Pennan & Co

DETAILED SITE INVESTIGATION

PENCARROW ESTATE,
1491 STATE HIGHWAY 2, PONGAKAWA

Prepared For: Momentum Planning and Design Limited

1. Record of Review

Report preparation	Ellen Sands	Environmental Scientist Pennan & Co Limited	2 years	
Report preparation and review	Emma Joss	Director Pennan & Co Limited	11 years	

Revision Schedule		
Revision	**Reason**	**Date**
Original Report	-	8 June 2022

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2. Executive Summary

Momentum Planning and Design Limited commissioned Pennan & Co Limited (Pennan & Co), on behalf of property owners, Kevin and Andrea Marsh (the "client"), to complete a Detailed Site Investigation (DSI) for the Pencarrow Estate development (the "site"), located on part of a larger parent property at 1491 State Highway 2, Pongakawa. The client proposes a plan change from rural to residential to develop the Pencarrow Estate. The development will be predominantly residential with a small commercial area (shop, grocery store, café etc), as well as a playground and reserve areas.

The site is currently in pasture for dairy grazing and has been predominantly in pasture since at least 1943. Kiwifruit and citrus were grown on the site in two paddocks from approximately 1982 to the early 1990's. There is a residential home and ancillary farm buildings located towards the southwest corner of the site, adjacent to the western boundary. The residential home was relocated from an adjacent property (formerly part of the larger property).

The site is not identified as a verified HAIL site within the Bay of Plenty Regional Council Mapping system. However, HAIL activities have been identified on the site and a Detailed Site Investigation (DSI) has been prepared in support of the resource consent application for a land use change from rural to residential.

An initial desktop investigation undertaken as part of this DSI indicted evidence of several activities having taken place on the site that could be classified under the National Environmental Standards for Contaminants in Soil to Protect Human Health (NESCS) regulations:

- Category A10: Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds, having identified historic kiwifruit and citrus orchards in the west of the site.
- Category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment, relating to the likely use of pesticides and superphosphate fertiliser on the pasture areas; stockpiles of refuse and soil/sand and the likely use of lead-based paint on a small, deteriorated shed in the western portion of the site.
- Category A17: Storage tanks or drums for fuel, chemicals or liquid waste, based on the presence of an above ground fuel storage tank in the west of the site.

Field investigations indicated that:

- Heavy metals were not detected above the soil guideline values for residential land use for any of the samples analysed.
- No samples exceeded the ecological guideline values for residential land use.
- Selected samples exceeded the predicted background concentrations for the Bay of Plenty for arsenic, cadmium, chromium, copper, nickel, lead and zinc.
- No organochlorine pesticides (OCPs) were recorded above the laboratory limit of reporting.
- Total Petroleum Hydrocarbons (TPH) in the C15-C36 fraction were detected in all the sample locations and depths targeted. However, TPH results did not exceed the guideline values for residential land use for all pathways.
- Benzo[a]pyrene toxic equivalency (TEQ) was detected at 0.06 mg/kg for sample S64 0.0-0.1 m although the sample did not exceed the guideline values for residential land use.

- Asbestos containing material (ACM) and asbestos fines/fibrous asbestos (AF/FA) was not detected in the sample analysed.

Pursuant to regulation 9(1)(b) and regulation 9(3)(b), it is demonstrated that soil contamination does not exceed soil guideline values for residential land use as outlined in regulation 7. Pennan and Co considers that there is negligible risk to human health and the environment because of the proposed residential development on the site.

3. Introduction

3.1. Purpose

Momentum Planning and Design Limited commissioned Pennan & Co Limited (Pennan & Co), on behalf of property owners, Kevin and Andrea Marsh (the "client"), to complete a Detailed Site Investigation (DSI) for the Pencarrow Estate development (the "site"), located on part of a larger parent property at 1491 State Highway 2, Pongakawa. The client proposes a plan change from rural to residential to develop the Pencarrow Estate. The development will be predominantly residential with a small commercial area (shop, grocery store, café etc), as well as a playground and reserve areas.

The site is currently in pasture for dairy grazing and has been predominantly in pasture since at least 1943. Kiwifruit and citrus were grown on the site in two paddocks from approximately 1982 to the early 1990's. There is a residential home and ancillary farm buildings located towards the southwest corner of the site, adjacent to the western boundary. The residential home was relocated from an adjacent property (formerly part of the larger property).

The site is not identified as a verified HAIL site within the Bay of Plenty Regional Council Mapping system. However, HAIL activities have been identified on the site and a Detailed Site Investigation (DSI) has been prepared in support of the resource consent application for a land use change from rural to residential.

The purpose of this DSI is to characterise potential contaminants in the site soils that may have occurred from historic hazardous activities and industries list (HAIL) activities.

3.2. Objectives

The objectives of the DSI are to:

- Determine whether land is a 'piece of land' subject to the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NESCS) regulations.
- Assess the potential risk to human health and the environment.

3.3. Scope of Work

The scope of work comprised:

- A desktop review of the history of the site, including a review of council property files, and historical photographs.
- A summary of the results from the laboratory analysis of soil samples collected across the site.
- Recommendations for management of any potential contamination.
- Preparation of this report.

This report has been prepared in accordance with Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand (revised 2021) (Ref: MfEa) and Contaminated Land Management Guidelines No. 5: Site Investigation and Analysis of Soils (revised 2021) (Ref: MfEb).

In accordance with the requirements of Regulation 3 of the NESCS, the person certifying this DSI is a suitably qualified and experienced practitioner (refer Certification, page 2).

4. Site Description

4.1. Site Details and Layout

Table 1 Site Details

Site Name:	**Pencarrow Estate, Arawa Road, Pongakawa**
Address:	1491 State Highway 2, RD6, Te Puke, 3186
Legal Description:	Lot 1 DPS 79072 (7.8 ha) and Lot 2 DPS 79072 (9.3 ha)
Relevant authorities:	Western Bay of Plenty District Council Bay of Plenty Regional Council
Site area:	Refer Figure 1. Site area is approximately 9.77 ha.
Zoning:	Rural
Elevation:	The site is undulating with several shallow gullies forming overland flow paths. The site generally slopes downwards towards the north and is subject to modelled flood hazards in places based on WBOPDC online mapping system. Elevations range between 4-8 m above mean sea level (amsl), although much of the site is at 6-7m amsl.
General description:	The site for the proposed development covers all of Lot 2 DPS 79072 and approximately one third of Lot 1 DPS 79092. The site is part of a much larger parent property referred to as 1491 State Highway 2, Pongakawa. Most of the site is currently in pasture land. There is a residential home and ancillary farm buildings located towards the southwest corner of the site, adjacent to the western boundary. There are also ponds located in a depressed area adjacent to the western boundary of the site, near the farm buildings.

The location and layout of the site is depicted in Figure 1 and Figure 2.

4.1. Site Inspection

A site visit was undertaken by Pennan & Co. on 12 May 2022.

The following observations were made in reference to the current site:

- The site is predominantly in pasture.
- There is a residential property in the southwest of the site being used by the farm worker. The property is in a tidy condition and is proposed to remain on the site.
- There are farm implement sheds and a storage area north of the residential property. The storage area contained a stockpile consisting of metal roof cladding, old metal farm gates, metal storage drums, whiteware, timber, plastic and tyres. No evidence that the stockpile had been burnt previously. A further two stockpiles of soil were also located nearby.

- A small shed in the northwest of the storage area was in a deteriorated condition had flaking paint on the exterior.
- A small stockpile of sand was located in the southwest paddock and a stockpile of old bricks was located in the southern paddock.
- An above ground petrol storage tank was identified to the west of the storage area. The tank was in good condition however, there was no bunding or sealed ground below the tank to capture any spills or leaks.
- Two implement sheds were located in the west of the site. The shed on the western boundary stored timber and firewood. The second shed which was adjacent to the storage area, stored a stockpile of soil and gravel, timber and metal with old fuel and chemical drums identified. The base of the shed was concrete which appeared to be in reasonable condition. The top half of the exterior appeared to be asbestos containing material (ACM). However, the ACM cladding was in reasonable condition.
- The current owner noted that a small kiwifruit orchard was situated on the property in the western portion of the site and planted by her parents. The kiwifruit was organic and was eventually removed.
- The current also owner noted that there was a citrus orchard in the southern paddock but they removed it all and turned it into pasture.

The site is surrounded primarily by large farms in pasture. State Highway 2 is located to the south of the site. The site is bounded by Arawa Road along the eastern boundary of the site. There are 8 residential properties located on the west side of Arawa Road, adjacent to the site, and a residential (zoned) area of approximately 68 properties is located on the eastern side of Arawa Road directly opposite.

There are kiwifruit orchards in the surrounding area, although most are located south of State Highway 2. The closest kiwifruit orchard is located adjacent to the eastern boundary of the site across Arawa Road. Two other kiwifruit orchards are also located opposite the Arawa Road residential area, south, across State Highway 2.

4.2. Local Geology and Hydrology

Soils

There are two soil types identified for the Lot 2 DPS 79072. Approximately 86.3% of Lot 2 (8 ha) is mapped as Buried-allophanic Orthic Pumice Soils (Oropi_1a.1) (high confidence) and the remaining 13.7% of the site (1 ha), which comprises a small section adjacent to the western boundary of the lot, is mapped as Typic Orthic Gley Soils (Tainu_2a.1) (high confidence). All of Lot 1 DPS79072 is mapped as Buried-allophanic Orthic Pumice Soils (Oropi_1a.1) (high confidence).

Buried-allophanic Orthic Pumice Soils (Oropi_1a.1)

Buried-allophanic Orthic Pumice Soils belongs to the Pumice soil order of the New Zealand soil classification. Pumice Soils are sandy or gravelly soils dominated by pumice, or pumice sand with a high content of natural glass. Drainage of excess water is rapid but the soils are capable of storing large amounts of water for plants. They occur in tephras ranging from 700 to 3500 years old. It is formed in fragmental material erupted from a volcano, from rhyolite parent material.

The topsoil typically has loam texture and is stoneless. The subsoil has dominantly loam textures, with at least 30 cm of rock fragments deposited by a volcano within 100 cm of the mineral soil depth. The plant rooting depth extends beyond 1m.

Generally the soil is well drained with very low vulnerability of water logging in non-irrigated conditions, and has high soil water holding capacity. Inherently these soils have a moderate structural vulnerability and a low N leaching potential (Ref: Landcare 2022).

Typic Orthic Gley Soils (Tainui_2a.1)

Typic Orthic Gley Soils belong to the Gley soil order of the New Zealand soil classification. Gley soils are strongly affected by waterlogging, have been chemically reduced, have light grey subsoils, and usually have reddish brown or brown mottles. Waterlogging occurs in winter and spring, and some soils remain wet all year. It is formed in fragmental material erupted from a volcano overlying peat, from rhyolite parent material.

The topsoil typically has sand texture and is stoneless. The subsoil has dominantly peat textures, with at least 30 cm of rock fragments deposited by a volcano within 100 cm of the mineral soil depth. The plant rooting depth is 60 - 80 (cm), due to lack of oxygen in soil pores.

Generally the soil is poorly drained with high vulnerability of water logging in non-irrigated conditions, and has very high soil water holding capacity. Inherently these soils have a high structural vulnerability and a very low N leaching potential (Ref: Landcare 2022).

Momentum Planning and Design Limited have mapped several peat areas within the site.

Geology

The site is mapped as a combination of Tauranga Group swamp deposits (Q1a) and Tauranga Group alluvium (IQa). Tauranga Group Swamp deposits are dark brown to black peat, organic rich mud silt and sand. Tauranga Group alluvium comprises alluvium, underlying variably degraded terraces, dominated by pumice, lava fragments and greywacke (Ref: GNS 2010).

Bay of Plenty Regional Council online mapping system identifies the site as primarily alluvial plans and river flats. The terrain is described as “very similar to the alluvial lowlands and swamp deposits, however this terrain has a higher topographical elevation. This terrain represents the sediments deposited from the active and historic river systems within the region. The surface of this terrain typically increases in elevation in a landward direction from the coast.” Its geological age is identified as Holocene. Groundwater depth is less than 4 m below ground level in this area.

Bay of Plenty Regional Council online mapping system identifies the southern portion of the site as alluvial terrace. This terrain is described as “generally steep-sided terraces and sea cliffs. The terraces typically comprise Pleistocene-age or older alluvium, with various interbedded ash and tephra deposits. Typically positioned below the hills and ranges terrain.” Its geological age is identified as early Pleistocene-middle Pleistocene. Groundwater depth is greater than 4 m below ground level in this area of the site.

Hydrogeology

As shown on the Bay of Plenty Regional Council (BOPRC) online mapping system, there are three active cold water bores located on the site. All are located within close proximity to one another on the southern portion of the site (Lot 2). BN-3510 was drilled to a depth of 70 m in 1998 and the reduced groundwater level was 6.78 m. BN-10209 and BN-10112 were both drilled in 2001, to a

depth of 90 m and 72 m, respectively. BN10209 had a reduced groundwater level of 6.81 m and BN-10112 had a reduced groundwater level of 6.87 m.

There are two other active bores drilled in relative proximity to the site, both associated with the nearest kiwifruit orchards to the site. BN-2692 is a cold water bore located 545 m south of the site (across State Highway 2), drilled to a depth of 131 m in 2006. BN-4071 is a cold water bore located 287 m south east of the site, drilled in 1986, depth not recorded.

There are other bores surrounding the site, identified on the BOPRC online mapping system, however, these are all located more than 800 m from any one of the site's boundaries.

Hydrology

There are man made drainage canals running along the western boundary of the property connecting to nearby Wharere Canal, which is approximately 680m to the east of the site.

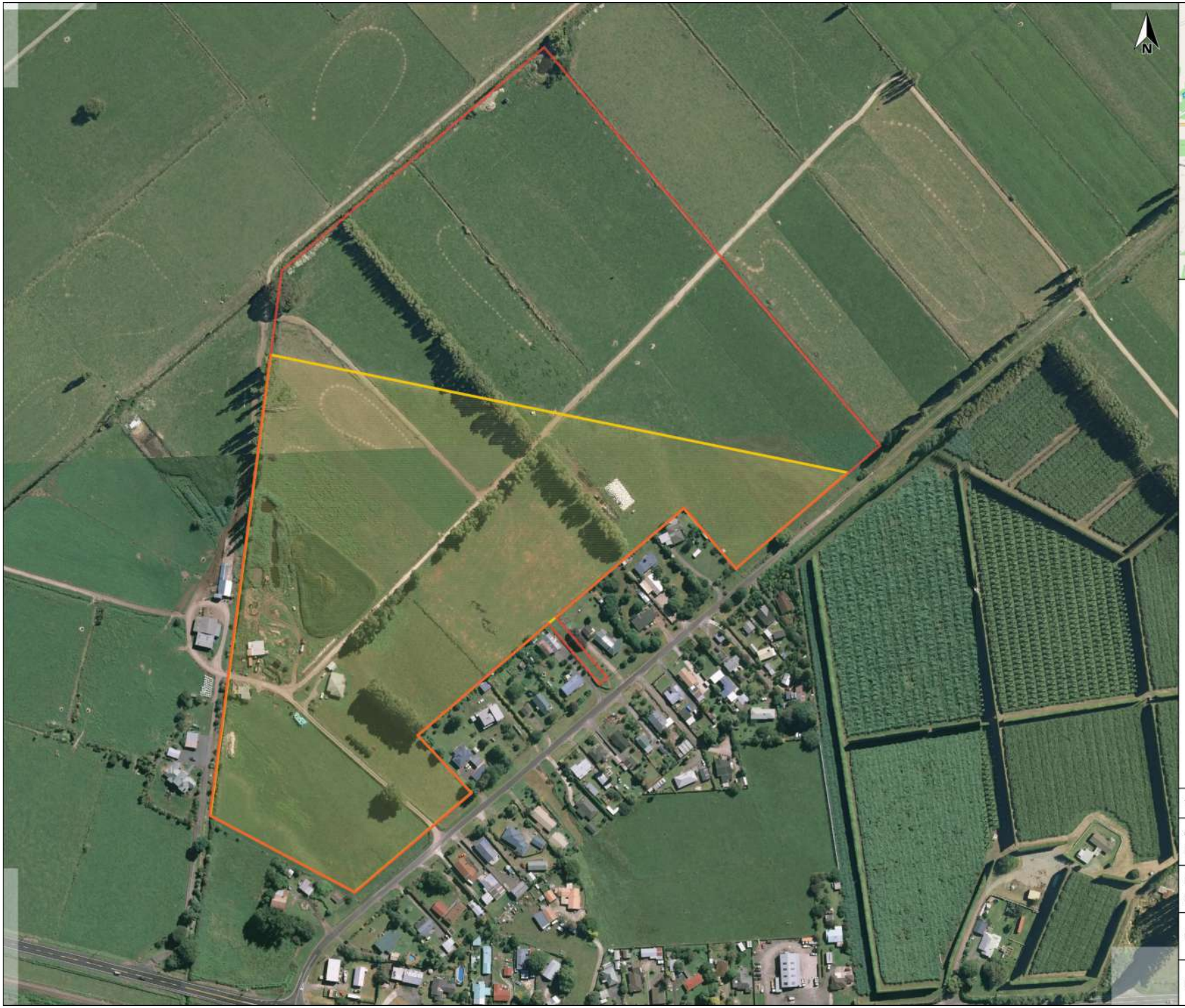
Kaikokopu Canal is located 1.7 km to the west of the site and Pongakawa Canal is located further east of Wharere Canal, approximately 3 km away from the site. Both the Kaikokopu Canal and the Pongakawa Canal are unlikely to be impacted by the site directly.

