



ENGEO

— Expect Excellence —

Detailed Environmental Site Investigation

3-11 London Street

Lyttelton

Christchurch

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Contents

1	Introduction.....	4
1.1	Objectives of the Assessment.....	4
1.2	Approach	4
2	Site Description and Setting.....	5
2.1	Geology and Hydrogeology.....	6
3	Site History	6
3.1	Listed Land Use Register (LLUR)	6
3.2	Historical Aerial Photograph Review.....	7
3.3	Christchurch City Council Property File	8
4	Current Site Conditions	9
5	Summary of Preliminary Site Investigation	9
6	Intrusive Investigation	10
6.1	Field Work Methodology	10
6.2	Quality Assurance and Quality Control	11
7	Regulatory Framework and Assessment Criteria	11
7.1	Environment Canterbury Regional Plan.....	12
7.1.1	Stormwater	12
7.2	Asbestos Criteria	12
7.3	Disposal Criteria	14
7.4	Assessment Criteria	14
8	Results	15
9	Conceptual Site Model	17
10	Summary of Findings	19
11	Conclusions and Recommendations	20
12	References	21
13	Limitations	22

Tables

Table 1:	Site Information
Table 2:	Site Setting
Table 3:	Site Setting
Table 4:	Historical Aerial Photograph Review
Table 5:	Christchurch City Council Property File Info
Table 6:	Site Conditions from Walkover
Table 7:	Potential Contaminants at the Site
Table 8:	Adopted Asbestos Investigation Criteria
Table 9:	Soil Analytical Results
Table 10:	Asbestos Soil Analysis Result
Table 11:	Asbestos Soil Analysis Result
Table 12:	Conceptual Site Model

Appendices

FIGURES

Appendix 1:	Site Photographs
Appendix 2:	Listed Land Use Register
Appendix 3:	Laboratory Analysis Certificates
Appendix 4:	Hand Auger Logs

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1 Introduction

ENGEO Ltd was requested by Collet's Corner Limited to undertake a combined Preliminary and Detailed Site Investigation (DSI) at 3-11 London Street in Lyttelton, Christchurch (herein referred to as "the site"). The investigation area is shown in Figure 1. ENGEO understands that the site is to be redeveloped for mixed commercial use.

The DSI was completed in order to satisfy Christchurch City Council (CCC) resource consent requirements in accordance with the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES).

If an activity included on the Ministry for the Environment (MfE) Hazardous Activities and Industries List (HAIL) has occurred on the site, under the NES the requirement for a contaminated land investigation prior to site disturbance or redevelopment is triggered. ENGEO understand that the following HAIL activities may have historically been associated with the site:

- E1: Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition;
- G5: Waste disposal to land; and
- 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 environment. In this instance this could include the use of lead based paint on previous buildings.

This DSI was undertaken in general accordance with the MfE 2011, *Contaminated Land Management Guidelines (CLMG) No.5: Guidelines for Site Investigation and Site Analysis of Soil* and reported in general accordance with the MfE 2011 *CLMG No. 1: Reporting on Contaminated Sites in New Zealand*.

This DSI was updated in February 2021 following additional delineation work of the previously identified contaminants of concern.

1.1 Objectives of the Assessment

The objectives of this assessment were to:

- Evaluate and identify conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property;
- Evaluate the presence of and extent of identified contaminants of concern (COC) at the site; and
- Assess whether the COCs pose an unacceptable risk to human health or the environment during and post site redevelopment.

1.2 Approach

To satisfy the objectives, ENGEO sought to gather information regarding the following:

- Current and past property uses and occupancies;
- Current and past uses of hazardous substances;

- Waste management and disposal activities that could have caused a release or threatened release of hazardous substances;
- Current and past corrective actions and response activities to address past and on-going releases of hazardous substances at the subject property;
- Properties adjoining or located near the subject property that have environmental conditions that could have resulted in conditions indicative of releases or threatened releases of hazardous substance to the subject property; and
- COC concentrations within the soils underlying the site.

2 Site Description and Setting

The total site area is 973 m², with the legal identifier Lot 1 DP 13455 and Part Section 31 TN OF Christchurch. It is located on sloping land with a height difference of approximately 1.5 – 2 m over a 25 m wide site. The site is sloping down from London Street towards Norwich Quay, from North to South. The site is currently vacant with bark chippings laid over the majority of the site. It is understood that the site is currently used for community purposes with market stalls present on Saturdays, as such, some landscaping such as planter boxes are present at the site.

It is understood that buildings previously occupied the site, with foundation elements remaining. Site information is summarised in Table 1 with photographs of the site taken during the site walkover provided in Appendix 1.

Table 1: Site Information

Item	Description
Location	3-11 London Street, Lyttelton, Christchurch
Legal Description	Lot 1 DP 13544 and Part Section 31 TN OF Christchurch
Current Land Use	Unoccupied
Proposed Land Use	Mixed commercial
Site Area	973 m ²
Territorial Authority	Christchurch City Council

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	Located on sloping land with a height difference of approximately 1.5 – 2 m over a 25 m wide site. The site is sloping down from London Street towards Norwich Quay, from North to South.
Local Setting	Residential and commercial
Nearest Surface Water & Use	Lyttelton harbour is present approximately 220 m to the south of the site.

2.1 Geology and Hydrogeology

The documented geology and hydrogeology of the site and surrounding area is summarised in Table 3 below.

Table 3: Site Setting

Item	Description
Geology	Yellow brown windblown silt on Banks Peninsula greater than 3 m thick and commonly in multiple layers.
Hydrogeology	Groundwater is estimated to flow in a southerly direction.
Groundwater Abstractions	There are no groundwater abstractions located on or within 100 m of the site.
Discharge Consents	There are no discharge consents located on the site. There are two discharge consents located within 100 m of the site: CRC156603: 26 Oxford Street and 1 Sumner Road; Ministry of Education; to discharge stormwater during the construction stage of the redevelopment of a school. CRC167417: Governors Bay, Diamond Harbour & Lyttelton Harbour; Christchurch City Council; to discharge stormwater.

3 Site History

A number of sources were used to investigate the past uses of the site. The findings of these information searches have been summarised in this section.

3.1 Listed Land Use Register (LLUR)

Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury Region. The LLUR documents properties on which potentially hazardous activities have been undertaken. The potentially hazardous activities are defined on the MfE HAIL (MfE, 2011). Identifying a HAIL activity on the site triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 3 December 2018 for the site and is presented in Appendix 2. No information related to HAIL activities located on the site was identified on the statement.

An updated LLUR statement was requested in February 2021 with no HAIL activities identified at the site.

3.2 Historical Aerial Photograph Review

Aerial photographs obtained from Canterbury Maps and Google Earth from 1940 to 2018 have been reviewed. The relevant visible features are summarised in Table 4.

Table 4: Historical Aerial Photograph Review

Date	Source	Description
1925-1929	Canterbury Maps	The image is poor quality, however, three buildings appear to be across the site. It is unclear as to what they are being used for. The surrounding area appears to be a mix of residential and commercial.
1965-1969	Canterbury Maps	Two buildings are present at the site, with both buildings different from the previous aerial photograph. The buildings occupy the northern portion of the site only, with the southern portion appearing to be used for courtyard purposes.
1970-1974	Canterbury Maps	The two buildings from the previous photograph are still present at the site. The southern portion of the eastern building is now occupied by another commercial building. The surrounding area remains a mix of commercial and residential.
1980-1984	Canterbury Maps	The site and surrounding area appear the same as the previous photograph.
1990-1994	Canterbury Maps	The site and surrounding area remain the same as the previous photograph apart from an additional building present along the southern boundary of the western building.
2003	Google Earth	The site and surrounding area remain the same as the previous photograph apart from the building along the southern boundary of the western site is no longer present.
March 2012	Google Earth	The western building has been demolished with the foundations / basement appearing to still be present at the site. The buildings on the eastern side of the site remain.
March 2013	Google Earth	The buildings on eastern portion of the site have been demolished. The site appears to be uneven – the photograph is poor quality but the site appears to be covered in rubble and vegetation. The surrounding area remains the same.

Date	Source	Description
September 2015	Google Earth	The whole site appears to be vacant with some vegetation present. The former foundations / basement from the western building is not visible. Tyres tracks are observed across the site. The surrounding area remains the same.
September 2016	Google Earth	The site remains largely vacant with what appears to be a concrete pad present along the southern boundary of the site. It is unclear as to what it was used for. The site is vegetated with exposed ground present in the centre of the site.
2018	Google Earth	The site appears to be being used for market stalls. The central area of the site has been barked. The surrounding area remains the same.

3.3 Christchurch City Council Property File

The property file for the site held by Christchurch City Council was requested as part of the investigation. The relevant information related to this investigation is shown in Table 5 below.

