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

Detailed Site Investigation

**270 – 292 Dukes Road North
Mosgiel**

for

Southern Link Property Limited

December 2025

Task	Responsibility	Signature
Prepared by:	Aleasha King, MSc	
Reviewed by:	Bernice Chapman, CEnvP, PhD	

Prepared By:

Environmental Consultants Otago 2025 Limited
www.ecotago.co.nz

Client: Southern Link Property Limited
Job Ref.: E-062 270-292 Dukes Road N
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Executive Summary

Environmental Consultants Otago 2025 Limited (EC Otago) was commissioned by Southern Link Property Limited to undertake a Detailed Site Investigation (DSI) of the properties at 270 – 292 Dukes Road North, Mosgiel, in accordance with the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES). The purpose of this report is to confirm whether Hazardous Activities and Industries List (HAIL) activities occurring on the properties have resulted in soil contamination.

The properties at 270 – 292 Dukes Road North are not listed on the Otago Regional Council (ORC) Otago Selected Land Use Sites (SLUS). However, a Preliminary Site Investigation (PSI) of the properties conducted by e3Scientific found three potential HAIL activities occurring at three localised areas on the site:

- HAIL Category A8 (*Livestock dip or spray race operations*) in association with the sheep dip, yards and woolshed in the northern end of the site.
- HAIL Category F4 (*Motor vehicle workshops*) relating to a building in the centre of the site used for workshop activities.
- 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*) relating to a previous use of part of the site for the Royal New Zealand Air Force (RNZAF) barracks during the 1940s and the potential accidental release of contaminants during the removal of these buildings.

In addition to the above, historical maps indicate that buildings been present on the property at 292 Dukes Road North since at least 1901, and historical aerial imagery indicates that a dwelling has been present at 274 Dukes Road North since at least 1942, and a dwelling present at 270 Dukes Road North since 1975. Due to the age of the buildings present, contamination from building materials (such as asbestos or lead from flaking lead paint) may have been accidentally released to site soils and additional HAIL Categories 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*) and E1 (*Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition*) may apply to these parts of the site.

Due to the long history of use of the site for farming, since at least the 1860s, there is also potential for contamination relating to general farming activities, such as persistent pesticide use, farm landfills and burn piles to be present on parts of the properties.

The properties are proposed to be redeveloped into an inland port, which will result in a change of land use and will require extensive soil disturbance works as part of the redevelopment. As a result of the potential HAIL status of the site, this DSI has been undertaken to assess the site for ground contamination which could present a potential risk to human health under the proposed commercial/industrial land use or during development works.

The sampling and analysis conducted indicates that contaminant concentrations across the majority of the site are consistent with predicted background concentrations. However, various localised areas of contamination were identified, as highlighted in Figures 19, 20 and 21.

- **Sheep Dip:** Concentrations of arsenic reported surrounding the sheep dip were found to exceed the *Commercial/Industrial outdoor worker (unpaved)* Soils Contaminant Standards (SCS), indicating that this part of the site presents a risk to human health under the proposed

commercial/industrial land use and during development works. Concentrations of arsenic reported directly adjacent to the sheep dip were found to be extremely high, over 20 times the human health guidelines. Average concentrations of arsenic across this area exceed the applicable environmental guidelines, indicating that this part of the site may also present a risk to environmental health. This area must be considered a HAIL site. The contamination was found to extend to at least 0.6 m depth directly adjacent to the sheep dip, although appears to reduce in depth in the wider halo surrounding the sheep dip. Contamination was found to extend laterally roughly 15 m south, 20 m north of the sheep dip and approximately 5 m east of the concrete platform at the end of the sheep dip.

- **Central Woolshed/Workshop:** Concentrations of heavy metals adjacent to the former woolshed/current workshop in the centre of the site were found to be elevated above predicted background levels. Concentrations of arsenic at one location were found to exceed the *Commercial/Industrial outdoor worker (unpaved) SCS*, and these soils may present a risk to human health under the proposed commercial/industrial land use and during development works. Average concentrations of zinc reported exceed the applicable environmental guidelines, indicating that this area may also present a risk to environmental health. This part of the site must be considered a HAIL site.
- **Burn Pile:** Concentrations of heavy metals within a suspected burn pile area (location D26) were found to be elevated above predicted background levels. Concentrations of arsenic were reported to exceed the *Commercial/Industrial outdoor worker (unpaved) SCS* and the applicable environmental guidelines, and these soils may present a risk to human and environmental health under the proposed commercial/industrial land use and during development works. This part of the site must be considered a HAIL site.
- **Dwellings at 274 and 292 Dukes Road North:** Concentrations of heavy metals surrounding the dwellings and associated sheds/garages at 274 and 292 Dukes Road North were found to be elevated above predicted background levels. Whilst heavy metal concentrations in these areas were found to be below the *Commercial/Industrial SCS/Soil Guideline Values (SGV)*, note that concentrations of arsenic and/or lead exceed the *Rural Residential SCS* in some locations (samples D23, D24 and D39), and therefore these soils present a risk to human health under the current land use. Average concentrations of zinc around both dwellings exceeds the applicable environmental guidelines, indicating that this area may also present a risk to environmental health. This area must be considered a HAIL site.
- **Northern Sheds:** Heavy metal concentrations in soils surrounding the northern sheds were found to be elevated above predicted background concentrations. No contaminant concentrations in this area were reported to exceed the *Commercial/Industrial SCS/SGV*, and average contaminant concentrations are below the applicable environmental guidelines, indicating that this part of the site is unlikely to present a risk to human or environmental health under the proposed commercial/industrial land use or during development works. However, note that concentrations of zinc reported at one location (D41) exceeds the environmental guidelines, and given the limited sampling and analysis conducted, this area must be considered a possible HAIL site.
- **Location D8:** Elevated concentrations of zinc were reported at location D8. The concentration of zinc reported is elevated above the applicable environmental guidelines, but is well below human health guidelines and is highly unlikely to present a risk to human health under the current or proposed land use, or during development works. This area should be considered a possible HAIL site.

Contaminant concentrations reported across the remainder of the site, including across the majority of the former RNZAF barracks area, were found to be consistent with predicted background concentrations, and the remainder of the site is not considered a HAIL site.

The information reviewed has confirmed that HAIL activity has occurred across parts of the site. As a result, the provisions of the NES apply to those parts of the site due to:

- Category A8 (*Livestock dip or spray race operations*) – very high levels of arsenic contamination have been reported in the area surrounding the sheep dip, at concentrations that present a risk to both human and environmental health under the proposed commercial/industrial land use and during development works. This activity presents a high risk to the site, but is localised to the area surrounding the sheep dip as identified in Figure 20.
- 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*) – accidental release of contaminants appears to have occurred surrounding the existing dwellings and sheds where contaminants such as lead from lead paint, arsenic from treated timber or accidental spillages may have been released to site soils. Additionally, heavy metal contamination has been released to site soils in the location of a burn pile. Concentrations of arsenic have been reported in these locations above the commercial/industrial human health guidelines, presenting a moderate to high but localised risk to the affected parts of the site.

From this investigation, EC Otago finds the following:

- Based on the information examined during this investigation, HAIL activities have historically been, or are currently being, undertaken on parts of the site under consideration. Consequently, the provisions of the NES apply to those parts of the site in accordance with Regulation 5(7).
- Soil sampling and analysis has identified that heavy metal contamination is present in localised parts of the site surrounding the northern sheds and sheep dip, the central woolshed/workshop, a burn pile (D26), the dwellings at 274 and 292 Dukes Road North, and location D8. Concentrations of arsenic reported surrounding the sheep dip (locations D44, D45, A – G, I and L), within the burn pile (D26) and adjacent to the central woolshed/workshop (D37) were found to exceed the *Commercial/Industrial outdoor worker (unpaved)* SCS. Concentrations of arsenic and/or lead were also found to exceed the *Rural Residential SCS* in some locations adjacent to the dwellings at 274 and 292 Dukes Road North (samples D23, D24 and D39). These localised areas present a risk to human health under the proposed commercial/industrial land use, and the current rural residential land use, and must be considered HAIL sites.
- Due to the exceedances of the *Commercial/Industrial SCS*, remediation of the affected parts of the site is advised. Remediation methods may include capping/encapsulation of the affected soils on-site, removal of soils, or a combination of both. Additional sampling and analysis may be required to facilitate the remediation. If the proposed commercial/industrial redevelopment of the site does not proceed, and the site is intended to retain the current rural residential land use, remediation or management of the area surrounding the dwellings at 274 and 292 Dukes Road North is also advised.
- Contaminant concentrations in soils across the majority of the site were found to be consistent with the predicted background and the majority of site soils may be treated as ‘clean fill’ for disposal. Where heavy metal contamination has been detected across the site, these soils cannot be treated as ‘clean fill’ and must be disposed to an appropriately consented location if removed from the site. The results of sampling and analysis indicate that soils are suitable for disposal to the Burnside Landfill. Soils in locations where exceedances of the applicable human health

guidelines were reported should not be retained on site for reuse if excavated, unless appropriately encapsulated.

- Heavy metal concentrations across the majority of the site were found to be well below the guidelines protective of environmental health. However, average concentrations of zinc surrounding the central woolshed/workshop and the dwellings at 274 and 292 Dukes Road North, at locations D8 and D41, arsenic within the burn pile, and both zinc and arsenic surrounding the sheep dip and yards, were found to exceed the environmental guidelines. Appropriate precautions, such as the implementation of a Contaminated Site Management Plan (CSMP) should be put into place prior to earthworks in these locations to ensure that the works do not pose a risk to environmental health.
- Whilst no asbestos was detected in any of the 15 soil samples analysed from across the site, council records indicate that asbestos containing material (ACM) may have been used on parts of the dwellings or sheds, and an asbestos survey is advised to be conducted prior to the demolition of any buildings. Additional soil sampling and analysis for asbestos may be recommended depending on the results of the asbestos survey.
- Given that the NES applies to parts of the site, a resource consent is required from the DCC if proposed earthworks in those parts of the site exceed the disturbance of more than 25 m³ per 500 m² or disposal off-site of more than 5 m³ per 500 m² per year. As contaminant concentrations have been detected above the applicable human and environmental health guidelines in the identified HAIL areas, consent will be required from the ORC for the disturbance of contaminated soil in these areas.
- If unexpected waste materials, or other visual or olfactory indicators of potential contamination, or anomalous ground conditions are observed during earthworks, a Contaminated Land Advisor must be consulted, and further sampling and analysis is required.

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Abbreviations

ACM	Asbestos Containing Material
BAP _{eq}	Benzo[a]pyrene equivalent
CSMP	Contaminated Site Management Plan
DCC	Dunedin City Council
DSI	Detailed Site Investigation
Eco-SGV	Ecological Soil Guideline Values
HAIL	Hazardous Activities and Industries List
IANZ	International Accreditation New Zealand
NES	Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011
OCP	Organochlorine Pesticides
ORC	Otago Regional Council
PAH	Polycyclic Aromatic Hydrocarbons
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/Quality Control
RNZAF	Royal New Zealand Air Force
RSD	Relative Standard Deviation
SCS	Soil Contaminant Standards
SGV	Soil Guideline Values
SLUS	Selected Land Use Sites
SPLP	Synthetic Precipitation Leaching Procedure
TCLP	Toxicity Characteristic Leaching Procedure
UCL	95% Upper Confidence Limit
XRF	X-Ray Fluorescence Analyser

1 Introduction

Environmental Consultants Otago 2025 Limited (EC Otago) was commissioned by Southern Link Property Limited to undertake a Detailed Site Investigation (DSI) of the properties at 270 – 292 Dukes Road North, Mosgiel, in accordance with the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES)¹. A statement of EC Otago’s experience is attached as Appendix A. The purpose of this report is to confirm whether Hazardous Activities and Industries List (HAIL) activities occurring on the properties has resulted in soil contamination.

1.1 Background and Objectives

The properties at 270 – 292 Dukes Road North are not listed on the Otago Regional Council (ORC) Otago Selected Land Use Sites (SLUS)². However, a Preliminary Site Investigation (PSI) of the properties conducted by e3Scientific³ found three potential HAIL activities occurring at three localised areas on the site:

- HAIL Category A8 (*Livestock dip or spray race operations*) in association with the sheep dip, yards and woolshed in the northern end of the site.
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In addition to the above, historical maps indicate that buildings been present on the property at 292 Dukes Road North since at least 1901, and historical aerial imagery indicates that a dwelling has been present at 274 Dukes Road North since at least 1942, and a dwelling present at 270 Dukes Road North since 1975. Due to the age of the buildings present, contamination from building materials (such as asbestos or lead from flaking lead paint) may have been accidentally released to site soils and additional HAIL Categories 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*) and E1 (*Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition*) may apply to these parts of the site.

Due to the long history of use of the site for farming, since at least the 1860s, there is also potential for contamination relating to general farming activities, such as persistent pesticide use, farm landfills and burn piles to be present on parts of the properties.

The properties are proposed to be redeveloped into an inland port, which will result in a change of land use and will require extensive soil disturbance works as part of the redevelopment. As a result of the potential HAIL status of the site, this DSI has been undertaken to assess the site for ground contamination which could present a potential risk to human health under the proposed commercial/industrial land use or during development works. The objective of this report is to assess whether contamination is present on the site.

¹ Ministry for the Environment, 2012. *Users’ Guide - National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*.

² <https://experience.arcgis.com/experience/7f3719181fba451a8d256ffad11edb10>

³ e3Scientific Limited, 2025. *Southern Link Inland Port Preliminary Site Investigation*.

1.2 Scope of Work

Consistent with the Ministry for the Environment guidelines⁴ for reporting on contaminated land, the following scope of work was undertaken:

- Source and review all available relevant information, including any previous reports.
 - Review of the 2025 PSI.
 - Search of the ORC Otago SLUS.
 - Other sources of information as cited herein.
- Carry out a walkover to verify site conditions and inspect for indicators of potential contamination.
- Collect soil samples across the site.
- Analyse samples for the potential contaminants associated with the identified HAIL activities.
- Prepare this report, which summarises our findings and assesses the following:
 - Whether previous and/or current activities have the potential to cause contamination.
 - The disposition of the site with respect to the NES.
 - The nature and extent of any contamination within the site.
 - The risks to current and future site occupants, and site contractors during development works.
 - The requirement for further investigations.
 - Any conclusions and/or recommendations specifically pertinent to this investigation.

2 Site Overview

2.1 Site Identification

The general location is shown in Figure 1, and the relevant property details are summarised in Table 1. For the purposes of this investigation, the site extent comprises 42.492 ha across 270 – 292 Dukes Road North, as outlined in Figure 2.

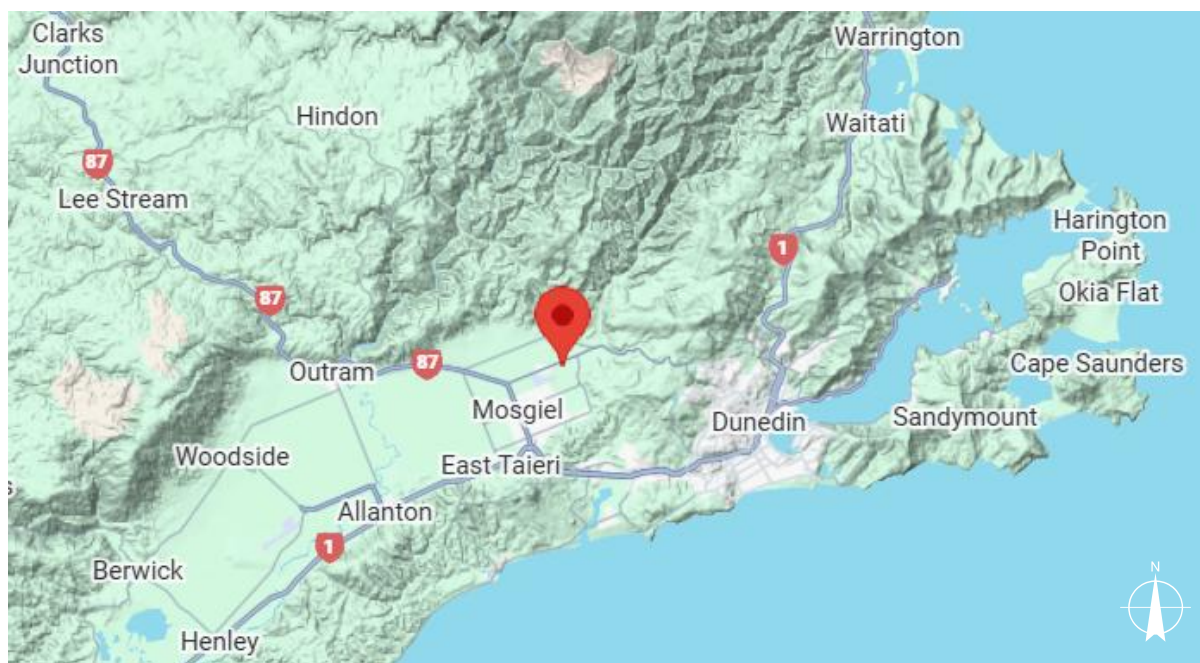


Figure 1: General location of the site, shown with a red tag (Map Data ©2025; Google Terrain).