All three canals drain to the Waihi Estuary located 4.8km north of the site.

Current aerial photographs of the site show two small ponds and a chain of four connected ponds, all located on the property in a depressed area adjacent to the western boundary of the site.

The site falls within the Waihi Estuary Primary Surface Drainage Catchment Area, Pongakawa Secondary Surface Drainage Catchment area, and the Wharere Tertiary Surface Drainage Catchment Area.

There are areas of the site that are subject to a floodable area hazard overlay, and liquefaction on the site according to the Western Bay of Plenty District Council online mapping system.



Legend

- Site Boundary
- Site Investigation Boundary

0 50 m 100 m

Pennan & Co

Produced by **Datanest.earth**

Title: Site Location		
Client: Momentum Planning and Design		Figure No: 1
Project: Arawa Rd, Pongakawa	Drawn: EJ	Size: A4
Date: 08-06-2022	Checked: EJ	
Proj No: 202206	Scale: 1:4000	Version: Final

5. Historical Site Use

The following information was used to prepare a site history:

- Review of Western Bay of Plenty District Council (WBOPDC) property file.
- Western Bay of Plenty District Council online mapping system.
- Bay of Plenty Regional Council online mapping system.
- Review of available aerial photography.

5.1. Review of Council Information

The property file for the site was obtained from the Western Bay of Plenty District Council on 28 April, 2022, and contained the following relevant information:

Table 2 Summary of WBOPDC files

Date:	File No:	Details
2003 (February)	BC68426	Consent to re-site dwelling from Lot 2 DPS 779714 (Parcel ID: 1570/5)) to Lot 2 DPS 79072 (Parcel ID: 1570/15).
2003 (August)	BC68426 amended	Consent to re-site dwelling within site was amended to move the house to a location on higher ground near existing sheds rather than the originally proposed site adjacent to Arawa Road.
2003 (Nov)	RC402506L	Approval to add an additional dwelling to Lot 2 DPS79072. A letter from the owners associated with this application and approval stated the following information: "…shift the family home across to another site on the farm to be used as a farm assistants house when a new home has been built for ourselves. The house is approximately 70 years old and in sound condition. Advice was that the dwelling could be moved in one piece. "
2018		Correspondence was sent to the property owners to indicate that Lot 1 (Parcel ID: 1570/14) of the larger property could potentially be inundated in an extreme tsunami event caused by a large earthquake along the Kermadec Trench, based on new studies.
2021		Correspondence was sent to the property owners to indicate that the property (including Lots 1 and 2 specifically) are at risk of flooding from a 1 in 100 year (extreme) rainfall event, based on new studies.

The property owners had a consent (66309) to discharge dairy effluent to pond and sludge to land, granted in August 16 2010, which expired on July 31, 2020.

They have a current Resource consent (RM20-0252) to discharge farm dairy effluent to land, granted on May 6, 2020, with no expiry date.

5.2. Selected Land Use Register

The site is not identified as a verified HAIL site within the Bay of Plenty Regional Council Mapping system.

There are 7 identified HAIL sites located within 300 m of the site. All are located south and southeast of the site. Two are the aforementioned kiwifruit orchards in close proximity to the site. The others are commercial premises located within the Arawa Road residential area. They are listed as follows:

- LUR-WBP-00078 Transport depot
- LUR-WBP-00057 Scrap yards
- LUR-WBP-04122 Persistent pesticide use (this is now residential housing)
- LUR-WBP-00058 Bulk storage tanks

- LUR-WBP-02926 Persistent pesticide use (orchard on Arawa Road)
- LUR-WBP-03835 Persistent pesticide use (orchard adjacent to State Highway 2)
- LUR-WBP-03804 Persistent pesticide use (orchard adjacent to State Highway 2)

5.3. Review of Aerial Photography

Aerial photographs were obtained from Retrolens for the years 1943, 1961, 1962, 1971, 1974, 1982, 1983, 1986, 1994, 1995; from Google Earth for the years 2003, and 2005; and from the Western Bay of Plenty District Council online mapping system for the years 2007-2008, 2010-2012, 2016-2017, and 2021. The following table (Table 2) summarises observations from each photograph in relation to the entire site, and the surrounding area. The historical aerial photography is included in Appendix A.

Table 3 Historical Aerial Photography Review

Year	Site Observations	Surrounding Area Observations
1943	The site is in pasture. There are two building located near the western boundary of the site.	The surrounding area is in pasture. There are buildings, one of which is residential, located on the land adjacent to the western boundary of the site and close to the buildings located on the site itself. There is a residential building located adjacent to the southern boundary of the site on the adjacent property.
1961	The site is in pasture. The paddock boundaries are all clearly distinguishable by hedging/windbreaks/possibly poplar trees. There also appears to be one building adjacent to the eastern site boundary and one located on the farm road running north/south through the centre of the site. There are small shed structures dotted in several of the paddocks in the southern portion of the site which are more clearly visible in the 1962 photo.	The surrounding area is still largely in pasture, however, there has been some residential development along Arawa Road and State Highway 2 on the land adjacent to the eastern boundary of the site. There is another piece of land that has been cleared on the property across State Highway 2 south of the site, however, it is not clear what has been build there.
1962	The site looks largely unchanged with the exception that there are two buildings clearly visible adjacent to the western boundary of the site, not just the one seen in the photo from 1961.	The surrounding area looks largely unchanged. The property at the junction of Arawa Road and State Highway 2 on the south side of the highway appears to be a commercial property.
1963	Site looks unchanged	Surrounding area looks unchanged.
1971	The site is still in pasture. It appears that most of the hedges around the paddocks have been removed. There are also three dark areas in the southern portion of the site. It is not clear what these are. Possibly standing water. They do appear to coincide with the peat areas identified by Momentum Planning and Design Limited. The shed on the farm road may have been removed but it is difficult to tell at the resolution of the photograph.	The surrounding area looks largely unchanged.
1974	The resolution of this photograph is much clearer, making it easier to see that most of the hedges around the paddocks have been removed. The paddock near the two existing buildings looks to have been cleared (possibly recontoured?) and grassed. Many of the small shed structures have been removed. There now	The surrounding area looks largely unchanged. The property adjacent to the southern boundary may be undertaking market gardening or some form of cropping.

Year	Site Observations	Surrounding Area Observations
	appears to be only one shed in the southwest corner of the property. There is a clear roadway from Arawa Road to the existing buildings.	
1982	Much of the site appears to be unchanged. However, orcharding activities (likely kiwifruit) are being undertaken on two of the western paddocks and windbreaks have been planted around the four western paddocks, thereby indicating that further orchard activities may be planned.	The surrounding area is largely in pasture. However, several properties have been converted to kiwifruit orchards, including two in close proximity to the site (south and southeast). There has been some infilling of residential properties in the Arawa Road residential area.
1983	Site appears unchanged	Surrounding area appears unchanged.
1986	Site appears unchanged. The orcharding activities appears to be kiwifruit.	Surrounding area appears unchanged. The property to the south of the site may have been converted back to pasture but it is difficult to tell at this resolution.
1994	The kiwifruit orchards have been removed, along with some of the windbreaks, and the land returned to pasture. The shed adjacent to the eastern boundary of the site may have also be removed, although it is difficult to tell at the resolution of the photo. Otherwise, the site appears unchanged.	Some more infill of residential properties in the Arawa Road residential area has occurred. The commercial property at the junction of Arawa Road and State Highway 2 (on the south side of State Highway 2) has been removed. The last of the three kiwifruit orchards in close proximity to the site has now been established. The property adjacent to the southern boundary of the site appears to be in pasture.
1995	The site appears largely unchanged.	The surrounding area looks unchanged.
2003	There appears to be an additional building adjacent to the western boundary of the site just north of the two existing buildings. Ponds can also be seen in this area. The shed in the southwest corner of the site has been removed. The remainder of the site remains in pasture.	Residential properties subdivided from the parent property have been built along Arawa Road adjacent to the eastern boundary of the site. Otherwise, the surrounding area looks unchanged.
2005	Further infill of residential properties along the eastern boundary of the site. A residential house is now present on the site near the existing farm buildings. Possibly a silage pile is located near the northern boundary of the site.	A residential home appears to have been built on the parent property adjacent to the western boundary of the site, near existing farm buildings. The surrounding area looks unchanged.
2007-2008	Site looks unchanged. There appears to be a lot of unidentified objects being stored in the paddock around the existing farm buildings. There is a stockpile located to the south of the farm buildings along the western boundary.	The surrounding area looks unchanged.
2010-2012 (1)	Site appears unchanged.	Surrounding area appears unchanged.
2010/2012 (2)	Site appears unchanged although, two paddocks have been cut, presumably for silage. There is a stockpile on the north side of the windbreak along the boundary between Lot 1 and Lot 2 of the site.	Surrounding area appears unchanged.
2016-2017	Site appears unchanged. There is another stockpile presumably silage located in close proximity to the site of the one seen in the previous photo.	Surrounding area appears unchanged.

Year	Site Observations	Surrounding Area Observations
2021	Site appears unchanged. The remnants of the shed in the southwest corner of the site may be visible. There are no silage stockpiles visible. Trees along the farm road (running north-south through the site) and along the boundary between Lot 1 and Lot 2 have been removed. Some stockpiles of tree debris remain.	The remainder of the Arawa Road residential area has been infilled with houses. There has been significant conversion of pasture lands to the southwest of the property to kiwifruit orchards, although none are in the immediate vicinity of the property. The only exception is that the orchard on the south side of State Highway 2 immediately opposite the Arawa Road residential area has been expanded.

6. Initial Site Characterisation

The Conceptual Site Model (CSM) (refer Table 4 below) was developed to inform the design of this DSI and to describe the relationship between sources of contamination on site, the human and environmental receptors that may be exposed to those contaminants in the context of the use of an area of the site for a residential home, and the pathways by which those receptors may be exposed.

The CSM will be updated in the later sections of this report to reflect the results of the intrusive ground investigation and inform the conclusions and recommendations.

Table 4 Initial Conceptual Site Model

Source	Receptor	Pathway	Pathway Complete?
Agrichemical and metal contaminants from pesticide use on the identified orchard. HAIL category A10: Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds)	Construction workers	Dermal contact	**Incomplete Pathway** – Contaminant exposure of a construction worker would be no more than a few occasions per year with minimal exposure. The risk to human health would be negligible for both threshold and non-threshold contaminants associated with HAIL A10.
		Ingestion	
		Inhalation of dust/vapours	
	Future site users	Dermal contact	**Potentially Complete Pathway** – Contaminants could be present at a level that poses a risk to human health with a change in land use from production land to residential and may require specific controls.
		Ingestion	
		Inhalation of dust/vapours	
	Current site users	Dermal contact	**Incomplete Pathway** – The site is currently in pasture with a small area used for storage of farm equipment. Due to the nature of the site, current site users would have minimal exposure to contaminants. The risk to human health would be negligible for both threshold and non-threshold contaminants associated with HAIL A10.
		Ingestion	
		Inhalation of dust/vapours	
	General public	Dermal contact	**Incomplete Pathway** – The site is not accessible to the general public and it is unlikely that contaminants associated with HAIL A10 would migrate offsite at concentrations that would be a risk to human health.
		Ingestion	
		Inhalation of dust/vapours	
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – The nearest surface water bodies are man-made drainage canals running along the western boundary of the property connecting to nearby Wharere Canal, which is approximately 680 m to the east of the site. However, the type of contaminants associated with HAIL A10 will generally remain in the surface soils on the site.
	Groundwater	Leaching and migration of soil contaminants into groundwater.	**Incomplete Pathway** – Groundwater is at depth and the type of contaminants associated with the source activity will generally remain in the surface soils on the site.

Source	Receptor	Pathway	Pathway Complete?
Presence of above ground fuel storage tanks. HAIL category A17: Storage tanks or drums for fuel, chemicals or liquid waste.	Construction workers	Dermal contact Ingestion Inhalation of dust/vapours	**Incomplete Pathway** – Contaminant exposure of a construction worker would be no more than a few occasions per year with minimal exposure. The risk to human health would be negligible for both threshold and non-threshold contaminants associated with HAIL A17.
	Future site users	Dermal contact Ingestion Inhalation of dust/vapours	**Potentially Complete Pathway** – Contaminants could be present at a level that poses a risk to human health with a change in land use from production land to residential and may require specific controls.
	Current site users	Dermal contact Ingestion Inhalation of dust/vapours	**Incomplete Pathway** – The site is currently in pasture with a small area used for storage and maintenance of farm equipment. Due to the nature of the site, current site users would have minimal exposure to contaminants. The risk to human health would be negligible for contaminants associated with HAIL A17.
	General public	Dermal contact Ingestion Inhalation of dust/vapours	**Incomplete Pathway** – The site is not accessible to the general public and it is unlikely that contaminants associated with HAIL A17 would migrate offsite at concentrations that would be a risk to human health.
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – The nearest surface water bodies are man-made drainage canals running along the western boundary of the property connecting to nearby Wharere Canal, which is approximately 680 m to the east of the site. However, the type of contaminants associated with HAIL A10 will generally remain in the surface soils on the site.
	Groundwater	Leaching and migration of soil contaminants into groundwater.	**Incomplete Pathway** – Groundwater is likely to be shallow given the drainage canals on the western boundary. However, the type of contaminants associated with the source activity will generally remain in the surface soils on the site.
Use of superphosphate fertiliser and pesticide sprays on pasture. HAIL category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it	Construction workers	Dermal contact Ingestion Inhalation of dust/vapours	**Incomplete Pathway** – Contaminant exposure of a construction worker would be no more than a few occasions per year with minimal exposure. The risk to human health would be negligible for both threshold and non-threshold contaminants associated with superphosphate use.
	Future site users	Dermal contact Ingestion	**Potentially Complete Pathway** – Contaminants, particularly cadmium, could be present at a level that poses a risk to human health with a change in land use from

Source	Receptor	Pathway	Pathway Complete?
could be a risk to human health or the environment.		Inhalation of dust/vapours	production land to residential and may require specific controls.
	Current site users	Dermal contact	**Incomplete Pathway** – The site is currently in pasture with a small area used for storage and maintenance of farm equipment. Due to the nature of the site, current site users would have minimal exposure to contaminants. The risk to human health would be negligible for contaminants associated with the use of superphosphate fertiliser.
		Ingestion	
		Inhalation of dust/vapours	
	General public	Dermal contact	**Incomplete Pathway** – The site is not accessible to the general public and it is unlikely that contaminants associated with the use of superphosphate fertiliser would migrate offsite at concentrations that would be a risk to human health.
		Ingestion	
		Inhalation of dust/vapours	
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – The nearest surface water bodies are man-made drainage canals running along the western boundary of the property connecting to nearby Wharere Canal, which is approximately 680 m to the east of the site. However, the type of contaminants associated with the use of superphosphate fertiliser will generally remain in the surface soils on the site.
	Groundwater	Leaching and migration of soil contaminants into groundwater.	**Incomplete Pathway** – Groundwater is likely to be shallow given the drainage canals on the western boundary. However, the type of contaminants associated with the source activity will generally remain in the surface soils on the site.
Stockpiles of refuse and soil/sand. HAIL category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	Construction workers	Dermal contact	**Incomplete Pathway** – Contaminant exposure of a construction worker would be no more than a few occasions per year with minimal exposure. The risk to human health would be negligible for both threshold and non-threshold contaminants associated with stockpiles. No asbestos containing material (ACM) was identified in the stockpiles and the risk has been deemed negligible.
		Ingestion	
		Inhalation of dust/vapours	
	Future site users	Dermal contact	**Potentially Complete Pathway** – Contaminants could be present at a level that poses a risk to human health with a change in land use from production land to residential and may require specific controls.
		Ingestion	
		Inhalation of dust/vapours	
	Current site users	Dermal contact	**Incomplete Pathway** – The site is currently in pasture with a small area used for storage and maintenance of farm equipment. Due to the nature of the site, current site users would have minimal exposure to contaminants. The risk to human health would be negligible for contaminants associated with the stockpiles.
		Ingestion	
		Inhalation of dust/vapours	

Source	Receptor	Pathway	Pathway Complete?
	General public	Dermal contact Ingestion Inhalation of dust/vapours	**Incomplete Pathway** – The site is not accessible to the general public and it is unlikely that contaminants associated with the stockpiles would migrate offsite at concentrations that would be a risk to human health.
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – The nearest surface water bodies are man-made drainage canals running along the western boundary of the property connecting to nearby Wharere Canal, which is approximately 680 m to the east of the site. However, the type of contaminants associated with the stockpiles will generally remain in the surface soils on the site.
	Groundwater	Leaching and migration of soil contaminants into groundwater.	**Incomplete Pathway** – Groundwater is likely to be shallow given the drainage canals on the western boundary. However, the type of contaminants associated with the source activity will generally remain in the surface soils on the site.
Use of lead-based paint. HAIL category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	Construction workers	Dermal contact Ingestion Inhalation of dust/vapours	**Incomplete Pathway** – Contaminant exposure of a construction worker would be no more than a few occasions per year with minimal exposure. The risk to human health would be negligible for lead.
	Future site users	Dermal contact Ingestion Inhalation of dust/vapours	**Potentially Complete Pathway** – Contaminants could be present at a level that poses a risk to human health with a change in land use from production land to residential and may require specific controls.
	Current site users	Dermal contact Ingestion Inhalation of dust/vapours	**Incomplete Pathway** – The site is currently in pasture with a small area used for storage and maintenance of farm equipment. Due to the nature of the site, current site users would have minimal exposure to lead. The risk to human health would be negligible.
	General public	Dermal contact Ingestion Inhalation of dust/vapours	**Incomplete Pathway** – The site is not accessible to the general public and it is unlikely that lead contamination would migrate offsite at concentrations that would be a risk to human health.
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – The nearest surface water bodies are man-made drainage canals running along the western boundary of the property connecting to nearby Wharere Canal, which is approximately 680 m to the east of the site. However, lead will generally remain in the surface soils on the site.
	Groundwater	Leaching and migration of soil contaminants into groundwater.	**Incomplete Pathway** – Groundwater is likely to be shallow given the drainage canals on the western boundary. However, the type of contaminants associated with the source

Source	Receptor	Pathway	Pathway Complete?
			activity will generally remain in the surface soils on the site.

