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Detailed Site Investigation

Wee Waa High School
105-107 Mitchell Street
Wee Waa NSW

(Our Reference:35754 ER02)

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EXECUTIVE SUMMARY

Barnson was engaged by the NSW Department of Education to carry out a detailed contaminated site investigation in support of the proposed Wee Waa High School development, at 105-107 Mitchell Street, Wee Waa, NSW.

The detailed investigation was undertaken in order to confirm and further investigate the findings of a preliminary site contamination investigation of the property carried out in April 2021, which identified asbestos containing materials as well as elevated levels of heavy metals and poly-aromatic hydrocarbons (PAHs) in samples of surface soil collected from the site. The preliminary site contamination investigation report identified concentrations of lead and zinc that exceeded health-risk and ecological screening values in samples of soil collected in a specific (hot spot) area of the Subject Site. The detailed investigation therefore focussed on the hot spot which is located in the northern portion of Lot 124 DP 757125, and referred to as the Primary Investigation Area.

A review of the available historical information (including contaminated sites databases and aerial photographs) and the findings of the preliminary site investigation concluded that the potential for significant environmental contamination to be present at the site to be low.

A site inspection, supplemented with confirmatory sampling and analysis, was conducted to identify the source of the contamination, determine the average concentrations of lead and zinc in the study area and identify and delineate any hot spot areas. Results of the chemical analysis of the surface soil samples confirm the findings of the preliminary site investigation, finding measurable concentrations of heavy metals, and hydrocarbon compounds and identifying concentrations of lead (Pb) and zinc exceeded the screening levels used in the assessment.

A source-pathway-receptor analysis and refinement of the existing conceptual site model (CSM) indicated the most likely sources of the observed contamination to be lead based paint and galvanised metal that formed part of structures that previously occupied the area or demolition waste that was subsequently disposed of at the site.

The main routes of exposure to these contaminants are through inhalation and ingestion. Surface soil is the only media likely to be contaminated with lead and secondary pathways that have the potential to expose humans to the contaminants include ingestion of contaminated garden crops and animal products. Exposure to elevated concentrations of zinc was assessed as presenting no risk to the health of humans visiting the area. The risks associated with the elevated zinc concentrations relate mainly to impacts to aquatic species and it is reasoned that the location and physical properties of the Investigation Area limit any possibility of risk to the ecology.

The most likely receptors identified for the Primary Investigation Area are visitors to the Subject Site, including students, teachers and parents. Evaluation of the potential for sensitive receptors to be exposed to contaminated soil at the Investigation Area concludes that exposure is possible but does not pose an immediate health risk as exposure to the contaminated soil can be appropriately managed. However, lowering the concentration of hazardous contaminants present in the soil is preferable as the dispersion of the contamination to uncontaminated areas of the Subject Site or even off-site is a concern.

Based on the findings of the further site investigation it is concluded that the Subject Site is suitable for the proposed development, but that use of the area where contamination was detected is subject to removal of fibre cement fragments present in the area and the implementation of a procedure to either lower the concentration of or lower the likelihood of exposure (i.e. application of soil cover) to the lead (Pb) present in the identified area of the Site.

The following recommendations are made in this regard:

- It is recommended that access to the contaminated area be restricted and that procedures be put in place to prevent the dispersion of contaminated soil to other areas of the Subject Site.
- Based on the findings of the further site investigation it is concluded that the Subject Site is suitable for the proposed development, as there are no contaminants present at the site which are likely to present an immediate risk of impact to the health of humans or the environment from the proposed activities.
- Development of the Investigation Area as part of a playing field is subject to the removal of fibre cement fragments from the surface of the site.
- It is recommended that a Remediation Action Plan (RAP) be developed to inform the removal of the fibre cement fragments from the surface of the site and provide recommendations for the appropriate application of fill as barrier over the contaminated soil.
- It is further recommended that Preliminary Long-term Environmental Management Plan (LEMP) be developed to provide recommendations for the long-term management of the containment.
- A Construction Environmental Management Plan (CEMP) is recommended to be prepared prior to any earth works being commenced. The purpose of the CEMP is for the management of contaminated soil as well as for the management of any excavated soils (which could include contaminated soils) and should include procedures for the classification of the soils as well as for the implementation of sediment and erosion controls for stockpiling of excavated soils.

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1.0 INTRODUCTION

1.1 Background

Students and staff were evacuated from the current Wee Waa High School site due to ongoing health issues in late 2020. Students are currently collocated within the town's primary school in an overcrowded site. A Ministerial announcement made on 3 June 2021 committed to the construction of a new High School at Wee Waa on existing Department of Education owned land and adjacent Crown land as an urgent priority. The site is located on Mitchell Street/Kamliaroi Highway and is legally described as Lot 1 DP577294, Lot 2 DP550633 and Lots 124-125 DP757125 (the Subject Site).

Barnson was engaged by the NSW Department of Education to carry out a detailed contaminated site investigation in support of this development and prepare a report of the findings. This report accompanies a State Significant Development Application (Application SSD-21854025) which seeks consent for the construction of a new high school with a capacity of up to approximately 300 students in a two-storey building, an Indigenous learning centre, sporting fields and associated civil and utilities works. For a detailed project description refer to the EIS prepared by Ethos Urban.

1.2 Objectives

The Secretary's Environmental Assessment Requirements (SEARs) issued 6 July 2021 for Application SSD-21854025, requires, among other, the assessment and quantification of any soil and groundwater contamination at the Subject Site. The assessment must further demonstrate that the site is suitable for the proposed use in accordance with State Encironmental Planning Policy 55 (DUAP, 1998), and must include the following prepared by certified consultants recognised by the NSW Environment Protection Authority:

- Preliminary Site Investigation (PSI).
- Detailed Site Investigation (DSI) where recommended in the PSI.
- Remediation Action Plan (RAP) where remediation is required. This must specify the proposed remediation strategy.
- Preliminary Long-term Environmental Management Plan (LEMP) where containment is proposed on-site.

The investigations and plans listed above must further be prepared in accordance with policies and guidelines relevant to the context of the site and nature of the proposed development. The relevant policies and guidelines include:

- Managing Land Contamination: Planning Guidelines - SEPP 55 Remediation of Land (DUAP, 1998).
- Sampling Design Guidelines (EPA, 1995).
- Consultants Reporting on Contaminated land – Contaminated Land Guidelines (EPA, 2020).
- Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (EPA, 2015).
- Guidelines for the NSW Site Auditor Scheme (3rd edition) (EPA, 2017).

- National Environment Protection (Assessment of Site Contamination) Measure (National Environment Protection Council, as amended 2013).

In addition to this, Education and Care Services National Regulations (Regulation 25(1)d) requires an assessment of the soil for possible contamination for any candidate site identified for the development of an education and childcare service premises. In accordance with the Regulation, a soil assessment means an analysis of soil conducted by an environmental consultant for the purposes of determining—

(a) the nature, extent and levels of contamination; and

(b) the actual or potential risk to human health resulting from that contamination;

A preliminary site contamination investigation of the various lots making up the subject site was undertaken in April 2021 (Barnson, 2021). This preliminary investigation included a site inspection and the collection of confirmatory samples of surface soils for chemical analysis. The site inspection identified elevated concentrations of heavy metals and hydrocarbon compounds in the north-eastern corner of Lot 124 on the northern boundary of the subject site. A copy of the Barnson Preliminary Site Investigation report is attached as Appendix A, for ease of reference.

Since the initial investigation of the site revealed areas of possible contamination, the assessing authority has the responsibility to ensure that any contamination is appropriately investigated and managed so that the land is suitable for the intended development.

Barnson undertook further, detailed, investigation of the site in order to delineate the contamination present, evaluate the level of risk posed by the contamination and provide recommendations with regard to any further actions to be undertaken.

The objectives of the detailed investigation are:

- Confirm the presence of contamination and delineate potentially affected areas;
- Identify the potential source(s) of the contamination;
- Determine the potential risks that may affect the site's suitability for development; and
- Assess the need for possible further investigations, remediation or management of any contamination issues identified.

1.3 Scope of Work

To meet the objectives, Barnson completed the following scope of work:

- Site identification including a review of site history, site condition, surrounding environment, geology, hydrogeology and hydrology.
- Desktop review of site history and assessment of potential sources of contamination.
- Refinement of the conceptual model developed for the site.
- Development of Data Quality Objectives (DQO) with information gathered from the data review and initial site inspection.
- Further site inspection to assess site conditions.

- Collection of soil samples and analysis to determine nature and extent of possible contamination.
- Assessment of the risk/impact of the identified contamination sources within the context of the site and the DQO.
- Preparation of a report including making conclusions as to the suitability of the site for the intended future land use.

The SEARS requirements are addressed in this report under the following sections as shown in Table 1.1.

Table 1.1: SEARs Requirements

Requirement	Section
Preparation of a Preliminary Site Investigation (PSI) report.	Appendix A
Preparation of a Detailed Site Investigation (DSI) report.	This report
Remediation Action Plan (RAP) where remediation is required.	Section 7.2
Preliminary Long-term Environmental Management Plan (LEMP) where containment is proposed on-site.	Section 7.2

1.4 Purpose of this report

The purpose of this report is to document, with cognisance of the Guidelines for Consultants Reporting on Contaminated Land (NSW EPA, 2020), works undertaken, in accordance with the scope of works as described in Section 1.3, results of the desktop review and site inspection, and recommendations for further actions required to determine fitness of the site for use.

1.5 Assumptions and Limitations

The following assumptions have been made in preparing this report:

- The future use of the site will be for education and training purposes (high school), with public open space included. This assumption forms the basis for the conceptual site model (Section 4).
- All information pertaining to the contamination status of the site has been obtained through public record searches, a site inspection and analysis of surface soil samples collected at the Subject Site. All documents and information in relation to the Subject Site, which were obtained from public records, are accepted to be correct and has not been independently verified or checked.

It should be recognised that even the most comprehensive site assessments may fail to detect all contamination on a site. This is due to the fact that contaminants may be present in areas that were not previously surveyed or sampled or may migrate to areas that showed no signs of contamination at the time of sample collection. Investigative works undertaken at the subject site by Barnson identified actual conditions only at those locations in which sampling and analysis were undertaken. Opinions regarding the conditions of the site have been expressed based on historical information and analytical data obtained and interpreted from previous assessments of the site. Barnson does not take responsibility for any consequences as a result of variations in site conditions.

2.0 SITE SETTING

2.1 Site Identification

Table 2.1 present a summary of the available information pertaining to the identification of the Subject Site. The Subject Site is comprised of four (4) separate vacant lots. The lots comprising the Subject Site are referred to as Lot 125 DP 757125, Lot 124 DP 757125, Lot 2 DP 550633 and Lot 1 DP 577294. Figure 2.1 presents a map indicating the location of the Subject Site.

Table 2.1: Summary of Subject Site identification details.

Information	Details
Site address	105-107 Mitchell Street, Wee Waa NSW 2388
Total Development Area	6.03 hectares
Lot and Deposited Plan No.	Lot 125 DP 757125, Lot 124 DP 757125, Lot 2 DP 550633, Lot 1 DP 577294
Zoning	R1 – General residential
Local Government Area	Narrabri Shire Council

Figure 2.1: Locality Map and Aerial Photo of Subject Site.
(Source: © 2021 Google / Image ©Maxar Technologies, Map Data © 2021)

2.2 Environmental Setting

Detailed information on the environmental setting of the Subject Site (including geology, soil, groundwater and drainage) was included in the PSI report (Barnson, 2021). The salient points from these sections, that are the most relevant to the evaluation of the Subject Site, include:

- The surface soil of the Subject Site is a thin layer (approx. 0.2m thick) of sandy silt, underlain by several metres of high plasticity clay (at least 4m thick, as confirmed by a geotechnical investigation of the Subject Site);
- Due to the dense underlaying clay, the Subject Site is poorly drained; and
- The depth to groundwater is estimated at more than 10m below ground level.

2.3 Site Description

2.3.1 Background

A description of the Subject Site was presented in the preliminary investigation report (Barnson, 2021). Some of the information is repeated here, for ease of reference, and a specific footprint for the detailed site investigation is identified, based on the findings of the preliminary investigation.

Figure 2.2 presents an aerial photograph of the Subject Site with the location and layout of important features of the site indicated. The Subject Site is approximately 6 hectares in size and is vacant land covered with maintained grass and several established trees. The Subject Site fronts onto Mitchell Street to the south-east, George Street to the north-east and Charles Street to the south-west.

The main feature of the site is a series of shallow drainage channels that enter the site from all three (3) street frontages. The site includes fencing on the boundary with the residential properties to the north. Near this boundary, in a corner formed with Lot 124 and an adjoining vacant Lot, remnants of structures as well as piles of discarded building material were observed during the initial site inspection (see Figure 2.3 to Figure 2.5). Figure 2.2 includes markers indicating the vantage point and direction of the photographs.

The conceptual site model identified this northern section of Lot 124 as one of the area/s most likely to contain contaminants. This finding was confirmed when the two (2) confirmatory soil samples collected in this area indicated concentrations of heavy metals that exceeded screening guidelines.

Figure 2.6 presents a concept design and layout for the proposed school development. A previous concept design (referenced in the preliminary investigation report (Barnson, 2021)) showed the northern section of Lot 124 to be used as large livestock paddocks for agricultural education purposes. The latest concept shows the area used as playing field.

Section 2.3.2 present a summary of the findings from the preliminary investigation as background to the description of an Investigation Area.

Figure 2.2: General layout of the Subject Site.

Figure 2.3: Photo A – Remnants of structures and demolition waste present in in northern section of Lot 124.

Figure 2.4: Photo B – Grass clippings dumped in the vegetation along northern boundary fence.

Figure 2.5: Photo C – Discarded garden and general waste in vegetation in northern section of Lot 124.

Figure 2.6: Concept landscape and development layout

(Source: Wee Waa High School Concept Design Package - Moir Landscape Architecture Pty Ltd Project No: 2049 Revision: 01, 2021)

2.3.2 Preliminary Investigation Findings

The preliminary investigation of the Subject Site (Barnson, 2021) identified historical land use activities, unregulated waste disposal and vehicles accessing the Site as potential sources of contamination. The Conceptual Site Model developed for the Subject Site identified surface soil as the most likely media to be contaminated by the potential sources. Confirmatory sampling undertaken during the preliminary site inspection therefore focussed on surface soil (50 to 300 mm), and ten (10) confirmatory soil samples were collected from sampling locations across the Subject Site to determine the presence of soil contaminants.

Figure 2.7 present a map of the Subject Site indicating the approximate locations of the confirmatory surface soil samples.

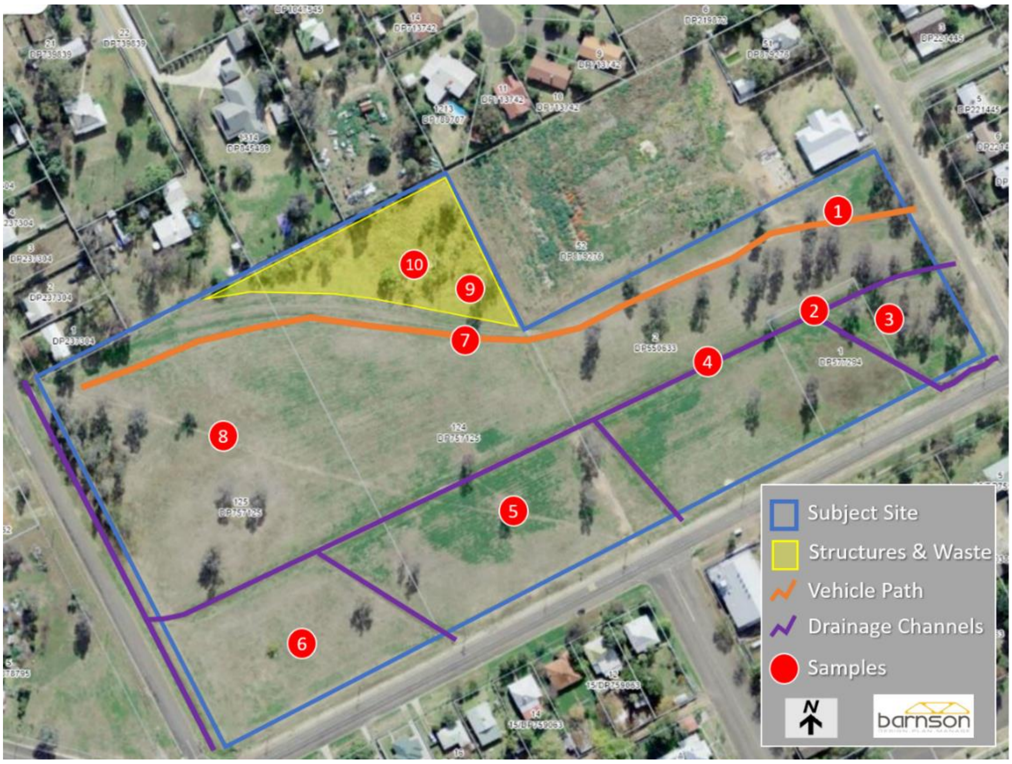

Figure 2.7: Map indicating locations of confirmatory sample collection.

The results from the analysis of the samples indicated that the concentrations of lead (2,600 $mg.kg^{-1}$ for sample 9 and 5,400$mg.kg^{-1}$ for sample 10) and zinc (4,300 $mg.kg^{-1}$ for sample 9 and 3,600$mg.kg^{-1}$ for sample 10) in two samples collected in the northern section of Lot 124 (refer Figure 2.7 for location of Lot 124) exceed the Health Investigation Levels (HIL) (300$mg.Pb.kg^{-1}$) and ecological investigation levels (EIL) (1,100$mgPb.kg^{-1}$ and 300$mgZn.kg^{-1}$) criteria used for assessment.

The sample collected from location 10 (refer Figure 2.7 for location) also contained detectable levels of PAHs and hydrocarbon fractions C29-C36 and >C16-C34 (F3) fraction, but none of the detected concentrations exceed any of the health or ecological risk-based screening criteria.

It is further noted that none of the samples analysed from the Subject Site contained detectible levels of BTEXN, Phenolic compounds, pesticides or PCBs.

Samples of fibre cement fragments observed in the area marked in yellow in Figure 2.7, was retrieved and analysed for asbestos. Both Chrysotile and Amosite asbestos fibres were detected in the fragments of fibre cement. The sample of soil (indicated as number 10 in Figure 2.7), retrieved from the location where the fragments of fibre cement were observed, was also analysed for the presence of asbestos fibres. No asbestos fibres were detected in the soil.

The Barnson (2021) report indicates that exceedance of the screening criteria for lead (Pb) and the presence of asbestos containing material requires further investigations to be undertaken in the indicated area of the Subject Site.

2.3.3 Investigation Area

The detailed site investigation is to be focussed on the area(s) of the Subject Site where the potential for contamination derived through the preliminary assessment of the site history and characteristics was confirmed through the analysis of surface soil samples.

During the preliminary site inspection the surface of the Subject Site was waterlogged following recent rain and access to the northern section of Lot 124 was limited by both a muddy surface and vegetation cover. Consequently, only two surface soil samples were collected and analysed in this area of the site. As both these soil samples showed elevated concentrations of contaminants it was assumed that the contamination relates to the structures and waste observed in the area and would likely be present in all areas where waste was observed.

The northern section of Lot 124, outlined in yellow on Figure 2.2, was therefore identified as an area of interest for further investigation.

However, with only two data points indicating contamination, the question remained whether the contamination is localised or also occurs in other locations in the area of interest. A further inspection of this area of interest was undertaken on 17 June 2021. A further 15 confirmatory surface soil samples were collected and grouped based on the location of waste and discarded building materials observed at the site. The purpose of the additional confirmatory sampling is not to be used for statistical evaluation of the site contamination and was thus collected using a Judgemental sampling approach, as described in the NSW EPA Sampling Design Guidelines for contaminated sites (NSW EPA, 1995). The samples were grouped into five (5) sample groups consisting of three (3) samples each. The three samples constituting each group were combined to form five composite samples representative of each group. Table 2.2 present a summary of the samples combined into composites for analysis, while Figure 2.8 show the approximate location of the 15 additional samples collected.

Table 2.2: Samples grouping and composite sample composition.

