fill – will be required as part of the validation works.

The validation criteria for the remainder of the in-situ contaminated material will comprise of the installation of a marker layer, the importation of clean material (for services installation) and the construction of a concrete slab. No soil sample collection or analysis – aside from those potentially required for the classification of the imported fill – will be required as part of the validation works.

9.5 Reporting

9.5.1 Validation Report

Following completion of the remediation works and laboratory analysis, a validation report will be prepared which presents the following.

- Details of the methodology used for all elements of the remediation program.
- Details of the validation sampling.
- Details of all inspections conducted.
- Laboratory analysis results, with comment on their reliability in consideration of the QA/QC data.
- Conclusions regarding the suitability of the site for redevelopment and future residential/public open space use.
- Copies of dockets for disposal of all material transported off-site to landfill.
- Copies of imported fill records, including VENM certificates (if available) and/or ENM compliance reports.

The report will be prepared in accordance with *Consultants Reporting on Contaminated Land* (NSW EPA 2020); and will be submitted to Council within 60 days following completion of remediation works.

9.5.2 Long Term Site Management Plan

In addition to the requirements of the validation plan, the site will require long term management following completion of the redevelopment.

To achieve this, an LTSMP will be prepared by the Remediation Consultant to detail the ongoing management and monitoring requirements for the site, however the precise nature and extent of management requirements will not be known until remediation/management works are conducted and validation data obtained. The LTSMP will be prepared following the completion of the validation report for the site.

The LTSMP is required to document the following information:

- A statement of the objectives of the LTSMP – i.e., to ensure continued suitability of the site following remediation.
- Identification of residual environmental contamination issues at the site that require ongoing management/monitoring to meet the LTSMP objectives, including the type of contamination and location within the site (including a survey plan prepared by a registered surveyor).
- Documentation of environmental management measures which have been implemented to address the identified environmental issues at the site.
- Description of management controls to limit the exposure of site users to known areas of contamination to acceptable levels.
- Description of responsibilities for implementing various elements of the provisions contained in the LTSMP.
- Timeframes for implementing the various control/monitoring, etc. elements outlined in the LTSMP.
- Environmental monitoring and reporting requirements (if required) for the future management of environmental impact underlying the site including the following:
    - Appropriate monitoring locations and depth within and down-gradient of any residual contamination.
    - Relevant assessment criteria to be used in evaluating monitoring results.
    - Frequency of monitoring and reporting.
    - Process for reviewing monitoring data and how decisions will be made regarding the ongoing management strategy.
    - The length of time for which monitoring is expected to continue.
    - The regulatory authorities involved and the management inputs required from each.
    - The integration of environmental management and monitoring measures for soil and groundwater.
    - Health and safety requirements for particular activities.
    - A program of review and audits.
    - The provisions in the LTSMP are feasible (i.e., able to be implemented) and able to be legally enforceable (i.e., a mechanism exists, such as development consent conditions, to give the plan a basis in law).
    - The relevant consent authority is satisfied that the inclusion of a development consent condition relating to the implementation of the LTSMP is acceptable.
    - Corrective action procedures to be implemented where LTSMP assessment criteria are breached.

10 REMEDIATION SCHEDULE

An estimated schedule for the remedial works is presented below in **Table 6**: Estimated Remediation Schedule.

Table 6: Estimated Remediation Schedule

Action		Timeframe
Council Approval of RAP		Up to 30 days
DA Submission for Category 1 Works in Floodway (if required)		Up to 30 days
Preparation of a Traffic Management Plan		1 week (if required)
Obtaining Relevant Permits	TfNSW	1 week (if required)
	SafeWork NSW	1 week (if required)
Excavation and Stockpile of Material from Planting Locations		1-3 days
Collection and Analysis of Stockpile Classification Samples		1 day (validation sampling) 7 days (laboratory analysis)
Removal of Stockpiled Material		1-2 days
Installation of Marker and Barrier Layers within Rainforest Area (including Planting location Excavations)		1 week
Importation of Clean Fill		1-3 days
Validation of Capping Arrangements		1 – 2 days
Site Disestablishment		2 - 3 days
Validation Report		4 weeks

11 SITE MANAGEMENT DETAILS

11.1 Site Management

11.1.1 Responsibilities and Contacts

The overall responsibilities and contacts for the remedial works are summarised in Table 7.

Table 7: Responsibilities and Contacts

Responsible Party	Contact	Responsibilities
Property Owner or Project Manager	Michael Atherton (Director, Balanced Earth Buildings) 0438 482 951	- Engagement of Contractor, Remediation Consultant (RC). - Liaise with planning and regulatory authorities, as required.
Remediation Contractor	To be confirmed (TBC)	- Site preparation/management measures. - Conduct all remedial works in accordance with the requirements of this RAP. - Consider complaints, refer to Property Owner and resolve complaints.
Class B Licensed Asbestos Removalist (if required)	To be confirmed (TBC)	- Application for a Class B – Asbestos removal licence. - Preparation of a notification letter to neighbouring parties. - Establishment of an 'asbestos exclusion zone' with relevant decontamination areas and infrastructure, signage and barricading. - Provision of asbestos PPE to all contracted staff. - Supervision of asbestos controls adherence and staff safety. - Installation of marker layer. - Site disestablishment including vehicle/plant decontamination, emu picking etc.
Remediation Consultant (RC)	Matt Greer (Senior Environmental Scientist, ENV Services Pty Ltd) or Josh Stainley (Environmental Scientist, ENV Services Pty Ltd) 1300 861 325	- Ensure that all site supervision and soil validation activities are carried out in accordance with this RAP. - Prepare Validation Report upon completion of the remedial program.

11.1.2 Site Management Plan

All remediation works will be undertaken with due regard to the minimisation of adverse environmental effects, and to meet all statutory environmental and safety requirements.

Overarching site management measures which will apply to the remedial works are presented in Table 8.

The site management plan will be reviewed prior to each day of work, and relevant sections discussed during the daily toolbox meetings.

Table 8: Site Management Plan

Item	Description/Requirements
Stormwater Management	- Measures will be adopted to ensure that potentially contaminated water does not leave the site. - In the event that excavations result in pooled stormwater/rainwater, it is the responsibility of the Contractor to engage the RC to obtain water samples for chemical analysis. Chemical analysis of water will be undertaken for the COPC and the RC will review the results prior to water being pumped from the excavation and irrigated to open areas of the of the site. Treatment of the water may be required prior to irrigation on-site. - As a minimum, the following controls will be considered and implemented: diversion and isolation of any stormwater from any contaminated areas; provision of sediment traps; discharge of any water to drains and water bodies must meet the appropriate effluent discharge consent condition under the *Protection of the Environment Operations Act (1997).*
Soil Management	- Soils are excavated and transported using methodologies that will ensure nuisance dust is not generated, and that no discernible dust crosses the property boundaries (refer also below – 'Dust'). - Different soil types, where practicable, are not mixed, and that potentially contaminated soils are segregated from those that are considered unlikely to be contaminated. - During periods of heavy rain, site works will cease to prevent sediment run-off from the works area(s). - Wheel washes, or other methods which effectively remove soil from vehicle wheels, will be used to prevent the tracking of contaminated soil onto adjacent roadways. If soil is tracked onto adjacent roadways, the Contractor will be responsible for cleaning the affected roadways as soon as reasonably practicable. - Surplus spoil will be disposed to an appropriately licensed landfill facility, in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014.*
Dust	- Implement measures to ensure that no nuisance dust is generated during the remedial works. These may include: the use of a water cart to wet soils; the use of sprinklers or spray to wet soils stored in the bunded area (before they can be appropriately covered).

Item	Description/Requirements
	- All heavy equipment used for the works will be appropriately serviced and maintained to minimise the generation of excessive diesel exhaust emissions. - During periods of high winds, site works will cease if dust generation cannot be controlled in accordance with the required site management measures. - Management measures specific for asbestos fibres are presented in Section 11.2 below.
Odour	- The Contractor will implement measures to ensure that no nuisance odour is generated during the remedial works. These may include the use of odour suppressing agents to control strong odours. Any odour suppressing agents used will contain only degradable and otherwise environmentally friendly constituents and will not affect the contamination status of site soils or alter the waste classification assigned to the soils by the Remediation Consultant (if required). - The Contractor, or Remediation Consultant, will monitor the work area with a PID and lower explosive limit (LEL) meter at all times during bulk excavation of areas with known hydrocarbon contamination. If the PID measurement exceeds 50 ppm_v and/or the LEL measurement exceeds 5%, stop work and assess the source of the vapours. Work should not re-commence until the PID measurement is less than 50 ppm_v and the LEL measurement is less than 5%. - Excessively windy days should be avoided, and the scheduling of works should consider the weather forecast. - All heavy equipment used for the works will be appropriately serviced and maintained to minimise the generation of excessive diesel exhaust emissions. - Soils producing odours will be covered where possible.
Noise and Vibration	- Noise and vibration will be restricted to reasonable levels. All plant and equipment used on site will have mufflers fitted (where practicable) to reduce noise generation and ensure that noise emissions do not breach levels defined within the Development Construction Specification C101 (General). - Vibration levels from backfill compaction activities will be monitored by the RC, and appropriate measures implemented to ensure that adjacent infrastructure is not damaged by the activities. All vibration levels will comply with the requirements of the Development Construction Specification C101 (General).

Hours of Operation	- As required by Development Construction Specification C101 (General) and/or Contaminated Land Management Policies (where applicable), site works will be limited to the following hours:
	  - Monday to Saturday: 7 am to 5 pm
	  - Sunday and Public Holidays: No operation.
	- Alternative hours may be agreed with Council prior to commencing works.

Community Engagement	- Commercial occupants immediately adjacent the site will be notified of the works a minimum of two weeks prior to on-site works commencing. The notification will be via a letter which

Item	Description/Requirements
	details the nature of the works, hours of operation, the expected duration of the works, and relevant contact details.
Incident Management and Community Relations	- While this RAP includes management measures to reduce the risk of potential human health and environmental impacts from the site activities, it is possible that unforeseen circumstances may occur which lead to a perceived risk by stakeholders such as nearby residents and the general public. To mitigate impacts from such events, the Contractor will include in its safety documentation details of responsible persons and the actions to be taken by them in such cases. - The Contractor will maintain a Complaints Register on site at all times. - The Contractor will notify the Property Owner as soon as practicable after a complaint is made. - The Property Owner will discuss with the Contractor and Remediation Consultant possible changes to the works program to address the complaint(s). The complainant will be contacted by the Property Owner or the Contractor following implementation of the changes, to ensure that the complaint has been adequately addressed.

11.2 Occupational Asbestos Monitoring

Where required during the removal of ACM or ACM contaminated soils, airborne asbestos fibre monitoring will be conducted by a Licensed Asbestos Assessor (LAA, as per SafeWork NSW requirements) in accordance with the requirements of the National Occupational Health and Safety Commission (NOHSC*) Asbestos Code of Practice and Guidance Notes*, in particular the Guidance note for the estimation of airborne asbestos dust [NOHSC 3002:2005]. The LAA shall undertake airborne asbestos fibre monitoring at a minimum of four static locations daily during remediation works that will disturb asbestos impacted or contaminated materials. Monitoring locations will include site perimeter locations and downwind locations. Wind information available from the Bureau of Meteorology (BOM) for the nearest weather stations will be used to determine common prevailing winds in the area.

Air filters shall be analysed by a NATA accredited laboratory and results shall be required to be below 0.01 fibres/mL. All detections of fibres shall be further analysed by scanning electron microscope (SEM) to confirm the fibres are asbestos.

If respirable asbestos fibres are confirmed and present between 0.01 and 0.02 fibres/mL, the following controls must be implemented by the licensed asbestos removalist, in accordance with *Code of Practice: How to Safely Remove Asbestos,* SafeWork NSW (SWNSW 2019a).

- Review control measures.
- Investigate the cause.
- Implement controls to eliminate or minimise exposure and prevent further release.

If respirable asbestos fibres are confirmed and present above 0.02 fibres/mL, the following controls must be implemented by the licensed asbestos removalist, in accordance with SWNSW 2019a.

- Stop removal work.
- Notify SafeWork NSW by phone, then by fax or written statement that work has ceased.
- Investigate the cause.
- Implement controls to eliminate or minimise exposure and prevent further release.
- Do not recommence removal work until further air monitoring is conducted and fibre levels are detected below 0.01 fibres/mL.

A daily air monitoring report will be prepared documenting the previous/same days' airborne asbestos fibre air monitoring results. This report will be made available to all relevant stakeholders upon request, including but not limited to the following:

- Site workers.
- Neighbouring commercial occupants.
- Unions.

11.3 Work Health and Safety

The *NSW Work Health and Safety Act 2011* and associated *Work Health and Safety Regulation 2017* require the preparation of documentation that addresses project-specific risks when undertaking construction work (which includes this program).

In accordance with these requirements, project-specific Safe Work Method Statements (SWMS) for the works will be prepared, prior to the remedial program commencing. Other documentation, including a Construction Environmental Management Plan (CEMP), may also be required by the planning authority (Council) prior to commencing the remedial program.

12 CONCLUSION

Subject to the successful implementation of the measures described in this RAP, it is concluded that the risks posed by contamination present at the site can be managed in such a way as to be adequately protective of human health and the environment, such that the site can be made suitable for the proposed educational facility.