⁴ Ministry for the Environment, 2021. *Contaminated Land Management Guidelines No. 1 - Reporting on Contaminated Sites in New Zealand (Revised 2021)*.

Table 1: Summary of relevant property details

Address	270 Dukes Road North	274 Dukes Road North	292 Dukes Road North	292A Dukes Road North
Legal Description	PT SEC 10 BLK V SO 63 EAST TAIERI SD	DP 5579 EAST TAIERI SD	PT SEC 9 BLK V SO 63 EAST TAIERI SD	PT SEC 9 BLK V SO 63 EAST TAIERI SD
Certificate of Title	3C/897	304/127	3C/899	329/233
Total Area	21.2324 ha	0.3068 ha	20.3053 ha	0.6475 ha
District Plan/Zoning	Section 16: Rural (Taieri Plain)			



Figure 2: The site extent at 270 – 292 Dukes Road North outlined in turquoise (DCC GIS | 2023-2024. Copyright DCC/ORC, CC BY 4.0).

2.2 Site Access

The site has established accessways via Dukes Road North.

2.3 Topography

The site topography is generally flat at approximately 28 – 30 m above sea level, but drops sharply at the southern end of the site to approximately 22 m above sea level where Silver Stream runs through the site.

2.4 Geology

The site is mapped by the GNS Science New Zealand Geology Web Map⁵ as primarily comprising Late Pleistocene river deposits, including poorly consolidated, slightly weathered, sandy quartz-, schist-, or volcanoclastic-derived gravel and sand. The eastern corner of the site is described as comprising Holocene river deposits, including poorly consolidated, often poorly sorted, fine to bouldery gravel with sand and mud.

The site is described by the ORC Natural Hazards Portal⁶ as having low to no liquefaction potential (Domain A), although underlain by deep or soft soil (Ground Class D). The majority of the site is also described as a river terrace landform and an inactive floodwater-dominated alluvial fan, with the Silver Stream noted as an active riverbed. The southern edge of the site, and northern corner, are described as part of an active floodwater-dominated alluvial fan.

2.5 Hydrology

2.5.1 Surface Water

Silver Stream runs through the southern end of the site. Mill Stream is also located approximately 700 m north of the site.

2.5.2 Groundwater

The site is located over the Lower Taieri Aquifer⁷, and is within Groundwater Protection Mapped Area B⁸. The bore records held by the ORC^{9,10} identify multiple bores located on the site as shown in Table 2. However, the depth to water is not recorded for any of these bores. At least 20 bores are listed within 500 m of the centre of the site, with the depth to water recorded in these bores ranging from 5.65 m to 11.02 m below ground level.

No groundwater was encountered during the site investigation for this report. The direction of groundwater flow at the site is expected to be in a westerly or south-westerly direction¹¹.

2.6 Hazards

The ORC Natural Hazards Portal and Dunedin City Council (DCC) Planning Map¹² indicate that the site is at risk of flooding. The western half of the site is listed as a high risk of flooding under the Hazard 1 (Flood) Overlay Zone, being part of flood hazard area 14B (North Taieri floodways). The eastern half of the site is listed as a moderate risk of flooding under the Hazard 2 (Flood) Overlay Zone, being part of flood hazard area 14D (North Taieri floodplain).

⁵ <https://data.gns.cri.nz/geology/>

⁶ <https://maps.orc.govt.nz/portal/apps/MapSeries/index.html?appid=b24672e379394bb79a32c9977460d4c2>

⁷ <https://data.mfe.govt.nz/layer/52675-location-and-extent-of-nzs-aquifers-2015/>

⁸ <https://dunedin.maps.arcgis.com/apps/webappviewer/index.html?id=f7fc69e07dba4db589ffe2ddcac4acc7>

⁹ <https://experience.arcgis.com/experience/7f3719181fba451a8d256ffad11edb10>

¹⁰ <https://maps.orc.govt.nz/OtagoViewer232/?map=2b72476ec76446cf8270dad325952215>

¹¹ Otago Regional Council, 2009. *Groundwater Lower Taieri Basin Summary Report December 09*.

¹² <https://dunedin.maps.arcgis.com/apps/webappviewer/index.html?id=f7fc69e07dba4db589ffe2ddcac4acc7>

Table 2: Bores located on or near the site

Well Number	Distance/Direction	Usage	Owner	Depth to Water
Bores located on site:				
I44/0820	On site	Domestic	Donnelly, P.R.	-
I44/0835	On site	Groundwater Monitoring	Irricon / ESR (Donnelly)	-
I44/0835-P1	On site	Groundwater Monitoring	Irricon / ESR (Donnelly)	-
I44/0836	On site	Groundwater Monitoring	Irricon / ESR (Donnelly)	-
I44/0836-P3	On site	Groundwater Monitoring	Irricon / ESR (Donnelly)	-
I44/0837	On site	Groundwater Monitoring	Irricon / ESR (Donnelly)	-
I44/0837-P5	On site	Groundwater Monitoring	Irricon / ESR (Donnelly)	-
Bores located within 500 m of site boundaries:				
I44/0947	10 m N	Stockwater	Knight, M. J. & Knight, K. M.	-
I44/0815	25 m W	Community Drinking Water Supply – Decommissioned	Mosgiel Borough Council	-
I44/0821	25 m N	Domestic, Groundwater Monitoring	Anderton, B. J.	11 m
I44/1077	50 m N	Domestic, Stockwater	Anderton, B. J. & L. E.	11.02 m
I44/1207	60 m W	Groundwater Monitoring	Young Brothers Limited	6 m
I44/0110	60 m W	Listed as not yet drilled	Tonkin & Taylor Limited	-
I44/0819	80 m E	Groundwater Monitoring	Morris, J. D.	-
I44/0822	170 m S	Unknown	MacKintosh, C. G.	-
I44/1210	190 m W	Groundwater Monitoring	Young Brothers Limited	6 m
I44/1038	220 m N	Groundwater Monitoring	Dunedin City Council	-
I44/0825	270 m S	Unknown	Botting, L.S.	-
I44/1209	300 m W	Groundwater Monitoring	Young Brothers Limited	6 m
I44/1208	310 m W	Groundwater Monitoring	Young Brothers Limited	6 m
I44/0823	310 m S	Unknown	Collins, M.P.	-
I44/1095	330 m S	Domestic	McCabe, M. J. & Paterson, M. C.	6.45 m
I44/0894	370 m S	Domestic	Botting, J. & S.	-
I44/0478	390 m E	Agriculture Irrigation	Invermay	5.65 m
I44/0976	390 m S	Stockwater	Noakes, C.	7.4 m
I44/1037	450 m N	Groundwater Monitoring	Dunedin City Council	-
I44/0824	470 m S	Unknown	Strang, D.	-

2.7 Site Use History Summary

The property history is described in detail in the PSI. In summary, the properties have a long history of farming and residential occupation, with Sections 9 and 10, Block V, East Taieri Survey District, covering the entire site extent, transferred from the crown to a Mr Shaw in 1861. Sections 9 and 10 are noted to remain on the same deed (along with Part Section 4 Block IX, which is to the north and outside of the site extent) in historical certificates of title issued in 1933. Subdivisions of the site removing the current extent of 274 and 292A Dukes Road North from the former larger property appear to have occurred in the 1940s, and the remaining Part Sections 9 and 10 (the current extents of 270 and 292 Dukes Road North, respectively) were separated in 1968.

The PSI notes that various buildings have been constructed on the site, including:

- Holmhead Farm – a map of the site from 1901 (Figure 3) identifies the property as “Holmhead Farm” and various buildings can be seen present in the northern site corner (currently 292 Dukes Road North). Subsequent aerial imagery contained within the PSI indicate that the buildings include a dwelling, various sheds, a sheep yards and a sheep dip. Comments contained in the PSI indicate that the original dwelling was constructed in the 1860s, with significant renovations conducted in the 1940s.
- RNZAF barracks – RNZAF barracks were constructed on the northern end of 270 Dukes Road North in 1939. Imagery of the site, including the barracks, is shown in Figure 4 from 1942. Subsequent aerial imagery contained within the PSI show the barracks to have been removed by 1949.
- Dwellings – in addition to the dwelling at 292 Dukes Road North, Figure 4 from 1942 also shows a dwelling to be present at 274 Dukes Road North. The PSI notes that consent records for a coal shed adjacent to the dwelling include polite, a potentially asbestos containing material (ACM). Imagery from 1975 shows the dwelling at 270 Dukes Road North under construction at this time. The PSI notes that consent records for the 1975 dwelling and a garage/workshop “*mention use of Decramastic roof and Hardies Flexiboard, which are both potentially asbestos containing building materials*” along with fibrolite sheeting which may also contain asbestos.
- Woolshed/workshop – a building in the centre of the site, currently used as a workshop, appears to have been constructed by 1985. Whilst this building is identified as a workshop in the PSI, aerial imagery contained within the PSI indicates that it was initially a woolshed and sheep yards are visible adjacent to the building on the western side, although they appear to have been removed by 2013.



Figure 3: The site in 1901, with the approximate site boundary outlined in turquoise, showing “Holmhead Farm” to be present on the site, including various buildings in the northern site corner (extract from W T Neill's Military Topographical Maps dated 1901, https://ndhadeliver.natlib.govt.nz/delivery/DeliveryManagerServlet?dps_pid=IE27293496).



Figure 4: The site in 1942, with the approximate site boundary outlined in turquoise, showing various buildings including dwellings, farm sheds and the RNZAF barracks present on the site (sourced from <http://retrolens.nz> and licensed by LINZ CC-BY 3.0).

2.8 Regulatory Matters

2.8.1 District Council Consents and Licenses

District council consent records for the property are discussed in the PSI, with relevant details summarised in Section 2.7.

2.8.2 Regional Consent Records

The ORC Consents in Otago Database¹³ identifies four regional council consents to be associated with the site:

- A bore construction consent (95871) which expired in 1997. The consent activity is described as “to construct a bore adjacent to the north branch of Silverstream one paddock up from Stedman Road for the purpose of investigation/monitoring bores for measuring water quality and water levels” [sic].

¹³ <https://maps.orc.govt.nz/OtagoViewer232/?map=2b72476ec76446cf8270dad325952215>

- A bore construction consent (2001.183) which expired in 2003 to “construct a bore for stock water and single domestic supply at 270 Dukes Road, Mosgiel”.
- One discharge to water permit (1848), which expired in 1989, issued to the Ministry for Primary Industries.
- One discharge to air permit (2002.686), which has been surrendered, to “discharge particulates to air for the purpose of sawing and milling up to 40,000 cubic metres per year of logs at 270 Dukes Road, North Taieri, Dunedin”.

No other regional consent records were found for the property.

2.8.3 HAIL/Contaminated Land Databases

ORC Otago Selected Land Use Sites (SLUS)

The property is not listed on the ORC Otago SLUS.

DCC HAIL Report

The DCC HAIL Report (HAIL-2025-144), partially appended within the 2025 PSI, did not find any explicit information regarding HAIL activities for the site. The DCC HAIL Report notes:

“270 Dukes Road North

Land uses (from HAIL):

- *Nil identified explicitly*

However, it should be noted that:

- *Part of this site was apparently used as part of the RNZAF Station Taieri airforce base during World War 2. Airports are listed on the HAIL, and typically include other associated aspects that are also HAIL activities (such as fuel storage, maintenance workshops, firefighting practice areas, ordnance storage, explosive detonation training, rifle ranges). However, it is presumed that this site was only used for accommodation purposes, and hence these HAIL activities are unlikely to have occurred on this property. Further information from RNZAF archives or from Archives New Zealand could clarify this.*
- *Previous and existing farming activity may have included HAIL activities that the Council holds no records about (such as agrichemical use, fertiliser bulk storage, livestock dips/spray races, persistent pesticide storage/use, storage tanks for fuel, farm landfills, burn piles).*
- *Building products containing asbestos were widely used in New Zealand. If there are/were any other buildings containing asbestos products in a deteriorated condition, or buildings containing asbestos have been demolished not in accordance with best practice, then Categories E1 and/or I on the HAIL may be applicable:*

E1: Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition

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

- *The long-term use of lead-based paints on buildings can, in some cases, cause soil contamination. Category I on the HAIL may be applicable in such a situation:*

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

274 Dukes Road North

Land uses (from HAIL):

- Nil identified explicitly

However, it should be noted that:

- *The long-term use of lead-based paints on buildings will, in some cases, cause soil contamination. The Ministry of Health have determined that pre-1945's dwellings' paintwork is almost certain to contain lead in a high concentration (Ministry of Health, 2024). Council's consultant environmental scientists from Stantec New Zealand Ltd have stated that it is 'most likely' that the soil immediately surrounding a pre-1945's painted building will have lead contamination above soil contaminant standards.*

In this case, the dwelling was seemingly established prior to 1945, potentially in the 1930s, but it is understood to be clad in unpainted brick. As a result, lead contamination of soil is not a relevant consideration for the dwelling. Nevertheless, if high concentration lead paint was used over an extended time on buildings on this site, Category I could possibly be relevant:

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

- *Building products containing asbestos were widely used in New Zealand. If there are/were any other buildings containing asbestos products in a deteriorated condition, or buildings containing asbestos have been demolished not in accordance with best practice, then Categories E1 and/or I on the HAIL may be applicable:*

E1: Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition

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

292 Dukes Road North

Land uses (from HAIL):

- Nil identified explicitly

However, it should be noted that:

- *Previous and existing farming activity may have included HAIL activities that the Council holds no records about (such as agrichemical use, fertiliser bulk storage, livestock dips/spray races, persistent pesticide storage/use, storage tanks for fuel, farm landfills, burn piles).*
- *The long-term use of lead-based paints on buildings will, in some cases, cause soil contamination. The Ministry of Health have determined that pre-1945's dwellings' paintwork is almost certain to contain lead in a high concentration (Ministry of Health, 2024). Council's consultant environmental scientists from Stantec New Zealand Ltd have stated that it is 'most likely' that the soil immediately surrounding a pre-1945's painted building will have lead contamination above soil contaminant standards.*

In this case, the dwelling was apparently initially established well before 1945, and is understood to be in painted plaster. If the property was a residential property or a small lifestyle block, then Category I could be applied with a Possible HAIL status. However, in this case, the property is 20ha in area, and hence it is the size of a farm holding. Nevertheless,

there may be the potential for lead paint contamination around the curtilage of the dwelling, plus any other buildings that may have been painted with high concentration lead paint.

- *Building products containing asbestos were widely used in New Zealand. If there are/were any other buildings containing asbestos products in a deteriorated condition, or buildings containing asbestos have been demolished not in accordance with best practice, then Categories E1 and/or I on the HAIL may be applicable:*

E1: Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition

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”.

2.9 Previous Investigations

The 2025 PSI found three areas on the site likely to comprise HAIL sites, as identified in Figure 5. These consist of the sheep dip area in the northern end of the site (within 292 Dukes Road North), the location of the former RNZAF barracks in the northern end of 270 Dukes Road North, and the workshop in the centre of the site, also within 270 Dukes Road North.

Additionally, the PSI notes that soil contamination may be present surrounding the older dwellings/sheds present on the site, due to building materials such as asbestos or lead paint. However, the PSI notes that no ACM were observed on the site in a degraded condition, and that heavy metal contamination from the buildings is unlikely to exceed the commercial/industrial human health guidelines. The PSI concludes therefore that whilst some soil contamination may be present in these locations, the areas surrounding the existing dwellings and sheds are unlikely to comprise HAIL sites.