Sample Number	Group Composite	Sample Number	Group Composite
1	Samples combined into composite sample WW-01	10	Samples combined into composite sample WW-04
2		11	
3		12	
4	Samples combined into composite sample WW-02	13	Samples combined into composite sample WW-05
5		14	
6		15	
7	Samples combined into composite sample WW-03		
8			
9			

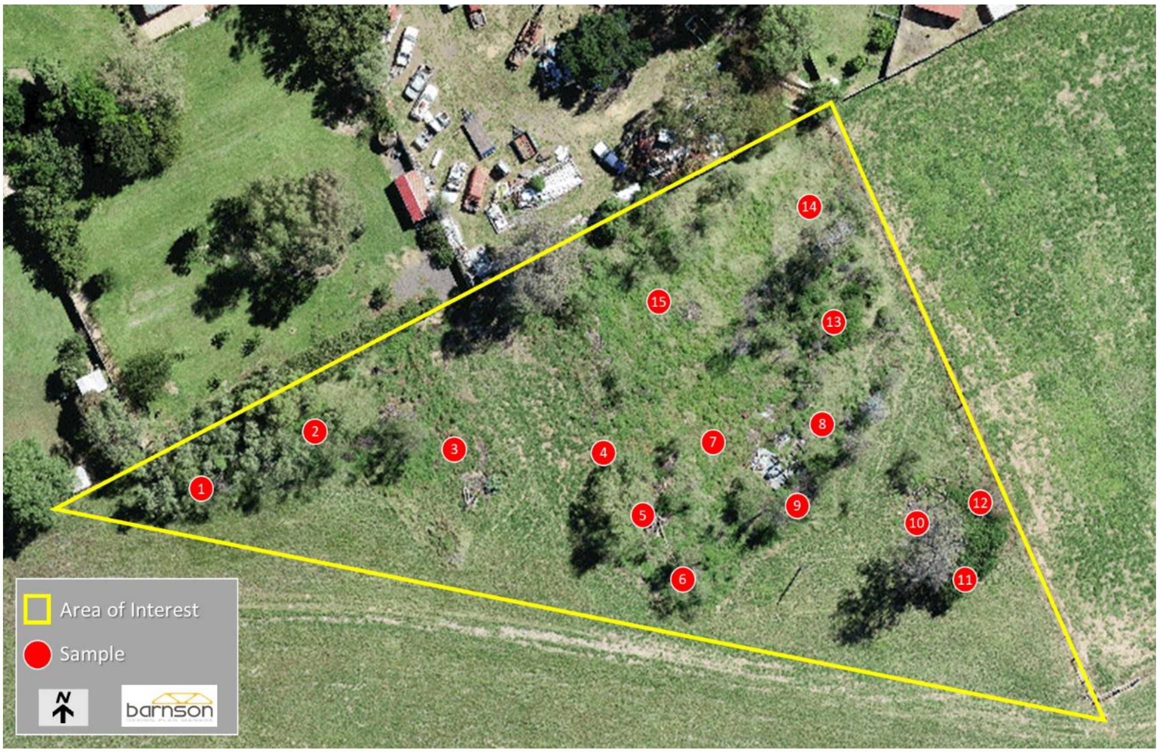

Figure 2.8: Area of Interest contaminant delineation

The purpose of the further sampling and analysis was to help define the investigation area. The composite samples were analysed for hydrocarbons (TRH, TPH, BTEX and PAH) and heavy metals. Table 2.3 present a summary of the metals and hydrocarbons reported above the limits of detection. What is important to note from the results are not the absolute concentrations detected but the relative values between the different samples.

Table 2.3: Measured concentrations of heavy metals and hydrocarbons in composite samples of surface soil from the area of interest.

Sample Number	WW-01	WW-02	WW-03	WW-04	WW-05
Contaminant			$mg.kg^{-1}$		
Arsenic	8	<5	<5	8	6
Cadmium	4	3	1	1	1
Chromium	41	40	52	29	31
Copper	62	28	25	34	30
Lead	247	449	1690	17	150
Mercury	0.1	<0.1	<0.1	<0.1	<0.1
Nickel	36	22	21	29	28
Zinc	1290	1390	1110	80	275
TPH Fraction C10 - C36 (sum)	160	110	<50	<50	<50

TPH Fraction C29 - C36	160	110	<100	<100	<100
TRH Fraction >C10 - C40 (sum)	380	240	<50	<50	<50
TRH Fraction >C16 - C34	180	100	<100	<100	<100
TRH Fraction >C34 - C40	200	140	<100	<100	<100

The results show that elevated heavy metal concentrations (lead and zinc) as well as fractions of petroleum hydrocarbons were detected in composite samples WW-01, 02 and 03. Concentrations of heavy metals were also found to be elevated in the WW-05 composite, compared to the levels detected in the WW-04 sample.

The results demonstrate that elevated levels of heavy metals and hydrocarbons are detectable at various locations across the area of interest and although large variation is to be expected, the contamination is largely localised in areas where demolition wastes were observed. The entire area of interest was defined as the Investigation Area.

Based on the results presented in Table 2.3 and the observations of where wastes are located, the Investigation Area was further subdivided in five (5) investigation Zones. Figure 2.9 show the approximate extent of the identified Zones. Zones 1, 2 and 3 included demolition wastes while Zone 4 include mainly disposed garden refuse and general waste.

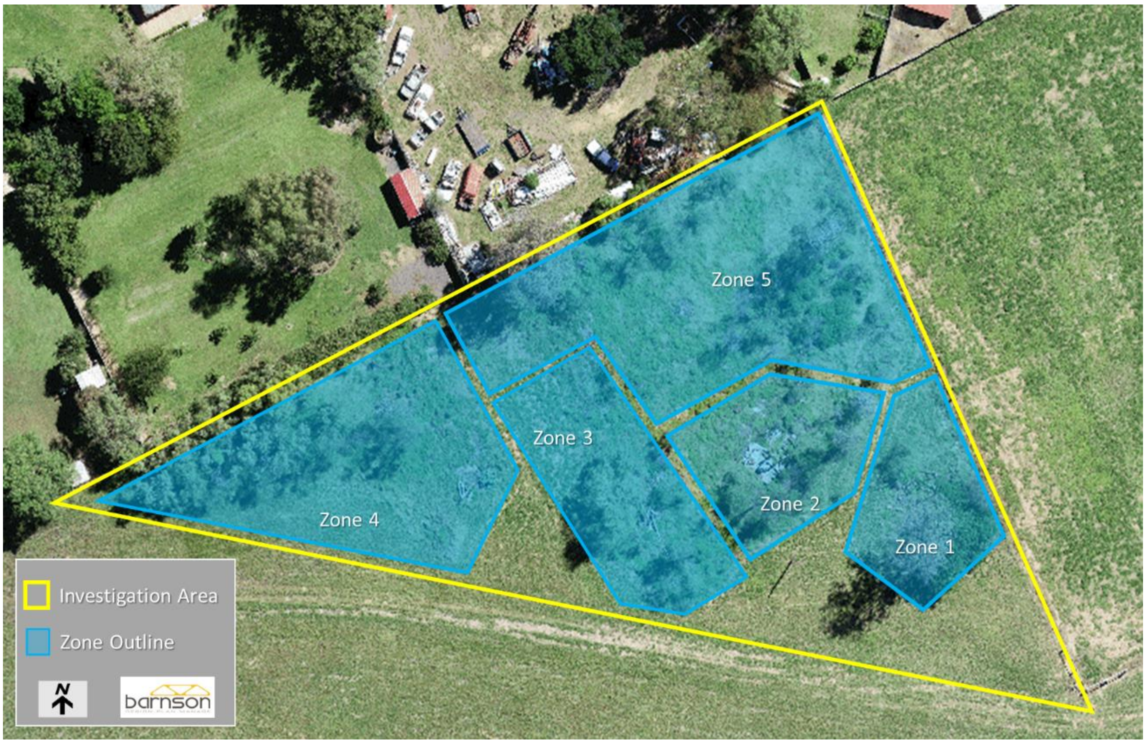

Figure 2.9: Investigation Area and identified investigation Zones.

No wastes or disposed garden refuse was observed in Zone 5. Fragments of fibre cement, previously confirmed to contain both chrysotile and amosite asbestos were observed in Zone 2 and Zone 3. Vegetation made it difficult to inspect other areas for the presence of fibre cement.

Following the 17 June 2021 site inspection it was recommended that the Investigation Area be cleared of waste and that the vegetation be mowed and cleared as far as possible to allow for further detailed investigation of the site.

3.0 CONCEPTUAL SITE MODEL

3.1 General

The conceptual site model (CSM) is intended to provide an understanding of the potential for contamination and exposure to contaminants within the investigation areas.

The CSM draws together the available historical information for the site, with site specific use and geological information to identify potential contaminants, contamination sources, migration and exposure pathways, as well as any sensitive receptors which may be relevant to the site.

3.2 Contaminants of Potential Concern

Based on the findings and recommendations of the preliminary site investigation report (Barnson, 2021) the contaminants of concern to this detailed site investigation are lead (Pb), zinc (Zn), and asbestos containing material. The available analytical data indicate that the presumed historical agricultural and landscape maintenance activities at the site did not significantly increase the concentration of pesticides or other contaminants related to agricultural chemicals in the surface soil.

Furthermore, the organic contaminants detected (polycyclic aromatic hydrocarbon (PAH) and petroleum hydrocarbons) are present at trace quantities and measured concentrations are below both health risk and ecological screening criteria.

The further samples collected during the site inspection of 17 June 2021, also indicated both Pb and Zn at elevated concentrations and the presence of trace quantities of hydrocarbons.

3.3 Sources

3.3.1 General

When the contaminants of concern (Pb, Zn and asbestos containing material), the location of the elevated contaminant concentrations and the changes to the proposed development are considered, the Conceptual Site Model (CSM) developed as part of the preliminary site investigation report (Barnson, 2021) is no longer accurate.

The primary sources identified in the previous CSM include the structures and wastes noted in the Investigation Area, but also contaminated stormwater, vehicles accessing the site and historical agricultural activities as potential sources. However, there is no direct correlation between the stormwater, vehicles and agricultural sources and the contaminants identified at the Investigation Area. The sections below present a discussion of the sources relevant to the Investigation Area.

3.3.2 Zinc

Zinc is one of the most common elements in the Earth's crust. A common use for zinc is to coat steel and iron in a process called galvanization, to prevent rust and corrosion. Zinc also readily combines with other elements, such as chlorine, oxygen, and sulphur, to form zinc compounds, which are widely used in industry. Zinc sulphide and zinc oxide are used to make white paints, ceramics, and other products while zinc acetate, zinc chloride, and zinc sulphate, are used in preserving wood and in manufacturing and dyeing fabrics. (ATSDR, 2005). Concentrations of zinc oxide in paint can be as high as 50% by weight (Nestler, et al., 2018).

The elevated concentrations of zinc detected in the soil samples at the Investigation Area correlate with the detection of elevated concentrations of lead. It is therefore accepted that both likely originate from deteriorated paint present in the demolition waste, or on the surface of former structures that occupied the site, from which paint chips and dust were released onto the ground where surface soils became contaminated. Galvanised metals present in the demolition waste potentially could contribute further to the zinc concentration of the soil.

3.3.3 Lead

Sources of lead in the environment are mainly associated with human activities including the historical use of leaded fuel, airborne emissions from some types of industrial facilities, and past use of lead-based paint (O'Connor, et al., 2018). As the highest concentrations of Pb were detected in samples of soil collected in areas where remnants of structures and demolition waste were observed, lead based paint historically used on the exterior surfaces of these buildings is considered the most likely source.

In the past, paint that contain lead compounds as pigment was widely used to cover surfaces in residential dwellings and other buildings and can still be found in older buildings on window frames, doors, skirting boards, kitchen and bathroom cupboards, exterior walls, gutters, metal surfaces and facias. The most common forms of lead used in paint are lead(II) chromate, lead(II, IV) oxide, and lead(II) carbonate (O'Connor, et al., 2018). The lead compounds are added to paint to accelerate drying, increase durability, maintain a fresh appearance, and resist moisture that causes corrosion in metals.

Lead pigments are brilliant white in colour and were most often used in white or light pastel-coloured paints. Lead concentrations in paints often exceed 10,000 mg/kg (O'Connor, et al., 2018). Exterior sanding, scraping or abrasive blasting of lead paint can cause high levels of lead in soil. As the paint surface ages, oxidation of the binder compound result in degradation of the paint surface that could lead to the release of the lead pigment particles as a fine powder or dust. Aged or weathered paint on flexible, porous, surfaces such as wood also tend to crack and flake. Paint chips and dust released from the surface can be released onto the ground where surface soils can become contaminated. This contamination has the potential to continue as long as the lead-based paint remain in place. Contaminant concentrations in the soil is expected to decrease rapidly with distance from the source as lead has low solubility and consequent low mobility in soil. However, the concentrations of lead in the contaminated soil are not expected to decrease and have the potential to increase over time as lead-based paint that cover the surface of structures, deteriorate.

3.3.4 Asbestos Containing Material

Asbestos is the generic name given to a group of naturally occurring fibrous silicate minerals. The three most common types are chrysotile (white asbestos), amosite (brown asbestos) and crocidolite (blue asbestos). Asbestos was mined in Australia until 1984, and 1.5 million tonnes of asbestos was imported between 1930 and 1983.

Asbestos containing materials are generally distinguished as either bonded or loose depending on the stability of the asbestos fibre in the material. Bonded products contain asbestos fibres that have been mixed with other materials such as cement or resin which bind the fibres and prevent the fibres from being broken and crumbled. Loose asbestos are un-stabilised asbestos fibres such as those typically used in insulation applications. If the material is bonded and in good condition, it poses little health risks but once it's loose and broken the risks escalate.

Because asbestos is flexible, strong, affordable and can insulate from heat and electricity, it was commonly used in the construction of homes and buildings. Most buildings and homes constructed in Australia before 1990 include asbestos containing material. The use of asbestos in Australia was banned in 2003.

The fragments of asbestos containing material observed at the subject site most likely originate from sheets of fibre cement used in the construction of gables, eaves or wall panels, that were discarded at the investigation area and were broken and dispersed over the area.

3.4 Pathways

3.4.1 Zinc - Environmental Behaviour and Pathways

Zinc is ubiquitous in the environment and is found in the air, soil, and water and is present in all foods. The average concentration of zinc in uncontaminated soil and surficial materials is approximately 60 mg/kg and can vary between <5 and 2,900 mg/kg, depending on location and local geology.

Human activities that can increase the levels of zinc in the environment are generally related to industrial processes, however zinc compounds used in products can result in small releases. For example, zinc oxide is a necessary ingredient in rubber manufacturing. Rubber is used to manufacture tires and as tire treads wear, small amounts of this zinc compound are released in the roadside environment. So too can the intensive use of synthetic fertiliser result in localised contamination of soil where the fertiliser is applied.

The fate and behaviour of Zinc in soil is determined by many factors including the rate of sorption and sequestration, leaching, degradation and uptake by plants. Once mobilized, zinc interacts with the different environmental media present (e.g. water, sediments and soil) and partitions between different fractions in these. The chemical form in which the zinc is present ultimately determines its environmental fate. The original and ultimate chemical forms of zinc (mainly oxide or sulphide) are very stable, and the contained zinc has very low solubility and very low potential for uptake by organisms (Nestler, et al., 2018).

Exposure of the general population to zinc is primarily by ingestion. Food may contain levels of zinc ranging from approximately 2 ppm (e.g., leafy vegetables) to 29 ppm (meats, fish, poultry) with the average daily zinc intake through the diet ranging from 5.2 to 16.2 mg. Other possible pathways for zinc exposure are water and air. However, significant exposure through these pathways mainly relate to occupational exposure of individuals involved in galvanizing, smelting, welding, or brass foundry operations and exposure to industrially contaminated water (ATSDR, 2005).

In most cases, dermal exposure to zinc or zinc compounds does not result in any noticeable toxic effects. Zinc oxide is used routinely in topical applications including sunscreens and creams designed to assist in wound healing (ATSDR, 2005).

The primary pathways by which receptors could be exposed to zinc identified in surface soils at the Investigation Area is through

- Incidental ingestion of contaminated soils.
- Inhalation of zinc-contaminated dust

Surface runoff and transport to surface waters as well as vertical and horizontal migration of contamination through the soils into the underlying groundwater is considered unlikely to occur given the low water solubility of zinc in soil.

3.4.2 Lead - Environmental Behaviour and Pathways

Small amounts of lead are naturally present in soil and in food such as vegetables. These small amounts of naturally occurring lead are generally in the range of 15 to 40 parts lead to one million parts soil (ppm) and should not cause alarm.

However, once soil has become contaminated with lead, which is not biodegradable, it remains a long term source of potential lead exposure. Through the addition of industrial lead pollutants, such as lead particles and chips from lead-based paints, lead levels in contaminated soil can range from 500 ppm to over 3,000 ppm (O'Connor, et al., 2018).

Exposure to lead can affect the health of adults, children and unborn babies. Once in the body, lead circulates in the blood. The amount of lead in a person's blood gives an indication of how much lead has recently entered the body and is expressed as the blood lead level. Lead is a health concern where there are pathways that allow individual blood lead levels to increase beyond a point where it becomes detrimental to health.

For both humans and animals the main pathways of exposure to lead in soils and dust is ingestion, with inhalation a minor pathway (NSW Lead Taskforce, 1994). Gardening may increase contact with lead if soil particles are swallowed, soil from the garden is tracked into the home, or vegetables grown in contaminated soil. Vegetables can absorb excess lead from highly contaminated soils are deliberately ingested. Higher concentrations of lead are typically found in leafy vegetables and root crops cultivated in lead contaminated soil, compared to fruiting plants (for example, fruit trees, tomatoes, and peas and beans).

Lead poisoning is also increasingly common problem in backyard chickens living in urban environments. Chickens scratch in the soil as part of their normal foraging behaviour and therefore will consume the lead-contaminated soil. Vegetation that grows on the soil will also be contaminated with lead, making the vegetation hazardous to chickens who frequently seek out forage to eat when free ranging. The increased consumption of lead is not only detrimental to the bird's health, but also to the humans who consume the eggs laid by the hens.

Exposure to lead-contaminated soil is of particular concern for young children as this age group tend to play on the ground most often and are more likely to place unwashed fingers, hands or objects in their mouths, leading to an increased propensity for ingesting lead particles. Lead can harm a young child’s growth, behaviour and ability to learn.

Based on the understanding of the likely modes of exposure and the primary pathways by which receptors could be exposed to lead identified in surface soils at the Investigation Area is through

- Incidental ingestion of contaminated soils.
- Inhalation of lead-contaminated dust

Exposure to lead in surface water or contaminated groundwater is considered unlikely to occur given the distance to the nearest groundwater bore. The groundwater well on site is not in use and is reportedly dry. The nearest surface water stream is the intermittent drainage channel located to the east of the site. The stream is on the opposite side of O'Connell Road at a distance of some 350m from the contaminated area. Coupled with the low water solubility of lead compounds in soil, the distance to the water resources is accepted to preclude these as potential pathways.

3.4.3 Asbestos - Environmental Behaviour and Pathways

As mentioned in Section 3.3.4, asbestos fibres can either be bonded or loose. Asbestos fibres normally disorient when damaged, mishandled or due to the wear and tear factors after continuous use.

When the asbestos is used in cement sheeting, the fibres are normally bonded and more stable. In materials such as pipe lagging & sprayed roof insulation, the fibres are not bound in a stable matrix hence when they are disturbed, they are more likely to be released into the atmosphere.

Loose fibres normally fall off buildings, settling on objects or floating in the air. Asbestos released to the air will eventually settle out by gravitational settling and dry deposition. Movement of deposited asbestos fibres only occur during runoff or erosion. Asbestos fibres will not volatilize or degrade in the environment and may easily be resuspended to the air by disturbance of soil surfaces containing asbestos fibres.

With time, these fibres can enter water bodies. Asbestos will not volatilize or degrade in water and the importance of the transport of asbestos from the surface of aquatic environments by wind-activated aerosol formation is presently indeterminate.

Long-term and unsafe exposure to asbestos has a number of well-documented health effects. The fibres are tiny and light, hence easily inhaled and carried into the lower regions of the lungs causing respiratory problems. The most typical routes of asbestos exposure include inhalation and ingestion. Absorption through skin is minimal, but residues on skin can be ingested or inhaled. Asbestos fibres are generally not well absorbed via ingestion or dermal routes.

The primary pathway by which receptors could be exposed to asbestos in soil is through inhalation of re-suspended fibres.

However, the asbestos identified in surface soils at the Investigation Area are fragments of bound asbestos containing material. No free fibres were detected in the soil where the fragments were observed.

3.5 Receptors

The identification of potential receptors relate to the proposed land use of the Investigation Area.

A conceptual masterplan drawing of the proposed development show that the north-eastern section of the Subject Site will be used as agriculture education areas and include animal pens, paddocks and vegetable gardening. The portion of the Subject Site that includes the Investigation Area is intended for use as large livestock paddocks. Potential receptors relating to this land use may include:

- Visitors to the site (e.g. students, teachers and parents/caregivers);
- Workers involved in the construction of the facilities; and

- Workers conducting maintenance of the grounds.

The potential environmental receptors that have to be considered also relate to the future use of the Investigation Area as large animal paddocks. Possible environmental receptor populations for the Investigation Area include:

- Local drainage channels and receiving surface water bodies.
- Groundwater resources beneath the site.
- Vegetation at the site and wildlife visiting the site.

Evaluation of the likely environmental pathways have concluded that the low solubility of contaminants and the distance to both surface and groundwater resources preclude either as receptors. However, as part of the most recent flood modelling for the Subject Site (see Figure 3.1), storm water from the Subject Site is proposed to be drained in a north westerly direction to ward the Namoi River. The concept landscape design shows that stormwater will also be drained from the northern portion of Lot 124, by means of a drainage channel (refer Figure 2.6). Consequently, although the contaminants present at the Investigation Area are unlikely to be transported off-site by means of surface runoff, future drainage of the site will introduce this as a possible pathway whereby surface water resources could potentially become impacted.