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APPENDIX A

Site Location Figures

Site Location (approximate)

0 m 400 m 800 m

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ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 1 – Site Location
65-69 Woodlark Street, Lismore NSW

Client: Living Schools
Project: Soil Delineation Report
Job No: 218078

Image source: SIXMaps (2023)

Site Area (approximate)

Investigation Area (approximate)

0 m 20 m 40 m

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Figure 2 – Investigation Area Location
65-69 Woodlark Street, Lismore NSW

Client: Living Schools
Project: Soil Delineation Report
Job No: 218078

Image source: SIXMaps (2023)

APPENDIX B

2023 Investigation Figures

Appendix A Figures

Site boundary

N

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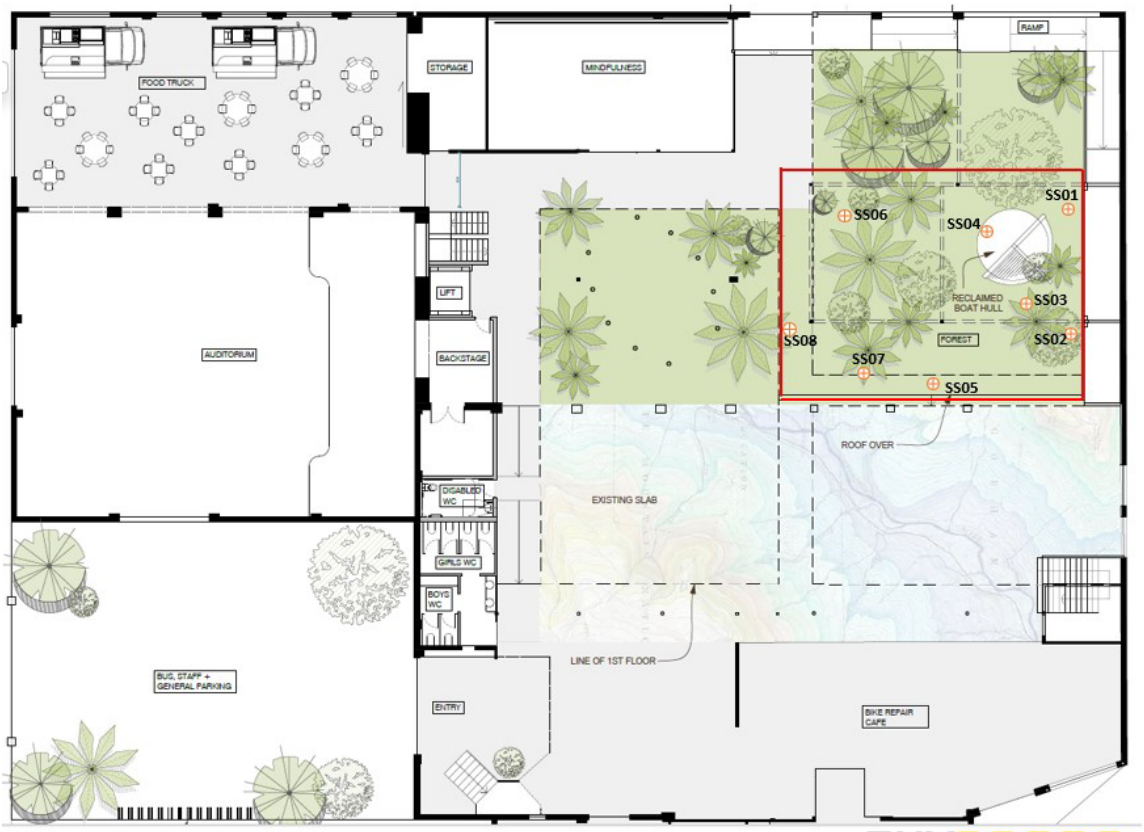
Figure 1 – Site Location
65-69 Woodlark St Lismore NSW 2480

Map By ENV Solutions, image from sixmaps (2023)

Project: 218078 Soil Assessment
Client: Balanced Earth Building



Map By ENV Solutions, image from sixmaps (2023)

Figure 2 – Soil sampling locations
65-69 Woodlark Street NSW 2480

Project: 218078 Soil Assessment
Client: Balanced Earth Building

APPENDIX C

2024 Investigation Figures

Site Area (approximate)

Investigation Area (approximate)

Sample Location (approximate)

0 m 6 m 12 m

Image source: SIXMaps (2023)

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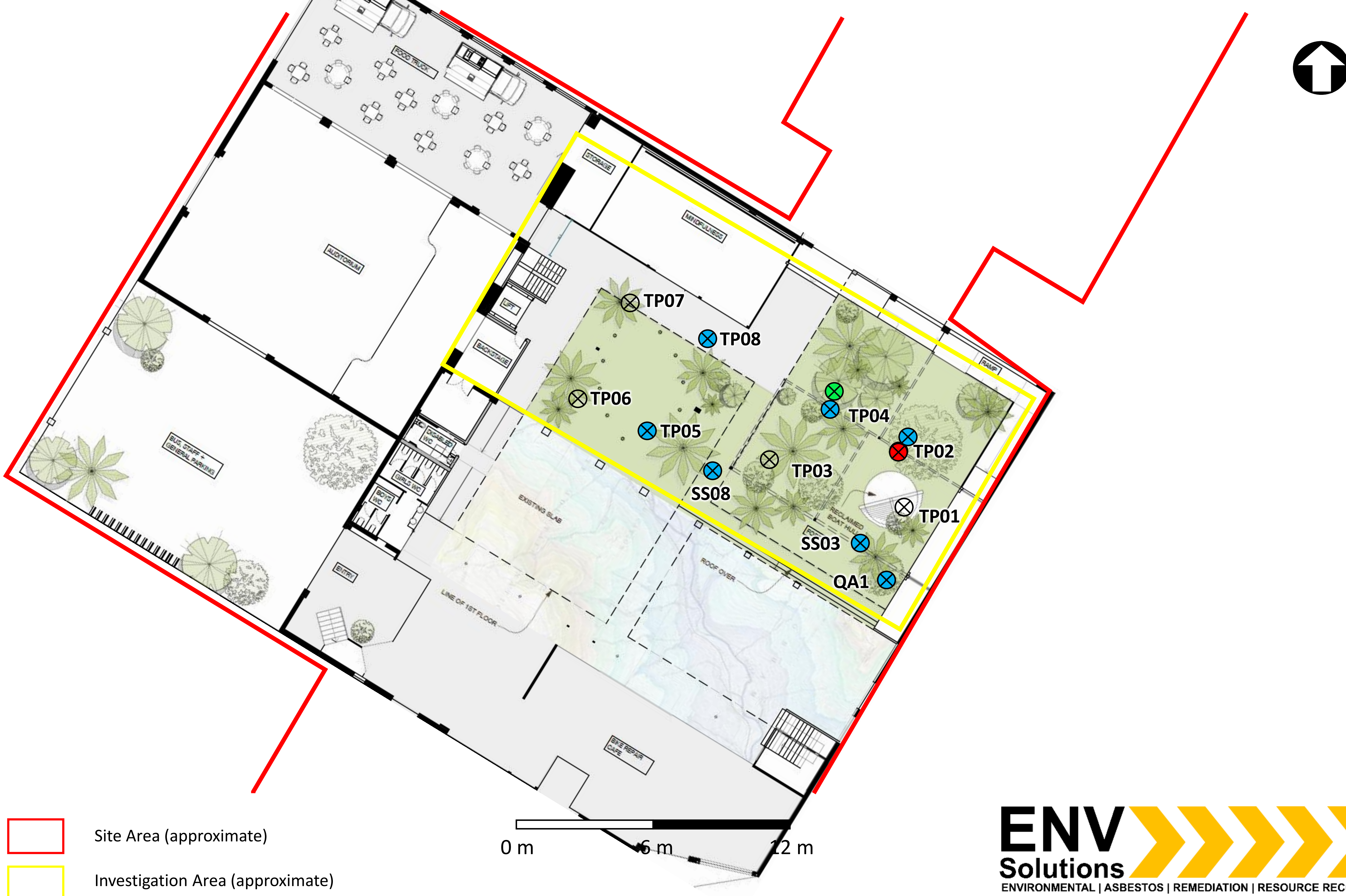
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 3 – Sample Plan
65-69 Woodlark Street, Lismore NSW

Client: Living Schools
Project: Soil Delineation Report
Job No: 218078

APPENDIX D

Contaminant Exceedance and Remediation Area Figures



Site Area (approximate)

Investigation Area (approximate)

Lead Exceedance Sample Locations (approximate)

Asbestos Fragment Location (approximate)

Zinc Exceedance Location (approximate)

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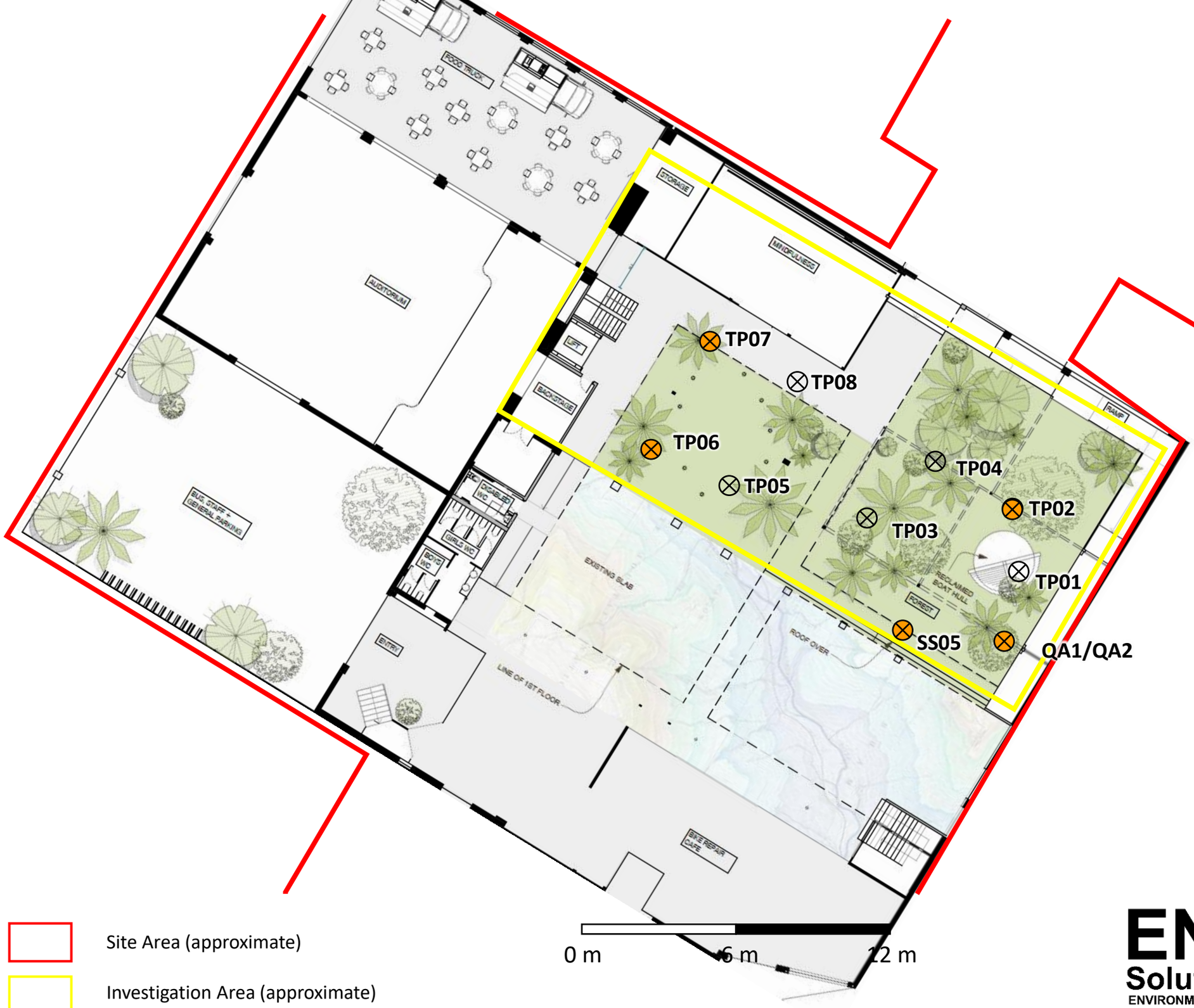
Figure 4 – Metals Exceedance Plan
65-69 Woodlark Street, Lismore NSW

Client: Living Schools
Project: Soil Delineation Report
Job No: 218078



Site Area (approximate)

Investigation Area (approximate)

Benzo (a) Pyrene Exceedance Sample Locations (approximate)

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Figure 5 – BaP Exceedance Plan
65-69 Woodlark Street, Lismore NSW

Client: Living Schools
Project: Soil Delineation Report
Job No: 218078

Site Area (approximate)

Investigation Area (approximate)

Indicative In-Situ Remediation Area (approximate)

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Figure 6 – Proposed Remediation Plan
65-69 Woodlark Street, Lismore NSW

Client: Living Schools
Project: Soil Delineation Report
Job No: 218078

APPENDIX E

Previous Reports and Laboratory Results

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SOIL CONTAMINATION ASSESSMENT

65-69 Woodlark St, Lismore NSW

Job Number: 218078

For:

Balanced Earth Building

By:

ENV Services

Date:

October 2023

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DOCUMENT CONTROL

Job No:	Job Number: 218078
Client:	Balanced Earth Building
Filename:	218078_Soil Sampling Report 65-69 Woodlark St Lismore

	Name:	**Date:**	**Signature:**
Prepared By:	Kirsten Hartshorne	28/09/2023	
Reviewed By:	Ben Pieterse	03/10/2023	
Approved By:			

Revision:	**Date:**	**Details:**

SCOPE OF ENGAGEMENT AND LIMITATIONS

This report has been prepared by ENV Services at the request of Balanced Earth Building for the purpose of a Soil Contamination Assessment. No other parties may rely on the contents of this report for any purposes except those stated.