7. Sampling and Analysis Plan

7.1. Contaminants of Potential Concern

Table 5 Contaminants of Potential Concern

Activity	HAIL code	Location	Rationale	Contaminants of Potential Concern
Agrichemical and metal contaminants from pesticide use on the identified orchard areas.	HAIL category A10: Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds)	Previous orchard areas.	Historical aerial photographs identified orchards in the western portion of the site.	Metals, in particular arsenic, and organochlorine pesticides.
Presence of above ground fuel storage tanks.	HAIL category A17: Storage tanks or drums for fuel, chemicals or liquid waste.	The above ground storage tank in the west of the site.	The tank was identified during the site walkover.	Total petroleum hydrocarbons.
Use of superphosphate fertiliser and pesticides on pasture.	HAIL category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	Pasture areas	Historical aerial photographs identified the pasture areas. Pasture was historically treated widely with pesticides for ground grub and superphosphate fertiliser is still in use.	Metals, particularly cadmium and zinc, and organochlorine pesticides.
Stockpiles of refuse and soil/sand.	HAIL category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	Farm storage area and paddock in western area of the site.	The stockpiles were identified during the site walkover. The refuse stockpile contained metal, whiteware, wood, plastic and tyres and the soil and sand stockpiles were from an unknown location.	Metals, total petroleum hydrocarbons, polycyclic aromatic hydrocarbons.
Use of lead-based paint.	HAIL category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	Small shed in farm storage area in the west of the site.	The shed was identified during the site walkover and was in a deteriorated condition with flaky paint and is of an age when lead-based paint was used.	Lead

Please note that asbestos was not included as a contaminant of potential concern as the exterior shed cladding did not meet the threshold of HAIL category E1: *Asbestos products manufacture or*

disposal including sites with buildings containing asbestos products known to be in a deteriorated condition. However, a soil sample will be collected adjacent to the shed to confirm that asbestos has not impacted the soil and to further quantify that the asbestos cladding is not a HAIL activity.

7.2. Data quality objectives

The data quality objective (DQO) Process is used to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of the investigation. The DQO process consists of seven iterative steps that are documented in Table 6.

Table 6 DQO Process

Step	Description	Outcomes
1	State the problem	The site has been used historically as pasture with a small kiwifruit and citrus orchard, so there is a risk of contamination. The level of risk of exposure to contaminants is unknown so to quantify the risk and how best to manage it, further investigations of the soil contaminants is required. The proposed works trigger the Resource Management (National Environmental Standard for Assessment and Management of Contaminated Soils to Protect Human Health) Regulations. Soil contaminant concentrations must be assessed to determine consenting requirements.
2	Identify the decisions/goal of the investigation	The decisions to be made for the investigation are as follows: • Is the site investigation design sufficiently robust to meet the requirements of Contaminated Land Management Guideline No. 5? • Have all the contaminants of concern been identified? • Are the data gaps at the site clear? • Are there contaminant risks which need to be managed during the works? • Are there contaminant risks that need to be managed on completion of the works? • What controls are needed to manage the contaminant risks during and on completion of the works? • Where can the soil excess be disposed of? • What consents are triggered by the presence of contamination? • What is the cost of managing contamination risks and what impact will this have on the overall works' budget?
	Identify the inputs to the decision	The inputs required to make the above decisions are as follows: • Background data on site history • Observation data including presence of odours and discolouration of the soil • Geological and hydrological data • Concentrations of contaminants of concern in soil • Site assessment criteria for soil • Distribution of identified soil contamination (if any)
4	Define the study boundary/constraints on data	The boundary of the investigation area is defined as the location of the proposed subdivision, as shown in Figure 2.
5	Develop a decision rule	If concentrations exceed the adopted assessment criteria, then: • Consent will be required. • Controls will be implemented to manage contaminant risks during and on completion of works.

Step	Description	Outcomes
		• Soil excess will be managed on site or disposed of at a facility that is licenced to accept this type of waste. • Requirements for further assessment, remedial and/or management options will be considered.
6	Specify limits on decision errors	The acceptable limits on decision errors to be applied in the investigation and the manner of addressing possible decision errors have been developed based on the data quality indicators (DQIs) of precision, accuracy, representativeness, comparability and completeness.
7	Optimise the design for obtaining data	This assessment has been designed considering the information obtained during the desktop review undertaken by Pennan & Co. It is based on the principles set out in Contaminated Land Management Guidelines (CLMG) No. 5 (revised 2021) and the details of the proposed works. To ensure the design satisfies the DQOs, DQIs (for accuracy, comparability, completeness, precision and reproducibility) have been established to set acceptance limits on field methodologies and laboratory data collected.

7.3. Basis for Guideline Values

As the proposed development is to build a residential home on an orchard, the assessment criteria for a residential land use scenario have been adopted using:

- Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011. Soil Contaminant Standards for a 'Residential' land use scenario.
- National Environmental Protection (Assessment of Site Contamination) Measures 1999. NEPM Schedule B health investigation levels – residential 'A' scenario.
- Landcare Research Updated User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco SGVs) Consultation draft – residential land use.
- SEM background Levels of Agrichemical Residues in Bay of Plenty Soils, SEM NZ Limited. Tauranga. 2005.
- BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil.
- Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand – residential all pathways.

Note that, Pennan & Co has not used predicted regional background concentrations for the contaminants of interest from the Land Resource Information Systems (LRIS) portal. These background soil concentration predictions were developed based on the underlying geology which is generally regarded as a major contributor to the soils and surficial material. In the case of this site, the prediction is based on andesite geology which is not the correct underlying geology and the overlying soils originate from a rhyolite volcanic eruption.

7.4. Sampling Design

The sampling design was systematic or grid sampling to detect contamination hotspots in the pasture and former orchard areas.

Additional targeted sampling was undertaken near the sheds, the above ground storage tank and implement storage areas.

The surface layer is the targeted location of potential contaminants in the soil.

7.5. Sample collection

Sampling included the following:

- Surface samples (0-0.1 m below ground level (bgl)) were collected from a total of 71 locations (refer Figure 2). The number of locations is in general accordance with Ministry for the Environment Contaminated Land Management Guidelines No. 5 (revised 2021).
- Soil sampling was undertaken using a stainless-steel hand auger. Soil samples were collected directly from the hand auger using disposable nitrile gloves and placed in a laboratory supplied glass jar for sample analytical purposes.
- Collection of quality control samples as per Section 7.6.
- Where re-useable sampling equipment was used, this equipment was decontaminated prior to collection of another sample.
- Soil samples were collected in the appropriate sample jars, stored and transported in chilled containers in accordance with IANZ laboratory requirements.

7.6. Quality Assurance and Quality Control

Analytica Laboratories is accredited by International Accreditation New Zealand (IANZ). Analyses was performed in accordance with the terms of accreditation.

Two field blind replicate samples were collected.

Decontamination of non-dedicated sampling equipment was undertaken between each sample collection, using Decon 90 solution, followed by rinsing each piece of equipment with potable water.

Personnel handling soil samples replaced nitrile gloves between each sample.

Legend

- Site Investigation Boundary
- Sample Locations
- Site Boundary

0 25 m 50 m

Pennan & Co

Produced by **Datanest.earth**

Title: Sample Location Plan		
Client: Momentum Planning and Design		Figure No: 2
Project: Arawa Rd, Pongakawa	Drawn: EJ	Size: A4
Date: 08-06-2022	Checked: EJ	
Proj No: 202206	Scale: 1:2300	Version: Final

8. Sampling Results

8.1. Investigation Rationale

The purpose of the sampling was to:

- Establish the type and location of any contamination on the site.
- Determine the concentration of any contaminants on the site.
- Determine whether the concentration of contaminants exceed soil guideline values for proposed future land uses.
- Establish the associated risk to human health with respect to the proposed land use change.

8.2. Field Investigation Methodology

The field investigation was completed 12 and 13 May 2022 by Pennan & Co. The field investigation was undertaken in general accordance with the Sampling and Analysis Plan (SAP). The field investigation comprised the collection of soil samples for laboratory analysis.

The sampling locations are shown on Figure 2.

The laboratory reports are provided in Appendix B.

8.3. Field Observations

The soil comprised a dark brown loam overlying brown/grey sand. No visual or olfactory signs of contamination were noted during the field investigation.

Two blind duplicate samples were collected during the field sampling.

The sample locations are identified on Figure 2.

8.4. Laboratory Analysis

Table 7 Summary of Laboratory Analysis of Soil Samples

Laboratory Analysis	Location	Additional Notes
Heavy metals suite (7 Elements: arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn))	All sample locations, both systematic and targeted	70 sample locations tested. S1- S70. All locations were sampled at 0.0-0.1 m. Deeper samples were collected at S63 and 64 (0.2-0.3 m) although S64 was put on cold hold pending S64 0.0-0.1 m results.
Organochlorine pesticides (OCP)	In the previous orchard and pasture areas.	18 composite samples were analysed. Each composite comprised soil taken at 0.0-0.1 m from either 3 or 4 sample locations. S1-S62 and S65-S66 sample locations were included in composites.
Total petroleum hydrocarbons / polycyclic aromatic hydrocarbons	Targeted locations around the above ground storage tank and refuse stockpile.	3 samples were analysed for total petroleum hydrocarbons: S63 0.0-0.1, S63 0.2-0.3 m and S64 0.0-0.1 m.

Laboratory Analysis	Location	Additional Notes
		1 sample was analysed for polycyclic aromatic hydrocarbons: S64 0.0-0.1 m.
Asbestos semi-quantitative analysis	Adjacent to shed with suspected ACM cladding.	1 sample was collected: S71 0.0-0.1 m.
Intra-laboratory (field) duplicate	Random selection	Analysed for heavy metals. 2 blind field replicates were submitted: S12 0.2-0.3 m and S51 0.2-0.3 m.

8.5. Results Summary

Metals

- Heavy metals were not detected above the soil guideline values for residential land use for any of the samples analysed.
- No samples exceeded the ecological guideline values for residential land use.
- Selected samples exceeded the predicted background concentrations for the Bay of Plenty for arsenic, cadmium, chromium, copper, nickel, lead and zinc.

Organochlorine Pesticides

- No organochlorine pesticides (OCPs) were recorded above the laboratory limit of reporting.

Total Petroleum Hydrocarbons

- Total Petroleum Hydrocarbons (TPH) in the C15-C36 fraction were detected in all the sample locations and depths targeted.
- TPH results did not exceed the guideline values for residential land use for all pathways.

Polycyclic Aromatic Hydrocarbons

- Benzo[a]pyrene toxic equivalency (TEQ) was detected at 0.06 mg/kg for sample S64 0.0-0.1 m.
- No sample exceeded the guideline values for residential land use.

Asbestos

- Asbestos containing material (ACM) and asbestos fines/fibrous asbestos (AF/FA) was not detected in the sample analysed.

Results are shown in Table 8 and the laboratory reports are provided in Appendix B.

Table 8 Laboratory Results

Sample ID	Depth	Date	Contaminant[1]									
			As	Cd	Cr	Cu	Pb	Ni	Zn	BaP TEQ (LOR)	Total DDT	Asbestos (w / w%)
S1	0.0-0.1m	12/05/2022	**18.2**	0.45	6	12.9	7.6	1.8	21.3	-	-	-
S2	0.0-0.1m	12/05/2022	**18.2**	0.31	3.4	8.55	2.5	1.4	11.1	-	-	-
S3	0.0-0.1m	12/05/2022	11	**0.755**	7.4	19.6	8.13	3.7	32.8	-	-	-
S4	0.0-0.1m	12/05/2022	5.1	0.39	2.2	8.45	3.2	1.1	13.7	-	-	-
S5	0.0-0.1m	12/05/2022	4.4	0.22	2.7	3.1	6.65	1.2	33.9	-	-	-
S6	0.0-0.1m	12/05/2022	12	0.45	4.5	11.1	6.81	2.4	45.4	-	-	-
S7	0.0-0.1m	12/05/2022	6.5	**0.659**	4.2	11.9	11.6	2.4	30.8	-	-	-
S8	0.0-0.1m	12/05/2022	1.3	0.07	0.42	0.63	0.79	0.18	11.6	-	-	-
S9	0.0-0.1m	12/05/2022	3.8	**0.561**	5	12.5	10.8	3.6	72.8	-	-	-
S10	0.0-0.1m	12/05/2022	3.9	0.44	3.2	14.6	11.1	1.3	33.1	-	-	-
S11	0.0-0.1m	12/05/2022	3.5	0.28	3.8	5.2	8.22	2	44.1	-	-	-
S12	0.0-0.1m	12/05/2022	4.8	0.42	3.2	17	5.2	1.7	32.5	-	-	-
S13	0.0-0.1m	12/05/2022	3.5	0.31	2.8	13.3	7.49	1.3	27.9	-	-	-
S14	0.0-0.1m	12/05/2022	8.7	0.4	3.7	24.1	3.2	2.3	27.9	-	-	-
S15	0.0-0.1m	12/05/2022	3	0.064	0.88	4.1	1.5	0.53	12.7	-	-	-
S16	0.0-0.1m	12/05/2022	5.3	**0.762**	3.2	17	3.8	2.6	27.5	-	-	-
S17	0.0-0.1m	12/05/2022	3.5	0.43	2	17.2	3.1	1.5	42.8	-	-	-
S18	0.0-0.1m	12/05/2022	6.5	**0.521**	6	12.9	3.3	1.7	15.8	-	-	-
S19	0.0-0.1m	12/05/2022	**18.9**	0.39	2.8	6.4	2	1.5	15.8	-	-	-