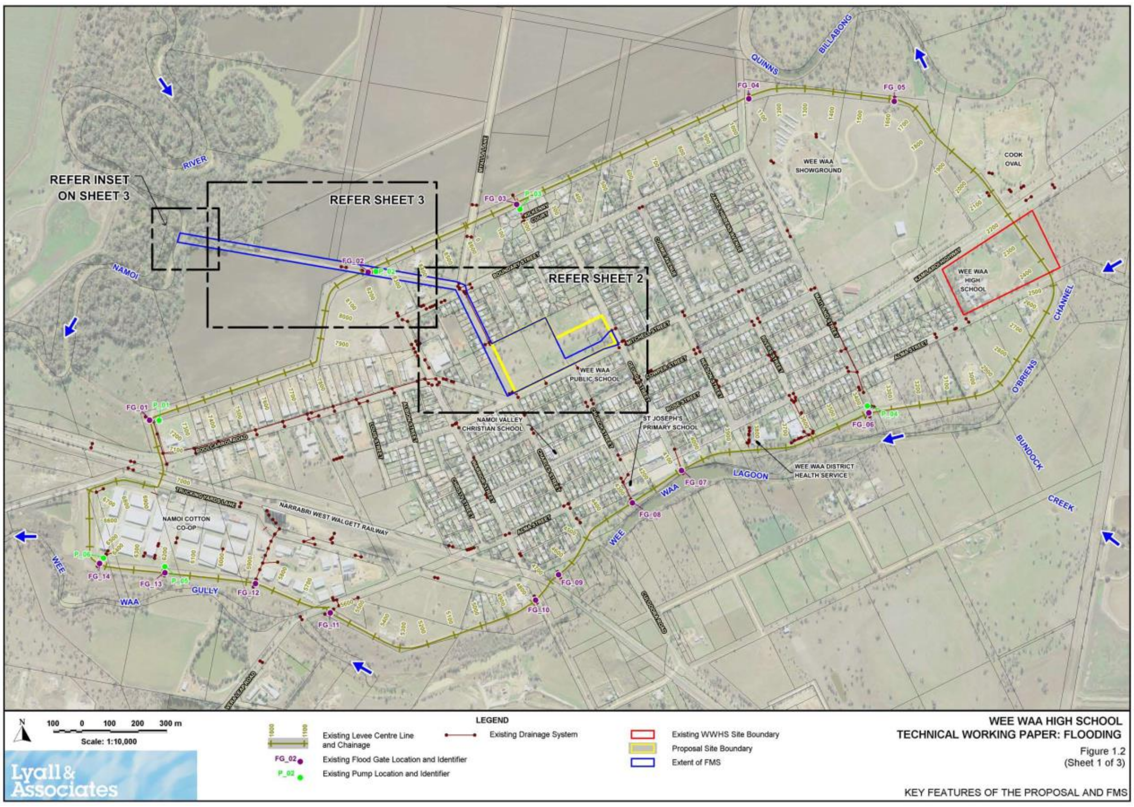

Figure 3.1: Flood planning overview showing drainage from Subject Site to Namoi River.

Plant life currently present at the Investigation Area exclude any root and leafy vegetables or fruit. In general, plants are unlikely to be affected as zinc and lead are not phytotoxic at the concentrations detected. However, should root or leafy vegetables be cultivated in the contaminated soil, humans or animals that consume the vegetables can indirectly be exposed to the metals taken up into the plants from the contaminated soil. It is considered unlikely that any wildlife would regularly enter the affected areas of the site and be exposed to the contaminated soils. The risk of health effects to wildlife from exposure to the contaminated surface soil is therefore considered minimal.

3.6 Exposure Model

3.6.1 General

The Subject Site is not listed in any of the contaminated land databases (Barnson, 2021). Based on the results of the desktop assessment, preliminary site investigation and additional site inspection, the overall likelihood for *significant* chemical contamination to be present at the Investigation Area is still considered low.

However, surface soils at the site were found to contain elevated concentrations of heavy metals and asbestos containing material. In the discussions presented above, the potential sources, pathways and receptors were evaluated and the linkages between these considered to determine whether the increased contaminant levels in fact poses a potential risk to human health or the environment. The evaluation demonstrated that source-pathway-receptor linkages does exist. Routes of Exposure

Health effects from exposure to zinc relate mainly to inhalation exposure to pure metallic zinc or zinc oxide fume from industrial processes or welding operations. It is considered unlikely that human receptor populations will be exposed to these forms of zinc from the elevated concentrations detected in the soil at the Investigation Area.

Zinc is an essential nutrient for humans and animals and zinc deficiency has been linked to several adverse health effects. The recommended dietary allowance (RDA) for zinc is 11 mg/day in men and 8 mg/day in women. Excess oral exposure to zinc can result in gastrointestinal symptoms including vomiting, abdominal cramps, and diarrhea. However exposure levels associated with such effects suggest that high concentrations of 910 mg zinc/L in water or single-dose exposures of ~140–560 mg zinc are required to cause these effects (ATSDR, 2005).

Consequently, the concentrations of zinc detected at the Investigation Area are not considered to pose a health risk to human receptors likely to attend the site.

Health effects from exposure to lead in soil relate to inhalation of dust as well as direct and indirect ingestion of soil. A single exposure, like eating a leaded-paint flake 1 cm^2 in size, can increase blood-lead levels for several weeks, however, a small exposure to lead does not always result in symptoms of lead poisoning in either adults or children (NSW Lead Taskforce, 1994). Nevertheless, lead can gradually build up in the body to cause health problems if exposure continues. Critically increased lead blood levels therefore also require at least sub-chronic direct exposure to contaminated soil or chronic indirect exposure (e.g. ingestion of vegetables grown in contaminated soil).

Asbestos has been classified for decades as a proven human carcinogen by the US Environmental Protection Agency, the International Agency for Research on Cancer (IARC), the World Health

Organization (WHO), and the US National Toxicology Program. There is no "safe" level of asbestos exposure for any type of asbestos fibre. The majority of impacts may occur many years after initial exposure. The most common health effects are asbestosis, a lung disease in which tissue scarring makes breathing difficult, and mesothelioma, a cancer of the lining of the lungs that is almost exclusively associated with asbestos exposure.

Symptoms of asbestos exposure may not appear for 10 to 20 years after initial exposure. Groups especially at risk of health effects from asbestos exposure include:

- Cigarette smokers and individuals with existing lung disease, who are at increased risk from asbestos exposure. Exposure to cigarette smoke, together with exposure to asbestos, leads to a greatly increased risk of lung cancer.
- Children exposed to asbestos are also at a higher risk of developing asbestos-related diseases due to their longer expected lifespan after exposure.

However, as long as the fragments of asbestos containing material observed at the Investigation Area remain intact, these are not expected to release asbestos fibres to the environment and no loose fibres were detected in the soil where the fragments were observed.

3.6.2 Assessment of Exposure

Workers attending the Investigation Area are accepted to be healthy adults that will be working under formal workplace health and safety measures. Under such measures, inhalation, dermal or ingestion exposure to surface soils is generally avoided through the implementation of hazard controls such as designated eating areas, personal protective equipment and hygiene procedures. The direct exposure of workers to contaminated surface soil during construction or earthworks activities is therefore considered minimal and unlikely to be at a level of concern.

However, activities involving the disturbance of the soil may expose workers conducting maintenance of the grounds directly to the contaminants in the soil. Workers should be informed of this hazard and appropriate hazard controls should be implemented.

Students, teachers and parents/caregivers that regularly attend the site for education related purposes, are the main receptor group for this assessment. The health effects associated with the heavy metal contaminants identified at the Investigation Area, require exposure to high concentrations of the contaminants via oral or inhalation routes, at a frequency that can be considered at least sub-chronic. Accepting that young children between the ages of one and five years are unlikely to spend a significant amount of time at the Investigation Area, exposure to the contaminated soil will be limited to adults and older children and can reasonably be expected to involve mainly the inhalation route and a very small contribution from incidental ingestion.

However, of concern is contaminated dust from the Investigation Area clinging to clothes and shoes of visitors to the area or equipment used in the area, and being transferred to other areas of the Subject Site, into buildings at the site and carried off-site. Should the contamination detected at the Investigation Area remain un-remediated, strict hygiene procedures will be necessary to prevent the dispersion of the contamination.

Figure 3.2 presents a flow diagram that summarises the conceptual understanding of the likely exposure scenario relevant to the contaminated surface soil at the Investigation Area.

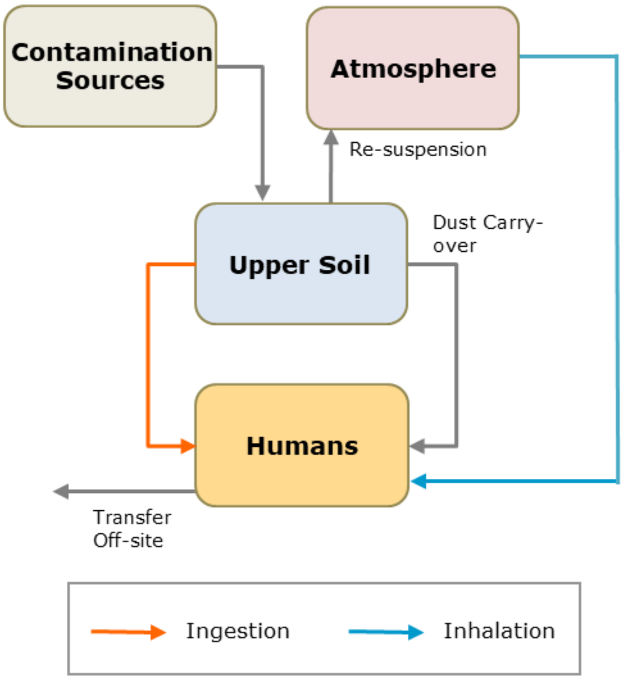

Figure 3.2: Conceptual model of exposure at the Littlebourne study area.

4.0 DATA QUALITY OBJECTIVES

4.1 Site Investigation

The objective of the detailed contaminated site investigation is to determine whether the site conditions exist that could result in the exposure to contaminated soil, leading to the realisation of the associated health and environmental risks and therefore would require further action to render the site suitable for its intended use. The desktop evaluation of the site history, current use of the site as well as the findings of the preliminary site investigation (Barnson, 2021), did not identify any significant risks in this regard but did note elevated concentrations of specifically Zn and Pb as well as the presence of asbestos containing material in the surface soils of the Investigation Area.

As discussed in Section 2.3.3, Barnson conducted a further inspection of the area where demolition waste, refuse and asbestos containing material was observed and the elevated concentrations of contaminants were detected. The purpose of this inspection was to verify the findings of the preliminary site investigation, as well as to collect further samples of surface soil from the potentially contaminated area in order to determine the distribution of the contaminants in this area and so define an Investigation Area.

Inspection of the Investigation Area in support of the detailed assessment was undertaken on 23 August 2021.

During the site inspection the following observations were made.

- At the time of the initial site investigations the Investigation Area was covered with vegetation (tall grass and trees) and included several heaps of demolition waste, and garden refuse (grass clippings). The investigation area was cleared of most of the demolition waste and mowed before the inspection was undertaken in August. Figure 4.1 shows pictures of the Investigation Area at the time of the June inspection and after the clearing in August.

Before | After

Figure 4.1: Investigation area before and after waste removal and vegetation clearing.

- During inspection of the cleared areas several fragments of fibre cement were again observed (see Figure 4.2). The observed fragments were localised to two of the zones identified in Section 2.3.3 (see Figure 4.3) specifically the area in Zone 2 where a shed structure and demolition rubble was previously observed, and Zone 3 in the vicinity of masonry building footings revealed by the clearing of the vegetation in this area.
- The total quantity of fibre cement fragments observed at the Investigation Area is likely less than 10 square meter in size.

Figure 4.2: Fragments of fibre cement observed at the Investigation Area.

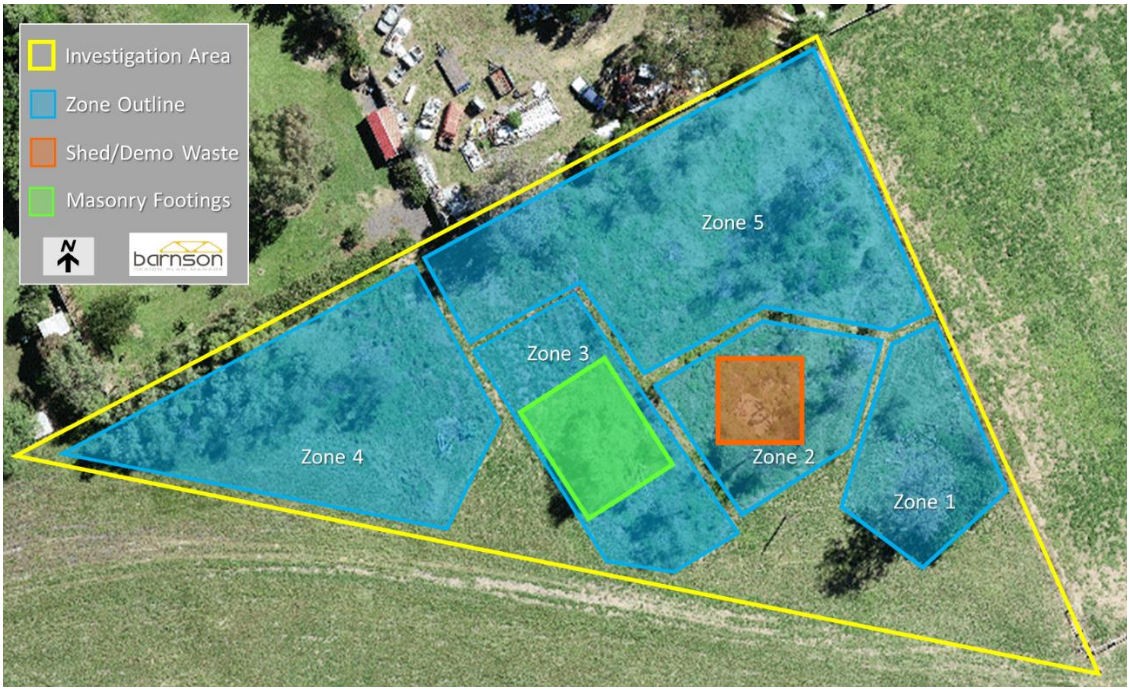

Figure 4.3: Location of fibre cement fragments.

- No visible discoloration or staining of open ground or soil was observed during the site inspection.

- In the area marked as Zone 1, pieces of painted wood were observed in the area to the west of the tree (see Figure 4.3 and Figure 4.4). A piece of wood similar to the pieces observed here, was previously collected from the same area, during the initial site investigation, and analysed for lead. The results indicated a low concentration of lead (300 ppm Pb) in the paint.

Figure 4.4: Pieces of painted wood observed in Zone 1.

- Discarded waste was still observed among the trees in Zone 4 (see Figure 4.5).

Figure 4.5: Uncleared waste observed in Zone 4

4.2 Sampling and analysis

4.2.1 Sampling Strategy

The contaminants of concern (zinc, lead and asbestos) are not readily soluble and is unlikely to dissolve and leach into sub-surface soil. Furthermore, the Investigation Area is underlain by hard clay which has a very low rate of infiltration. In less disturbed, contaminants at the surface of the site is likely to remain within the surface soil. Sampling was therefore focussed on the surface soils (0-300mm) as it is accepted that the identified sources will result in 'top-down' contamination.

Sampling was planned with consideration of the NSW EPA Sampling Design Guidelines for contaminated sites (NSW EPA, 1995), and the sensitivity of the proposed land use (educational facility) in mind. The sampling was limited to the Investigation Area and included all the zones as identified in Section 2.3.3.

The NSW EPA Sampling Design Guidelines for contaminated sites (NSW EPA, 1995) prescribe a sampling density of approximately 25 samples per hectare for statistically defensible characterisation of surface soil contamination. However, the Guidelines also provides a procedure to determine the number of samples required to show whether the average concentration of a contaminant is above or below an acceptable limit.

The procedure makes use of the following equation, as well as average contaminant concentration and standard deviation estimated from previous sampling results:

$$n = \frac{6.2\sigma^2}{(C_s - \mu)^2}$$

Where:

n = number of samples needed

σ = estimated standard deviation of contaminant concentrations

μ = estimated average contaminant concentration

C_s = acceptable limit (in this case HIL-A for Zn and Pb was used)

Using the concentrations of Zn and Pb measured during the preliminary site investigation the minimum number of samples required to statistically evaluate the average contaminant concentration of the Investigation Area is calculated as 30.

The sampling strategy used for the Investigation Area was focussed on ensuring that the different Zones are characterised and that possible differences between the Zones are identified.

The pattern followed for the soil sampling can be described as Judgement Sampling, where points are selected on the basis of the investigator's knowledge of the probable distribution of contaminants at a site. It is an efficient sampling method which utilises knowledge of the site history and field observations (NSW EPA, 1995).

Accepting the five composite samples collected during the further site inspection in June as five data points, a further 25 sample locations were selected, for the characterisation of the Investigation Area. The locations of the samples were selected to coincide with the areas where demolition waste and structures were observed and is aimed at determining:

1) The average concentration of contaminants in each of the five identified Zones
2) The distribution of contamination in each of the Zones.

Figure 4.6 presents a map of the study area with the locations of the surface soil samples indicated.

4.2.2 Analysis

All 25 discrete surface soil samples were submitted for chemical analysis. The soil samples were submitted to Australian Laboratory Services Pty Ltd (ALS) laboratory in Mudgee for determination of the following parameters:

- metallic element (cadmium, chromium, copper, lead, nickel and zinc) concentrations, including arsenic and mercury in soil.
- extraction with organic solvent and analysis of Total Recoverable Hydrocarbons (TRH) fractions C_6 to C_{40}, benzene, toluene, ethylbenzene and total xylene (BTEX) and Polycyclic Aromatic Hydrocarbons (PAHs).
- laboratory QC duplicates and spikes

4.2.3 Field Data Quality Procedures

All fieldwork is to be conducted in accordance with Barnsons's Standard Field Operating Procedures, which are aimed at ensuring that all environmental samples are collected by a set of uniform and systematic methods. Key requirements of these procedures are:

Sample identification procedures - collected samples will be immediately transferred to sample containers of appropriate composition and preservation for the required NATA accredited laboratory analysis. All sample containers will be clearly labelled with a sample number, sample location, sample depth (for sediment) and sample date.

The sample containers will then be transferred (as appropriate) to a chilled container for sample preservation prior to and during shipment to the testing laboratory.

Sample QA/QC

- Intra-laboratory field duplicate samples will be collected at a rate of 1 in 10 soil samples.
- One rinsate sample will be collected per day where non-dedicated sampling equipment is used (hand auger, trowel etc).
- Chain of custody information requirements - a chain-of-custody form will be completed and forwarded to the testing laboratory.
- Preparation and analysis of trip blanks and trip spikes are not proposed at this stage as significant contamination from volatile hydrocarbons is not expected at the site.

A standard procedure for surface soil sample collection was followed throughout and field records were kept for each sample collected noting sample location, site observations, sample identification, sample depth and a description of the soil. Sampling locations were mapped at the time of sampling.

Figure 4.6: Map indicating soil sample locations at the Investigation Area.

Samples were collected in glass jars provided by the laboratory and marked with the assigned identification number. All filled sample jars were kept in insulated containers and refrigerated after collection and during transport to the laboratory. Chain of custody was recorded for all samples. A copy of the signed chain of custody sheet is attached as Appendix B. Disposable gloves were used for the collection of surface samples, and were renewed prior to the collection of each sample. Decontamination of sampling equipment was therefore not necessary.

Two intra-laboratory field duplicate samples were collected and submitted with the soil samples for analysis. The samples numbered WW-26 and WW-27 were, respectively, collected at the same locations indicated as 1 (sample numbered WW-01) and 20 (sample numbered WW-20) in Figure 4.6. The concentrations of analysed parameters detected in the duplicate samples are within the Relative Percent Difference (RPD) limit accepted for laboratory duplicate samples.

4.2.4 Analytical Data Quality

Analyses of the surface soil samples collected at the Investigation Area was undertaken by the Australian Laboratory Services Pty Ltd (ALS). ALS adopts the National Association of Testing Authorities (NATA) laboratory quality control procedures as its internal quality assurance system.

A summary of the laboratory QA/QC procedures implemented is presented in Table 4.1.

Table 4.1: Laboratory QA/QC Program

Procedure		Acceptable Limit
Laboratory Duplicate Sample	The analytical laboratory collects duplicate sub samples from one sample submitted for analytical testing at a rate equivalent to one in twenty samples per analytical batch, or one sample per batch if less than twenty samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the test result.	If contaminant concentration is less than 10 times the Limit of Reporting (LOR): no Relative Percent Difference (RPD) limit applies. If concentration 10 to 20 times the LOR: 0% to 50% RPD. If greater than 20 times the LOR: 0% to 20% RPD
Spiked Sample	An authentic field sample is 'spiked' by adding an aliquot of known concentration of the target analyte(s) prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques. Spiked samples will be analysed for each batch where samples are analysed for organic chemicals of concern.	70-130% recovery for metals/ inorganics and 60-140% for organics
Surrogate Standard/ Spike	These are organic compounds which are similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions (retention time), but which are not normally found in environmental samples. These surrogate compounds are 'spiked' into blanks, standards and samples submitted for organic analyses by gas-chromatographic techniques prior to sample extraction. Surrogate Standard/Spikes provide a means of checking that no gross errors have occurred during any stage of the test method leading to significant analyte loss.	60% - 140% recovery (organics only)

Method Blank	Usually an organic or aqueous solution that is as free as possible of analytes of interest to which is added all the reagents, in the same volume, as used in the preparation and subsequent analysis of the samples. The reagent blank is carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample.	<LOR

In the analysis undertaken of the soil samples by ALS, duplicates as well as analyte and surrogate spikes were applied to all contaminant classes analysed. The results reported for the four duplicate samples, are within the Relative Percent Difference range of the acceptance criteria for a laboratory duplicate sample. The analyte spike recoveries reported for the different sets of organic analytes are indicated as within the acceptance criteria (see Appendix C).