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LIST OF ACRONYMS

Below is a list of commonly used acronyms in this report:

COC	Chain of Custody
COPC	Chemical of Potential Concern
EILs	Ecological Investigation Levels
ENV	ENV Services Pty Ltd
ESLs	Ecological Screening Levels
HILs	Health Investigation Levels
HSLs	Health Screening Levels
NEPC	National Environment Protection Council
NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)
NSW EPA	New South Wales Environment Protection Authority
PID	Photo Ionisation Detector
ppm	Parts Per Million (by volume)
QA/QC	Quality Assurance and Quality Control
RPD	Reproducibility Percent Difference

EXECUTIVE SUMMARY

ENV Services Pty Ltd (ENV) has undertaken a Soil Contamination Assessment for 65-69 Woodlark St, Lismore NSW (hereafter referred to as the 'Site'). ENV understands that a Soil Contamination Assessment has been requested to investigate health and safety related to the development of a proposed indoor forest on the site.

The Soil Contamination Assessment included the following components:

- Identification of past and present potential chemicals of potential concern (COPC);
- An inspection of the site and subject area;
- Collection of soil samples from eight discrete sampling locations within the proposed rainforest area on the ground level covering a total area of approximately 100 m^2.
- Assessment of the soil analytical results against relevant Tier 1 investigation levels detailed in the *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999, as amended 2013* (NEPC, 2013); and
- Assessment of the environmental suitability of the site for the proposed land use.

The site is currently undergoing Rectification after flood damage to the buildings. It is understood that previous site usage was retail and an education facility.

A site inspection and soil sampling program were undertaken on 8 August 2023, with visible signs of building materials, concrete and bitumen within surface soils observed. Targeted soil samples were collected from the surface soils of the proposed indoor forest at eight discrete locations.

Laboratory analysis results reported exceedances of the adopted Health-based Investigation Levels (HILs) for the site for Lead and Benzo(a)pyrene TEQ (BAP TEQ) in three soil samples and Total PAHs in one sample. Other analytes were either below the adopted soil criteria or detected at the laboratory limit of reporting (LOR).

Based on the Soil Contamination Assessment findings, further delineation of contaminants is required within the inaccessible areas to develop Remediation Action Plan for the site to facilitate the excavation and disposal of impacted soils and replacement with suitable growing media.

1 INTRODUCTION

ENV Services Pty Ltd was engaged by Balanced Earth Building to complete a Soil Contamination Assessment for a proposed development at 65-69 Woodlark St, Lismore NSW 2480, (Lot 1 DP780375; Lot A DP397258, Lot 1 DP341873, Lot 1 DP341874) (hereafter referred to as the 'Site').

ENV understands that the Soil Contamination Assessment has been requested by Council as part of a Development Application for a proposed education facility with an indoor forest.

This Soil Contamination Assessment has been prepared with reference to the requirements of the NSW EPA (2020) document entitled *Consultants Reporting on Contaminated Land (Contaminated Land Guidelines).*

1.1 Objective

The objective of the Soil Contamination Assessment is to indicate if the potential for contamination to exist at the site as a result of historical or current land uses. Further, the Soil Contamination Assessment aims to determine if further investigation and/or remediation would be required for the site to be considered suitable for the proposed land use as an education facility and indoor forest area.

1.2 Scope of Works

The PSI included the following components:

- A basic desktop review of the site conditions, history and surrounding environment;
- Identification of past and present potentially contaminating activities and chemicals of potential concern (COPC);
- An inspection of the site and adjacent areas of land;
- Development of a preliminary conceptual site model (CSM);
- Collection of soil samples from eight discrete sampling locations within the proposed forest area in the building, with a total area of 430 m^2;
- Assessment of the soil analytical results against relevant Tier 1 investigation levels detailed in the *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999, as amended 2013* (NEPC, 2013); and
- Assessment of the environmental (chemical) suitability of the site as an education facility and indoor forest area.

1.3 Technical and Regulatory Framework

The following technical and regulatory framework has been considered in preparing this PSI:

- *Contaminated Land Management Act 1997 (CLM Act);*
- *Environmental Planning and Assessment Act 1979;*
- *State Environment Planning Policy (Resilience and Hazards) 2021.*
- *Sampling Design Guidelines (NSW EPA, 2022);*

- *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999, as amended 2013* (NEPC, 2013);
- *Consultants Reporting on Contaminated Land (Contaminated Land Guidelines)* (NSW EPA, 2020);
- *Regional Policy for the Management of Contaminated Land* (Northern Rivers Regional Councils, 2007).

2 SITE DESCRIPTION AND CHARACTERISTICS

2.1 Site Identification Details

The site is located within the Lismore CBD precinct. It is understood that the site was previously used as commercial retail and education facility. The building was submerged in the floods that occurred in 2022 and the site is currently undergoing internal flood rectification works.

Table 1 provides an overview of relevant identification details for the site. The site location and sampling plan is depicted in Figure 1, Appendix A.

Table 1: Site Details

Site Address	65-69 Woodlark St Lismore NSW
Real Property Description	Previously a retail centre within building fronting Woodlark St. Educational centre in building fronting Larkin Lane/Carrington St
Site Area	~2,392 m^2
Investigation Area	Ground level, approximately 440 m^2
Height (AHD)	25 m
Site Layout	Two buildings connected with a bridge over Larkin Lane from Level one. Investigation area located on ground floor of north-eastern section of southern building
Local Government Area	Lismore City Council
Land Zoning	3 (a) Business
Proposed Land Use	Educational centre with indoor forest feature

2.2 Topography and Drainage

Topography of the Lismore CBD is generally flat with a gentle slope toward the Wilson River to the west of Woodlark Street. Drainage is to the west to the Wilson River.

Surface soils within the investigation area comprise of surficial sandy clays with various fill materials including glass, bitumen blue metal, bricks and timber.

2.3 Geology and Soils

Soils maps accessed via eSpade indicate that the soils of the Lismore CBD precinct are Leycester le which are light to medium strongly structured clays of the upper horizon and a medium to heavy clay subsoil. Geology is Quaternary alluvial valley in-fill sediments with minor sand and river gravels and weathered basalt in some areas.

2.4 Surface Water Bodies and Flooding

The Wilson River is located 200 m to the west of the site. The site and surrounding areas have been subject to flooding in 1954, 1974, 2017 and 2022 with the 2022 flood events reaching Level 2 ceilings of the building.

2.5 Contaminated Land Record and Record of Notices

The NSW EPA Contaminated Land Record (EPA Notifications) contains a list of sites which have been notified to the NSW EPA under the Contaminated Land Management Act 1997 (CLM Act). Upon receiving the notification, the EPA then assesses the contamination status of the site and decides whether the contamination is significant enough to warrant formal regulation by the EPA in accordance with the provisions of the CLM Act. The NSW EPA Record of Notices contains selected information about sites which have been issued with a Regulatory Notice by the NSW EPA under the CLM Act.

The NSW EPA Contaminated Land Record and Record of Notices were searched on 30th August 2023. One record was returned for the Lismore precinct, Lismore Gasworks located on the corner of John and Keen Streets, approximately 1.5 km to the southwest of the subject site.

2.6 POEO Act Public Register Search

The Protection of the Environment Operations Act 1997 (POEO Act) Public Register contains information about environment protection licences, licence applications, notices issued under the POEO Act, and pollution studies and reduction programs. The POEO Act Public Register was searched on 30th August 2023 with no records identified within a 1 km radius of the site.

2.7 Historic and Surrounding Land Use

Surrounding land usage is commercial. Retail outlets are situated on the east, west and south boundaries of the subject site.

Historical aerial photographs indicate that site usage has been commercial since the date of the earliest accessed aerial photograph in 1958. There is a minor possibility that, prior to development as a commercial precinct, the area was under agricultural usage.

3 CONCEPTUAL SITE MODEL

3.1 Contamination Sources

Historical and current land use of the site includes retail and commercial activities. A machinery workshop is located within the building footprint. The primary source of soil contamination from land usage is lead from painted building surfaces, Organochlorine Pesticides (OCPs) from potential historical site usage as agricultural land, Total Recoverable Hydrocarbons (TRH) and Polycyclic Aromatic Hydrocarbons (PAHs) from oil/fuel storage due to heating and ancillary machinery on site.

Another potential contamination source is contaminated floodwater ingress. Floodwaters are known to transport hydrocarbons and chemicals from compromised fuel storage facilities and chemical storage depots.

3.2 Chemicals of Potential Concern

The chemicals of Potential Concern (COPC) associated with the identified contamination sources include:

- Metals (e.g. lead);
- OCPs;
- PAHs; and
- BTEX/TRH.

3.3 Potentially Affected Environmental Media

Potentially affected environmental media include surface soils within the subject site. While other environmental media may be affected by the contamination sources described above, surface soils are considered the most likely media to be directly impacted by the presence of potential contamination sources. If the surface soils at the site are contaminated, it is possible that also other environmental media have been impacted, which will then require further investigation.

3.4 Potential Migration and Exposure Pathways

Potential migration pathways depend on a number of factors including the chemical properties of the contaminant, soil texture, topography, and hydraulic gradient of shallow groundwater etc.

In consideration of the above, potential migration pathways for identified COPC include:

- Fugitive dusts; and
- Plant uptake and bioaccumulation.

Subsequently, potential exposure pathways include:

- Direct contact (ingestion or dermal) with contaminated environmental media;
- Inhalation of dust;
- Ingestion of food grown in contaminated soils; and

- Direct toxicity for plants and terrestrial ecosystems.

3.5 Potential Receptors of Contamination

Potential receptors of contamination have been identified as:

- Staff and students on-site.
- Visitors to the site.
- Workers planting and maintaining the forest area.
- Terrestrial ecosystems on the site

It is noted that the potential for off-site receptors to be exposed to contamination originating from the site depends on the nature and extent of the contamination, soil properties, local surface water and groundwater hydrology, and distance to the receptors. If contamination is identified on-site, additional investigations may be required to identify and assess the risk to potential off-site receptors.

4 DATA QUALITY OBJECTIVES

4.1 Step 1: State the Problem

ENV understands that Lismore City Council has requested a Soil Contamination Assessment as part of the Development Application documentation to investigate the potential for contaminants on site. The purpose of the Soil Contamination Assessment is to assess the potential for contamination to exist as a result of current or previous land use.

4.2 Step 2: Identify the Decision(s)

The principal decisions (questions) for this investigation are:

- What are the current and previous land uses at the site and is there a potential for contamination to exist as a result of associated land use activities?
- What are the COPC associated with current and historical land uses?
- Do the concentrations of COPC exceed relevant assessment criteria for the protection of potential receptors?
- Is the investigation area suitable for growing trees and forest vegetation from a contamination perspective, or is further investigation and/or remediation required?

4.3 Step 3: Inputs into the Decision(s)

To address the decisions in Step 2, the following activities were completed:

- An inspection of the site and surrounding areas; and
- Soil sampling and laboratory analysis of COPC.

4.4 Step 4: Define the Study Boundaries

The study boundaries comprised an area of approximately 440m^2 within the building described as 65-69 Woodlark St Lismore NSW. This area is proposed as an indoor rainforest area, situated within the property boundaries of the Site, with the investigation area of the soil sampling program on the Ground Floor of the building to the south of Larkin Lane Figure 2, Appendix A.

The site inspection and soil sampling program were undertaken over the course of one day, and therefore provides a snapshot only of the current soil conditions.

The investigation was limited to the surface soils of 100m^2 of the 440m^2 study area due to access constraints within the proposed forest footprint. Surface soils are considered the most likely to be impacted by the contamination caused by historical activities at the Site. Deeper soils and other media on-site, including groundwater and soil vapour, have not been included in this study. Should contamination be identified in surface soils, further investigation may be required to assess the extent and other impacted media both on and off-site.

4.5 Step 5: Develop the Analytical Approach (Decision Rule)

The number of discrete soil sampling locations required for site characterisation was determined in accordance with the *Contaminated land sampling design guidelines part 1 - application* (NSW Environment Protection Authority, 2022). In consideration of the limited opportunity for soil access, and due to a relatively small area and access issues, a semi-grid-based sampling approach was adopted where feasible. The sampling regime included the collection of soil samples from eight discrete locations. A visual inspection was undertaken to identify areas with visual and olfactory signs of contamination. Soil samples were then collected from the surface soils (0 - 0.10 m below ground level [BGL]) of the assessment area (Figure 2, Appendix A). ENV consider this sampling approach and adopted sampling density sufficient to characterise the approximately 100 m^2 of investigation area.

Samples were sent to a NATA accredited laboratory for analysis of COPC identified to be a risk due to past land use of the Site and contamination sources from neighbouring properties. Laboratory analysis results were then compared to residential investigation levels presented in the *NEPM* (NEPC, 2013). To characterise the site, the maximum observed contaminant concentration of each COPC was compared to the adopted assessment criteria. If concentrations of all analysed COPC are reported at concentrations above the adopted criteria within any sample, the client will be notified. In this case, further investigation will be recommended to better characterise the potential risk to human health and the environment and determine whether remediation measures are required to make the Site suitable.

The precision (reproducibility), accuracy, representativeness and overall reliability of the data sets were assessed using the indicators presented in Table 2. This included the collection of appropriate quality assurance (QA) samples during soil sampling activities, and internal QA testing conducted by the analytical laboratories. The QA sampling regime was adopted in accordance with the *NEPM* (NEPC, 2013) and Australian Standard (1999 and 2005).