Table 5: Christchurch City Council Property File Info

Date	Description
8/11/1999	7 London Street – building occupied by Lyttelton Seafoods
July 1967	Alterations to the Empire Hotel – mention of red lead paint used to make pipes watertight; use of fibrous plaster; Fyrestop in internal walls.
1863	Empire Hotel built on-site. Latest building structure built in 1915.

4 Current Site Conditions

Table 6: Site Conditions from Walkover

Site Condition	Comments
Visible signs of contamination	Fill material consisting of bricks observed in material placed along the northern and western boundary of the site. No other visible signs of contamination noted.
Surface water appearance	No surface water present on site.
Current surrounding land use	Commercial and residential.
Local sensitive environments	No local sensitive environments.
Visible signs of plant stress	No obvious signs of plant stress noted.
Ground cover	The site was largely covered with bark with some exposed silt along the northern and western boundaries (where fill material was observed).
Buildings present	No buildings present on the site.

5 Summary of Preliminary Site Investigation

Potential sources of contamination at the site were assessed. The information is summarised in Table 7.

Table 7: Potential Contaminants at the Site

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES (soil)
Asbestos containing material in former residential buildings	Asbestos	Whole site	E1
Building materials – lead based paint	Lead	Whole site	I
Land disturbance – fill material	Heavy Metals PAHs	Whole site	G5

6 Intrusive Investigation

Based on the review of the historical site uses the COCs identified as part of this investigation were heavy metals, polycyclic aromatic hydrocarbons (PAHs) and asbestos.

A total of six intrusive investigation samples were completed across the site. Soil samples were collected from each location to assess the potential risks to human health posed by the potential historical contamination sources, disposal options for soils removed during the redevelopment and for the suitability of the site for the intended long term use of the site (commercial). The soil sample depths and analysis at each location were determined by the site's history and on-site observations.

6.1 Field Work Methodology

The following fieldwork methodology was undertaken:

- Completion of six sample locations across the site with soil samples taken from 0.0 to 0.5 m bgl, depending on location. The depths were considered suitable to provide an indication of potential impacts from the former uses of the site and to assess potential impacts to future land users.
- All soil samples collected were placed in jars supplied by R J Hills Laboratory (Hills), which were then capped, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to Hills under standard chain of custody documentation provided in Appendix 3.
- The asbestos soil samples were double bagged and sent to EIAG Laboratory (EIAG) for analysis. Samples were transported to EIAG under standard chain of custody documentation provided in Appendix 3.
- To reduce the potential cross-contamination, each sample was collected using disposable nitrile gloves that were discarded following the collection of each sample.
- After collection of each sample, the sampling equipment was decontaminated by washing with a solution of Decon90 and rinsing with tap water followed by deionised water.
- The intrusive sampling was completed in accordance with ENGEO standard operating procedures while geological logging was completed in general accordance with the New Zealand Geotechnical Society Inc. 'Guideline for the Field Classification of Soil and Rock for Engineering Purposes' December 2005.
- All field work and sampling was completed in general accordance with the procedures for the appropriate handling of potentially contaminated soils as described in the MfE *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*.
- Samples were collected from the hand auger or hand trowel at each location and inspected for visual and olfactory indicators of contamination.

6.2 Quality Assurance and Quality Control

The quality assurance / quality control (QA / QC) procedures employed during the works included:

- Standard sample registers and chain of custody records have been kept for all samples.
- The use of Hills and EIAG laboratories who are both International Accreditation New Zealand (IANZ) laboratories for the analyses performed. To maintain their IANZ accreditation, Hills and EIAG undertake rigorous cross checking and routine duplicate sample testing to ensure the accuracy of their results.
- During the site investigation, every attempt was made to ensure that cross contamination did not occur through the use of procedures outlined within this document.

6.3 Delineation Sampling 2021

Following the identification of asbestos fibres in the 2018 soil investigation, additional delineation soil sampling was completed. The delineation sampling involved collecting samples at 0.5m intervals out from the original sample location (HA05). The first round of soil samples were then analysed for the presence of asbestos, and once those results were returned, dependent on the result, the next round of samples would be analysed, if appropriate.

The soil samples were collected using the same methodology as the previous investigation, with the only change being that the samples were sent for analysis at Terra Scientific laboratories.

7 Regulatory Framework and Assessment Criteria

The NES came into effect on 1 January 2012 (MfE, 2011).

The NES introduced soil contaminant standards (SCSs) for 12 priority contaminants for the protection of human health under a variety of land use scenarios.

The NES requires the *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values* be used where a NES SCS is not available.

The NES does not consider environmental receptors; accordingly, the application of guidelines relevant to environmental receptors shall be implemented according to the MfE CLMG No.2 and any relevant rules in the Regional Plan.

In addition, local background levels in soil have been referenced to establish consenting implications under the NES and disposal requirements. Background levels for metals in soils in the area were obtained from CRC's online GIS – Trace Level 2 concentrations.

7.1 Environment Canterbury Regional Plan

7.1.1 Stormwater

Under the Canterbury Land and Water Regional Plan (LWRP) Rule 5.93, the discharge of Stormwater from a reticulated Stormwater system onto or into land in circumstances where a contaminant may enter water, or into groundwater or a surface waterbody is a restricted discretionary activity, provided the following conditions are met:

- i. For a discharge that existed at 11 August 2012, an application for a discharge permit is lodged prior to 30 June 2018, or at a later date as agreed between the reticulated Stormwater system operator and the CRC.
- ii. A Stormwater management plan has been prepared to address the management of Stormwater in the catchment and is lodged with the application.
- iii. The discharge will not cause a limit in Schedule 8 to be exceeded.

The discharge of Stormwater onto or into and where contaminants may enter groundwater is a permitted activity, provided the following conditions are met:

- i. The discharge is into a reticulated Stormwater system and the discharger has obtained written permission from the system owner to discharge into the system.
- ii. The discharge is not into a reticulated Stormwater system.
 - a. The discharge is not from, into or onto contaminated or potentially contaminated land.
 - b. The discharge:
 - i. Does not cause Stormwater from up to and including a 24 hour duration 2% Annual Exceedance Probability rainfall event to enter any other property.
 - ii. Does not result in the ponding of Stormwater on the ground for more than 48 hours, unless part of the Stormwater treatment system.
 - iii. Is located at least 1 m above the seasonal high water table that can be reasonably inferred for the site at the time the discharge system constructed.
 - iv. Is only from residentially zoned land.

7.2 Asbestos Criteria

The Building Research Association New Zealand (BRANZ) released the New Zealand Guidelines for Assessing and Managing Asbestos in Soil on 6 November 2017. The BRANZ Asbestos (2017) Guidelines have been developed based on the WA DOH Guidelines but with the New Zealand regulatory scene in mind.

The BRANZ Guideline asbestos investigation criteria are presented in Table 8. The BRANZ guideline criteria have been adopted as investigation criteria for this assessment.

Table 8: Adopted Asbestos Investigation Criteria

Form of asbestos	Soil guideline values for asbestos (w/w)			
	Residential ¹	High-density residential ²	Recreational ³	Commercial and Industrial ⁴
ACM (bonded)	0.01%	0.04%	0.02%	0.05%
FA and/or AF ⁵	0.001%			
All forms of asbestos – surface	No visible asbestos on surface soil ⁶			
Capping requirements for residual contamination above selected soil guideline value				
Depth ⁷	Hard cap	No depth limitation, no controls – except for long-term management		
	Soft cap	≥0.5 m		≥0.2 m

Table 8 Notes:

ACM: Asbestos-containing material i.e. asbestos bound in a matrix; material that cannot pass through a 7 mm x 7 mm sieve.

FA: Fibrous asbestos. Encompasses friable asbestos material, such as severely weathered ACM, and asbestos in the form of loose fibrous material such as insulation products. Friable asbestos is defined here as asbestos material that is in a degraded condition, such that it can be broken or crumbled by hand pressure.

AF: Asbestos fines. It includes free fibres of asbestos, small fibre bundles and also ACM fragments that pass through a 7 mm x 7 mm sieve.