All media appropriate to the objectives of this investigation have been adequately analysed and no area of significant uncertainty exist. It is concluded the data is usable for the purposes of the contaminated site investigation.

5.0 RESULTS

5.1 Analytical Results

The ALS laboratory report for the samples is attached as Appendix C. The report lists the heavy metal and hydrocarbon concentrations detected in each sample. Table 5.1 presents a summary of the hydrocarbon fractions and PAH compounds detected in the soil samples.

Only compounds and samples where concentrations were detected are listed. Table 5.2 present a summary of the heavy metals detected in each of the samples. Note that sample WW-26 and WW-27 are duplicate samples for analysis collected at the same location as Samples WW-01 and WW-20.

Table 5.1: Hydrocarbons detected in samples of soil.

	WW-04	WW-12	WW-14	WW-16	WW-20
Surface			mg.kg^{-1}		
C15 - C28 Fraction	<100	<100	<100	120	<100
C29 - C36 Fraction	<100	100	<100	320	210
>C16 - C34 Fraction	110	<100	<100	320	190
>C34 - C40 Fraction	<100	<100	<100	270	170
Fluoranthene	<0.5	<0.5	0.8	<0.5	<0.5
Pyrene	<0.5	<0.5	0.8	<0.5	<0.5
Total PAHs	<0.5	<0.5	1.6	<0.5	<0.5

Table 5.2: Heavy metals detected in samples of soil.

Surface Soil Sample Numbers	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
				mg.kg-1				
WW-01	<5	<1	27	22	14	<0.1	22	103
WW-02	<5	<1	27	25	20	<0.1	21	111
WW-03	<5	<1	28	24	11	<0.1	23	60
WW-04	<5	<1	26	21	14	<0.1	20	246
WW-05	<5	<1	26	22	14	<0.1	20	111
WW-06	5	1	25	73	230	0.2	19	1610
WW-07	<5	<1	32	50	623	0.1	24	1410
WW-08	<5	1	32	32	114	<0.1	27	1070
WW-09	<5	<1	28	28	520	0.1	20	1310
WW-10	<5	<1	24	16	1480	<0.1	15	880
WW-11	11	<1	27	36	664	0.1	24	407
WW-12	5	<1	22	23	253	<0.1	17	460
WW-13	<5	<1	24	20	386	0.2	21	309
WW-14	11	3	26	32	565	0.2	18	2270
WW-15	<5	5	28	29	139	<0.1	24	4840
WW-16	<5	<1	27	41	126	<0.1	22	240
WW-17	<5	<1	26	43	108	<0.1	22	2710
WW-18	<5	<1	25	38	108	<0.1	20	390
WW-19	<5	<1	29	34	211	<0.1	23	206
WW-20	<5	<1	24	35	92	<0.1	20	216
WW-21	<5	<1	34	32	21	<0.1	28	106
WW-22	7	<1	32	27	23	<0.1	27	79
WW-23	<5	<1	33	27	16	<0.1	27	106
WW-24	<5	<1	27	28	69	<0.1	22	695
WW-25	<5	1	25	51	435	0.1	19	503
*WW-26 (1)	<5	<1	27	24	20	<0.1	22	97
*WW-27 (20)	<5	<1	27	25	51	<0.1	21	236

*Filed duplicates, (x) primary sample to which duplicate relate.

6.0 ASSESSMENT

6.1 Assessment Criteria - Human Health and Environmental Risk

Screening for human health risk, utilises published human health investigation levels (HILs) from the National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999) to identify contaminant concentrations in soil that may pose a risk to humans.

HILs are scientifically based, generic assessment criteria designed to be used in the screening of potential risks to human health from chronic exposure to contaminants. HIL's are conservatively derived and are designed to be protective of human health under the majority of circumstances, soil types and human susceptibilities and thus represent a reasonable 'worst-case' scenario for specific land-use settings. The HILs selected for evaluation of the Subject Site are those derived for public open space (HIL-C) and include land uses such as parks, playgrounds, playing fields and secondary schools.

It is accepted that the land use activities and exposure scenarios associated with the proposed development at the Subject Site and the proposed use of the Investigation Area, will be similar in nature to those relevant to a secondary school. The HIL-C criteria is therefore considered suitable for evaluation of the contaminant concentrations detected at the Investigation Area.

The health risks associated with petroleum hydrocarbon compounds are assessed using Health Screening Levels (HSLs) developed to be protective of human health by determining the reasonable maximum exposure from sources for a range of situations commonly encountered on contaminated sites. HSLs are derived for soil, groundwater and soil vapour and relate to exposure to petroleum hydrocarbons through the vapour inhalation exposure pathway only. Direct exposure pathways such as incidental soil ingestion and dermal exposure pathways are generally not the risk drivers when compared to inhalation exposure (NEPC, 1999). HSLs have been developed for BTEX and naphthalene plus four hydrocarbon fractions namely:

- C6 – C10- Fraction number F1
- >C10 – C16 less Naphthalene - Fraction number F2
- >C16 – C34 - Fraction number F3
- >C34 – C40 - Fraction number F4

Screening values published for polycyclic aromatic hydrocarbons (PAHs) consider the combined total concentration of all PAH compounds detected.

Although the primary concern in most site assessments is protection of human health, the assessment should also include consideration of ecological risks and protection of groundwater resources that may result from site contamination. EILs provide screening criteria to assess the effect of contaminants on a soil ecosystem and afford species level protection for organisms that frequent or inhabit soil and protect essential soil processes.

Ecological investigation levels (EILs) have been derived for common metal contaminants in soil. The values selected for the evaluation of the heavy metals and PAHs detected in the soil samples from the Investigation Area considers the physicochemical properties of soil and contaminants and the capacity of the soil to accommodate increases in contaminant levels above natural background while maintaining ecosystem protection for identified land uses.

Table 6.1 presents a summary of the health-risk based criteria selected for the assessment.

Table 6.1: Human health and ecological risk screening levels

Element/Compound	Health-based Investigation Levels HIL C Recreational $mg.kg^{-1}$	Ecological Investigation Levels (EIL) $mg.kg^{-1}$
Arsenic (As)	300	160
Cadmium (Cd)	90	NA
Chromium (Cr) (Total)	NR	680
Copper (Cu)	17,000	320
Lead (Pb)	600	1,800
Mercury (Hg)	80	NA
Nickel (Ni)	1,200	460
Zinc (Zn)	30,000	460
Total PAH	300	NA

Note: NR=not relevant due to low human toxicity of Cr(III). EILs selected for urban residential land use scenario.

Ecological risks associated with hydrocarbons are evaluated by using ecological screening levels (ESLs), which are based on EC_{25} weight-of-evidence ecotoxicity data, evaluated for a specific land use scenario (NEPC, 1999). The ESLs (Table 6.2) are evaluated for the same four carbon chain fraction ranges (F1 to F4) listed above. Screening values relevant to both commercial and residential exposure scenarios are listed.

Table 6.2: Human health and ecological risk screening levels for hydrocarbon fractions.

Fraction	Management limits for TPH in Soil Residential/ Commercial $mg.kg^{-1}$	Health Screening Levels (HSLs) for vapour intrusion Commercial (sand) $mg.kg^{-1}$ (soil)	Ecological Screening Levels (ESL) Commercial $mg.kg^{-1}$
F1	700	260	215
F2	1,000	NA	170
F3	2,500	NA	2,500
F4	10,000	NA	6,600

NA=No applicable screening level.

It was confirmed that limits of detection reported by the laboratory are below the criteria values. All other contaminants analysed for in the soil samples that are reported below the limit of detection by the laboratory can therefore be excluded from further assessment.

6.2 Findings

6.2.1 General

Direct comparison of the analytical results presented in Section 5.1 with the health-risk based assessment criteria (refer Table 6.1) show that heavy metal concentrations (except for lead), as well as concentrations of hydrocarbons and PAH compounds are well below health-risk based criteria values (HIL-C).

The concentrations of zinc detected in the soil, although elevated, also does not exceed the health risk based investigation level, but does exceed the Ecological Investigation Level. The sections that follow discuss the detected concentrations of Pb and Zn.

6.2.2 Lead

Comparison of the lead concentrations detected in soil with the HIL-C criterion of 600 mg.kg^{-1} (see Figure 6.1), indicate that several samples exceed or approach this health-risk based investigation level.

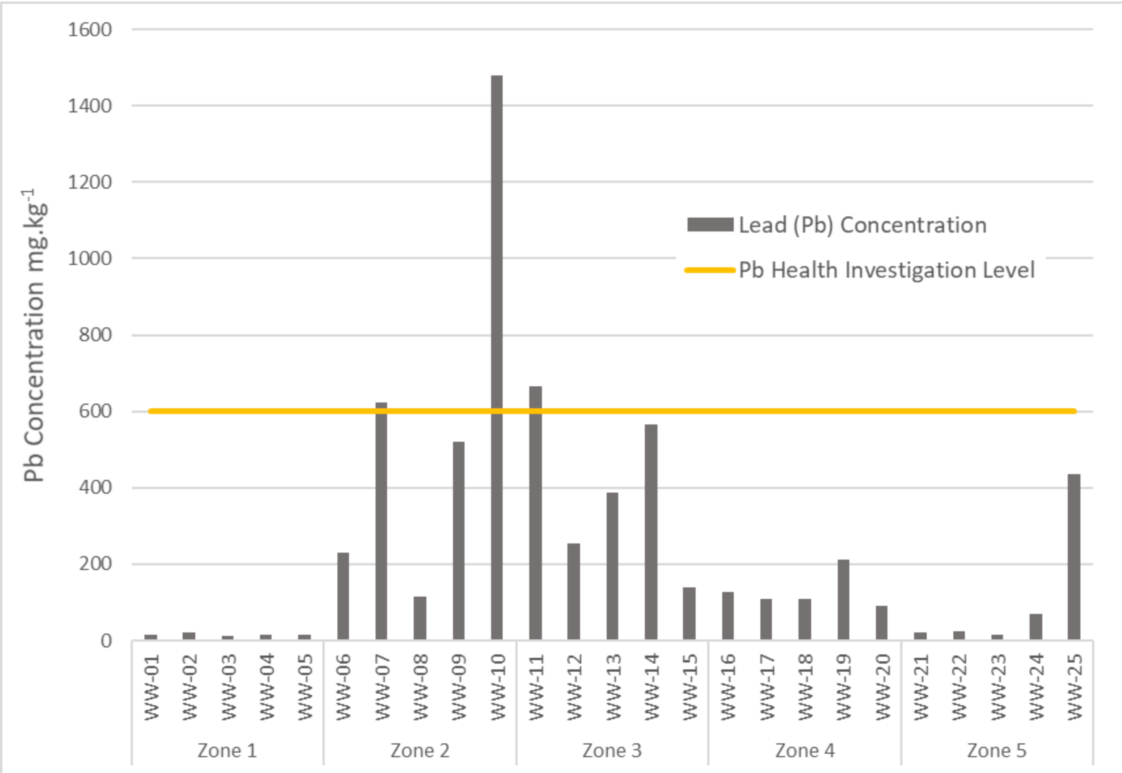

Figure 6.1: Comparison of Pb concentrations detected in surface soil samples from the Investigation area with the health-risk based investigation level.

The three locations where the lead concentrations in soil exceed the HIL are limited to Zone 2 and Zone 3. Since the contamination seems to be localised around these two Zones it is necessary to determine whether the Investigation Area, as a whole, can be considered contaminated. This is determined by statistical analysis of the measured lead concentrations through calculation of the 95th percentile upper confidence limit of the average. The method selected considers the distribution of the measurement data as lognormal and assesses this assumption through evaluation of the coefficient of variation (CV) where:

$$CV = \frac{s}{\bar{x}}$$

and

x = the arithmetic average (in this case 250 mg $Pb.kg^{-1}$)

s = standard deviation (in this case 331)

The CV for the lead concentrations is calculated as 1.32, which supports the assertion that the data is lognormally distributed. The lognormal distribution of the data allows the upper confidence limit of the average to be calculated using the following relationship:

$$UCL_{ave} = \bar{x} + t_{\alpha.n-1} \frac{s}{\sqrt{n}}$$

where:

$t_{\alpha,n-1}$ = a test statistic

n = number of sample measurements (in this case 21, including the duplicates)

Using a test statistic number of 1.725 based on the 95% confidence limit, the UCL is calculated as 140 mg $Pb.kg^{-1}$. This statistical analysis indicates that there is a 95% probability that the arithmetic average concentration of Pb at the Investigation Area will not exceed the 600 $mg.kg^{-1}$ risk-based investigation level.

Overall, the metallic element concentrations reported for the soil samples are consistent with the different sampling areas as lead concentration in soil is generally expected to be closely associated with the areas where the demolition wastes were previously observed. The general degree of homogeneity across the Investigation Area and absence of elevated concentrations of organic contaminants in the confirmatory soil samples, support the notion that the likelihood of significant chemical contamination across the entire Investigation Area is low.

6.2.3 Zinc

Comparison of the zinc concentrations detected in soil with the EIL criterion of 460 $mg.kg^{-1}$ (see Figure 6.2), indicate that several samples exceed or approach this risk based investigation level. The locations where the zinc concentrations in soil exceed the EIL include Zones 2, 3, 4 and 5. Elevated concentrations of zinc are spread into more of the Investigation Area compared to lead. This is likely due to galvanised metal being observed in more locations compared to structures that included painted surfaces.

The Ecological Investigation Level used in the evaluation of the zinc concentrations detected at the Investigation Area, relates mainly to the toxicity of zinc to aquatic organisms.

The general mechanism of zinc oxide toxicity in aquatic organisms is shared by multiple metals. Zinc is both essential for life and potentially toxic above certain concentrations. Zinc oxide itself is not the toxic form, nor is zinc alone; it is the free Zn^{2+} ion that causes lethality in aquatic organisms (Nestler, et al., 2018).

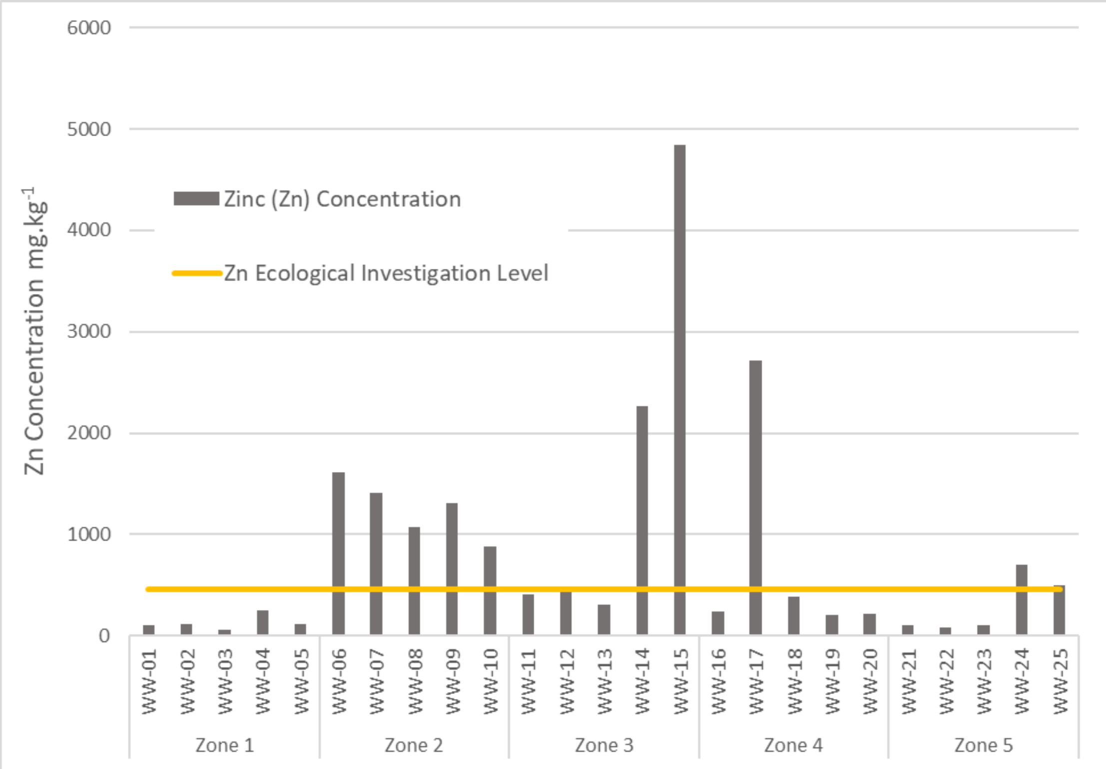

Figure 6.2: Comparison of Zn concentrations detected in surface soil samples from the Investigation area with the ecological-risk based investigation level.

The Investigation Area and indeed the Subject Site is not identified as an area of high ecological value, nor is the site located close to such an area. Given the low in-situ leachability of zinc oxide and sulphide compounds and the low infiltration rate and runoff potential of the Investigation Area soils and site, it is considered unlikely that the zinc present in the Area would represent any risk to the ecosystem.

6.3 Discussion

Based on the concentrations of contaminants detected in the surface soils of the Investigation Area and the evaluation of the detected values against both health risk based and ecological screening levels, the only remaining contaminant of concern is lead. The analytical results show that elevated concentrations of lead at the Investigation Area is limited to the areas identified as Zone 2 and Zone 3, with the single elevated concentration detected in Zone 5, located just outside the Zone 2 area.

The soil lead concentration of 600 $mg.kg^{-1}$ as a level for further investigation, is based on principles of risk assessment and should be used only for screening purposes (NSW Lead Taskforce, 1994). In order to determine the risk posed to potential receptors factors such as land use, the distribution of contaminants and the statistical distribution of elevated concentrations is very important to interpreting the results of a site investigation.

When soil lead concentrations that exceed the investigation level are encountered, the probability of a receptor coming into contact with the contaminated soil should be assessed by considering factors such as accessibility, frequency of exposure and contaminant concentrations.

The screening level is based on the assumption that a receptor is chronically exposed to the lead in the soil, at the maximum concentration.

Remedial actions should only be recommended if conditions exist that would allow exposure, in accordance with that assumed for the screening level, to occur. That is, where receptors regularly come into contact with bare soils containing lead at concentrations equal or greater than 600 $mg.kg^{-1}$. However, if a barrier existed between the soil and the receptor, higher concentrations of lead could theoretically be permitted as the risk presented to the receptor would not increase.

Barriers range from grass cover and topsoil to clay tops and concrete. In general, the more impenetrable a barrier the higher the lead concentrations which can be tolerated. The NSW Lead Management Action Plan (NSW Interdepartmental Lead Taskforce, Environment Protection Authority, 1994) sets the following levels for remedial action at contaminated residential properties:

- $[Pb_{soil}]$ < 300 $mg.kg^{-1}$ - no action
- $[Pb_{soil}]$ 300 - 1,500 $mg.kg^{-1}$ - grass cover or other appropriate barrier
- $[Pb_{soil}]$ 1,500 - 5,000 $mg.kg^{-1}$ - top dress with 50 mm clean soil and grass cover
- $[Pb_{soil}]$ >5,000 $mg.kg^{-1}$ - soil replacement (top 200mm)

The highest lead concentrations detected at the Investigation Area were in the order of 1,500 $mg.kg^{-1}$ with a maximum of 5,400 $mg.kg^{-1}$ detected during the preliminary investigation.

In the case of the Investigation Area, the proposed playing field that will be partially located over the contaminated areas will be constructed from fill brought in to raise and level the northern portion of the site. The proposed cut and fill strategy (see Figure 6.3) indicate that most of the investigation area will be filled to a depth ranging between 100mm to 600mm.

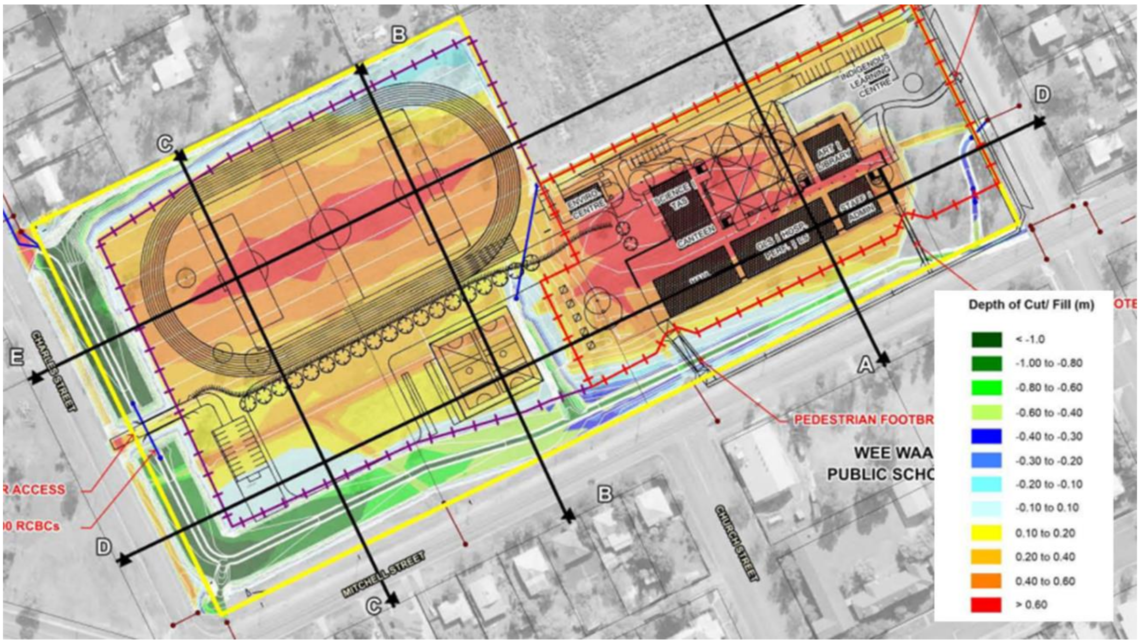

Figure 6.3: Excerpt from the proposed cut/fill strategy for the Subject Site (Lyall & Associates, 2021)

Based on the concentration of lead detected in the soil at the Investigation Area, following the removal of the demolition waste, the average concentration of lead is expected to be in the region of 140 mg $Pb.kg^{-1}$ with isolated maximum concentrations unlikely to exceed 2,000 mg $Pb.kg^{-1}$ Provided that the contaminated areas remain undisturbed during the earthworks, the proposed filling and grassing of the area for construction of the playing field is expected to provide a barrier that will eliminate the direct exposure of visitors to the site to the lead contaminated soil.