Table 2: Summary of QA Sample Parameters for Assessing Data Reliability

QA Sample Type	Media	Frequency	Acceptable Range of Results
Field Samples			
Intra-laboratory duplicate	Soil	1 per 20 primary samples	Relative percent difference (RPD) ≤50%
Inter-laboratory duplicate	Soil	1 per 20 primary samples	RPD ≤50%
Laboratory Samples			
Internal duplicate	Soil	1 per 10 primary samples	Laboratory specified
Matrix Spike	Soil	1 per sampling batch (20 samples)	Laboratory specified
Surrogate Spike	Soil	1 per sampling batch (20 samples)	Laboratory specified
Control Sample	Soil	1 per sampling batch (20 samples)	Laboratory specified
Laboratory Blank	Soil	1 per sampling batch (20 samples)	Results <LOR

4.6 Step 6: Specify the Performance or Acceptance Criteria

In consideration of the sites proposed usage as an education facility with forested area, the most appropriate land use criteria for the site is deemed to be **HIL A**, Standard residential.

Assessment criteria were adopted from the Tier 1 investigation levels outlined in *Schedule B(1) Guideline on Investigation Levels For Soil and Groundwater* (NEPC, 2013). Although the site is in a commercial zone, the most appropriate criteria for soils with gardens with accessible soils and includes children's day care centres, preschools and primary schools. The criteria here is the most conservative criteria available for the Site. Criteria used included:

- Health screening levels (HSLs) for high density residential in clay soils from 0 - <1 m.
- Health investigation levels (HILs): for soil in residential A, soils with gardens with accessible soils.

Ecological criteria were not considered appropriate for the site as although the area is proposed to be a rainforest/food forest, due to its indoor location no higher order species is expected to access the forest.

Tier 1 investigation levels adopted for this contamination assessment are summarised below in Table 3. The criteria are also displayed above soil sample results in Table 1, Appendix C. Furthermore, the investigation and screening levels contained in NEPC (2013) have been established through toxicity tests and field and laboratory experiments. In some cases, insufficient data currently exist to provide thresholds. In these cases, the laboratory analysis data is simply used as an indicator of the presence and extent of contamination.

Table 3: Adopted Assessment Criteria (HSLs/HILs)

Chemical	Unit	HSL	HIL
Metals and Inorganics			
Arsenic (As)	mg/kg	-	100
Cadmium (Cd)	mg/kg	-	20
Copper (Cu)	mg/kg	-	6000
Lead (Pb)	mg/kg	-	300
Mercury (Hg) inorganic	mg/kg	-	40
Nickel (Ni)	mg/kg	-	400
Zinc (Zn)	mg/kg	-	7400
Organochlorine Pesticides			
DDT	mg/kg	-	-
DDT+DDE+DDD	mg/kg	-	240
Aldrin + Dieldrin	mg/kg	-	6
Chlordane	mg/kg	-	50
Endrin	mg/kg	-	10
Heptachlor	mg/kg	-	6

Chemical	Unit	HSL	HIL
Methoxychlor	mg/kg	-	300
Toxaphene	mg/kg	-	20
Halogenated benzenes			
Hexachlorobenzene	mg/kg	-	10
BTEX			
Naphthalene (VOC)	mg/kg	5	-
Benzene	mg/kg	0.7	-
Toluene	mg/kg	480	-
Ethylbenzene	mg/kg	-	-
Xylene Total	mg/kg	110	
TRH			
C6-C10 (F1 minus BTEX)	mg/kg	50	-
>C10-C16 Fraction	mg/kg	-	-
F2 (>C10-C16 minus Naphthalene)	mg/kg	280	-
>C16-C34 Fraction (F3)	mg/kg	-	-
>C34-C40 Fraction (F4)	mg/kg		
PAH			
Benzo(a) pyrene	mg/kg	-	-
Naphthalene	mg/kg	5	-
Benzo(a)pyrene TEQ calc (Half)	mg/kg	-	3
Benzo(a)pyrene TEQ (LOR)	mg/kg	-	3
Benzo(a)pyrene TEQ calc (Zero)	mg/kg	-	3
Total PAHs	mg/kg	-	300

4.7 Step 7: Optimise the Design for Obtaining Data

The sampling regime was designed to collect soil data from surface soils within the investigation area and with reference to the proposed land use and environmental setting of the site. The design incorporated guidance and requirements presented in NEPC (2013) and Australian Standard (2005), as well as other current industry standards relating to the objectives of the assessment. To optimise the design of the investigation, the sampling and analytical program was devised to specifically target information required to meet the site soil investigation objectives.

5 SITE INVESTIGATION METHODOLOGY

5.1 Site Inspection Overview

A site inspection was completed concurrently with the soil sampling program on 8th August 2023. The aim of the site inspection was to assess the current condition of the site, record any visible or olfactory signs of contamination, and identify potential contamination sources not identified by the desktop review.

5.2 Soil Sampling and Analysis Plan

The soil sampling program comprised the collection of soil samples from the upper soil stratum (0 – 0.10 m BGL) at eight discrete locations within the investigation area. Sampling locations are depicted in Figure 2, Appendix A. The soil sampling methodology is summarised in Table 4. All works were undertaken in accordance with the site-specific and task-relevant safe work method statement (SWMS) developed for the project.

Table 4: Soil Sampling Methodology

Activity	Details
Sampling	• Soil samples were collected from eight discrete locations established based on a gridded sampling approach where practicable within 100m^2 of the investigation area. • At each discrete sampling location, soil was loosened with a shovel and samples collected using a fresh pair of disposable nitrile gloves. Organic matter, gravels and building materials were removed from the sample as much as practically possible prior to collection.
Laboratory Analysis	• All primary and duplicate samples were analysed for identified COPC.
Sample Preservation and Transport	• Samples were placed in laboratory-supplied sample jars, with no headspace. • Each sample was labelled with the project number, sampling date and unique sample identifier, and immediately placed into a chilled esky with ice, pending dispatch to the laboratory. • Samples were transported to a laboratory accredited by the National Association of Testing Authorities (NATA) for the required analysis, and with accompanying chain of custody (COC) documentation.
Decontamination Procedure	• Any reusable equipment was cleaned between sampling locations using a triple wash procedure. This involved preliminary washing with potable water, further washing with phosphate-free detergent (Decon 90), and final rinsing in clean, de-ionised water.

5.3 Justification of Sampling Design and Analysis Plan

Justification for the sampling design and analysis plan is as follows:

- Due to the relatively small size of the investigation area, ENV has adopted a gridded sampling approach including the collection of soil samples from eight discrete locations.
- A visual inspection was undertaken to identify areas with visual and olfactory signs of contamination. Soil samples were then collected from the upper soil stratum (0-0.1 m below ground level [BGL]) within accessible soils in the assessment area.
- COPC include contaminants that are persistent in the environment; and are suspected as having been used historically within and near to the Site for the following purposes:
    - Application of pesticides and fertilisers (i.e., OCPs, metals).
    - Historical application of lead (Pb) based paints to building structures and machinery.
    - Chemicals associated with crude oil or petroleum (BTEX, TRH, PAHs).

6 RESULTS

6.1 Site Inspection

The site is currently undergoing internal flood rectification works. The floor has been removed in a section of the ground floor building area to the south of Larkin Lane. It is understood that this area forms part of the proposed forest area. A machinery workshop is located to the south of the proposed forest area.

Visible signs of contamination in the form of bitumen type materials were observed during the site inspection and soil sampling program.

Photographs taken during the site inspection and soil sampling activities are provided in Appendix B.

6.2 Laboratory Analysis Results

Laboratory analysis results for soil samples are tabulated and provided in Appendix C, along with the laboratory issued reports and certificates.

Exceedances of the adopted HILs occurred for Lead and Benzo(a)pyrene TEQ in three samples, including the two QA samples. One sample exceeded adopted HILs for Total PAHs. The remaining samples were below the adopted soil criteria or below the level of reporting (LOR).

The 95% Upper Confidence Limit (UCL) of the mean is used to estimate the true average of the underlying population, however for very small sample sizes, the 95% UCL has a high degree of uncertainty. The 95% UCL for Lead, BAP, Benzo(a)pyrene TEQ and Total PAHs exceeded the HILs for these contaminants.

6.3 QA/QC Results

Quality assurance and quality control (QA/QC) involved an assessment of the completeness, comparability, representativeness, precision and accuracy of the investigation and collected data. QA/QC indicators and results are presented in Table 5.

Table 5: Summary of QA/QC Indicators and Results

QA/QC Indicator	Compliance	Details
Details of Sampling Team	Yes	Field sampling was undertaken by an ENV appropriately qualified Environmental Scientist, Kirsten Hartshorne.
Sampling Plan Adhered To	Yes	All planned samples were collected and hence a complete dataset obtained.
Decontamination of Equipment	Yes	Reusable equipment was cleaned between sampling locations using a triple wash procedure.
Sample Collection	Yes	Laboratory supplied jars used (no headspace). Collected samples placed in cooler box with ice. Each sample labelled with a unique sample ID. Samples collected in accordance with the methodology detailed in Section 5.2.
Chain of Custody	Yes	COC was completed with full and demonstrable delivery of samples. COC documentation is presented in Appendix C.
Holding Times	Yes	Samples analysed within the laboratory specified holding times.
Sufficient Duplicates Analysed	Yes	Field duplicates (inter- and intra-laboratory) collected in accordance with NEPC (2013), with a ratio exceeding 2 duplicates per 20 primary samples. Field duplicates were collected at sampling location SS02.
Field Duplicate Results – Relative Percentage Difference (RPD)	Yes	RPD calculated between the primary sample and each of the corresponding duplicates. The calculated RPDs are tabulated and presented in Appendix D. Calculated RPDs were above the threshold of ≤ 50% however this can be attributed to the high heterogeneity and disturbance of the soils and not an indication of laboratory practices.
Analyses NATA accredited	Yes	Samples analysed by Eurofins in Sydney, which is NATA accredited for the analyses required. Intra-laboratory sample analysed by Envirolab a NATA accredited laboratory.
Laboratory Internal QC	Yes	Satisfactory internal quality control data reported. Analytical methods used are presented in the Laboratory Reports, Appendix C.

6.4 Summary of Data Usability

On the basis of the calculated RPDs and other internal quality control data reported by the laboratories (Envirolab and Eurofins), the reproducibility, accuracy and representativeness of the analytical results is considered suitable to meet the objectives of this assessment, and to provide sufficient confidence in the primary dataset for interpretative purposes. N.B. no data has been excluded from the soil data sets for interpretation.

7 DISCUSSION AND CONCLUSION

The Site and surrounding properties have been used for retail and commercial purposes historically and up to present. Potential sources of contamination primarily include the use of pesticides and fertilisers in historic agricultural activity, lead contamination from lead-based paints applied within the building, hydrocarbon contamination from oil and fuel storage, and metals that may have accumulated due to storage of machinery and ancillary equipment. As such, identified COPC included organochlorine pesticides, metals (e.g., arsenic, lead), and petroleum compounds.

Balanced Earth Building engaged ENV Services to carry out a site soil assessment in relation to the potential development of a forest area including food trees within the building on the Site. Potentially contaminated environmental media of interest were deemed to primarily comprise surface soils in the area where the forest will be located (the Investigation Area).

A visual site inspection and targeted soil sampling program were undertaken on 8th August, 2023 with visible signs of contamination in the form of fill material including bitumen and building materials were observed. Soil samples were collected from the upper soil stratum (0 to 0.1 mBGL) at eight discrete locations.

Laboratory analysis results reported concentrations of lead, BAP, TRH and Total PAHs above assessment criteria levels. No OCPs were detected. Subsequently, the maximum reported COPC concentrations in four samples at were above the adopted assessment criteria which incorporated HIL, HSLs and ESLs presented in the *NEPM* (NEPC, 2013).

Based on the Soil Contamination Assessment findings, further delineation of contaminants is required within the inaccessible areas of the proposed rainforest area to develop a Remediation Action Plan for the site to facilitate the excavation and disposal of impacted soils and replacement with suitable growing media.