- Residential:** Single dwelling site with garden and / or accessible soil. Also includes daycare centres, preschools, primary and secondary schools and rural residential.
- High-density residential:** Urban residential site with limited exposed soil / soil contact, including small gardens. Applicable to urban townhouses, flats and ground-floor apartments with small ornamental gardens but not high-rise apartments (with very low opportunity for soil contact).
- Recreational:** Public and private green areas and sports and recreation reserves. Includes playing fields, suburban reserves where children play frequently and school playing fields.
- Commercial and industrial:** Includes accessible soils within retail, office, factory and industrial sites. Many commercial and industrial properties are well paved with concrete pavement and buildings that will adequately cover / cap any contaminated soils.
- FA and / or AF:** Where free fibre is present at concentrations at or below 0.001% w/w, a proportion of these samples should be analysed using the laboratory analysis method described in section 5.4.4 (≥10% of samples). This is due to limitations in the AS 4964-2004 and WA Guidelines 500 ml sample method for free fibre (see section 5.4 for more information).
- Surface:** Effective options include raking/tilling the top 100 mm of asbestos-contaminated soil (or to clean soil / fill if shallower to avoid contaminating clean material at depth) and hand picking to remove visible asbestos and ACM fragments or covering with a soft cap of virgin natural material (VNM) 100 mm thick delineated by a permeable geotextile marker layer or hard cap. Near-surface fragments of ACM can become exposed in soft soils such as sandy pumiceous soils after periods of rain.
- Depth:** Capping is used where contamination levels exceed soil guideline values. Considerations of depth need to incorporate the type and likelihood of future disturbance activities at the site and site capping requirements (see section 6.1). Ideally, any capping layer should be delineated by a permeable geotextile marker layer between the cap and underlying asbestos / contaminated material. Institutional controls must be used to manage long-term risks, particularly where the cap may be disturbed (see section 7). Two forms of capping are typically used:
 - Hard cap comprises surfaces that are difficult to penetrate and isolate the asbestos contamination, such as tar seal or concrete driveway cover. This would typically not include pavers or decking due to maintenance and coverage factors.
 - Soft cap consists of a layer(s) of material which either comprise virgin natural material or soils that meet the asbestos residential soil guideline value from an on-site source. Use of on-site soils may require resource consent.

7.3 Disposal Criteria

An assessment of potential off-site disposal options for any excess spoil generated during site development works has been conducted. Dependent on the contamination conditions of the spoil, off-site disposal options range from disposal to “cleanfill” (Class 5) sites to licensed Class 1 to 4 landfills. As outlined in the publication “Technical Guidelines for Disposal to Land” (WasteMINZ, 2018), cleanfill is:

“Virgin excavated natural materials (VENM) such as clay, soil and rock that are free of:

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances or materials (such as municipal solid waste) likely to create leachate by means of biological breakdown;
- Products or materials derived from hazardous waste treatment, stabilisation or disposal practices;
- Materials such as medical and veterinary waste, asbestos or radioactive substances that may present a risk to human health if excavated;
- Contaminated soil and other contaminated materials; and
- Liquid waste.”

7.4 Assessment Criteria

Contaminant concentrations in soil were compared to human health criteria based on one land use:

- Commercial / industrial land use (based on an outdoor worker scenario) (for proposed land use and redevelopment workers).

The land use scenario is relevant to the likely future use of the site and is being used as a surrogate to assess short term risks to redevelopment earth workers on site during the development activities.

The NES methodology document notes that the exposure parameters assumed for the maintenance / excavation scenario in other New Zealand guidelines are unrealistic (perhaps by a factor of 10 or more). The technical committee preparing the NES decided that a maintenance / excavation worker scenario should not be included in the NES as sites would not be cleaned up to this standard; it was considered more appropriate that exposures to these workers be limited through the use of site-specific controls that are required under health and safety legislation. However, this report uses commercial / industrial outdoor worker criteria to get a general sense of potential risks to excavation workers during the redevelopment. Note that commercial / industrial outdoor worker criteria are based on personnel carrying out maintenance activities involving soil exposure to surface soil during landscaping activities, and occasional shallow excavation for routine underground service maintenance. Exposure to soil is less intensive than would occur during construction works but occurs over a longer period. For a construction worker developing the site, the soil exposure is limited when compared to a large earthworks project (e.g. for a residential subdivision or industrial development). As such, the commercial / industrial outdoor worker criteria are considered suitable for obtaining a high-level understanding of potential risks to excavation workers during site redevelopment and confirming the need for site controls.

To enable disposal of the soil at Christchurch City Council (CCC) Burwood Landfill, contaminant concentrations must be below the NES Recreational land use criteria.

The soil analysis results have been compared to Regional Background levels for heavy metals and PAHs. These provide information into the possible disposal options at a cleanfill facility.

The asbestos assessment criteria have been outlined in Section 7.3 above.

8 Results

Please refer to Appendix 4 for the full soil logs for the six sample locations across the site.

Groundwater was not encountered in any of the sample locations. No potential asbestos containing material was identified in the sample locations.

Soil analytical results and the adopted soil assessment criteria are presented in Tables 9 to 10 below. Certified laboratory reports are included in Appendix 3.

The analytical results can be summarised as follows:

- There were no exceedances against the applicable NES human health criteria for outdoor / industrial workers or recreational land use.
- There are exceedances in all samples taken against the site specific regional background guidelines.
- Asbestos was identified in the soil sample HA05 at 0.00019 % w/w. This concentration of asbestos fibres is considered to be below the BRANZ guidelines for the proposed end use.

Table 9: Soil Analytical Results

Sample Name	HA01	HA02	HA03	HA04	HA05	HA06	Human health criteria - Commercial / industrial outdoor worker (unpaved) ^a	Human health criteria - Recreational Land use ^a	Regional background - Trace Elements (Level 2) ^b
Soil Type									
Sample Depth, m	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5			
Heavy Metals in soil, mg/kg									
Arsenic	6	6	6	6	6	32	70	80	4.9
Cadmium ^d	0.13	0.12	0.11	0.16	0.17	0.23	1,300	400	0.13
Chromium ^e	16	15	15	14	16	14	6,300	2,700	16.9
Copper	12	12	12	15	14	32	>10,000	>10,000	12.4
Lead	48	98	80	100	45	162	3,300	880	21.3
Nickel	12	12	12	11	13	11	6,000 ^c	1,200 ^c	13.1
Zinc	98	113	123	168	114	350	400,000 ^c	30,000 ^c	69.6
Polycyclic Aromatic Hydrocarbons in soil, mg/kg									
BaP eq ^f	0.33	0.12	0.38	0.65	0.21	5.09	35	40	0.922 ^g

Notes: ^a Human health criteria from the NES except where noted. Commercial Industrial Outdoor Worker criteria exceedances are in *italics*, Recreational land use criteria exceedances are underlined.
^b ECan (2007) Background Concentrations of Selected Trace Elements in Canterbury Soils Exceedances are shaded.
^c NEPM Health Investigation Level for 'Commercial / Industrial land use'.
^d Assumes soil pH of 5.
^e Criteria for Chromium VI were conservatively selected.
^f Risk associated with a mixture of carcinogenic PAH's is based on the Benzo(a)pyrene equivalent (BaP Eq.) concentration. The BaP Eq. concentration was calculated according to the NES Methodology.
^g ECan (2007) Background Concentrations of Polycyclic Aromatic Hydrocarbons in Christchurch Urban Soils Exceedances are shaded.
 NA – No analysis completed.

Table 10: Asbestos Soil Analysis Result

Sample Name	Description of Asbestos Analysis	Asbestos as FA/AF (%w/w)
HA01_0.0-0.5 m bgl	No asbestos detected	-
HA02_0.0-0.5 m bgl	No asbestos detected	-
HA03_0.0-0.5 m bgl	No asbestos detected	-
HA04_0.0-0.5 m bgl	No asbestos detected	-
HA05_0.0-0.5 m bgl	Chrysotile	0.00019 %
HA06_0.0-0.5 m bgl	No asbestos detected	-

Note: BRANZ guideline criteria: Commercial and Industrial land use 0.001 % AF &/or FA and 0.05% ACM

8.1 Delineation Sampling Results

As HA05 previously returned a positive identification for the presence of asbestos, soil samples were collected and analysed around this location. The results are shown in Table 11 below.

Table 11: Asbestos Soil Analysis Result

Sample Name	Description of Asbestos Analysis	Asbestos as FA/AF (%w/w)
AS 1.1	Crocidolite	0.00020 %
AS 2.1	No asbestos detected	-
AS 3.1	No asbestos detected	-
AS 4.1	No asbestos detected	-
AS 1.2	No asbestos detected	-

Note: BRANZ guideline criteria: Commercial and Industrial land use 0.001 % AF &/or FA and 0.05% ACM

Due to the positive identification in AS1.1, the next sample out from the delineation sampling, AS 1.2, was requested to be analysed. This returned a negative result for the presence of asbestos.

9 Conceptual Site Model

A conceptual site model consists of four primary components. For contaminants to present a risk to human health or an environmental receptor, all four components are required to be present and connected. The four components of a conceptual site model are:

- Source of contamination
- Pathway(s) in which contamination could potentially mobilise along (e.g. vapour or groundwater migration)
- Sensitive receptor(s) which may be exposed to the contaminants
- An exposure route, where the sensitive receptors and contaminants come into contact (e.g. ingestion, inhalation, dermal contact)

The potential source, pathway, receptor linkages at this subject site are provided in Table 11.

Table 11: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable risk? So samples meet acceptance criteria?
Former buildings present on the site	Asbestos, arsenic, lead	Dermal contact with impacted soil, inhalation of dust and incidental ingestion during earthworks and long-term use of the site.	On-site redevelopment construction workers	Yes , there were no exceedances against the applicable NES / BRANZ human health guidelines.
Importation of fill material – land disturbance observed in aerial photographs	Heavy metals PAHs Asbestos		Future subsurface maintenance workers Future land users Surrounding environment	Yes , there were no exceedances against the applicable NES / BRANZ human health guidelines.