Although it is considered unlikely that receptors will be exposed directly to the contaminated soil following the development of the site, precautions would nevertheless be appropriate to prevent the potential dispersion of the contamination to other areas of the Subject Site during construction and earthmoving activities.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

In accordance with the objectives stated in Section 1.2, and based on the information contained within this assessment, the following conclusions are presented (subject to the limitations noted in Section 1.5):

- The further investigation and surface soil sampling undertaken in the northern portion of Lot 124 DP 757125 (the Investigation Area) at of the property at 105-107 Mitchell Street, Wee Waa NSW 2388, confirm the conclusions of the preliminary site investigation, finding measurable concentrations of heavy metals, hydrocarbon and polycyclic aromatic hydrocarbon compounds.
- Of the contaminants detected in the individual surface soil samples concentrations of lead (Pb) and zinc (Zn) exceeded the screening levels used in the assessment.
- Statistical analysis of the analytical data indicates that the upper 95th percentile confidence level (UCL) average concentration of Pb detected at the Investigation Area does not exceed the health-risk based investigation level of 600 $mg.kg^{-1}$. Based on the calculated UCL the the contamination does not have to be reported to the EPA as it does not trigger the notification thresholds listed in Section 2.3 of the Guidelines on the Duty to Report Contamination (NSW EPA, 2015).
- The heavy metal contamination is localised to specific locations in the Investigation Area.
- The detected consecrations of Zn were found to be below human health-risk based criteria but were found to exceed ecological investigation levels.
- Evaluation of the potential for ecological receptors to be exposed to the Zn present in the surface soil of the Investigation Area concluded that exposure is unlikely to occur and that the risk presented to the environment by elevated concentrations of Zn are negligible.
- It is recognised that there is a difference between contaminated land that is a direct and immediate health or ecological risk and that which does not pose a health risk but is recognised as a potential hazard. The soil containing elevated concentrations of Pb and Zn at the Investigation Area is recognised as a potential hazard only during the construction phase of the proposed development, as potential exposure to the contaminated soil is considered unlikely following development of the playing field.

- The Subject Site is not currently subject to a Statutory Site Audit. In terms of the Guidelines for the NSW Site Auditor Scheme (NSW EPA, 2017), the EPA may recommend that any remedial work proposed as a result of this assessment be independently verified.

7.2 Recommendations

Based on the conclusions above, the following is recommended:

- Based on the findings of the further site investigation it is concluded that the Subject Site is suitable for the proposed development, as there are no contaminants present at the site which are likely to present an immediate risk of impact to the health of humans or the environment from the proposed activities.
- Development of the Investigation Area as part of a playing field is subject to the removal of fibre cement fragments from the surface of the site and the implementation of precautionary measures to prevent the dispersion of lead (Pb) contamination from the identified areas to other areas of the Subject Site during the construction phase.
- It is recommended that a Remediation Action Plan (RAP) be developed to inform the removal of the fibre cement fragments from the surface of the site and provide recommendations for the appropriate application of fill as barrier over the contaminated soil.
- It is further recommended that Preliminary Long-term Environmental Management Plan (LEMP) be developed to provide recommendations for the long-term management of the containment.
- It is recommended that a Construction Environmental Management Plan (CEMP) be prepared prior to any earthworks being started. The purpose of the CEMP is for the management of lead contaminated soil as well as for the management of any excavated soils (which could include contaminated soils) and should include procedures for the classification of the soils as well as for the implementation of sediment and erosion controls for stockpiling of the excavated soils.

8.0 REFERENCES

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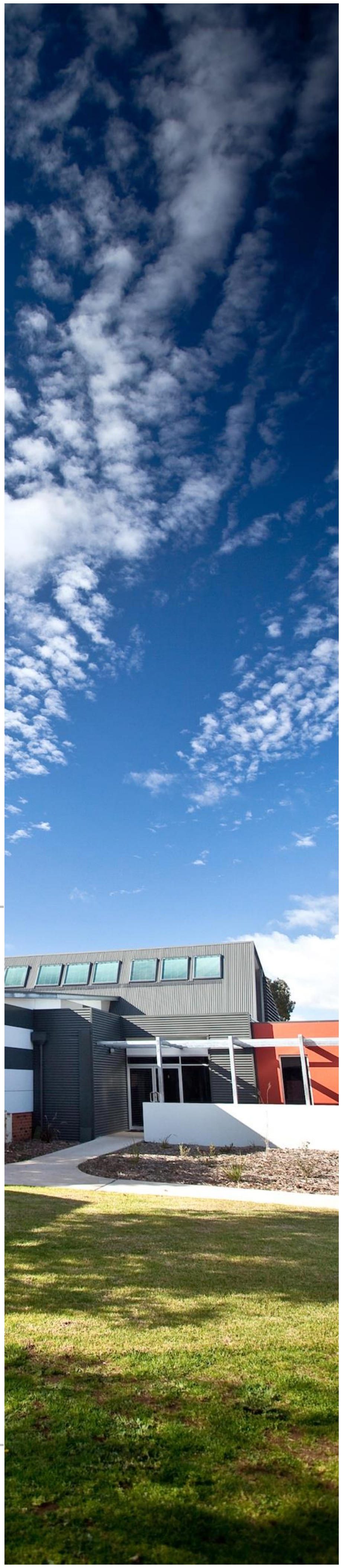
Appendix A
Preliminary Site Investigation report

barnson

Preliminary Site Contamination Assessment

Wee Waa High School
105-107 Mitchell Street
Wee Waa NSW

(Our Reference:35754 ER01)



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Project Name:	Wee Waa High School, 105-107 Mitchell Street, Wee Waa, NSW
Client:	NSW Department of Education
Project No.	35754
Report Reference	35754 ER01
Date:	29/04/2021
Revision:	Final

Prepared by:	**Reviewed by:**
Nardus Potgieter MSc(Chem) Environmental Scientist	Jim Sarantzouklis MAIBS MEHA RPIA Director

EXECUTIVE SUMMARY

Barnson was engaged by the NSW Department of Education to undertake a preliminary contaminated site investigation in support of the application for Approval of the proposed new Wee Waa High School development, 105-107 Mitchell Street, Wee Waa, NSW.

The investigation had as its objectives to identify contamination issues that may affect the site's suitability for development and assess the need for possible further investigations, remediation or management of any contamination issues identified.

The investigation was based on a desktop review of information available for the Subject Site, as well as the findings of a site inspection and confirmatory sampling and analysis of surface soils collected at the site.

A review of the available historical information, including contaminated sites databases, indicated no recorded activities with the potential to significantly contaminate the site.

Although the potential for *significant* environmental contamination to be present across the site was concluded to be low, activities associated with the current and historical use of the Subject Site were identified as having a potential to contaminate surface soil. The following potential sources and areas of contamination were identified:

- Historical structures and unregulated waste disposal activities;
- Contaminated stormwater and vehicles accessing the Site; and
- Historical livestock farming and grazing activities.

A site inspection, supplemented with confirmatory sampling and analysis, was conducted to determine the presence and significance of potential contamination associated with the identified sources. The site investigation revealed evidence of localised heavy metal contamination associated with the historical structures and unregulated disposal in the north eastern corner of Lot 124.

Since the concentrations of heavy metals detected in this area of the Subject Site exceed both health and ecological risk based screening guidelines, it was concluded that the contamination represent a possible risk to human health and the environment and this area specifically is not currently suitable for the proposed redevelopment. Further investigation of the contaminated area and development of a remedial action plan is recommended.

However, as no contamination was discovered in any of the other Lots comprising the Subject Site (Lot 125 (DP 757125), Lot 2 (DP 550633) and Lot 1 (DP 577294)) these areas, as well as the southern half of Lot 124, are considered suitable for the proposed re-development and use for education and training purposes.

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APPENDICES

1.0 INTRODUCTION

1.1 Background

Students and staff were evacuated from the current Wee Waa High School site due to ongoing health issues in late 2020. Students are currently collocated within the town's primary school in an overcrowded site. A Ministerial announcement made on 3 June 2021 committed to the construction of a new High School at Wee Waa on existing Department of Education owned land and adjacent Crown land as an urgent priority. The site is located on Mitchell Street/Kamliaroi Highway and is legally described as Lot 1 DP577294, Lot 2 DP550633 and Lots 124-125 DP757125 (the Subject Site).

Barnson was engaged by the NSW Department of Education to carry out a preliminary contaminated site investigation in support of this development and prepare a report of the findings. This report accompanies a State Significant Development Application (Application SSD-21854025) which seeks consent for the construction of a new high school with a capacity of up to approximately 300 students in a two-storey building, an Indigenous learning centre, sporting fields and associated civil and utilities works. For a detailed project description refer to the EIS prepared by Ethos Urban.

1.2 Objectives

The Secretary's Environmental Assessment Requirements (SEARs) issued for Application SSD-21854025, requires, among other, the assessment and quantification of any soil and groundwater contamination at the Subject Site. The assessment must further demonstrate that the site is suitable for the proposed use in accordance with State Environmental Planning Policy 55 (DUAP, 1998), and must include the following prepared by certified consultants recognised by the NSW Environment Protection Authority:

- Preliminary Site Investigation (PSI).
- Detailed Site Investigation (DSI) where recommended in the PSI.
- Remediation Action Plan (RAP) where remediation is required. This must specify the proposed remediation strategy.
- Preliminary Long-term Environmental Management Plan (LEMP) where containment is proposed on-site.

The investigations and plans listed above must further be prepared in accordance with policies and guidelines relevant to the context of the site and nature of the proposed development. The relevant policies and guidelines include:

- Managing Land Contamination: Planning Guidelines - SEPP 55 Remediation of Land (DUAP, 1998).
- Sampling Design Guidelines (EPA, 1995).
- Consultants Reporting on Contaminated land – Contaminated Land Guidelines (EPA, 2020).
- Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (EPA, 2015).
- Guidelines for the NSW Site Auditor Scheme (3rd edition) (EPA, 2017).

- National Environment Protection (Assessment of Site Contamination) Measure (National Environment Protection Council, as amended 2013).

In addition to this, Education and Care Services National Regulations (Regulation 25(1)d) requires an assessment of the soil for possible contamination for any candidate site identified for the development of an education and childcare service premises. In accordance with the Regulation, a soil assessment means an analysis of soil conducted by an environmental consultant for the purposes of determining—

(a) the nature, extent and levels of contamination; and

(b) the actual or potential risk to human health resulting from that contamination;

In order to fulfil these requirements Barnson undertook a Preliminary Site Investigation (PSI) of the Subject Site in support of both the approval of the facility under the Education and Care Services National Law as well as the Development Approval under NSW Environmental Planning and Assessment Act (1979).

The objectives of the investigation are:

- Identify contamination that may affect the site's suitability for development, and;
- Assess the need for possible further investigations, remediation or management of any contamination identified.

1.3 Scope of Work

To meet the objectives, Barnson completed the following scope of work:

- Site identification including a review of site history, site condition, surrounding environment, geology and hydrogeology.
- Desktop review of site history and assessment of potential sources of contamination.
- Development of a Conceptual Site Model (CSM) with information gathered from the data review and site inspection.
- Site inspection to assess site conditions.
- Collection of confirmatory soil samples and analysis to determine nature of possible contamination.
- Provide conclusions as to the suitability of the site for the intended future land use.
- Preparation of a report.

The SEARS requirements, where relevant, are addressed in this report under the following sections as shown in Table 1.1.

1.4 Purpose of this report

The purpose of this report is to document, with cognisance of the Guidelines for Consultants Reporting on Contaminated sites (NSW EPA, 2020), works undertaken, in accordance with the scope of works as described in Section 1.3, results of the desktop review and site inspection, and recommendations for further actions required to determine fitness of the site for use.

Table 1.1: SEARs Requirements

Requirement	Section
Preparation of a Preliminary Site Investigation (PSI) report.	This report
Preparation of a Detailed Site Investigation (DSI) report.	Section 8.2
Remediation Action Plan (RAP) where remediation is required.	Outside the scope of this report
Preliminary Long-term Environmental Management Plan (LEMP) where containment is proposed on-site.	Outside the scope of this report

1.5 Assumptions and Limitations

The following assumptions have been made in preparing this report:

- The future use of the site will be for education and training purposes (high school), with public open space included. This assumption forms the basis for the conceptual site model (Section 4).

- All information pertaining to the contamination status of the site has been obtained through public record searches, a preliminary site inspection and analysis of confirmatory samples collected at the Subject Site. All documents and information in relation to the Subject Site, which were obtained from public records, are accepted to be correct and has not been independently verified or checked.

It should be recognised that even the most comprehensive site assessments may fail to detect all contamination on a site. This is because contaminants may be present in areas that were not previously surveyed or sampled or may migrate to areas that showed no signs of contamination when sampled. Investigative works undertaken at the subject site by Barnson identified actual conditions only at those locations in which sampling and analysis were performed. Opinions regarding the conditions of the site have been expressed based on historical information and analytical data obtained and interpreted from previous assessments of the site. Barnson does not take responsibility for any consequences as a result of variations in site conditions.

2.0 SITE SETTING

2.1 Site Identification

Table 2.1 present a summary of the available information pertaining to the identification of the Subject Site. The Subject Site is comprised of four (4) separate vacant lots, adjoining another vacant lot to the north east, which is not included in the proposed development. The lots comprising the Subject Site are Lot 125 DP 757125, Lot 124 DP 757125, Lot 2 DP 550633 and Lot 1 DP 577294.

Figure 2.1 presents a map indicating the location of the Subject Site.

Table 2.1: Summary of Subject Site identification details.

Information	Details
Site address	105-107 Mitchell Street, Wee Waa NSW 2388
Total Development Area	6.03 hectares
Lot and Deposited Plan No.	Lot 125 DP 757125, Lot 124 DP 757125, Lot 2 DP 550633, Lot 1 DP 577294
Zoning	R1 – General residential
Local Government Area	Narrabri Shire Council

Figure 2.1: Locality Map and Aerial Photo of Subject Site.
(Source: © 2021 Google / Image ©Maxar Technologies, Map Data © 2021)

2.2 Geology

Geologically, the Subject Site is underlain by unnamed alluvial units consisting of sand, silt and clay. A review of the Narrabri 1:250000 Geology map (refer to Figure 2.2) shows the majority of the basin sequences are covered with Quaternary age alluvial sandy material.

Figure 2.2: Narrabri 1:250000 geology map showing the location of the Subject Site

An examination of the Geological Survey of NSW maps of Naturally Occurring Asbestos (accessed on 15 April 2021), shows that the geological units underlaying the Wee Waa area has no asbestos potential.

2.3 Soils

The Subject Site and is mapped mainly within the Namoi soil landscape. In the Namoi landscape, soils are described deep to very deep, imperfectly drained Grey Vertosols (grey clay) and Black Vertosols (black earths). The Vertosols have high shrink-swell properties and represent a widespread foundation hazard. The soils are further known for poor drainage properties and seasonal waterlogging and is amenable to sheet erosion.

Results from the geotechnical investigation of the Subject Site confirm the soil encountered as sandy silty clay. The Atlas of Australian Acid Sulfate Soil has the subject site in an area of 'extremely low' probability of occurrence (a 1-5% chance of occurrence). Surface soils of the Namoi landscape are not saline.

2.4 Topography and Drainage

Figure 2.3 presents topographical information overlain on a map of the Subject Site. The presented data shows that the site is very flat with almost no slope to facilitate surface water runoff. Precipitation runoff at the site and from the surrounding streets will most likely enter the drainage channels on the site where it will remain until evaporated or infiltrated into the surface soil of the site.

The closest natural water body to the Subject Site is a feature referred to as the Wee Waa Lagoon, located approximately 400m to the south east.

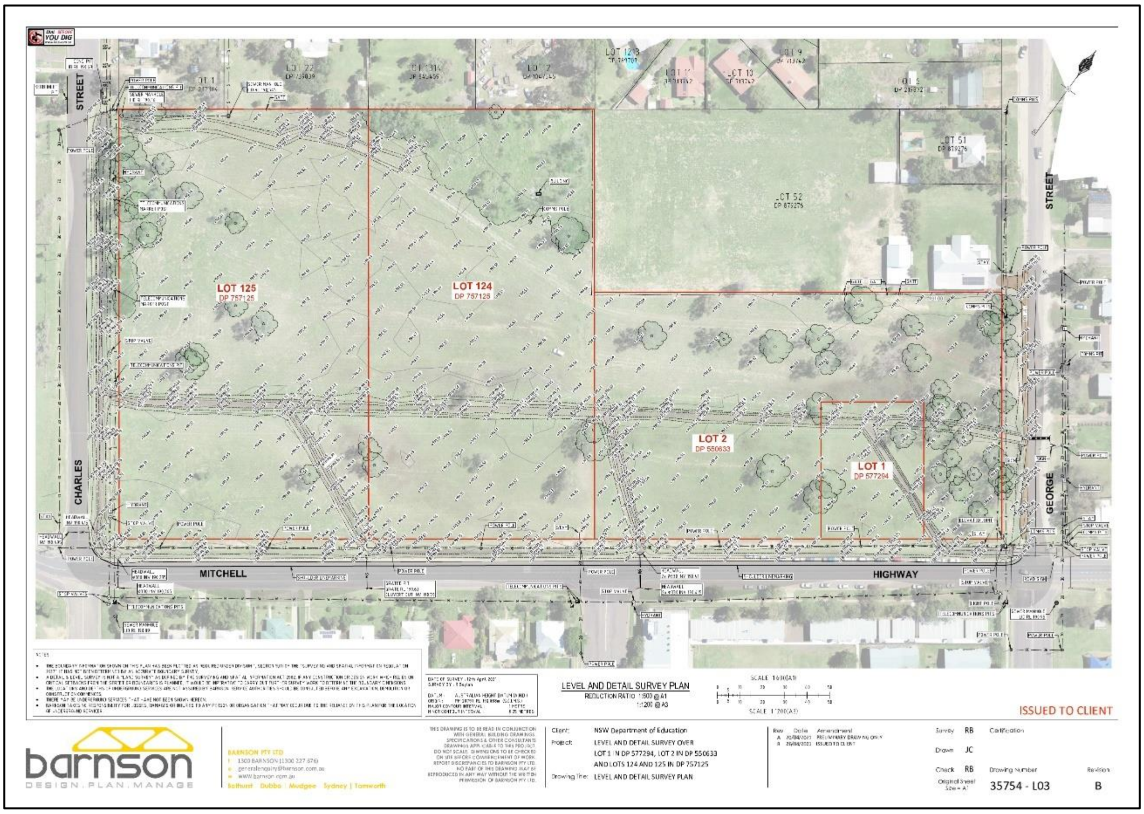

Figure 2.3: Topography of the Subject Site

2.5 Groundwater Resources

A review of existing groundwater bore records (WaterNSW, 2021) indicate 14 registered groundwater bores within 500m of the Subject Site. The information recorded in the database for the bores closest to the Subject Site indicate an average standing water level of between 14m and 18m (where reported) and average yields around 0.3 L/s. Two groundwater bores located in proximity to the development are to the west and north-west of the Subject Site, at a distance of 123m and 150m respectively. According to the database entry the bores are used for domestic purposes.

Information on the chemical quality of the groundwater (e.g. salinity) is recorded for some of the bores and indicates the water to be fresh (0-500ppm salinity). Based on the lithology of the area, aquifers are likely unconfined with groundwater flow occurring vertically and laterally through porous geology. Logs for the groundwater bores confirm that hard, white clay is encountered to a depth of 20 to 25 meters.

The Narrabri Local Environmental Plan (Narrabri LEP, 2011) does not show the Subject Site inside a zone of groundwater vulnerability.

3.0 SITE HISTORY

3.1 Historical Land Use

Historical aerial images show that parts of the site have been used for agricultural activities, mainly livestock grazing. There are remnants of simple structures in the northern portion of Lot 124, but we cannot confirm that this area was formally occupied for residential purposes.

3.2 Historical Record of Site Contamination

Datasets maintained by the Office of Environment and Heritage (OEH) including notices under CLM Act, POEO Environment Protection License Register and environmental incidents were reviewed.