8 REFERENCES

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APPENDIX A

Figures

Appendix A Figures

Site boundary

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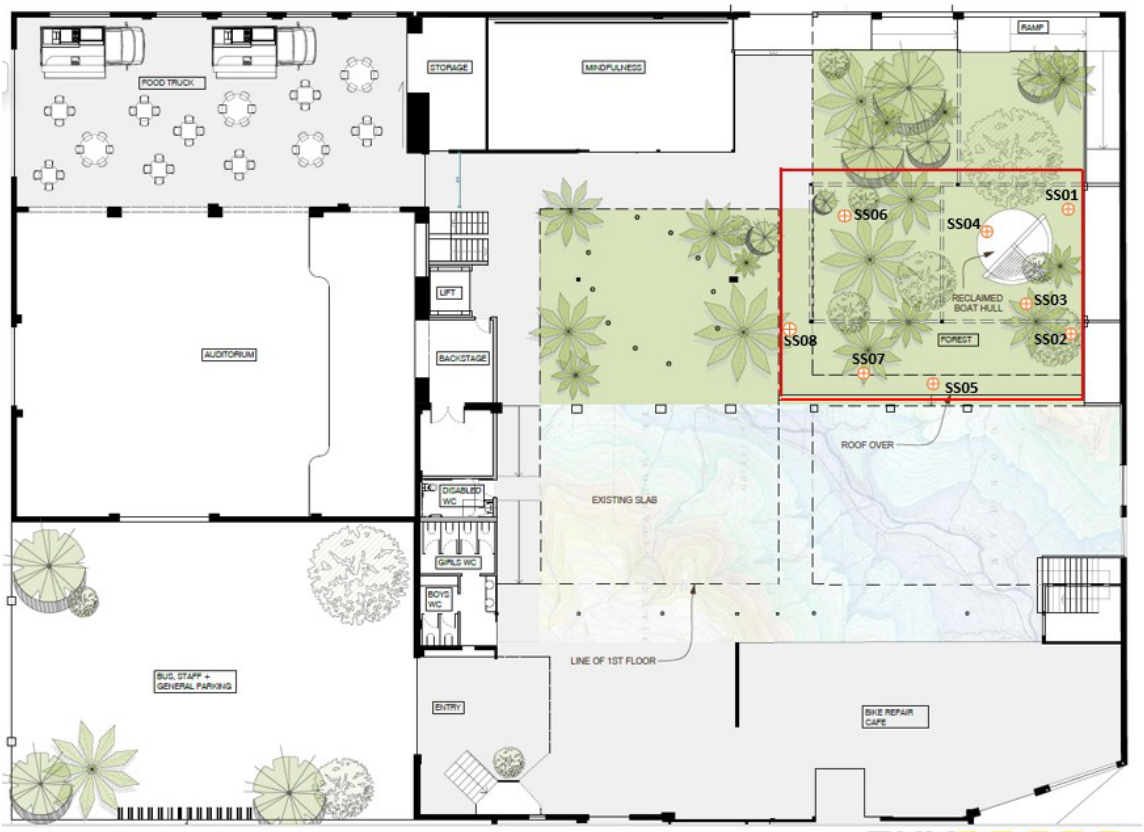
Figure 1 – Site Location
65-69 Woodlark St Lismore NSW 2480

Map By ENV Solutions, image from sixmaps (2023)

Project: 218078 Soil Assessment
Client: Balanced Earth Building



Map By ENV Solutions, image from sixmaps (2023)

Figure 2 – Soil sampling locations
65-69 Woodlark Street NSW 2480

Project: 218078 Soil Assessment
Client: Balanced Earth Building

APPENDIX B

Laboratory Results and Documentation

Table 1 - Laboratory Analysis Results: XXXX Samples

RESULTS TABLES

Lab Report Number	Field ID	Date	Depth	Naphthalene (VOC) (BTEX)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 Fraction (TRH)	F1 (C6-C10 minus BTEX)	>C10-C16 Fraction	F2 (>C10-C16 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)	Moisture Content (Inorganics)	Moisture Content (dried @ 103°C)	Hexachlorobenzene (Halogenated Benzenes)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	mg/kg
EQL				0.5	0.1	0.1	0.1	0.2	0.1	0.3	20	20	50	50	100	100	50	0.1	1	0.05
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand				3	0.5 | 0.5 | 0.5 | 0.5	160 | 220 | 310 | 540	55			40 | 60 | 95 | 170		45 | 70 | 110 | 200		110 | 240 | 440						
NEPM 2013 Table 1A(1) HILs Res A Soil																				10
1018460	SS01	08 Aug 2023																	30	<0.5
1018460	SS02	08 Aug 2023		<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	140	<100	140		16	<0.5
1018460	SS03	08 Aug 2023																	21	<0.5
1018460	SS04	08 Aug 2023																	13	<0.5
1018460	SS05	08 Aug 2023		<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	82	82	2,200	310	2,592		18	<0.5
1018460	SS07	08 Aug 2023																	9.2	<0.5
1018460	SS08	08 Aug 2023																	12	<0.5
1018460	QA1	08 Aug 2023		<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	250	<100	250		20	<0.5
331648	QA2	08 Aug 2023		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	320	<100	320	24		<0.1
Statistics																				
Maximum Concentration				<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	82	82	2,200	310	2,592	24	30	<0.5

Field ID	Arsenic (Metals)	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	2	0.4	1	1	1	0.1	1	1
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand								
NEPM 2013 Table 1A(1) HILs Res A Soil	100	20		6,000	300	40	400	7,400
SS01	12	0.5	36	29	300	0.8	23	590
SS02	2.7	<0.4	24	17	120	0.3	21	290
SS03	2.1	0.7	9.7	24	760	0.1	11	1,600
SS04	18	0.6	22	13	120	<0.1	19	220
SS05	4.5	0.5	17	31	180	0.2	18	280
SS07	<2	0.6	18	22	150	<0.1	17	240
SS08	3.1	0.8	35	25	420	0.2	42	1,200
QA1	3.0	0.4	23	21	110	0.2	21	360
QA2	<4	<0.4	28	29	410	0.3	21	420
Maximum Concentration	18	0.8	36	31	760	0.8	42	1,600

Field ID	Organochlorine pesticides EPAVic (Organochlorine Pesticides)	Other organochlorine pesticides EPAVic	4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Toxaphene
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.5
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																										
NEPM 2013 Table 1A(1) HILs Res A Soil						6		50						240					10				6		300	20
SS01	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS02	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS03	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS04	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS05	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS07	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS08	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
QA1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
QA2			<0.1	<0.1	<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	
Maximum Concentration	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10

Field ID	Benzo(b+j+k)fluoranthene (PAH)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)	PAHs (Sum of positives)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.2	0.1	0.1	0.1	0.1	0.05	0.5	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.5	0.5	0.05
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand															3							
NEPM 2013 Table 1A(1) HILs Res A Soil																		3	3	3	300	
SS01																						
SS02		<0.5	<0.5	1.0	1.0	<0.5	0.6	0.6	0.8	1.9	<0.5	2.5	<0.5	<0.5	<0.5	2.0	2.4	0.8	1.3	<0.5	13	
SS03																						
SS04																						
SS05		2.1	6.5	22	38	35	23	21	29	49	5.5	85	3.5	16	1.7	74	88	52	52	52	500	
SS07																						
SS08																						
QA1		<0.5	0.5	4.5	3.8	3.0	2.8	1.8	3.5	6.1	<0.5	9.6	<0.5	1.1	<0.5	6.1	10	4.4	4.7	4.2	53	
QA2	23	0.3	1.4	7.1	14	9.2		3.0		10	0.9	23	0.8	2.4	0.4	25	25	14	14	14		150
Maximum Concentration	23	2.1	6.5	22	38	35	23	21	29	49	5.5	85	3.5	16	1.7	74	88	52	52	52	500	150

Field ID	Mirex (Pesticides)	C6-C9 Fraction (TPH)	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.1	20	20	50	50	50
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand						
NEPM 2013 Table 1A(1) HILs Res A Soil	10					
SS01						
SS02		<20	<20	89	67	156
SS03						
SS04						
SS05		<20	29	1,700	610	2,339
SS07						
SS08						
QA1		<20	<20	190	90	280
QA2	<0.1	<25	<50	230	130	360
Maximum Concentration	<0.1	<25	<50	1,700	610	2,339

Environmental Standards

2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand

2013, NEPM 2013 Table 1A(1) HILs Res A Soil

QA/QC TABLES

Lab Report Number	Field ID	Date	Matrix Type	Naphthalene (VOC) (BTEX)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 Fraction (TRH)	F1 (C6-C10 minus BTEX)	>C10-C16 Fraction	F2 (>C10-C16 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)	Moisture Content (Inorganics)	Moisture Content (dried @ 103°C)	Hexachlorobenzene (Halogenated Benzenes)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	mg/kg
EQL				0.5	0.1	0.1	0.1	0.2	0.1	0.3	20	20	50	50	100	100	50	0.1	1	0.05
1018460	SS02	08 Aug 2023	Soil	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	140	<100	140		16	<0.5
1018460	QA1	08 Aug 2023	Soil	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	250	<100	250		20	<0.5
RPD				0	0	0	0	0	0	0	0	0	0	0	56	0	56		22	0
1018460	SS02	08 Aug 2023	Soil	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	140	<100	140		16	<0.5
331648	QA2	08 Aug 2023	Soil	<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	320	<100	320	24		<0.1
RPD				0	0	0	0	0	0	0	0	0	0	0	78	0	78			0

Field ID	Arsenic (Metals)	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	2	0.4	1	1	1	0.1	1	1
SS02	2.7	<0.4	24	17	120	0.3	21	290
QA1	3.0	0.4	23	21	110	0.2	21	360
RPD	11	0	4	21	9	40	0	22
SS02	2.7	<0.4	24	17	120	0.3	21	290
QA2	<4	<0.4	28	29	410	0.3	21	420
RPD	0	0	15	52	109	0	0	37

Field ID	Organochlorine pesticides EPAVic (Organochlorine Pesticides)	Other organochlorine pesticides EPAVic	4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Toxaphene
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.5
SS02	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
QA1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
RPD	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SS02	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
QA2			<0.1	<0.1	<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	
RPD			0	0	0		0				0	0	0	0	0	0	0	0	0	0		0	0	0	0	

Field ID	Benzo(b+j+k)fluoranthene (PAH)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)	PAHs (Sum of positives)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.2	0.1	0.1	0.1	0.1	0.05	0.5	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.5	0.5	0.05
SS02		<0.5	<0.5	1.0	1.0	<0.5	0.6	0.6	0.8	1.9	<0.5	2.5	<0.5	<0.5	<0.5	2.0	2.4	0.8	1.3	<0.5	13	
QA1		<0.5	0.5	4.5	3.8	3.0	2.8	1.8	3.5	6.1	<0.5	9.6	<0.5	1.1	<0.5	6.1	10	4.4	4.7	4.2	53	
RPD		0	0	127	117	143	129	100	126	105	0	117	0	75	0	101	123	138	113	157	121	
SS02		<0.5	<0.5	1.0	1.0	<0.5	0.6	0.6	0.8	1.9	<0.5	2.5	<0.5	<0.5	<0.5	2.0	2.4	0.8	1.3	<0.5	13	
QA2	23	0.3	1.4	7.1	14	9.2		3.0		10	0.9	23	0.8	2.4	0.4	25	25	14	14	14		150
RPD		0	95	151	173	179		133		136	57	161	46	131	0	170	165	178	166	186		

Field ID	Mirex (Pesticides)	C6-C9 Fraction (TPH)	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.1	20	20	50	50	50
SS02		<20	<20	89	67	156
QA1		<20	<20	190	90	280
RPD		0	0	72	29	57
SS02		<20	<20	89	67	156
QA2	<0.1	<25	<50	230	130	360
RPD		0	0	88	64	79

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 81 (1 - 10 x EQL); 50 (10 - 30 x EQL); 30 (> 30 x EQL))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

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Attention: **Kirsten Hartshorne**

Report **1018460-S**
Project name 65 WOODLARK ST SOIL SAMPLING
Project ID 218078
Received Date Aug 18, 2023

Client Sample ID			**SS01**	**SS02**	**SS03**	**SS04**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S23-Au0049153**	**S23-Au0049154**	**S23-Au0049155**	**S23-Au0049156**
Date Sampled			**Aug 08, 2023**	**Aug 08, 2023**	**Aug 08, 2023**	**Aug 08, 2023**
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 1	< 1	< 1	< 1
4.4'-DDD	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
4.4'-DDE	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
4.4'-DDT	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
a-HCH	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Aldrin	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
b-HCH	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
d-HCH	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Dieldrin	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endosulfan I	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endosulfan II	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endosulfan sulphate	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endrin	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endrin aldehyde	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endrin ketone	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
g-HCH (Lindane)	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Heptachlor	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Heptachlor epoxide	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Hexachlorobenzene	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Methoxychlor	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Toxaphene	0.5	mg/kg	< 10	< 10	< 10	< 10
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 1	< 1	< 1	< 1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 1	< 1	< 1	< 1
Dibutylchlorendate (surr.)	1	%	98	105	86	86
Tetrachloro-m-xylene (surr.)	1	%	84	87	93	81
Heavy Metals						
Arsenic	2	mg/kg	12	2.7	2.1	18
Cadmium	0.4	mg/kg	0.5	< 0.4	0.7	0.6
Chromium	5	mg/kg	36	24	9.7	22
Copper	5	mg/kg	29	17	24	13
Lead	5	mg/kg	300	120	760	120
Mercury	0.1	mg/kg	0.8	0.3	0.1	< 0.1
Nickel	5	mg/kg	23	21	11	19
Zinc	5	mg/kg	590	290	1600	220

Client Sample ID			SS01	SS02	SS03	SS04
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S23-Au0049153	S23-Au0049154	S23-Au0049155	S23-Au0049156
Date Sampled			Aug 08, 2023	Aug 08, 2023	Aug 08, 2023	Aug 08, 2023
Test/Reference	LOR	Unit				
Sample Properties						
% Moisture	1	%	30	16	21	13
Total Recoverable Hydrocarbons						
TRH C6-C9	20	mg/kg	-	< 20	-	-
TRH C10-C14	20	mg/kg	-	< 20	-	-
TRH C15-C28	50	mg/kg	-	89	-	-
TRH C29-C36	50	mg/kg	-	67	-	-
TRH C10-C36 (Total)	50	mg/kg	-	156	-	-
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	-	140	-	-
TRH >C34-C40	100	mg/kg	-	< 100	-	-
TRH >C10-C40 (total)*	100	mg/kg	-	140	-	-
BTEX						
Benzene	0.1	mg/kg	-	< 0.1	-	-
Toluene	0.1	mg/kg	-	< 0.1	-	-
Ethylbenzene	0.1	mg/kg	-	< 0.1	-	-
m&p-Xylenes	0.2	mg/kg	-	< 0.2	-	-
o-Xylene	0.1	mg/kg	-	< 0.1	-	-
Xylenes - Total*	0.3	mg/kg	-	< 0.3	-	-
4-Bromofluorobenzene (surr.)	1	%	-	INT	-	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	-	< 0.5	-	-
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	-	< 0.5	-	-
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	-	0.8	-	-
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	-	1.3	-	-
Acenaphthene	0.5	mg/kg	-	< 0.5	-	-
Acenaphthylene	0.5	mg/kg	-	< 0.5	-	-
Anthracene	0.5	mg/kg	-	1.0	-	-
Benz(a)anthracene	0.5	mg/kg	-	1.0	-	-
Benzo(a)pyrene	0.5	mg/kg	-	< 0.5	-	-
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	-	0.6	-	-
Benzo(g.h.i)perylene	0.5	mg/kg	-	0.6	-	-
Benzo(k)fluoranthene	0.5	mg/kg	-	0.8	-	-
Chrysene	0.5	mg/kg	-	1.9	-	-
Dibenz(a.h)anthracene	0.5	mg/kg	-	< 0.5	-	-
Fluoranthene	0.5	mg/kg	-	2.5	-	-
Fluorene	0.5	mg/kg	-	< 0.5	-	-
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	-	< 0.5	-	-
Naphthalene	0.5	mg/kg	-	< 0.5	-	-
Phenanthrene	0.5	mg/kg	-	2.0	-	-
Pyrene	0.5	mg/kg	-	2.4	-	-
Total PAH*	0.5	mg/kg	-	13	-	-
2-Fluorobiphenyl (surr.)	1	%	-	90	-	-
p-Terphenyl-d14 (surr.)	1	%	-	85	-	-