Sample ID	Depth	Date	Contaminant[1]									
			As	Cd	Cr	Cu	Pb	Ni	Zn	BaP TEQ (LOR)	Total DDT	Asbestos (w / w%)
S20	0.0-0.1m	12/05/2022	12.9	**0.538**	5	10.6	4.2	1.6	21.4	-	-	-
S21	0.0-0.1m	12/05/2022	5.6	0.36	2.6	6.6	2.9	1.7	14.1	-	-	-
S22	0.0-0.1m	12/05/2022	10	**0.567**	5.6	10.7	3.2	2.3	27.9	-	-	-
S23	0.0-0.1m	12/05/2022	3.9	0.49	3.9	10.3	9.62	2.2	47.4	-	-	-
S24	0.0-0.1m	12/05/2022	9.6	**0.86**	4.1	14.9	3.4	2.4	25.2	-	-	-
S25	0.0-0.1m	12/05/2022	4.1	0.31	2.4	4.8	1.5	1.5	16.2	-	-	-
S26	0.0-0.1m	12/05/2022	11	**0.892**	6	13.3	3.3	2.5	31.4	-	-	-
S27	0.0-0.1m	12/05/2022	7.1	0.46	3.1	6	2.8	1.9	22.5	-	-	-
S28	0.0-0.1m	12/05/2022	6.7	**0.636**	4.1	**62.5**	3.9	2.6	26.2	-	-	-
S29	0.0-0.1m	12/05/2022	8.9	0.46	4	8.67	4.7	2.4	21	-	-	-
S30	0.0-0.1m	13/05/2022	1.9	**0.665**	3.2	5.5	2.6	2.1	26.3	-	-	-
S31	0.0-0.1m	13/05/2022	2.3	**0.727**	4.4	6.1	4.1	5.16	23.3	-	-	-
S32	0.0-0.1m	13/05/2022	3.9	**0.647**	3	5.1	2	2.3	20.5	-	-	-
S33	0.0-0.1m	13/05/2022	2.3	**0.756**	3.8	6.1	2.5	2.5	28.4	-	-	-
S34	0.0-0.1m	13/05/2022	2.6	**0.614**	3.2	4.4	2.7	2.7	25.2	-	-	-
S35	0.0-0.1m	13/05/2022	2.1	**0.537**	3.4	5	5.97	1.9	26.6	-	-	-
S36	0.0-0.1m	13/05/2022	2.4	**0.64**	2.9	7.2	3.2	1.5	44	-	-	-
S37	0.0-0.1m	13/05/2022	2.1	**0.566**	2.6	6.4	3.1	1.4	31.9	-	-	-
S38	0.0-0.1m	13/05/2022	2.5	0.41	2.7	7	3.3	1.2	43.4	-	-	-
S39	0.0-0.1m	13/05/2022	5	**0.505**	3.5	6.4	2.5	2.3	23.1	-	-	-

Sample ID	Depth	Date	Contaminant[1]									
			As	Cd	Cr	Cu	Pb	Ni	Zn	BaP TEQ (LOR)	Total DDT	Asbestos (w / w%)
S40	0.0-0.1m	13/05/2022	2	0.39	3.6	5.5	3	2.1	26.5	-	-	-
S41	0.0-0.1m	13/05/2022	2.9	0.38	3.6	4	4.6	2.1	24.4	-	-	-
S42	0.0-0.1m	13/05/2022	2.5	0.48	3.1	4.9	19.7	1.6	40.3	-	-	-
S43	0.0-0.1m	13/05/2022	**17.2**	**0.726**	5.7	12.4	3.9	3.6	23.2	-	-	-
S44	0.0-0.1m	13/05/2022	**14.6**	**0.578**	4.4	9.52	2.8	3.1	16.1	-	-	-
S45	0.0-0.1m	13/05/2022	2.1	0.34	2.2	3.9	2.5	1.3	22.4	-	-	-
S46	0.0-0.1m	13/05/2022	2.4	0.4	2	4.9	8.44	1.6	25.7	-	-	-
S47	0.0-0.1m	13/05/2022	0.76	0.041	2.8	2.3	2.2	0.67	44.7	-	-	-
S48	0.0-0.1m	13/05/2022	13.7	0.23	1.7	6.1	2	1	20.4	-	-	-
S49	0.0-0.1m	13/05/2022	8.7	0.36	3	10.6	2.6	1.4	20.6	-	-	-
S50	0.0-0.1m	13/05/2022	6.9	**0.761**	4	9.12	3.2	3.2	40.8	-	-	-
S51	0.0-0.1m	13/05/2022	5.7	**0.569**	3	6.7	2.8	2	21.4	-	-	-
S52	0.0-0.1m	13/05/2022	3	0.32	1.7	2.8	1.5	1.2	14.5	-	-	-
S53	0.0-0.1m	13/05/2022	7.9	**0.807**	4	8.76	2.6	5.55	27.9	-	-	-
S54	0.0-0.1m	13/05/2022	6.2	0.27	2	4.7	1.5	1.6	11.8	-	-	-
S55	0.0-0.1m	13/05/2022	1.6	0.052	0.74	0.83	0.69	0.38	11.5	-	-	-
S56	0.0-0.1m	13/05/2022	12	0.54	5.4	8.85	4.4	2.4	27.8	-	-	-
S57	0.0-0.1m	13/05/2022	1.6	0.083	0.85	1.9	0.81	0.44	11.6	-	-	-
S58	0.0-0.1m	13/05/2022	4.1	0.36	1.8	4.3	1.5	0.94	11.7	-	-	-
S59	0.0-0.1m	13/05/2022	8.3	**0.952**	5.7	12.3	14.1	3.7	31.8	-	-	-

Sample ID	Depth	Date	Contaminant[1]									
			As	Cd	Cr	Cu	Pb	Ni	Zn	BaP TEQ (LOR)	Total DDT	Asbestos (w / w%)
S60	0.0-0.1m	13/05/2022	10	**0.624**	4	9.57	2.7	2.8	22	-	-	-
S61	0.0-0.1m	13/05/2022	12	0.2	3.7	11	5.14	1.9	32.1	-	-	-
S62	0.0-0.1m	13/05/2022	2.1	0.088	1.6	5.2	3.8	0.57	10.1	-	-	-
S63	0.0-0.1m	13/05/2022	9	0.22	9.4	18.6	18.5	3.1	97.3	-	-	-
S63	0.2-0.3m	13/05/2022	2.7	0.053	1.7	3.7	4.6	0.69	24.6	-	-	-
S64	0.0-0.1m	13/05/2022	4.1	0.14	4.1	6	12.3	1.8	77.9	0.060	-	-
S65	0.0-0.1m	13/05/2022	8.1	**0.672**	4.4	12.8	12.1	2.5	38.4	-	-	-
S66	0.0-0.1m	13/05/2022	2.7	0.13	1.6	4.3	3.1	0.76	13.3	-	-	-
S67	0.0-0.1m	13/05/2022	2.3	0.38	2.3	**27.6**	4	1.8	**165**	-	-	-
S68	0.0-0.1m	13/05/2022	8.8	0.46	7.4	17.8	30.1	1.5	**269**	-	-	-
S69	0.0-0.1m	13/05/2022	5.4	0.46	6.4	23.1	**46.6**	1.8	**194**	-	-	-
S70	0.0-0.1m	13/05/2022	9.8	0.43	**12**	24.2	25.1	2.3	**323**	-	-	-
S71	0.0-0.1m	13/05/2022	-	-	-	-	-	-	-	-	-	ND
Composite 1 (S1 0.0-0.1, S2 0.0-0.1, S3 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 2 (S4 0.0-0.1, S5 0.0-0.1, S6 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 3 (S7 0.0-0.1, S8 0.0-0.1, S9 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 4 (S10 0.0-0.1, S11 0.0-0.1, S12 0.0-0.1, S13 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-

Sample ID	Depth	Date	Contaminant[1]									
			As	Cd	Cr	Cu	Pb	Ni	Zn	BaP TEQ (LOR)	Total DDT	Asbestos (w / w%)
Composite 5 (S14 0.0-0.1, S15 0.0-0.1, S16 0.0-0.1, S17 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 6 (S18 0.0-0.1, S19 0.0-0.1, S22 0.0-0.1, S23 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 7 (S20 0.0-0.1, S21 0.0-0.1, S26 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 8 (S24 0.0-0.1, S25 0.0-0.1, S28 0.0-0.1, S29 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 9 (S30 0.0-0.1, S31 0.0-0.1, S34 0.0-0.1, S35 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 10 (S27 0.0-0.1, S32 0.0-0.1, S33 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 11 (S36 0.0-0.1, S37 0.0-0.1, S38 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 12 (S43 0.0-0.1, S44 0.0-0.1, S45 0.0-0.1, S46 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 13 (S39 0.0-0.1, S40 0.0-0.1, S41 0.0-0.1, S42 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 14 (S50 0.0-0.1, S51 0.0-0.1, S52 0.0-0.1, S53 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 15 (S48 0.0-0.1, S49 0.0-0.1, S54 0.0-0.1, S55 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 16 (S56 0.0-0.1, S57 0.0-0.1, S58 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-

Sample ID	Depth	Date	Contaminant[1]									
			As	Cd	Cr	Cu	Pb	Ni	Zn	BaP TEQ (LOR)	Total DDT	Asbestos (w / w%)
Composite 17 (S59 0.0-0.1, S60 0.0-0.1, S61 0.0-0.1, S62 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Composite 18 (S65 0.0-0.1, S66 0.0-0.1)			-	-	-	-	-	-	-	-	<LOR	-
Guideline Values	SCS (residential)[2]		20	3	460	>10,000	210	-	-	10	70	-
	NEPM[5]		-	-	-	-	-	400	8,000	-	-	-
	EcoSGV[3]		60	12	390	240	900	-	300	-	-	-
	BRANZ[6] (residential)		-	-	-	-	-	-	-	-	-	0.01 (ACM) 0.001 (AF/FA)
Soil Background	SEM[4]		<2 - 14	<0.1 – 0.5	<2 - 11	3 - 26	2.9 – 37.7	<2 - 6	19 - 99	-	-	-

Table notes:
1 All concentrations listed are in mg/kg
2 National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES) 2012. Soil Contaminant Standard for residential land use
3 Landcare Research: Updated User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors (Eco SGVs) Consultation draft. Residential/recreational area.
4 SEM background Levels of Agrichemical Residues in Bay of Plenty Soils, SEM NZ Limited. Tauranga. 2005. Control Sites (range n = 25)
5 National Environmental Protection (Assessment of Site Contamination) Measures 1999. NEPM Schedule B health investigation levels – residential A
6 New Zealand Guidelines for Assessing and Managing Asbestos in Soil, BRANZ 2017
LOR - Limit of reporting; ACM – asbestos containing material; AF/FA – asbestos fines/fibrous asbestos; ND = not detected; - = not tested
Black bold text denotes concentrations above background range

Table 9 Total Petroleum Hydrocarbon Results

Sample ID	Depth	Date	Contaminant[1]			
			C7-C9	C10-C14	C15-C36	C7-C36 (Total)
S63	0.0-0.1 m	13/05/2022	<10	<15	61	61
S63	0.2-0.3 m	13/05/2022	<10	<15	99	99
S64	0.0-0.1 m	13/05/2022	<10	<15	39	<50
Guideline Values	Petroleum Guidelines (sand < 1 m)[2]		120	470	NA	

Table notes:

1 All concentrations listed are in mg/kg

2 Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011). Residential use for all pathways.

NA indicates estimated criterion exceeds 20,000 mg/kg.

8.6. Quality Assurance and Quality Control

Analytica Laboratories is accredited by International Accreditation New Zealand (IANZ). Analyses were performed in accordance with the terms of accreditation.

Two blind field duplicates were collected and analysed for and analysed for heavy metals (sample S12 0.2-0.3 m which corresponded to S12 0.0-0.1 m and sample S51 0.2-0.3 m which corresponded to S51 0.0-0.1 m). The mean relative percent difference (RPD) of the metal duplicate analyses was between 0 and 17.16% and the results were within the acceptable limits (< ± 30-50% of the mean concentration of the analyte).

Analytica split three laboratory samples and analysed them for metals (sample S3, S45 and S63). The RPD of the metal duplicate analyses were between 0 and 31.25%. The results are determined to be within the acceptable limits.

9. Risk Assessment

No samples exceeded the soil guideline values for residential land use. Concentrations of arsenic, cadmium, chromium, copper, lead and zinc were above regional background concentrations.

Based on the DSI results and risk assessment, no complete linkages for contaminants from source-pathway-receptor have been identified.

9.1. Final Conceptual Site Model

Table 10 Final Conceptual Site Model

Source	Receptor	Pathway	Pathway Complete?
Agrichemical and metal contaminants from pesticide use on the identified orchard. HAIL category A10: Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds)	Construction workers	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Future site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Current site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	General public	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	

Source	Receptor	Pathway	Pathway Complete?
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
	Groundwater	Leaching and migration of soil contaminants into groundwater.	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
Presence of above ground fuel storage tanks. HAIL category A17: Storage tanks or drums for fuel, chemicals or liquid waste.	Construction workers	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Future site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Current site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	General public	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
	Groundwater	Leaching and migration of soil contaminants into groundwater.	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
Use of superphosphate fertiliser and pesticide sprays on pasture. HAIL category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it	Construction workers	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Future site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	

Source	Receptor	Pathway	Pathway Complete?
could be a risk to human health or the environment.		Inhalation of dust/vapours	
	Current site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	General public	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
	Groundwater	Leaching and migration of soil contaminants into groundwater.	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
Stockpiles of refuse and soil/sand. HAIL category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	Construction workers	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Future site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Current site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	General public	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
	Groundwater	Leaching and migration of soil	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.

Source	Receptor	Pathway	Pathway Complete?
		contaminants into groundwater.	
Use of lead-based paint. HAIL category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.	Construction workers	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Future site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Current site users	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	General public	Dermal contact	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
		Ingestion	
		Inhalation of dust/vapours	
	Surface water	Sediment and runoff directly into surface water discharging into nearby watercourses.	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.
	Groundwater	Leaching and migration of soil contaminants into groundwater.	**Incomplete Pathway** – Contaminant concentrations do not pose a risk to human health or the environment.

9.2. Risk Evaluation

Pursuant to regulation 9(1)(b) and regulation 9(3)(b), it is demonstrated that soil contamination does not exceed soil guideline values for residential land use as outlined in regulation 7. Pennan and Co considers that there is negligible risk to human health and the environment because of the proposed residential development on the site.

10. Soil Management

Concentrations of arsenic, cadmium, chromium, copper, lead and zinc were above regional background concentrations. While soil at these locations can remain on the wider site, the soil may not meet cleanfill criteria. If proposed to be disposed off-site, Pennan & Co recommends that once the earthworks details are known, further statistical analysis is completed on the soils for waste characterisation purposes.

11. Conclusions

An initial desktop investigation undertaken as part of this DSI indicted evidence of several activities having taken place on the site that could be classified under the National Environmental Standards for Contaminants in Soil to Protect Human Health (NESCS) regulations:

- Category A10: Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds, having identified historic kiwifruit and citrus orchards in the west of the site.
- Category I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment, relating to the likely use of pesticides and superphosphate fertiliser on the pasture areas; stockpiles of refuse and soil/sand and the likely use of lead-based paint on a small, deteriorated shed in the western portion of the site.
- Category A17: Storage tanks or drums for fuel, chemicals or liquid waste, based on the presence of an above ground fuel storage tank in the west of the site.

Field investigations indicated that:

- Heavy metals were not detected above the soil guideline values for residential land use for any of the samples analysed.
- No samples exceeded the ecological guideline values for residential land use.
- Selected samples exceeded the predicted background concentrations for the Bay of Plenty for arsenic, cadmium, chromium, copper, nickel, lead and zinc.
- No organochlorine pesticides (OCPs) were recorded above the laboratory limit of reporting.
- Total Petroleum Hydrocarbons (TPH) in the C15-C36 fraction were detected in all the sample locations and depths targeted. However, TPH results did not exceed the guideline values for residential land use for all pathways.
- Benzo[a]pyrene toxic equivalency (TEQ) was detected at 0.06 mg/kg for sample S64 0.0-0.1 m although the sample did not exceed the guideline values for residential land use.
- Asbestos containing material (ACM) and asbestos fines/fibrous asbestos (AF/FA) was not detected in the sample analysed.

Pennan & Co has demonstrated that soil contamination does not exceed the soil guideline values for residential land use. Therefore, Pennan & Co concludes that the land does not pose a risk to human health and the environment and the site is suitable for the proposed residential development.

12. Limitations

This report has been prepared for Momentum Planning and Design Limited, on behalf of property owners, Kevin and Andrea Marsh, by Pennan & Co in accordance with the purpose and scope set out above, and the usual care and thoroughness of the consulting profession. Any use of any part of this report by any other party, or in any other context, is the responsibility of the user.

- Information from cited sources has not been independently verified unless specifically stated, and Pennan & Co assumes no responsibility for any inaccuracy or omission therein.
- The locations of apparent current and historical HAIL activities are used to target soil sampling locations. Unreported activities may have occurred on other areas of the site, and the condition of soils in such areas is unknown.
- Systematic grid soil sampling does not ensure that localised hotspots do not exist between sample locations.

This document does not purport to give legal or financial advice.

13. Certifying Statement

National Environmental Standard for assessing and managing contaminants in soil to protect human health - DETAILED SITE INVESTIGATION CERTIFYING STATEMENT

I *Emma Joss of Pennan & Co Limited* certify that:

1) this detailed site investigation meets the requirements of the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (the NESCS) because it has been:
   a) done by a suitably qualified and experienced practitioner, and
   b) done in accordance with the current edition of *Contaminated land management guidelines No 5 – Site investigation and analysis of soils*, and
   c) reported on in accordance with the current edition of *Contaminated land management guidelines No 1 – Reporting on contaminated sites in New Zealand*, and
   d) the report is certified by a suitably qualified and experienced practitioner.