10 Summary of Findings

Due to the potential HAIL activities historically undertaken at the site (demolished buildings built in an era where asbestos or lead based paint could have been used and importation of fill material) at 3-11 London Street in Lyttelton, Christchurch, an intrusive investigation was undertaken to assess the site's suitability for commercial redevelopment. A total of six locations across the site were sampled, with sample depths and analysis type dependent on the site's history and on-site observations. Soil samples were analysed for contaminants of concern including heavy metals, PAHs and asbestos.

The soil across the site was comprised mainly of fill. Areas of fill were encountered between the surface soils down to 3.0 m bgl. The fill material consisted mainly of silt with trace brick, charcoal, organics and plastics. No odours or staining of soil was noted in the soil sample locations.

One soil sample analysed for semi-quantitative analysis for asbestos in soils returned concentrations of asbestos below the BRANZ Guideline. If the soils around HA05 are to be removed for the redevelopment works the soils should be disposed of to an asbestos accepting facility and soil validation samples should be undertaken after the removal of soils to ensure that the asbestos impact has been removed from the site. The removal of asbestos contaminated soils around HA05 may be able to be undertaken as unlicensed asbestos work. Additional sampling was completed around HA05 in 2021 to try and delineate the extent of the asbestos present at the site. One additional sample returned a positive identification for the presence of asbestos, which was located to the north of the HA05. The remaining samples analysed returned no detection of asbestos fibres.

The soil samples were analysed for heavy metals and PAHs which returned concentrations below the applicable NES human health criteria for outdoor / industrial workers and the recreational land use criteria.

The soil samples were also compared against the regional background site specific criteria. Soil samples taken exceeded the regional background levels for arsenic, lead and zinc with HA01, HA04, HA05 and HA06 exceeding concentrations of cadmium, HA06 also exceeded the BaP eq. background criteria. As all soil samples exceed the background criteria, the soil would not be accepted as cleanfill.

Due to the elevated concentrations of contaminants identified at the site, and the presence of asbestos, the NES regulations apply to the site and resource consent is likely to be required should the redevelopment of the site not meet permitted activity criteria as specified in the NES regulations.

11 Conclusions and Recommendations

The information collected indicates that the site has been used for commercial land use since the early 1900s. The on-site buildings sustained damage from the Canterbury Earthquake sequence, and as such were demolished between 2011 and 2013. The proposed redevelopment of the site includes the construction of a new commercial building to encompass the entirety of the site. ENGEO were engaged by Collet's Corner Limited to complete soil testing to assess the concentrations of contaminants of concern and to provide advice regarding the suitability of the site for continued commercial land use, the health and safety of the excavation workers during development, soil disposal options and whether resource consents would be required during the redevelopment of the site.

Based on the results of the investigation, soils at the site are considered suitable for the intended commercial land use. Due to the identification of asbestos in one of the soil samples, if the soils around HA05 are to be removed during the redevelopment works the soils should be disposed of to an asbestos accepting facility and soil validation samples should be undertaken after the removal of soils to ensure that the asbestos contamination has been removed from the site. The removal of asbestos contaminated soils around HA05 may be able to be undertaken as unlicensed asbestos work. It is estimated that the area would be approximately 8 m² with an excavation depth of approximately 0.3 m.

From the analysis results, it is unlikely that site redevelopment workers will be significantly impacted based on comparison with the commercial / industrial outdoor worker criteria. However, to minimise the impacts on the site workers, the surrounding population and environment, mitigation measures should be outlined in a redevelopment SMP.

Due to the concentrations of heavy metals above regional background levels and the presence of asbestos, a resource consent for land disturbance and removal may be required during the redevelopment of the site. If a volume of soil exceeding 25 m³ per 500 m² of development area is proposed to be disturbed, or if a volume of soil exceeding 5 m³ per 500 m² of development area per year is proposed to be disposed of off-site, a consent should be obtained according to the requirements of the NES. It is understood that the current fill material located across the site may be removed as part of the redevelopment works. As such, it is considered likely that a consent under the NES would be required. It is recommended that final volume calculations are checked for compliance against the NES trigger volumes during the design stage so that the project is not delayed by the requirement for potential consent applications. Additional stormwater discharge consent may be required from Canterbury Regional Council for the duration of the redevelopment works on-site.

It is recommended that any soil containing asbestos fibres is disposed of to a suitable waste facility such as Kate Valley Landfill or Frews Hororata.

The remaining soils on site did not exceed the Recreational land use criteria so are considered suitable for disposal at the CCC Burwood Managed Landfill; however, this should be confirmed with the landfill operator before removal of soils from the site. Due to the exceedances of the Regional Background levels and the presence of asbestos fibres, soils excavated from the site are not considered suitable for cleanfill disposal.

The conclusions of this report are limited to the areas / depths of soil sampled. Therefore, there is the potential for unidentified hot spots of contamination to exist at the site. A site management plan (SMP) should outline procedures to identify and mitigate exposure to unidentified contamination is encountered during the redevelopment works.

12 References

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

ECan (2007a). *Background Concentrations of Selected Trace Elements in Canterbury Soils. Addendum 1: Additional Samples and Timaru Specific Background Levels*. Report prepared for Environment Canterbury by Tonkin & Taylor Limited, Christchurch, New Zealand. Report Number R07/1/2. Tonkin & Taylor Reference: 50875.003.

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MfE (2002). *A Guide to the Management of Cleanfills*.

MfE (2011a). *Ministry for the Environment Hazardous Activities and Industries List*.

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MfE (2011c). *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values*.

MfE (2011d). *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*.

MfE (2011f). *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011*.

MfE (2012). *Users' guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*.

13 Limitations

- iii. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Collet's Corner Limited, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.
- iv. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.
- v. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.
- vi. This Limitation should be read in conjunction with the Engineers NZ/ACENZ Standard Terms of Engagement.
- vii. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by



Hazel Atkins, CEnvP

Senior Engineering / Environmental Geologist

Report reviewed by



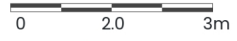
Dave Robotham, CEnvP SC

Principal Environmental Consultant

FIGURES



- Legend**
- ▭ Site Boundary
 - ⊕ 2018 Hand Augers
 - ⊕ Delineation Sampling
 - polyline



© Nearmaps

ENGEO

Produced by **Evalua8.earth**

Title: Investigation Location Plan

Client: Collet's Corner Limited		Figure No: 1
Project: 1 London Street	Drawn: LEG	
Date: 09-02-2021	Checked: NC	Size: A4
Proj No: 15681		Version: 1

APPENDIX 1:
Site Photographs



Photo 1: HA01 Location



Photo 2: HA02 Location



Photo 3: HA03 Location



Photo 4: HA04 Location



Photo 5: HA05 Location



Photo 6: HA06 Location



Date taken	Dec 2018	Client	Office for Holistic Urbanism Development
Taken by	JDW	Project	3-11 London Street, Lyttelton
Approved by	DR	Description	Site Photographs
Photo No.	1 to 6	ENGEEO Ref.	15681.000.000

APPENDIX 2:
Listed Land Use Register

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz

www.ecan.govt.nz

Dear Sir/Madam

Thank you for submitting your property enquiry in regards to our Listed Land Use Register (LLUR) which holds information about sites that have been used, or are currently used for activities which have the potential to have caused contamination.

The LLUR statement provided indicates the location of the land parcel(s) you enquired about and provides information regarding any LLUR sites within a radius specified in the statement of this land.

Please note that if a property is not currently entered on the LLUR, it does not mean that an activity with the potential to cause contamination has never occurred, or is not currently occurring there. The LLUR is not complete, and new sites are regularly being added as we receive information and conduct our own investigations into current and historic land uses.

The LLUR only contains information held by Environment Canterbury in relation to contaminated or potentially contaminated land; other information relevant to potential contamination may be held in other files (for example consent and enforcement files).

If your enquiry relates to a farm property, please note that many current and past activities undertaken on farms may not be listed on the LLUR. Activities such as the storage, formulation and disposal of pesticides, offal pits, foot rot troughs, animal dips and underground or above ground fuel tanks have the potential to cause contamination.

Please contact and Environment Canterbury Contaminated Sites Officer if you wish to discuss the contents of the LLUR statement, or if you require additional information. For any other information regarding this land please contact Environment Canterbury Customer Services.

Yours sincerely

Contaminated Sites Team

Property Statement from the Listed Land Use Register

Visit www.ecan.govt.nz/HAIL for more information about land uses.

Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

P. 03 365 3828
F. 03 365 3194
E. ecinfo@ecan.govt.nz

www.ecan.govt.nz

Date:	03 December 2018	
Land Parcels:	Lot 1 DP 13544 Part Section 31 TN OF Lyttelton	Valuation No(s): 2380148700 Valuation No(s): 2380148800



The information presented in this map is specific to the area within a 50m radius of property you have selected. Information on properties outside the search radius may not be shown on this map, even if the property is visible.