Client Sample ID			SS05	SS07	SS08	QA1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S23-Au0049157	S23-Au0049158	S23-Au0049159	S23-Au0049160
Date Sampled			Aug 08, 2023	Aug 08, 2023	Aug 08, 2023	Aug 08, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 1	< 1	< 1	< 1
4.4'-DDD	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
4.4'-DDE	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
4.4'-DDT	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
a-HCH	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Aldrin	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
b-HCH	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
d-HCH	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Dieldrin	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endosulfan I	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endosulfan II	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endosulfan sulphate	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endrin	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endrin aldehyde	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Endrin ketone	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
g-HCH (Lindane)	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Heptachlor	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Heptachlor epoxide	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Hexachlorobenzene	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Methoxychlor	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Toxaphene	0.5	mg/kg	< 10	< 10	< 10	< 10
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 1	< 1	< 1	< 1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 1	< 1	< 1	< 1
Dibutylchlorendate (surr.)	1	%	89	129	105	108
Tetrachloro-m-xylene (surr.)	1	%	67	94	95	89
Heavy Metals						
Arsenic	2	mg/kg	4.5	< 2	3.1	3.0
Cadmium	0.4	mg/kg	0.5	0.6	0.8	0.4
Chromium	5	mg/kg	17	18	35	23
Copper	5	mg/kg	31	22	25	21
Lead	5	mg/kg	180	150	420	110
Mercury	0.1	mg/kg	0.2	< 0.1	0.2	0.2
Nickel	5	mg/kg	18	17	42	21
Zinc	5	mg/kg	280	240	1200	360
Sample Properties						
% Moisture	1	%	18	9.2	12	20
Total Recoverable Hydrocarbons						
TRH C6-C9	20	mg/kg	< 20	-	-	< 20
TRH C10-C14	20	mg/kg	29	-	-	< 20
TRH C15-C28	50	mg/kg	1700	-	-	190
TRH C29-C36	50	mg/kg	610	-	-	90
TRH C10-C36 (Total)	50	mg/kg	2339	-	-	280
TRH C6-C10	20	mg/kg	< 20	-	-	< 20
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	-	-	< 20
TRH >C10-C16	50	mg/kg	82	-	-	< 50
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	82	-	-	< 50
TRH >C16-C34	100	mg/kg	2200	-	-	250

Client Sample ID			SS05	SS07	SS08	QA1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S23-Au0049157	S23-Au0049158	S23-Au0049159	S23-Au0049160
Date Sampled			Aug 08, 2023	Aug 08, 2023	Aug 08, 2023	Aug 08, 2023
Test/Reference	LOR	Unit				
Total Recoverable Hydrocarbons						
TRH >C34-C40	100	mg/kg	310	-	-	< 100
TRH >C10-C40 (total)*	100	mg/kg	2592	-	-	250
BTEX						
Benzene	0.1	mg/kg	< 0.1	-	-	< 0.1
Toluene	0.1	mg/kg	< 0.1	-	-	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	-	-	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	-	-	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	-	-	< 0.1
Xylenes - Total*	0.3	mg/kg	< 0.3	-	-	< 0.3
4-Bromofluorobenzene (surr.)	1	%	INT	-	-	81
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.5	mg/kg	< 0.5	-	-	< 0.5
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	52	-	-	4.2
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	52	-	-	4.4
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	52	-	-	4.7
Acenaphthene	0.5	mg/kg	2.1	-	-	< 0.5
Acenaphthylene	0.5	mg/kg	6.5	-	-	0.5
Anthracene	0.5	mg/kg	22	-	-	4.5
Benz(a)anthracene	0.5	mg/kg	38	-	-	3.8
Benzo(a)pyrene	0.5	mg/kg	35	-	-	3.0
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	23	-	-	2.8
Benzo(g.h.i)perylene	0.5	mg/kg	21	-	-	1.8
Benzo(k)fluoranthene	0.5	mg/kg	29	-	-	3.5
Chrysene	0.5	mg/kg	49	-	-	6.1
Dibenz(a.h)anthracene	0.5	mg/kg	5.5	-	-	< 0.5
Fluoranthene	0.5	mg/kg	85	-	-	9.6
Fluorene	0.5	mg/kg	3.5	-	-	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	16	-	-	1.1
Naphthalene	0.5	mg/kg	1.7	-	-	< 0.5
Phenanthrene	0.5	mg/kg	74	-	-	6.1
Pyrene	0.5	mg/kg	88	-	-	10
Total PAH*	0.5	mg/kg	500	-	-	53
2-Fluorobiphenyl (surr.)	1	%	79	-	-	94
p-Terphenyl-d14 (surr.)	1	%	71	-	-	92

Sample History

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

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Organochlorine Pesticides	Sydney	Aug 21, 2023	14 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Metals M8	Sydney	Aug 21, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Aug 21, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Aug 21, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Aug 21, 2023	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Sydney	Aug 21, 2023	14 Days
- Method: LTM-ORG-2010 BTEX and Volatile TRH			
Polycyclic Aromatic Hydrocarbons	Sydney	Aug 21, 2023	14 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
% Moisture	Sydney	Aug 19, 2023	14 Days
- Method: LTM-GEN-7080 Moisture			

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ABN: 50 005 085 521

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NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

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Company Name: ENV Services Pty Ltd
Address: 313 River Street
Ballina
NSW 2478

Project Name: 65 WOODLARK ST SOIL SAMPLING
Project ID: 218078

Order No.:
Report #: 1018460
Phone: 1300 861 325
Fax:

Received: Aug 18, 2023 9:35 AM
Due: Aug 25, 2023
Priority: 5 Day
Contact Name: Kirsten Hartshorne

Eurofins Analytical Services Manager : Bonnie Pu

Sample Detail						CANCELLED	Organochlorine Pesticides	Metals M8	Moisture Set	Eurofins Suite B7
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	X	X
External Laboratory										
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**					
1	SS01	Aug 08, 2023		Soil	S23-Au0049153		X	X	X	
2	SS02	Aug 08, 2023		Soil	S23-Au0049154		X		X	X
3	SS03	Aug 08, 2023		Soil	S23-Au0049155		X	X	X	
4	SS04	Aug 08, 2023		Soil	S23-Au0049156		X	X	X	
5	SS05	Aug 08, 2023		Soil	S23-Au0049157		X		X	X
6	SS07	Aug 08, 2023		Soil	S23-Au0049158		X	X	X	
7	SS08	Aug 08, 2023		Soil	S23-Au0049159		X	X	X	
8	QA1	Aug 08, 2023		Soil	S23-Au0049160		X		X	X
9	SS06	Aug 08, 2023		Soil	S23-Au0049161	X				
10	QA2	Aug 08, 2023		Soil	S23-Au0049162	X				
Test Counts						2	8	5	8	3

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Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. 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 SRA.

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.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
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.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

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%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

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. 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.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/kg	< 0.1			0.1	Pass	
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-HCH	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-HCH	mg/kg	< 0.05			0.05	Pass	
d-HCH	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-HCH (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	
Methoxychlor	mg/kg	< 0.05			0.05	Pass	
Toxaphene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
Method Blank							
Total Recoverable Hydrocarbons							
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	
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							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total*	mg/kg	< 0.3			0.3	Pass	
Method Blank							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
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	
LCS - % Recovery							
Organochlorine Pesticides							
Chlordanes - Total	%	75			70-130	Pass	
4.4'-DDD	%	80			70-130	Pass	
4.4'-DDE	%	86			70-130	Pass	
4.4'-DDT	%	100			70-130	Pass	
a-HCH	%	87			70-130	Pass	
Aldrin	%	78			70-130	Pass	
b-HCH	%	91			70-130	Pass	
d-HCH	%	94			70-130	Pass	
Dieldrin	%	82			70-130	Pass	
Endosulfan I	%	95			70-130	Pass	
Endosulfan II	%	89			70-130	Pass	
Endosulfan sulphate	%	96			70-130	Pass	
Endrin	%	92			70-130	Pass	
Endrin aldehyde	%	77			70-130	Pass	
Endrin ketone	%	97			70-130	Pass	
g-HCH (Lindane)	%	100			70-130	Pass	
Heptachlor	%	81			70-130	Pass	
Heptachlor epoxide	%	74			70-130	Pass	
Hexachlorobenzene	%	79			70-130	Pass	
Methoxychlor	%	116			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	97			80-120	Pass	
Cadmium	%	96			80-120	Pass	
Chromium	%	97			80-120	Pass	
Copper	%	95			80-120	Pass	
Lead	%	98			80-120	Pass	
Mercury	%	97			80-120	Pass	
Nickel	%	93			80-120	Pass	
Zinc	%	95			80-120	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
TRH C6-C9	%	107			70-130	Pass	
TRH C10-C14	%	78			70-130	Pass	
TRH C6-C10	%	98			70-130	Pass	
TRH >C10-C16	%	79			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	110			70-130	Pass	
Toluene	%	126			70-130	Pass	
Ethylbenzene	%	117			70-130	Pass	
m&p-Xylenes	%	116			70-130	Pass	
o-Xylene	%	129			70-130	Pass	
Xylenes - Total*	%	120			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	103			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	92			70-130	Pass	
Acenaphthylene	%	94			70-130	Pass	
Anthracene	%	91			70-130	Pass	
Benz(a)anthracene	%	80			70-130	Pass	
Benzo(a)pyrene	%	95			70-130	Pass	
Benzo(b&j)fluoranthene	%	75			70-130	Pass	
Benzo(g.h.i)perylene	%	92			70-130	Pass	
Benzo(k)fluoranthene	%	101			70-130	Pass	
Chrysene	%	99			70-130	Pass	
Dibenz(a.h)anthracene	%	80			70-130	Pass	
Fluoranthene	%	87			70-130	Pass	
Fluorene	%	99			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	83			70-130	Pass	
Naphthalene	%	93			70-130	Pass	
Phenanthrene	%	80			70-130	Pass	
Pyrene	%	90			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
Chlordanes - Total	S23-Au0049589	NCP	%	107			70-130	Pass	
4.4'-DDE	S23-Au0049589	NCP	%	116			70-130	Pass	
4.4'-DDT	S23-Au0049589	NCP	%	110			70-130	Pass	
a-HCH	S23-Au0049589	NCP	%	112			70-130	Pass	
Aldrin	S23-Au0049589	NCP	%	90			70-130	Pass	
b-HCH	S23-Au0049837	NCP	%	105			70-130	Pass	
d-HCH	S23-Au0049589	NCP	%	108			70-130	Pass	
Dieldrin	S23-Au0049589	NCP	%	102			70-130	Pass	
Endosulfan I	S23-Au0049589	NCP	%	105			70-130	Pass	
Endosulfan II	S23-Au0049837	NCP	%	125			70-130	Pass	
Endosulfan sulphate	S23-Au0049589	NCP	%	125			70-130	Pass	
Endrin	S23-Au0049837	NCP	%	79			70-130	Pass	
Endrin aldehyde	S23-Au0049589	NCP	%	95			70-130	Pass	
g-HCH (Lindane)	S23-Au0049837	NCP	%	110			70-130	Pass	
Heptachlor	S23-Au0049589	NCP	%	116			70-130	Pass	
Heptachlor epoxide	S23-Au0049589	NCP	%	101			70-130	Pass	
Hexachlorobenzene	S23-Au0049589	NCP	%	110			70-130	Pass	
Spike - % Recovery									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Heavy Metals				Result 1					
Arsenic	S23-Au0049612	NCP	%	101			75-125	Pass	
Cadmium	S23-Au0049612	NCP	%	99			75-125	Pass	
Chromium	S23-Au0049612	NCP	%	108			75-125	Pass	
Copper	S23-Au0049612	NCP	%	88			75-125	Pass	
Lead	S23-Au0049612	NCP	%	97			75-125	Pass	
Mercury	S23-Au0049612	NCP	%	92			75-125	Pass	
Nickel	S23-Au0049612	NCP	%	96			75-125	Pass	
Zinc	S23-Au0049612	NCP	%	95			75-125	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons				Result 1					
TRH C6-C9	S23-Au0049134	NCP	%	85			70-130	Pass	
TRH C10-C14	S23-Au0052396	NCP	%	89			70-130	Pass	
TRH C6-C10	S23-Au0049134	NCP	%	80			70-130	Pass	
TRH >C10-C16	S23-Au0052396	NCP	%	90			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S23-Au0049134	NCP	%	92			70-130	Pass	
Toluene	S23-Au0049134	NCP	%	105			70-130	Pass	
Ethylbenzene	S23-Au0049134	NCP	%	113			70-130	Pass	
m&p-Xylenes	S23-Au0049134	NCP	%	102			70-130	Pass	
o-Xylene	S23-Au0049134	NCP	%	110			70-130	Pass	
Xylenes - Total*	S23-Au0049134	NCP	%	105			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	S23-Au0049134	NCP	%	71			70-130	Pass	
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
4.4'-DDD	S23-Au0062786	NCP	%	103			70-130	Pass	
Endrin ketone	S23-Au0062786	NCP	%	125			70-130	Pass	
Methoxychlor	S23-Au0062786	NCP	%	79			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	S23-Au0051744	NCP	%	113			70-130	Pass	
Acenaphthylene	S23-Au0051744	NCP	%	112			70-130	Pass	
Anthracene	S23-Au0051744	NCP	%	113			70-130	Pass	
Benz(a)anthracene	S23-Au0051744	NCP	%	94			70-130	Pass	
Benzo(a)pyrene	S23-Au0051744	NCP	%	111			70-130	Pass	
Benzo(b&j)fluoranthene	S23-Au0051744	NCP	%	92			70-130	Pass	
Benzo(g.h.i)perylene	S23-Au0051744	NCP	%	112			70-130	Pass	
Benzo(k)fluoranthene	S23-Au0051744	NCP	%	124			70-130	Pass	
Chrysene	S23-Au0051744	NCP	%	120			70-130	Pass	
Dibenz(a.h)anthracene	S23-Au0051744	NCP	%	112			70-130	Pass	
Fluoranthene	S23-Au0051744	NCP	%	108			70-130	Pass	
Fluorene	S23-Au0051744	NCP	%	116			70-130	Pass	
Indeno(1.2.3-cd)pyrene	S23-Au0051744	NCP	%	107			70-130	Pass	
Naphthalene	S23-Au0051744	NCP	%	115			70-130	Pass	
Phenanthrene	S23-Au0051744	NCP	%	101			70-130	Pass	
Pyrene	S23-Au0051744	NCP	%	106			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	S23-Au0049612	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-HCH	S23-Au0047611	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-HCH	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-HCH	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-HCH (Lindane)	S23-Au0047611	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	S23-Au0049612	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Toxaphene	S23-Au0049612	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	S23-Au0049137	NCP	%	23	21	10.0	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C9	S23-Au0049133	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C6-C10	S23-Au0049133	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S23-Au0049133	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	S23-Au0049133	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	S23-Au0049133	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	S23-Au0049133	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	S23-Au0049133	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total*	S23-Au0049133	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	S23-Au0049133	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C10-C14	S23-Au0049157	CP	mg/kg	29	35	19	30%	Pass	
TRH C15-C28	S23-Au0049157	CP	mg/kg	1700	2200	23	30%	Pass	
TRH C29-C36	S23-Au0049157	CP	mg/kg	610	800	27	30%	Pass	
TRH >C10-C16	S23-Au0049157	CP	mg/kg	82	100	19	30%	Pass	
TRH >C16-C34	S23-Au0049157	CP	mg/kg	2200	2700	23	30%	Pass	
TRH >C34-C40	S23-Au0049157	CP	mg/kg	310	440	34	30%	Fail	Q15

Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	S23-Au0049157	CP	mg/kg	2.1	1.8	12	30%	Pass	
Acenaphthylene	S23-Au0049157	CP	mg/kg	6.5	6.1	6.4	30%	Pass	
Anthracene	S23-Au0049157	CP	mg/kg	22	24	8.3	30%	Pass	
Benz(a)anthracene	S23-Au0049157	CP	mg/kg	38	50	27	30%	Pass	
Benzo(a)pyrene	S23-Au0049157	CP	mg/kg	35	45	27	30%	Pass	
Benzo(b&j)fluoranthene	S23-Au0049157	CP	mg/kg	23	34	38	30%	Fail	
Benzo(g.h.i)perylene	S23-Au0049157	CP	mg/kg	21	28	28	30%	Pass	
Benzo(k)fluoranthene	S23-Au0049157	CP	mg/kg	29	31	8.2	30%	Pass	
Chrysene	S23-Au0049157	CP	mg/kg	49	59	19	30%	Pass	
Dibenz(a.h)anthracene	S23-Au0049157	CP	mg/kg	5.5	5.9	6.5	30%	Pass	
Fluoranthene	S23-Au0049157	CP	mg/kg	85	110	26	30%	Pass	
Fluorene	S23-Au0049157	CP	mg/kg	3.5	4.0	12	30%	Pass	
Indeno(1.2.3-cd)pyrene	S23-Au0049157	CP	mg/kg	16	21	26	30%	Pass	
Naphthalene	S23-Au0049157	CP	mg/kg	1.7	2.1	19	30%	Pass	
Phenanthrene	S23-Au0049157	CP	mg/kg	74	93	23	30%	Pass	
Pyrene	S23-Au0049157	CP	mg/kg	88	120	28	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S23-Au0049159	CP	mg/kg	3.1	3.1	1.1	30%	Pass	
Cadmium	S23-Au0049159	CP	mg/kg	0.8	0.8	1.6	30%	Pass	
Chromium	S23-Au0049159	CP	mg/kg	35	34	1.8	30%	Pass	
Copper	S23-Au0049159	CP	mg/kg	25	25	<1	30%	Pass	
Lead	S23-Au0049159	CP	mg/kg	420	410	1.8	30%	Pass	
Mercury	S23-Au0049159	CP	mg/kg	0.2	0.2	3.3	30%	Pass	
Nickel	S23-Au0049159	CP	mg/kg	42	41	<1	30%	Pass	
Zinc	S23-Au0049159	CP	mg/kg	1200	1100	1.6	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	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 Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Bonnie Pu	Analytical Services Manager
Mickael Ros	Senior Analyst-Metal
Roopesh Rangarajan	Senior Analyst-Volatile
Roopesh Rangarajan	Senior Analyst-Organic
Fang Yee Tan	Senior Analyst-Metal

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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CERTIFICATE OF ANALYSIS 331648

Client Details

Client	ENV Services Pty Ltd
Attention	Kirsten Hartshorne
Address	313 River St, Ballina, NSW, 2478

Sample Details

Your Reference	**218078 65 Woodlark St Soil Sampling**
Number of Samples	1 Soil
Date samples received	29/08/2023
Date completed instructions received	29/08/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	28/09/2023
Date of Issue	28/09/2023

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Dragana Tomas, Senior Chemist
Liam Timmins, Organics Supervisor
Loren Bardwell, Development Chemist

Authorised By
Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		331648-1
Your Reference	UNITS	QA2
Date Sampled		08/08/2023
Type of sample		Soil
Date extracted	-	27/09/2023
Date analysed	-	28/09/2023
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
Naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<1
Surrogate aaa-Trifluorotoluene	%	96

svTRH (C10-C40) in Soil		
Our Reference		331648-1
Your Reference	UNITS	QA2
Date Sampled		08/08/2023
Type of sample		Soil
Date extracted	-	27/09/2023
Date analysed	-	28/09/2023
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	230
TRH C_{29} - C_{36}	mg/kg	130
Total +ve TRH (C10-C36)	mg/kg	360
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	320
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	320
Surrogate o-Terphenyl	%	81

PAHs in Soil		
Our Reference	UNITS	331648-1
Your Reference		QA2
Date Sampled		08/08/2023
Type of sample		Soil
Date extracted	-	27/09/2023
Date analysed	-	27/09/2023
Naphthalene	mg/kg	0.4
Acenaphthylene	mg/kg	1.4
Acenaphthene	mg/kg	0.3
Fluorene	mg/kg	0.8
Phenanthrene	mg/kg	25
Anthracene	mg/kg	7.1
Fluoranthene	mg/kg	23
Pyrene	mg/kg	25
Benzo(a)anthracene	mg/kg	14
Chrysene	mg/kg	10
Benzo(b,j+k)fluoranthene	mg/kg	23
Benzo(a)pyrene	mg/kg	9.2
Indeno(1,2,3-c,d)pyrene	mg/kg	2.4
Dibenzo(a,h)anthracene	mg/kg	0.9
Benzo(g,h,i)perylene	mg/kg	3.0
Total +ve PAH's	mg/kg	150
Benzo(a)pyrene TEQ calc (zero)	mg/kg	14
Benzo(a)pyrene TEQ calc(half)	mg/kg	14
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	14
Surrogate p-Terphenyl-d14	%	105

Organochlorine Pesticides in soil		
Our Reference		331648-1
Your Reference	UNITS	QA2
Date Sampled		08/08/2023
Type of sample		Soil
Date extracted	-	27/09/2023
Date analysed	-	27/09/2023
alpha-BHC	mg/kg	<0.1
HCB	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Mirex	mg/kg	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1
Surrogate TCMX	%	86

Acid Extractable metals in soil		
Our Reference		331648-1
Your Reference	UNITS	QA2
Date Sampled		08/08/2023
Type of sample		Soil
Date prepared	-	28/09/2023
Date analysed	-	28/09/2023
Arsenic	mg/kg	<4
Cadmium	mg/kg	<0.4
Chromium	mg/kg	28
Copper	mg/kg	29
Lead	mg/kg	410
Mercury	mg/kg	0.3
Nickel	mg/kg	21
Zinc	mg/kg	420

Moisture		
Our Reference		331648-1
Your Reference	UNITS	QA2
Date Sampled		08/08/2023
Type of sample		Soil
Date prepared	-	27/09/2023
Date analysed	-	28/09/2023
Moisture	%	24

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.

Method ID	Methodology Summary
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-13	[NT]
Date extracted	-			27/09/2023	[NT]	[NT]	[NT]	[NT]	27/09/2023	[NT]
Date analysed	-			28/09/2023	[NT]	[NT]	[NT]	[NT]	28/09/2023	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	<25	[NT]	[NT]	[NT]	[NT]	89	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	[NT]	[NT]	[NT]	[NT]	89	[NT]
Benzene	mg/kg	0.2	Org-023	<0.2	[NT]	[NT]	[NT]	[NT]	90	[NT]
Toluene	mg/kg	0.5	Org-023	<0.5	[NT]	[NT]	[NT]	[NT]	87	[NT]
Ethylbenzene	mg/kg	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	89	[NT]
m+p-xylene	mg/kg	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	90	[NT]
o-Xylene	mg/kg	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Naphthalene	mg/kg	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	102	[NT]	[NT]	[NT]	[NT]	80	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-13	[NT]
Date extracted	-			27/09/2023	[NT]	[NT]	[NT]	[NT]	27/09/2023	[NT]
Date analysed	-			27/09/2023	[NT]	[NT]	[NT]	[NT]	27/09/2023	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	111	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	110	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	111	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	110	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate o-Terphenyl	%		Org-020	80	[NT]	[NT]	[NT]	[NT]	89	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-13	[NT]
Date extracted	-			27/09/2023	[NT]	[NT]	[NT]	[NT]	27/09/2023	[NT]
Date analysed	-			27/09/2023	[NT]	[NT]	[NT]	[NT]	27/09/2023	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	89	[NT]
Fluorene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Anthracene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Pyrene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	75	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	104	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	99	[NT]	[NT]	[NT]	[NT]	97	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-13	[NT]
Date extracted	-			27/09/2023	[NT]	[NT]	[NT]	[NT]	27/09/2023	[NT]
Date analysed	-			27/09/2023	[NT]	[NT]	[NT]	[NT]	27/09/2023	[NT]
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
HCB	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	95	[NT]
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Endrin	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Mirex	mg/kg	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	91	[NT]	[NT]	[NT]	[NT]	97	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-14	[NT]
Date prepared	-			28/09/2023	[NT]	[NT]	[NT]	[NT]	28/09/2023	[NT]
Date analysed	-			28/09/2023	[NT]	[NT]	[NT]	[NT]	28/09/2023	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	112	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	108	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

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			BTEX						TRH							Halogenated Benzenes	Inorganics	Metals							
			Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)	Hexachlorobenzene	Moisture Content (dried @ 103°C)	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.5	0.1	0.1	0.1	0.2	0.1	0.3	20	20	50	50	100	100	100	0.05	1	2	0.4	5	5	5	0.1	5	5
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand (0 - 1.0 m)			3	0.5	160	55			40		45		110													
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space			170																100							
Site Specific EILs			170																100		800	240	1,100		430	670
NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil (0 - 2.0m)				65	105	125			45		180	120	120	1,300	5,600											
NEPM 2013 Table 1A(1) HILs Res A Soil																	10		100	20		6,000	300	40	400	7,400
Field ID	**Location Code**	**Date**																								
QA1		**08 Aug 2023**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	250	<100	250	<0.5	20	3.0	0.4	23	21	110	0.2	21	360
SS01		**08 Aug 2023**															<0.5	30	12	0.5	36	29	300	0.8	23	590
SS02		**08 Aug 2023**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	140	<100	140	<0.5	16	2.7	<0.4	24	17	120	0.3	21	290
SS03		**08 Aug 2023**															<0.5	21	2.1	0.7	9.7	24	760	0.1	11	1,600
SS04		**08 Aug 2023**															<0.5	13	18	0.6	22	13	120	<0.1	19	220
SS05		**08 Aug 2023**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	82	82	2,200	310	2,592	<0.5	18	4.5	0.5	17	31	180	0.2	18	280
SS07		**08 Aug 2023**															<0.5	9.2	<2	0.6	18	22	150	<0.1	17	240
SS08		**08 Aug 2023**															<0.5	12	3.1	0.8	35	25	420	0.2	42	1,200
Statistics																										
Maximum Concentration			**<0.5**	**<0.1**	**<0.1**	**<0.1**	**<0.2**	**<0.1**	**<0.3**	**<20**	**<20**	**82**	**82**	**2,200**	**310**	**2,592**	**<0.5**	**30**	**18**	**0.8**	**36**	**31**	**760**	**0.8**	**42**	**1,600**