2) This detailed site investigation concludes that:
   a) [For activities under R9 of the NESCS] does exceed the applicable standard in Regulation 7 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations

Evidence of the qualifications and experience of the suitably qualified and experienced practitioner(s) who have done this investigation and have certified this report is detailed on page 2 of the detailed site investigation report.

Signed and dated: ……8 June 2022

14. References

BRANZ 2017: New Zealand Guidelines for Assessing and Managing Asbestos in Soil.

GNS Science (GNS) 2010: Geology of the Rotorua area: scale 1:250,000. 1:250,000 geological map 5. Leonard, G.S., Begg, J.G, Wilson, C.J.N (compilers). Institute of Geological and Nuclear Sciences Limited. Lower Hutt.

GNS Science (GNS) and Bay of Plenty Regional Council (BOPRC) 2021: Bay of Plenty Geothermal Systems, The Science Story. https://atlas.boprc.govt.nz/api/v1/edms/document/A3957052/content

Landcare Research S-Map Online (2022): https://smap.landcareresearch.co.nz/

Landcare Research 2019: User Guide: Background soil concentrations and soil guideline values for the protection of ecological receptors.

MfE 1999: Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

Ministry for the Environment (MfE) 2011a: Hazardous activities and industries list (HAIL). Revised edition. Ministry for the Environment. Wellington.

MfE 2011b Methodology for deriving standards for contaminants in soil to protect human health. Ministry for the Environment. Wellington.

MfE 2021a: Contaminated land management guideline No. 1: Reporting on contaminated sites in New Zealand. Revised edition. Ministry for the Environment. Wellington.

MfE 2021b: Contaminated land management guideline No. 5: Site investigation and analysis of soils. Revised edition. Ministry for the Environment. Wellington.

NES:CS 2011: Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations.

National Environment Protection Council (NEPC) 1999: National Environmental Protection (Assessment of Site Contamination) Measures 1999 – Schedule B1.

Retrolens Aerial images Sourced from http://retrolens.nz and licensed by LINZ CC-BY 3.0

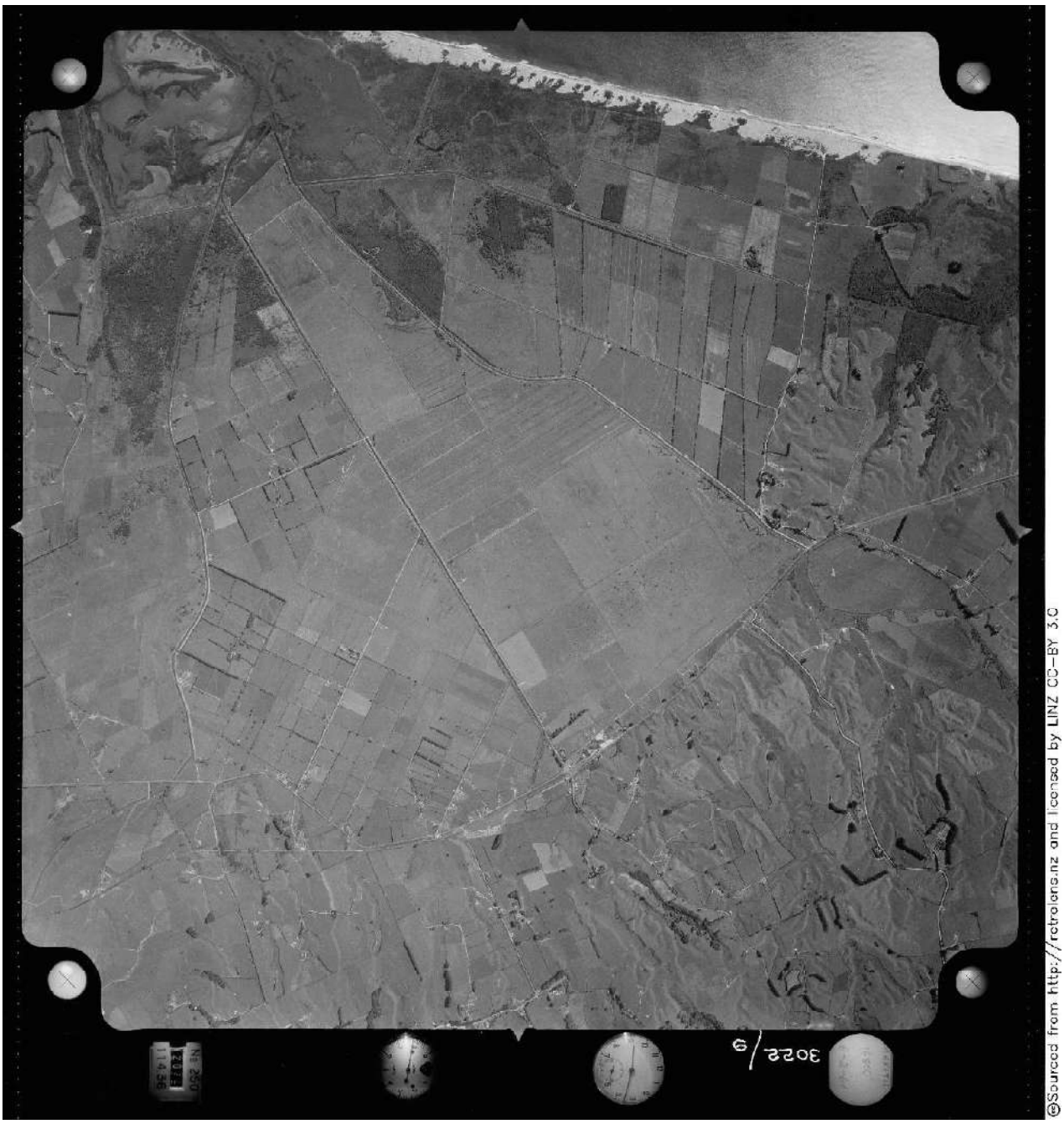
Appendix A

Historical Aerial Photographs

1943

1943 (cropped)

1961


3022/9
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1961 (cropped)

1962

1962 (cropped)

1963

1963 (cropped)

1971

1971 (cropped)

1974

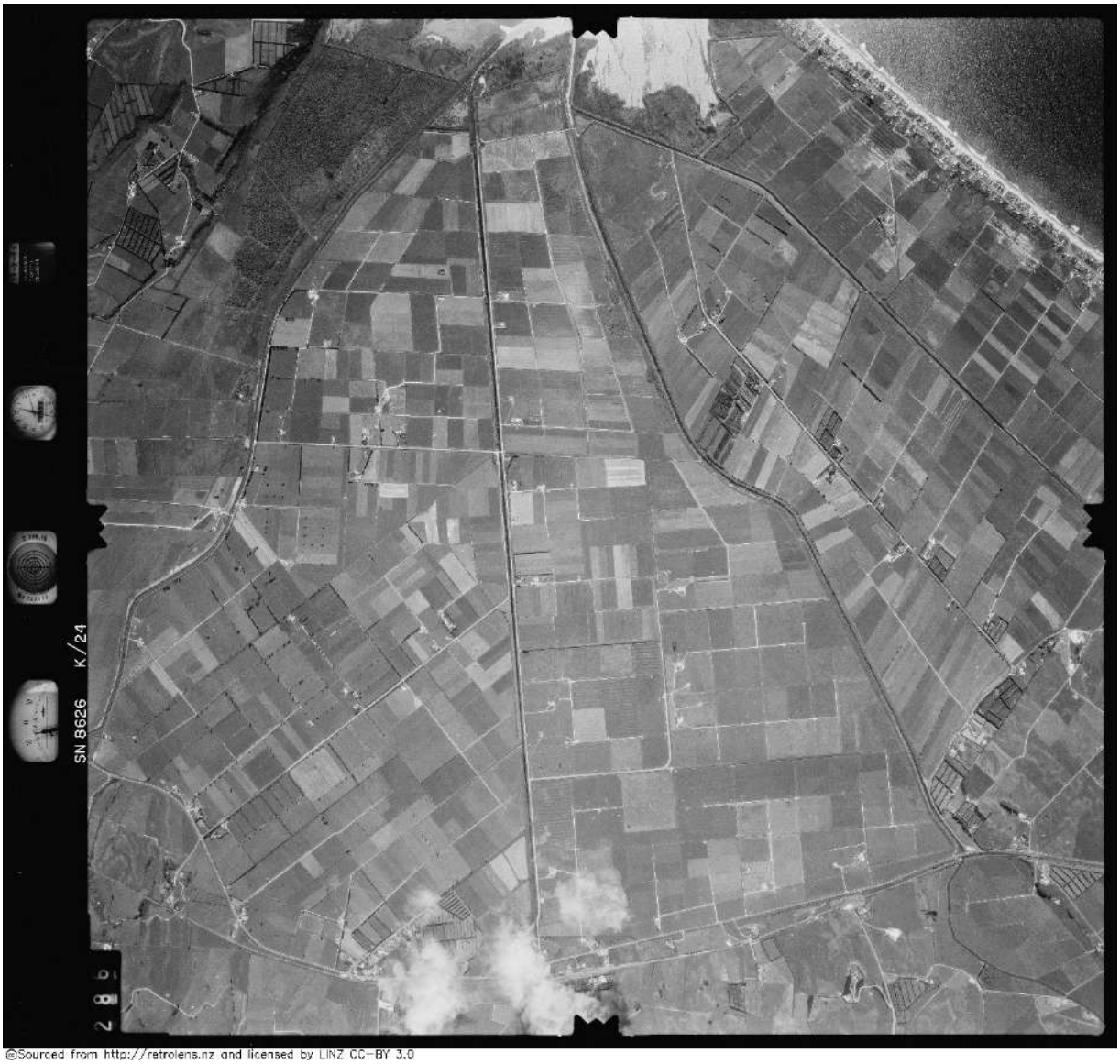
1974 (cropped)

1982

1983

1983 (cropped)

1986

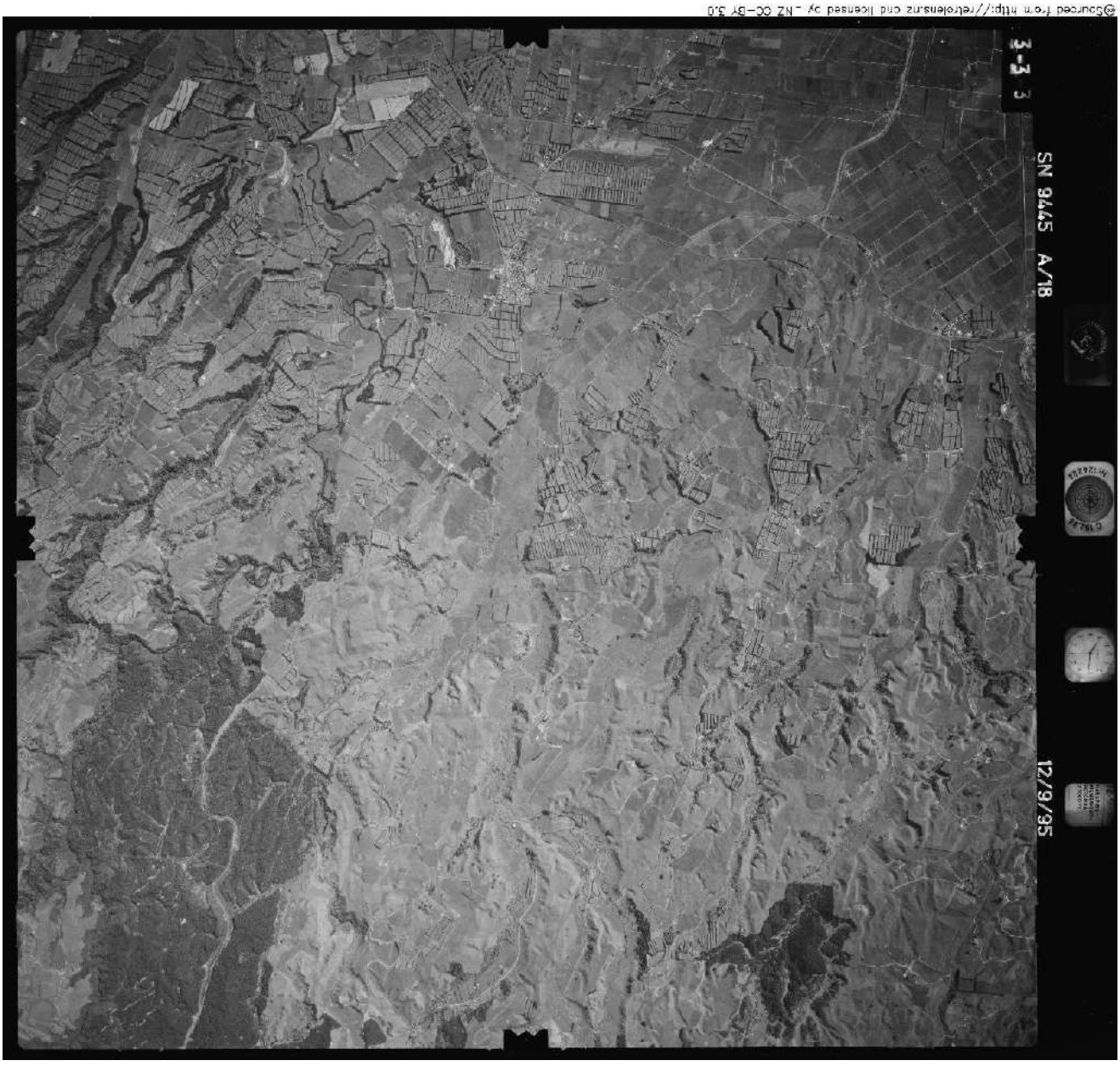


1986 (cropped)

1994

1994

1995



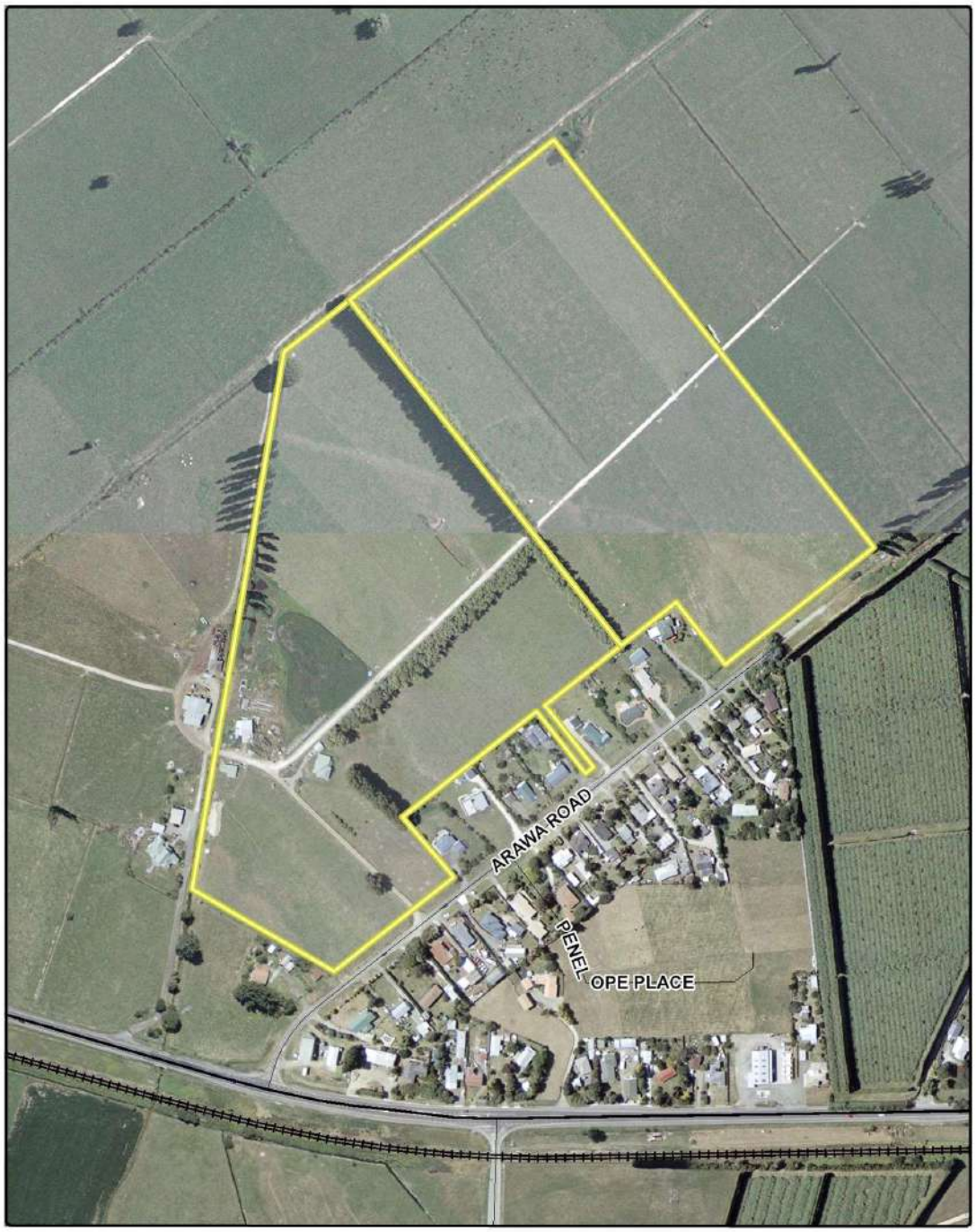
1995 (cropped)