Summary of sites:

There are no sites associated with the area of enquiry.

Information held about the sites on the Listed Land Use Register

There are no sites associated with the area of enquiry.

Information held about other investigations on the Listed Land Use Register

2 May 2014 **INV 27495: Preliminary Site Investigation - Lyttelton Main School - 1 Sumner Road and 26 Oxford Street, Lyttelton (Preliminary Site Investigation)**
OPUS

19 Mar 2015 **INV 89869: INV#89869 - Detailed Site Investigation - 26 Oxford Street, Lyttelton, (Preliminary Site Investigation)**
OPUS

Summary of investigation(s):

Environment Canterbury has received a Preliminary Site Investigation report that includes all or part of the property you have selected.

A Preliminary Site Investigation seeks to identify potential sources of contamination resulting from current and historical land uses.

The preliminary site investigation may not have found any potential sources of contamination on the property you have enquired about. Where potential sources of contamination have been identified, a site identification number (e.g. SIT 1234) and land uses from the Hazardous Activities and Industries List (HAIL) will be shown on your statement.

This investigation has not been summarised.

21 Nov 2014 **INV 71279: Detailed Site Investigation: Former Lyttelton Main School, Oxford Street, Lyttelton, Christchurch**
(Detailed Site Investigation)
OPUS

28 Feb 2017 **INV 167896: Site Validation Report - Lyttelton School (Detailed Site Investigation)**
OPUS

Summary of investigation(s):

Report(s) have not yet been audited.

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ224078.

Disclaimer: *The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987 and Environment Canterbury's Contaminated Land Information Management Strategy (ECan 2009).*

The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

Listed Land Use Register

What you need to know



What is the Listed Land Use Register (LLUR)?

The LLUR is a database that Environment Canterbury uses to manage information about land that is, or has been, associated with the use, storage or disposal of hazardous substances.

Why do we need the LLUR?

Some activities and industries are hazardous and can potentially contaminate land or water. We need the LLUR to help us manage information about land which could pose a risk to your health and the environment because of its current or former land use.

Section 30 of the Resource Management Act (RMA, 1991) requires Environment Canterbury to investigate, identify and monitor contaminated land. To do this we follow national guidelines and use the LLUR to help us manage the information.

The information we collect also helps your local district or city council to fulfil its functions under the RMA. One of these is implementing the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil, which came into effect on 1 January 2012.

For information on the NES, contact your city or district council.

How does Environment Canterbury identify sites to be included on the LLUR?

We identify sites to be included on the LLUR based on a list of land uses produced by the Ministry for the Environment (MfE). This is called the Hazardous Activities and Industries List (HAIL)¹. The HAIL has 53 different activities, and includes land uses such as fuel storage sites, orchards, timber treatment yards, landfills, sheep dips and any other activities where hazardous substances could cause land and water contamination.

We have two main ways of identifying HAIL sites:

- We are actively identifying sites in each district using historic records and aerial photographs. This project started in 2008 and is ongoing.
- We also receive information from other sources, such as environmental site investigation reports submitted to us as a requirement of the Regional Plan, and in resource consent applications.

¹The Hazardous Activities and Industries List (HAIL) can be downloaded from MfE's website www.mfe.govt.nz, keyword search HAIL

How does Environment Canterbury classify sites on the LLUR?

Where we have identified a HAIL land use, we review all the available information, which may include investigation reports if we have them. We then assign the site a category on the LLUR. The category is intended to best describe what we know about the land use and potential contamination at the site and is signed off by a senior staff member.

Please refer to the Site Categories and Definitions factsheet for further information.

What does Environment Canterbury do with the information on the LLUR?

The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list of any investigation reports.

We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

If you are conducting an environmental investigation or removing an underground storage tank at your property, you will need to comply with the rules in the Regional Plan and send us a copy of the report. This means we can keep our records accurate and up-to-date, and we can assign your property an appropriate category on the LLUR. To find out more, visit www.ecan.govt.nz/HAIL.



My land is on the LLUR – what should I do now?

IMPORTANT! Just because your property has a land use that is deemed hazardous or is on the LLUR, it doesn't necessarily mean it's contaminated. The only way to know if land is contaminated is by carrying out a detailed site investigation, which involves collecting and testing soil samples.

You do not need to do anything if your land is on the LLUR and you have no plans to alter it in any way. It is important that you let a tenant or buyer know your land is on the Listed Land Use Register if you intend to rent or sell your property. If you are not sure what you need to tell the other party, you should seek legal advice.

You may choose to have your property further investigated for your own peace of mind, or because you want to do one of the activities covered by the National Environmental Standard for Assessing and Managing Contaminants in Soil. Your district or city council will provide further information.

If you wish to engage a suitably qualified experienced practitioner to undertake a detailed site investigation, there are criteria for choosing a practitioner on www.ecan.govt.nz/HAIL.



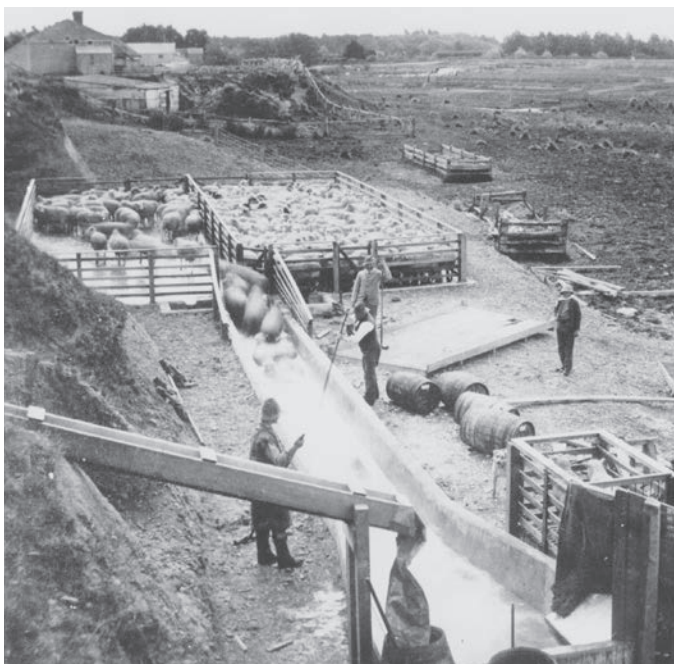
I think my site category is incorrect – how can I change it?

If you have an environmental investigation undertaken at your site, you must send us the report and we will review the LLUR category based on the information you provide. Similarly, if you have information that clearly shows your site has not been associated with HAIL activities (eg. a preliminary site investigation), or if other HAIL activities have occurred which we have not listed, we need to know about it so that our records are accurate.

If we have incorrectly identified that a HAIL activity has occurred at a site, it will be not be removed from the LLUR but categorised as Verified Non-HAIL. This helps us to ensure that the same site is not re-identified in the future.

IMPORTANT!

The LLUR is an online database which we are continually updating. A property may not currently be registered on the LLUR, but this does not necessarily mean that it hasn't had a HAIL use in the past.



Sheep dipping (ABOVE) and gas works (TOP) are among the former land uses that have been identified as potentially hazardous. (Photo above by Wheeler & Son in 1987, courtesy of Canterbury Museum.)

Contact us

Property owners have the right to look at all the information Environment Canterbury holds about their properties.

It is free to check the information on the LLUR, online at www.llur.ecan.govt.nz.

If you don't have access to the internet, you can enquire about a specific site by phoning us on (03) 353 9007 or toll free on 0800 EC INFO (32 4636) during business hours.

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:

Calling from Christchurch: (03) 353 9007

Calling from any other area: 0800 EC INFO (32 4636)

Listed Land Use Register

Site categories and definitions

When Environment Canterbury identifies a Hazardous Activities and Industries List (HAIL) land use, we review the available information and assign the site a category on the Listed Land Use Register. The category is intended to best describe what we know about the land use.

If a site is categorised as **Unverified** it means it has been reported or identified as one that appears on the HAIL, but the land use has not been confirmed with the property owner.

If the land use has been confirmed but analytical information from the collection of samples is not available, and the presence or absence of contamination has therefore not been determined, the site is registered as:

Not investigated:

- A site whose past or present use has been reported and verified as one that appears on the HAIL.
- The site has not been investigated, which might typically include sampling and analysis of site soil, water and/or ambient air, and assessment of the associated analytical data.
- There is insufficient information to characterise any risks to human health or the environment from those activities undertaken on the site. Contamination may have occurred, but should not be assumed to have occurred.

If analytical information from the collection of samples is available, the site can be registered in one of six ways:

At or below background concentrations:

The site has been investigated or remediated. The investigation or post remediation validation results confirm there are no hazardous substances above local background concentrations other than those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterise the site.