The PSI also notes that it is *“possible that shallow soils at the site contain residual cadmium concentrations associated with the historic application of superphosphate fertilisers during the use of the site for pastoral grazing”* or that shallow soils may *“contain the organochlorine pesticide dichlorodiphenyl-trichloroethane (DDT), which was often added to superphosphate fertilisers to control grass grub and porina moth in pastoral grazing soils”*. However, the report notes that in *“all investigations [completed by e3Scientific throughout Otago and Southland] of low-intensity pastoral grazing land, concentrations of cadmium and DDT have been orders of magnitude lower than applicable soil guideline values for human health or the environment. At this site, it is highly unlikely the broadacre application of fertiliser has occurred at a rate and intensity that would result in an accumulation of contaminants in concentrations that could present a risk to human health or the environment. As such, broadacre fertiliser use is not considered a HAIL activity”*.

Additionally, the PSI notes that *“From the site walkover, there was evidence of dumping on the north banks of Silver Stream. While the disposal of waste to land can constitute a HAIL activity, the volumes of waste seen in the site walkover are unlikely to result in significant soil contamination”*. No photographs of the stream banks were provided in the PSI.



Figure 5: Three areas of potential HAIL activity on the site as identified in the 2025 PSI (e3Scientific Limited, 2025. Southern Link Inland Port Preliminary Site Investigation).

2.10 Proposed Future Use

The property is proposed to be redeveloped into an inland port, as shown in the concept plan in Figure 6.

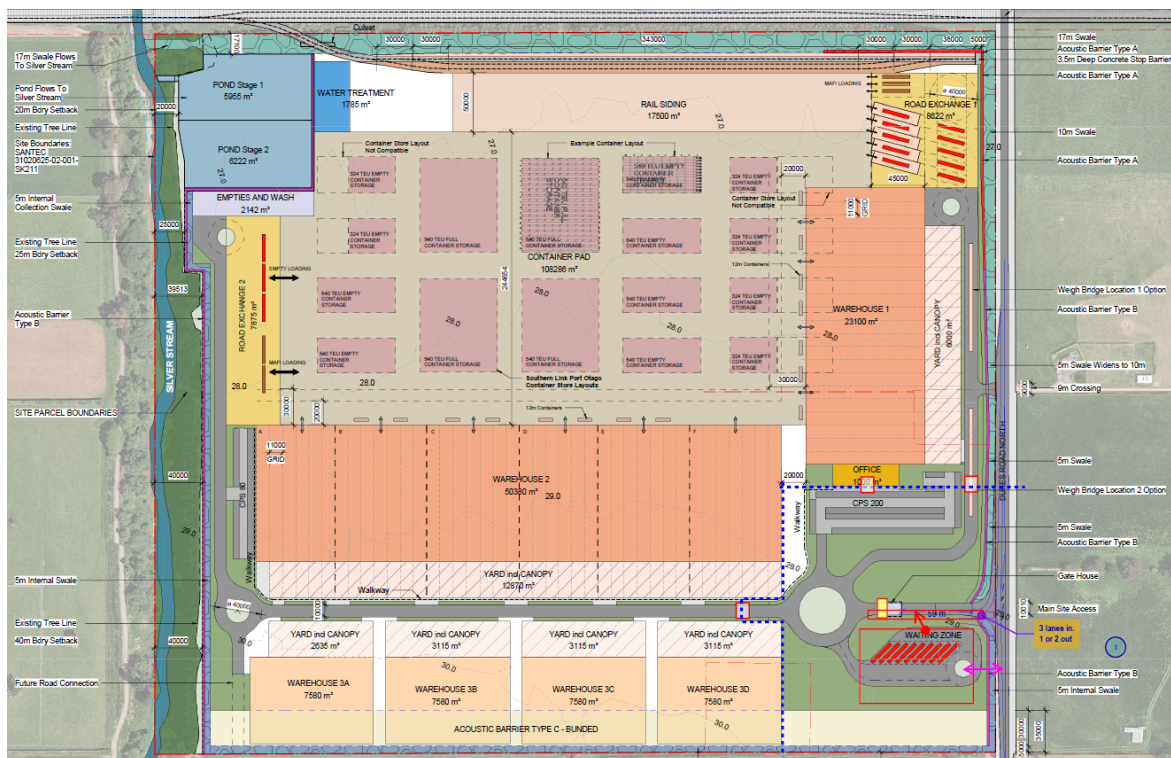


Figure 6: Excerpt of the concept plan for the proposed redevelopment (Williams Architects Limited, Sheet C8.001, dated 09/09/2024).

3 Site Condition

3.1 Site Inspection

A site visit with soil sampling was conducted by an EC Otago Contaminated Land Consultant on 16 and 17 October, and 11 November 2025. Imagery of the site is shown in Figures 7 to 15.

The site is primarily in farmland and currently used for grazing a number of sheep and cows. The majority of paddocks are currently in grass, although a small number appear to be used for crops.

The site currently contains three existing dwellings, one on each of 270 (Figure 7), 274 (Figure 8) and 292 (Figure 9) Dukes Road North. Various additional garages and sheds are also present adjacent to the dwellings. Numerous garages/sheds (Figures 10 and 11) are present in the northern end of 292 Dukes Road North, along with sheep yards (Figure 12) and a sheep dip (Figure 13). Part of the sheep yards are concreted, including the part of the yards adjacent to the sheep dip. The sheep dip appears to be disused and has been infilled with soil and brick. The adjacent sheds generally appear to be of corrugated metal construction, except for one shed directly to the northwest of the sheep dip (as seen in Figure 13) which appeared to be older than the rest and partially painted timber weatherboard construction.

In the centre of the site, a woolshed is present which has been converted into a workshop (Figure 14). The workshop was in active use at the time of the site visit.

Earthworks were being undertaken along the southern end of the site adjacent to the Silver Stream at the time of the site visit, and this part of the site was not inspected. Earthworks have also recently been undertaken in the northwestern end of the site adjacent to the dwelling at 270 Dukes Road North, creating a large gravel platform (Figure 15). Topsoil stripped during excavations remains stockpiled on site, and imported gravel fill materials have also been stockpiled on site. The excavation work has been conducted adjacent to the location of the former RNZAF barracks. It was advised by the site contact that no signs of the former barracks have been uncovered during excavation works.



Figure 7: The existing dwelling at 270 Dukes Road North (16 October 2025).



Figure 8: The existing dwelling at 274 Dukes Road North (17 October 2025).



Figure 9: The existing dwelling at 292 Dukes Road North (17 October 2025).



Figure 10: An example of one of the sheds present in the northern corner of the site (17 October 2025).



Figure 11: An example of the interior of one of the sheds present in the northern corner of the site (17 October 2025).



Figure 12: The concreted sheep yards in the northern end of the site (17 October 2025).



Figure 13: The sheep dip in the northern end of the site, leading from the yards to a concrete platform (17 October 2025).



Figure 14: The woolshed in the centre of the site which has been converted into a workshop (17 October 2025).



Figure 15: Recent excavation works conducted on the site to create a gravel platform (16 October 2025).

3.2 Conditions at Site Boundaries

The site is bounded by Dukes Road North on the northern side and railway to the west. Silver Stream runs along the southern end of the site. The site is generally surrounded by rural or rural residential properties to the north, east and south, with industrial land present to the west, on the opposite side of the railway and Stedman Road.

Site boundaries are fenced with a combination of fencing types, including timber and wire fencing and hedging. Site boundaries did not appear to show signs of recent instability or erosion, although note that the southern site boundary was not inspected due to current site works in that area.

3.3 Signs of Contamination

No sign of the former RNZAF barracks were observed on the site during the site visit, and no sign of demolition waste or other indicators of the presence of the former barracks, such as fill materials, were observed during collection of soil samples. Soils within this area appeared to comprise a topsoil layer approximately 0.2 – 0.3 m thick underlain by subsoil.

As seen in Figure 13 above, a sheep dip is present in the northern end of the site, which is likely to be a major source of localised contamination on the site. No obvious signs of contamination, such as phytotoxicity, were observed surrounding the sheep dip. However, fill materials primarily comprising

topsoil with minor gravel and brick fragments were encountered within the sheep dip and in the area surrounding the sheep dip extending up to approximately 0.6 m depth.

In one of the northern paddocks, just to the south of the dwelling at 274 Dukes Road North, a large circular area (Figure 16) was observed that contained charred remains of timber, and this area is likely used for burning waste.

As noted in the PSI, minor hydrocarbon staining is present surrounding parts of the former woolshed/current workshop in the centre of the site. The interior of this building was not inspected, although the active workshop area appears to be at least partially floored with a concrete slab.

Apart from the above, there was very little indication of possible contamination across the majority of the site. There were no olfactory indicators of contamination or other visible signs of contamination such as spills or leaks, buried rubbish waste, or signs of phytotoxicity across the majority of the property.

Note that the interior of sheds and buildings on the site were not inspected during the site investigation. However, a description of the interior of many of the buildings can be found in the PSI.



Figure 16: A suspected burn pile area within the northwestern end of 292 Dukes Road North (17 October 2025).

4 HAIL Activities

The site history and site investigation provide evidence of HAIL land use at the site which may have resulted in contamination, as summarised in Table 3.

Table 3: Potential HAIL land uses and associated contaminants on the site

HAIL Code and Description	Potential Contaminants	Indicator/Risk
A1. Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application	Arsenic, lead, copper; wide range of organic agrichemicals including organochlorine pesticides, organophosphate pesticides, herbicides, fungicides, carbamates, and synthetic pyrethroids; compounds may be mixed with diesel before spraying	Historical maps and aerial imagery indicate that farming activities have been occurring on the site since at least the 1860s, with farm buildings present on the site from at least 1901 and likely earlier. Whilst agrichemicals and pesticides, such as DDT which was often added to superphosphate fertilisers to control grass grub, may have been used on the property, the PSI notes that broadacre applications of these agrichemicals as you would find on a site such as this do not typically result in high levels of soil contamination and this activity presents a low risk to the site.
A10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds	Arsenic, lead, copper, mercury; wide range of organic compounds including acidic herbicides, organophosphates, and organochlorines (eg, endosulfan on golf and bowling greens)	PSI notes that broadacre applications of these agrichemicals as you would find on a site such as this do not typically result in high levels of soil contamination and this activity presents a low risk to the site.
A8. Livestock dip or spray race operations	Arsenic, organochlorines (eg, aldrin, dieldrin, DDT, lindane) and organophosphates, carbamates, and synthetic pyrethroids	A sheep dip is located at the northern end of the site, within 292 Dukes Road North. Contamination surrounding sheep dips is typically high and can extend to some depth below the surface. This activity presents a high risk to the site but is expected to be localised to the paddock containing the sheep dip and any areas where chemicals may have been disposed of or equipment washed out. Note that sheep yards are also apparent adjacent to the former woolshed in the centre of the site in aerial imagery from 1985 up until 2013. However, as these yards appear to have been constructed in the early 1980s, they are unlikely to have contained a sheep dip as mobile pour-on methods of sheep dipping were available by this time, such as those applied using a backpack and hand held nozzle which do not generally result in chemicals released to site soils except where equipment may be washed out. Therefore, the former sheep yards in the centre of the site present a low risk.
E1. Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition	Asbestos	The PSI notes that ACM may be present in dwellings or sheds on the site, with consent records indicating that ACM is likely to be present on the dwellings and/or adjacent sheds/garages at 270 and 274 Dukes Road North. Additionally, the RNZAF barracks were erected at a time when ACM was in use, and these buildings also have the potential to have contained ACM. This activity presents a moderate to high risk to localised parts of the site surrounding the ACM, depending on the state of deterioration of the ACM or, in the case of the removed buildings, how the buildings were demolished.

<p>F2. Motor vehicle workshops</p>	<p>Hydrocarbons including PAHs, solvents, and metals contained in waste oil</p>	<p>The former woolshed in the centre of the site appears to have been converted to a workshop during the 2000s. Minor hydrocarbon staining was noted to be present in gravel surfaces adjacent to the building footprint. Given the recent conversion of the building and that at least parts of the building appear to contain a concrete floor, this activity presents a low, highly localised risk to the site.</p>
<p>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</p>	<p>Dependent on contaminants associated with release</p>	<p>Historical maps indicate that buildings/sheds have been present on the site since at least 1901, and evidence contained within the PSI suggests that a dwelling was present on 292 Dukes Road as early as the 1860s. Given the age of the buildings, there is a moderate to high risk to parts of the site surrounding the buildings due to the potential for accidental release of contaminants, such as asbestos or lead from flaking lead paint. The risk to the site from lead contamination is higher surrounding the older dwellings and sheds at 274 and 292 Dukes Road North which were constructed prior to 1950 when concentrations of lead in paint were higher.</p> <p>This HAIL category may also apply to parts of the site where contamination has been released to soils through burning of waste material, or leaching of treated timber. At least one burn pile location was observed to be present on the site, and this presents a moderate to high, but highly localised risk to the site.</p>

5 Soil Sampling

5.1 Sampling Plan

Soil samples were collected from surface soils (generally 0 – 0.15 m depth) at 46 locations (D1 – D46) across the site on 16 and 17 October 2025, as shown in Figure 17. An additional site visit with soil sampling was conducted on 11 November 2025 in order to further refine the extent of contamination surrounding the sheep dip (locations A to N) in the northern end of the site (Figure 18). The additional soil sampling surrounding the sheep dip included sample collection from deeper soils up to 0.6 m depth. Samples D1 to D46 from the original site visits on 16 and 17 October were collected for laboratory analysis, whilst samples A to N from the subsequent site visit were analysed via a hand-held X-Ray Fluorescence (XRF) analyser.

The samples were collected with a combined systematic and targeted approach, with a low-density coverage across the majority of the site and targeted samples in areas of interest. Samples D1 to D16 were targeted to the locations of former RNZAF barracks, samples D39, D40 and D46 were targeted to the dwelling and outbuildings at 274 Dukes Road North, samples D23 and D24 were targeted to the dwelling at 292 Dukes Road North, samples D18 – D22, D41 – D45 and A to N were targeted to the sheds, sheep yards and sheep dip in the northern end of the site, samples D37 and D38 were targeted to the woolshed/workshop in the centre of the site and sample D26 was targeted to the suspected burn pile area. Samples D17, D25, and D27 – D36 were collected systematically across the fields. Samples collected across the fields were aimed to be as equally spread across the fields as possible, but note that some paddocks were not accessible at the time of the site investigation due to the presence of livestock (bulls), and therefore the grid of sample collection across the fields is slightly skewed.

The samples collected from across the fields (D17, D25, and D27 – D36) were analysed as composites with three sub-samples each for heavy metals and organochlorine pesticides (OCP), as the main contaminants of concern associated with the historical farming activities at the site. The remaining samples were analysed individually, with all samples analysed for heavy metals. Samples collected from the sheep dip and northern sheds area (D18 – D22, D41 – D45) along with some select locations from the barracks area (D2, D3, D14 – D16) were also analysed individually for OCP, and samples collected from adjacent to the workshop area (D37, D38) and the burn pile (D26) were also analysed for polycyclic aromatic hydrocarbons (PAH).

Due to high concentrations of contaminants reported in samples D24, D26, D37, D39, D45, these samples were subsequently reanalysed for leachable arsenic, lead and/or zinc via Toxicity Characteristic Leaching Procedure (TCLP) to determine a suitable disposal location. Due to significantly higher concentrations of arsenic reported in sample D44, this sample was reanalysed for leachable arsenic via Synthetic Precipitation Leaching Procedure (SPLP) using leachate from the Burnside Landfill as the extractant in accordance with Condition 6 of the Burnside Landfill Consent RM17.198.01.V3.

Additional samples were collected from select locations across the former barracks area (D1, D4 – D13), including location D5 which is near the dwelling at 270 Dukes Road North, and adjacent to the dwellings at 292 and 274 Dukes Road North (D23, D24, D39, D40) and analysed individually via the New Zealand Guidelines for Semi-Quantitative Asbestos in Soil due to the potential for ACM to be/have been present in those locations.



Figure 17: Sampling locations across the site (Google Earth, Image ©2025 Airbus).



Figure 18: Sampling locations in the northern end of the site, with samples A-N indicating additional sampling locations analysed via XRF (Google Earth, Image ©2025 Airbus).

5.2 Sampling Methods

5.2.1 Laboratory Analysis

Samples were collected using freshly gloved hands from material retrieved by a stainless-steel hand auger which was cleaned between locations with a paper towel and/or Decon 90 diluted with water. Samples were transferred into clean, contaminant-free containers provided by the testing laboratory and placed into a chilly bin cooled with icepacks. During sampling, the date, time and location of collection was recorded. Containers were labelled with sample name, date and time on both label and lid as the samples were taken, and the location was recorded with a handheld Garmin GPSMAP 64. The chain of custody form was completed during field operations, and samples were dispatched to the analytical laboratory by courier on the day of collection. The samples were received and analysed by RJ Hill Laboratories Limited, an International Accreditation New Zealand (IANZ) accredited laboratory.