- List of NSW contaminated sites notified to EPA – The sites appearing on the OEH "List of NSW contaminated sites notified to the EPA" indicate that the notifiers consider that the sites are contaminated and warrant reporting to EPA. However, the contamination may or may not be significant enough to warrant regulation by the EPA. The EPA needs to review information before it can make a determination as to whether the site warrants regulation. A search of the listing returned no record for the Subject Site.
- Contaminated Land Record of Notices – A site will be on the Contaminated Land Record of Notices only if the EPA has issued a regulatory notice in relation to the site under the *Contaminated Land Management Act* 1997. A search of the register in April 202. returned no record for the Subject Site and indicated no listings for any site within a radius of 1,000m.

There is further no record of the Subject Site or within a radius of 1,000m from these areas, in any of the following databases:

- Former Gasworks database
- EPA PFAS Investigation Program
- Defence PFAS Investigation & Management Program
- Airservices Australia National PFAS Management Program
- Defence 3 Year Regional Contamination Investigation Program

3.3 Previous Site Investigations

No information relating to any previous assessment of contamination at the Subject Site was available for review.

4.0 SITE DESCRIPTION

4.1 Layout and Features

The Subject Site formed part of land used for agricultural purposes. The Subject Site has been vacant for an extended period of time and, except for the remnants of simple structures located in the north eastern sector of Lot 124, there is no indication of any formal structures previously occupying the Site. The Subject site is covered with maintained grass and there are several established trees currently present on the property. The main feature of the site is the series of shallow drainage channels that enter the site from all three street frontages.

The site includes fencing on the boundary with the residential properties to the north. Near this boundary, in a corner formed with an adjoining paddock, there are remnants of former structures as well as piles of discarded building material.

Figure 4.1 presents a sketch plan of the basic layout of the Subject Site, supplemented with photographs showing the different elements of the Site (Figure 4.2 to Figure 4.3). Figure 4.1 includes markers indicating the vantage point and direction of the photographs.

Figure 4.1: General site layout.

Figure 4.2: Photo A –View across the Subject Site from the north west corner of Lot 125 (see Figure 4.1 for location of photo).

Figure 4.3: Photo B – Shallow drainage channel across the Subject Site (see Figure 4.1 for location of photo).

Figure 4.4: Photo C – Culvert and drainage channel north of Mitchel Street (see Figure 4.1 for location of photo).

Figure 4.5: Photo D – Remnants of structures and demolition waste (see Figure 4.1 for location of photo).

4.2 Proposed Development

The proposed development at the Subject Site involves the construction of a new high school with a capacity of up to approximately 300 students in a two-storey building, an Indigenous learning centre, sporting fields and associated civil and utilities works.

Figure 5.1 presents a map indicating the proposed location of the different areas of the proposed development. It is expected that the proposed layout of the development may change as the project progresses. However, the plan presented in Figure 5.1 was valid at the time of this report and is the bases on which the Preliminary Site investigation was undertaken.

5.0 CONCEPTUAL SITE MODEL

5.1 General

The conceptual site model (CSM) is intended to provide an understanding of the potential for contamination and exposure to contaminants within the investigation areas. The CSM draws together the available historical information for the site, with site specific geological, hydrogeological and hydro-geochemical information to identify potential contaminants, contamination sources, migration and exposure pathways and sensitive receptors.

Figure 5.1: Proposed development masterplan, valid at the time of this report (April 2021).

5.2 Sources

The identification of sources presented here is based on the review of available historical information and photographs, as well as an understanding of current conditions at the Subject Site. The following is a summary of the potentially contaminated areas and sources of contamination identified:

- Historical structures and unregulated waste disposal activities

Remnants of former structures and evidence of demolition waste disposal was observed in the north eastern corner of Lot 124. The former structures and demolition waste could potentially include hazardous materials such as asbestos and lead based paint. Deterioration and demolition of the former structures and disposal of the demolition waste potentially can result in the localised dispersion of hazardous materials over the adjoining lots of the Subject Site.

- Contaminated stormwater and vehicles accessing the Site

The stormwater flow entering the site drainage channels from the adjoining roads could potentially contain fuel and lubricants from vehicles driving on the road or parked along the edge of the site. As the site is poorly drained, any contaminants entering the Site from the road could be deposited onto sediment in the drainage channels. Furthermore, the defined informal vehicle path crossing the site is evidence of motorised vehicles entering and driving across the northern half of the Subject Site. These vehicles can potentially contribute to localised hydrocarbon contamination of the surface soils in this area.

- Historical land use

Historical livestock management activities on portions of the Subject Site have various potential sources of contamination associated including sheep or cattle dip, spraying for the control of parasites or management of animal waste, all of which could result in localised contamination. Potential contaminants include pesticides, hydrocarbons, heavy metals and elevated nutrients. In addition, the use of portions of the site for grazing purposes may be associated with the use of pesticides and herbicides.

5.3 Contaminants of Potential Concern

Considering the potential sources relevant to the Subject Site, a wide variety of contaminants may be present. With the historical structures and activities at the site considered the primary potential sources of contamination, the residues of agricultural chemicals such as pesticides and fertilisers used on the grazing areas, as well as hazardous materials (asbestos and heavy metals) are accepted as the most likely contaminants.

Of interest here are chlorinated organic compounds which historically have been widely used as insecticides, fungicides, herbicides and soil fumigants in agriculture and which are stable enough in the environment (persistent) to remain in soil for extended periods of time. Inorganic compounds that contain heavy metal including arsenic, copper, lead and mercury were also historically used as pesticides. The use of fertiliser, although not commonly considered a source of soil contamination, potentially could lead to a build-up of heavy metals such as cadmium in soils in areas where it has been extensively applied.

The potential presence of heavy metals or hydrocarbons in stormwater entering the site could have contributed to the dispersion of these substances onto the surface soil of the site. Fuels and lubricants are further potentially relevant to the on-site movement of vehicles entering the Subject Site.

Based on this understanding of the site history and activities, the contaminants of potential concern identified for the investigation of the Subject Site include:

- pesticides (organochlorines, organophosphates);
- hydrocarbons (mainly fuel and lubricants);
- heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn) and asbestos.

5.4 Pathways

The primary pathways by which receptors could be exposed to the contaminants outlined above include:

- Inhalation of dust or vapours.
- Dermal contact with contaminated soils.
- Incidental ingestion of contaminated soils.
- Surface runoff, sediment transport and discharge to surface waters.
- Vertical and horizontal migration of contamination through the soils into the underlying groundwater.

Of the listed potential pathways, the contamination of water resources through infiltration is considered the most unlikely. The Subject Site is not indicated as a groundwater vulnerable zone and the depth to groundwater at the site is estimated to be in the order of 17m. Furthermore, the clay encountered at surface is reported to continue to at least 20m below surface (based on groundwater bore logs). This clay layer extends over the entire site and it is expected that it would limit vertical migration of any contaminants which may be entering the surface soil from above.

5.5 Receptors

Potential receptors may include:

Human receptor populations

- Visitors to the site (e.g. students, teachers and parents/caregivers);
- Workers involved in the construction of the facilities; and
- Workers conducting maintenance of the gardens or facilities at the site.

Environmental Receptors

- Local drainage channels and receiving surface water bodies; and
- Groundwater resources beneath the site (negligible likelihood of contamination expected).

5.6 Potential for Contamination

The Development Area is not listed in any of the contaminated land databases. Based on the results of the desktop assessment, the overall likelihood for *significant* chemical contamination to be present within the site is low.

Although former land use and activities at the site is reasoned to have a potential for contaminating surface soils, the type and quantity of contaminants introduced through this land use is not expected to have led to significant contamination.

6.0 SITE INSPECTION

6.1 General

The objective of the investigation is to determine whether there are any environmental risks associated with the Subject Site that could affect the proposed development and would require further investigation or action to render the site suitable for its intended use.

The desktop evaluation of the site history and current use of the site did not identify any significant risks in this regard but did identify both historical and current land use activities that could contribute to contamination of the surface soils of the Subject Site.

Barnson conducted an inspection of the Subject Site on 19 March 2021. The purpose of the site inspection was to verify the findings of the desktop assessment, as well as to collect a number of confirmatory samples of soil from areas of the Subject Site where development is proposed or contamination is suspected.

Based on the findings of the CSM the inspection and sampling were focussed on the surface soils (50-300mm). The site inspection included all areas of the Subject Site.

During the site inspection the following observations were made:

- The site is not fenced and access to the site is possible from all street frontages. There is an informal vehicle path traversing the northern part of the Subject Site between Charles and George Streets and there are several footpaths crossing the site.
- At the time Barnson conducted the site inspection, most of the Subject Site was covered with vegetation following seasonal rain. Most of the Site surface was also waterlogged and all drainage trenches contained standing water (see Figure 6.1).

Figure 6.1: Waterlogging near Mitchel Street and George Street frontage.

- The site was systematically walked over and all visible open ground was inspected. No visible discoloration or staining of open ground or soil, and no obvious discoloration or irregularities in the occurrence of vegetation was observed during the site inspection.
- Several small mounds of mostly garden waste (grass clippings) and some demolition and general waste were observed in the north eastern corner of Lot 124 (see Figure 6.2).

Figure 6.2: Demolition waste and grass clippings dumped in the vegetation in north eastern corner of Lot 124.

- No general waste or any demolition waste was observed in any other part of the Subject Site during the site inspection.

6.2 Confirmatory Sampling

The purpose of collecting confirmatory samples as part of the preliminary site inspection is to determine if any of the potential contaminants identified from the CSM are present. The samples are not intended for statistically valid characterisation or quantification of contamination levels. The collection of surface soil samples at the Subject Site was therefore focussed on areas where the development is proposed and where contamination of the surface soil could most likely have occurred. The site inspection and collection of samples specifically targeted areas of the site where future students and visitors to the Subject Site could likely be exposed to the surface soil and in that regard considered the proposed site layout as presented in Figure 5.1. It is understood that the site layout will likely change is future, but it was valid at the time of the site inspection.

Samples of soil were specifically collected from the drainage ditches as well as the informal vehicle access path, as both these features represent areas where contaminants potentially deposited on site (e.g. pesticides and vehicle associated hydrocarbons) can accumulate. The area where demolition wastes and remnants of structures were observed was also further investigated.

Figure 6.3 presents a map of the Subject Site with the locations of the surface soil samples indicated. Table 6.1 is a summary of the collected samples indicating which samples were included in composites for analysis.

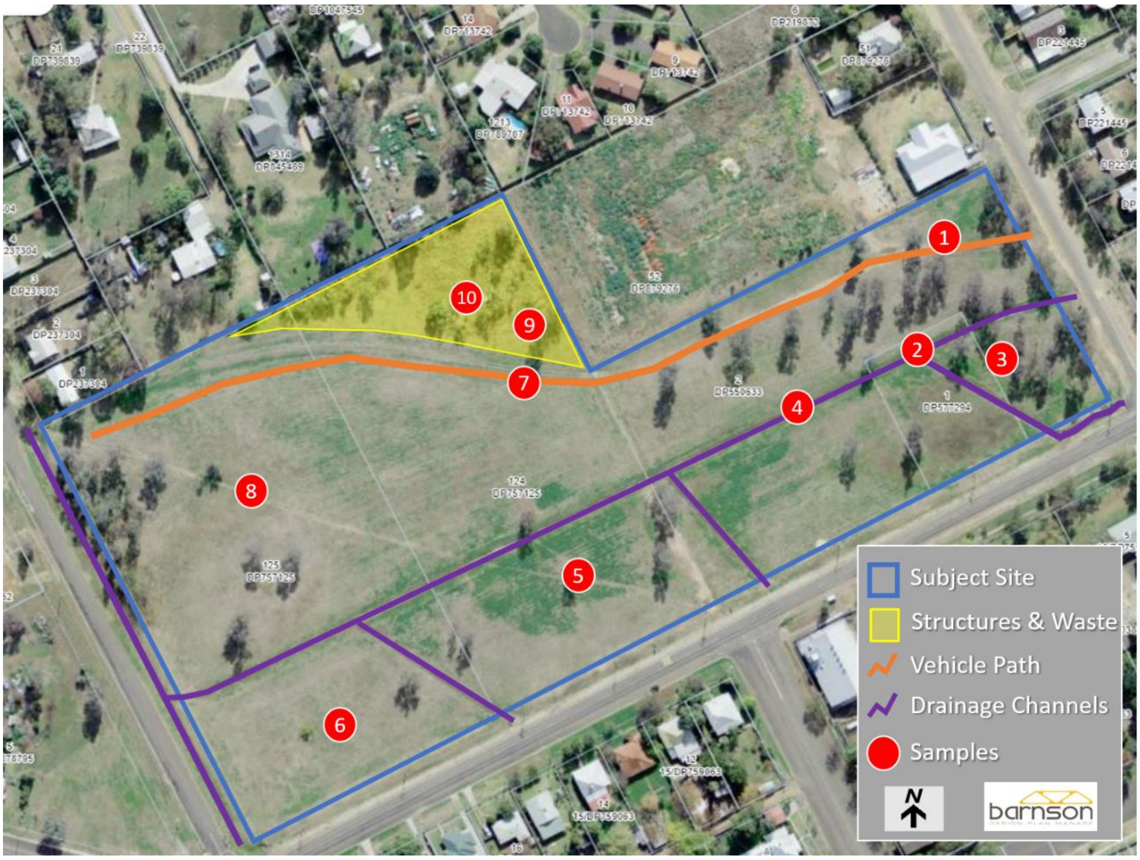

Figure 6.3: Map indicating locations of confirmatory sample collection.

Table 6.1: Summary of sample details.

Sample ID	Description	Sample Submitted for Analysis
1	Surface soil (50-300mm) sample from North East corner of site. Included in composite sample WW-02 for analysis.	WW-02
2	Surface soil (50-300mm) sample from Drainage Channel Node. Submitted as discrete sample.	WW-01
3	Surface soil (50-300mm) sample from South East corner of site. Included in composite sample WW-02 for analysis.	WW-02
4	Surface soil (50-300mm) sample from future school courtyard area. Included in composite sample WW-02 for analysis.	WW-02
5	Surface soil (50-300mm) sample from future sports field 1. Included in composite sample WW-03 for analysis.	WW-03
6	Surface soil (50-300mm) sample from future sports field 2. Included in composite sample WW-03 for analysis.	WW-03
7	Surface soil (50-300mm) sample from North West open area on vehicle path. Included in composite sample WW-04 for analysis.	WW-04
8	Surface soil (50-300mm) sample from North West open area. Included in composite sample WW-04 for analysis.	WW-04
9	Surface soil (50-300mm) sample near hut structure from big tree South East of hut. Submitted as discrete sample.	WW-05
10	Surface soil (50-300mm) sample at visible ACM NW of hut	WW-06

The surface soil samples were collected in glass jars, supplied by the laboratory. The pattern followed for the soil sampling can be described as Judgement Sampling, where points are selected on the basis of the investigator's knowledge of the proposed development and likely distribution of contaminants at a site. It is an efficient sampling method for confirmatory sampling, which utilises knowledge of the site history and field observations to direct sample collection (NSW EPA, 1995).

All composite surface soil samples were submitted for chemical analysis.

The soil samples were submitted to Envirolab Services Pty Ltd, Chatswood, Sydney, for determination of the following parameters:

- metallic element (cadmium, chromium, copper, lead, nickel and zinc) concentrations, including arsenic and mercury in soil.
- extraction with organic solvent and analysis of Total Recoverable Hydrocarbons (TRH) fractions C_6 to C_{40}, benzene, toluene, ethylbenzene and total xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs).
- extraction with organic solvent and analysis of Organochlorine (OCP) and Organophosphorus (OPP) Pesticides.
- presence of asbestos fibres
- laboratory QC duplicates and spikes

In addition to the surface soil samples a sample of painted wood (marked WW-11) and a fragment of fibre cement material were collected from the 'Structure and Waste Area' identified in Figure 6.3. These material samples were also submitted with the surface soil samples to the Envirolab Services laboratory. The laboratory was requested to analyse the paint on the wood for lead content and the fibre cement sample for the presence of asbestos.

The Envirolab Services laboratory is NATA accredited for all the analysis indicated above.

6.3 Analytical Results

The Envirolab Services laboratory report for the samples is attached as Appendix A. The laboratory report indicates that heavy metals, mixtures of straight chain organic compounds ranging from C10 to C40 and trace quantities of polycyclic organic compounds were detected in the soil. The concentrations of petroleum hydrocarbons, asbestos (total recoverable) as well as persistent pesticide and herbicide compounds are indicated as below the limits of detection in the surface soil samples.

The metals detected include chromium (Cr), copper (Cu), lead (Pb), nickel (Ni, and zinc (Zn). Concentrations of cadmium and mercury were detected only in two (2) of the samples. The concentration of arsenic remains below detection in all samples.

Table 6.2 presents a summary of the compounds and elements detected above the limit of detection. The laboratory performed a duplicate analysis of sample WW-01 for quality control purposes. The results of this duplicate analysis are also listed in Table 6.2.

Table 6.2: Metal and metalloid concentrations analysed in surface soil samples from the Subject Site.

Analyte	WW-01	WW-01 Duplicate	WW-02	WW-03	WW-04	WW-05	WW-06
	mg.kg-1						
Metals (mg.kg^{-1})							
Arsenic (As)	<4	<4	<4	<4	<4	<4	<4
Cadmium (Cd)	<0.4	<0.4	<0.4	<0.4	<0.4	1	1
Chromium (Cr)	22	27	21	33	28	29	31
Copper (Cu)	27	32	25	35	32	29	26
Lead (Pb)	11	11	9	12	11	2600	5400
Mercury (Hg)	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1
Nickel (Ni)	29	27	23	29	28	18	17
Zinc (Zn)	50	52	35	60	48	4300	3600
Hydrocarbons (mg.kg^{-1})							
TRH C29 - C36	<100	<100	<100	<100	<100	130	<100
TRH >C16 - C34 (F3)	<100	<100	<100	<100	<100	150	<100
Total PAHs	<0.05	<0.05	<0.05	<0.05	<0.05	2.9	<0.05

Results for the material samples were positive for lead in the paint (measured at 300 mg/kg) and both chrysotile and amosite asbestos were identified in the sample of fibre cement collected.

6.4 Analytical Data Quality

Samples were collected in glass jars provided by the laboratory, refrigerated after collection and transported in an insulated container to the laboratory. Chain of custody was recorded for all samples. A copy of the signed sheet is attached as Appendix A.

The analyses were undertaken at a NATA accredited laboratory. The laboratory quality control procedures in the form of duplicates as well as analyte and surrogate spikes were applied to all contaminant classes analysed. The results reported for the duplicate is within the Relative Percent Difference range of the acceptance criteria for a duplicate sample. The analyte spike recoveries reported for the different sets of organic analytes are indicated as within the acceptance criteria (see Appendix A).

All media appropriate to the objectives of this investigation have been adequately analysed and no area of significant uncertainty exist. It is concluded the data is usable for the purposes of the contaminated site investigation.

7.0 ASSESSMENT

7.1 Assessment Criteria - Human Health and Environmental Risk

Screening for human health and ecological risk, utilises published human health investigation levels (HILs) and ecological screening and investigation levels (ESLs & EILs) from the National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999) to identify contaminant concentrations in soil that may pose a risk to future residents, people visiting the site, or to ecological receptors.

HILs are scientifically based, generic assessment criteria designed to be used in the screening of potential risks to human health from chronic exposure to contaminants. HIL's are conservatively derived and are designed to be protective of human health under the majority of circumstances, soil types and human susceptibilities and thus represent a reasonable 'worst-case' scenario for specific land-use settings. The HILs selected for evaluation of the Subject Site are those derived for public open space (HIL-C) and include land uses such as parks, playgrounds, playing fields and secondary schools.

The health risks associated with petroleum hydrocarbon compounds are assessed using Health Screening Levels (HSLs) developed to be protective of human health by determining the reasonable maximum exposure from sources for a range of situations commonly encountered on contaminated sites. HSLs are derived for soil, groundwater and soil vapour and relate to exposure to petroleum hydrocarbons through the vapour inhalation exposure pathway only. Direct exposure pathways such as incidental soil ingestion and dermal exposure pathways are generally not the risk drivers when compared to inhalation exposure (NEPC, 1999). HSLs have been developed for BTEX and naphthalene plus four carbon chain fractions namely:

- C6 – C10- Fraction number F1

- >C10 – C16 - Fraction number F2
- >C16 – C34 - Fraction number F3
- >C34 – C40 - Fraction number F4

Screening values published for polycyclic aromatic hydrocarbons (PAHs) consider the total concentration of all PAH compounds detected.

Although the primary concern in most site assessments is protection of human health, the assessment should also include consideration of ecological risks and protection of groundwater resources that may result from site contamination. EILs provide screening criteria to assess the effect of contaminants on a soil ecosystem and afford species level protection for organisms that frequent or inhabit soil and protect essential soil processes.

Ecological investigation levels (EILs) have been derived for common metallic contaminants in soil. The values selected for the evaluation of the heavy metals detected in the soil samples from the Subject Site considers the physicochemical properties of soil and contaminants and the capacity of the soil to accommodate increases in contaminant levels above natural background while maintaining ecosystem protection for identified land uses.

Table 7.1 presents a summary of the health-risk based criteria and ecological investigation levels selected for assessment of the detected metal concentrations.