Below guideline values for:

The site has been investigated. Results show that there are hazardous substances present at the site but indicate that any adverse effects or risks to people and/or the environment are considered to be so low as to be acceptable. The site may have been remediated to reduce contamination to this level, and samples taken after remediation confirm this.

Managed for:

The site has been investigated. Results show that there are hazardous substances present at the site in concentrations that have the potential to cause adverse effects or risks to people and/or the environment. However, those risks are considered managed because:

- the nature of the use of the site prevents human and/or ecological exposure to the risks; and/or
- the land has been altered in some way and/or restrictions have been placed on the way it is used which prevent human and/or ecological exposure to the risks.

Partially investigated:

The site has been partially investigated. Results:

- demonstrate there are hazardous substances present at the site; however, there is insufficient information to quantify any adverse effects or risks to people or the environment; or
- do not adequately verify the presence or absence of contamination associated with all HAIL activities that are and/or have been undertaken on the site.

Significant adverse environmental effects:

The site has been investigated. Results show that sediment, groundwater or surface water contains hazardous substances that:

- have significant adverse effects on the environment; or
- are reasonably likely to have significant adverse effects on the environment.

Contaminated:

The site has been investigated. Results show that the land has a hazardous substance in or on it that:

- has significant adverse effects on human health and/or the environment; and/or
- is reasonably likely to have significant adverse effects on human health and/or the environment.

If a site has been included incorrectly on the Listed Land Use Register as having a HAIL, it will not be removed but will be registered as:

Verified non-HAIL:

Information shows that this site has never been associated with any of the specific activities or industries on the HAIL.

Please contact Environment Canterbury for further information:

(03) 353 9007 or toll free
on 0800 EC INFO (32 4636)
email ecinfo@ecan.govt.nz

APPENDIX 3:
Laboratory Analysis Certificates



Certificate of Analysis

Client:	Engeo Limited	Lab No:	2098202	SPV1
Contact:	Jimmy Whitmore C/- Engeo Limited PO Box 373 Christchurch 8140	Date Received:	15-Dec-2018	
		Date Reported:	19-Dec-2018	
		Quote No:	82742	
		Order No:		
		Client Reference:	15681.000.000	
		Submitted By:	Jimmy Whitmore	

Sample Type: Soil

Sample Name:	15681_HA01_@ 0.0-0.5 mbgl 14-Dec-2018 10:00 am	15681_HA02_@ 0.0-0.5 mbgl 14-Dec-2018 10:30 am	15681_HA03_@ 0.0-0.5 mbgl 14-Dec-2018 11:00 am	15681_HA04_@ 0.0-0.5 mbgl 14-Dec-2018 12:30 pm	15681_HA05_@ 0.0-0.5 mbgl 14-Dec-2018 1:00 pm
Lab Number:	2098202.1	2098202.2	2098202.3	2098202.4	2098202.5

Individual Tests

Dry Matter	g/100g as rcvd	86	77	84	82	85
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Heavy Metals, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	6	6	6	6	6
Total Recoverable Cadmium	mg/kg dry wt	0.13	0.12	0.11	0.16	0.17
Total Recoverable Chromium	mg/kg dry wt	16	15	15	14	16
Total Recoverable Copper	mg/kg dry wt	12	12	12	15	14
Total Recoverable Lead	mg/kg dry wt	48	98	80	100	45
Total Recoverable Nickel	mg/kg dry wt	12	12	12	11	13
Total Recoverable Zinc	mg/kg dry wt	98	113	123	168	114

Polycyclic Aromatic Hydrocarbons Screening in Soil

1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.013	< 0.012	0.016	< 0.012
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.013	< 0.012	0.016	< 0.012
Perylene	mg/kg dry wt	0.084	0.028	0.089	0.158	0.054
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.46	0.16	0.50	0.87	0.29
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.46	0.15	0.50	0.87	0.29
Acenaphthylene	mg/kg dry wt	0.038	< 0.013	0.037	0.048	0.030
Acenaphthene	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.012	< 0.012
Anthracene	mg/kg dry wt	0.065	< 0.013	0.046	0.065	0.038
Benzo[a]anthracene	mg/kg dry wt	0.23	0.072	0.25	0.40	0.148
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.33	0.112	0.36	0.62	0.21
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.32	0.110	0.36	0.63	0.20
Benzo[e]pyrene	mg/kg dry wt	0.20	0.072	0.23	0.40	0.128
Benzo[g,h,i]perylene	mg/kg dry wt	0.21	0.077	0.25	0.45	0.133
Benzo[k]fluoranthene	mg/kg dry wt	0.125	0.043	0.150	0.23	0.079
Chrysene	mg/kg dry wt	0.26	0.087	0.29	0.45	0.162
Dibenzo[a,h]anthracene	mg/kg dry wt	0.038	< 0.013	0.040	0.074	0.023
Fluoranthene	mg/kg dry wt	0.55	0.160	0.57	0.75	0.32
Fluorene	mg/kg dry wt	0.023	< 0.013	< 0.012	< 0.012	< 0.012
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.21	0.071	0.24	0.42	0.132
Naphthalene	mg/kg dry wt	< 0.06	< 0.07	< 0.06	< 0.06	< 0.06
Phenanthrene	mg/kg dry wt	0.26	0.058	0.22	0.175	0.099
Pyrene	mg/kg dry wt	0.59	0.165	0.58	0.82	0.34
Total of Reported PAHs in Soil*	mg/kg	3.6	1.1	3.7	5.8	2.1



Sample Type: Soil

Sample Name:	15681_HA06_@ 0.0-0.5 mbgl 14-Dec-2018 2:00 pm				
Lab Number:	2098202.6				

Individual Tests

Dry Matter	g/100g as rcvd	85	-	-	-	-
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Heavy Metals, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	32	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.23	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	14	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	32	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	162	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	11	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	350	-	-	-	-

Polycyclic Aromatic Hydrocarbons Screening in Soil

1-Methylnaphthalene	mg/kg dry wt	0.041	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	0.041	-	-	-	-
Perylene	mg/kg dry wt	1.09	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	6.7	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	6.7	-	-	-	-
Acenaphthylene	mg/kg dry wt	0.51	-	-	-	-
Acenaphthene	mg/kg dry wt	0.022	-	-	-	-
Anthracene	mg/kg dry wt	0.78	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	4.2	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	4.6	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	5.0	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	3.0	-	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	2.9	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	2.0	-	-	-	-
Chrysene	mg/kg dry wt	3.8	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	0.55	-	-	-	-
Fluoranthene	mg/kg dry wt	8.0	-	-	-	-
Fluorene	mg/kg dry wt	0.114	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	3.0	-	-	-	-
Naphthalene	mg/kg dry wt	0.11	-	-	-	-
Phenanthrene	mg/kg dry wt	2.3	-	-	-	-
Pyrene	mg/kg dry wt	8.2	-	-	-	-
Total of Reported PAHs in Soil*	mg/kg	50	-	-	-	-

Analyst's Comments

Appendix No.1 - Chain of Custody

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 clean 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. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-6
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-6
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	-	1-6

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Dry Matter (Env)	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	1-6
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(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 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + 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.	0.002 mg/kg dry wt	1-6
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-6
Total of Reported PAHs in Soil*	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg	1-6

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

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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



Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental

ENVIRONMENTAL Analysis Request Form

Hill Laboratory **209 8202**

R J Hill Laboratories Limited — accredited
Accreditation NZ

CLIENT

Name **ENGE0 Ltd.** [160117]
PO Box 373
Christchurch 8140

1 Clyde Street, Telephone: +
 Private Bag 3205, Facsimile: +
Hill Laboratories office use only:
 Date In Job # No. of Samples

Received by: Kayley Stesel



Phone: 03 328 9012 Fax:

Client Reference: ~~15618.000.000~~ **15681.000.000** (Project Code)

Quote Number: Order No: (Cost Centre)

Submitted By **Jimmy Whitmore**

Charge To: **ENGE0. [160117]**

RESULTS TO

Mail Client Mail Submitter

Fax Results X - Nflatman@engeo.co.nz
 X Email Results X - HAtkins@engeo.co.nz

C.O.C & coversheet to be scanned and emailed back

Chain of Custody Record

Delivered to **Hill Laboratories** Date & Time: 14/12/18 1500
 (Depatched by) Name: Jimmy Whitmore
 Signature:

Received at **Hill Laboratories** Date & Time:
 Name:
 Signature:

Condition Ambient Temp Chilled 16.3 °C

Additional Information

May contain asbestos fibres

PRIORITY

Normal (up to 10 days) High (approx 5 days) Urgent (MUST be pre-arranged)
 Results required by:

Sample types

GW Bore/well **TW** Trade waste **S** Saline water **ES** Soil/Solid **PI** Plant
SW Surface water **E** Effluent **O** Oil **Sed** Sediment **BM** Fish/shellfish/Biota
P Potable/DI **L** Leachate **SI** Sludge **BS** Biosolid **M** Misc (Specify)