5.2.2 XRF Analysis

XRF samples were analysed in the field using an Olympus Vanta VMR. The XRF survey was undertaken by a suitably qualified practitioner who has completed a relevant XRF training course and holds a current licence for the use of the XRF.

The following procedures were adopted by the operators during the soil assessment process:

- Prior to every XRF reading, instrument checks were undertaken.
- A blank control was read prior to the first sample analysis and after the final sample analysis.
- Soil samples were collected by hand auger that was cleaned between locations, as described in Section 5.2.1.
- Clean plastic wrap was placed around the sensor head of the XRF to protect it from fouling.
- The samples were analysed in situ (i.e. directly from the extracted core), not through plastic bags.
- The samples collected were analysed for 45 seconds (15 seconds on each exposure beam).

5.3 Soil Acceptance Criteria

As part of the process of determining the risk to human health from potential contaminants, results from analysis must be compared to Soil Contaminant Standards (SCS) which reflect acceptable risk levels of contamination in soil for the appropriate use scenarios¹⁴. For some analytes, the Ministry for the Environment has not established SCS, in this case, Soil Guideline Values (SGV) from other sources may be used according to an established hierarchy¹⁵. For contaminants without an SCS in the NES, the Australian National Environment Protection (Assessment of Site Contamination) Measure (NEPM)¹⁶ were applied.

The land where the site is located is primarily zoned Rural in the DCC Second Generation District Plan, and the land is currently used for farming and rural residential purposes. As the proposed development will be commercial/industrial, for assessment purposes the *Commercial/Industrial* SCS/SGV have been applied.

¹⁴ Ministry for the Environment, 2011. *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health*.

¹⁵ Ministry for the Environment, 2011. *Contaminated Land Management Guidelines No. 2: Hierarchy and application in New Zealand of environmental guideline values (revised 2011)*.

¹⁶ National Environment Protection Council (Australia), 2013. *National Environment Protection (Assessment of Site Contamination) Measure 1999*.

The soils are also compared to the Ecological Soil Guideline Values (Eco-SGV)¹⁷ using the 80% protection values and sensitive soil type as default as an indication of the environmental risk from potential contaminants.

5.4 Results of Analysis

The results are summarised in Tables 4 – 7, and the full laboratory analysis reports are attached as Appendix B.

Heavy metals

The results show that heavy metal concentrations across the majority of the site are consistent with predicted background concentrations based on the underlying geology. However, heavy metal concentrations in soils adjacent to the dwellings at 274 and 292 Dukes Road North, along with soils surrounding the sheds and sheep dip in the northern end of the site, the woolshed/workshop in the centre of the site, location D8, and the suspected burn pile at location D26 were found to be elevated above the predicted background.

Concentrations of arsenic reported surrounding the sheep dip (D44, A – G, I and L), adjacent to a shed near the sheep dip (D45), within the burn pile (D26) and adjacent to the central woolshed/workshop (D37) were found to exceed the *Commercial/Industrial outdoor worker (unpaved)* SCS. Note that arsenic concentrations surrounding the sheep dip were found to be extremely high and were reported to be over 20 times the human health guidelines in XRF samples and over 17 times the guidelines in laboratory samples collected from directly adjacent to the sheep dip. The exceedances were found to extend to at least 0.6 m depth directly adjacent to the sheep dip, but the contamination reduces in depth in the wider halo surrounding the sheep dip. Contamination was found to extend laterally roughly 15 m south and 20 m north of the sheep dip.

Whilst heavy metal concentrations surrounding the dwellings were found to be below the *Commercial/Industrial SCS/SGV*, note that concentrations of arsenic and/or lead exceed the *Rural Residential SCS* in some locations adjacent to the dwellings at 274 and 292 Dukes Road North (samples D23, D24 and D39).

Except for elevated zinc at D8, heavy metal concentrations reported within the former RNZAF barracks area were found to be consistent with predicted background concentrations.

Heavy metal concentrations across the majority of the site were found to be well below the Eco-SGV guidelines protective of environmental health. However, average concentrations of zinc surrounding the central woolshed/workshop and the dwellings at 274 and 292 Dukes Road North, zinc at locations D8 and D41, arsenic within the burn pile, and both zinc and arsenic surrounding the sheep dip and yards, were found to exceed the environmental guidelines.

OCP

OCP were only detected in 5 of the samples analysed, all located at the northern end of the site (D2, D3, D22, D43 and D45). The OCP results are shown in the tables as the total DDT isomers, as these were generally the only OCP detected in the samples analysed, except for sample D45 which also reported traces of beta-BHC, delta-BHC, and gamma-BHC (Lindane) to be present (0.035 mg/kg, 0.021 mg/kg and 0.056 mg/kg dry weight, respectively). OCP concentrations were found to be

¹⁷ Manaaki Whenua – Landcare Research, 2023. *An implementation framework for ecological soil guideline values.*

consistent with those typically detected in provincial New Zealand soils¹⁸ and well below the applicable human and environmental health guidelines.

PAH

The PAH results are summarised in Table 2 as the Benzo[a]pyrene equivalent (BAP_{eq}) which represents the carcinogenic components. Concentrations of BAP_{eq} were found to be consistent with levels typically detected in urban New Zealand soils¹⁹, and well below the applicable human and environmental health guidelines.

Asbestos

Asbestos results are not shown in the tables as no asbestos was detected in the 15 samples analysed for asbestos.

5.4.1 Disposal

The results show that due to the heavy metal contamination reported in soils surrounding the sheep dip and adjacent sheds, the central woolshed/workshop, the burn pile, the dwellings at 274 and 292 Dukes Road North, and the area surrounding location D8, these soils cannot be considered ‘clean fill’ and must be regarded as contaminated for disposal.

Average heavy metal total concentrations in the above noted locations (particularly lead and zinc) exceed the Green Island Landfill acceptance criteria, along with the leachable zinc at locations D24 and D37 and arsenic at D45 (Table 7). The total concentrations of arsenic, lead and/or zinc at locations D24, D26, D37, D39, D44 and D45 also exceed the Burnside Landfill acceptance criteria, however leachability analysis (Table 7) indicates that the material meets the leachable acceptance criteria and is suitable for disposal to the Burnside Landfill. Note that the leachable arsenic at location D45 was assessed via SPLP using leachate from the Burnside Landfill as the extractant in accordance with Condition 6 of the Burnside Landfill Consent RM17.198.01.V3, and this result cannot be used to assess acceptance at Green Island Landfill (or any other landfill). It is expected that the TCLP result would exceed the Green Island Landfill acceptance criteria.

Soils in locations where exceedances of the applicable human health guidelines were reported should not be retained on site for reuse if excavated, unless appropriately encapsulated.

Across the remainder of the site outside of the above noted areas, soils may be generally treated as ‘clean fill’ for disposal or retained on-site for reuse.

¹⁸ Manaaki Whenua – Landcare Research, 2015. *Background soil concentrations of selected trace elements and organic contaminants in New Zealand.*

¹⁹ Manaaki Whenua – Landcare Research, 2015. *Background soil concentrations of selected trace elements and organic contaminants in New Zealand.*

Table 4: Summary results of laboratory analysis

Sample ^A	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	BAP _{eq} ^B	DDT ^C
Former NZRAF Barracks:									
D1 (0-0.15 m)	14	0.26	29	23	32	28	87	-	-
D2 (0-0.15 m)	14	0.35	28	23	23	27	98	-	< 0.09
D3 (0-0.15 m)	14	0.26	29	22	25	27	94	-	< 0.08
D4 (0-0.15 m)	14	0.23	26	20	31	26	83	-	-
D5 (0-0.15 m)	14	0.29	30	21	36	27	95	-	-
D6 (0-0.15 m)	14	0.28	26	21	29	25	94	-	-
D7 (0-0.15 m)	15	0.28	28	23	39	26	95	-	-
D8 (0-0.15 m)	17	0.35	28	26	31	23	380	-	-
D9 (0-0.15 m)	13	0.23	26	24	26	25	119	-	-
D10 (0-0.15 m)	15	0.26	27	21	37	25	88	-	-
D11 (0-0.15 m)	14	0.33	28	23	27	26	90	-	-
D12 (0-0.15 m)	14	0.35	28	22	28	28	88	-	-
D13 (0-0.15 m)	17	0.31	34	28	34	28	92	-	-
D14 (0-0.15 m)	14	0.26	26	20	27	25	82	-	< 0.10
D15 (0-0.15 m)	15	0.26	29	21	23	28	85	-	< 0.09
D16 (0-0.15 m)	14	0.30	27	22	25	27	89	-	< 0.10
<i>Average</i>	15	0.29	28	23	30	26	110	-	< 0.09
<i>RSD</i>	8%	14%	7%	9%	17%	6%	66%	-	9%
Workshop:									
D37 (0-0.15 m)	75	4.1	81	76	210	40	1,160	< 0.029	-
D38 (0-0.15 m)	13	0.18	18	24	26	16	210	< 0.033	-
<i>Average</i>	44	2.14	50	50	118	28	685	< 0.031	-
<i>RSD</i>	100%	130%	90%	74%	110%	61%	98%	9%	-
Burn pile:									
D26 (0-0.15 m)	110	0.48	49	57	23	28	189	< 0.035	-
Fields (composite samples):									
D17, D35 & D36 (0-0.15 m)	15	0.28	25	20	21	24	75	-	< 0.10
D25, D27 & D28 (0-0.15 m)	14	0.37	27	22	21	28	88	-	< 0.11
D29, D30 & D31 (0-0.15 m)	16	0.38	29	22	23	29	90	-	< 0.10
D32, D33 & D34 (0-0.15 m)	17	0.30	28	21	24	25	89	-	< 0.10
<i>Average</i>	16	0.33	27	21	22	27	86	-	< 0.10
<i>RSD</i>	8%	15%	6%	5%	7%	9%	8%	-	5%
Soil Acceptance Criteria (Human Health – Commercial/Industrial)									
NES ^D SCS	70	1,300	6,300	>10,000	3,300	-	-	35	1,000
NEPM ^E SGV	-	-	-	-	-	6,000	400,000	-	-
Soil Quality Guidelines (Environmental Health)									
Eco-SGV ^F	60	17	400	190	1,290	35	285	22	4.8
Predicted Background									
Median ^G	2.64	0.085	12.57	11.05	10.67	5.93	46.03	0.052	0.053
95 th Quantile ^G	11.04	0.43	60.82	47.36	38.8	33.42	191	0.64	0.245
PBC Range ^H	8	0.01	2	3.8	17.2	1.4	47.5	-	-
	18.7	0.08	15.5	15.7	18.6	9.5	62.9	-	-
Landfill Screening Acceptance Criteria^I									
Green Island Landfill	100	20	100	100	100	200	200	300	50
Burnside Landfill	100	20	400	400	400	200	800	30	500

^A Results for total concentration analysis, average, SCS/SGV, in mg/kg dry weight; relative standard deviation (RSD) in %. Sample numbers are as marked in Figure 17.

^B The benzo(a)pyrene equivalent (BAP_{eq}) is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and indeno(1,2,3-cd)pyrene), multiplied by their respective potency equivalency factors from Table 40 in the *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health* (Ministry for the Environment, 2011. Wellington).

^C The total DDT isomers are reported.

^D Ministry for the Environment, 2012. *Users' Guide, National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*. Wellington. Cr SCS is reported as Cr(VI). *Commercial/industrial outdoor worker (unpaved)* scenario applied.

^E National Environment Protection Council (Australia), 2013. *National Environment Protection (Assessment of Site Contamination) Measure 1999*. The values applied represent a Health Investigation Level (HIL) for Commercial/industrial land use (HIL D).

^F Manaaki Whenua – Landcare Research, 2023. *An implementation framework for ecological soil guideline values*. 80% protection values applied. Cu and Zn values are based on the sensitive soil type. And Ni values from Manaaki Whenua – Landcare Research, 2015. *Background concentrations of trace elements and options for managing soil quality in the Tasman and Nelson Districts*.

^G Landcare Research, 2015. *Background soil concentrations of selected trace elements and organic contaminants in New Zealand*. Predicted median and 95th Quantile reported for the site (Chemical4 Factor: Conglomerate Maui). Note that part of the site is listed as Conglomerate Maui and part listed as Mudstone Pakihi. Conglomerate Maui has been selected as the more geologically relevant option based on site soils. BAP_{eq} and DDT for provincial land applied.

^H <https://iris.scinfo.org.nz/layer/114281-pbc-predicted-background-soil-concentrations-new-zealand-h3-resolution-9/>. (Ranges 1-5,0 ->99 percentile).

^I Ministry for the Environment, 2004. *Module 2: Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification*. And Burnside Landfill in Dunedin (RM17.198.01.V3).

Table 5: Summary results of laboratory analysis

Sample ^A	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc	DDT ^B
Sheep dip and yards area:								
D19 (0-0.15 m)	37	0.85	13	32	109	13	590	< 0.08
D20 (0-0.15 m)	16	0.30	17	17	29	14	118	< 0.09
D21 (0-0.15 m)	19	0.16	12	15	30	12	77	< 0.10
D22 (0-0.4 m)	38	1.19	16	37	390	15	550	< 0.08
D44 (0-0.15 m)	1,200	0.39	17	26	152	13	450	< 0.10
D45 (0-0.15 m)	144	0.46	14	47	135	23	380	< 0.07
<i>Average</i>	<i>242</i>	<i>0.56</i>	<i>15</i>	<i>29</i>	<i>141</i>	<i>15</i>	<i>361</i>	<i>< 0.09</i>
<i>RSD</i>	<i>195%</i>	<i>69%</i>	<i>14%</i>	<i>42%</i>	<i>94%</i>	<i>27%</i>	<i>60%</i>	
Northern sheds:								
D18 (0-0.15 m)	22	0.36	13	16	80	10	270	< 0.08
D41 (0-0.15 m)	25	0.84	17	43	250	17	390	< 0.09
D42 (0-0.15 m)	13	0.20	10	15	53	12	124	< 0.09
D43 (0-0.15 m)	21	0.31	18	28	121	17	186	< 0.08
<i>Average</i>	<i>20</i>	<i>0.43</i>	<i>15</i>	<i>26</i>	<i>126</i>	<i>14</i>	<i>243</i>	<i>< 0.09</i>
<i>RSD</i>	<i>25%</i>	<i>66%</i>	<i>25%</i>	<i>51%</i>	<i>69%</i>	<i>25%</i>	<i>47%</i>	<i>-</i>
Dwelling 292 Dukes Road North:								
D23 (0-0.15 m)	14	0.26	20	37	440	13	550	-
D24 (0-0.15 m)	17	1.98	26	115	750	18	1,610	-
<i>Average</i>	<i>16</i>	<i>1.12</i>	<i>23</i>	<i>76</i>	<i>595</i>	<i>16</i>	<i>1,080</i>	<i>-</i>
<i>RSD</i>	<i>14%</i>	<i>109%</i>	<i>18%</i>	<i>73%</i>	<i>37%</i>	<i>23%</i>	<i>69%</i>	<i>-</i>
Dwelling 274 Dukes Road North:								
D39 (0-0.15 m)	21	0.45	28	32	580	25	400	-
D40 (0-0.15 m)	14	0.43	25	54	152	23	290	-
D46 (0-0.15 m)	16	0.82	30	27	174	29	430	-
<i>Average</i>	<i>17</i>	<i>0.57</i>	<i>28</i>	<i>38</i>	<i>302</i>	<i>26</i>	<i>373</i>	<i>-</i>
<i>RSD</i>	<i>21%</i>	<i>39%</i>	<i>9%</i>	<i>38%</i>	<i>80%</i>	<i>12%</i>	<i>20%</i>	<i>-</i>
Soil Acceptance Criteria (Human Health – Commercial/Industrial)								
NES ^C SCS	70	1,300	6,300	>10,000	3,300	-	-	1,000
NEPM ^D SGV	-	-	-	-	-	6,000	400,000	-
Soil Quality Guidelines (Environmental Health)								
Eco-SGV ^E	60	17	400	190	1,290	35	285	4.8
Predicted Background								
Median ^F	2.64	0.085	12.57	11.05	10.67	5.93	46.03	0.052
95 th Quantile ^F	11.04	0.43	60.82	47.36	38.8	33.42	191	0.64
PBC Range ^G	8	0.01	2	3.8	17.2	1.4	47.5	-
	18.7	0.08	15.5	15.7	18.6	9.5	62.9	-
Landfill Screening Acceptance Criteria^H								
Green Island Landfill	100	20	100	100	100	200	200	50
Burnside Landfill	100	20	400	400	400	200	800	500

^A Results for total concentration analysis, average, SCS/SGV, in mg/kg dry weight; relative standard deviation (RSD) in %. Sample numbers are as marked in Figure 17.