2003


2003
Legend
1491 State Highway 2
Google Earth
N
900 ft

2005


2005
Legend
1491 State Highway 2
Google Earth
N
800 ft



Date: 08/05/2022
Printed By: MAP1
A4 Scale 1: 3,954
0 198 Meters

Western Bay of Plenty District Council

2007-2008

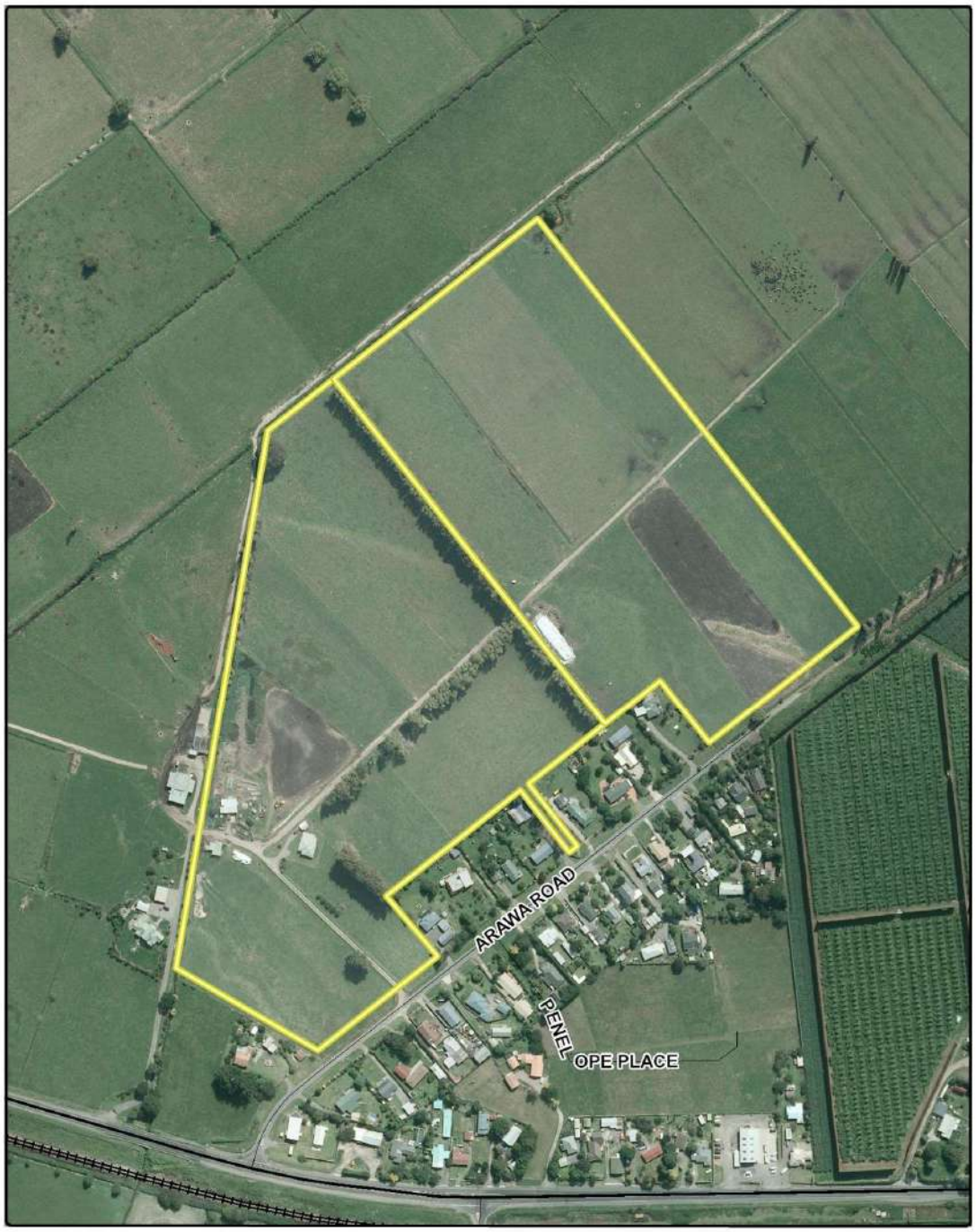
N

Date: 08/05/2022
Printed By: MAP1
A4 Scale 1: 3,954
0 198 Meters

Western Bay of Plenty District Council

2010-2012 (1)

N



Date: 08/05/2022
Printed By: MAP1
A4 Scale 1: 3,954
0 198 Meters

Western Bay of Plenty District Council

2010-2012 (2)

N

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Location of services is indicative only. Council accepts no liability for any error.
Archaeological data supplied by NZ Archaeological Assoc/Dept. of Conservation.

Date: 08/05/2022
Printed By: MAP1
A4 Scale 1: 3,954
0 198 Meters

Western Bay of Plenty District Council

2016-2017

N

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Archaeological data supplied by NZ Archaeological Assoc/Dept. of Conservation.

Date: 08/05/2022
Printed By: MAP1
A4 Scale 1: 3,954
0 198 Meters

Western Bay of Plenty District Council

2021

N

Appendix B

Laboratory Documentation

ENVIRONMENTAL TESTING

CHAIN OF CUSTODY

ANALYTICA LABORATORIES

CLIENT INFORMATION						Lab ID (Lab use only)	22-18358		
Client	Pennan & Co Limited					Registered By (Lab use only)	FH	Date Registered (Lab use only)	17/05/22
Client Address	96 Freeburn Rd, Pyes Pa, Tauranga 3112					*Can I please have the Evalu8 data file as well. Thank you.*			
Project Leader	Emma Joss								
Project ID	202206	PO Number							
Site	Arawa Road, Pongakawa								
Sampler	Emma Joss								
Phone	0274845555								
Email	emma.joss@pennan.co.nz								
Invoice Email	emma.joss@pennan.co.nz								

22-18358

CLIENT REQUESTS (Please Tick)							
Routine	x	Urgent		ESDAT		QC Report	

MATRIX KEY (Customers: Please ensure all samples have the correct matrix assigned)			
S (Solids)	CW (Clean Water)	SW (Saline Water)	WW (Waste Water)
All soils, sediment, sludge	Surface, Ground, Bore, Fresh	Sea Water, Geothermal	Effluent, Trade Waste, Leachate

TESTS REQUESTED

	Sample ID	Depth	Sampling Date	Time	Matrix (Please Circle)	Analysis Requests/Suites [Enter Test Code Below]					Sample Comments (ie: extra test requests, high odour, bulk material)
						ICP_S_HM 7	OCP_S	TPH_S	SOIL_COMP	ASB_S_SEMI Q	
1	S1	0.0-0.1m	12/05/2022		S	x			x		
2	S2	0.0-0.1m	12/05/2022		S	x			x		
3	S3	0.0-0.1m	12/05/2022		S	x			x		
4	S4	0.0-0.1m	12/05/2022		S	x			x		
5	S5	0.0-0.1m	12/05/2022		S	x			x		
6	S6	0.0-0.1m	12/05/2022		S	x			x		
7	S7	0.0-0.1m	12/05/2022		S	x			x		
8	S8	0.0-0.1m	12/05/2022		S	x			x		
9	S9	0.0-0.1m	12/05/2022		S	x			x		
10	S10	0.0-0.1m	12/05/2022		S	x			x		
11	S11	0.0-0.1m	12/05/2022		S	x			x		
12	S12	0.0-0.1m	12/05/2022		S	x			x		
13	S13	0.0-0.1m	12/05/2022		S	x			x		
14	S14	0.0-0.1m	12/05/2022		S	x			x		
15	S15	0.0-0.1m	12/05/2022		S	x			x		
16	S16	0.0-0.1m	12/05/2022		S	x			x		
17	S17	0.0-0.1m	12/05/2022		S	x			x		
18	S18	0.0-0.1m	12/05/2022		S	x			x		
19	S19	0.0-0.1m	12/05/2022		S	x			x		
20	S20	0.0-0.1m	12/05/2022		S	x			x		

Sender Name	Emma Joss	Date Sent	17/05/2022	Time sent	9:00	Courier company	NZC	Courier #	
Received by Staff Member	Brent	Date Received	17-05	Time Received	8AM	Seal Status	✓	Sample Temp	

2-CRA-2745143.01.xlDG00009275.02.00020000.001010.3
H: HZ 0.5
NAME: (please write clearly)
ANALYTICAL LABORATORIES (SITE E), RUAKURA
RESEARCH CENTRE, 10 BISLEY
ROAD, ENDERLEY, HAMILTON

Analytica Laboratories Ltd
Ruakura Research Centre
10 Bisley Road, Private Bag 3123
Hamilton 3240, New Zealand
Phone +64 7 974 4740
Email enviroreception@analytica.co.nz
analytica.co.nz

ENVIRONMENTAL TESTING

CHAIN OF CUSTODY

ANALYTICA LABORATORIES

CLIENT INFORMATION							Lab ID (Lab use only)			
Client	Pennan & Co Limited						Registered By (Lab use only)		Date Registered (Lab use only)	
Client Address	96 Freeburn Rd, Pyes Pa, Tauranga 3112						*Can I please have the Evalu8 data file as well. Thank you.*			
Project Leader	Emma Joss									
Project ID	202206	PO Number								
Site	Arawa Road, Pongakawa									
Sampler	Emma Joss									
Phone	0274845555									
Email	emma.joss@pennan.co.nz									
Invoice Email	emma.joss@pennan.co.nz									

CLIENT REQUESTS (Please Tick)						
Routine	X	Urgent		ESDAT		QC Report

MATRIX KEY (Customers: Please ensure all samples have the correct matrix assigned)			
S (Solids)	CW (Clean Water)	SW (Saline Water)	WW (Waste Water)
All soils, sediment, sludge	Surface, Ground, Bore, Fresh	Sea Water, Geothermal	Effluent, Trade Waste, Leachate

TESTS REQUESTED											
	Sample ID	Depth	Sampling Date	Time	Matrix (Please Circle)	Analysis Requests/Suites [Enter Test Code Below]					Sample Comments (ie: extra test requests, high odour, bulk material)
						ICP_S_HM 7	OCP_S	TPH_S	SOIL_COMP	ASB_S_SEMI Q	
1	S21	0.0-0.1m	12/05/2022		S	x			x		
2	S22	0.0-0.1m	12/05/2022		S	x			x		
3	S23	0.0-0.1m	12/05/2022		S	x			x		
4	S24	0.0-0.1m	12/05/2022		S	x			x		
5	S25	0.0-0.1m	12/05/2022		S	x			x		
6	S26	0.0-0.1m	12/05/2022		S	x			x		
7	S27	0.0-0.1m	12/05/2022		S	x			x		
8	S28	0.0-0.1m	12/05/2022		S	x			x		
9	S29	0.0-0.1m	12/05/2022		S	x			x		
10	S30	0.0-0.1m	13/05/2022		S	x			x		
11	S31	0.0-0.1m	13/05/2022		S	x			x		
12	S32	0.0-0.1m	13/05/2022		S	x			x		
13	S33	0.0-0.1m	13/05/2022		S	x			x		
14	S34	0.0-0.1m	13/05/2022		S	x			x		
15	S35	0.0-0.1m	13/05/2022		S	x			x		
16	S36	0.0-0.1m	13/05/2022		S	x			x		
17	S37	0.0-0.1m	13/05/2022		S	x			x		
18	S38	0.0-0.1m	13/05/2022		S	x			x		
19	S39	0.0-0.1m	13/05/2022		S	x			x		
20	S40	0.0-0.1m	13/05/2022		S	x			x		

Sender Name	Emma Joss	Date Sent	17/05/2022	Time sent	9:00	Courier company		Courier #	
Received by Staff Member		Date Received		Time Received	am / pm	Seal Status		Sample Temp	

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CHAIN OF CUSTODY

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Email	emma.joss@pennan.co.nz							
Invoice Email	emma.joss@pennan.co.nz							

CLIENT REQUESTS (Please Tick)						
Routine	X	Urgent		ESDAT		QC Report

MATRIX KEY (Customers: Please ensure all samples have the correct matrix assigned)			
S (Solids)	CW (Clean Water)	SW (Saline Water)	WW (Waste Water)
All soils, sediment, sludge	Surface, Ground, Bore, Fresh	Sea Water, Geothermal	Effluent, Trade Waste, Leachate

TESTS REQUESTED

	Sample ID	Depth	Sampling Date	Time	Matrix (Please Circle)	Analysis Requests/Suites [Enter Test Code Below]					Sample Comments (ie: extra test requests,high odour, bulk material)
						ICP_S_HM7	OCP_S	TPH_S	SOIL_COMP	ASB_S_SEMIQ	
1	S41	0.0-0.1m	13/05/2022		S	x			x		
2	S42	0.0-0.1m	13/05/2022		S	x			x		
3	S43	0.0-0.1m	13/05/2022		S	x			x		
4	S44	0.0-0.1m	13/05/2022		S	x			x		
5	S45	0.0-0.1m	13/05/2022		S	x			x		
6	S46	0.0-0.1m	13/05/2022		S	x			x		
7	S47	0.0-0.1m	13/05/2022		S	x			x		(NOT IN THE COMPOSITE
8	S48	0.0-0.1m	13/05/2022		S	x			x		L> NOT INCLUDED
9	S49	0.0-0.1m	13/05/2022		S	x			x		IN THE COMPOSITE,
10	S50	0.0-0.1m	13/05/2022		S	x			x		EMMA CONFIRMED.
11	S51	0.0-0.1m	13/05/2022		S	x			x		17/05/22 FH
12	S52	0.0-0.1m	13/05/2022		S	x			x		
13	S53	0.0-0.1m	13/05/2022		S	x			x		
14	S54	0.0-0.1m	13/05/2022		S	x			x		
15	S55	0.0-0.1m	13/05/2022		S	x			x		
16	S56	0.0-0.1m	13/05/2022		S	x			x		
17	S57	0.0-0.1m	13/05/2022		S	x			x		
18	S58	0.0-0.1m	13/05/2022		S	x			x		
19	S59	0.0-0.1m	13/05/2022		S	x			x		
20	S60	0.0-0.1m	13/05/2022		S	x			x		

Sender Name	Emma Joss	Date Sent	17/05/2022	Time sent	9:00	Courier company		Courier #	
Received by Staff Member		Date Received		Time Received	am pm	Seal Status		Sample Temp	

ENVIRONMENTAL TESTING:

CHAIN OF CUSTODY

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Phone	0274845555									
Email	emma.joss@pennan.co.nz									
Invoice Email	emma.joss@pennan.co.nz									

CLIENT REQUESTS (Please Tick)						
Routine	x	Urgent		ESDAT		QC Report

MATRIX KEY (Customers: Please ensure all samples have the correct matrix assigned)			
S (Solids)	CW (Clean Water)	SW (Saline Water)	WW (Waste Water)
All soils, sediment, sludge	Surface, Ground, Bore, Fresh	Sea Water, Geothermal	Effluent, Trade Waste, Leachate