Site ID	Sample type	Tests required	Comments
15618 HA01_@ 0.0 – 0.5 mbgl	ES	Heavy metals, PAHS	
15618 HA02_@ 0.0 – 0.5 mbgl	ES	"	
15618 HA03_@ 0.0 – 0.5 mbgl	ES	"	
15618 HA04_@ 0.0 – 0.5 mbgl	ES	"	
15618 HA05_@ 0.0 – 0.5 mbgl	ES	"	
15618 HA06_@ 0.0 – 0.5 mbgl	ES	"	
15618 HA03_@ 1.6 – 2.5 mbgl	ES	HOLD COLD PLEASE	

ASBESTOS ANALYSIS REPORT

Wednesday 19th December 2018

Reference No: F11482

Laboratory Reference No.	Client Sample No.	Sampling Address/Sampling Location/Description/Dimensions	Fibre Identification Analysis Results
F11482.1	1	15681.000.000 15681_HA01_@0.0 – 0.5 mbgl, Soil	
		>10 mm Sample weight: 5.50 g	Organic Fibres No Asbestos Detected
		10-2 mm Sample weight: 30.18 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 675.66 g) Sub sample weight: 49.40 g Total sample weight: 711.34 g	Organic Fibres No Asbestos Detected
F11482.2	2	15681.000.000 15681_HA02_@0.0 – 0.5 mbgl, Soil	
		>10 mm Sample weight: 3.75 g	Organic Fibres No Asbestos Detected
		10-2 mm Sample weight: 10.00 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 490.92 g) Sub sample weight: 52.00 g Total sample weight: 504.67 g	Organic Fibres No Asbestos Detected

ASBESTOS ANALYSIS REPORT

Wednesday 19th December 2018

Reference No: F11482

Laboratory Reference No.	Client Sample No.	Sampling Address/Sampling Location/Description/Dimensions	Fibre Identification Analysis Results
F11482.3	3	15681.000.000 15681_HA03_@0.0 – 0.5 mbgl, Soil	
		>10 mm Sample weight: 7.70 g	Organic Fibres No Asbestos Detected
		10-2 mm Sample weight: 12.26 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 483.74 g) Sub sample weight: 52.00 g Total sample weight: 503.70 g	Organic Fibres No Asbestos Detected
F11482.4	4	15681.000.000 15681_HA04_@0.0 – 0.5 mbgl, Soil	
		>10 mm Sample weight: 33.06 g	Organic Fibres No Asbestos Detected
		10-2 mm Sample weight: 13.60 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 563.37 g) Sub sample weight: 49.12 g Total sample weight: 610.03 g	Organic Fibres No Asbestos Detected

ASBESTOS ANALYSIS REPORT

Wednesday 19th December 2018

Reference No: F11482

Laboratory Reference No.	Client Sample No.	Sampling Address/Sampling Location/Description/Dimensions	Fibre Identification Analysis Results
F11482.5	5	15681.000.000 15681_HA05_@0.0 – 0.5 mbgl, Soil	
		>10 mm Sample weight: N/A	
		10-2 mm Sample weight: 19.68 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 531.04 g) Sub sample weight: 50.28 g Total sample weight: 550.72 g	Chrysotile (White Asbestos) Organic Fibres AF Weight: 0.0001 g
F11482.6	6	15681.000.000 15681_HA06_@0.0 – 0.5 mbgl, Soil	
		>10 mm Sample weight: 90.23 g	Organic Fibres No Asbestos Detected
		10-2 mm Sample weight: 70.89 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 495.61 g) Sub sample weight: 50.23 g Total sample weight: 656.73 g	Organic Fibres No Asbestos Detected

Note: The results contained in this report relate specifically to the samples submitted.

Reporting limit is 0.1g/kg as per the AS4964-2004.

Reporting raw asbestos weights within soil samples is outside of EIAG's IANZ accreditation.

This document may not be reproduced except in full.

Identified By:



Brigitt White PgDip (Geol)
Laboratory Technician

Reviewed By:



Belinda Hughes PgDip (Envr)
National Quality Manager

15681

Form No: QLA001 – A				CONTROLLED DOCUMENT						
CHAIN OF CUSTODY FORM – ENGEO				Version Number: 2						
				Issue Date: November 2018						
EIAG Contact Name: EIAG Contact Email: Client Business Name: ENGEO				Authorised By: Belinda Hughes <i>Document is Uncontrolled When Printed</i>						
				Receiving Laboratory: Please complete sample receipt details below and email copy of COC to EIAG contact						
Contact Name:				Received By:						
Company Address:				Date & Time:						
Contact No:				Signature: 15681						
Report Email: JDW, NF, HA				ENGEO Ref. #: 15618.000.000 15681.000.000						
Account Email: HA, NF				Client Ref. #:						
Sample Details: VFC – Vinyl Floor Covering VFT – Vinyl Floor Tile IB – Insulation Board w PB – With Paper Backing S/C – Skim Coat T/C – Textured Coating				COC emailed to EIAG: Yes / No (Circle)						
				Turn Around time Requested (Circle)						
				3 - 5 Business days <input checked="" type="checkbox"/>						
				48 Hour <input checked="" type="checkbox"/>						
Site Reference:				24 Hour						
Accessibility: ✓				Analysis Required BRAVZ						
Time & Date: 14/12/18										
Sampled By: JDW/MK				AS RECEIVED						
Lab. Sample Number	Client Sample Number	Product	Sample Location: (Provide the information you require on the analysis report)	Bulk ID	Fibre. C	Bulk	Tape	Dust	Soil/Ore	
	1	Soil	15681_HA01_@ 0.0 – 0.5 mbgl						✓	
	2	"	15681_HA02_@ 0.0 – 0.5 mbgl						✓	
	3	"	15681_HA03_@ 0.0 – 0.5 mbgl						✓	
	4	"	15681_HA04_@ 0.0 – 0.5 mbgl						✓	
	5	"	15681_HA05_@ 0.0 – 0.5 mbgl						✓	
	6	"	15681_HA06_@ 0.0 – 0.5 mbgl						✓	
	7	"	15681_HA03_@ 1.6 – 2.5 mbgl	HOLD PLEASE						
Number of Samples Received: 7				Date required: 17/12/18						
Date/Time Received: 14/12/18 ~1700				Results to be sent to client by:						
Name: T. WATSON				Email <input checked="" type="checkbox"/> Post <input type="checkbox"/>						
Signature:										
Job Number: F11482										
WFM UPDATED WITH SAMPLE AMOUNT AND COSTS: YES / NO										

This form has been altered to suit the client (ENGEO) and has been approved by EIAG's Quality Manager



TERRA SCIENTIFIC

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Addington,
Christchurch, 8011

Terra Scientific Ltd

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Version Number: 10

Date Issued: August 2020

Authorised By: JC

Controlled Document

Client Name:	ENGEO Christchurch	Job Number:	T004012a	Total Samples Received:	5
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	Site Reference / Address:	15681	Date Received:	2/02/2021
Client Reference:	15681			Date Analysed:	4/02/2021
Client Contact:	Hazel Atkins	Analyst:	Sarah Giles	Date Reported:	11/02/2021

ASBESTOS IN SOIL ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description	Received Weight (g)	Dry Weight (g)	Results	ACM Weight (g)	FA Weight (g)	AF Weight (g)	ACM w/w %	FA w/w %	AF w/w %	Combined AF/FA %	Comments
T004012.1	1	AS 1.1 @ 0.1 - 0.2											
		Layer 1: >10 mm	856.93	10.68	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00020%	0.00020%	
		Layer 2: 10 - 2 mm		68.04	Crocidolite (Blue Asbestos) Organic Fibres	N/A	0.00000	0.00108					
		Layer 3: <2 mm		462.54	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		52.83									
Total sample weight:	541.26	Total Combined:		0.00000	0.00000	0.00108							
T004012.2	2	AS 2.1 @ 0.1 - 0.2											
		Layer 1: >10 mm	709.56	10.82	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected
		Layer 2: 10 - 2 mm		59.09	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		552.54	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		52.41									
Total sample weight:	622.45	Total Combined:		0.00000	0.00000	0.00000							

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Client Reference:	15681			Date Analysed:	4/02/2021
Client Contact:	Hazel Atkins	Analyst:	Sarah Giles	Date Reported:	11/02/2021

ASBESTOS IN SOIL ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description	Received Weight (g)	Dry Weight (g)	Results	ACM Weight (g)	FA Weight (g)	AF Weight (g)	ACM w/w %	FA w/w %	AF w/w %	Combined AF/FA %	Comments
T004012.3	3	AS 3.1 @ 0.1 - 0.2											
		Layer 1: >10 mm	662.88	9.83	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected
		Layer 2: 10 - 2 mm		108.44	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		313.50	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		50.92									
Total sample weight:	431.77	Total Combined:		0.00000	0.00000	0.00000							
T004012.4	4	AS 4.1 @ 0.1 - 0.2											
		Layer 1: >10 mm	491.66	26.82	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected
		Layer 2: 10 - 2 mm		128.66	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		241.65	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		53.81									
Total sample weight:	397.13	Total Combined:		0.00000	0.00000	0.00000							