^B The total DDT isomers are reported.

^C Ministry for the Environment, 2012. *Users' Guide, National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*. Wellington. Cr SCS is reported as Cr(VI). *Commercial/industrial outdoor worker (unpaved)* scenario applied.

^D National Environment Protection Council (Australia), 2013. *National Environment Protection (Assessment of Site Contamination) Measure 1999*. The values applied represent a Health Investigation Level (HIL) for Commercial/industrial land use (HIL D).

^E Manaaki Whenua – Landcare Research, 2023. *An implementation framework for ecological soil guideline values*. 80% protection values applied. Cu and Zn values are based on the sensitive soil type. And Ni values from Manaaki Whenua – Landcare Research, 2015. *Background concentrations of trace elements and options for managing soil quality in the Tasman and Nelson Districts*.

^F Landcare Research, 2015. *Background soil concentrations of selected trace elements and organic contaminants in New Zealand*. Predicted median and 95th Quantile reported for the site (Chemical4 Factor: Conglomerate Maui). Note that part of the site is listed as Conglomerate Maui and part listed as Mudstone Pakihi. Conglomerate Maui has been selected as the more geologically relevant option based on site soils. DDT for provincial land applied.

^G <https://iris.scinfo.org.nz/layer/114281-pbc-predicted-background-soil-concentrations-new-zealand-h3-resolution-9/>. (Ranges 1-5.0 - >99 percentile).

^H Ministry for the Environment, 2004. *Module 2: Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification*. And Burnside Landfill in Dunedin (RM17.198.01.V3).

Table 6: Summary results of XRF analysis (sheep dip area)

Sample ^A	Arsenic	Chromium	Copper	Lead	Nickel	Zinc
Identified area of contamination surrounding the sheep dip:						
A (0-0.15 m) average	866	< 47	24	158	10	242
A (0.5-0.6 m) average	1,394	62	22	37	16	133
B (0-0.15 m) average	1,071	39	17	52	12	167
B (0.3 m)	1,357	< 65	24	31	25	164
B (0.4 m)	552	38	12	12	8	65
C (0-0.3 m) average	75	< 55	16	20	12	115
D (0-0.15 m) average	218	< 53	17	24	< 11	161
D (0.4-0.6 m)	32	40	18	26	21	92
E (0-0.3 m) average	435	48	49	32	10	112
F (0-0.15 m)	256	< 53	12	37	7	132
G (0-0.15 m)	128	< 49	16	26	8	97
I (0-0.15 m)	111	< 46	16	23	7	111
J (0-0.15 m)	36	< 42	13	18	6	185
L (0-0.15 m)	110	< 52	22	47	< 10	186
<i>Average</i>	513	< 50	21	42	12	143
<i>RSD</i>	105%	17%	60%	97%	42%	33%
<i>UCL</i>	837	53	25	55	14	161
Estimated edge of the sheep dip contamination:						
H (0-0.15 m)	13	< 45	7	15	< 9	63
K (0-0.15 m)	19	< 60	26	17	11	136
M (0-0.15 m)	15	< 60	14	33	< 12	82
N (0-0.15 m)	16	< 45	19	48	< 9	190
<i>Average</i>	16	< 53	17	28	10	118
<i>RSD</i>	16%	16%	49%	55%	15%	49%
Soil Acceptance Criteria (Human Health – Commercial/Industrial)						
NES ^B SCS	70	6,300	>10,000	3,300	-	-
NEPM ^C SGV	-	-	-	-	6,000	400,000
Soil Quality Guidelines (Environmental Health)						
Eco-SGV ^D	60	400	190	1,290	35	285
Predicted Background						
Median ^E	2.64	12.57	11.05	10.67	5.93	46.03
95 th Quantile ^E	11.04	60.82	47.36	38.8	33.42	191
PBC Range ^F	8	2	3.8	17.2	1.4	47.5
	18.7	15.5	15.7	18.6	9.5	62.9
Landfill Screening Acceptance Criteria^G						
Green Island Landfill	100	100	100	100	200	200
Burnside Landfill	100	400	400	400	200	800

^A Results for XRF analysis, average and 95% upper confidence limit (UCL) in ppm, SCS/SGV in mg/kg dry weight; relative standard deviation (RSD) in %. UCL calculated with ProUCL. Where concentrations are reported less than the limit of detection (LOD), the LOD value has been used in calculations. Sample numbers are as marked in Figure 18.

^B Ministry for the Environment, 2012. *Users' Guide, National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*. Wellington. Cr SCS is reported as Cr(VI). *Commercial/industrial outdoor worker (unpaved)* scenario applied.

^C National Environment Protection Council (Australia), 2013. *National Environment Protection (Assessment of Site Contamination) Measure 1999*. The values applied represent a Health Investigation Level (HIL) for Commercial/industrial land use (HIL D).

^D Manaaki Whenua – Landcare Research, 2023. *An implementation framework for ecological soil guideline values*. 80% protection values applied. Cu and Zn values are based on the sensitive soil type. And Ni values from Manaaki Whenua – Landcare Research, 2015. *Background concentrations of trace elements and options for managing soil quality in the Tasman and Nelson Districts*.

^E Landcare Research, 2015. *Background soil concentrations of selected trace elements and organic contaminants in New Zealand*. Predicted median and 95th Quantile reported for the site (Chemical4 Factor: Conglomerate Maui). Note that part of the site is listed as Conglomerate Maui and part listed as Mudstone Pakihi. Conglomerate Maui has been selected as the more geologically relevant option based on site soils.

^F <https://iris.scinfo.org.nz/layer/114281-pbc-predicted-background-soil-concentrations-new-zealand-h3-resolution-9/>. (Ranges 1-5.0 - >99 percentile).

^G Ministry for the Environment, 2004. *Module 2: Hazardous Waste Guidelines - Landfill Waste Acceptance Criteria and Landfill Classification*. And Burnside Landfill in Dunedin (RM17.198.01.V3).

Table 7. Summary of leachability analysis

Sample ^A	Arsenic	Lead	Zinc
TCLP			
D24 (0-0.15 m)	-	0.089	3.1
D26 (0-0.15 m)	0.34	-	-
D37 (0-0.15 m)	-	-	3.5
D39 (0-0.15 m)	-	0.05	-
D45 (0-0.15 m)	0.96	-	-
SPLP			
D44 (0-0.15 m)	0.123	-	-
Landfill Acceptance Criteria ^B – Leachability			
Burnside Landfill	2.5	2.5	5

^A Results for total concentration analysis in mg/kg dry weight, leachable analysis in g/m³.

^B RM17.198.01.V3.

5.5 Quality Control

The following quality assurance/quality control (QA/QC) procedures were employed:

- The use of independent accredited laboratories:
Hill Laboratories is an independent IANZ accredited laboratory. The laboratory complies with the accreditation requirements including the confirmation of validity and suitability of results. No breaches in laboratory quality are noted in the analysis reports. Samples were composited in the laboratory.
- Sample handling and holding times:
The chain of custody records show that the samples were submitted to the laboratory within the accepted holding times for the analyses conducted.
- Field QA/QC:
 - Sampling equipment was cleaned between sampling locations.
 - Soil samples were individually numbered together with collection date and time, as marked on the sample containers and chain of custody documents, and the location recorded with a handheld Garmin GPSMAP 64.
 - Samples were collected in laboratory supplied sample containers.
 - Samples were stored and transported in a chilly bin cooled with icepacks, together with the chain of custody documents.
- XRF QA/QC:
 - The Olympus Vanta VMR limits of detection are more than 5-fold lower than the guideline value that are being assessed, with the exception of cadmium.
 - No saturated soils were assessed.
 - Blank controls were used to validate the XRF readings in the field.

6 Site Characterisation

6.1 Type and Extent of Environmental Contamination

The results indicate that heavy metal contamination is present across parts of the site surrounding the northern sheds and sheep dip, the central woolshed/workshop, a burn pile (D26), the dwellings at 274 and 292 Dukes Road North, and location D8. Contaminant concentrations across the remainder of the site, including within the former RNZAF barracks area, were found to be consistent with predicted background concentrations.

These results indicate that HAIL activities have occurred across various parts of the site. The results are highlighted in Figures 19, 20 and 21, where locations reporting exceedances of the *Commercial/Industrial SCS/SGV* are denoted in red, and locations reporting elevations above the predicted background level but below the *Commercial/Industrial SCS/SGV* are denoted in orange. Locations found to be consistent with predicted background levels are coloured green. Identified HAIL sites are outlined in red, and possible HAIL sites outlined in orange.

Identified HAIL sites/possible HAIL sites:

Based on the results reported, various areas of confirmed or possible HAIL activity have been identified, as outlined in Figures 19, 20 and 21.

Sheep Dip:

Concentrations of arsenic reported surrounding the sheep dip and yards (D44, D45, A – G, I and L) were found to exceed the *Commercial/Industrial outdoor worker (unpaved) SCS*, indicating that this part of the site presents a risk to human health under the proposed commercial/industrial land use and during development works. Average concentrations of arsenic and zinc across this area exceed the applicable environmental guidelines, indicating that this part of the site may also present a risk to environmental health. This area must be considered a HAIL site under HAIL Category A8 (*Livestock dip or spray race operations*).

Note that arsenic concentrations surrounding the sheep dip were found to be extremely high and were reported to be over 20 times the human health guidelines in XRF samples and over 17 times the guidelines in laboratory samples collected from directly adjacent to the sheep dip. The exceedances were found to extend to at least 0.6 m depth directly adjacent to the sheep dip, but the contamination reduces in depth in the wider halo surrounding the sheep dip. Due to gravel and brick fill material present, the full depth of contamination present adjacent to the sheep dip was not able to be determined, and contamination may extend beyond 0.6 m depth. Contamination was found to extend laterally roughly 15 m south, 20 m north of the sheep dip and approximately 5 m east of the concrete platform at the end of the sheep dip. On the western side of the dip, site soils were not able to be analysed as the base of the sheep yards is currently surfaced in concrete. The age of the concrete is unknown and there is potential for contamination to be present extending beneath the concrete.

Northern Sheds:

Heavy metal concentrations in soils surrounding the northern sheds were found to be elevated above predicted background concentrations. No contaminant concentrations in this area were reported to exceed the *Commercial/Industrial SCS/SGV*, and average contaminant concentrations are below the applicable environmental guidelines, indicating that this part of the site is unlikely to present a risk to human or environmental health under the proposed commercial/industrial land use or during development works. However, note that concentrations of zinc reported at one location (D41) exceed the environmental guidelines, and given the limited sampling and analysis conducted,

this area must be considered a possible HAIL site. As the contamination is likely due to the accidental release of contaminants from building materials on the sheds, such as lead paint, from spillages associated with materials stored in the sheds, or leaching of contaminants from treated timber, the HAIL activity is associated with 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*).

Central Woolshed/Workshop:

Concentrations of heavy metals adjacent to the former woolshed/current workshop in the centre of the site were found to be elevated above predicted background levels. Concentrations of arsenic at one location were found to exceed the *Commercial/Industrial outdoor worker (unpaved) SCS*, and these soils may present a risk to human health under the proposed commercial/industrial land use and during development works. Average concentrations of zinc reported exceed the applicable environmental guidelines, indicating that this area may also present a risk to environmental health.

This part of the site must be considered a HAIL site. Whilst the current use of the building appears to be for workshop related activities, PAH concentrations in the samples collected were found to be consistent with predicted background concentrations. Given the PAH results and the small scale of the workshop activities (non-commercial) which appear to have only been occurring since the early 2010s, HAIL Category F8 (*Motor vehicle workshops*) is unlikely to apply. The heavy metal contamination detected is likely to be related to treated timber from the former sheep yards, or accidental release of contaminants from building materials or spillages, and therefore the most relevant HAIL category for this part of the site is HAIL Category I.

Burn Pile:

Concentrations of heavy metals within a suspected burn pile area (location D26) were found to be elevated above predicted background levels. Concentrations of arsenic were reported to exceed the *Commercial/Industrial outdoor worker (unpaved) SCS* and the applicable environmental guidelines, and these soils may present a risk to human and environmental health under the proposed commercial/industrial land use and during development works. This part of the site must be considered a HAIL site under HAIL Category I.

Dwellings at 274 and 292 Dukes Road North:

Concentrations of heavy metals surrounding the dwellings and associated sheds/garages at 274 and 292 Dukes Road North were found to be elevated above predicted background levels. Whilst heavy metal concentrations in these areas were found to be below the *Commercial/Industrial SCS/SGV*, note that concentrations of arsenic and/or lead exceed the *Rural Residential SCS* in some locations (samples D23, D24 and D39), and therefore these soils present a risk to human health under the current land use. Average concentrations of zinc across both dwellings exceed the applicable environmental guidelines, indicating that this area may also present a risk to environmental health. This area must be considered a HAIL site under HAIL Category I.

Location D8:

Elevated concentrations of zinc were reported at location D8. The concentration of zinc reported is above the applicable environmental guidelines, but is well below human health guidelines and is highly unlikely to present a risk to human health under the current or proposed land use, or during development works. The area surrounding location D8 should be considered a possible HAIL site.

Remainder of the site:

Contaminant concentrations reported across the remainder of the site, including within the majority of the former RNZAF barracks area, were found to be consistent with predicted background concentrations, and these soils may be considered ‘clean fill’ for disposal.



Figure 19: Sampling locations across the site. Locations denoted in red indicate samples with contaminant concentrations that exceed the Commercial/Industrial SCS/SGV, and locations coloured orange indicate samples with contaminant concentrations above background but below the Commercial/Industrial SCS/SGV. Locations coloured green indicate samples consistent with predicted background. Areas outlined in red indicate identified HAIL sites and areas outlined in orange indicate possible HAIL sites (aerial imagery sourced from Google Earth, imagery © 2025 Airbus).

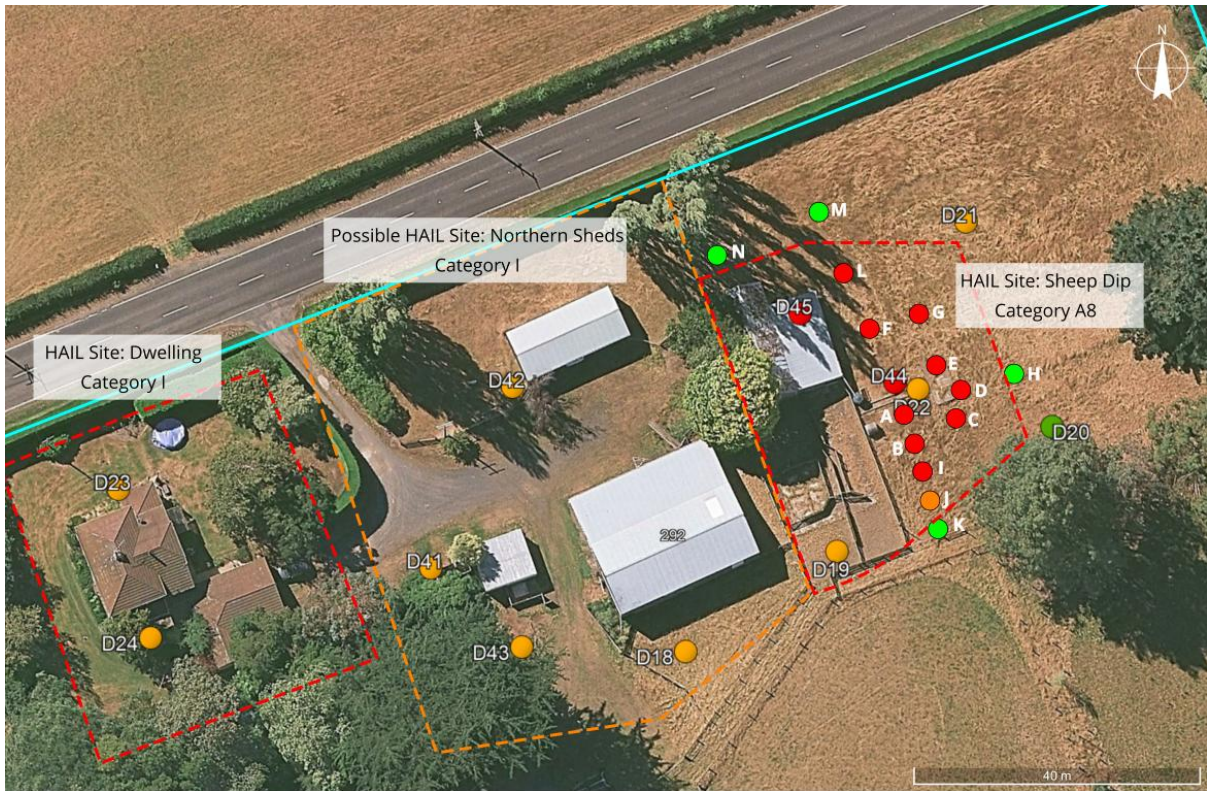


Figure 20: Sampling locations across the northern end of the site. Locations denoted in red indicate samples with contaminant concentrations that exceed the Commercial/Industrial SCS/SGV, and locations coloured orange indicate samples with contaminant concentrations above background but below the Commercial/Industrial SCS/SGV. Locations coloured green indicate samples consistent with predicted background. Areas outlined in red indicate identified HAIL sites and areas outlined in orange indicate possible HAIL sites (aerial imagery sourced from Google Earth, imagery © 2025 Airbus).