Table 7.1: Human health and ecological risk screening levels for metals.

Element	Health-based Investigation Levels HIL C $mg.kg^{-1}$	Ecological Investigation Levels (EIL) Residential $mg.kg^{-1}$
Arsenic (As)	300	160
Cadmium (Cd)	90	NA
Chromium (Cr) (Total)	NR	680
Copper (Cu)	17,000	320
Lead (Pb)	600	1,800
Mercury (Hg)	80	NA
Nickel (Ni)	1,200	460
Zinc (Zn)	30,000	460
Total PAH	300	NA

Note: NR=not relevant due to low human toxicity of Cr(III). NA=No applicable screening level. EILs selected for urban residential and public open space land use scenario.

Ecological risks associated with hydrocarbons are evaluated by using ecological screening levels (ESLs), which are based on EC_{25} weight-of-evidence ecotoxicity data, evaluated for a residential land use scenario (NEPC, 1999). The ESLs (Table 7.2) are evaluated for the same four carbon chain fraction ranges (F1 to F4) listed above.

Table 7.2: Human health and ecological risk screening levels for hydrocarbon fractions.

Fraction	Management limits for TPH in Soil Residential mg.kg^{-1}	Health Screening Levels (HSLs) for vapour intrusion Residential (sand) mg.kg^{-1} (soil)	Ecological Screening Levels (ESL) Residential mg.kg^{-1}
F1	700	45	180
F2	1,000	110	120
F3	2,500	-	1,300
F4	10,000	-	5,600

It was confirmed that limits of detection reported by the laboratory are below the criteria values. All other contaminants analysed for in the soil samples that are reported below the limit of detection by the laboratory can therefore be excluded from further assessment.

7.2 Findings

Direct comparison of the analytical results presented in Table 6.2 with the assessment criteria (refer Table 7.1) show that metallic element concentrations for most elements and in most samples are well below health-risk based screening values. However, the surface soil samples collected in the north eastern corner of Lot 124 (refer sample 9 and 10 Figure 6.3) show elevated levels of lead and zinc. The general low concentrations of heavy metals detected in the surface soil samples at the Subject Site suggest naturally occurring element abundance and are most likely not related to contamination. However, the elevated lead and zinc concentrations detected are significantly higher than the concentrations observed in other areas of the Subject Site and clearly indicate potential contamination, most likely associated with the demolition wastes located in the north eastern corner of Lot 124.

The lead concentration detected in samples 9 and 10 exceed the health risk criteria for residential and public open space land use, while both the lead and zinc concentrations exceed ecological investigation levels. No other contaminants evaluated were detected at concentrations exceeding screening criteria. The organic contaminants detected are present at trace quantities and measured concentrations are below screening criteria (Table 7.2). However, given the hydrocarbons were detected in a sample of surface soil that also had elevated metal concentrations, there is a high probability that the contamination is related and that similar or higher concentrations of hydrocarbon contaminants potentially could be present elsewhere in the area.

Overall, the metallic element concentrations reported for the discrete and composite surface soil samples collected over the remainder of the Subject Site are consistently low, while the elevated levels detected appear to be localised to the north eastern corner of Lot 124, specifically the area where demolition wastes were observed. The confirmatory soil samples thus support the assertion that significant and widespread chemical contamination is unlikely to be present within the Subject Site.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

In accordance with the objectives stated in Section 1.2, and based on the information contained within this assessment, the following conclusions are presented (subject to the limitations noted in Section 1.5):

- Activities associated with the historical and current use of the Subject Site were identified as having a potential to contaminate surface soil at the site.
- The following potential sources of contamination were identified:
  - Historical structures and unregulated waste disposal activities;
  - Contaminated stormwater and vehicles accessing the Site; and
  - Historical livestock farming and grazing activities.
- A review of the available historical information, including contaminated sites databases and aerial photographs, indicated a low potential for significant environmental contamination to be present across the Subject Site.
- A site investigation and confirmatory sampling revealed evidence of localised contamination associated with the historical structures and unregulated disposal in the north eastern corner of Lot 124, with concentrations of lead and zinc exceeding health and ecological risk-based criteria.
- The concentrations of all other contaminants investigated were below screening criteria in all surface soil samples collected.
- The screening criteria used in the evaluation of the contaminant concentrations were appropriately conservative and suitable for assessment of both the proposed education and training, and public open space land use categories.
- The samples of paint and fibre cement collected from the demolition waste present in the north eastern corner of Lot 124 were confirmed to contain hazardous substances, specifically lead based paint and asbestos fibres. Special precautions should be implemented during any removal of these materials from the Subject Site.
- Based on the findings of the site investigation it is concluded that the heavy metal contamination identified in the north eastern corner of Lot 124 represent a potential risk to human health and the environment and this area specifically is not currently suitable for the proposed redevelopment.
- On the remainder of the Subject Site (that is Lot 125 (DP 757125), Lot 2 (DP 550633), Lot 1 (DP 577294) and the southern half of Lot 124 (DP 757125)), no contaminant were detected above health risk or ecological risk screening criteria. Based on the findings of the desktop review and site investigation, the remainder of the Subject Site is considered suitable for the proposed re-development and use for education and training purposes.
- The Subject Site is not currently subject to a Statutory Site Audit. In terms of the Guidelines for the NSW Site Auditor Scheme (NSW EPA, 2017), the EPA may recommend that any remedial work proposed as a result of this assessment be independently verified.

8.2 Recommendations

- Based on the findings of the desktop review and site investigation it can be stated with a reasonable level of confidence that Lot 125 (DP 757125), Lot 2 (DP 550633), Lot 1 (DP 577294) and the southern half of Lot 124 (DP 757125) is suitable for the proposed re-development and land use.
- It is recommended that the contamination identified in the north eastern corner of Lot 124 be investigated further to determine the level and extent of contamination and to develop a plan for remedial action.
- This further investigation should conclude whether the contamination must be reported to the EPA based on consideration of the findings in relation to the notification triggers listed in Section 2.3 of the Guidelines on the Duty to Report Contamination (NSW EPA, 2015)
- It is recommended that a suitable contractor, licensed to manage and dispose hazardous materials, be appointed to remove all visible waste from this area of the Site before commencement of any further investigation.
- The asbestos containing material (ACM) and lead based paint identified in the area to the north of the informal vehicle path, requires specialist attention during any removal or remedial action. It is recommended that during any removal of waste from this area, the ACM be removed and transported to a landfill, licensed to accept the waste, for disposal. The removal and disposal task can be undertaken by either a competent person or a licensed asbestos removalist (holding either a Class A or B license).
- Clearance inspection of the asbestos removal area must be undertaken following completion of removal work. The clearance inspection is to be carried out by a licensed, independent, asbestos assessor. A clearance certificate must be obtained from the asbestos assessor.
- Notification to SafeWork of the asbestos removal works will be required if the ACM to be removed is more than $10m^2$.
- Tracking of the collected ACM will be required. Transport of asbestos waste is regulated under EPA legislation. Disposal sites are regulated by the NSW EPA and local government regulations. Each load of asbestos waste must be tracked to the landfill facility using the EPA *WasteLocate* application.

9.0 REFERENCES

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Appendix A - Chain of Custody and Laboratory Report

barnson
DESIGN . PLAN . MANAGE

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Mudgee NSW 2850
t 1300 BARNSON (1300 227 676)
e generalenquiry@barnson.com.au
w www.barnson.com.au

CHAIN OF CUSTODY AND ANALYTICAL REQUEST

Job Number	35754	Date	29/03/2021
Laboratory	Envirolab Sydney	Report to	Nardus Potgieter npotgieter@barnson.com.au
Sample Temperature on Receipt		Notes	
18 °C	Signature: AB		

Sample ID	Description	Sample Date/Time	Analysis request 1	2	3	4	5	6
WW01 (1)	50-300mm from Drainage Node	29/03/2021	X					
WW02 (2)	50-300mm from future courtyard area	29/03/2021	X					
WW03 (3)	50-300mm from future sports field 2	29/03/2021	X					
WW04 (4)	50-300mm from north west open area comp	29/03/2021		X				
WW05 (5)	50-300mm near hut structure	29/03/2021	X					
WW06 (6)	50-300mm at ACM NW of hut	29/03/2021		X				
WW11 (7)	Painted wood	29/03/2021			X			
WW12 (8)	Fibre cement fragments	29/03/2021				X		

Analysis Request	
1	Combo 6 (BTEXN, TRH, PAH, OCP, OPP, PCB, 8Metals)
2	Combo 6 (BTEXN, TRH, PAH, OCP, OPP, PCB, 8Metals) + Asbestos
3	Lead (Pb) in paint
4	Asbestos ID bulk materials
5	
6	

Relinquished by / Affiliation	Accepted by / Affiliation	Date
[signature] / Barnson	A·BU / Envirolab Sydney	29/03/2021

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 265550
Date Received: 31/3/21
Time Received: 1215
Received By: AB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 265550

Client Details

Client	Barnson (Mudgee)
Attention	Nardus Potgieter
Address	Unit 2/108-110 Market St, Mudgee, NSW, 2850

Sample Details

Your Reference	**35754**
Number of Samples	6 Soil, 1 Paint, 1 Material
Date samples received	31/03/2021
Date completed instructions received	31/03/2021

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	09/04/2021
Date of Issue	09/04/2021

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Asbestos Approved By

Analysed by Asbestos Approved Identifier: Wonnie Condos, Ridwan Wijaya

Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By

Dragana Tomas, Senior Chemist

Giovanni Agosti, Group Technical Manager

Lucy Zhu, Asbestos Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		265550-1	265550-2	265550-3	265550-4	265550-5
Your Reference	UNITS	WW01	WW02	WW03	WW04	WW05
Date Sampled		29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/04/2021	01/04/2021	01/04/2021	01/04/2021	01/04/2021
Date analysed	-	06/04/2021	06/04/2021	06/04/2021	06/04/2021	06/04/2021
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	99	94	93	91	102

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		265550-6
Your Reference	UNITS	WW06
Date Sampled		29/03/2021
Type of sample		Soil
Date extracted	-	01/04/2021
Date analysed	-	06/04/2021
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	<3
Surrogate aaa-Trifluorotoluene	%	97

svTRH (C10-C40) in Soil						
Our Reference		265550-1	265550-2	265550-3	265550-4	265550-5
Your Reference	UNITS	WW01	WW02	WW03	WW04	WW05
Date Sampled		29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/04/2021	01/04/2021	01/04/2021	01/04/2021	01/04/2021
Date analysed	-	08/04/2021	02/04/2021	08/04/2021	08/04/2021	08/04/2021
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	130
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	150
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	150
Surrogate o-Terphenyl	%	119	123	102	99	103

svTRH (C10-C40) in Soil		
Our Reference		265550-6
Your Reference	UNITS	WW06
Date Sampled		29/03/2021
Type of sample		Soil
Date extracted	-	01/04/2021
Date analysed	-	02/04/2021
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
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	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	100

PAHs in Soil						
Our Reference		265550-1	265550-2	265550-3	265550-4	265550-5
Your Reference	UNITS	WW01	WW02	WW03	WW04	WW05
Date Sampled		29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/04/2021	01/04/2021	01/04/2021	01/04/2021	01/04/2021
Date analysed	-	06/04/2021	08/04/2021	06/04/2021	06/04/2021	06/04/2021
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.3
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	0.7
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	0.4
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.3
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.3
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	2.9
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	0.6
Surrogate p-Terphenyl-d14	%	79	83	77	73	71

PAHs in Soil		
Our Reference		265550-6
Your Reference	UNITS	WW06
Date Sampled		29/03/2021
Type of sample		Soil
Date extracted	-	01/04/2021
Date analysed	-	08/04/2021
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Total +ve PAH's	mg/kg	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Surrogate p-Terphenyl-d14	%	69

Organochlorine Pesticides in soil						
Our Reference		265550-1	265550-2	265550-3	265550-4	265550-5
Your Reference	UNITS	WW01	WW02	WW03	WW04	WW05
Date Sampled		29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/04/2021	01/04/2021	01/04/2021	01/04/2021	01/04/2021
Date analysed	-	06/04/2021	08/04/2021	06/04/2021	06/04/2021	06/04/2021
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	80	82	78	80	83

Organochlorine Pesticides in soil		
Our Reference		265550-6
Your Reference	UNITS	WW06
Date Sampled		29/03/2021
Type of sample		Soil
Date extracted	-	01/04/2021
Date analysed	-	08/04/2021
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
Total +ve DDT+DDD+DDE	mg/kg	<0.1
Surrogate TCMX	%	73

Organophosphorus Pesticides in Soil						
Our Reference		265550-1	265550-2	265550-3	265550-4	265550-5
Your Reference	UNITS	WW01	WW02	WW03	WW04	WW05
Date Sampled		29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/04/2021	01/04/2021	01/04/2021	01/04/2021	01/04/2021
Date analysed	-	06/04/2021	08/04/2021	06/04/2021	06/04/2021	06/04/2021
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	80	82	78	80	83

Organophosphorus Pesticides in Soil		
Our Reference		265550-6
Your Reference	UNITS	WW06
Date Sampled		29/03/2021
Type of sample		Soil
Date extracted	-	01/04/2021
Date analysed	-	08/04/2021
Dichlorvos	mg/kg	<0.1
Dimethoate	mg/kg	<0.1
Diazinon	mg/kg	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1
Ronnel	mg/kg	<0.1
Fenitrothion	mg/kg	<0.1
Malathion	mg/kg	<0.1
Chlorpyriphos	mg/kg	<0.1
Parathion	mg/kg	<0.1
Bromophos-ethyl	mg/kg	<0.1
Ethion	mg/kg	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1
Surrogate TCMX	%	73

PCBs in Soil						
Our Reference		265550-1	265550-2	265550-3	265550-4	265550-5
Your Reference	UNITS	WW01	WW02	WW03	WW04	WW05
Date Sampled		29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/04/2021	01/04/2021	01/04/2021	01/04/2021	01/04/2021
Date analysed	-	06/04/2021	08/04/2021	06/04/2021	06/04/2021	06/04/2021
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	80	82	78	80	83

PCBs in Soil		
Our Reference		265550-6
Your Reference	UNITS	WW06
Date Sampled		29/03/2021
Type of sample		Soil
Date extracted	-	01/04/2021
Date analysed	-	08/04/2021
Aroclor 1016	mg/kg	<0.1
Aroclor 1221	mg/kg	<0.1
Aroclor 1232	mg/kg	<0.1
Aroclor 1242	mg/kg	<0.1
Aroclor 1248	mg/kg	<0.1
Aroclor 1254	mg/kg	<0.1
Aroclor 1260	mg/kg	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1
Surrogate TCMX	%	73

Acid Extractable metals in soil						
Our Reference		265550-1	265550-2	265550-3	265550-4	265550-5
Your Reference	UNITS	WW01	WW02	WW03	WW04	WW05
Date Sampled		29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	06/04/2021	06/04/2021	06/04/2021	06/04/2021	06/04/2021
Date analysed	-	06/04/2021	06/04/2021	06/04/2021	06/04/2021	06/04/2021
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	1
Chromium	mg/kg	22	21	33	28	29
Copper	mg/kg	27	25	35	32	29
Lead	mg/kg	11	9	12	11	2,600
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
Nickel	mg/kg	29	23	29	28	18
Zinc	mg/kg	50	35	60	48	4,300

Acid Extractable metals in soil		
Our Reference		265550-6
Your Reference	UNITS	WW06
Date Sampled		29/03/2021
Type of sample		Soil
Date prepared	-	06/04/2021
Date analysed	-	06/04/2021
Arsenic	mg/kg	<4
Cadmium	mg/kg	1
Chromium	mg/kg	31
Copper	mg/kg	26
Lead	mg/kg	5,400
Mercury	mg/kg	<0.1
Nickel	mg/kg	17
Zinc	mg/kg	3,600

Moisture						
Our Reference		265550-1	265550-2	265550-3	265550-4	265550-5
Your Reference	UNITS	WW01	WW02	WW03	WW04	WW05
Date Sampled		29/03/2021	29/03/2021	29/03/2021	29/03/2021	29/03/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	31/03/2021	31/03/2021	31/03/2021	31/03/2021	31/03/2021
Date analysed	-	01/04/2021	01/04/2021	01/04/2021	01/04/2021	01/04/2021
Moisture	%	23	26	38	26	15

Moisture		
Our Reference		265550-6
Your Reference	UNITS	WW06
Date Sampled		29/03/2021
Type of sample		Soil
Date prepared	-	31/03/2021
Date analysed	-	01/04/2021
Moisture	%	9.4

Asbestos ID - soils			
Our Reference		265550-4	265550-6
Your Reference	UNITS	WW04	WW06
Date Sampled		29/03/2021	29/03/2021
Type of sample		Soil	Soil
Date analysed	-	07/04/2021	07/04/2021
Sample mass tested	g	Approx. 35g	Approx. 45g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected

Asbestos ID - materials		
Our Reference		265550-8
Your Reference	UNITS	WW12
Date Sampled		29/03/2021
Type of sample		Material
Date analysed	-	01/04/2021
Mass / Dimension of Sample	-	120x50x4mm
Sample Description	-	Beige fibre cement material
Asbestos ID in materials	-	Chrysotile asbestos detected Amosite asbestos detected
Trace Analysis	-	[NT]

Lead in Paint		
Our Reference		265550-7
Your Reference	UNITS	WW11
Date Sampled		29/03/2021
Type of sample		Paint
Date prepared	-	06/04/2021
Date analysed	-	06/04/2021
Lead in paint	%w/w	0.03

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
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-020/021/022	Digestion of Paint chips/scrapings/liquids for Metals determination by ICP-AES/MS and or CV/AAS.
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-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-022	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
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.

Method ID	Methodology Summary
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.
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-3	265550-2
Date extracted	-			01/04/2021	1	01/04/2021	01/04/2021		01/04/2021	01/04/2021
Date analysed	-			06/04/2021	1	06/04/2021	06/04/2021		06/04/2021	06/04/2021
TRH C_6 - C_9	mg/kg	25	Org-023	<25	1	<25	<25	0	100	87
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	1	<25	<25	0	100	87
Benzene	mg/kg	0.2	Org-023	<0.2	1	<0.2	<0.2	0	120	104
Toluene	mg/kg	0.5	Org-023	<0.5	1	<0.5	<0.5	0	110	97
Ethylbenzene	mg/kg	1	Org-023	<1	1	<1	<1	0	100	86
m+p-xylene	mg/kg	2	Org-023	<2	1	<2	<2	0	84	74
o-Xylene	mg/kg	1	Org-023	<1	1	<1	<1	0	108	93
naphthalene	mg/kg	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	106	1	99	88	12	105	93

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-9	265550-2
Date extracted	-			01/04/2021	1	01/04/2021	01/04/2021		01/04/2021	01/04/2021
Date analysed	-			02/04/2021	1	08/04/2021	08/04/2021		02/04/2021	02/04/2021
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	1	<50	<50	0	99	103
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	1	<100	<100	0	82	85
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	1	<100	<100	0	91	92
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	1	<50	<50	0	99	103
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	1	<100	<100	0	82	85
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	1	<100	<100	0	91	92
Surrogate o-Terphenyl	%		Org-020	90	1	119	61	64	109	123

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	265550-2
Date extracted	-			01/04/2021	1	01/04/2021	01/04/2021		01/04/2021	01/04/2021
Date analysed	-			08/04/2021	1	06/04/2021	06/04/2021		08/04/2021	08/04/2021
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	86	106
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	79	113
Fluorene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	79	112
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	105	109
Anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	91	102
Pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	93	106
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	67	105
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	1	<0.05	<0.05	0	83	121
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	104	1	79	82	4	119	67

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	265550-2
Date extracted	-			01/04/2021	1	01/04/2021	01/04/2021		01/04/2021	01/04/2021
Date analysed	-			08/04/2021	1	06/04/2021	06/04/2021		08/04/2021	08/04/2021
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	97	118
HCB	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	94	123
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	89	99
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	103	106
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	97	105
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	99	106
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	101	108
Endrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	88	102
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	85	95
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	91	103
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	109	1	80	82	2	108	68

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	265550-2
Date extracted	-			01/04/2021	1	01/04/2021	01/04/2021		01/04/2021	01/04/2021
Date analysed	-			08/04/2021	1	06/04/2021	06/04/2021		08/04/2021	08/04/2021
Dichlorvos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	71	137
Dimethoate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	91	112
Fenitrothion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	63	89
Malathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	138
Chlorpyriphos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	101	117
Parathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	75	98
Bromophos-ethyl	mg/kg	0.1	Org-022	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	65	115
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	109	1	80	82	2	108	68

QUALITY CONTROL: PCBs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	265550-2
Date extracted	-			01/04/2021	1	01/04/2021	01/04/2021		01/04/2021	01/04/2021
Date analysed	-			08/04/2021	1	06/04/2021	06/04/2021		08/04/2021	08/04/2021
Aroclor 1016	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	100	90
Aroclor 1260	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	109	1	80	82	2	108	68

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	265550-2
Date prepared	-			06/04/2021	1	06/04/2021	06/04/2021		06/04/2021	06/04/2021
Date analysed	-			06/04/2021	1	06/04/2021	06/04/2021		06/04/2021	06/04/2021
Arsenic	mg/kg	4	Metals-020	<4	1	<4	<4	0	94	75
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	95	75
Chromium	mg/kg	1	Metals-020	<1	1	22	27	20	93	82
Copper	mg/kg	1	Metals-020	<1	1	27	32	17	95	96
Lead	mg/kg	1	Metals-020	<1	1	11	11	0	95	77
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	99	93
Nickel	mg/kg	1	Metals-020	<1	1	29	27	7	95	78
Zinc	mg/kg	1	Metals-020	<1	1	50	52	4	92	74

QUALITY CONTROL: Lead in Paint					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			06/04/2021	[NT]	[NT]	[NT]	[NT]	06/04/2021	[NT]
Date analysed	-			06/04/2021	[NT]	[NT]	[NT]	[NT]	06/04/2021	[NT]
Lead in paint	%w/w	0.005	Metals-020/021/022	<0.005	[NT]	[NT]	[NT]	[NT]	92	[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.