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Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	Site Reference / Address:	15681	Date Received:	2/02/2021
Client Reference:	15681			Date Analysed:	4/02/2021
Client Contact:	Hazel Atkins	Analyst:	Sarah Giles	Date Reported:	11/02/2021

ASBESTOS IN SOIL ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description	Received Weight (g)	Dry Weight (g)	Results	ACM Weight (g)	FA Weight (g)	AF Weight (g)	ACM w/w %	FA w/w %	AF w/w %	Combined AF/FA %	Comments
T004012.5	5	AS 1.2 @ 0.1 - 0.2, Soil											
		Layer 1: >10 mm	787.07	N/A	N/A	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected
		Layer 2: 10 - 2 mm		30.62	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		558.26	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		51.53									
Total sample weight:	588.88	Total Combined:		0.00000	0.00000	0.00000							

AMENDED REPORT: This report supersedes report T004012 reported 05/02/2021. Reason for amendment - sample 5 added to report at customer request

Method References and Disclaimers

Samples were analysed in accordance with: AS4964-2004 Australian Standard - Method for Qualitative Identification of Asbestos in Bulk Samples
BRANZ - New Zealand Guidelines for Assessing and Managing Asbestos in Soil 2017

Disclaimers: Samples are reported 'As Received'. Terra Scientific takes no responsibility for sampling processes, client sample descriptions and sample locations as these were provided by the client. The results presented in this report relate specifically to the samples submitted for this job. The detection limit is 0.1g/1kg (0.01% w/w) as stated in the AS4964-2004. Samples that contain asbestos less than this limit are outside the scope of accreditation. Asbestos calculations are outside the scope of accreditation. All opinions and interpretations are outside the scope of accreditation. This report shall not be reproduced, except in full, without the written consent of the Key Technical Person assigned to this report.

For any queries regarding this report, please do not hesitate to contact the laboratory and speak with the Key Technical Person.

Sarah Giles
Laboratory Analyst
Key Technical Person

APPENDIX 4:
Hand Auger Logs

LOG OF TEST HA01

Collet's Corner
3-11 London Street
Lyttelton
15681.000.000

Client : Collet's Corner Ltd
Client Ref. : 15681.000.000
Date : 14/12/18
Hole Depth : 1.5 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : JDW / MK
Reviewed By : JDW
Latitude :
Longitude :

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Sample	PID (ppm)
0.5		ML	SILT with trace brick, charcoal, sand and rootlets; brown. Low plasticity. [FILL]	[Cross-hatched pattern]			HA01	0
		ML	SILT with trace brick, charcoal and sand; brown. Low plasticity. [FILL]					
1.0		ML	Becomes yellowish brown from 0.9 m depth. Becomes brown from 1.1 m depth.					
1.5	End of Hole Depth: 1.5 m Termination Condition: Practical refusal							
2.0								

ENGEO NZ - ENVIRO + PHOTOS COLLETS CORNER SOIL LOGS.GPJ NZ DATA TEMPLATE 2.GDT 20/12/18



Hand auger met practical refusal at 1.5 m depth on hard material.

LOG OF TEST HA02

Collet's Corner
3-11 London Street
Lyttelton
15681.000.000

Client : Collet's Corner Ltd
Client Ref. : 15681.000.000
Date : 14/12/18
Hole Depth : 3 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : JDW / MK
Reviewed By : JDW
Latitude :
Longitude :

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Sample	PID (ppm)
0.5		ML	SILT with trace brick, charcoal, plastic and rootlets; brown. Low plasticity. [FILL]				HA02	0
0.5			SILT with trace brick, charcoal and plastic; brown. Low plasticity. [FILL]					
1.0		ML	Major woodchips encountered from 1.0 m depth.					
2.0		ML	SILT with minor sand, trace charcoal and brick; yellowish brown. Low Plasticity. [FILL]					
2.5		ML	SILT with trace sand, charcoal and brick; bluish grey. Low plasticity [FILL]					
3.0			Purple colour encountered at 2.8 m depth.					
3.0	End of Hole Depth: 3 m Termination Condition: Practical refusal							

ENGEO NZ - ENVIRO + PHOTOS COLLETS CORNER SOIL LOGS.GPJ NZ DATA TEMPLATE 2.GDT 20/12/18



Hand auger met practical refusal at 3 m depth on hard material.

LOG OF TEST HA03

Collet's Corner
3-11 London Street
Lyttelton
15681.000.000

Client : Collet's Corner Ltd
Client Ref. : 15681.000.000
Date : 14/12/18
Hole Depth : 3 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : JDW / MK
Reviewed By : JDW
Latitude :
Longitude :

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Sample	PID (ppm)
0.5		ML	SILT with minor sand, trace brick, charcoal and rootlets; brown. Low plasticity [FILL]	[Cross-hatched pattern]			HA03	0
			SILT with minor sand, trace brick and charcoal; yellowish brown. Low plasticity [FILL]					
		ML	White crystalline (unknown) substance encountered at 0.8 m depth. Trace wood encountered from 1.1 m depth Major brick, pottery and charcoal encountered at 1.3 m depth.					
		ML	SILT with major fine to medium sand; yellowish brown. Low plasticity. [FILL] Sand, poorly graded.					
3.0		ML	SILT with major fine to medium sand, trace charcoal and brick; black. Low plasticity. [FILL] Sand, poorly graded. End of Hole Depth: 3 m Termination Condition: Practical refusal					

ENGEO NZ - ENVIRO + PHOTOS COLLETS CORNER SOIL LOGS.GPJ NZ DATA TEMPLATE 2.GDT 20/12/18



Hand auger met practical refusal at 3 m depth on hard material.

LOG OF TEST HA04

Collet's Corner
3-11 London Street
Lyttelton
15681.000.000

Client : Collet's Corner Ltd
Client Ref. : 15681.000.000
Date : 14/12/18
Hole Depth : 2 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : JDW / MK
Reviewed By : JDW
Latitude :
Longitude :

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Sample	PID (ppm)
0.5		ML	SILT with trace brick and rootlets; brown. Low plasticity [FILL].	[Cross-hatched pattern]			HA04	0
		N/A	Ash layer encountered from 0.5 - 0.6 m depth.					
		ML	SILT with trace brick and charcoal; black. Low plasticity [FILL].					
		ML	SILT with some fine to coarse sand; yellowish brown. Low plasticity. Sand, well graded. [FILL]					
2.0			End of Hole Depth: 2 m Termination Condition: Practical refusal					



Hand auger met practical refusal at 2 m depth on hard material.

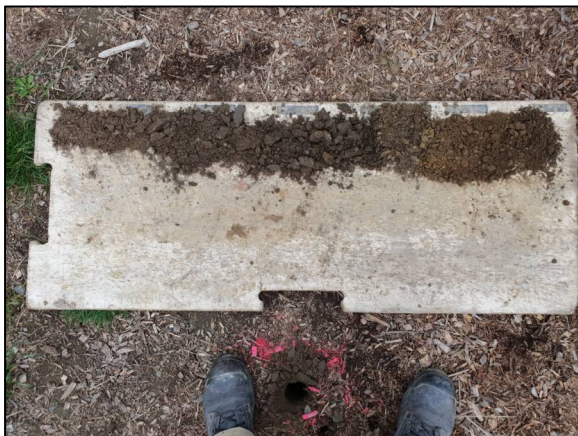
LOG OF TEST HA05

Collet's Corner
3-11 London Street
Lyttelton
15681.000.000

Client : Collet's Corner Ltd
Client Ref. : 15681.000.000
Date : 14/12/18
Hole Depth : 0.9 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : JDW / MK
Reviewed By : JDW
Latitude :
Longitude :

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Sample	PID (ppm)
0.5		ML	SILT with trace sand, gravel, brick and charcoal; brown. Low plasticity. [FILL]				HA05	0
		ML	SILT with minor sand, gravel, brick and charcoal; yellowish brown. Low plasticity [FILL].					
1.0	End of Hole Depth: 0.9 m Termination Condition: Practical refusal							
1.5								
2.0								



Hand auger met practical refusal at 0.9 m depth on inferred gravel.

LOG OF TEST HA06

Collet's Corner
3-11 London Street
Lyttelton
15681.000.000

Client : Collet's Corner Ltd
Client Ref. : 15681.000.000
Date : 14/12/18
Hole Depth : 0.6 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : JDW / MK
Reviewed By : JDW
Latitude :
Longitude :

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Sample	PID (ppm)	
0.5			SILT with trace brick, gravel, glass, terracotta and charcoal; brown. Low plasticity [FILL] Trace ash encountered at 0.5 m depth.				HA06	0	
			End of Hole Depth: 0.6 m Termination Condition: Practical refusal						



Hand auger met practical refusal at 0.6 m depth on hard material.