TESTS REQUESTED											
	Sample ID	Depth	Sampling Date	Time	Matrix (Please Circle)	Analysis Requests/Suites [Enter Test Code Below]					Sample Comments (ie: extra test requests,high odour, bulk material)
						ICP_S_HM7	OCP_S	TPH_S	SOIL_COMP	ASB_S_SEMIQ	
1	S61	0.0-0.1m	13/05/2022		S	x			x		
2	S62	0.0-0.1m	13/05/2022		S	x			x		
3	S63	0.0-0.1m	13/05/2022		S	x		x			
4	S64	0.0-0.1m	13/05/2022		S	x		x			Can I add PAH_S to this sample.
5	S65	0.0-0.1m	13/05/2022		S	x			x		
6	S66	0.0-0.1m	13/05/2022		S	x			x		
7	S67	0.0-0.1m	13/05/2022		S	x					
8	S68	0.0-0.1m	13/05/2022		S	x					
9	S69	0.0-0.1m	13/05/2022		S	x					
70 10	S70	0.0-0.1m	13/05/2022		S	x					
11	S71	0.0-0.1m	13/05/2022		S					x	
75 12	COMP (S1,S2,S3)	0.0-0.1m	12/05/2022		S		x				
76 13	COMP (S4,S5,S6)	0.0-0.1m	12/05/2022		S		x				
77 14	COMP (S7,S8,S9)	0.0-0.1m	12/05/2022		S		x				
78 15	COMP (S10,S11,S12,S13)	0.0-0.1m	12/05/2022		S		x				
79 16	COMP (S14,S15,S16,S17)	0.0-0.1m	12/05/2022		S		x				
80 17	COMP (S18,S19,S22,S23)	0.0-0.1m	12/05/2022		S		x				
81 18	COMP (S20,S21,S26)	0.0-0.1m	12/05/2022		S		x				
82 19	COMP (S24,S25,S28,S29)	0.0-0.1m	12/05/2022		S		x				
83 20	COMP (S30,S31,S34,S35)	0.0-0.1m	13/05/2022		S		x				

Sender Name	Emma Joss	Date Sent	17/05/2022	Time sent	9:00	Courier company		Courier #	
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ENVIRONMENTAL TESTING

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Email	emma.joss@pennan.co.nz								
Invoice Email	emma.joss@pennan.co.nz								

CLIENT REQUESTS (Please Tick)							
Routine	X	Urgent		ESDAT		QC Report	

MATRIX KEY (Customers: Please ensure all samples have the correct matrix assigned)			
S (Solids)	CW (Clean Water)	SW (Saline Water)	WW (Waste Water)
All soils, sediment, sludge	Surface, Ground, Bore, Fresh	Sea Water, Geothermal	Effluent, Trade Waste, Leachate

TESTS REQUESTED

		Sample ID	Depth	Sampling Date	Time	Matrix (Please Circle)	Analysis Requests/Suites [Enter Test Code Below]					Sample Comments (ie: extra test requests,high odour, bulk material)
							ICP_S_HM7	OCP_S	TPH_S	SOIL_COMP	ASB_S_SEMIQ	
4	1	COMP (S27,S32,S33)	0.0-0.1m	12/05/2022 13/05/2022		S		x				
5	2	COMP (S36,S37,S38)	0.0-0.1m	13/05/2022		S		x				
6	3	COMP (S43,S44,S45,S46)	0.0-0.1m	13/05/2022		S		x				
7	4	COMP (S39,S40,S41,S42)	0.0-0.1m	13/05/2022		S		x				
8	5	COMP (S50,S51,S52,S53)	0.0-0.1m	13/05/2022		S		x				
9	6	COMP (S48,S49,S54,S55)	0.0-0.1m	13/05/2022		S		x				
10	7	COMP (S56,S57,S58)	0.0-0.1m	13/05/2022		S		x				
11	8	COMP (S59,S60,S61,S62)	0.0-0.1m	13/05/2022		S		x				
12	9	COMP (S65,S66)	0.0-0.1m	13/05/2022		S		x				
13	10	S12	0.2-0.3m	12/05/2022		S	x					
14	11	S51	0.2-0.3m	13/05/2022		S	x					
15	12	S63	0.2-0.3m	13/05/2022		S	x		x			
16	13	S64	0.2-0.3m	13/05/22		S						COLD HOLD
	14											
	15											
	16											
	17											
	18											
	19											
	20											

Sender Name	Emma Joss	Date Sent	17/05/2022	Time sent	9:00	Courier company		Courier #	
Received by Staff Member		Date Received		Time Received	am / pm	Seal Status		Sample Temp	

ANALYTICA LABORATORIES

Analytica Laboratories Limited
Ruakura Research Centre
10 Bisley Road
Hamilton 3214, New Zealand
Ph +64 (07) 974 4740
sales@analytica.co.nz
www.analytica.co.nz

Certificate of Analysis

Pennan & Co Limited
96 Freeburn Rd
Tauranga 3112

Attention: Emma Joss
Phone: 0274845555
Email: emma.joss@pennan.co.nz

Lab Reference: 22-18358
Submitted by: Emma Joss
Date Received: 17/05/2022
Testing Initiated: 17/05/2022
Date Completed: 23/05/2022
Order Number:
Reference: 202206

Sampling Site: Arawa Road, Pongakawa

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Heavy Metals in Soil

	Client Sample ID		S1 0.0-0.1m	S2 0.0-0.1m	S3 0.0-0.1m	S4 0.0-0.1m	S5 0.0-0.1m
	Date Sampled		12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-1	22-18358-2	22-18358-3	22-18358-4	22-18358-5
Arsenic	mg/kg dry wt	*0.125*	18.2	18.2	11	5.1	4.4
Cadmium	mg/kg dry wt	*0.005*	0.45	0.31	0.755	0.39	0.22
Chromium	mg/kg dry wt	*0.125*	6.0	3.4	7.4	2.2	2.7
Copper	mg/kg dry wt	*0.075*	12.9	8.55	19.6	8.45	3.1
Lead	mg/kg dry wt	*0.25*	7.60	2.5	8.13	3.2	6.65
Nickel	mg/kg dry wt	*0.05*	1.8	1.4	3.7	1.1	1.2
Zinc	mg/kg dry wt	*0.05*	21.3	11.1	32.8	13.7	33.9

Heavy Metals in Soil

	Client Sample ID		S6 0.0-0.1m	S7 0.0-0.1m	S8 0.0-0.1m	S9 0.0-0.1m	S10 0.0-0.1m
	Date Sampled		12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-6	22-18358-7	22-18358-8	22-18358-9	22-18358-10
Arsenic	mg/kg dry wt	*0.125*	12	6.5	1.3	3.8	3.9
Cadmium	mg/kg dry wt	*0.005*	0.45	0.659	0.070	0.561	0.44
Chromium	mg/kg dry wt	*0.125*	4.5	4.2	0.42	5.0	3.2
Copper	mg/kg dry wt	*0.075*	11.1	11.9	0.63	12.5	14.6
Lead	mg/kg dry wt	*0.25*	6.81	11.6	0.79	10.8	11.1
Nickel	mg/kg dry wt	*0.05*	2.4	2.4	0.18	3.6	1.3
Zinc	mg/kg dry wt	*0.05*	45.4	30.8	11.6	72.8	33.1

Heavy Metals in Soil

Client Sample ID			S11 0.0-0.1m	S12 0.0-0.1m	S13 0.0-0.1m	S14 0.0-0.1m	S15 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-11	22-18358-12	22-18358-13	22-18358-14	22-18358-15
Arsenic	mg/kg dry wt	*0.125*	3.5	4.8	3.5	8.7	3.0
Cadmium	mg/kg dry wt	*0.005*	0.28	0.42	0.31	0.40	0.064
Chromium	mg/kg dry wt	*0.125*	3.8	3.2	2.8	3.7	0.88
Copper	mg/kg dry wt	*0.075*	5.2	17.0	13.3	24.1	4.1
Lead	mg/kg dry wt	*0.25*	8.22	5.20	7.49	3.2	1.5
Nickel	mg/kg dry wt	*0.05*	2.0	1.7	1.3	2.3	0.53
Zinc	mg/kg dry wt	*0.05*	44.1	32.5	27.9	27.9	12.7

Heavy Metals in Soil

Client Sample ID			S16 0.0-0.1m	S17 0.0-0.1m	S18 0.0-0.1m	S19 0.0-0.1m	S20 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-16	22-18358-17	22-18358-18	22-18358-19	22-18358-20
Arsenic	mg/kg dry wt	*0.125*	5.3	3.5	6.5	18.9	12.9
Cadmium	mg/kg dry wt	*0.005*	0.762	0.43	0.521	0.39	0.538
Chromium	mg/kg dry wt	*0.125*	3.2	2.0	6.0	2.8	5.0
Copper	mg/kg dry wt	*0.075*	17.0	17.2	12.9	6.4	10.6
Lead	mg/kg dry wt	*0.25*	3.8	3.1	3.3	2.0	4.2
Nickel	mg/kg dry wt	*0.05*	2.6	1.5	1.7	1.5	1.6
Zinc	mg/kg dry wt	*0.05*	27.5	42.8	15.8	15.8	21.4

Heavy Metals in Soil

Client Sample ID			S21 0.0-0.1m	S22 0.0-0.1m	S23 0.0-0.1m	S24 0.0-0.1m	S25 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-21	22-18358-22	22-18358-23	22-18358-24	22-18358-25
Arsenic	mg/kg dry wt	*0.125*	5.6	10	3.9	9.6	4.1
Cadmium	mg/kg dry wt	*0.005*	0.36	0.567	0.49	0.860	0.31
Chromium	mg/kg dry wt	*0.125*	2.6	5.6	3.9	4.1	2.4
Copper	mg/kg dry wt	*0.075*	6.6	10.7	10.3	14.9	4.8
Lead	mg/kg dry wt	*0.25*	2.9	3.2	9.62	3.4	1.5
Nickel	mg/kg dry wt	*0.05*	1.7	2.3	2.2	2.4	1.5
Zinc	mg/kg dry wt	*0.05*	14.1	27.9	47.4	25.2	16.2

Heavy Metals in Soil

Client Sample ID			S26 0.0-0.1m	S27 0.0-0.1m	S28 0.0-0.1m	S29 0.0-0.1m	S30 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-26	22-18358-27	22-18358-28	22-18358-29	22-18358-30
Arsenic	mg/kg dry wt	*0.125*	11	7.1	6.7	8.9	1.9
Cadmium	mg/kg dry wt	*0.005*	0.892	0.46	0.636	0.46	0.665
Chromium	mg/kg dry wt	*0.125*	6.0	3.1	4.1	4.0	3.2
Copper	mg/kg dry wt	*0.075*	13.3	6.0	62.5	8.67	5.5
Lead	mg/kg dry wt	*0.25*	3.3	2.8	3.9	4.7	2.6
Nickel	mg/kg dry wt	*0.05*	2.5	1.9	2.6	2.4	2.1
Zinc	mg/kg dry wt	*0.05*	31.4	22.5	26.2	21.0	26.3

Heavy Metals in Soil

Client Sample ID			S31 0.0-0.1m	S32 0.0-0.1m	S33 0.0-0.1m	S34 0.0-0.1m	S35 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-31	22-18358-32	22-18358-33	22-18358-34	22-18358-35
Arsenic	mg/kg dry wt	*0.125*	2.3	3.9	2.3	2.6	2.1
Cadmium	mg/kg dry wt	*0.005*	0.727	0.647	0.756	0.614	0.537
Chromium	mg/kg dry wt	*0.125*	4.4	3.0	3.8	3.2	3.4
Copper	mg/kg dry wt	*0.075*	6.1	5.1	6.1	4.4	5.0
Lead	mg/kg dry wt	*0.25*	4.1	2.0	2.5	2.7	5.97
Nickel	mg/kg dry wt	*0.05*	5.16	2.3	2.5	2.7	1.9
Zinc	mg/kg dry wt	*0.05*	23.3	20.5	28.4	25.2	26.6

Heavy Metals in Soil

Client Sample ID			S36 0.0-0.1m	S37 0.0-0.1m	S38 0.0-0.1m	S39 0.0-0.1m	S40 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-36	22-18358-37	22-18358-38	22-18358-39	22-18358-40
Arsenic	mg/kg dry wt	*0.125*	2.4	2.1	2.5	5.0	2.0
Cadmium	mg/kg dry wt	*0.005*	0.640	0.566	0.41	0.505	0.39
Chromium	mg/kg dry wt	*0.125*	2.9	2.6	2.7	3.5	3.6
Copper	mg/kg dry wt	*0.075*	7.2	6.4	7.0	6.4	5.5
Lead	mg/kg dry wt	*0.25*	3.2	3.1	3.3	2.5	3.0
Nickel	mg/kg dry wt	*0.05*	1.5	1.4	1.2	2.3	2.1
Zinc	mg/kg dry wt	*0.05*	44.0	31.9	43.4	23.1	26.5

Heavy Metals in Soil

Client Sample ID			S41 0.0-0.1m	S42 0.0-0.1m	S43 0.0-0.1m	S44 0.0-0.1m	S45 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-41	22-18358-42	22-18358-43	22-18358-44	22-18358-45
Arsenic	mg/kg dry wt	*0.125*	2.9	2.5	17.2	14.6	2.1
Cadmium	mg/kg dry wt	*0.005*	0.38	0.48	0.726	0.578	0.34
Chromium	mg/kg dry wt	*0.125*	3.6	3.1	5.7	4.4	2.2
Copper	mg/kg dry wt	*0.075*	4.0	4.9	12.4	9.52	3.9
Lead	mg/kg dry wt	*0.25*	4.6	19.7	3.9	2.8	2.5
Nickel	mg/kg dry wt	*0.05*	2.1	1.6	3.6	3.1	1.3
Zinc	mg/kg dry wt	*0.05*	24.4	40.3	23.2	16.1	22.4

Heavy Metals in Soil

Client Sample ID			S46 0.0-0.1m	S47 0.0-0.1m	S48 0.0-0.1m	S49 0.0-0.1m	S50 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-46	22-18358-47	22-18358-48	22-18358-49	22-18358-50
Arsenic	mg/kg dry wt	*0.125*	2.4	0.76	13.7	8.7	6.9
Cadmium	mg/kg dry wt	*0.005*	0.40	0.041	0.23	0.36	0.761
Chromium	mg/kg dry wt	*0.125*	2.0	2.8	1.7	3.0	4.0
Copper	mg/kg dry wt	*0.075*	4.9	2.3	6.1	10.6	9.12
Lead	mg/kg dry wt	*0.25*	8.44	2.2	2.0	2.6	3.2
Nickel	mg/kg dry wt	*0.05*	1.6	0.67	1.0	1.4	3.2
Zinc	mg/kg dry wt	*0.05*	25.7	44.7	20.4	20.6	40.8

Heavy Metals in Soil

Client Sample ID			S51 0.0-0.1m	S52 0.0-0.1m	S53 0.0-0.1m	S54 0.0-0.1m	S55 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-51	22-18358-52	22-18358-53	22-18358-54	22-18358-55
Arsenic	mg/kg dry wt	*0.125*	5.7	3.0	7.9	6.2	1.6
Cadmium	mg/kg dry wt	*0.005*	0.569	0.32	0.807	0.27	0.052
Chromium	mg/kg dry wt	*0.125*	3.0	1.7	4.0	2.0	0.74
Copper	mg/kg dry wt	*0.075*	6.7	2.8	8.76	4.7	0.83
Lead	mg/kg dry wt	*0.25*	2.8	1.5	2.6	1.5	0.69
Nickel	mg/kg dry wt	*0.05*	2.0	1.2	5.55	1.6	0.38
Zinc	mg/kg dry wt	*0.05*	21.4	14.5	27.9	11.8	11.5

Heavy Metals in Soil

Client Sample ID			S56 0.0-0.1m	S57 0.0-0.1m	S58 0.0-0.1m	S59 0.0-0.1m	S60 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-56	22-18358-57	22-18358-58	22-18358-59	22-18358-60
Arsenic	mg/kg dry wt	*0.125*	12	1.6	4.1	8.3	10
Cadmium	mg/kg dry wt	*0.005*	0.540	0.083	0.36	0.952	0.624
Chromium	mg/kg dry wt	*0.125*	5.4	0.85	1.8	5.7	4.0
Copper	mg/kg dry wt	*0.075*	8.85	1.9	4.3	12.3	9.57
Lead	mg/kg dry wt	*0.25*	4.4	0.81	1.5	14.1	2.7
Nickel	mg/kg dry wt	*0.05*	2.4	0.44	0.94	3.7	2.8
Zinc	mg/kg dry wt	*0.05*	27.8	11.6	11.7	31.8	22.0

Heavy Metals in Soil

Client Sample ID			S61 0.0-0.1m	S62 0.0-0.1m	S63 0.0-0.1m	S64 0.0-0.1m	S65 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-61	22-18358-62	22-18358-63	22-18358-64	22-18358-65
Arsenic	mg/kg dry wt	*0.125*	12	2.1	9.0	4.1	8.1
Cadmium	mg/kg dry wt	*0.005*	0.20	0.088	0.22	0.14	0.672
Chromium	mg/kg dry wt	*0.125*	3.7	1.6	9.4	4.1	4.4
Copper	mg/kg dry wt	*0.075*	11.0	5.2	18.6	6.0	12.8
Lead	mg/kg dry wt	*0.25*	5.14	3.8	18.5	12.3	12.1
Nickel	mg/kg dry wt	*0.05*	1.9	0.57	3.1	1.8	2.5
Zinc	mg/kg dry wt	*0.05*	32.1	10.1	97.3	77.9	38.4