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.

Report Comments

Asbestos: A portion of the supplied sample was sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g of sample in its own container.
Note: Samples 265550-4,6 were sub-sampled from jars provided by the client.

Appendix B
Chain of Custody

Environmental Division
Mudgee
Work Order Reference
ME2101373

Telephone 02 6372 6735

barnson

a Unit 4 / 108-110 Market Street
Mudgee NSW 2850
t 1300 BARNSON (1300 227 676)
e generalenquiry@barnson.com.au
w www.barnson.com.au

CHAIN OF CUSTODY AND ANALYTICAL REQUEST

Job Number	35754	Date	25/08/2021
Laboratory	ALS	Report to	Nardus Potgieter npotgieter@barnson.com.au
Sample Temperature on Receipt 8°C ice bricks			
6°C	Signature: [signature]		

Sample ID	Description	Sample Date	Analysis request			
			1	2	3	4
WW-01	Soil collected at 50-300mm Area 1	23/08/2021	X			
WW-02	Soil collected at 50-300mm Area 1	23/08/2021	X			
WW-03	Soil collected at 50-300mm Area 1	23/08/2021	X			
WW-04	Soil collected at 50-300mm Area 1	23/08/2021	X			
WW-05	Soil collected at 50-300mm Area 1	23/08/2021	X			
WW-06	Soil collected at 50-300mm Area 2	23/08/2021	X			
WW-07	Soil collected at 50-300mm Area 2	23/08/2021	X			
WW-08	Soil collected at 50-300mm Area 2	23/08/2021	X			
WW-09	Soil collected at 50-300mm Area 2	23/08/2021	X			
WW-10	Soil collected at 50-300mm Area 2	23/08/2021	X			
WW-11	Soil collected at 50-300mm Area 3	23/08/2021	X			
WW-12	Soil collected at 50-300mm Area 3	23/08/2021	X			
WW-13	Soil collected at 50-300mm Area 3	23/08/2021	X			
WW-14	Soil collected at 50-300mm Area 3	23/08/2021	X			
WW-15	Soil collected at 50-300mm Area 3	23/08/2021	X			
WW-16	Soil collected at 50-300mm Area 4	23/08/2021	X			
WW-17	Soil collected at 50-300mm Area 4	23/08/2021	X			
WW-18	Soil collected at 50-300mm Area 4	23/08/2021	X			
WW-19	Soil collected at 50-300mm Area 4	23/08/2021	X			
WW-20	Soil collected at 50-300mm Area 4	23/08/2021	X			
WW-21	Soil collected at 50-300mm Area 5	23/08/2021	X			
WW-22	Soil collected at 50-300mm Area 5	23/08/2021	X			
WW-23	Soil collected at 50-300mm Area 5	23/08/2021	X			

WW-24	Soil collected at 50-300mm Area 5	23/08/2021	X			
WW-25	Soil collected at 50-300mm Area 5	23/08/2021	X			
WW-26	Soil collected at 50-300mm Area 1	23/08/2021	X			
WW-27	Soil collected at 50-300mm Area 3	23/08/2021	X			

	Analysis Request	ALS Method Code
1	TRH (C6-C40) / BTEXN / PAH / 8 metals	S-26
2		
3		
4		

Relinquished by / Affiliation	Accepted by / Affiliation	Date
/ Barnson	/ ALS Mudgee	25/08/2021 920

Esky 1

Appendix C
Laboratory Report

CERTIFICATE OF ANALYSIS

Work Order	: **ME2101373**	Page	: 1 of 21
Client	: **BARNSON**	Laboratory	: Environmental Division Mudgee
Contact	: Nardus Potgieter	Contact	: Mary Monds (ALS Mudgee Sampler)
Address	: Unit 4 108-110 Market Street MUDGEE NSW 2850	Address	: 1/29 Sydney Road Mudgee NSW Australia 2850
Telephone	: 1300227676	Telephone	: +61 2 6372 6735
Project	: Soil	Date Samples Received	: 25-Aug-2021 09:20
Order number	: ----	Date Analysis Commenced	: 26-Aug-2021
C-O-C number	: ----	Issue Date	: 02-Sep-2021 08:55
Sampler	: Client Sampler		
Site	: ----		
Quote number	: SY/053/14		
No. of samples received	: 27		
No. of samples analysed	: 27		

NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Sample ID				WW-01 Soil collected at 50-300mm Area 1	WW-02 Soil collected at 50-300mm Area 1	WW-03 Soil collected at 50-300mm Area 1	WW-04 Soil collected at 50-300mm Area 1	WW-05 Soil collected at 50-300mm Area 1
Sampling date / time				23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
Compound	*CAS Number*	*LOR*	*Unit*	ME2101373-001	ME2101373-002	ME2101373-003	ME2101373-004	ME2101373-005
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**9.8**	**6.8**	**7.0**	**6.4**	**6.2**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**27**	**27**	**28**	**26**	**26**
Copper	7440-50-8	5	mg/kg	**22**	**25**	**24**	**21**	**22**
Lead	7439-92-1	5	mg/kg	**14**	**20**	**11**	**14**	**14**
Nickel	7440-02-0	2	mg/kg	**22**	**21**	**23**	**20**	**20**
Zinc	7440-66-6	5	mg/kg	**103**	**111**	**60**	**246**	**111**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-01 Soil collected at 50-300mm Area 1	WW-02 Soil collected at 50-300mm Area 1	WW-03 Soil collected at 50-300mm Area 1	WW-04 Soil collected at 50-300mm Area 1	WW-05 Soil collected at 50-300mm Area 1
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ME2101373-001	ME2101373-002	ME2101373-003	ME2101373-004	ME2101373-005
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	**110**	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	**110**	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**89.9**	**90.8**	**99.9**	**93.3**	**93.8**
2-Chlorophenol-D4	93951-73-6	0.5	%	**84.2**	**85.2**	**93.7**	**88.1**	**88.6**
2.4.6-Tribromophenol	118-79-6	0.5	%	**68.1**	**70.8**	**79.9**	**81.1**	**82.2**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**104**	**96.8**	**103**	**105**	**99.4**
Anthracene-d10	1719-06-8	0.5	%	**104**	**107**	**105**	**108**	**109**
4-Terphenyl-d14	1718-51-0	0.5	%	**98.4**	**102**	**103**	**103**	**104**
EP080S: TPH(V)/BTEX Surrogates								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-01 Soil collected at 50-300mm Area 1	WW-02 Soil collected at 50-300mm Area 1	WW-03 Soil collected at 50-300mm Area 1	WW-04 Soil collected at 50-300mm Area 1	WW-05 Soil collected at 50-300mm Area 1
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ME2101373-001	ME2101373-002	ME2101373-003	ME2101373-004	ME2101373-005
				Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**113**	**113**	**100**	**113**	**108**
Toluene-D8	2037-26-5	0.2	%	**122**	**122**	**111**	**123**	**116**
4-Bromofluorobenzene	460-00-4	0.2	%	**112**	**112**	**106**	**113**	**104**

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	WW-06 Soil collected at 50-300mm Area 2	WW-07 Soil collected at 50-300mm Area 2	WW-08 Soil collected at 50-300mm Area 2	WW-09 Soil collected at 50-300mm Area 2	WW-10 Soil collected at 50-300mm Area 2
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
				ME2101373-006	ME2101373-007	ME2101373-008	ME2101373-009	ME2101373-010
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	4.4	3.2	7.4	3.0	5.0
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	1	<1	1	<1	<1
Chromium	7440-47-3	2	mg/kg	25	32	32	28	24
Copper	7440-50-8	5	mg/kg	73	50	32	28	16
Lead	7439-92-1	5	mg/kg	230	623	114	520	1480
Nickel	7440-02-0	2	mg/kg	19	24	27	20	15
Zinc	7440-66-6	5	mg/kg	1610	1410	1070	1310	880
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	0.2	0.1	<0.1	0.1	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	0.6	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	1.2	1.2	1.2	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	WW-06 Soil collected at 50-300mm Area 2	WW-07 Soil collected at 50-300mm Area 2	WW-08 Soil collected at 50-300mm Area 2	WW-09 Soil collected at 50-300mm Area 2	WW-10 Soil collected at 50-300mm Area 2
Sampling date / time				23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
				ME2101373-006	ME2101373-007	ME2101373-008	ME2101373-009	ME2101373-010
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**89.9**	**95.4**	**90.2**	**89.5**	**92.9**
2-Chlorophenol-D4	93951-73-6	0.5	%	**85.0**	**90.0**	**83.9**	**84.6**	**88.2**
2.4.6-Tribromophenol	118-79-6	0.5	%	**66.5**	**73.1**	**71.6**	**75.3**	**74.4**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**103**	**104**	**105**	**104**	**98.6**
Anthracene-d10	1719-06-8	0.5	%	**106**	**110**	**105**	**104**	**109**
4-Terphenyl-d14	1718-51-0	0.5	%	**101**	**105**	**102**	**98.7**	**103**
EP080S: TPH(V)/BTEX Surrogates								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-06 Soil collected at 50-300mm Area 2	WW-07 Soil collected at 50-300mm Area 2	WW-08 Soil collected at 50-300mm Area 2	WW-09 Soil collected at 50-300mm Area 2	WW-10 Soil collected at 50-300mm Area 2
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ME2101373-006	ME2101373-007	ME2101373-008	ME2101373-009	ME2101373-010
				Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	108	101	104	112	102
Toluene-D8	2037-26-5	0.2	%	114	105	111	120	108
4-Bromofluorobenzene	460-00-4	0.2	%	103	96.0	99.9	106	98.2

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	WW-11 Soil collected at 50-300mm Area 3	WW-12 Soil collected at 50-300mm Area 3	WW-13 Soil collected at 50-300mm Area 3	WW-14 Soil collected at 50-300mm Area 3	WW-15 Soil collected at 50-300mm Area 3
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
				ME2101373-011	ME2101373-012	ME2101373-013	ME2101373-014	ME2101373-015
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**2.6**	**1.5**	**1.2**	<1.0	**8.4**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	**11**	**5**	<5	**11**	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	**3**	**5**
Chromium	7440-47-3	2	mg/kg	**27**	**22**	**24**	**26**	**28**
Copper	7440-50-8	5	mg/kg	**36**	**23**	**20**	**32**	**29**
Lead	7439-92-1	5	mg/kg	**664**	**253**	**386**	**565**	**139**
Nickel	7440-02-0	2	mg/kg	**24**	**17**	**21**	**18**	**24**
Zinc	7440-66-6	5	mg/kg	**407**	**460**	**309**	**2270**	**4840**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	**0.1**	<0.1	**0.2**	**0.2**	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	**0.8**	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	**0.8**	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	**1.6**	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	WW-11 Soil collected at 50-300mm Area 3	WW-12 Soil collected at 50-300mm Area 3	WW-13 Soil collected at 50-300mm Area 3	WW-14 Soil collected at 50-300mm Area 3	WW-15 Soil collected at 50-300mm Area 3
Sampling date / time				23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
				ME2101373-011	ME2101373-012	ME2101373-013	ME2101373-014	ME2101373-015
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	**100**	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	**100**	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**95.5**	**96.5**	**88.0**	**92.9**	**93.9**
2-Chlorophenol-D4	93951-73-6	0.5	%	**90.2**	**91.1**	**83.7**	**92.7**	**89.8**
2.4.6-Tribromophenol	118-79-6	0.5	%	**71.4**	**80.4**	**65.4**	**80.6**	**76.2**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**96.0**	**102**	**102**	**103**	**99.8**
Anthracene-d10	1719-06-8	0.5	%	**110**	**112**	**103**	**101**	**109**
4-Terphenyl-d14	1718-51-0	0.5	%	**106**	**106**	**98.8**	**95.1**	**104**
EP080S: TPH(V)/BTEX Surrogates								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-11 Soil collected at 50-300mm Area 3	WW-12 Soil collected at 50-300mm Area 3	WW-13 Soil collected at 50-300mm Area 3	WW-14 Soil collected at 50-300mm Area 3	WW-15 Soil collected at 50-300mm Area 3
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ME2101373-011	ME2101373-012	ME2101373-013	ME2101373-014	ME2101373-015
				Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**107**	**106**	**106**	**115**	**102**
Toluene-D8	2037-26-5	0.2	%	**112**	**116**	**116**	**127**	**108**
4-Bromofluorobenzene	460-00-4	0.2	%	**99.6**	**103**	**103**	**112**	**97.4**

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	ME2101373-016	ME2101373-017	ME2101373-018	ME2101373-019	ME2101373-020
Sample ID				WW-16 Soil collected at 50-300mm Area 4	WW-17 Soil collected at 50-300mm Area 4	WW-18 Soil collected at 50-300mm Area 4	WW-19 Soil collected at 50-300mm Area 4	WW-20 Soil collected at 50-300mm Area 4
Sampling date / time				23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**10.7**	**9.0**	**15.6**	**13.4**	**9.4**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**27**	**26**	**25**	**29**	**24**
Copper	7440-50-8	5	mg/kg	**41**	**43**	**38**	**34**	**35**
Lead	7439-92-1	5	mg/kg	**126**	**108**	**108**	**211**	**92**
Nickel	7440-02-0	2	mg/kg	**22**	**22**	**20**	**23**	**20**
Zinc	7440-66-6	5	mg/kg	**240**	**2710**	**390**	**206**	**216**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-16 Soil collected at 50-300mm Area 4	WW-17 Soil collected at 50-300mm Area 4	WW-18 Soil collected at 50-300mm Area 4	WW-19 Soil collected at 50-300mm Area 4	WW-20 Soil collected at 50-300mm Area 4
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ME2101373-016	ME2101373-017	ME2101373-018	ME2101373-019	ME2101373-020
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	**120**	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	**320**	<100	<100	<100	**210**
^ C10 - C36 Fraction (sum)	----	50	mg/kg	**440**	<50	<50	<50	**210**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	**320**	<100	<100	<100	**190**
>C34 - C40 Fraction	----	100	mg/kg	**270**	<100	<100	<100	**170**
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	**590**	<50	<50	<50	**360**
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**91.9**	**92.2**	**90.2**	**85.4**	**88.7**
2-Chlorophenol-D4	93951-73-6	0.5	%	**86.2**	**87.8**	**86.4**	**80.7**	**83.7**
2.4.6-Tribromophenol	118-79-6	0.5	%	**75.2**	**78.9**	**79.3**	**64.1**	**72.4**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**98.2**	**102**	**104**	**102**	**104**
Anthracene-d10	1719-06-8	0.5	%	**106**	**108**	**104**	**102**	**103**
4-Terphenyl-d14	1718-51-0	0.5	%	**103**	**105**	**102**	**98.9**	**100**
EP080S: TPH(V)/BTEX Surrogates								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-16 Soil collected at 50-300mm Area 4	WW-17 Soil collected at 50-300mm Area 4	WW-18 Soil collected at 50-300mm Area 4	WW-19 Soil collected at 50-300mm Area 4	WW-20 Soil collected at 50-300mm Area 4
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ME2101373-016	ME2101373-017	ME2101373-018	ME2101373-019	ME2101373-020
				Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	103	102	95.1	92.1	104
Toluene-D8	2037-26-5	0.2	%	111	109	102	101	112
4-Bromofluorobenzene	460-00-4	0.2	%	97.6	94.2	87.4	89.8	97.4

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	WW-21 Soil collected at 50-300mm Area 5	WW-22 Soil collected at 50-300mm Area 5	WW-23 Soil collected at 50-300mm Area 5	WW-24 Soil collected at 50-300mm Area 5	WW-25 Soil collected at 50-300mm Area 5
Sampling date / time				23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
				ME2101373-021	ME2101373-022	ME2101373-023	ME2101373-024	ME2101373-025
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**13.2**	**11.4**	**14.0**	**7.8**	**4.0**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	**7**	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	**1**
Chromium	7440-47-3	2	mg/kg	**34**	**32**	**33**	**27**	**25**
Copper	7440-50-8	5	mg/kg	**32**	**27**	**27**	**28**	**51**
Lead	7439-92-1	5	mg/kg	**21**	**23**	**16**	**69**	**435**
Nickel	7440-02-0	2	mg/kg	**28**	**27**	**27**	**22**	**19**
Zinc	7440-66-6	5	mg/kg	**106**	**79**	**106**	**695**	**503**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	**0.1**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-21 Soil collected at 50-300mm Area 5	WW-22 Soil collected at 50-300mm Area 5	WW-23 Soil collected at 50-300mm Area 5	WW-24 Soil collected at 50-300mm Area 5	WW-25 Soil collected at 50-300mm Area 5
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ME2101373-021	ME2101373-022	ME2101373-023	ME2101373-024	ME2101373-025
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	90.2	85.1	90.6	92.4	91.7
2-Chlorophenol-D4	93951-73-6	0.5	%	87.5	81.4	88.4	90.2	90.7
2.4.6-Tribromophenol	118-79-6	0.5	%	77.8	70.4	74.7	84.1	71.9
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	97.8	98.0	103	103	104
Anthracene-d10	1719-06-8	0.5	%	98.3	98.8	101	101	99.2
4-Terphenyl-d14	1718-51-0	0.5	%	87.2	87.3	92.0	89.6	88.3
EP080S: TPH(V)/BTEX Surrogates								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-21 Soil collected at 50-300mm Area 5	WW-22 Soil collected at 50-300mm Area 5	WW-23 Soil collected at 50-300mm Area 5	WW-24 Soil collected at 50-300mm Area 5	WW-25 Soil collected at 50-300mm Area 5
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00	23-Aug-2021 00:00
Compound	CAS Number	LOR	Unit	ME2101373-021	ME2101373-022	ME2101373-023	ME2101373-024	ME2101373-025
				Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	92.1	94.2	94.7	98.2	100
Toluene-D8	2037-26-5	0.2	%	98.2	86.7	87.7	93.3	93.9
4-Bromofluorobenzene	460-00-4	0.2	%	89.4	88.7	90.2	93.6	92.4

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

			Sample ID	WW-26 Soil collected at 50-300mm Area 1	WW-27 Soil collected at 50-300mm Area 3	----	----	----
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ME2101373-026	ME2101373-027	--------	--------	--------
				Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	7.7	7.8	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg	27	27	----	----	----
Copper	7440-50-8	5	mg/kg	24	25	----	----	----
Lead	7439-92-1	5	mg/kg	20	51	----	----	----
Nickel	7440-02-0	2	mg/kg	22	21	----	----	----
Zinc	7440-66-6	5	mg/kg	97	236	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	----	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	0.6	0.6	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	1.2	1.2	----	----	----
EP080/071: Total Petroleum Hydrocarbons								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-26 Soil collected at 50-300mm Area 1	WW-27 Soil collected at 50-300mm Area 3	----	----	----
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ME2101373-026	ME2101373-027	--------	--------	--------
				Result	Result	----	----	----
EP080/071: Total Petroleum Hydrocarbons - Continued								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg	<50	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg	<100	<100	----	----	----
C29 - C36 Fraction	----	100	mg/kg	<100	<100	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	----	----	----
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	----	----	----
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	----	----	----
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	----	----	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	----	----	----
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg	<1	<1	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**92.6**	**90.9**	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	**91.4**	**90.0**	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%	**80.4**	**74.4**	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**106**	**105**	----	----	----
Anthracene-d10	1719-06-8	0.5	%	**102**	**100**	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	**91.0**	**88.1**	----	----	----
EP080S: TPH(V)/BTEX Surrogates								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	WW-26 Soil collected at 50-300mm Area 1	WW-27 Soil collected at 50-300mm Area 3	----	----	----
			Sampling date / time	23-Aug-2021 00:00	23-Aug-2021 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ME2101373-026	ME2101373-027	--------	--------	--------
				Result	Result	----	----	----
EP080S: TPH(V)/BTEX Surrogates - Continued								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	90.2	97.0	----	----	----
Toluene-D8	2037-26-5	0.2	%	89.5	93.8	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%	91.8	94.7	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

Inter-Laboratory Testing

Analysis conducted by ALS Sydney, NATA accreditation no. 825, site no. 10911 (Chemistry) 14913 (Biology).

(SOIL) EG005(ED093)T: Total Metals by ICP-AES

(SOIL) EG035T: Total Recoverable Mercury by FIMS

(SOIL) EA055: Moisture Content (Dried @ 105-110°C)

(SOIL) EP080/071: Total Petroleum Hydrocarbons

(SOIL) EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions

(SOIL) EP080: BTEXN

(SOIL) EP080S: TPH(V)/BTEX Surrogates

(SOIL) EP075(SIM)B: Polynuclear Aromatic Hydrocarbons

(SOIL) EP075(SIM)S: Phenolic Compound Surrogates

(SOIL) EP075(SIM)T: PAH Surrogates