Figure 21: Sampling locations across the northern end of the site. Locations denoted in red indicate samples with contaminant concentrations that exceed the Commercial/Industrial SCS/SGV, and locations coloured orange indicate samples with contaminant concentrations above background but below the Commercial/Industrial SCS/SGV. Locations coloured green indicate samples consistent with predicted background. Areas outlined in red indicate identified HAIL sites, and areas outlined in orange indicate possible HAIL sites (aerial imagery sourced from Google Earth, imagery © 2025 Airbus).

Development risk

Concentrations of arsenic reported surrounding the sheep dip (D44, D45, A – G, I and L), within the burn pile (D26) and adjacent to the central woolshed/workshop (D37) were found to exceed the *Commercial/Industrial outdoor worker (unpaved) SCS*, and soils in these locations present a risk to human health during development works. Note that concentrations of arsenic reported within the sheep dip area are extremely high. Appropriate precautions, such as the implementation of a Contaminated Site Management Plan (CSMP) should be put into place prior to earthworks in this location to ensure that the works do not pose a risk to human health.

Environmental Risk

Heavy metal concentrations across the majority of the site were found to be well below the Eco-SGV guidelines protective of environmental health. However, average concentrations of zinc surrounding the central woolshed/workshop and the dwellings at 274 and 292 Dukes Road North, zinc at locations D8 and D41, arsenic within the burn pile, and zinc and arsenic and surrounding the sheep dip and yards, were found to exceed the environmental guidelines. Appropriate precautions, such as the implementation of a CSMP should be put into place prior to earthworks in these locations to ensure that the works do not pose a risk to environmental health.

Asbestos

Whilst no asbestos was detected in any of the 15 soil samples analysed from across the site, note that council records indicate that ACM may have been used on parts of the dwellings or sheds on the site, and an asbestos survey is advised to be conducted prior to the demolition of any buildings. Additional soil sampling and analysis for asbestos may be recommended (potentially post-demolition) depending on the results of the asbestos survey.

Remediation

Due to the exceedances of the *Commercial/Industrial outdoor worker (unpaved)* SCS reported surrounding the sheep dip (locations D44, D45, A – G, I and L), within the burn pile (D26) and adjacent to the central woolshed/workshop (D37), remediation of these parts of the site are advised. Remediation methods may include capping or encapsulation of the affected soils on-site, removal of soils, or a combination both. Additional sampling and analysis may be required to facilitate the remediation.

If the proposed commercial/industrial redevelopment of the site does not proceed, and the site is intended to retain the current rural residential land use, remediation or management of the area surrounding the dwellings at 274 and 292 Dukes Road North is also advised. However, note that no exceedances of the commercial/industrial human health guidelines were reported surrounding the dwellings, and remediation of these areas is not required under the proposed commercial industrial land use.

6.2 Conceptual Site Model and Exposure Routes

Based on the results of the soil sampling presented in this report, localised parts of the site surrounding the sheep dip (locations D44, D45, A – G, I and L), within the burn pile (D26) and adjacent to the central woolshed/workshop (D37) present a risk to human health under a commercial/industrial land use scenario due to exceedances of the *Commercial/Industrial outdoor worker (unpaved)* SCS for arsenic. A conceptual site model has been developed, and the likely routes of exposure and potential receptors are outlined in Table 8, which has been developed based on the proposed commercial/industrial land use. However, note that the site is currently used in part for rural residential land use, and parts of the site surrounding the dwellings present a risk to human health under this current land use, which is not outlined in Table 8 below.

The pathways for human exposure to contaminants consist of ingestion of soil, dust or contaminated groundwater, particulate inhalation, consumption of produce grown in contaminated soils, and absorption through the skin during contact with contaminated soil. Under the proposed commercial/industrial land use, consumption of contaminated produce is not considered a valid pathway. As a reticulated water supply is available at Dukes Road North, the consumption of potentially contaminated groundwater at the site is not considered likely, although note that bores are currently present on the property.

Ingestion of soil or dust is the primary pathway for arsenic contamination at the site, with dermal absorption being insignificant for arsenic.

Future staff on the property are the primary receptors. Other receptors include construction/site workers during site development works, and ongoing maintenance activities. Residents on the adjoining land may also be exposed, primarily from dust emissions or run-off.

Table 8: Assessment of exposure routes and receptors

Receptor	Pathways					Risk/Justification
	Soil Ingestion	Produce Ingestion	Water Ingestion	Dermal Contact	Inhalation	
Regular Staff	Complete	Incomplete	Possibly complete	Complete	Complete	Moderate to high in localised affected areas due to exceedances of the commercial/industrial human health guidelines for arsenic. The risk is particularly high surrounding the sheep dip.
Maintenance & Service Staff	Complete	Incomplete	Possibly complete	Complete	Complete	
Construction Workers	Complete	Incomplete	Possibly complete	Complete	Complete	
Neighbouring Properties	Possibly Complete	Incomplete	Incomplete	Possibly Complete	Possibly Complete	Low – the risk is particularly low if the works are appropriately managed. Given the location of the identified HAIL sites are generally contained within the wider property, surface water/rainwater run off carrying contaminants is unlikely to enter neighbouring properties. Dust emissions could affect all nearby neighbours.

6.3 Integrity Assessment

The site history spans a period of over 160 years and is mostly continuous since 1942. Together with aerial photography, sufficient supporting evidence is available to provide a relatively complete history of land use. Based on the continuity and amount of evidence, the information available provides a reasonable record of activity at the site, which reflects data integrity. Whether all activities at the site have been discovered cannot be answered with confidence. Given the history of potential HAIL activities at and near the site, a programme of investigative sampling and analysis was undertaken as a part of this DSI, which provides a reliable indicator of the presence (or lack thereof) of contamination that might arise from prior and/or present land use.

7 Summary and Conclusions

EC Otago has undertaken a DSI of the properties at 270 – 292 Dukes Road North, Mosgiel. The DSI included undertaking historical research, a site inspection and soil sampling. During this investigation, samples were collected from 46 locations across the site and analysed as a mixture of individual and composite samples for heavy metals, with 15 individual and four composite samples also analysed for OCP and three individual samples also analysed for PAH. An additional 14 locations surrounding the sheep dip were analysed for heavy metals via XRF. Fifteen locations around former and existing buildings were also analysed for asbestos.

The sampling and analysis conducted indicates that contaminant concentrations across the majority of the site are consistent with predicted background concentrations. However, various localised areas of contamination were identified, as highlighted in Figures 19, 20 and 21.

- Sheep Dip:** Concentrations of arsenic reported surrounding the sheep dip were found to exceed the *Commercial/Industrial outdoor worker (unpaved)* SCS, indicating that this part of the site presents a risk to human health under the proposed commercial/industrial land use and during development works. Concentrations of arsenic reported directly adjacent to the sheep dip were found to be extremely high, over 20 times the human health guidelines. Average concentrations of arsenic across this area exceed the applicable environmental guidelines, indicating that this part of the site may also present a risk to environmental health. This area must be considered a HAIL site. The contamination was found to extend to at least 0.6 m depth directly adjacent to the sheep dip, although appears to reduce in depth in the wider halo surrounding the sheep dip. Contamination was found to extend laterally roughly 15 m south, 20 m north of the sheep dip and approximately 5 m east of the concrete platform at the end of the sheep dip.
- Central Woolshed/Workshop:** Concentrations of heavy metals adjacent to the former woolshed/current workshop in the centre of the site were found to be elevated above predicted background levels. Concentrations of arsenic at one location were found to exceed the *Commercial/Industrial outdoor worker (unpaved)* SCS, and these soils may present a risk to human health under the proposed commercial/industrial land use and during development works. Average concentrations of zinc reported exceed the applicable environmental guidelines, indicating that this area may also present a risk to environmental health. This part of the site must be considered a HAIL site.
- Burn Pile:** Concentrations of heavy metals within a suspected burn pile area (location D26) were found to be elevated above predicted background levels. Concentrations of arsenic were reported to exceed the *Commercial/Industrial outdoor worker (unpaved)* SCS and the applicable environmental guidelines, and these soils may present a risk to human and environmental health under the proposed commercial/industrial land use and during development works. This part of the site must be considered a HAIL site.
- Dwellings at 274 and 292 Dukes Road North:** Concentrations of heavy metals surrounding the dwellings and associated sheds/garages at 274 and 292 Dukes Road North were found to be elevated above predicted background levels. Whilst heavy metal concentrations in these areas were found to be below the *Commercial/Industrial SCS/SGV*, note that concentrations of arsenic and/or lead exceed the *Rural Residential SCS* in some locations (samples D23, D24 and D39), and therefore these soils present a risk to human health under the current land use. Average concentrations of zinc around both dwellings exceeds the applicable environmental guidelines, indicating that this area may also present a risk to environmental health. This area must be considered a HAIL site.

- **Northern Sheds:** Heavy metal concentrations in soils surrounding the northern sheds were found to be elevated above predicted background concentrations. No contaminant concentrations in this area were reported to exceed the *Commercial/Industrial SCS/SGV*, and average contaminant concentrations are below the applicable environmental guidelines, indicating that this part of the site is unlikely to present a risk to human or environmental health under the proposed commercial/industrial land use or during development works. However, note that concentrations of zinc reported at one location (D41) exceed the environmental guidelines, and given the limited sampling and analysis conducted, this area must be considered a possible HAIL site.
- **Location D8:** Elevated concentrations of zinc were reported at location D8. The concentration of zinc reported is elevated above the applicable environmental guidelines, but is well below human health guidelines and is highly unlikely to present a risk to human health under the current or proposed land use, or during development works. This area should be considered a possible HAIL site.

Contaminant concentrations reported across the remainder of the site, including across the majority of the former RNZAF barracks area, were found to be consistent with predicted background concentrations, and the remainder of the site is not considered a HAIL site.

The information reviewed has confirmed that HAIL activity has occurred across parts of the site. As a result, the provisions of the NES apply to those parts of the site due to:

- Category A8 (*Livestock dip or spray race operations*) – very high levels of arsenic contamination have been reported in the area surrounding the sheep dip, at concentrations that present a risk to both human and environmental health under the proposed commercial/industrial land use and during development works. This activity presents a high risk to the site, but is localised to the area surrounding the sheep dip as identified in Figure 20.
- 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*) – accidental release of contaminants appears to have occurred surrounding the existing dwellings and sheds where contaminants such as lead from lead paint, arsenic from treated timber or accidental spillages may have been released to site soils. Additionally, heavy metal contamination has been released to site soils in the location of a burn pile. Concentrations of arsenic have been reported in these locations above the commercial/industrial human health guidelines, presenting a moderate to high but localised risk to the affected parts of the site.

From this investigation, EC Otago finds the following:

- Based on the information examined during this investigation, HAIL activities have historically been, or are currently being, undertaken on parts of the site under consideration. Consequently, the provisions of the NES apply to those parts of the site in accordance with Regulation 5(7).
- Soil sampling and analysis has identified that heavy metal contamination is present in localised parts of the site surrounding the northern sheds and sheep dip, the central woolshed/workshop, a burn pile (D26), the dwellings at 274 and 292 Dukes Road North, and location D8. Concentrations of arsenic reported surrounding the sheep dip (locations D44, D45, A – G, I and L), = within the burn pile (D26) and adjacent to the central woolshed/workshop (D37) were found to exceed the *Commercial/Industrial outdoor worker (unpaved) SCS*. Concentrations of arsenic and/or lead were also found to exceed the *Rural Residential SCS* in some locations adjacent to the dwellings at 274 and 292 Dukes Road North

(samples D23, D24 and D39). These localised areas present a risk to human health under the proposed commercial/industrial land use, and the current rural residential land use, and must be considered HAIL sites.

- Due to the exceedances of the *Commercial/Industrial SCS*, remediation of the affected parts of the site is advised. Remediation methods may include capping/encapsulation of the affected soils on-site, removal of soils, or a combination of both. Additional sampling and analysis may be required to facilitate the remediation. If the proposed commercial/industrial redevelopment of the site does not proceed, and the site is intended to retain the current rural residential land use, remediation or management of the area surrounding the dwellings at 274 and 292 Dukes Road North is also advised.
- Contaminant concentrations in soils across the majority of the site were found to be consistent with the predicted background and the majority of site soils may be treated as 'clean fill' for disposal. Where heavy metal contamination has been detected across the site, these soils cannot be treated as 'clean fill' and must be disposed to an appropriately consented location if removed from the site. The results of sampling and analysis indicate that soils are suitable for disposal to the Burnside Landfill. Soils in locations where exceedances of the applicable human health guidelines were reported should not be retained on site for reuse if excavated, unless appropriately encapsulated.
- Heavy metal concentrations across the majority of the site were found to be well below the guidelines protective of environmental health. However, average concentrations of zinc surrounding the central woolshed/workshop and the dwellings at 274 and 292 Dukes Road North, at locations D8 and D41, arsenic within the burn pile, and both zinc and arsenic surrounding the sheep dip and yards, were found to exceed the environmental guidelines. Appropriate precautions, such as the implementation of a CSMP should be put into place prior to earthworks in these locations to ensure that the works do not pose a risk to environmental health.
- Whilst no asbestos was detected in any of the 15 soil samples analysed from across the site, council records indicate that ACM may have been used on parts of the dwellings or sheds, and an asbestos survey is advised to be conducted prior to the demolition of any buildings. Additional soil sampling and analysis for asbestos may be recommended depending on the results of the asbestos survey.
- Given that the NES applies to parts of the site, a resource consent is required from the DCC if proposed earthworks in those parts of the site exceed the disturbance of more than 25 m³ per 500 m² or disposal off-site of more than 5 m³ per 500 m² per year. As contaminant concentrations have been detected above the applicable human and environmental health guidelines in the identified HAIL areas, consent will be required from the ORC for the disturbance of contaminated soil in these areas.
- If unexpected waste materials, or other visual or olfactory indicators of potential contamination, or anomalous ground conditions are observed during earthworks, a Contaminated Land Advisor must be consulted, and further sampling and analysis is required.

8 References

- e3Scientific Limited, 2025. *Southern Link Inland Port Preliminary Site Investigation*.
- Manaaki Whenua – Landcare Research, 2015. *Background soil concentrations of selected trace elements and organic contaminants in New Zealand*. Landcare Research Contract Report: LC2440.
- Manaaki Whenua – Landcare Research, 2023. *An implementation framework for ecological soil guideline values*.
- Ministry for the Environment, 2021. *Contaminated Land Management Guidelines No. 1 - Reporting on Contaminated Sites in New Zealand (Revised 2021)*. Publication number: ME 1475; ISBN 978-1-98-857958-0.
- Ministry for the Environment, 2012. *Users' Guide - National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*. Publication number: ME 1092; ISBN 978-0-478-37281-6 (print); 978-0-478-37282-3 (electronic).
- Ministry for the Environment, 2011. *Contaminated Land Management Guidelines No. 2 – Hierarchy and Application in New Zealand of Environmental Guideline Values (Revised 2011)*. Publication number: ME 1072; ISBN 978-0-478-37259-5.
- Ministry for the Environment, 2011. *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health*. Publication number: ME 1055; ISBN 978-0-478-37237-3.
- National Environment Protection Council (Australia), 2013. *National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013)*. (<https://www.legislation.gov.au/Details/F2013C00288>).
- Otago Regional Council, 2009. *Groundwater Lower Taieri Basin Summary Report December 09*.