Environmental Standards

2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil
2013, NEPM 2013 Table 1A(1) HILs Res A Soil

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			Organochlorine Pesticides																								
			Organochlorine pesticides EPAVic	Other organochlorine pesticides EPAVic	4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Toxaphene
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.5
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand (0 - 1.0 m)																											
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space													180														
Site Specific EILs													180														
NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil (0 - 2.0m)																											
NEPM 2013 Table 1A(1) HILs Res A Soil								6		50				240						10				6		300	20
Field ID	**Location Code**	**Date**																									
QA1		**08 Aug 2023**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS01		**08 Aug 2023**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS02		**08 Aug 2023**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS03		**08 Aug 2023**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS04		**08 Aug 2023**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS05		**08 Aug 2023**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS07		**08 Aug 2023**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
SS08		**08 Aug 2023**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
Statistics																											
Maximum Concentration			**<1**	**<1**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<1**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<10**

Environmental Standards

2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil
2013, NEPM 2013 Table 1A(1) HILs Res A Soil

ENV218078 - 2024 Investigation - Surface Soil Samples

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

			PAH																TPH				
			Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	20	20	50	50	50
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand (0 - 1.0 m)																3								
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space																170								
Site Specific EILs																170								
NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil (0 - 2.0m)							0.7																	
NEPM 2013 Table 1A(1) HILs Res A Soil																			300					
Field ID	**Location Code**	**Date**																						
QA1		**08 Aug 2023**	<0.5	0.5	4.5	3.8	3.0	2.8	1.8	3.5	6.1	<0.5	9.6	<0.5	1.1	<0.5	6.1	10	53	<20	<20	190	90	280
SS01		**08 Aug 2023**																						
SS02		**08 Aug 2023**	<0.5	<0.5	1.0	1.0	<0.5	0.6	0.6	0.8	1.9	<0.5	2.5	<0.5	<0.5	<0.5	2.0	2.4	13	<20	<20	89	67	156
SS03		**08 Aug 2023**																						
SS04		**08 Aug 2023**																						
SS05		**08 Aug 2023**	2.1	6.5	22	38	35	23	21	29	49	5.5	85	3.5	16	1.7	74	88	500	<20	29	1,700	610	2,339
SS07		**08 Aug 2023**																						
SS08		**08 Aug 2023**																						
Statistics																								
Maximum Concentration			**2.1**	**6.5**	**22**	**38**	**35**	**23**	**21**	**29**	**49**	**5.5**	**85**	**3.5**	**16**	**1.7**	**74**	**88**	**500**	**<20**	**29**	**1,700**	**610**	**2,339**

Environmental Standards
2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil
2013, NEPM 2013 Table 1A(1) HILs Res A Soil

ENV218078 - 2024 Investigation - Samples at 0.4 m Depth

ENV Solutions
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	Asbestos										Mass							
	ACM - Comment	AF - Comment	Asbestos Reported Result	Asbestos Sample Dimensions	Bonded Asbestos	FA- Comment	Friable Asbestos (FA & AF)	Organic Fibres - Comment	Respirable Fibres - Comment	Synthetic Fibres - Comment	Approximate Sample Mass	Mass ACM	Mass AF	Mass Asbestos in ACM	Mass asbestos in AF	Mass Asbestos in FA	Mass Asbestos in FA & AF	Mass FA
	Comment	Comment	Comment	Comment	%w/w	Comment	%w/w	Comment	Comment	Comment	g	g	g	g	g	g	g	g
EQL																		
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand (0-1.0m)																		
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space																		
Site Specific EILs																		
NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil (0 - 2.0m)																		
NEPM 2013 Table 1A(1) HILs Res A Soil																		
Field ID **Location Code** **Date**																		
TP01 **04 Mar 2024**																		
TP02 **04 Mar 2024**																		
TP02_FRAGS **04 Mar 2024**	1	1	Chrysotile Asbestos Detected	1	0	1	0	1	1	1	78	78	0.0000	11.7	0	0	0	0.0000
TP03 **04 Mar 2024**																		
TP04 **04 Mar 2024**																		
TP05 **04 Mar 2024**																		
TP06 **04 Mar 2024**																		
TP07 **04 Mar 2024**																		
TP08 **04 Mar 2024**																		
Statistics																		
Maximum Concentration	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**1**	**1**	**78**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Environmental Standards
2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil
2013, NEPM 2013 Table 1A(1) HILs Res A Soil

ENV218078 - 2024 Investigation - Samples at 0.4 m Depth

ENV Solutions
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			BTEX						TRH							Halogenated Benzenes	Inorganics	Metals							
			Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)	Hexachlorobenzene	Moisture Content (dried @ 103°C)	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.5	0.1	0.1	0.1	0.2	0.1	0.3	20	20	50	50	100	100	100	0.05	1	2	0.4	5	5	5	0.1	5	5
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand (0-1.0m)			3	0.5	160	55			40		45		110													
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space			170																100							
Site Specific EILs			170																100		800	240	1,100		430	670
NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil (0 - 2.0m)				65	105	125			45		180	120	120	1,300	5,600											
NEPM 2013 Table 1A(1) HILs Res A Soil																	10		100	20		6,000	300	40	400	7,400
Field ID	**Location Code**	**Date**																								
TP01		**04 Mar 2024**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	<100	<100	<100	<0.05	28	<2	<0.4	44	22	35	<0.1	22	190
TP02		**04 Mar 2024**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	540	170	710	<0.5	11	9.7	<0.4	15	40	720	0.4	27	280
TP02_FRAGS		**04 Mar 2024**																								
TP03		**04 Mar 2024**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	<100	<100	<100	<0.5	13	33	<0.4	19	27	250	0.8	24	240
TP04		**04 Mar 2024**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	<100	<100	<100	<0.5	28	2.2	1.2	44	21	310	0.4	27	900
TP05		**04 Mar 2024**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	140	160	300	<0.5	21	9.1	<0.4	30	27	580	0.6	23	320
TP06		**04 Mar 2024**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	500	<100	500	<0.5	24	4.5	<0.4	51	34	170	0.3	39	290
TP07		**04 Mar 2024**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	550	110	660	<0.5	24	2.1	<0.4	44	19	33	0.1	21	120
TP08		**04 Mar 2024**	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	<20	<20	<50	<50	<100	<100	<100	<0.05	31	3.9	<0.4	46	42	520	0.6	23	330
Statistics																										
Maximum Concentration			**<0.5**	**<0.1**	**<0.1**	**<0.1**	**<0.2**	**<0.1**	**<0.3**	**<20**	**<20**	**<50**	**<50**	**550**	**170**	**710**	**<0.5**	**31**	**33**	**1.2**	**51**	**42**	**720**	**0.8**	**39**	**900**

Environmental Standards

2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil
2013, NEPM 2013 Table 1A(1) HILs Res A Soil

ENV218078 - 2024 Investigation - Samples at 0.4 m Depth

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

			Organochlorine Pesticides																						
			Organochlorine pesticides EPAVic	Other organochlorine pesticides EPAVic	4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Toxaphene
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.5
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand (0-1.0m)																										
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space													180													
Site Specific EILs													180													
NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil (0 - 2.0m)																										
NEPM 2013 Table 1A(1) HILs Res A Soil								6		50				240					10				6		300	20
Field ID	**Location Code**	**Date**																								
TP01		**04 Mar 2024**	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
TP02		**04 Mar 2024**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
TP02_FRAGS		**04 Mar 2024**																								
TP03		**04 Mar 2024**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
TP04		**04 Mar 2024**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
TP05		**04 Mar 2024**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
TP06		**04 Mar 2024**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
TP07		**04 Mar 2024**	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10
TP08		**04 Mar 2024**	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5
Statistics																										
Maximum Concentration			**<1**	**<1**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<1**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	**<10**

Environmental Standards

2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil
2013, NEPM 2013 Table 1A(1) HILs Res A Soil

ENV218078 - 2024 Investigation - Samples at 0.4 m Depth

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

			PAH																TPH				
			Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	20	20	50	50	50
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand (0-1.0m)																3								
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space																170								
Site Specific EILs																170								
NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil (0 - 2.0m)							0.7																	
NEPM 2013 Table 1A(1) HILs Res A Soil																			300					
Field ID	**Location Code**	**Date**																						
TP01		**04 Mar 2024**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50	<50
TP02		**04 Mar 2024**	<0.5	1.0	3.3	6.0	4.7	3.4	2.7	4.8	6.4	0.8	15	0.8	2.2	0.6	13	15	79.7	<20	<20	560	220	780
TP02_FRAGS		**04 Mar 2024**																						
TP03		**04 Mar 2024**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50	<50
TP04		**04 Mar 2024**	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	1.3	<0.5	<0.5	<0.5	1.5	1.4	5.5	<20	<20	<50	<50	<50
TP05		**04 Mar 2024**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<20	59	110	120	289
TP06		**04 Mar 2024**	0.7	0.8	17	8.7	8.4	11	3.3	13	11	1.3	19	0.7	3.4	<0.5	18	21	137.3	<20	<20	380	170	550
TP07		**04 Mar 2024**	<0.5	0.7	7.4	5.9	5.4	2.9	2.5	5.0	8.0	0.8	17	0.7	2.1	<0.5	17	17	92.4	<20	26	640	160	826
TP08		**04 Mar 2024**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<20	<20	<50	<50	<50
Statistics																								
Maximum Concentration			**0.7**	**1**	**17**	**8.7**	**8.4**	**11**	**3.3**	**13**	**11**	**1.3**	**19**	**0.8**	**3.4**	**0.6**	**18**	**21**	**137.3**	**<20**	**59**	**640**	**220**	**826**

Environmental Standards

2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) ESLs for Urban Res, Fine Soil
2013, NEPM 2013 Table 1A(1) HILs Res A Soil

APPENDIX F

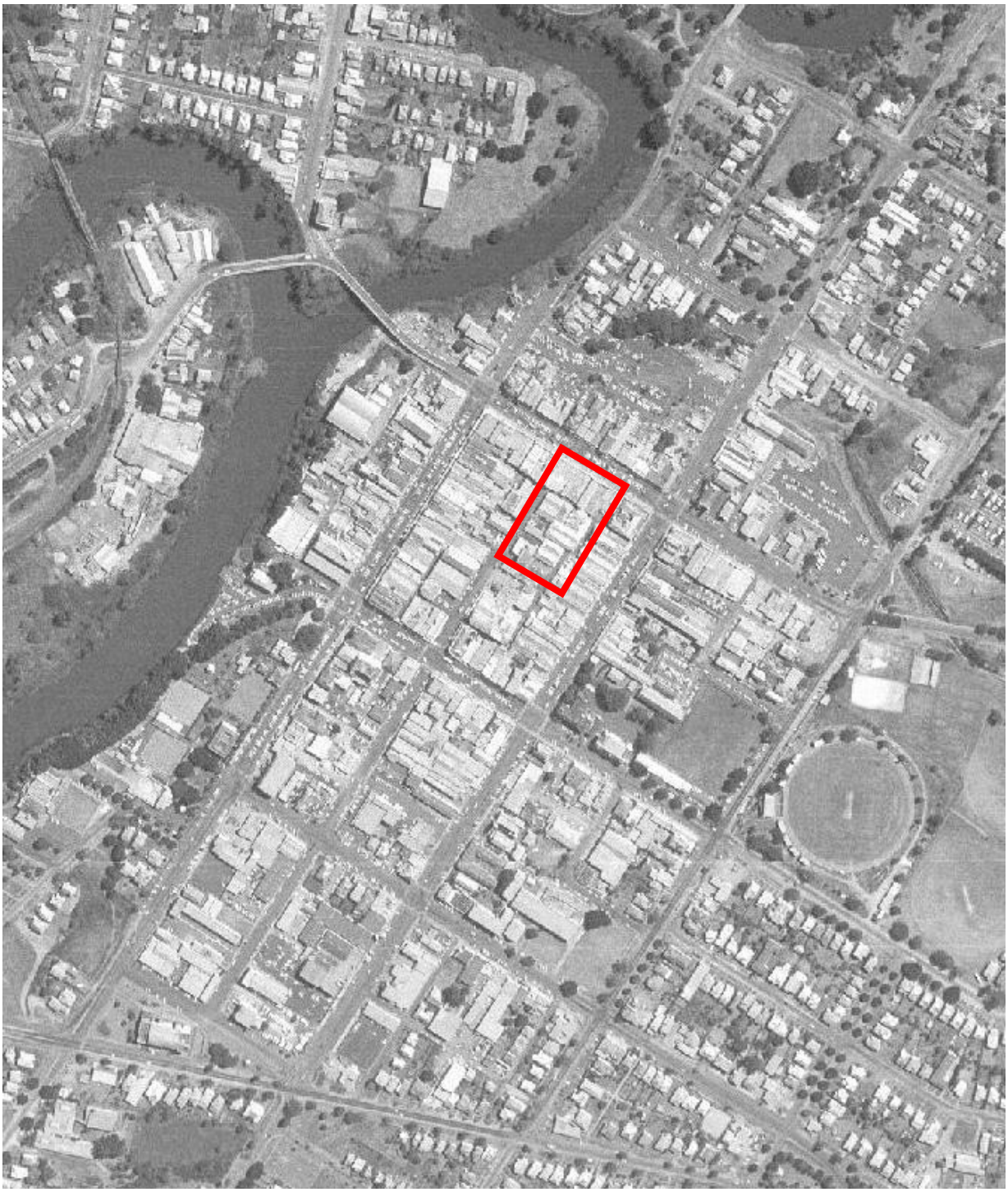
Historic Aerial Images

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Historic Aerial Image - 1971

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Historic Aerial Image - 1979



Historic Aerial Image - 1987

Historic Aerial Image - 1991

Historic Aerial Image - 1997