Heavy Metals in Soil

Client Sample ID			S66 0.0-0.1m	S67 0.0-0.1m	S68 0.0-0.1m	S69 0.0-0.1m	S70 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-66	22-18358-67	22-18358-68	22-18358-69	22-18358-70
Arsenic	mg/kg dry wt	*0.125*	2.7	2.3	8.8	5.4	9.8
Cadmium	mg/kg dry wt	*0.005*	0.13	0.38	0.46	0.46	0.43
Chromium	mg/kg dry wt	*0.125*	1.6	2.3	7.4	6.4	12
Copper	mg/kg dry wt	*0.075*	4.3	27.6	17.8	23.1	24.2
Lead	mg/kg dry wt	*0.25*	3.1	4.0	30.1	46.6	25.1
Nickel	mg/kg dry wt	*0.05*	0.76	1.8	1.5	1.8	2.3
Zinc	mg/kg dry wt	*0.05*	13.3	165	269	194	323

Heavy Metals in Soil

	Client Sample ID		S12 0.2-0.3	S51 0.2-0.3	S63 0.2-0.3
	Date Sampled		12/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-71	22-18358-72	22-18358-73
Arsenic	mg/kg dry wt	*0.125*	4.8	5.0	2.7
Cadmium	mg/kg dry wt	*0.005*	0.44	0.554	0.053
Chromium	mg/kg dry wt	*0.125*	3.3	2.9	1.7
Copper	mg/kg dry wt	*0.075*	16.7	6.3	3.7
Lead	mg/kg dry wt	*0.25*	5.48	2.8	4.6
Nickel	mg/kg dry wt	*0.05*	2.0	2.0	0.69
Zinc	mg/kg dry wt	*0.05*	38.6	22.8	24.6

Total Petroleum Hydrocarbons - Soil

	Client Sample ID		S63 0.0-0.1m	S64 0.0-0.1m	S63 0.2-0.3
	Date Sampled		13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-63	22-18358-64	22-18358-73
C7-C9	mg/kg dry wt	*10*	<10	<10	<10
C10-C14	mg/kg dry wt	*15*	<15	<15	<15
C15-C36	mg/kg dry wt	*25*	61	39	99
C7-C36 (Total)	mg/kg dry wt	*50*	61	<50	99

Polycyclic Aromatic Hydrocarbons - Soil

	Client Sample ID		S64 0.0-0.1m
	Date Sampled		13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-64
1-Methylnaphthalene	mg/kg dry wt	*0.01*	<0.010
2-Methylnaphthalene	mg/kg dry wt	*0.01*	<0.010
Acenaphthene	mg/kg dry wt	*0.01*	<0.010
Acenaphthylene	mg/kg dry wt	*0.01*	<0.010
Anthracene	mg/kg dry wt	*0.01*	<0.010
Benz[a]anthracene	mg/kg dry wt	*0.02*	0.022
Benzo[a]pyrene	mg/kg dry wt	*0.01*	0.040
Benzo[b]&[j] fluoranthene	mg/kg dry wt	*0.02*	0.046
Benzo[g,h,i]perylene	mg/kg dry wt	*0.02*	0.024
Benzo[k]fluoranthene	mg/kg dry wt	*0.01*	0.016
Chrysene	mg/kg dry wt	*0.01*	0.035
Dibenz(a,h)anthracene	mg/kg dry wt	*0.01*	<0.010
Fluoranthene	mg/kg dry wt	*0.02*	0.040
Fluorene	mg/kg dry wt	*0.01*	<0.010
Indeno(1,2,3-cd)pyrene	mg/kg dry wt	*0.01*	0.026
Naphthalene	mg/kg dry wt	*0.01*	<0.010
Phenanthrene	mg/kg dry wt	*0.01*	<0.010
Pyrene	mg/kg dry wt	*0.02*	0.055
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.03*	0.060
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.01*	0.050
Anthracene-d10 (Surrogate)	%	*1*	110

Moisture Content

Client Sample ID			S63 0.0-0.1m	S64 0.0-0.1m	S63 0.2-0.3
Date Sampled			13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-63	22-18358-64	22-18358-73
Moisture Content	%	*1*	16	29	19

Organochlorine Pesticides - Soil

Client Sample ID			Composite 1 (S1 0.0-0.1, S2 0.0-0.1, S3 0.0-0.1)	Composite 2 (S4 0.0-0.1, S5 0.0-0.1, S6 0.0-0.1)	Composite 3 (S7 0.0-0.1, S8 0.0-0.1, S9 0.0-0.1)	Composite 4 (S10 0.0-0.1, S11 0.0-0.1, S12 0.0-0.1, S13 0.0-0.1)	Composite 5 (S14 0.0-0.1, S15 0.0-0.1, S16 0.0-0.1, S17 0.0-0.1)
Date Sampled							
Analyte	Unit	*Reporting Limit*	22-18358-75	22-18358-76	22-18358-77	22-18358-78	22-18358-79
2,4'-DDD	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
4,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total DDT	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
alpha-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Aldrin	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
beta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
delta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dieldrin	mg/kg dry wt	*0.05*	<0.050	<0.050	<0.050	<0.050	<0.050
Endosulfan I	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Endosulfan II	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Endrin	mg/kg dry wt	*0.05*	<0.050	<0.050	<0.050	<0.050	<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Endrin ketone	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
gamma-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Heptachlor	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Methoxychlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
trans-nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
trans-Chlordane	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	*1*	88	85	86	87	87

Organochlorine Pesticides - Soil

Client Sample ID			Composite 6 (S18 0.0-0.1, S19 0.0-0.1, S22 0.0-0.1, S23 0.0-0.1)	Composite 7 (S20 0.0-0.1, S21 0.0-0.1, S26 0.0-0.1)	Composite 8 (S24 0.0-0.1, S25 0.0-0.1, S28 0.0-0.1, S29 0.0-0.1)	Composite 9 (S30 0.0-0.1, S31 0.0-0.1, S34 0.0-0.1, S35 0.0-0.1)	Composite 10 (S27 0.0-0.1, S32 0.0-0.1, S33 0.0-0.1)
Date Sampled							
Analyte	Unit	*Reporting Limit*	22-18358-80	22-18358-81	22-18358-82	22-18358-83	22-18358-84
2,4'-DDD	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

Organochlorine Pesticides - Soil

Client Sample ID			Composite 6 (S18 0.0-0.1, S19 0.0-0.1, S22 0.0-0.1, S23 0.0-0.1)	Composite 7 (S20 0.0-0.1, S21 0.0-0.1, S26 0.0-0.1)	Composite 8 (S24 0.0-0.1, S25 0.0-0.1, S28 0.0-0.1, S29 0.0-0.1)	Composite 9 (S30 0.0-0.1, S31 0.0-0.1, S34 0.0-0.1, S35 0.0-0.1)	Composite 10 (S27 0.0-0.1, S32 0.0-0.1, S33 0.0-0.1)
Date Sampled							
2,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
4,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total DDT	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
alpha-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Aldrin	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
beta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
delta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dieldrin	mg/kg dry wt	*0.05*	<0.050	<0.050	<0.050	<0.050	<0.050
Endosulfan I	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Endosulfan II	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Endrin	mg/kg dry wt	*0.05*	<0.050	<0.050	<0.050	<0.050	<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Endrin ketone	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
gamma-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Heptachlor	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Methoxychlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
trans-nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
trans-Chlordane	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	*1*	84	79	77	79	81

Organochlorine Pesticides - Soil

Client Sample ID			Composite 11 (S36 0.0-0.1, S37 0.0-0.1, S38 0.0-0.1)	Composite 12 (S43 0.0-0.1, S44 0.0-0.1, S45 0.0-0.1, S46 0.0-0.1)	Composite 13 (S39 0.0-0.1, S40 0.0-0.1, S41 0.0-0.1, S42 0.0-0.1)	Composite 14 (S50 0.0-0.1, S51 0.0-0.1, S52 0.0-0.1, S53 0.0-0.1)	Composite 15 (S48 0.0-0.1, S49 0.0-0.1, S54 0.0-0.1, S55 0.0-0.1)
Date Sampled							
Analyte	Unit	*Reporting Limit*	22-18358-85	22-18358-86	22-18358-87	22-18358-88	22-18358-89
2,4'-DDD	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
4,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total DDT	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
alpha-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Aldrin	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
beta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
delta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dieldrin	mg/kg dry wt	*0.05*	<0.050	<0.050	<0.050	<0.050	<0.050

Organochlorine Pesticides - Soil

Client Sample ID			Composite 11 (S36 0.0-0.1, S37 0.0-0.1, S38 0.0-0.1)	Composite 12 (S43 0.0-0.1, S44 0.0-0.1, S45 0.0-0.1, S46 0.0-0.1)	Composite 13 (S39 0.0-0.1, S40 0.0-0.1, S41 0.0-0.1, S42 0.0-0.1)	Composite 14 (S50 0.0-0.1, S51 0.0-0.1, S52 0.0-0.1, S53 0.0-0.1)	Composite 15 (S48 0.0-0.1, S49 0.0-0.1, S54 0.0-0.1, S55 0.0-0.1)
Date Sampled							
Endosulfan I	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Endosulfan II	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Endrin	mg/kg dry wt	*0.05*	<0.050	<0.050	<0.050	<0.050	<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Endrin ketone	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
gamma-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Heptachlor	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Methoxychlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
trans-nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
trans-Chlordane	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	*1*	81	92	91	89	87

Organochlorine Pesticides - Soil

Client Sample ID			Composite 16 (S56 0.0-0.1, S57 0.0-0.1, S58 0.0-0.1)	Composite 17 (S59 0.0-0.1, S60 0.0-0.1, S61 0.0-0.1, S62 0.0-0.1)	Composite 18 (S65 0.0-0.1, S66 0.0-0.1)
Date Sampled					
Analyte	Unit	*Reporting Limit*	22-18358-90	22-18358-91	22-18358-92
2,4'-DDD	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*	<0.0030	<0.0030	<0.0030
4,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
Total DDT	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020
alpha-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
Aldrin	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
beta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010
delta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
Dieldrin	mg/kg dry wt	*0.05*	<0.050	<0.050	<0.050
Endosulfan I	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
Endosulfan II	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
Endrin	mg/kg dry wt	*0.05*	<0.050	<0.050	<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010
Endrin ketone	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
gamma-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
Heptachlor	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*	<0.0050	<0.0050	<0.0050
Methoxychlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010
trans-nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010

Organochlorine Pesticides - Soil

Client Sample ID			Composite 16 (S56 0.0-0.1, S57 0.0-0.1, S58 0.0-0.1)	Composite 17 (S59 0.0-0.1, S60 0.0-0.1, S61 0.0-0.1, S62 0.0-0.1)	Composite 18 (S65 0.0-0.1, S66 0.0-0.1)
Date Sampled					
trans-Chlordane	mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	*1*	84	84	83

Soil Composite

Client Sample ID			S1 0.0-0.1m	S2 0.0-0.1m	S3 0.0-0.1m	S4 0.0-0.1m	S5 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-1	22-18358-2	22-18358-3	22-18358-4	22-18358-5
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S6 0.0-0.1m	S7 0.0-0.1m	S8 0.0-0.1m	S9 0.0-0.1m	S10 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-6	22-18358-7	22-18358-8	22-18358-9	22-18358-10
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S11 0.0-0.1m	S12 0.0-0.1m	S13 0.0-0.1m	S14 0.0-0.1m	S15 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-11	22-18358-12	22-18358-13	22-18358-14	22-18358-15
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S16 0.0-0.1m	S17 0.0-0.1m	S18 0.0-0.1m	S19 0.0-0.1m	S20 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-16	22-18358-17	22-18358-18	22-18358-19	22-18358-20
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S21 0.0-0.1m	S22 0.0-0.1m	S23 0.0-0.1m	S24 0.0-0.1m	S25 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	12/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-21	22-18358-22	22-18358-23	22-18358-24	22-18358-25
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S26 0.0-0.1m	S27 0.0-0.1m	S28 0.0-0.1m	S29 0.0-0.1m	S30 0.0-0.1m
Date Sampled			12/05/2022	12/05/2022	12/05/2022	12/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-26	22-18358-27	22-18358-28	22-18358-29	22-18358-30
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S31 0.0-0.1m	S32 0.0-0.1m	S33 0.0-0.1m	S34 0.0-0.1m	S35 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-31	22-18358-32	22-18358-33	22-18358-34	22-18358-35
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S36 0.0-0.1m	S37 0.0-0.1m	S38 0.0-0.1m	S39 0.0-0.1m	S40 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-36	22-18358-37	22-18358-38	22-18358-39	22-18358-40
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S41 0.0-0.1m	S42 0.0-0.1m	S43 0.0-0.1m	S44 0.0-0.1m	S45 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-41	22-18358-42	22-18358-43	22-18358-44	22-18358-45
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S46 0.0-0.1m	S48 0.0-0.1m	S49 0.0-0.1m	S50 0.0-0.1m	S51 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-46	22-18358-48	22-18358-49	22-18358-50	22-18358-51
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

Client Sample ID			S52 0.0-0.1m	S53 0.0-0.1m	S54 0.0-0.1m	S55 0.0-0.1m	S56 0.0-0.1m
Date Sampled			13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-52	22-18358-53	22-18358-54	22-18358-55	22-18358-56
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

	Client Sample ID		S57 0.0-0.1m	S58 0.0-0.1m	S59 0.0-0.1m	S60 0.0-0.1m	S61 0.0-0.1m
	Date Sampled		13/05/2022	13/05/2022	13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-57	22-18358-58	22-18358-59	22-18358-60	22-18358-61
Soil - Composite prep - DS			Complete	Complete	Complete	Complete	Complete

Soil Composite

	Client Sample ID		S62 0.0-0.1m	S65 0.0-0.1m	S66 0.0-0.1m
	Date Sampled		13/05/2022	13/05/2022	13/05/2022
Analyte	Unit	*Reporting Limit*	22-18358-62	22-18358-65	22-18358-66
Soil - Composite prep - DS			Complete	Complete	Complete

Method Summary

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

TPH in Soil Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36). (In accordance with in-house procedure based on US EPA 8015).

PAH in Soil Solvent extraction, silica cleanup, followed by GC-MS analysis.
Benzo[a]pyrene TEQ (LOR): The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.
Benzo[a]pyrene TEQ (Zero): The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.
Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. (In accordance with in-house procedure).

Moisture Moisture content is determined gravimetrically by drying at 103 °C.

OCP in Soil Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS. (Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor). (In accordance with in-house procedure).

Total DDT Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)

Soil Composite* Analytica Laboratories is not accredited for the preparation of composite samples; however, the chemical analysis does hold IANZ accreditation. As composite analysis is conducted when requested by the sampler if they deem fit as per the NES guideline, the results of the chemical analyses still hold proper accreditation based on Analytica's methods.

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Certificate of Analysis

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Lab Reference: 22-18409
Submitted by: Emma Joss
Date Received: 17/05/2022
Testing Initiated: 18/05/2022
Date Completed: 19/05/2022
Order Number:
Reference: 202206

Sampling Site: Arawa Road, Pongakawa
Description of Work: 202206

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Asbestos in Soil (Semi-Quantitative)

Sample Details

Laboratory ID	Client Sample ID	Sample Location	Sample Description	Date Sampled	Date Analysed
22-18409-1	S71		Soil	13/05/2022	19/05/2022

Information in the above table supplied by the client: Client Sample ID, Sample Location, Date Sampled

Analysis Results (Summary)

Laboratory ID	Client Sample ID	Asbestos	Sample Weight as Received	Moisture Content	Trace Asbestos (Presence / Absence)	Asbestos (Presence / Absence)
	Units		g	%		
22-18409-1	S71	Asbestos NOT Detected. Organic Fibres	459.0	29.8	Absent	Absent

Information in the above table supplied by the client: Client Sample ID

Analysis Results (Size Fraction Breakdown)

Laboratory ID	Client Sample ID	Fraction Size	Fraction Weight*	AF/FA Weight*	ACM Weight*	ACM Content*	Asbestos Matrix	Asbestos Weight*	W/W% Asbestos*
Units			g	g	g	%		g	
Reporting Limit			0	0	0			0	
22-18409-1	S71	>10mm	41.50	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	77.50	0.0000	-	-	No Asbestos Detected	0.0000	
		<2mm	203.00	0.0000	-	-	No Asbestos Detected	0.0000	

Information in the above table supplied by the client: Client Sample ID

Asbestos in Soil (Semi-Quantitative) Approver:

John Lai, B.Sc.
Laboratory Technician

Method Summary

Asbestos Fibres in Soil (Semi-Quantitative)

Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with AS4964-2004 Method for the qualitative identification of asbestos in soil samples.

Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques.

Note 2: Trace asbestos is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present.

Note 3: If mineral fibres of unknown type are detected, by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised.

Note 4: The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description.