9 Limitations

Services for this project have been performed in accordance with current professional standards for environmental site assessments. No guarantees are either expressed or implied. This report meets the requirements of the NES as it has been undertaken in accordance with the *Contaminated Land Management Guidelines (No. 1 and No. 5)* and is certified by a suitably qualified and experienced practitioner. A statement of EC Otago's experience is attached as Appendix A. This report does not attempt to fulfil the requirements of legal due diligence.

There is no investigation that is thorough enough to preclude the presence of materials at the site that presently, or in the future, may be considered hazardous. As regulatory criteria are subject to change, a status with respect to contamination that is presently considered to be acceptable may, in the future, become subject to different regulatory standards that cause the site to become unacceptable for existing or proposed land use activities. Any recommendations, opinions or findings stated in this report are based on circumstances, facts and assessment criteria as they existed at the time that we performed the work and on data obtained from the investigations and site observations as detailed in this report.

Opinions and judgments expressed in this report, which are based on an understanding and interpretation of assessment standards should not be construed as legal opinions. This report, and the information it contains have been prepared solely for the use of by Southern Link Property Limited. Any reliance on this report by other parties shall be at such party's own risk without prior agreement to the contrary.

Appendix A - EC Otago Statement of Experience

Environmental Consultants Otago Limited (EC Otago) was originally established in Dunedin in 2014 when the principal, Ciaran Keogh, recognized the need for a dedicated environmental consultancy in the region. Following Ciaran's retirement in 2025, the company continues to operate as Environmental Consultants Otago 2025 Limited. The company is particularly focused on contaminated land issues, with more than 400 site investigations completed. EC Otago undertakes the preparation of Preliminary and Detailed Site Investigation Reports, Assessments of Environmental Effects, Site Remedial Action Plans, Soil Disposition Reports and Site Validation Reports, working together with other environmental consultancies when a broader range of experience is required.

Bernice Chapman - Senior Contaminated Land Consultant

CEnvP, PhD in Biochemistry.

Berni is a Certified Environmental Practitioner (Certification Number 1376) who has worked in consultancy firms for over 20 years in the waste management, waste-to-energy and contaminated land sectors, with a focus on contaminated land management for the past 8 years with EC Otago. She has a strong ethos of waste minimisation, containment and management, the effective operation of existing resources with beneficial reuse where possible, protection of the environment and overall sustainability coupled with a pragmatic approach from direct involvement in day-to-day operations. Her experience includes preliminary and detailed site investigations, sampling and analysis, site remediation, feasibility studies, problem solving and process design. This work includes the management of a range of environmentally polluting industrial effluents, contaminated land investigations and site remediation.

Berni has previously worked as Laboratory Manager for Waste Solutions Ltd, an Associate for CPG New Zealand Ltd, and a Wastewater Treatment Specialist for ADI Systems.

Aleasha King – Contaminated Land Consultant

Graduate diploma in Geology, Master in Geophysics.

Aleasha is a Contaminated Land Consultant with a background in geology and geophysics and a strong commitment to the environment. Her experience in contaminated land investigations includes four years with EC Otago undertaking preliminary and detailed site investigations, sampling, data analysis and site remediation.

Aleasha has previously worked in Engineering Geology with experience in site soils investigations and bearing capacity assessments. For her master's degree, she studied the structure of the Alpine Fault at a formerly unmapped location on the West Coast of New Zealand.

Appendix B – Hill Laboratories Analysis Reports

Certificate of Analysis

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Client:	Environmental Consultants Otago 2025 Limited	Lab No:	4011665	A2Pv1
Contact:	Bernice Chapman C/- Environmental Consultants Otago 2025 Limited 20 Hilton Road Highcliff Dunedin 9013	Date Received:	18-Oct-2025	
		Date Reported:	23-Oct-2025	
		Quote No:	137150	
		Order No:		
		Client Reference:	270 Dukes	
		Submitted By:	Aleasha King	

Sample Type: Soil

Sample Name:	D1 0-0.15m 16-Oct-2025 11:05 am	D4 0-0.15m 16-Oct-2025 11:40 am	D5 0-0.15m 16-Oct-2025 12:05 pm	D6 0-0.15m 16-Oct-2025 12:15 pm	D7 0-0.15m 16-Oct-2025 12:25 pm
Lab Number:	4011665.1	4011665.2	4011665.3	4011665.4	4011665.5
Asbestos Presence / Absence	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form	-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001
As Received Weight	g 650.6	g 746.8	g 730.1	g 716.4	g 647.3
Dry Weight	g 469.0	g 487.5	g 434.5	g 431.4	g 402.7
Moisture*	% 28	% 35	% 40	% 40	% 38
Sample Fraction >10mm	g dry wt < 0.1	g dry wt 81.2	g dry wt 88.6	g dry wt 38.8	g dry wt 44.6
Sample Fraction <10mm to >2mm	g dry wt 119.4	g dry wt 107.2	g dry wt 161.6	g dry wt 156.6	g dry wt 78.2
Sample Fraction <2mm	g dry wt 347.8	g dry wt 297.2	g dry wt 182.0	g dry wt 233.4	g dry wt 277.0
<2mm Subsample Weight	g dry wt 51.0	g dry wt 50.2	g dry wt 55.0	g dry wt 50.7	g dry wt 51.8
Weight of Asbestos in ACM (Non-Friable)	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001	g dry wt < 0.00001

Sample Name:	D8 0-0.15m 16-Oct-2025 12:35 pm	D9 0-0.15m 16-Oct-2025 12:55 pm	D10 0-0.15m 16-Oct-2025 1:15 pm	D11 0-0.15m 16-Oct-2025 1:35 pm	D12 0-0.15m 16-Oct-2025 1:25 pm
Lab Number:	4011665.6	4011665.7	4011665.8	4011665.9	4011665.10
Asbestos Presence / Absence	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form	-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001	% w/w < 0.001
As Received Weight	g 696.3	g 677.1	g 791.6	g 737.5	g 719.8
Dry Weight	g 476.9	g 443.1	g 556.6	g 515.8	g 489.9



This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised. The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil

Sample Name:	D8 0-0.15m 16-Oct-2025 12:35 pm	D9 0-0.15m 16-Oct-2025 12:55 pm	D10 0-0.15m 16-Oct-2025 1:15 pm	D11 0-0.15m 16-Oct-2025 1:35 pm	D12 0-0.15m 16-Oct-2025 1:25 pm	
Lab Number:	4011665.6	4011665.7	4011665.8	4011665.9	4011665.10	
Moisture*	%	32	35	30	30	32
Sample Fraction >10mm	g dry wt	72.4	96.2	60.6	33.0	104.5
Sample Fraction <10mm to >2mm	g dry wt	99.8	164.4	239.4	155.8	134.1
Sample Fraction <2mm	g dry wt	302.4	179.6	253.8	324.5	248.6
<2mm Subsample Weight	g dry wt	50.6	52.5	55.6	51.4	51.1
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Sample Name:	D13 0-0.15m 16-Oct-2025 1:05 pm	D23 0-0.15m 17-Oct-2025 12:30 pm	D24 0-0.15m 17-Oct-2025 12:40 pm	D39 0-0.5m 17-Oct-2025 12:55 pm	D40 0-0.5m 17-Oct-2025 1:05 pm	
Lab Number:	4011665.11	4011665.12	4011665.13	4011665.14	4011665.15	
Asbestos Presence / Absence	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	
Description of Asbestos Form	-	-	-	-	-	
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	< 0.001	
As Received Weight	g	761.2	651.4	732.4	669.6	704.2
Dry Weight	g	493.2	521.3	551.4	479.1	509.0
Moisture*	%	35	20	25	28	28
Sample Fraction >10mm	g dry wt	146.8	67.0	70.8	22.6	37.8
Sample Fraction <10mm to >2mm	g dry wt	171.7	145.7	167.3	79.6	244.2
Sample Fraction <2mm	g dry wt	172.8	308.3	312.8	376.2	225.6
<2mm Subsample Weight	g dry wt	52.3	56.8	54.2	53.4	56.0
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Glossary of Terms

- Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
 - Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
 - ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
 - ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
 - Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
 - Trace - Trace levels of asbestos, as defined by AS4964-2004.
- For further details, please contact the Asbestos Team.

Please refer to the BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil.
<https://www.branz.co.nz/asbestos>

The following assumptions have been made:

1. Asbestos Fines in the <2mm fraction, after homogenisation, is evenly distributed throughout the fraction
2. The weight of asbestos in the sample is unaffected by the ashing process.

Results are representative of the sample provided to Hill Laboratories only.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch.	0.1 g	1-15
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch.	0.1 g	1-15
Moisture*	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1-15
Sample Fraction >10mm	Sample dried at 100 to 105°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch.	0.1 g dry wt	1-15
Sample Fraction <10mm to >2mm	Sample dried at 100 to 105°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch.	0.1 g dry wt	1-15
Sample Fraction <2mm	Sample dried at 100 to 105°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch.	0.1 g dry wt	1-15
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1-15
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-15
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-15
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-15
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-15
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-15
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1-15
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-15
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1-15

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 22-Oct-2025 and 23-Oct-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Belinda Hughes BSc, PGDipSci
Laboratory Technician - Asbestos

Certificate of Analysis

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Client:	Environmental Consultants Otago 2025 Limited	Lab No:	4011778	SPV2
Contact:	Bernice Chapman C/- Environmental Consultants Otago 2025 Limited 20 Hilton Road Highcliff Dunedin 9013	Date Received:	20-Oct-2025	
		Date Reported:	14-Nov-2025	(Amended)
		Quote No:	137150	
		Order No:		
		Client Reference:	270 Dukes	
		Submitted By:	Aleasha King	

Sample Type: Soil						
Sample Name:		D1 0-0.15m 16-Oct-2025 11:00 am	D2 0-0.15m 16-Oct-2025 11:15 am	D3 0-0.15m 16-Oct-2025 11:30 am	D4 0-0.15m 16-Oct-2025 11:35 am	D5 0-0.15m 16-Oct-2025 12:00 pm
Lab Number:		4011778.1	4011778.2	4011778.3	4011778.4	4011778.5
Individual Tests						
Dry Matter	g/100g as rcvd	-	72	72	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	14	14	14	14	14
Total Recoverable Cadmium	mg/kg dry wt	0.26	0.35	0.26	0.23	0.29
Total Recoverable Chromium	mg/kg dry wt	29	28	29	26	30
Total Recoverable Copper	mg/kg dry wt	23	23	22	20	21
Total Recoverable Lead	mg/kg dry wt	32	23	25	31	36
Total Recoverable Nickel	mg/kg dry wt	28	27	27	26	27
Total Recoverable Zinc	mg/kg dry wt	87	98	94	83	95
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	< 0.014	< 0.014	-	-
alpha-BHC	mg/kg dry wt	-	< 0.014	< 0.014	-	-
beta-BHC	mg/kg dry wt	-	< 0.014	< 0.014	-	-
delta-BHC	mg/kg dry wt	-	< 0.014	< 0.014	-	-
gamma-BHC (Lindane)	mg/kg dry wt	-	< 0.014	< 0.014	-	-
cis-Chlordane	mg/kg dry wt	-	< 0.014	< 0.014	-	-
trans-Chlordane	mg/kg dry wt	-	< 0.014	< 0.014	-	-
2,4'-DDD	mg/kg dry wt	-	< 0.014	< 0.014	-	-
4,4'-DDD	mg/kg dry wt	-	< 0.014	< 0.014	-	-
2,4'-DDE	mg/kg dry wt	-	< 0.014	< 0.014	-	-
4,4'-DDE	mg/kg dry wt	-	< 0.014	< 0.014	-	-
2,4'-DDT	mg/kg dry wt	-	< 0.014	< 0.014	-	-
4,4'-DDT	mg/kg dry wt	-	0.023	0.017	-	-
Total DDT Isomers	mg/kg dry wt	-	< 0.09	< 0.08	-	-
Dieldrin	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Endosulfan I	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Endosulfan II	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Endosulfan sulphate	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Endrin	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Endrin aldehyde	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Endrin ketone	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Heptachlor	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Heptachlor epoxide	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Hexachlorobenzene	mg/kg dry wt	-	< 0.014	< 0.014	-	-
Methoxychlor	mg/kg dry wt	-	< 0.014	< 0.014	-	-

Sample Type: Soil

Sample Name:	D6 0-0.15m 16-Oct-2025 12:10 pm	D7 0-0.15m 16-Oct-2025 12:20 pm	D8 0-0.15m 16-Oct-2025 12:30 pm	D9 0-0.15m 16-Oct-2025 12:50 pm	D10 0-0.15m 16-Oct-2025 1:10 pm	
Lab Number:	4011778.6	4011778.7	4011778.8	4011778.9	4011778.10	
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	14	15	17	13	15
Total Recoverable Cadmium	mg/kg dry wt	0.28	0.28	0.35	0.23	0.26
Total Recoverable Chromium	mg/kg dry wt	26	28	28	26	27
Total Recoverable Copper	mg/kg dry wt	21	23	26	24	21
Total Recoverable Lead	mg/kg dry wt	29	39	31	26	37
Total Recoverable Nickel	mg/kg dry wt	25	26	23	25	25
Total Recoverable Zinc	mg/kg dry wt	94	95	380	119	88

Sample Name:	D11 0-0.15m 16-Oct-2025 1:30 pm	D12 0-0.15m 16-Oct-2025 1:20 pm	D13 0-0.15m 16-Oct-2025 1:00 pm	D14 0-0.15m 16-Oct-2025 1:40 pm	D15 0-0.15m 16-Oct-2025 1:45 pm
Lab Number:	4011778.11	4011778.12	4011778.13	4011778.14	4011778.15

Individual Tests						
Dry Matter	g/100g as rcvd	-	-	-	64	66
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	14	14	17	14	15
Total Recoverable Cadmium	mg/kg dry wt	0.33	0.35	0.31	0.26	0.26
Total Recoverable Chromium	mg/kg dry wt	28	28	34	26	29
Total Recoverable Copper	mg/kg dry wt	23	22	28	20	21
Total Recoverable Lead	mg/kg dry wt	27	28	34	27	23
Total Recoverable Nickel	mg/kg dry wt	26	28	28	25	28
Total Recoverable Zinc	mg/kg dry wt	90	88	92	82	85

Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	-	< 0.016	< 0.015
alpha-BHC	mg/kg dry wt	-	-	-	< 0.016	< 0.015
beta-BHC	mg/kg dry wt	-	-	-	< 0.016	< 0.015
delta-BHC	mg/kg dry wt	-	-	-	< 0.016	< 0.015
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	< 0.016	< 0.015
cis-Chlordane	mg/kg dry wt	-	-	-	< 0.016	< 0.015
trans-Chlordane	mg/kg dry wt	-	-	-	< 0.016	< 0.015
2,4'-DDD	mg/kg dry wt	-	-	-	< 0.016	< 0.015
4,4'-DDD	mg/kg dry wt	-	-	-	< 0.016	< 0.015
2,4'-DDE	mg/kg dry wt	-	-	-	< 0.016	< 0.015
4,4'-DDE	mg/kg dry wt	-	-	-	< 0.016	< 0.015
2,4'-DDT	mg/kg dry wt	-	-	-	< 0.016	< 0.015
4,4'-DDT	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Total DDT Isomers	mg/kg dry wt	-	-	-	< 0.10	< 0.09
Dieldrin	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Endosulfan I	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Endosulfan II	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Endosulfan sulphate	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Endrin	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Endrin aldehyde	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Endrin ketone	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Heptachlor	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Heptachlor epoxide	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Hexachlorobenzene	mg/kg dry wt	-	-	-	< 0.016	< 0.015
Methoxychlor	mg/kg dry wt	-	-	-	< 0.016	< 0.015

Sample Name:	D16 0-0.15m 16-Oct-2025 1:50 pm	D18 0-0.15m 17-Oct-2025 10:40 am	D19 0-0.15m 17-Oct-2025 10:45 am	D20 0-0.15m 17-Oct-2025 10:50 am	D21 0-0.15m 17-Oct-2025 10:55 am
Lab Number:	4011778.16	4011778.18	4011778.19	4011778.20	4011778.21

Individual Tests						
Dry Matter	g/100g as rcvd	59	82	78	66	63

Sample Type: Soil						
Sample Name:		D16 0-0.15m 16-Oct-2025 1:50 pm	D18 0-0.15m 17-Oct-2025 10:40 am	D19 0-0.15m 17-Oct-2025 10:45 am	D20 0-0.15m 17-Oct-2025 10:50 am	D21 0-0.15m 17-Oct-2025 10:55 am
Lab Number:		4011778.16	4011778.18	4011778.19	4011778.20	4011778.21
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	14	22	37	16	19
Total Recoverable Cadmium	mg/kg dry wt	0.30	0.36	0.85	0.3	0.16
Total Recoverable Chromium	mg/kg dry wt	27	13	13	17	12
Total Recoverable Copper	mg/kg dry wt	22	16	32	17	15
Total Recoverable Lead	mg/kg dry wt	25	80	109	29	30
Total Recoverable Nickel	mg/kg dry wt	27	10	13	14	12
Total Recoverable Zinc	mg/kg dry wt	89	270	590	118	77
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
alpha-BHC	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
beta-BHC	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
delta-BHC	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
gamma-BHC (Lindane)	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
cis-Chlordane	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
trans-Chlordane	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
2,4'-DDD	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
4,4'-DDD	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
2,4'-DDE	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
4,4'-DDE	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
2,4'-DDT	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
4,4'-DDT	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Total DDT Isomers	mg/kg dry wt	< 0.10	< 0.08	< 0.08	< 0.09	< 0.10
Dieldrin	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Endosulfan I	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Endosulfan II	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Endosulfan sulphate	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Endrin	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Endrin aldehyde	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Endrin ketone	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Heptachlor	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Heptachlor epoxide	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Hexachlorobenzene	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Methoxychlor	mg/kg dry wt	< 0.017	< 0.012	< 0.013	< 0.015	< 0.016
Sample Name:		D22 0-0.4m 17-Oct-2025 11:00 am	D23 0-0.15m 17-Oct-2025 12:30 pm	D24 0-0.15m 17-Oct-2025 12:40 pm	D26 0-0.15m 17-Oct-2025 2:05 pm	D37 0-0.15m 17-Oct-2025 1:10 pm
Lab Number:		4011778.22	4011778.23	4011778.24	4011778.26	4011778.37
Individual Tests						
Dry Matter	g/100g as rcvd	79	-	-	66	82
TCLP Weight of Sample Taken	g	-	-	50	50	50
TCLP Initial Sample pH	pH Units	-	-	6.9	8.8	6.4
TCLP Acid Adjusted Sample pH	pH Units	-	-	1.6	2.6	1.6
TCLP Extractant Type*		-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	NaOH/Acetic acid at pH 4.93 +/- 0.05	NaOH/Acetic acid at pH 4.93 +/- 0.05
TCLP Extraction Fluid pH	pH Units	-	-	5.0	5.0	5.0
TCLP Post Extraction Sample pH	pH Units	-	-	5.0	5.6	5.0
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	38	14	17	110	75
Total Recoverable Cadmium	mg/kg dry wt	1.19	0.26	1.98	0.48	4.1
Total Recoverable Chromium	mg/kg dry wt	16	20	26	49	81
Total Recoverable Copper	mg/kg dry wt	37	37	115	57	76
Total Recoverable Lead	mg/kg dry wt	390	440	750	23	210
Total Recoverable Nickel	mg/kg dry wt	15	13	18	28	40
Total Recoverable Zinc	mg/kg dry wt	550	550	1,610	189	1,160

Sample Type: Soil						
Sample Name:	D22 0-0.4m 17-Oct-2025 11:00 am	D23 0-0.15m 17-Oct-2025 12:30 pm	D24 0-0.15m 17-Oct-2025 12:40 pm	D26 0-0.15m 17-Oct-2025 2:05 pm	D37 0-0.15m 17-Oct-2025 1:10 pm	
Lab Number:	4011778.22	4011778.23	4011778.24	4011778.26	4011778.37	
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.013	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.013	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.013	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.013	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013	-	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.013	-	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.013	-	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.013	-	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.013	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.013	-	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.013	-	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.013	-	-	-	-
4,4'-DDT	mg/kg dry wt	0.017	-	-	-	-
Total DDT Isomers	mg/kg dry wt	< 0.08	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.013	-	-	-	-
Endosulfan I	mg/kg dry wt	< 0.013	-	-	-	-
Endosulfan II	mg/kg dry wt	< 0.013	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.013	-	-	-	-
Endrin	mg/kg dry wt	< 0.013	-	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.013	-	-	-	-
Endrin ketone	mg/kg dry wt	< 0.013	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.013	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.013	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.013	-	-	-	-
Methoxychlor	mg/kg dry wt	< 0.013	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	-	-	-	< 0.4	< 0.3
1-Methylnaphthalene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
2-Methylnaphthalene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Acenaphthylene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Acenaphthene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Anthracene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Benzo[a]anthracene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	-	-	-	< 0.035	< 0.029
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	-	-	-	< 0.035	< 0.029
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	-	-	-	< 0.015	0.016
Benzo[e]pyrene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Chrysene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Fluoranthene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Fluorene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Naphthalene	mg/kg dry wt	-	-	-	< 0.08	< 0.06
Perylene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Phenanthrene	mg/kg dry wt	-	-	-	< 0.015	< 0.012
Pyrene	mg/kg dry wt	-	-	-	< 0.015	< 0.012

Sample Type: Soil						
Sample Name:	D38 0-0.15m 17-Oct-2025 1:15 pm	D39 0-0.15m 17-Oct-2025 12:50 pm	D40 0-0.15m 17-Oct-2025 1:00 pm	D41 0-0.15m 17-Oct-2025 10:30 am	D42 0-0.15m 17-Oct-2025 10:35 am	
Lab Number:	4011778.38	4011778.39	4011778.40	4011778.41	4011778.42	
Individual Tests						
Dry Matter	g/100g as rcvd	73	-	-	71	73
TCLP Weight of Sample Taken	g	-	50	-	-	-
TCLP Initial Sample pH	pH Units	-	7.1	-	-	-
TCLP Acid Adjusted Sample pH	pH Units	-	1.6	-	-	-
TCLP Extractant Type*		-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-	-
TCLP Extraction Fluid pH	pH Units	-	5.0	-	-	-
TCLP Post Extraction Sample pH	pH Units	-	5.0	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	13	21	14	25	13
Total Recoverable Cadmium	mg/kg dry wt	0.18	0.45	0.43	0.84	0.20
Total Recoverable Chromium	mg/kg dry wt	18	28	25	17	10
Total Recoverable Copper	mg/kg dry wt	24	32	54	43	15
Total Recoverable Lead	mg/kg dry wt	26	580	152	250	53
Total Recoverable Nickel	mg/kg dry wt	16	25	23	17	12
Total Recoverable Zinc	mg/kg dry wt	210	400	290	390	124
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	-	< 0.014	< 0.014
alpha-BHC	mg/kg dry wt	-	-	-	< 0.014	< 0.014
beta-BHC	mg/kg dry wt	-	-	-	< 0.014	< 0.014
delta-BHC	mg/kg dry wt	-	-	-	< 0.014	< 0.014
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	< 0.014	< 0.014
cis-Chlordane	mg/kg dry wt	-	-	-	< 0.014	< 0.014
trans-Chlordane	mg/kg dry wt	-	-	-	< 0.014	< 0.014
2,4'-DDD	mg/kg dry wt	-	-	-	< 0.014	< 0.014
4,4'-DDD	mg/kg dry wt	-	-	-	< 0.014	< 0.014
2,4'-DDE	mg/kg dry wt	-	-	-	< 0.014	< 0.014
4,4'-DDE	mg/kg dry wt	-	-	-	< 0.014	< 0.014
2,4'-DDT	mg/kg dry wt	-	-	-	< 0.014	< 0.014
4,4'-DDT	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Total DDT Isomers	mg/kg dry wt	-	-	-	< 0.09	< 0.09
Dieldrin	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Endosulfan I	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Endosulfan II	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Endosulfan sulphate	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Endrin	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Endrin aldehyde	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Endrin ketone	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Heptachlor	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Heptachlor epoxide	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Hexachlorobenzene	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Methoxychlor	mg/kg dry wt	-	-	-	< 0.014	< 0.014
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	-	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.014	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.014	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.014	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.014	-	-	-	-
Anthracene	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.033	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.033	-	-	-	-

Sample Type: Soil

Sample Name:	D38 0-0.15m 17-Oct-2025 1:15 pm	D39 0-0.15m 17-Oct-2025 12:50 pm	D40 0-0.15m 17-Oct-2025 1:00 pm	D41 0-0.15m 17-Oct-2025 10:30 am	D42 0-0.15m 17-Oct-2025 10:35 am
Lab Number:	4011778.38	4011778.39	4011778.40	4011778.41	4011778.42

Polycyclic Aromatic Hydrocarbons Screening in Soil*

Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.014	-	-	-	-
Chrysene	mg/kg dry wt	< 0.014	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.014	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.014	-	-	-	-
Fluorene	mg/kg dry wt	< 0.014	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.014	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.07	-	-	-	-
Perylene	mg/kg dry wt	< 0.014	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.014	-	-	-	-
Pyrene	mg/kg dry wt	< 0.014	-	-	-	-

Sample Name:	D43 0-0.15m 17-Oct-2025 11:05 am	D44 0-0.15m 17-Oct-2025 11:30 am	D45 0-0.15m 17-Oct-2025 11:40 am	D46 0-0.15m 17-Oct-2025 1:05 pm	Composite of D17 0-0.15m, D35 0-0.15m & D36 0-0.15m
Lab Number:	4011778.43	4011778.44	4011778.45	4011778.46	4011778.47

Individual Tests

Dry Matter	g/100g as rcvd	77	60	89	-	62
SPLP Sample Weight	g	-	50	-	-	-
SPLP Extractant Type*		-	Client Supplied Fluid	-	-	-
SPLP Final pH	pH Units	-	6.9	-	-	-
TCLP Weight of Sample Taken	g	-	-	50	-	-
TCLP Initial Sample pH	pH Units	-	-	7.4	-	-
TCLP Acid Adjusted Sample pH	pH Units	-	-	2.0	-	-
TCLP Extractant Type*		-	-	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-
TCLP Extraction Fluid pH	pH Units	-	-	5.0	-	-
TCLP Post Extraction Sample pH	pH Units	-	-	5.1	-	-

Heavy Metals, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	21	1,200	144	16	15
Total Recoverable Cadmium	mg/kg dry wt	0.31	0.39	0.46	0.82	0.28
Total Recoverable Chromium	mg/kg dry wt	18	17	14	30	25
Total Recoverable Copper	mg/kg dry wt	28	26	47	27	20
Total Recoverable Lead	mg/kg dry wt	121	152	135	174	21
Total Recoverable Nickel	mg/kg dry wt	17	13	23	29	24
Total Recoverable Zinc	mg/kg dry wt	186	450	380	430	75

Organochlorine Pesticides Screening in Soil

Aldrin	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
alpha-BHC	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
beta-BHC	mg/kg dry wt	< 0.013	< 0.017	0.035	-	< 0.017
delta-BHC	mg/kg dry wt	< 0.013	< 0.017	0.021	-	< 0.017
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013	< 0.017	0.056	-	< 0.017
cis-Chlordane	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
trans-Chlordane	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
2,4'-DDD	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
4,4'-DDD	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
2,4'-DDE	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
4,4'-DDE	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
2,4'-DDT	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
4,4'-DDT	mg/kg dry wt	0.013	< 0.017	0.013	-	< 0.017
Total DDT Isomers	mg/kg dry wt	< 0.08	< 0.10	< 0.07	-	< 0.10

Sample Type: Soil

Sample Name:	D43 0-0.15m 17-Oct-2025 11:05 am	D44 0-0.15m 17-Oct-2025 11:30 am	D45 0-0.15m 17-Oct-2025 11:40 am	D46 0-0.15m 17-Oct-2025 1:05 pm	Composite of D17 0-0.15m, D35 0-0.15m & D36 0-0.15m
Lab Number:	4011778.43	4011778.44	4011778.45	4011778.46	4011778.47

Organochlorine Pesticides Screening in Soil						
Dieldrin	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Endosulfan I	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Endosulfan II	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Endosulfan sulphate	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Endrin	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Endrin aldehyde	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Endrin ketone	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Heptachlor	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Heptachlor epoxide	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Hexachlorobenzene	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017
Methoxychlor	mg/kg dry wt	< 0.013	< 0.017	< 0.011	-	< 0.017

Sample Name:	Composite of D32 0-0.15m, D33 0-0.15m & D34 0-0.15m	Composite of D29 0-0.15m, D30 0-0.15m & D31 0-0.15m	Composite of D25 0-0.15m, D27 0-0.15m & D28 0-0.15m
Lab Number:	4011778.48	4011778.49	4011778.50

Individual Tests				
Dry Matter	g/100g as rcvd	64	59	57
Heavy Metals, Screen Level				
Total Recoverable Arsenic	mg/kg dry wt	17	16	14
Total Recoverable Cadmium	mg/kg dry wt	0.30	0.38	0.37
Total Recoverable Chromium	mg/kg dry wt	28	29	27
Total Recoverable Copper	mg/kg dry wt	21	22	22
Total Recoverable Lead	mg/kg dry wt	24	23	21
Total Recoverable Nickel	mg/kg dry wt	25	29	28
Total Recoverable Zinc	mg/kg dry wt	89	90	88

Organochlorine Pesticides Screening in Soil					
Aldrin	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
alpha-BHC	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
beta-BHC	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
delta-BHC	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
gamma-BHC (Lindane)	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
cis-Chlordane	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
trans-Chlordane	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
2,4'-DDD	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
4,4'-DDD	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
2,4'-DDE	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
4,4'-DDE	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
2,4'-DDT	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
4,4'-DDT	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Total DDT Isomers	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.11
Dieldrin	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Endosulfan I	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Endosulfan II	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Endosulfan sulphate	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Endrin	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Endrin aldehyde	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Endrin ketone	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Heptachlor	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Heptachlor epoxide	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Hexachlorobenzene	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017
Methoxychlor	mg/kg dry wt	< 0.016	< 0.017	< 0.017	< 0.017

Sample Type: Aqueous

Sample Type: Aqueous						
Sample Name:	D24 0-0.15m [TCLP Extract]	D26 0-0.15m [TCLP Extract]	D37 0-0.15m [TCLP Extract]	D39 0-0.15m [TCLP Extract]	D44 0-0.15m [SPLP Extract]	
Lab Number:	4011778.51	4011778.52	4011778.53	4011778.54	4011778.55	
Individual Tests						
Total Arsenic	g/m ³	-	0.34	-	-	0.123
Total Lead	g/m ³	0.089	-	-	0.050	-
Total Zinc	g/m ³	3.1	-	3.5	-	-

Sample Name:	D45 0-0.15m [TCLP Extract]					
Lab Number:	4011778.56					
Individual Tests						
Total Arsenic	g/m ³	0.96				

Analyst's Comments

Amended Report: This certificate of analysis replaces report '4011778-SPv1' issued on 28-Oct-2025 at 5:03 pm. Reason for amendment: Additional testing added, at the request of the client.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Labs, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed).	-	1-16, 18-24, 26, 37-50
Total of Reported PAHs in Soil	Sonication extraction, GC-MS/MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	26, 37-38
Dry Matter	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	2-3, 14-16, 18-22, 26, 37-38, 41-45, 47-50
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	17, 25, 27-36
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.024 mg/kg dry wt	26, 37-38
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.024 mg/kg dry wt	26, 37-38
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required. US EPA 200.2 (modified), APHA 3125 B: Online Edition.	0.10 - 4 mg/kg dry wt	1-16, 18-24, 26, 37-50
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD analysis. Tested on as received sample. In-house based on US EPA 8081.	0.010 - 0.06 mg/kg dry wt	2-3, 14-16, 18-22, 41-45, 47-50
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.010 - 0.05 mg/kg dry wt	26, 37-38
SPLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1312.	-	44
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311.	-	24, 26, 37, 39, 45
SPLP Profile			
SPLP Sample Weight	Gravimetric. US EPA 1312.	0.1 g	44

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
SPLP Extractant Type*	US EPA 1312 (Modified for New Zealand conditions to use De-ionised Water unless otherwise specified).	-	44
SPLP Final pH	pH meter. US EPA 1312.	0.1 pH Units	44
TCLP Profile			
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	24, 26, 37, 39, 45
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	24, 26, 37, 39, 45
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	24, 26, 37, 39, 45
TCLP Extractant Type*	US EPA 1311.	-	24, 26, 37, 39, 45
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	24, 26, 37, 39, 45
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	24, 26, 37, 39, 45

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E (modified) : Online Edition.	-	51-56
Total Arsenic	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.021 g/m ³	52, 56
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B : Online Edition.	0.0011 g/m ³	55
Total Lead	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.0021 g/m ³	51, 54
Total Zinc	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B : Online Edition.	0.053 g/m ³	51, 53

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 20-Oct-2025 and 14-Nov-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental