Private Plan Change Request – Hughes Developments Limited
Appendix E – Preliminary Site Investigation, Soil Contamination

23 October 2020

Mr Kelvin Back
Hughes Developments Ltd
8 Mill Lane
Merivale
Christchurch 8014

Dear Kelvin

RE: Summary of Environmental Investigations - Faringdon Far West, Rolleston, Canterbury (Our Reference: 12903.000.000_104)

1 Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to provide a summary of environmental investigations for the properties at Faringdon Far West, Rolleston, Canterbury. The purpose of the letter is to summarise several environmental preliminary site investigation (PSI) and detailed site investigation (DSI) reports previously completed by ENGEO. This document should be considered supplementary to the reports outlined below and the full reports should be consulted for further detail.

2 Site Description

We understand that the Faringdon Far West development is the area bordered by Dunns Crossing Road, Goulds Road and East Maddisons Road to the west of the existing Faringdon Development. The approximate site location is shown in Appendix 1 of this report. ENGEO has previously completed the following environmental reports within this site:

- 3/144 Dunns Crossing Road, Rolleston dated 14 August 2020.
- 108 Dunns Crossing Road, Rolleston dated 8 November 2019.
- 92 Dunns Crossing Road, Rolleston dated 17 December 2020.
- 597 East Maddisons Road, Rolleston dated 3 September 2020.

3 Environmental Investigation Summary

A summary of the environmental works undertaken to date are included in Table 1 below.

Table 1: Summary of Environmental Works

Address	Phase	Work required
3/144 Dunns Crossing Road	DSI completed – one minor exceedance against NES residential criteria.	Remediation not considered to be required. Topsoil from the site is proposed to be stripped, stockpiled and redistributed across the site which will cause mixing. Targeted remediation not required. Site management plan required. NES consent likely to be required. Asbestos demolition survey for buildings required as constructed pre-2000.
108 Dunns Crossing Road	DSI completed – two areas of concern and samples are below NES residential criteria.	Asbestos demolition survey for hay / implement shed is required as constructed pre-2000.
92 Dunns Crossing Road	DSI completed – three areas identified that require remediation. One additional area potentially present below large radio tower.	Remediation is required prior to development of sheep dip area, waste pit and above ground storage tank. Site management plan required. Unlikely that radio tower or mobile phone tower will be removed during development works therefore potential waste pit under this area is likely to remain *in situ* and not be investigated. Asbestos demolition survey for buildings required as constructed pre-2000.
597 East Maddisons Road	DSI completed – two areas identified that require remediation.	Remediation of burn pile and lead in soils are required prior to development. Site management plan required. Asbestos demolition survey for buildings required as constructed pre-2000.

4 Environmental Recommendations

Going forward, it is required that remediation occurs at 92 Dunns Crossing Road and 597 East Maddisons Road. Remedial action plans will be required to be written to outline the requirements for remediation, disposal options and validation requirements. A site management plan should also be outlined for 3/144 Dunns Crossing Road due to the presence of heavy metals above the site specific background levels across the site.

It is recommended due to the age of the buildings present that asbestos demolition surveys are undertaken at 3/144 Dunns Crossing Road, 108 Dunns Crossing Road, 92 Dunns Crossing Road and 597 East Maddisons Road. The Health and Safety at Work (Asbestos) Regulations 2016 state if a building constructed or installed prior to January 2000 requires demolition or refurbishment, a full asbestos survey must be undertaken by a competent person.

5 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Ltd, 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.

ii. 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.

iii. 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.

iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.

v. 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

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Environmental Scientist

Report reviewed by

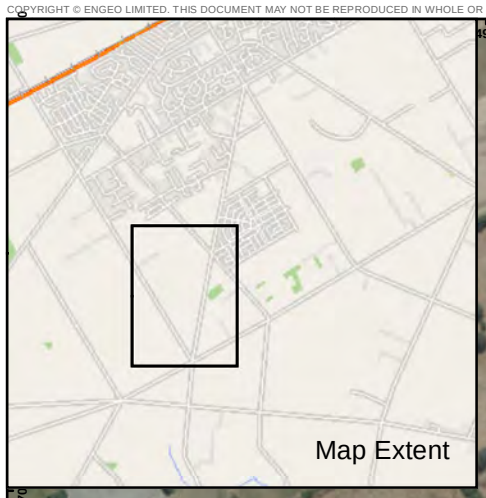
Dave Robotham, CEnvP SC

Principal Environmental Consultant

Attachments:

Figure of Sites

DATE PLOTTED: 23 October 2020 9:22:49 am BY: NFlatman



3/144
Dunns Crossing Road

597
East Maddisons Road

108
Dunns Crossing Road

92
Dunns Crossing Road

N

Legend

Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

0 50 100
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

PATH: Z:\Projects\12901 to 13000\12903 - Faringdon South Subdivision\102_Far West\01_GIS\Fig01.mxd

ENGEO

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Title: Site location plan

Client: Hughes Developments

Project: Faringdon Far West

Designed: NF
Drawn: NF
Checked: DR
Date: Oct 20

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ORIGINAL FIGURE PRINTED IN COLOUR

ENGEO

Celebrating 10 YEARS IN NZ

Detailed Environmental Site Investigation

3/144 Dunns Crossing

Rolleston

Canterbury

Submitted to:

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ENGEO Document Control:

Report Title	Detailed Environmental Site Investigation - 3/144 Dunns Crossing, Rolleston			
Project No.	12903.003.000	Doc ID	92	
Client	Hughes Development Ltd	Client Contact	Kelvin Back	
Distribution (PDF)	Hughes Development Ltd			
Date	Revision Details/Status	WP	Author	Reviewer
14/08/2020	Issued to Client	-	NF	HA/CD

1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a combined preliminary and detailed environmental site investigation (PSI/DSI) of the property at 3/144 Dunns Crossing, Rolleston, Canterbury (herein referred to as 'the site'). Figure 1 attached indicated the location of the property. The purpose of the assessment was to assess the property's suitability for a change of land use consent and subdivision under the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES) and to satisfy the requirements of Selwyn District Council (SDC).

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*.

1.1 Objectives of the Assessment

The objective of this DSI was to assess conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property and report on the potential risk posed to future site users.

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; and
- 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 substances to the subject property.

1.2.1 Review of Site Information

During this assessment, a number of sources of information were contacted for information relating to the site regarding its past and present uses. This included contacting Canterbury Regional Council (CRC) to determine if there were records on the Listed Land Use Register (LLUR), reviewing records held by Selwyn District Council (SDC) including the property file, and obtaining the certificate of titles for the property from Land Information New Zealand (LINZ). A review of a number of historical and current aerial photographs was also undertaken using images from Canterbury Maps and Google Earth.

1.2.2 Site Inspection

A site walkover was undertaken on 6 August 2020 by ENGEO.

2 Site Description and Setting

Site information is summarised in Table 1.

Table 1: Site Information

Item	Description
Location	3/144 Dunns Crossing Road, Rolleston
Legal Description	LOT 3 DP 70352 BLK III LEESTON SD-INT IN R/W EASEMENT DP 72978 OVER LOT 4 DP 7 0352
Site Area	Approximately 4.00 ha
Property Owner	Property is under contract to Hughes Developments Limited
Current Land Use	Residential and Horticultural - Walnut Orchard
Proposed Land Use	Standard residential subdivision, for single dwelling sites with gardens, including home-grown produce consumption (10%)
Building Construction	Main Dwelling: Concrete foundation, brick cladding, concrete tile roof. Garage: Concrete foundation, metal, cement board and timber cladding, metal roof. Shed: Open earth ground, timber pole, metal cladding and roof.
Territorial Authority	Selwyn District Council
Zoning	Inner Plains / Living Z

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	The site is predominately flat.
Local Setting	The surrounding area is a mix of agricultural and residential.
Nearest Surface Water & Use	An un-named stream runs along the eastern boundary of the site from the south-eastern corner and is diverted at a right angle into the neighbouring paddock to the northeast. The stream is presumed to be used for stormwater runoff.
Geology (GNS Science)	Late Quaternary unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin.
Hydrogeology (ECan GIS)	The site is located over an unconfined / semiconfined gravel aquifer. The well on-site logged initial water depth at 6.8 m below ground level. Groundwater is presumed to flow from the northwest to the southeast towards Lake Ellesmere.
Groundwater Abstractions (ECan GIS)	There is one groundwater abstraction located on the site and three within 250 m of the site: M36/5041: Kajens Trading Development Ltd, active well (32.0 m) for domestic supply onsite. M36/5042: Kajens Trading Development Ltd, active well (32.10 m) for domestic supply to the northwest of the site. M36/4450: LK & JC Blackmore, active well (25.2 m) for irrigation to the south of the site. M36/5043: Kajens Trading Development Ltd, active well (35.2 m) for domestic supply to the west of the site.
Discharge Consents (ECan GIS)	There are no active discharge consents located on the site, and one active consent within 250 m of the site: CRC053035: Ogon & Magnum Properties Ltd, active discharge consent for human effluent discharge into land and water to the north of the site.

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 Discussions with Site Owners

A discussion was held between ENGEO and the current site owner on 3 August 2020The owner has owned the site within a family trust for the past eight years. The owner stated that the walnut tree orchard was present when they purchased the property, and that the previous owners had harvested approximately 500 kg of walnuts annually for sale.

The current owners mentioned that the previous owners who planted the orchard were described as “Greenies” but didn’t have explicit information that sprays had or hadn’t been used on the trees. The current owner hasn’t sprayed any of the trees in the last eight years and have removed some of the blocks of trees.

The greenwaste from the trees were burnt off on-site with no additional rubbish, fence posts or other inorganic materials being burnt.

During their occupancy at the site no offal pits were dug on the land, and they cannot recall any pits or areas of land disturbance when they purchased the site.

3.2 Selwyn District Council Property File

The property file for the site, held by Selwyn District Council, was reviewed on 12 August 2020 as part of the DSI. :

- 20 February 1997 – Building consent for a garage
- 8 August 1997 – Building consent for a farm shed
- 8 August 1997 - Building consent for a dwelling
- 18 January 2000 – Building consent for a lean-to garage addition

The property file information did not pertain to any asbestos containing materials being used in the construction of the buildings. Because of the age of the buildings (constructed pre-2000) a full asbestos demolition survey is required; this is to ensure that any asbestos materials are identified prior to demolition works so that they can be removed in a safe manner.

3.3 Certificate of Title

A review of the certificate of title was completed with no information related to potential contaminating activities identified. The Certificates of Title are attached in Appendix 2.

3.4 Listed Land Use Register (LLUR)

Potentially hazardous activities are defined on the Ministry for the Environmental (MfE) Hazardous Activities and Industries List (HAIL). Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury region which have potentially had an activity included on the HAIL undertaken on them. Under the NES, the listing of the property on the LLUR triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 30 July 2020 for the site and is presented in Appendix 3.

Table 3: LLUR Summary

Period From	Period To	HAIL Activity(s)	LLUR Category
2000	Present	A10: Persistent pesticide bulk storage or use	Not Investigated
Additional Information		Area defined on aerial photographs from 2000 to present. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.	

3.5 Historical Aerial Photograph Review

Aerial photographs dating from 1940 to 2016 have been reviewed. The relevant visible features are summarised in Table 4.

Table 4: Aerial Photographs

Date	Source	Description
1940-1944	Canterbury Maps	The site is a part of a larger block of land which appears to be grassed and may be used for grazing. A fence line is present running along the current fence line in the north. No buildings are visible on the site. The surrounding area appears to also be undeveloped and used for grazing or cropping. A large forest block is present to the west of Dunns Crossing Road.
1960-1964	Canterbury Maps	The site has no significant changes from the previous photograph. The surrounding area remains mainly unchanged from the previous photograph. Some small land disturbance (stockpiles and cleared areas) is observed in the paddocks to the northwest and west but it is unclear what the stockpiles or cleared areas would have been used for.
1970-1974	Canterbury Maps	The site is mainly unchanged from the previous aerial photograph. The area is still grassed and is used for grazing. The surrounding area is mainly unchanged from the previous photograph.
1980-1984	Canterbury Maps	There is a small area of ponding observed along the eastern boundary line of the site with obvious ponding observed in neighbouring paddocks as well. The site is still grassed and undeveloped. The surrounding area is mainly unchanged from the previous photograph.
1990-1994	Canterbury Maps	The site is undeveloped with apparent channels running across the site from the northwest to the southeast. A tree line is visible along the northern boundary line. The surrounding area is still undeveloped and appears to be used for crop growing and grazing.
2000-2004	Canterbury Maps	The site has been developed into a residential site with a dwelling and shed visible in the western corner and an orchard area covering the remainder of the site. Three lines are visible running northwest to southeast and trees have been divided into smaller square blocks. Many of the surrounding sites have been redeveloped with residential dwellings present on properties to the northwest and west of the site. A horse track is present at 108 Dunns Crossing Road to the south of the site.
2010-2015	Canterbury Maps	The residential dwelling is still present on the site, and small buildings (possible barns) have been constructed to the southwest of the dwelling. The area around the dwelling is planted with a driveway coming into the site from the western corner. A small potential burn off area is apparent to the south of the dwelling. Eight areas are visible that are planted in trees which are bordered with a different tree specimen. There is a block of planting in the southern corner of the site. The site to the north at 4/144 Dunns Crossing Road has planting around the dwelling. The remainder of the surrounding area is mainly unchanged.

2017	Canterbury Maps	Three blocks of trees to the south of the site have been cleared. A ring structure which is presumed to be a horse corral is visible in the southern corner of the site. The remainder of the site appears unchanged since the previous photograph. The surrounding area remains mainly unchanged.

Table 5 below describes the site conditions during the site walkover on 6 August 2020. Photographs taken during the site walkover are included in Appendix 1.

Table 5: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	Four areas of orchard were observed in the north-eastern section of the site. The walnut trees were planted in rows with eucalyptus trees planted between each area. Three burn piles were observed in the cleared paddocks on the site. The material appeared to be free from any building materials or domestic rubbish. The site owner indicated that the burn piles were used for burning green waste only with no domestic rubbish or treated timber being burnt. The horse corral which was observed in the aerial photograph review was no longer present on site however obvious markings were in the ground from the previous corral ring.
Surface water appearance	No visual indication of potential contamination such as suspended sediment or sheen was observed in the stream running along the north-eastern boundary. The stream was flowing during the visit.
Currently surrounding land use	The properties around the site are all mixed residential and grazing sites.
Local sensitive environments	The stream running along the north-eastern boundary.
Visible signs of plant stress	No visible signs of plant stress were noted on-site.
Additional observations	A well, pump shed and water tank were observed to the south of the dwelling. A previous chicken coup area which was constructed from timber fence poles and metal wire was observed to the south of the dwelling. A glasshouse (domestic scale) was observed near the chicken coup along with several plastic bread trays which were used for drying the walnuts. A few empty 100 L plastic drums were observed on the site which were being used for horse jumps. It was confirmed with the site owners that they were brought onto site as empty containers. A wrecked car was observed near the barn along the south-western boundary line. No staining was observed in surface soils below the car.

4 Potential HAIL Activities

Activities included on the Hazardous Activities and Industries List (HAIL) trigger the requirement for a contaminated land investigation prior to redevelopment. Following the site walkover and review of the desktop information, it is considered that the following HAIL activities are or have been present at the site.

Table 6: Potential HAIL Activities

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES
Orchard – walnut trees	Heavy metals Organochlorine pesticides (OCPs)	The entire site	A10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds

5 Intrusive Investigation

Potential contamination on-site as a result of historical pesticide application is likely limited to shallow soils. An intrusive investigation was developed to investigate the upper 0.3 meters below ground level (m bgl).

The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario. The results can also be used to indicate whether there is a likely impact to the surrounding environment.

5.1 Methodology

The following was undertaken during the soil sampling works:

- Collection for 40 discrete soil samples from 0.0-0.3 m depth from across the site. The samples were grouped into 10 separate areas defined by areas of trees. The soil samples were composited in the laboratory into ten, four-point composite soil samples.
- Each composite sample was scheduled for analysis for heavy metals and OCPs;
- Each sample was inspected for visual and olfactory indicators of contamination;
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to RJ Hill Laboratories (Hills) under the standard ENGEO chain of custody documentation provided in Appendix 4;
- To reduce the potential for 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 scrubbing 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;
- All fieldwork and sampling was undertaken 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;
- Following receipt of the samples by Hill Laboratories, the soil samples were scheduled for a selection of contaminants of concern including heavy metals (arsenic, cadmium, chromium, copper, mercury, lead, nickel and zinc) and organochlorine pesticides (OCPs); and
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

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 Hill Laboratories, ISO/IEC 17025 and IANZ accredited laboratory, to conduct all laboratory analysis. To maintain their International Accreditation, Hill Laboratories undertakes rigorous cross checking and routine duplicate sampling testing to ensure the accuracy of their results;
- Prior to sampling the equipment (hand auger) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water; and
- During the site investigation every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

6 Regulatory Framework and Assessment Criteria

The regulatory frameworks and rules relating to the management and control of contaminated sites in the Canterbury Region are specified in two documents: the NES and the ECan Regional Plan. A summary of each and its implications for the site is provided in Sections 6.1-6.2.

6.1 NES

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

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 ECan's online GIS – Trace Level 2 concentrations.

6.2 Disposal Criteria

An assessment of potential off-site disposal options for excess soil generated during site development works has been conducted. Dependent on the condition of the spoil, off-site disposal options range from disposal to "cleanfill" sites to managed fill sites. As outlined in the publication Waste Management Institute of New Zealand Technical Guidelines for Disposal to Land (August 2018) definition of cleanfill which states:

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

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances or material (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."

6.3 Assessment Criteria

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

- Residential land use (10% produce); and
- Commercial / industrial land use (based on an outdoor worker scenario) (for redevelopment workers).

The land use scenarios are relevant to the likely future use of the site and are 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.

Where appropriate, the standard NES criteria were adjusted according to the requirements for composite samples specified in the MfE (2011) Contaminated Land Management Guidelines No.5 – Site Investigation and Analysis of Soils. As the composite sample consisted of four sub-samples, the guideline criteria were divided by four to result in the adjusted criteria for the composite sample used in this investigation.

The soil analysis results have also been compared to Regional Background concentrations for heavy metals and OCPs. These provide information into the possible disposal options at a clean-fill facility. These criteria have not been adjusted as the composite sample results provide an indication of the average contaminant concentrations. These provide information into the possible disposal options at a cleanfill facility.

7 Results

7.1 Soil Encountered

Please refer to Table 7 from the summary of subsurface soil encountered within the near surface soils in the shallow soils. Please refer to the ENGEO Geotechnical Report (ENGEO, 2020) for deeper soil profiles.

Table 7: Summary of Subsurface Soils

Depth	Soil Description
0.0-0.3	Sandy SILT with trace rootlets and gravel; brown. [TOPSOIL].
0.3-0.4	Sandy fine to coarse GRAVEL with minor cobbles; brownish grey.

7.2 Analytical Results

The analytical results from the ENGEO investigation can be summarised as follows:

- One composite sample (Composite 5) reported arsenic above the adjusted NES criteria for residential land use. The reported concentration of arsenic was 6 mg/kg, where the adjusted NES residential value is 5 mg/kg;
- One composite sample (Composite 5) reported cadmium and lead above the site specific regional background levels;

- Upon request, Hills Laboratory supplied the file for the uncertainty of measure for the laboratory report for the samples (Appendix 4) which reports that the arsenic reported in Composite 5 has an uncertainty measure of 5.7 mg/kg +/- 1.6 mg/kg;
- Organochlorine pesticides (OCPs) were reported as above the laboratory limit of detection; 4,4'-DDE in all samples, and 4,4' DDT for Composite 3 and 4, however all OCP samples are below the NES criteria and the regional background guidelines; and
- All other samples analysed for heavy metals are below the applicable NES criteria and regional background levels.

Please refer to Appendix 4 for the full laboratory certificate and results. Only detectable concentrations of analytes are shown in Table 7 below

Table 8: Analysis Results

Analyte	Units	Composite 1	Composite 2	Composite 3	Composite 4	Composite 5	Composite 6	Composite 7	Composite 8	Composite 9	Composite 10	Assessment Criteria				
No. of sub samples in composite		4	4	4	4	4	4	4	4	4	4	Background (bl) - Canterbury Regional	Residential - 10% produce (unadjusted)	Recreational Land Use (unadjusted)	Commercial/ Industrial Outdoor Worker (unadjusted)	Residential (composite samples adjusted) made up from 4 subsamples
Subsample Numbers		1, 2, 3, 4	5, 6, 7, 8	9, 10, 11, 12	13, 14, 15, 16	17, 18, 19, 20	21, 22, 23, 24	25, 26, 27, 28	29, 30, 31, 32	33, 34, 35, 36	37, 38, 39 40					
Soil Depth		0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3					
Heavy Metals																
Arsenic	mg/kg	2	3	3	3	6	3	3	3	3	3	6.35	20 (A)	80 (A)	70 (A)	5 (A)
Cadmium	mg/kg	0.1	< 0.1	0.1	0.14	**0.27**	< 0.1	0.11	< 0.1	< 0.1	< 0.1	0.14	3 (A)	400 (A)	1300 (A)	0.75 (A)
Chromium (total)	mg/kg	11	10	11	12	12	11	10	11	11	11	19.89	460 (A)	2700 (A)	6300 (A)	115 (A)
Copper	mg/kg	4	4	6	5	8	5	5	5	4	5	11.68	10000 (A)	10000 (A)	10000 (A)	2500 (A)
Lead	mg/kg	13.1	13.3	13.6	13.8	**27**	13.4	13.4	13.8	13.6	14	19.75	210 (A)	880 (A)	3300 (A)	52.5 (A)
Mercury (inorganic)	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.07	310 (A)	1800 (A)	4200 (A)	77.5 (A)
Nickel	mg/kg	8	8	8	10	8	9	8	9	9	8	13.91	400 (B)	1200 (B)	6000 (B)	100 (B)
Zinc	mg/kg	47	47	52	47	58	49	48	51	46	48	59.58	7400 (B)	30000 (B)	400000 (B)	1850 (B)
4,4'-DDD	mg/kg	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	-	1.9 (C)	-	9.6 (C)	0.475 (C)
4,4'-DDE	mg/kg	0.106	0.071	0.09	0.121	0.07	0.045	0.026	0.069	0.07	0.079	-	2 (C)	-	9.3 (C)	0.5 (C)
4,4'-DDT	mg/kg	< 0.013	< 0.013	0.012	0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	-	1.9 (C)	-	8.5 (C)	0.475 (C)
DDT Isomers	mg/kg	0.11	< 0.08	0.1	0.13	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	0.08	-	70 (A)	400 (A)	1000 (A)	17.5 (A)

General Notes:
Cells highlighted red exceed one or more assessment criteria, highlighted yellow exceed the lab detection limit.
Adjusted assessment criteria are developed from the number of subsamples to form an adjusted guideline value
*** represents that the composite's guideline is excluded from dividing by the subsamples.**
This table does not represent the full analytical results, please refer to the laboratory results for full details.
Values in bold exceed the adopted background concentrations.
bl - denotes background samples compared to Canterbury Regional -> Yellow brown stony.
Assumes soil pH of 5.
Criteria for Chromium VI were conservatively selected.

Guideline Notes:
A - Methodology for Deriving Soil Guideline Values Protective of Human Health (NES, 2011), B - National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013), C - Regional Screening Levels Targeted Hazard Quotient 1.0 (US EPA, 2020), D - Identifying, Investigating and Managing Risks Associated with Former Sheep-dip Sites (MfE, 2006)

8 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; and
- An exposure route, where the sensitive receptor 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 9.

Table 9: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Orchard	Heavy metals and OCPs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers.	**Yes,** one composite sample was reported above the adjusted residential guideline criteria, however the exceedance is considered marginal.

9 Conclusions and Recommendations

ENGEO Ltd were engaged by Hughes Developments Limited to undertake an environmental assessment of a site situated at 3/144 Dunns Crossing Road in Rolleston for change in land use, subdivision and soil disturbance consent. Information was gathered and reviewed regarding the potential releases of hazardous substances to the subject property.

A review of information identified that the site had been used for grazing since circa 1940 and residential land use with an associated walnut orchard since 1997.

The site is listed on the Canterbury Regional Council's Listed Land Use Register as A10: Persistent pesticide bulk storage or use, with the walnut orchard being identified in a historical aerial review by Selwyn District Council. The property file was obtained from Selwyn District Council and Certificate of Titles obtained by Land Information New Zealand and these files contained no information related to potentially hazardous activities having occurred at the site.

Based on the information gathered during the desk based study, it was considered that site soils may have been impacted by the past and previous uses of the site as an orchard. A total of 40 soil samples were collected from areas across the site and composited into 10 soil samples for analysis of

heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) and organochlorine pesticides (OCPs).

One composite sample (Composite 5), made up of four subsamples, returned concentrations of arsenic above the adjusted NES residential 10% land use criteria. The arsenic concentration reported by the laboratory is 6 mg/kg with the adjusted criteria at 5 mg/kg. The same composite sample also reported concentrations of cadmium and lead above the site specific background levels. Although the arsenic exceedances is considered marginal, it is recommended that analysis of the four subsamples comprising Composite 5 is completed to determine the risk to human health and determine potential remediation and disposal options (if required).

Due to the presence of arsenic concentrations above the adopted human health criterion in an isolated area of the site, additional analysis is recommended to determine whether remediation of soils is required for the site to be suitable for the proposed redevelopment.

If a volume of soil exceeding 25 m^3 per 500 m^2 of development area is proposed to be disturbed, or if a volume of soil exceeding 5 m^3 per 500 m^2 per development area per year is proposed to be disposed of off-site, a consent should be obtained according to the requirements of the NES. Due to the concentrations of the contaminants of concern at the site, a resource consent for land disturbance and removal may be required during the site works.

A stormwater discharge consent is not likely to be required from Canterbury Regional Council for the duration of the redevelopment works on site due to the low concentrations of heavy metal contamination at the site.

Council will likely require preparation of a Site Management Plan (SMP) as part of the resource consent application. The SMP will outline monitoring and management procedures for the earthworks due to the detection of contaminants above background levels and potential for encountering unidentified contamination. If additional sample analysis indicates that remediation of soil is required, provision of a remedial action plan for the disturbance and disposal of these soils will also need to be prepared.

If the groundwater well is to be removed from site during the development works, the well should be appropriately abandoned/disestablished by a suitably qualified professional.

If the buildings on-site are to be refurbished or demolished, the presence of asbestos in these buildings should be identified by undertaking full asbestos demolition surveys. If identified on the outside of the buildings in a deteriorated state, the soils surrounding the buildings should also be tested.

10 References

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.

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

MfE (2011b). *Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites*.

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.*

11 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Development Ltd, 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.

ii. 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.

iii. 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.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. 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

Natalie Flatman

Environmental Scientist

Report reviewed by

Hazel Atkins, CEnvP

Senior Engineering / Environmental Geologist

Claire Davies, CEnvP

Senior Environmental Consultant

FIGURES

ENGEO
Tauranga Office
1/314 Maunganui Road
Mount Maunganui, Tauranga 3116
Tel: 07 777 0209, www.engeo.co.nz

Title:

Site Location Plan

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Client: Hughes Developments Ltd		Figure No: 1
Project: 3/144 Dunns Crossing Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Aug 20	Size: A4
Proj No: 12903.000.003	Scale: 1:3,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

ENGEO
Tauranga Office
1/314 Maunganui Road
Mount Maunganui, Tauranga 3116
Tel: 07 777 0209, www.engeo.co.nz

Title:

Sample Locaiton Plan

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Client: Hughes Developments Ltd		Figure No: 2
Project: 3/144 Dunns Crossing Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Aug 20	Size: A4
Proj No: 12903.000.003	Scale: 1:2,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 1:

Site Photographs

Photo 1: Dwelling

Photo 2: Garage and lean-to

Photo 3: Water tank, well and pumpshed

Photo 4: 4. Shed along south-western boundary line

Photo 5: 5. Burnpile 1

Photo 6: 6. Burnpile 2

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments Ltd**		
Taken by	NF	**Project**	**3/144 Dunns Crossing Road**		
Approved by	HA/CD	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref:**	12903	**Appendix No.**	1a

Photo 7: Burn pile 3

Photo 8: Orchard area

Photo 9: Orchard area

Photo 10: Stream along north-eastern boundary line

Photo 11: Cleared paddock in south-western section of the site

Photo 12: Horse corral in south-western section of the site

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments Ltd**		
Taken by	NF	**Project**	**3/144 Dunns Crossing Road**		
Approved by	HA/CD	**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref.**	12903	**Appendix No.**	1b

APPENDIX 2:

Certificate of Titles

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Historical Record

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Identifier **CB40D/788**
Land Registration District **Canterbury**
Date Issued 14 November 1995

Prior References
CB39A/686

Estate	Fee Simple
Area	4.0000 hectares more or less
Legal Description	Lot 3 Deposited Plan 70352

Original Registered Owners
Stuart Robert Pluck and Glenys Joy Pluck

Interests

Subject to Part IV A Conservation Act 1987

A204853.21 Easement Certificate specifying the following easements - 14.11.1995 at 12.12 pm

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way, right to drain sewage, convey water, electric power and telephonic communications	Lot 4 Deposited Plan 70352 - CT CB40D/789	A DP 70352	Lot 3 Deposited Plan 70352 - herein	

The easements specified in Easement Certificate A204853.21 when created will be subject to Section 243(a) Resource Management Act 1991

Fencing Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

Land Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

A290610.4 Mortgage to Bank of New Zealand - 7.4.1997 at 2.25 pm

9224154.1 Discharge of Mortgage A290610.4 - 5.11.2012 at 12:41 pm

9224154.2 Transfer to Robert John Mackie, Elizabeth Gaynor Mackie and Mackie Family Trustees Limited - 5.11.2012 at 12:41 pm

9224154.3 Mortgage to ANZ Bank New Zealand Limited - 5.11.2012 at 12:41 pm

11211027.1 Court Order Varying Land Covenant in Transfer A204853.22 - 24.8.2018 at 7:00 am

References
Prior C/T 39A/686

Transfer No.
N/C. Order No. A204853/4-19

Land and Deeds 69

REGISTER

No. 40D/788

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 14th day of November one thousand nine hundred and ninety-five under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that KAJENS TRADING & DEVELOPMENT LIMITED at Christchurch ---

is seised of an estate in fee-simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that parcel of land containing 4.0000 hectares or thereabouts being Lot 3 Deposited Plan 70352 ---

DISTRICT LAND REGISTRAR

ASSISTANT LAND REGISTRAR

Subject to:

Part IVA Conservation Act 1987

Mortgage A141598/3 to Bank of New Zealand - 27.10.1994 at 11.16am

No. A204853/2 Bond pursuant to Section 222 Resource Management Act 1991 to The Selwyn District Council - 14.11.1995 at 12.12pm

A.L.R.

No. A204853/21 Easement Certificate specifying intended easements on DP 70352

Nature	Servient Tenement		Dominant Tenement
Right of way, right to drain sewage, convey water, electric power and telephonic communications	4 (40D/789)	A	3 (herein)

- 14.11.1995 at 12.12pm

A.L.R.

Measurements are Metric

The easements specified in Easement Certificate A204853/21 when created will be subject to Section 243(a) Resource Management Act 1991

A.L.R.

Transfer A204853/22 to Kajens Trading & Development Limited at Christchurch - 14.11.1995 at 12.12pm (Fencing and Land Covenants)

A.L.R.

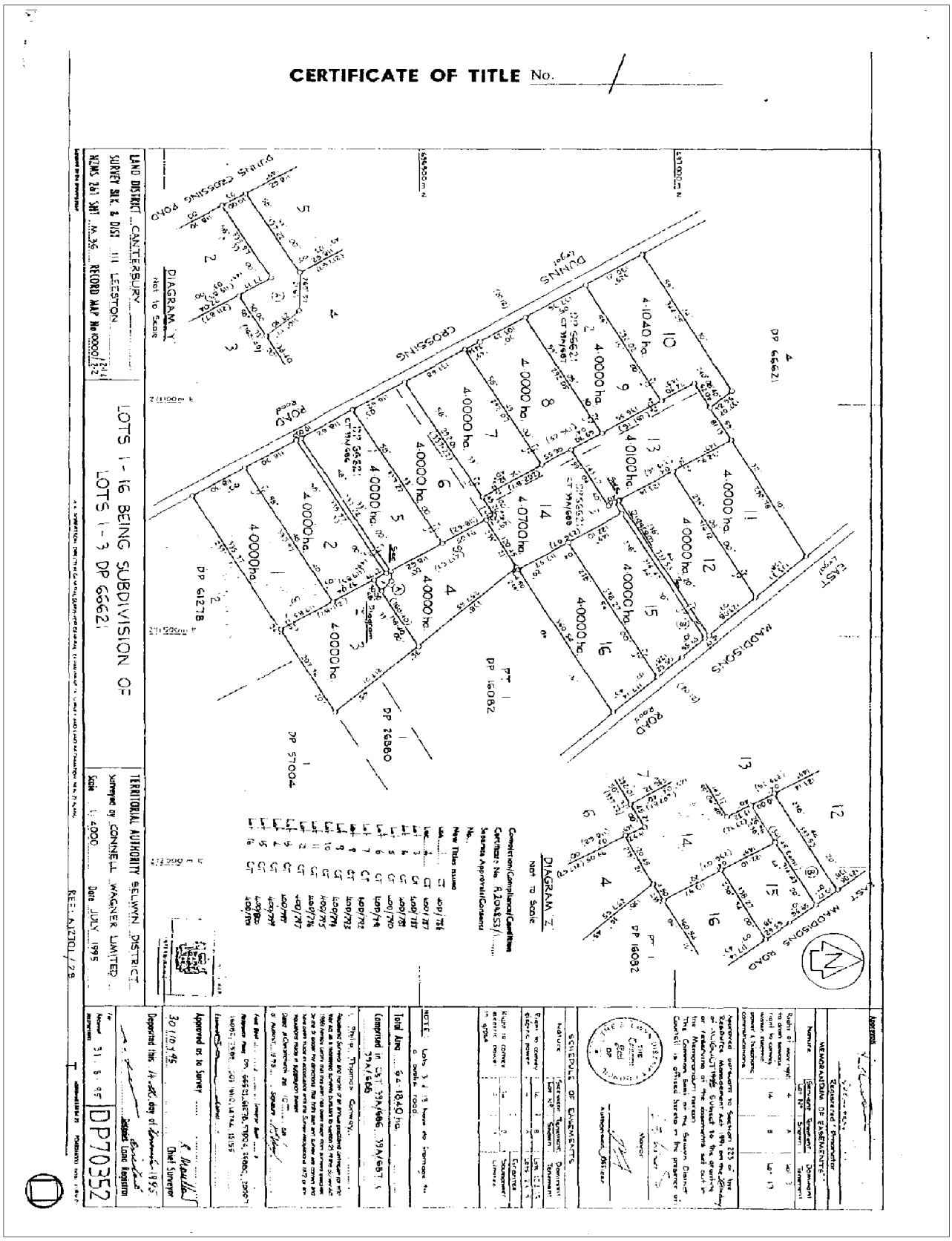
Transfer A290610/3 to Stuart Robert Pluck, Technical Sales Manager and Glenys Joy Pluck, Bank Officer, both of Christchurch - 7.4.1997 at 2.25pm

Mortgage A290610/4 to Bank of New Zealand - 7.4.1997 at 2.25pm

for A.L.R.

No. 40D/788

Identifier **CB40D/788**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

R.W. Muir
Registrar-General
of Land

Identifier **CB40D/788**
Land Registration District **Canterbury**
Date Issued 14 November 1995

Prior References
CB39A/686

Estate	Fee Simple
Area	4.0000 hectares more or less
Legal Description	Lot 3 Deposited Plan 70352

Registered Owners
Robert John Mackie, Elizabeth Gaynor Mackie and Mackie Family Trustees Limited

Interests

Subject to Part IV A Conservation Act 1987

A204853.21 Easement Certificate specifying the following easements - 14.11.1995 at 12.12 pm

Type	Servient Tenement	Easement Area	Dominant Tenement	Statutory Restriction
Right of way, right to drain sewage, convey water, electric power and telephonic communications	Lot 4 Deposited Plan 70352 - CT CB40D/789	A DP 70352	Lot 3 Deposited Plan 70352 - herein	

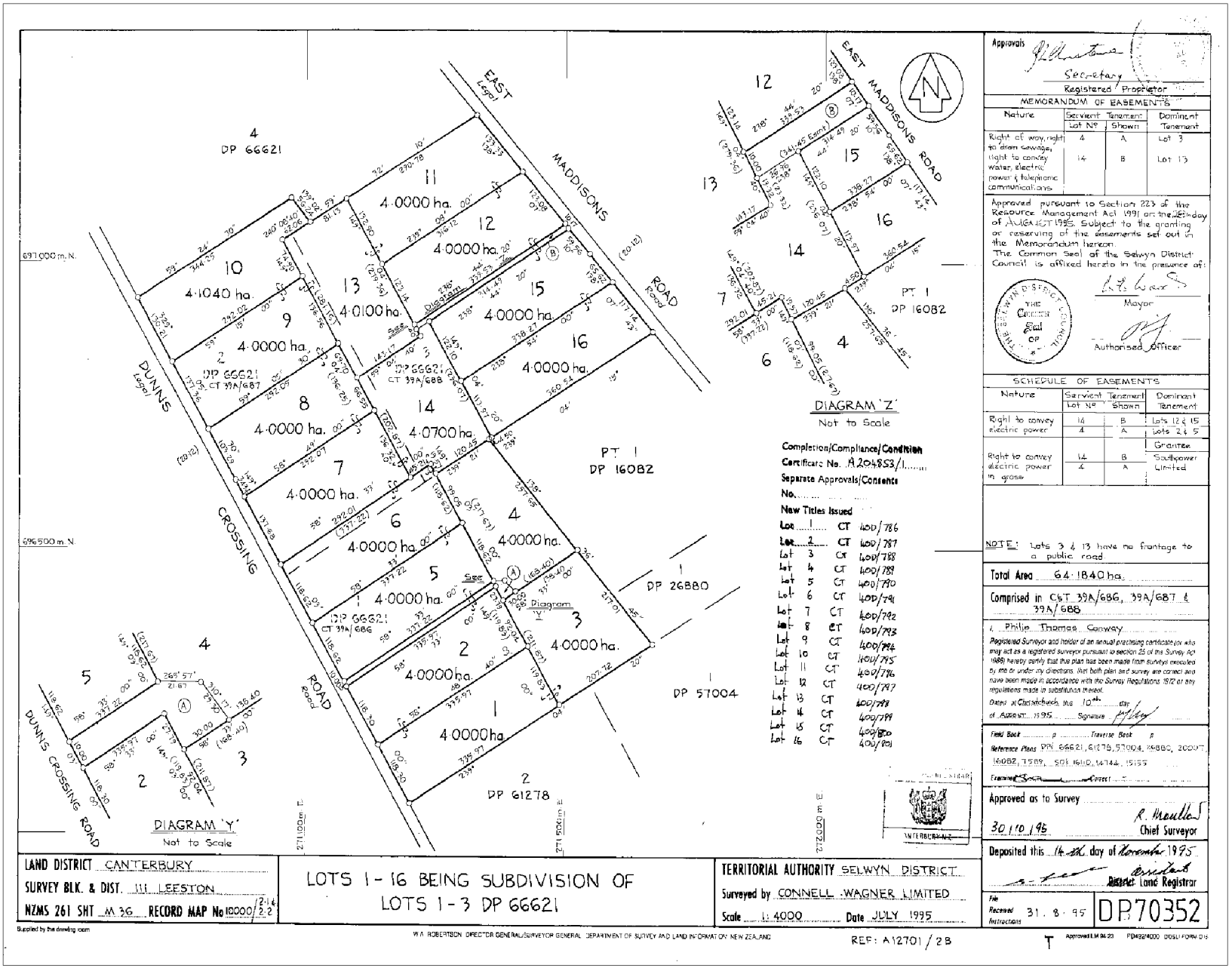
The easements specified in Easement Certificate A204853.21 when created will be subject to Section 243(a) Resource Management Act 1991

Fencing Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

Land Covenant in Transfer A204853.22 - 14.11.1995 at 12.12 pm

9224154.3 Mortgage to ANZ Bank New Zealand Limited - 5.11.2012 at 12:41 pm

11211027.1 Court Order Varying Land Covenant in Transfer A204853.22 - 24.8.2018 at 7:00 am



Completion/Compliance/Condition
Certificate No. A204853/1
Separate Approvals/Consents No.
New Titles Issued

Lot 1	CT	400/786
Lot 2	CT	400/787
Lot 3	CT	400/788
Lot 4	CT	400/789
Lot 5	CT	400/790
Lot 6	CT	400/791
Lot 7	CT	400/792
Lot 8	CT	400/793
Lot 9	CT	400/794
Lot 10	CT	400/795
Lot 11	CT	400/796
Lot 12	CT	400/797
Lot 13	CT	400/798
Lot 14	CT	400/799
Lot 15	CT	400/800
Lot 16	CT	400/801

Approvals
Secretary
Registered Proprietor

MEMORANDUM OF EASEMENTS

Nature	Servient Tenement Lot No	Shown	Dominant Tenement
Right of way, right to drain sewage, right to convey water, electric power & telephonic communications	4	A	Lot 3
	14	B	Lot 13

Approved pursuant to Section 223 of the Resource Management Act 1991 on the 22nd day of AUGUST 1995. Subject to the granting or reserving of the easements set out in the Memorandum hereon.
The Common Seal of the Selwyn District Council is affixed hereto in the presence of:
Mayor
Authorised Officer

SCHEDULE OF EASEMENTS

Nature	Servient Tenement Lot No	Shown	Dominant Tenement
Right to convey electric power	14	B	Lots 12 & 15
	4	A	Lots 2 & 5
			Grantee
Right to convey electric power in gross	14	B	Southpower Limited
	4	A	

NOTE: Lots 3 & 13 have no frontage to a public road.

Total Area 64·1840 ha.
Comprised in CST 39A/686, 39A/687 & 39A/688

I, Philip Thomas Conway
Registered Surveyor and holder of an annual practising certificate (or who may act as a registered surveyor pursuant to section 23 of the Survey Act 1986) hereby certify that this plan has been made from surveys executed by me or under my directions, that both plan and survey are correct and have been made in accordance with the Survey Regulations 1972 or any regulations made in substitution thereof.
Dated at Christchurch, this 10th day of August 1995. Signature

Field Book p Traverse Book p
Reference Plans PTN 66621, 61278, 57004, 26880, 20007, 16082, 7589, SO 16110, 14744, 15155
Examined Correct

Approved as to Survey
30/10/95
Chief Surveyor

Deposited this 14th day of November 1995
District Land Registrar

File
Received 31.8.95
Instructions

DP 70352

LAND DISTRICT CANTERBURY
SURVEY BLK. & DIST. III LEESTON
NZMS 261 SHT M 36 RECORD MAP No 10000/2·1·4 2·2

LOTS 1-16 BEING SUBDIVISION OF LOTS 1-3 DP 66621

TERRITORIAL AUTHORITY SELWYN DISTRICT
Surveyed by CONNELL WAGNER LIMITED
Scale 1:4000 Date JULY 1995

Supplied by the drawing room

W.A. ROBERTSON, DIRECTOR GENERAL/SURVEYOR GENERAL, DEPARTMENT OF SURVEY AND LAND INFORMATION, NEW ZEALAND

REF: A12701/2B

Approved LM 94.23 PD492/4000 DOSLI FORM D15

APPENDIX 3:

LLUR Statement

Property Statement
from the Listed Land Use Register

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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

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:	30 July 2020
Land Parcels:	Lot 3 DP 70352 Valuation No(s): 2405537600;2405537700

The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Summary of sites:

Site ID	Site Name	Location	HAIL Activity(s)	Category
120683	3/144 Dunns Crossing Road, Rolleston	3/144 Dunns Crossing Road, Rolleston	A10 - Persistent pesticide bulk storage or use;	Not Investigated

Please note that the above table represents a summary of sites and HAILs intersecting the area of enquiry only.

Information held about the sites on the Listed Land Use Register

Site 120683: 3/144 Dunns Crossing Road, Rolleston (Intersects enquiry area.)

Site Address:	3/144 Dunns Crossing Road, Rolleston
Legal Description(s):	Lot 3 DP 70352

Site Category:	Not Investigated
Definition:	Verified HAIL has not been investigated.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
2000	Present	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

8 Jan 2016 This record was created as part of the Selwyn District Council 2015 HAIL identification project.

8 Jan 2016 Area defined from 2000 to Present aerial photographs. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.

Investigations:

There are no investigations associated with this site.

Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ260363.

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.

APPENDIX 4:

Laboratory Reports

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2415802	SPv1
Contact:	Natalie Flatman	**Date Received:**	10-Aug-2020	
	C/- Engeo Limited	**Date Reported:**	13-Aug-2020	
	PO Box 373	**Quote No:**	82742	
	Christchurch 8140	**Order No:**		
		Client Reference:	12903.003.000	
		Submitted By:	Natalie Flatman	

Sample Type: Soil

Sample Name:		Composite of S1, S2, S3 & S4	Composite of S5, S6, S7 & S8	Composite of S9, S10, S11 & S12	Composite of S13, S14, S15 & S16	Composite of S17, S18, S19 & S20
Lab Number:		2415802.41	2415802.42	2415802.43	2415802.44	2415802.45
Individual Tests						
Dry Matter	g/100g as rcvd	77	80	78	78	76
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	2	3	3	3	6
Total Recoverable Cadmium	mg/kg dry wt	0.10	< 0.10	0.10	0.14	0.27
Total Recoverable Chromium	mg/kg dry wt	11	10	11	12	12
Total Recoverable Copper	mg/kg dry wt	4	4	6	5	8
Total Recoverable Lead	mg/kg dry wt	13.1	13.3	13.6	13.8	27
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	8	8	8	10	8
Total Recoverable Zinc	mg/kg dry wt	47	47	52	47	58
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
alpha-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
beta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
delta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
cis-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
trans-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDE	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDE	mg/kg dry wt	0.106	0.071	0.090	0.121	0.070
2,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	0.012	0.013	< 0.013
Total DDT Isomers	mg/kg dry wt	0.11	< 0.08	0.10	0.13	< 0.08
Dieldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan I	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan II	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan sulphate	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin aldehyde	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin ketone	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor epoxide	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Hexachlorobenzene	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Methoxychlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013

Sample Type: Soil						
Sample Name:		Composite of S21, S22, S23 & S24	Composite of S25, S26, S27 & S28	Composite of S29, S30, S31 & S32	Composite of S33, S34, S35 & S36	Composite of S37, S38, S39 & S40
Lab Number:		2415802.46	2415802.47	2415802.48	2415802.49	2415802.50
Individual Tests						
Dry Matter	g/100g as rcvd	80	77	80	78	80
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.11	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	10	11	11	11
Total Recoverable Copper	mg/kg dry wt	5	5	5	4	5
Total Recoverable Lead	mg/kg dry wt	13.4	13.4	13.8	13.6	14.0
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	9	8	9	9	8
Total Recoverable Zinc	mg/kg dry wt	49	48	51	46	48
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
alpha-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
beta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
delta-BHC	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
cis-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
trans-Chlordane	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDD	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
2,4'-DDE	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDE	mg/kg dry wt	0.045	0.026	0.069	0.070	0.079
2,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
4,4'-DDT	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Total DDT Isomers	mg/kg dry wt	< 0.08	< 0.08	< 0.08	< 0.08	0.08
Dieldrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan I	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan II	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endosulfan sulphate	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin aldehyde	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Endrin ketone	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Heptachlor epoxide	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Hexachlorobenzene	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Methoxychlor	mg/kg dry wt	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013

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 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%.	-	41-50
Heavy Metals with Mercury, 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	41-50
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD or GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8081 or 8270.	0.010 - 0.06 mg/kg dry wt	41-50
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	41-50

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-40

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

Testing was completed between 11-Aug-2020 and 12-Aug-2020. 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.

Martin Cowell - BSc
Client Services Manager - Environmental

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Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2415802	SUPv1
Contact:	Natalie Flatman	**Date Received:**	10-Aug-2020	
	C/- Engeo Limited	**Date Reported:**	13-Aug-2020	
	PO Box 373	**Quote No:**	82742	
	Christchurch 8140	**Order No:**		
		Client Reference:	12903.003.000	
		Submitted By:	Natalie Flatman	

Sample Type: Soil

Sample Name:		Composite of S1, S2, S3 & S4	Composite of S5, S6, S7 & S8	Composite of S9, S10, S11 & S12	Composite of S13, S14, S15 & S16
Lab Number:		2415802.41	2415802.42	2415802.43	2415802.44
Individual Tests					
Dry Matter	g/100g as rcvd	77.1 ± 5.0	79.6 ± 5.0	77.6 ± 5.0	78.2 ± 5.0
Heavy Metals with Mercury, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	2.4 ± 1.4	2.6 ± 1.4	3.0 ± 1.4	3.3 ± 1.4
Total Recoverable Cadmium	mg/kg dry wt	0.101 ± 0.067	< 0.10 ± 0.067	0.102 ± 0.067	0.138 ± 0.068
Total Recoverable Chromium	mg/kg dry wt	11.4 ± 2.2	10.1 ± 2.1	11.1 ± 2.2	12.2 ± 2.3
Total Recoverable Copper	mg/kg dry wt	4.0 ± 1.5	4.1 ± 1.5	6.4 ± 1.6	5.3 ± 1.5
Total Recoverable Lead	mg/kg dry wt	13.1 ± 2.0	13.3 ± 2.1	13.6 ± 2.1	13.8 ± 2.1
Total Recoverable Mercury	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067
Total Recoverable Nickel	mg/kg dry wt	8.1 ± 1.7	8.3 ± 1.7	8.2 ± 1.7	9.6 ± 1.8
Total Recoverable Zinc	mg/kg dry wt	47.2 ± 4.3	46.5 ± 4.3	52.5 ± 4.6	47.3 ± 4.3
Organochlorine Pesticides Screening in Soil					
Aldrin	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0047	< 0.013 ± 0.0048	< 0.013 ± 0.0048
alpha-BHC	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0047	< 0.013 ± 0.0048	< 0.013 ± 0.0048
beta-BHC	mg/kg dry wt	< 0.013 ± 0.0055	< 0.013 ± 0.0054	< 0.013 ± 0.0055	< 0.013 ± 0.0055
delta-BHC	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0051	< 0.013 ± 0.0051
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0046	< 0.013 ± 0.0047
cis-Chlordane	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
trans-Chlordane	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0047	< 0.013 ± 0.0048	< 0.013 ± 0.0048
2,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	< 0.013 ± 0.0053	< 0.013 ± 0.0053
4,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0064
2,4'-DDE	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
4,4'-DDE	mg/kg dry wt	0.106 ± 0.053	0.071 ± 0.036	0.090 ± 0.045	0.121 ± 0.061
2,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0068	< 0.013 ± 0.0067	< 0.013 ± 0.0068	< 0.013 ± 0.0068
4,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0075	< 0.013 ± 0.0072	0.0124 ± 0.0074	0.0125 ± 0.0075
Total DDT Isomers	mg/kg dry wt	0.106 ± 0.055	< 0.08 ± 0.039	0.102 ± 0.047	0.134 ± 0.063
Dieldrin	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0059	< 0.013 ± 0.0060	< 0.013 ± 0.0061
Endosulfan I	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	< 0.013 ± 0.0053	< 0.013 ± 0.0053
Endosulfan II	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0059	< 0.013 ± 0.0060	< 0.013 ± 0.0061
Endosulfan sulphate	mg/kg dry wt	< 0.013 ± 0.0079	< 0.013 ± 0.0076	< 0.013 ± 0.0078	< 0.013 ± 0.0078
Endrin	mg/kg dry wt	< 0.013 ± 0.0083	< 0.013 ± 0.0080	< 0.013 ± 0.0082	< 0.013 ± 0.0082
Endrin aldehyde	mg/kg dry wt	< 0.013 ± 0.0072	< 0.013 ± 0.0071	< 0.013 ± 0.0072	< 0.013 ± 0.0072
Endrin ketone	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0064
Heptachlor	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0051	< 0.013 ± 0.0051
Heptachlor epoxide	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0046	< 0.013 ± 0.0047
Hexachlorobenzene	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0051	< 0.013 ± 0.0051
Methoxychlor	mg/kg dry wt	< 0.013 ± 0.0083	< 0.013 ± 0.0080	< 0.013 ± 0.0082	< 0.013 ± 0.0082

Sample Type: Soil					
Sample Name:		Composite of S17, S18, S19 & S20	Composite of S21, S22, S23 & S24	Composite of S25, S26, S27 & S28	Composite of S29, S30, S31 & S32
Lab Number:		2415802.45	2415802.46	2415802.47	2415802.48
Individual Tests					
Dry Matter	g/100g as rcvd	75.9 ± 5.0	79.8 ± 5.0	77.5 ± 5.0	79.6 ± 5.0
Heavy Metals with Mercury, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	5.7 ± 1.6	2.9 ± 1.4	3.1 ± 1.4	2.6 ± 1.4
Total Recoverable Cadmium	mg/kg dry wt	0.270 ± 0.076	< 0.10 ± 0.067	0.107 ± 0.067	< 0.10 ± 0.067
Total Recoverable Chromium	mg/kg dry wt	12.4 ± 2.4	11.2 ± 2.2	10.2 ± 2.1	11.5 ± 2.2
Total Recoverable Copper	mg/kg dry wt	8.2 ± 1.8	4.7 ± 1.5	4.5 ± 1.5	4.9 ± 1.5
Total Recoverable Lead	mg/kg dry wt	26.5 ± 4.0	13.4 ± 2.1	13.4 ± 2.1	13.8 ± 2.1
Total Recoverable Mercury	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067	< 0.10 ± 0.067
Total Recoverable Nickel	mg/kg dry wt	7.9 ± 1.7	8.6 ± 1.8	8.3 ± 1.7	9.2 ± 1.8
Total Recoverable Zinc	mg/kg dry wt	57.6 ± 4.9	48.9 ± 4.4	48.2 ± 4.4	50.7 ± 4.5
Organochlorine Pesticides Screening in Soil					
Aldrin	mg/kg dry wt	< 0.013 ± 0.0049	< 0.013 ± 0.0048	< 0.013 ± 0.0048	< 0.013 ± 0.0048
alpha-BHC	mg/kg dry wt	< 0.013 ± 0.0049	< 0.013 ± 0.0048	< 0.013 ± 0.0048	< 0.013 ± 0.0048
beta-BHC	mg/kg dry wt	< 0.013 ± 0.0056	< 0.013 ± 0.0054	< 0.013 ± 0.0055	< 0.013 ± 0.0055
delta-BHC	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0052	< 0.013 ± 0.0052
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0047	< 0.013 ± 0.0047
cis-Chlordane	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
trans-Chlordane	mg/kg dry wt	< 0.013 ± 0.0049	< 0.013 ± 0.0048	< 0.013 ± 0.0048	< 0.013 ± 0.0048
2,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0054	< 0.013 ± 0.0053	< 0.013 ± 0.0053	< 0.013 ± 0.0053
4,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0065
2,4'-DDE	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	< 0.013 ± 0.0050	< 0.013 ± 0.0050
4,4'-DDE	mg/kg dry wt	0.070 ± 0.035	0.045 ± 0.023	0.026 ± 0.014	0.069 ± 0.035
2,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0069	< 0.013 ± 0.0067	< 0.013 ± 0.0068	< 0.013 ± 0.0069
4,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0075	< 0.013 ± 0.0073	< 0.013 ± 0.0074	< 0.013 ± 0.0075
Total DDT Isomers	mg/kg dry wt	< 0.08 ± 0.038	< 0.08 ± 0.027	< 0.08 ± 0.020	< 0.08 ± 0.038
Dieldrin	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0060	< 0.013 ± 0.0061	< 0.013 ± 0.0061
Endosulfan I	mg/kg dry wt	< 0.013 ± 0.0054	< 0.013 ± 0.0053	< 0.013 ± 0.0053	< 0.013 ± 0.0053
Endosulfan II	mg/kg dry wt	< 0.013 ± 0.0061	< 0.013 ± 0.0060	< 0.013 ± 0.0061	< 0.013 ± 0.0061
Endosulfan sulphate	mg/kg dry wt	< 0.013 ± 0.0080	< 0.013 ± 0.0077	< 0.013 ± 0.0078	< 0.013 ± 0.0079
Endrin	mg/kg dry wt	< 0.013 ± 0.0084	< 0.013 ± 0.0081	< 0.013 ± 0.0083	< 0.013 ± 0.0083
Endrin aldehyde	mg/kg dry wt	< 0.013 ± 0.0073	< 0.013 ± 0.0071	< 0.013 ± 0.0072	< 0.013 ± 0.0073
Endrin ketone	mg/kg dry wt	< 0.013 ± 0.0065	< 0.013 ± 0.0063	< 0.013 ± 0.0064	< 0.013 ± 0.0065
Heptachlor	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0052	< 0.013 ± 0.0052
Heptachlor epoxide	mg/kg dry wt	< 0.013 ± 0.0047	< 0.013 ± 0.0046	< 0.013 ± 0.0047	< 0.013 ± 0.0047
Hexachlorobenzene	mg/kg dry wt	< 0.013 ± 0.0052	< 0.013 ± 0.0051	< 0.013 ± 0.0052	< 0.013 ± 0.0052
Methoxychlor	mg/kg dry wt	< 0.013 ± 0.0084	< 0.013 ± 0.0081	< 0.013 ± 0.0083	< 0.013 ± 0.0083

Sample Name:		Composite of S33, S34, S35 & S36	Composite of S37, S38, S39 & S40		
Lab Number:		2415802.49	2415802.50		
Individual Tests					
Dry Matter	g/100g as rcvd	78.1 ± 5.0	79.8 ± 5.0	-	-
Heavy Metals with Mercury, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt	2.7 ± 1.4	2.9 ± 1.4	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	-	-
Total Recoverable Chromium	mg/kg dry wt	11.0 ± 2.2	11.0 ± 2.2	-	-
Total Recoverable Copper	mg/kg dry wt	4.2 ± 1.5	4.5 ± 1.5	-	-
Total Recoverable Lead	mg/kg dry wt	13.6 ± 2.1	14.0 ± 2.2	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10 ± 0.067	< 0.10 ± 0.067	-	-
Total Recoverable Nickel	mg/kg dry wt	8.5 ± 1.8	8.1 ± 1.7	-	-
Total Recoverable Zinc	mg/kg dry wt	46.1 ± 4.2	47.8 ± 4.3	-	-
Organochlorine Pesticides Screening in Soil					
Aldrin	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0048	-	-
alpha-BHC	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0048	-	-
beta-BHC	mg/kg dry wt	< 0.013 ± 0.0055	< 0.013 ± 0.0054	-	-

Sample Type: Soil						
Sample Name:		Composite of S33, S34, S35 & S36	Composite of S37, S38, S39 & S40		
Lab Number:		2415802.49	2415802.50		
Organochlorine Pesticides Screening in Soil					
delta-BHC	mg/kg dry wt	< 0.013 ± 0.0051	< 0.013 ± 0.0051	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.013 ± 0.0046	< 0.013 ± 0.0046	-	-
cis-Chlordane	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	-	-
trans-Chlordane	mg/kg dry wt	< 0.013 ± 0.0048	< 0.013 ± 0.0048	-	-
2,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	-	-
4,4'-DDD	mg/kg dry wt	< 0.013 ± 0.0064	< 0.013 ± 0.0063	-	-
2,4'-DDE	mg/kg dry wt	< 0.013 ± 0.0050	< 0.013 ± 0.0049	-	-
4,4'-DDE	mg/kg dry wt	0.070 ± 0.035	0.079 ± 0.040	-	-
2,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0068	< 0.013 ± 0.0067	-	-
4,4'-DDT	mg/kg dry wt	< 0.013 ± 0.0074	< 0.013 ± 0.0073	-	-
Total DDT Isomers	mg/kg dry wt	< 0.08 ± 0.038	0.079 ± 0.042	-	-
Dieldrin	mg/kg dry wt	< 0.013 ± 0.0060	< 0.013 ± 0.0060	-	-
Endosulfan I	mg/kg dry wt	< 0.013 ± 0.0053	< 0.013 ± 0.0052	-	-
Endosulfan II	mg/kg dry wt	< 0.013 ± 0.0060	< 0.013 ± 0.0060	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.013 ± 0.0078	< 0.013 ± 0.0077	-	-
Endrin	mg/kg dry wt	< 0.013 ± 0.0082	< 0.013 ± 0.0081	-	-
Endrin aldehyde	mg/kg dry wt	< 0.013 ± 0.0072	< 0.013 ± 0.0071	-	-
Endrin ketone	mg/kg dry wt	< 0.013 ± 0.0064	< 0.013 ± 0.0063	-	-
Heptachlor	mg/kg dry wt	< 0.013 ± 0.0051	< 0.013 ± 0.0051	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.013 ± 0.0046	< 0.013 ± 0.0046	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.013 ± 0.0051	< 0.013 ± 0.0051	-	-
Methoxychlor	mg/kg dry wt	< 0.013 ± 0.0082	< 0.013 ± 0.0081	-	-

The reported uncertainty is an expanded uncertainty with a level of confidence of approximately 95 percent (i.e. two standard deviations, calculated using a coverage factor of 2). Reported uncertainties are calculated from the performance of typical matrices, and do not include variation due to sampling.

For further information on uncertainty of measurement at Hill Laboratories, refer to the technical note on our website: www.hill-laboratories.com/files/Intro_To_UOM.pdf, or contact the laboratory.

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 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%.	-	41-50
Heavy Metals with Mercury, 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	41-50
Organochlorine Pesticides Screening in Soil	Sonication extraction, GC-ECD or GC-MS/MS analysis. Tested on as received sample. In-house based on US EPA 8081 or 8270.	0.010 - 0.06 mg/kg dry wt	41-50
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	41-50
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-40

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

Testing was completed between 11-Aug-2020 and 12-Aug-2020. 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.

Kim Harrison MSc
Client Services Manager - Environmental

ENGEO

Expect Excellence

Combined Preliminary and Detailed Site Investigation

108 Dunns Crossing Road

Springston

Canterbury

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ENGEO Document Control:

Report Title	Combined Preliminary and Detailed Site Investigation - 108 Dunns Crossing Road, Springston			
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1 Introduction

ENGEO Ltd was requested by Hughes Developments Limited to undertake a combined preliminary and detailed site investigation of the property at 108 Dunns Crossing Road in Springston, Canterbury.

The site location and investigation areas are shown in Figure 1. ENGEO understands that the site is to be redeveloped into a residential subdivision. The environmental assessment was performed as part of an investigation into the potential contaminants at the site and the suitability of the site for residential land use.

This combined PSI / DSI was completed in order to satisfy Selwyn District Council (SDC) 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).

This DSI was performed in general accordance with the MfE's *Contaminated Land Management Guidelines (CLMG) No.5: Site Investigation and Analysis of Soils* and reported in general accordance with the MfE's *CLMG No.1: Reporting on Contaminated Sites in New Zealand*.

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 substances to the subject property; and
- Following the desktop review, ENGEO collected representative soil samples for laboratory analysis from shallow soil sampling completed across the site.

2 Site Description and Setting

The total site area is 101,150 m^2 and has the legal description of LOT 2 DP 61278. We understand that the property at 108 Dunns Crossing Road is to be subdivided into residential lots. The site location is displayed in Figure 1.

Site information is summarised in Table 1 with photographs of the site taken during the site sampling works provided in Appendix 1.

Table 1: Site Information

Item	Description
Location	108 Dunns Crossing Road, Springston, Canterbury
Legal Description	Lot 2 DP 61278
Site Area	10.1 ha
Property Owner	Under contract to Hughes Developments Limited
Current Land Use	Mixed residential and agricultural
Proposed Land Use	Residential
Territorial Authority	Selwyn District Council

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	The site is generally flat.
Local Setting	The surrounding area is mixed agricultural and residential lifestyle blocks. The remnants of an orchard are visible at 3/144 Dunns Crossing Road.
Nearest Surface Water & Use	There is an unnamed stream/drain approximately 420 m to the northeast of the site, running northwest to northeast.

2.1 Geology and Hydrogeology

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

Table 3: Geology and Hydrogeology

Item	Description
Geology	Unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin.
Groundwater Abstractions	There is one groundwater abstraction located on the site and six active abstractions within 250 m of the site: M36/4450: LK & JC Blackmore, active well (25.2 m) for irrigation use on the site. M36/5041: Kajens Trading Development Ltd, active well (32.0 m) for domestic supply to the north of the site. M36/4449: GJ & FR Tyack, active well (24.2 m) for irrigation use of the south of the site. M36/4451: GJ & FR Tyack active well (no depth) for domestic supply to the south of the site. M36/8130: DB Irvine, active well (97.11 m) for irrigation use to the west of the site. M36/5038: Kajens Trading Developments Ltd, active well (32.1 m) for domestic supply to the northwest of the site. M36/5040: Kajens Trading Developments Ltd, active well (34.5 m) for irrigation use to the northwest of the site.
Discharge Consents	There are no discharge consents located on or within 250 m of the site.

2.2 Groundwater and Surface Water Sensitivity

Groundwater is not considered to be shallow with a groundwater bore search indicating that there are no groundwater abstractions located within 100 m of the site.

An assessment to establish whether the groundwater aquifer below the site is a ‘sensitive aquifer, as defined by the Ministry for the Environment (MfE) Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand – Module 5 – Tier 1 Groundwater Acceptance Criteria (2011), has been undertaken (refer to Table 4). It is noted that an aquifer is sensitive when either all of the first three criteria set out below are met or the fourth criterion is met in accordance with Modules 5.2.3 of the MfE Guidelines.

Table 4: Groundwater Sensitivity

Criteria	Assessment
The aquifer is not artesian or confined.	**No**. The site is overlying an unconfined or semi-confined aquifer.
The aquifer is expected to be less than 10 m below the potential suspected source of impact.	**No**. The aquifer is expected to be greater than 10 m below the site.
The aquifer is of a quality appropriate for use, can yield water at a useful rate and is in an area where abstraction and use of groundwater may be reasonably foreseen.	**Yes**. There is a groundwater abstraction on-site for irrigation supply.
The source is less than 100 m from a sensitive surface water body (i.e. a surface water body where limited dilution is available to mitigate the impact of contaminated groundwater discharging into the surface water body).	**No**. The nearest surface water is approximately 420 m to the east of the site.
Sensitivity Assessment	The aquifer is considered **NOT SENSITIVE**

Groundwater is considered to be NOT SENSITIVE in relation to the MfE sensitive aquifer assessment.

The Canterbury Land and Water Regional Plan (LWRP) Rule 5.187, states that the passive discharge of contaminants from contaminated land onto or into in circumstance where those contaminants may enter water is a permitted activity, provided the following conditions are met:

1. There has been a site investigation report provided to the CRC in accordance with Rule 5.185.
2. Either the site investigation report or water quality sampling demonstrates that the discharge does not result in the concentration of contaminants in groundwater:
    a. At the property boundary.
    b. At any existing groundwater bore (excluding any monitoring bore located on the property).
    c. Within a Community Drinking-Water Protection Zone.
    d. Exceeding the limits applicable to groundwater set out in Schedule 8.
3. Either the site investigation report or water quality sampling demonstrates that the discharge does not result in the concentration of contaminants in groundwater at any point where groundwater exits to surface water, exceeding the receiving water quality standards in Schedule 5 for 90% of species.
4. At any point where the groundwater exits to surface water the discharge does not produce any:
    a. Conspicuous oil or grease films, scums of foam, or floatable or suspended materials.

b. Conspicuous change in the colour or visual clarity.

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 Conversations with Site Owner/Occupier

A conversation with Lindsay Blackmore was held regarding the site and its current and past uses. Lindsay bought the property in 1992 and the site was undeveloped at the time of purchase. Lindsay stated that he had never used any chemical sprays on plants and only used snail bait and small amounts of fertilisers on the vegetable garden to the north of the dwelling. The horse track had been constructed by stripping back the topsoil from the ground and then placing a small amount of imported gravel to form the track. A small amount of left-over soil and gravel is observed to the west of the track. He stated that the top north-western corner of the site was planted with gum trees (*Eucalyptus*) and he was not aware if the neighbour from 3/144 had used pesticides on the trees prior to selling the property to the new owners. He stated that he had never buried any offal or rubbish on the property but had burnt small piles of green waste historically in different sections of the site.

3.2 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. 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 24 October 2019 for the site and is presented in Appendix 2. No areas of concern were identified on the CRC LLUR for the sites.

3.3 Selwyn District Council Property File

The property file for the site, held by Selwyn District Council, was reviewed on 5 November 2019 as a part of the PSI / DSI. The information below was gathered from the property file:

- 12 October 1995: Resource consent to erect 3 poultry sheds and establish a factory farming operation – retracted.
- 30 May 1997: Building consent for a hay/implement shed.
- 19 March 2003: Building consent for a 5 bay farm building – 120 m^2.
- 3 June 2003: Building consent for a 3 bedroom domestic dwelling with attached garage.

3.4 Certificate of Title

A review of the certificate of title was completed with no information related to the potential contaminating activities listed. The Certificates of Titles are attached in Appendix 3.

3.5 Historical Aerial Photograph Review

Aerial photographs obtained from Canterbury Maps and Google Earth from 1940 to 2017 have been reviewed. The relevant visible features are summarised in Table 5.

Table 5: Historical Aerial Photograph Review

Date	Source	Description
1940-1944	Canterbury Maps	The site appears to be a part of two relatively large paddocks which appear to have been ploughed or are bare (non-vegetated). Visible paleo channels are visible across the site running from the northwest boundary to the southeast boundary. The surrounding sites to the north, east and south are undeveloped and appear to be used for grazing. A small shed is visible along the south-western boundary at 92 Dunns Crossing Road. The sites to the west across Dunns Crossing Road is planted in forest.
1960-1964	Canterbury Maps	The site appears to be unchanged. The north-eastern section of the paddocks appears to be planted in crops in visible large sections. Sheep are visible in the south-western section of the site. The surrounding area remains mainly unchanged. One additional structure has been constructed along the south-western boundary line at 92 Dunns Crossing Road. This structure may be a sheep dip.
1970-1974	Canterbury Maps	The site no longer appears to have any crops growing on it and appears to be used for grazing. The potential sheep dip structure at 92 Dunns Crossing Road is still present. Additional trees have been planted along the roadside across Dunns Crossing Road in the forest area.
1980-1984	Canterbury Maps	The site appears to still be used for grazing. A large area of ponding is visible from the top north corner of the site to the south-eastern boundary line. It is presumed this area is ponding of water as there are other areas of ponding visible in paddocks to the northeast of the site. The surrounding areas remain mainly unchanged. The sheep dip structure appears to still be in place at 92 Dunns Crossing Road, however the photograph is low quality so it may be disused. Some of the forest block across Dunns Crossing Road appears to have been cleared.
1990-1994	Canterbury Maps	The site appears to still be used for grazing. Three paddocks are now visible with a new hedge/vegetation line running northwest to southeast across the top third of the site. The sites to the north and east of the site remain unchanged. The site at 92 Dunns Crossing Road appears to have been developed with a residential dwelling and associated sheds present in the western section of the site. A horse track is visible which covers most of the east section of the site. The sites across Dunns Crossing Road appear to have been replanted in trees.

Date	Source	Description
2000-2004	Canterbury Maps	The site has been developed. A horse track is visible which covers most of the north-western part of the site. The top north-western corner of the site appears to be vegetated. A shed or barn has been constructed in the south-eastern corner of the site with a driveway running to the barn from Dunns Crossing Road. Vegetation is visible planted in a rectangular shape (around current dwelling) to the north of the driveway. An area of land disturbance is visible on the western corner of the race track. Residential development has occurred to the sites to the northwest of the site. The remainder of the surrounding area remains mainly unchanged.
2010-2015	Canterbury Maps	A residential dwelling has been constructed to the north of the driveway coming off Dunns Crossing Road. Trees and other vegetation has been planted around the dwelling. A small vegetable garden and small sheds are visible on the north-eastern side of the dwelling. The shed/barn to the south of the driveway appears to have been added onto or another barn has been constructed next to the original. The horse track is still visible. The trees in the north-western corner of the site have matured. A small burn pit is visible in the middle of the horse track area. An orchard is visible at 3/144 Dunns Crossing Road directly northwest of the site. There is an area of land disturbance or ponding at 597 East Maddisons Road just beyond the north-eastern boundary of the site. The forestry block across Dunns Crossing Road has been cleared and is undeveloped. A small residential dwelling and shed has been constructed at 130 Dunns Crossing Road to the northwest of the site.
2018	Canterbury Maps	The site remains unchanged from the previous photograph. Some of the orchard at 3/144 Dunns Crossing Road has been cleared. The remainder of the surrounding area is unchanged from the previous photograph.

4 Current Site Conditions

A site walkover was completed by an ENGEO representative on 4 November 2019. A summary of the walkover is provided in Table 6 below.

Table 6: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	No visible signs of contamination were observed on either site.
Surface water appearance	There was no surface water identified on the site.

Site Conditions	Comments
Currently surrounding land use	The sites to the north, east, south and west are all mixed use – residential and agricultural.
Local sensitive environments	No sensitive environments were observed on-site.
Visible signs of plant stress	No visible signs of plant stress were observed on the site.
Additional observations	Small stockpile of gravel was observed to the west of the horse track. Small piles of greenwaste were observed in the north-west corner of the site below the gum trees. One 10L drum and one 100L drum were observed near the sheds. These drums were empty and no soil staining was visible on the ground.

5 Summary of Preliminary Site Investigation

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

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)	Potential to be a risk on-site?
Horse track	Heavy metals PAHs	Area of horse track	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.	**Unknown**. Analysis of soils from track required.

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES (Soil)	Potential to be a risk on-site?
Spray Drift from Neighbouring Orchard.	Heavy metals. Organochlorine pesticides.	North-western section of the site.	H: Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment. A10: Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds.	**Unknown.** Analysis of soil in north-western section of the site is required.

6 Intrusive Investigation

An intrusive investigation was developed to investigate if the soils have been impacted to 0.3 meters below ground level (m bgl). The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario.

6.1 Methodology

The following was undertaken during the soil sampling works:

- Collection of four soil samples using a hand trowel from across the horse track area from the imported fill (0.0-0.3 m);
- Collection of six soil samples using a hand trowel from across the north-western section of the site close to the neighbouring orchard (0.0-0.3 m);
- Each sample was inspected for visual and olfactory indicators of contamination;
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to Hill Laboratories under the standard chain of custody documentation provided in Appendix 4;
- To reduce the potential for 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 scrubbing 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 fieldwork and sampling was undertaken 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;
- Following receipt of the samples by Hill Laboratories, the soil samples were scheduled for a selection of contaminants of concern including heavy metals, polycyclic aromatic hydrocarbons (PAHs) and organochlorine pesticides (OCPs); and
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

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 Hill Laboratories, ISO/IEC 17025 and IANZ accredited laboratory, to conduct all laboratory analysis. To maintain their International Accreditation, Hill Laboratories undertakes rigorous cross checking and routine duplicate sampling testing to ensure the accuracy of their results;
- Prior to sampling the equipment (hand auger) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water; and
- During the site investigation every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

7 Regulatory Framework and Assessment Criteria

The regulatory frameworks and rules relating to the management and control of contaminated sites in the Canterbury Region are specified in two documents: the NES and the ECan Regional Plan. A summary of each and its implications for the site is provided in Sections 6.1-6.2.

7.1 NES

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

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 ECan's online GIS – Trace Level 2 concentrations.

7.2 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" sites to management fill sites. As outlined in the publication "A Guide to the Management of Clean Fills" (MfE, 2002), cleanfill is defined as:

"Material that when buried will have no adverse effect on people or the environment. Cleanfill material includes virgin natural materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of:

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances;
- Products or materials derived from hazardous waste treatment, hazardous waste stabilization or hazardous waste disposal practices;
- Material that may present a risk to human health such as medical and veterinary waste, asbestos or radioactive substances; and
- Liquid waste."

7.3 Assessment Criteria

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

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

The land use scenarios are relevant to the likely future use of the site and are 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 exposure to surface or near 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.

The soil analysis results have also been compared to Regional Background levels for heavy metals (arsenic, copper, cadmium, mercury, nickel, zinc) and organochlorine pesticides (OCPs). These provide information into the possible disposal options at a cleanfill facility.

8 Results

8.1 Soil Encountered

Please refer to Table 8 from the summary of subsurface soil encountered within the near surface soils in the burn pit area. Please refer to ENGEO's Geotechnical Report (ENGEO, 2019) for the site for additional soil profiles.

No potential asbestos containing material was visually identified in the fill material on the race track; therefore soil analysis for asbestos was not undertaken.

Table 8: Summary of Subsurface Soils

	Depth	Soil Description
Orchard	0.0-0.1	SILT with some sand, trace gravel and rootlets.
	0.1-0.3	SILT with some sand, trace gravel.
Horse Track	0.0-0.15	Silty GRAVEL with some sand.
	0.15-0.3	SILT with some sand, trace gravel.

8.2 Analytical Results

Six samples were collected from around the north-western section of the site closest to the neighbouring orchard in the surface soils (0.1 m bgl). All samples returned concentrations of heavy metals and OCPs below the applicable NES criteria and below the site specific background levels. Samples O-3, O-4, O-5 and O-6 reported very low concentrations of 4,4'-DDT, however these concentrations are only marginally above the laboratory detection of limit.

The horse rack samples (T-1, T-2, T-3, T-4) analysed for heavy metals and PAHs were reported below the applicable NES criteria and below the site specific background levels. All PAH analytes were reported below the laboratory detection of limit.

Table 9: Sample Analysis Results

Sample Name	T-1	T-2	T-3	T-4	O-1	O-2	O-3	O-4	O-5	O-6	Human health criteria – Residential Land Use	Human health criteria - Commercial / industrial outdoor worker (unpaved)[a]	Regional background - Trace Elements (Level 2)[b]
Soil Type	GRAVEL	GRAVEL	GRAVEL	GRAVEL	SILT	SILT	SILT	SILT	SILT	SILT			
Sample Depth, m	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.1-0.3	0.1-0.3	0.1-0.3	0.1-0.3	0.1-0.3	0.1-0.3			
Heavy Metals in soil, mg/kg													
Arsenic	3	3	3	3	3	3	3	3	3	3	20	70	6.35
Cadmium[c]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	0.10	3	1,300	0.14
Chromium[d]	12	11	11	12	13	12	13	11	13	12	460	6,300	19.89
Copper	4	5	5	4	3	5	4	4	4	4	>10,000	>10,000	11.68
Lead	16.7	11.3	12.4	13.7	16.7	13.7	14.8	11.6	13.7	12.5	210	3,300	19.75
Mercury	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	310	4,200	0.07
Nickel	8	8	8	8	8	7	8	7	8	7	400[c]	6,000[c]	13.91
Zinc	51	41	42	44	50	46	49	42	46	43	7,400[c]	400,000[c]	69.58
Organochlorine Pesticides in soil, mg/kg													
∑DDT	-	-	-	-	<0.07	<0.07	0.07	0.12	0.14	0.12	23.33	333.33	0.431
Dieldrin	-	-	-	-	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	0.86	53.33	-
Polycyclic aromatic hydrocarbons in soil, mg/kg													
BaP eq.	<0.03	<0.03	<0.03	0.03	-	-	-	-	-	-			0.922

[a] Human health criteria from the NES except where noted.

Bold text indicates that the concentration exceeds the Residential land use criterion.

Italics indicates that the concentration exceeds the Commercial/industrial land user criterion.

[b] ECan (2007) Background Concentrations of Selected Trace Elements in Canterbury Soils. Exceedances are underlined.

[c] Assumes soil pH of 5.

[d] Criteria for Chromium VI were conservatively selected.

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; and
- An exposure route, where the sensitive receptor 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 10.

Table 10: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Horse Track	Heavy metals and PAHs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers.	**Yes.** All samples were below the applicable NES criteria.
Orchard	Heavy metals and OCPs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers.	**Yes.** All samples were below the applicable NES criteria.

10 Conclusions and Recommendations

ENGEO Ltd was engaged by Hughes Developments Ltd to undertake a Preliminary and Detailed Site Investigation at a 10.1 ha site, situated at 108 Dunns Crossing Road, Rolleston, for a change in land use, subdivision and soil disturbance consent. Information was gathered and reviewed regarding the current and past uses of the site that could have resulted in releases or potential releases of hazardous substances to the subject property.

The review of information identified that the site has been used for agricultural grazing from circa 1940, and residential land use including a horse trotting track and various shed since 1990's/2000's.

No activities were identified on Canterbury Regional Council's Listed Land Use Register (CRC LLUR). The property file for the site was viewed at Selwyn District Council, and contained no information related to potential hazardous activities having occurred at the site.

During the site walkover the horse track was sampled for impacted imported fill material. It was noted that the imported fill consisted of gravel and shells. The laboratory analysis of four samples from around the trotting track area were submitted for analysis for heavy metals and PAHs. Six samples were also collected from the north-western corner of the site for heavy metals and OCPs due to the neighbouring site being a historic orchard. All ten samples returned concentrations below the site specific regional background criteria and the applicable NES human health criteria.

Based on the information gathered, we consider that it is highly unlikely for the soils to have been impacted from past and current uses of the site. As per regulation 7 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011, it is highly unlikely that an activity included on the HAIL has or is being carried out on the site therefore this piece of land is not covered by this piece of legislation.

11 References

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

MfE (2011b). *Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites*.

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.*

12 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments 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.

ii. 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.

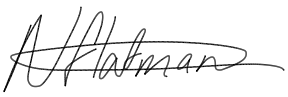
iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. 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.

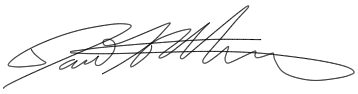
Report prepared by



Natalie Flatman

Environmental Scientist

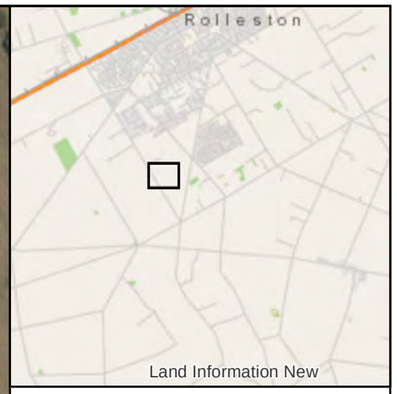
Report reviewed by



Dave Robotham, CEnvP SC

Principal Environmental Consultant

FIGURES



Legend

Site boundary

Sample locations

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

Christchurch Office
124 Montreal Street, Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title:
Site Location Plan

Client: Hughes Developments Ltd		Figure No: 1
Project: 108 Dunns Crossing Road Rolleston	Designed: NF Drawn: NF Checked: XX Date: Nov 19	Size: A3
Proj No: 12903.001.000	Scale: 1:2,000	Revision: A

APPENDIX 1:

Site Photographs

Photo 1: Dwelling at 108 Dunns Crossing Road

Photo 2: Shed on site

Photo 3: Shed on site

Photo 4: Small sheds to the north of the dwelling

Photo 5: Residential vegetable garden to the north of the dwelling

Photo 6: Horse track

ENGEO
Expect Excellence

Date taken	Nov 19	**Client**	**Hughes Developments**		
Taken by	JH	**Project**	**108 Dunns Crossing Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref.**	12903	**Appendix No.**	1a

Photo 7: Middle of horse track looking north

Photo 8: Middle of horse track area

Photo 9: Southern Gravel Stockpile (old oval track material)

Photo 10: Typical strata of horse track material

Photo 11: Green waste pile in gum trees northwest corner of the site

Photo 12: Empty storage containers near sheds

ENGEO
Expect Excellence

Date taken	Nov 19	**Client**	**Hughes Developments**		
Taken by	JH	**Project**	**108 Dunns Crossing Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref**	12903	**Appendix No**	1b

APPENDIX 2:

CRC LLUR

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

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.

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

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:	24 October 2019	
Land Parcels:	Lot 2 DP 61278	Valuation No(s): 2405538000

The information presented in this map is specific to the property you have selected. Information on nearby properties 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

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ244766.

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.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know

Everything is connected

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.

[1] The 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?

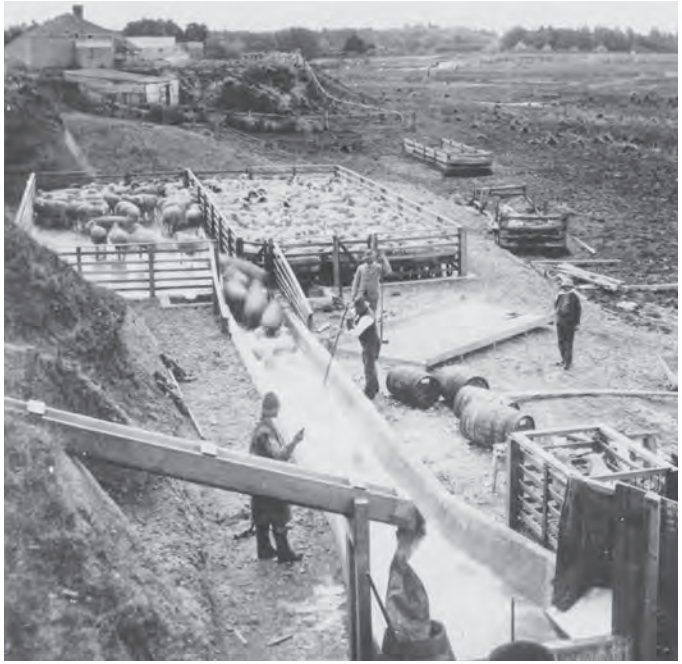
The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list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

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.)

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.

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)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

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.

Environment Canterbury Regional Council
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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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

E13/102

APPENDIX 3:

Certificate of Titles

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB36C/248**
Land Registration District	**Canterbury**
Date Issued	29 October 1992

Prior References
CB33K/66

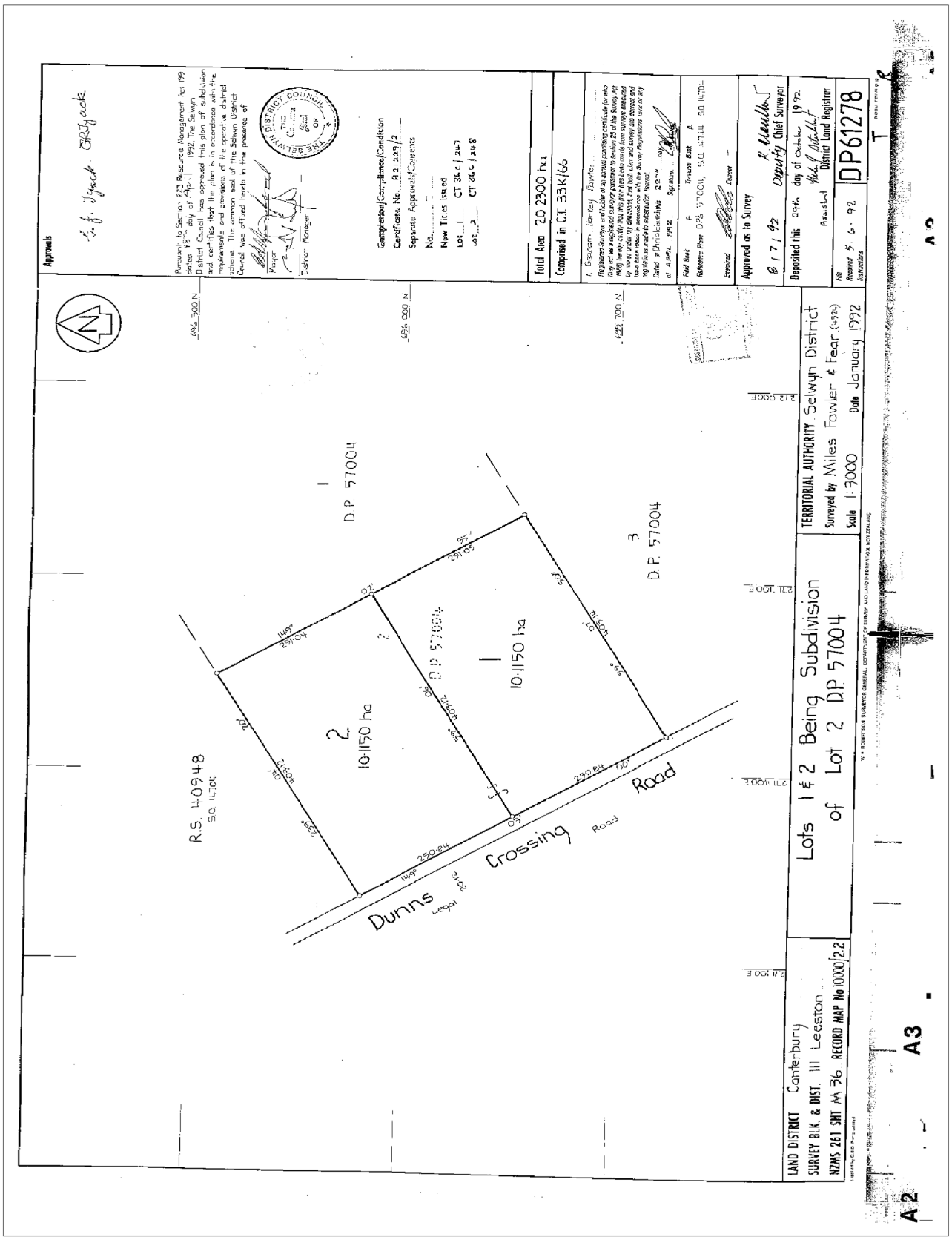
Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 2 Deposited Plan 61278

Registered Owners
Lindsay Kenneth Blackmore as to a 1/2 share
Judith Christina Blackmore as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Identifier **CB36C/248**



APPENDIX 4:

Laboratory Certificates

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2269325 SPv2
Contact:	Natalie Flatman	**Date Received:**	05-Nov-2019
	C/- Engeo Limited	**Date Reported:**	07-Nov-2019
	PO Box 373	**Quote No:**	82742
	Christchurch 8140	**Order No:**	
		Client Reference:	12903.000.000-108DC
		Submitted By:	Natalie Flatman

Sample Type: Soil

Sample Name:		T-1 @ 0.0-0.1 04-Nov-2019	T-2 @ 0.0-0.1 04-Nov-2019	T-3 @ 0.0-0.1 04-Nov-2019	T-4 @ 0.0-0.1 04-Nov-2019	0-1 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.1	2269325.2	2269325.3	2269325.4	2269325.5
Individual Tests						
Dry Matter	g/100g as rcvd	87	97	96	92	84
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	12	11	11	12	-
Total Recoverable Copper	mg/kg dry wt	4	5	5	4	-
Total Recoverable Lead	mg/kg dry wt	16.7	11.3	12.4	13.7	-
Total Recoverable Nickel	mg/kg dry wt	8	8	8	8	-
Total Recoverable Zinc	mg/kg dry wt	51	41	42	44	-
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	-	3
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	-	-	-	13
Total Recoverable Copper	mg/kg dry wt	-	-	-	-	3
Total Recoverable Lead	mg/kg dry wt	-	-	-	-	16.7
Total Recoverable Mercury	mg/kg dry wt	-	-	-	-	< 0.10
Total Recoverable Nickel	mg/kg dry wt	-	-	-	-	8
Total Recoverable Zinc	mg/kg dry wt	-	-	-	-	50
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	-	-	< 0.012
alpha-BHC	mg/kg dry wt	-	-	-	-	< 0.012
beta-BHC	mg/kg dry wt	-	-	-	-	< 0.012
delta-BHC	mg/kg dry wt	-	-	-	-	< 0.012
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	-	< 0.012
cis-Chlordane	mg/kg dry wt	-	-	-	-	< 0.012
trans-Chlordane	mg/kg dry wt	-	-	-	-	< 0.012
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	-	-	< 0.04
2,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.012
4,4'-DDD	mg/kg dry wt	-	-	-	-	< 0.012
2,4'-DDE	mg/kg dry wt	-	-	-	-	< 0.012
4,4'-DDE	mg/kg dry wt	-	-	-	-	< 0.012
2,4'-DDT	mg/kg dry wt	-	-	-	-	< 0.012
4,4'-DDT	mg/kg dry wt	-	-	-	-	< 0.012
Total DDT Isomers	mg/kg dry wt	-	-	-	-	< 0.08
Dieldrin	mg/kg dry wt	-	-	-	-	< 0.012
Endosulfan I	mg/kg dry wt	-	-	-	-	< 0.012
Endosulfan II	mg/kg dry wt	-	-	-	-	< 0.012

Sample Type: Soil						
Sample Name:		T-1 @ 0.0-0.1 04-Nov-2019	T-2 @ 0.0-0.1 04-Nov-2019	T-3 @ 0.0-0.1 04-Nov-2019	T-4 @ 0.0-0.1 04-Nov-2019	0-1 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.1	2269325.2	2269325.3	2269325.4	2269325.5
Organochlorine Pesticides Screening in Soil						
Endosulfan sulphate	mg/kg dry wt	-	-	-	-	< 0.012
Endrin	mg/kg dry wt	-	-	-	-	< 0.012
Endrin aldehyde	mg/kg dry wt	-	-	-	-	< 0.012
Endrin ketone	mg/kg dry wt	-	-	-	-	< 0.012
Heptachlor	mg/kg dry wt	-	-	-	-	< 0.012
Heptachlor epoxide	mg/kg dry wt	-	-	-	-	< 0.012
Hexachlorobenzene	mg/kg dry wt	-	-	-	-	< 0.012
Methoxychlor	mg/kg dry wt	-	-	-	-	< 0.012
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Acenaphthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[a]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[e]pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Chrysene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	0.012	-
Fluorene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	-
Perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Phenanthrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-
Pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.011	< 0.011	-

Sample Name:		0-2 @ 0.1-0.3 04-Nov-2019	0-3 @ 0.1-0.3 04-Nov-2019	0-4 @ 0.1-0.3 04-Nov-2019	0-5 @ 0.1-0.3 04-Nov-2019	0-6 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.6	2269325.7	2269325.8	2269325.9	2269325.10
Individual Tests						
Dry Matter	g/100g as rcvd	83	83	91	83	90
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.10	0.10
Total Recoverable Chromium	mg/kg dry wt	12	13	11	13	12
Total Recoverable Copper	mg/kg dry wt	5	4	4	4	4
Total Recoverable Lead	mg/kg dry wt	13.7	14.8	11.6	13.7	12.5
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	7	8	7	8	7
Total Recoverable Zinc	mg/kg dry wt	46	49	42	46	43
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
alpha-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
beta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
delta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
gamma-BHC (Lindane)	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011

Sample Type: Soil						
Sample Name:		0-2 @ 0.1-0.3 04-Nov-2019	0-3 @ 0.1-0.3 04-Nov-2019	0-4 @ 0.1-0.3 04-Nov-2019	0-5 @ 0.1-0.3 04-Nov-2019	0-6 @ 0.1-0.3 04-Nov-2019
Lab Number:		2269325.6	2269325.7	2269325.8	2269325.9	2269325.10
Organochlorine Pesticides Screening in Soil						
cis-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
trans-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
4,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
2,4'-DDE	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
4,4'-DDE	mg/kg dry wt	< 0.012	0.013	0.064	0.078	0.060
2,4'-DDT	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
4,4'-DDT	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Total DDT Isomers	mg/kg dry wt	< 0.07	< 0.07	< 0.07	0.08	< 0.07
Dieldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endosulfan I	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endosulfan II	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endosulfan sulphate	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endrin	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endrin aldehyde	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Endrin ketone	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Heptachlor	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Heptachlor epoxide	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Hexachlorobenzene	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011
Methoxychlor	mg/kg dry wt	< 0.012	< 0.012	< 0.011	< 0.012	< 0.011

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%.	-	1-10
Total of Reported PAHs in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg dry wt	1-4
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	1-4
Heavy Metals with Mercury, 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	5-10
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082). Tested on as recieved sample	0.010 - 0.06 mg/kg dry wt	5-10
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]	0.002 - 0.3 mg/kg dry wt	1-4
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	1-10
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.	0.002 mg/kg dry wt	1-4

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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).	0.002 mg/kg dry wt	1-4

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.

Martin Cowell - BSc
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street, Hamilton 3204
Private Bag 3205
Hamilton 3240, New Zealand

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Job No: **226 9325**
Date Recv: 05-Nov-19 05:49
Received by: Nathaniel Sue
3122693254

Quote No

Primary Contact Natalie Flatman

Submitted By Natalie Flatman

Client Name ENGEO Ltd

Address 124 Montreal Street, Syndeham

Christchurch *Postcode* 8014

Phone *Mobile* 0273350114

Email nflatman@engeo.co.nz

Charge To ENGEO Ltd

Client Reference 12903.000.000_108DC

Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other

ADDITIONAL INFORMATION

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
Date & Time: 4/11/19 4:00
Name: N Flatman
☑ *Tick if you require COC to be emailed back*
Signature:

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen
Temp: >0.3

☐ *Sample and Analysis details checked*
Signature:

Priority ☐ Low ☐ Normal ☑ High
☐ **Urgent** (ASAP, extra charge applies, please contact lab first)

Requested Reporting Date:

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
1	T-1 @0.0-0.1	4/11/19		ES	Heavy metals & PAHs
2	T-2 @0.0-0.1				" "
3	T-3 @0.0-0.1				" "
4	T-4 @0.0-0.1				" "
5	0-1 @0.1-0.3				Heavy metals incl Mercury & OCPs
6	0-2 @0.1-0.3				" "
7	0-3 @0.1-0.3				" "
8	0-4 @0.1-0.3				" "
9	0-5 @0.1-0.3				" "
10	0-6 @0.1-0.3				" "
11					
12					

Continued on next page

ENGEO

Expect Excellence

Detailed Environmental Site Investigation

92 Dunns Crossing Road

Rolleston

Canterbury

Submitted to:

Hughes Developments Ltd
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Merivale
Christchurch 8014

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ENGEO Document Control:

Report Title	Detailed Environmental Site Investigation - 92 Dunns Crossing Road, Rolleston			
Project No.	12903.000.001	Doc ID	79	
Client	Hughes Developments Ltd	Client Contact	Kelvin Back	
Distribution (PDF)	Hughes Developments Ltd			
Date	Revision Details/Status	WP	Author	Reviewer
06/12/2019	Issued to Client	LL	NF	DR
16/12/2019	Revision 1	BK	NF	DR

1 Introduction

ENGEO Ltd was requested by Hughes Developments Limited to undertake a combined Preliminary and Detailed Site Investigation (PSI / DSI) of neighbouring properties at 92 Dunns Crossing Road and Goulds Road (Lot 3 DP 54007) (herein referred to as 'the sites'). The purpose of the assessment was to assess the property's suitability for a change of land use consent, subdivision and soil disturbance under the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES) to satisfy the requirements of Selwyn District Council (SDC).

Figure 1h attached indicates the location of the property. This PSI / DSI was undertaken in accordance with the Ministry for the Environment (MfE) 2001, *Guidelines for Reporting on Contaminated Sites*.

1.1 Objectives of the Assessment

The objective of this PSI / DSI was to evaluate and identify conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property and report on the potential risk posed to future site users.

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 ongoing releases of hazardous substances at the subject property; and
- 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 substances to the subject property.

1.2.1 Review of Site Information

During this assessment, a number of sources of information were contacted for information relating to the sites regarding their past and present uses. This included contacting Canterbury Regional Council (CRC) to determine if there were records on the Listed Land Use Register (LLUR) and reviewing records held by Selwyn District Council (SDC) including the property file and dangerous goods file (if available). A review of a number of historical and current aerial photographs was also undertaken using images from Canterbury Maps and Google Earth.

1.2.2 Site Inspection

A site walkover was undertaken on 22 November 2019 by Natalie Flatman of ENGEO.

2 Site Description and Setting

Site information is summarised in Table 1.

Table 1: Site Information

Item	Description	
Location	92 Dunns Crossing Road	Goulds Road
Legal Description	Lot 1 DP 61278	Lot 3 DP 57004
Site Area	10.1 ha	20.7 ha
Property Owner	Property is under contract to Hughes Developments Limited.	
Current Land Use	Residential and Agricultural	
Proposed Land Use	Residential	
Building Construction	Dwelling – Concrete ring foundation, brick cladding, cement soffits, metal roof. Garage – concrete foundation, metal cladding and roof. Barns – timber frame with metal cladding and roof.	Not applicable
Territorial Authority	Selwyn District Council	

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	The sites are predominately flat.
Local Setting	The surrounding area is a mix of agricultural and residential.
Nearest Surface Water & Use	An un-named drain runs northeast to southwest along the southern side of Goulds Road.
Geology	Late Quaternary unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin.
Hydrogeology	The sites are located over an unconfined / semiconfined gravel aquifer.
Groundwater Abstractions	There are two groundwater abstractions located on the sites and three within 250 m of the sites: M36/4451: GJ & FR Tyack, active well (no depth recorded) on-site for domestic supply. M36/4387: G & DC Robertson, active well (35.6 m) on-site for domestic supply. M36/20535: S & M Baxter, active well (30.0 m) to the east of the site for domestic and stockwater use. BX23/0895: M & T Croucher, active well (53.5m) to the south of the site for domestic and stormwater supply. M36/4450: LK & JC Blackmore, active well (25.2 m) to the northwest of the sites of irrigation use.
Discharge Consents	There is no active discharge consent located on the sites and one active consent within 250 m of the sites: CRC110335: S Baxter, active discharge consent for the discharge of contaminant into land and water.

3 Site History

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

3.1 Discussions with Site Owners

Ivan Robertson has been the owner of the sites at 92 Dunns Crossing Road and Gould Road for approximately 15 years. ENGEO spoke with Mr Robertson in regards to the past and current uses of the sites. Mr Robertson stated that he used the paddocks for grazing and growing hay. Mr Robertson stated that that no pesticides or chemicals had been stored on site. He mentioned a waste pit, which is roughly located along the trees on the eastern boundary directly across from the dwelling.

Mr Robertson did not place anything in the pit but remembers it being there when they purchased the property.

Mr Robertson also stated that he used to drive past the sites every day prior to owning the sites and does not recall the area identified as a sheep dip being a sheep dip – he thought it was more of a holding pen. He also mentioned that the only storage tank for fuel is the above ground storage tank located east of the largest barn.

3.2 Selwyn District Council Property File

The property file for the sites, held by Selwyn District Council, was reviewed on 12 September 2018 as part of the PSI. The details below were identified in the property file search:

92 Dunns Crossing Road

- 1990 Relocation of a house onto the site
- 1990 Extension of a stable building 67 m^2
- 1990 Extension of a shed 100 m^2
- 1990 Building Consent for a Versatile garage 36 m^2
- 2001 Building consent for an extension of the dwelling to include a porch area 24 m^2
- 2002 Building Consent for a 3 bay implement shed

Lot 3 DP 57004

- 1992 Building Consent for a small Pump shed

3.3 Certificate of Title

A review of the certificate of title was completed with no information related to potential contaminating activities identified. The Certificates of Title are attached in Appendix 1.

3.4 Listed Land Use Register (LLUR)

Potentially hazardous activities are defined on the Hazardous Activities and Industries List (HAIL). Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury region which have potentially had an activity included on the HAIL undertaken on them. Under the NES, the listing of the property on the LLUR triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 8 November 2019 for the sites and is presented in Appendix 2.

Table 2: LLUR Summary

Period From	Period To	HAIL Activity(s)	LLUR Category
Pre 1941	Pre 1984	A8: Livestock dip or spray race operations	Not Investigated
Additional Information		Area defined from aerial photographs. Defined from 1961-1974 aerials.	

3.5 Historical Aerial Photograph Review

Aerial photographs dating from 1940 to 2017 have been reviewed. The relevant visible features are summarised in Table 4. Please refer to the figures for each aerial photograph.

Table 3: Aerial Photographs

Date	Figure	Source	Description
1940-1944	1a	Canterbury Maps	The sites are undeveloped and appear to be grassed and presumably used for grazing. A small shed is observed in the western corner of 92 Dunns Crossing Road. Alluvial flow paths are visible across the sites running northwest to southeast. The surrounding areas are also undeveloped to the north, east and south. The land to the west across Dunns Crossing Road is a part of a large forestry block.
1960-1964	1b	Canterbury Maps	A pen or sheep dip is observed just north of the shed in the western corner of 92 Dunns Crossing Road. There is a visible fence line around the shed, which can be seen to feed into the paddock with the pen / sheep dip in it. A large area of the Gould Road site has been planted with crops. A line of vegetation is visible between the Gould Road site and 92 Dunns Crossing Road. The surrounding area remains mainly unchanged. The forestry block across Dunns Crossing Road appears to have been thinned or felled.
1970-1974	1c	Canterbury Maps	The shed and pen / sheep dip area is still visible in the western corner of the Dunns Crossing Road site. Another small structure is visible to the east of the shed. The remainder of this site appears unchanged from the previous photograph. The surrounding areas to the north, east and south are unchanged and the forestry block to the west of Dunns Crossing Road is maturing again.
1980-1984	1d	Canterbury Maps	The shed near the sheep dip / pen area is not visible. A small area of ponding is visible to the northeast of the sheep dip area. There is a small area of land disturbance / un-vegetated ground on the north-eastern corner of the Goulds Road site. The surrounding areas from the sites remain unchanged.

Date	Figure	Source	Description
1990-1994	1e	Canterbury Maps	A dwelling and shed / garage have been constructed at 92 Dunns Crossing Road near the west of the site. A horse track is visible which spans across the southern part of 92 Dunns Crossing Road – east of the dwelling. The sheep dip area is no longer present on the site. A small shed has been constructed in the Goulds Road site to the west towards Dunns Crossing Road. The surrounding areas from the sites remain mainly unchanged.
2000-2004	1f	Canterbury Maps	A large shed has been constructed to the northwest of the dwelling. A small shed is visible in the northern section of 92 Dunns Crossing Road. The horse track is no longer visible at the site. The site at Goulds Road is mainly unchanged. A shed and horse track have been constructed at 108 Dunns Crossing Road to the north of the site. The remainder of the surrounding area is mainly unchanged.
2010-2015	1g	Canterbury Maps	Another shed has been constructed to the east of the newly constructed shed observed in the 2000-2004 photograph. A small glasshouse is observed near a vegetable garage to the east of the dwelling. The surrounding areas from the sites remain mainly unchanged.
2017	1h	Canterbury Maps	The sites and surrounding area remains mainly unchanged from the previous aerial photograph.

Table 5 below describes the site conditions during the site walkover on 19 September 2019. Photographs taken during the site walkover are included in Appendix 3.

Table 4: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	A small area of soil staining was present below a 1000 L above ground storage tank (diesel).
Surface water appearance	There was no surface water identified on the sites.
Currently surrounding land use	The sites to the north, east, south and west are all mixed use – residential and agricultural.
Local sensitive environments	No sensitive environments were observed.
Visible signs of plant stress	No visible signs of plant stress were observed on the sites.

Site Conditions	Comments
Additional observations	A 1000 L above ground storage tank was observed to the north of the large barn near the dwelling. A 100 L metal drum was observed to the south of the dwelling. The drum contained cardboard waste and there was visible ashy material spilling from the bottom of the drum. A large (10 m long, 3 m wide and 1.5 m deep) waste pit was observed along the eastern boundary line at 92 Dunns Crossing Road. Please refer to Section 7.1 for additional information for the waste pit. A large radio tower was observed in the eastern corner of the Goulds Road property.

4 Potential HAIL Activities

Activities included on the Hazardous Activities and Industries List (HAIL) trigger the requirement for a contaminated land investigation prior to redevelopment.

Table 5: Potential HAIL Activities

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES
Sheep dip	Heavy metals OCPs ONPs	Area in the north-western paddock at 92 Dunns Crossing Rd	A8. Livestock dip or spray race operations
Area of land disturbance – potential waste or offal pit	Unknown – dependent on type of waste (if any)	Area along eastern boundary line at 92 Dunns Crossing Rd	G5. Waste disposal to land
Storage tank AST	Heavy metals TPH	Underlying soils around AST	A17: Storage tanks or drums for fuels chemicals or liquid waste
Area of land disturbance – potential waste or offal pit	Unknown – dependent on type of waste (if any)	Area in eastern corner of the Goulds Road site.	G5. Waste disposal to land

No other activities included on the HAIL were identified on the remaining areas of the sites inspected.

5 Intrusive Investigation

An intrusive investigation was developed to investigate if the soils have been impacted to 0.3 metres below ground level (m bgl). The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario.

5.1 Methodology

The following was undertaken during the soil sampling works:

- Collection of eight soil samples using a hand trowel from the surface soils (0.0-0.2 m bgl) from across the former sheep dip area. Samples were also collected from depth (0.4-0.5 m bgl) using a hand auger. Samples were collected on 22 November 2019.
- Collection of one soil sample from the visual staining below the AST using a hand trowel. Samples were collected on 22 November 2019.
- Collection of one soil sample from the material from the burn drum using a hand trowel. Samples were collected on 22 November 2019.
- Collection of three samples from the waste pit material. Samples were collected on 5 December 2019.
- Each sample was inspected for visual and olfactory indicators of contamination.
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to Hill Laboratories and Terra Scientific under the standard chain of custody documentation provided in Appendix 4.
- To reduce the potential for 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 scrubbing 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*.
- Fieldwork and sampling was undertaken 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.
- Following receipt of the samples by Hill Laboratories, the soil samples were scheduled for a selection of contaminants of concern including heavy metals and organochlorine pesticides.
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

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 Hill Laboratories, ISO/IEC 17025 and IANZ accredited laboratory, to conduct all laboratory analysis. To maintain their International Accreditation, Hill Laboratories undertake rigorous cross checking and routine duplicate sampling testing to ensure the accuracy of their results.
- Prior to sampling, the equipment (hand auger) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water.
- During the site investigation, every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

6 Regulatory Framework and Assessment Criteria

The regulatory frameworks and rules relating to the management and control of contaminated sites in the Canterbury Region are specified in two documents: the NES and the ECan Regional Plan. A summary of each and its implications for the site is provided in Sections 6.1-6.2.

6.1 NES

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

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 ECan's online GIS – Trace Level 2 concentrations.

6.2 Disposal Criteria

An assessment of potential off-site disposal options for any excess soil 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" sites to managed waste sites. As outlined in the publication Waste Management Institute of New Zealand Technical Guidelines for Disposal to Land (August 2018) definition of cleanfill, which states:

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

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances or material (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."

6.3 Asbestos Criteria

The field work and reporting for these sites have been done in accordance with the New Zealand Guidelines for Assessing and Managing Asbestos in Soil released on 6 November 2017. The BRANZ Asbestos (2017) Guidelines have been developed based on the WA DOH Guidelines but with the New Zealand regulatory environment in mind.

The BRANZ guideline criteria have been adopted as investigation criteria for this assessment and are presented in Table 7.

Table 6: 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 7 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 of the BRANZ Guideline (≥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 of the BRANZ guideline 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 of the BRANZ guideline). 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 of the BRANZ guideline). Two forms of capping are typically used:

a. 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. b. 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.

6.4 Assessment Criteria

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

- Residential land use; and
- Commercial / Industrial land use (based on an outdoor worker scenario) (for redevelopment workers).

The land use scenarios are relevant to the likely future use of the sites and are 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 ten 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 exposure to surface or near 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 sites, 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.

The soil analysis results have also been compared to Regional Background levels for heavy metals (arsenic, copper, cadmium, mercury, nickel, zinc) and organochlorine pesticides (OCPs). These provide information into the possible disposal options at a cleanfill facility.

7 Results

7.1 Soil Encountered

Please refer to Table 8 for the summary of the general subsurface soil encountered within the near surface soils in the burn pit area. Please refer to ENGEO's Geotechnical Report (ENGEO, 2019) for the sites for additional soil profiles.

Ash and charcoal material was observed in the sample collected from the burn drum. The soil collected from beneath the AST was visually stained a black colour and smelt of diesel.

The waste pit material consisted of silt, gravel, metals (wire fencing), plastics (bags, bottles and food wrappers), cans, glass bottles, bones, material, potential asbestos containing material and timber.

Table 7: Summary of Subsurface Soils

Depth	Soil Description
0.0-0.1	Sandy SILT with trace rootlets; brown.
0.1-0.5	Sandy SILT with trace gravel; greyish brown.

7.2 Analytical Results

Eight samples were collected from around the former sheep dip area and storage shed from the surface soils (0.0-0.2 m below ground level). One sample (HA08) returned concentrations of lead above the NES residential land use criteria. Several other samples analysed from the sheep dip area returned concentrations of heavy metals above the site-specific regional background criteria. DDT was detected in HA05 and HA06 but was still below the NES human health residential criteria. Additional samples (HA09-HA16) have been collected from around HA08 to assess the extent of the lead impact; all of these samples were below the NES human health criteria for residential land use. These locations are included on Figure 2.

One soil sample (SS01) was collected from stained material below the AST. The total petroleum hydrocarbon results for C10-C14 were reported above the NES human health criteria for residential land use in silty sand soil types. The sample SS01 also reported elevated heavy metal concentrations against the regional background levels.

One sample (SS02) was collected from the burn pile to the east of the house. The analysis reports that arsenic, cadmium and chromium are above the NES human health residential criteria and arsenic is also above the NES commercial / industrial outdoor worker human health criteria. All heavy metals were reported as being above the site-specific background criteria.

Samples have been collected from the waste pit along the eastern boundary line at 92 Dunns Crossing Road. Three samples have been submitted for heavy metals, PAHs and asbestos semi-quantitative analysis. Asbestos results collected from the waste pit reported that the PACM cement board was positive for chrysotile and amosite asbestos. One of the three soil samples collected returned concentrations of asbestos fines and fibres above the BRANZ guidelines. The other two samples were reported as not asbestos containing. The soil samples were also analysed for heavy metals and polycyclic aromatic hydrocarbons. A number of heavy metals from the samples WP01, WP02 and WP03 were reported above the background levels with no exceedances against the NES human health criteria. All PAH results were below the laboratory detection limits.

Table 8: Analytical Results – Heavy Metals and OCPs

Sample ID	HA01	HA02	HA03	HA04	HA05	HA06	HA07	HA08	SS01	SS02	WP01	WP02	WP03	Background (bl)	Assessment Criteria	
Soil Depth	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	surface - 0.2 m	-	-	-	Canterbury Regional	Residential - 10% produce	Industrial
Sample Date	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	22-11-2019	5-12-2019	5-12-2019	5-12-2019			
Arsenic	3	3	**7**	6	3	3	3	**9**	**10**	**1,470**	5	**13**	**19**	6.35	20 (A)	70 (A)
Cadmium	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	**0.73**	**0.15**	**5.2**	**0.35**	**0.68**	**1.32**	0.14	3 (A)	1300 (A)
Chromium (total)	11	11	14	13	10	10	10	13	**22**	**480**	14	18	**24**	19.89	460 (A)	6300 (A)
Copper	7	5	**13**	8	4	4	4	**35**	**68**	**1,630**	10	**340**	**640**	11.68	NL (A)	NL (A)
Lead	**19.8**	16.6	**20**	18.3	12.9	13	19.4	**290**	**159**	**149**	**27**	**115**	**61**	19.75	210 (A)	3300 (A)
Nickel	7	7	8	7	6	7	6	10	8	**22**	9	11	**340**	13.91	400 (B)	6000 (B)
Zinc	56	51	**117**	**62**	42	45	46	**1,530**	**220**	**370**	**113**	**320**	**580**	59.58	7400 (B)	350000 (C)
DDE	< 0.012	< 0.012	< 0.013	< 0.012	0.012	0.1	< 0.013	0.023	-	-	-	-	-	-	2 (C)	9.3 (C)
2,4'-DDT	< 0.012	< 0.012	< 0.013	< 0.012	< 0.012	0.015	< 0.013	< 0.013	-	-	-	-	-	-	-	-
DDT	0.012	0.012	0.013	0.012	0.02	0.046	< 0.013	0.019	-	-	-	-	-	-	1.9 (C)	8.5 (C)
DDT Isomers	< 0.07	< 0.07	< 0.08	< 0.08	< 0.08	0.16	< 0.08	< 0.08	-	-	-	-	-	-	70 (A)	1000 (A)
Fluoranthene	-	-	-	-	-	-	-	-	-	0.018	-	-	-	-	650 (D)	2400 (C)
Phenanthrene	-	-	-	-	-	-	-	-	-	0.016	-	-	-	-	180 (D)	-
Pyrene	-	-	-	-	-	-	-	-	-	0.015	-	-	-	1600	NA	NA

General Notes:
Values highlighted red exceed one or more assessment criteria, highlighted yellow exceed the lab detection limit.
All data by default is in mg/kg.
Adjusted assessment criteria are developed from the number of subsamples to form an adjusted guideline value.
Values in bold exceed the adopted background concentrations.
bl - denotes background samples compared to Canterbury Regional -> Yellow brown stony.
Guideline Notes: A - Methodology for Deriving Soil Guideline Values Protective of Human Health (MfE, 2011), B - National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013), C - Environmental Protection Agency – Regional Screening Levels (May 2019), D - Users' Guide to the Guidelines for Assessing and Managing Contaminated Gasworks Sites in New Zealand (MfE, 1997).

Table 9: TPH Analysis Results

Sample ID	SS01	Residential
		Sandy Silt
Soil Depth	**surface - 0.2 m**	< 1 m (A)
Sample Date	**22-11-2019**	
Sample Soil Type	**Sandy Silt**	
Guideline Soil Depth	**< 1 m**	
C7-C9	91	1,600
C10-C14	10,200	2,400
C15-C36	85,000	NA

General Notes:
Values highlighted red exceed one or more assessment criteria, highlighted yellow exceed the lab detection limit.
All data by default is in mg/kg.
Adjusted assessment criteria are developed from the number of subsamples to form an adjusted guideline value.
Values in bold exceed the adopted background concentrations.
bl - denotes background samples compared to Canterbury Regional -> Yellow brown stony.
Guideline Notes: A - Users' Guide to the Guidelines for Assessing and Managing Contaminated Gasworks Sites in New Zealand (MfE, 1997).

Table 10: Asbestos Semi-quantitative Analysis Results

Sample Name	Asbestos Type	AF and FA as % w/w of total sample
PACM 1 Waste Pit	Chrysotile and Amosite	NA
Waste Pit 01	No asbestos detected	-
Waste Pit 02	No asbestos detected	-
Waste Pit 03	Chrysotile and Amosite	**0.02035**

Table 11: Lead Delineation Analysis Results

Sample Name	Lead (mg/kg)
HA09	85
HA10	79
HA11	57
HA12	42
HA13	67
HA14	43
HA15	39
HA16	54
HA17	51
Background Criteria	19.75
Residential - 10% produce	210

Notes: b ECan (2007) Background Concentrations of Selected Trace Elements in Canterbury Soils Exceedances are shaded.

8 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; and
- An exposure route, where the sensitive receptor and contaminants come into contact (e.g. ingestion, inhalation, dermal contact).

The potential source, pathway and receptor linkages at the subject sites are provided in Table 13.

Table 12: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Former sheep dip	Heavy metals, ONPs and OCPs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On site redevelopment workers Future subsurface maintenance workers Future land users – residents	No. one exceedance (HA08) was reported above the applicable NES residential land use guidelines.
Area of land disturbance (potential waste pit or offal pit)	Heavy metal, PAHs and asbestos containing material	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On site redevelopment workers Future subsurface maintenance workers Future land users – residents	No. Asbestos samples returned results above the BRANZ guidelines.
Above ground storage tank	TPH and heavy metals	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On site redevelopment workers Future subsurface maintenance workers Future land users – residents	No. An exceedance of TPH was reported above the applicable NES residential land use guidelines.
Area of land disturbance (potential waste pit or offal pit)	Unknown - Dependent on waste	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers Future subsurface maintenance workers Future land users – residents	Unknown. The area of concern was unable to be assessed as a large radio tower is directly on the area where land disturbance was observed. An investigation should occur if the area is to be redeveloped or disturbed.

9 Conclusions and Recommendations

ENGEO Ltd was engaged by Hughes Development Ltd to undertake an environmental assessment of two sites totalling 30.8 ha at 92 Dunns Crossing Road and Goulds Road (Lot 3 DP 54007) for change in land use, subdivision and soil disturbance land consent. Information was gathered and reviewed regarding the past and potential releases of hazardous substances to the subject property.

The review of information identified that the sites have been used for grazing since circa 1940 and residential land use since 1990 when a dwelling was relocated onto the sites.

The Canterbury Regional Council's Listed Land Use Register identified HAIL activity *A8. Livestock dip or spray race operations* as being on the sites. The sheep dip area was identified during a Selwyn District Council historical aerial photograph review. The property file for the sites was viewed at Selwyn District Council, and contained no information related to potentially hazardous activities having occurred at the sites.

The current owner of the sites was interviewed as a part of the investigation. Mr Robertson stated that when he purchased the property a waste pit was visible along the eastern boundary line of 92 Dunns Crossing Road. He also stated that the only storage tank was the above ground storage tank (AGST) near the large barn at 92 Dunns Crossing Road. During the site walkover, a small burn drum was observed to the south of the dwelling which had ashy material spilling from the drum onto the underlying soils.

During the review of the SDC property file, the main dwelling was relocated onto the site at 92 Dunns Crossing in 1990. The Health and Safety at Work (Asbestos) Regulations 2016 states if a building constructed or installed prior to 1 January 2000 requires demolition or refurbishment, a full asbestos survey must be undertaken by a competent person.

Based on the information gathered, soil samples were collected from around the former sheep dip area, below the AGST, burn drum and waste pit.

One sample from the sheep dip area (HA08), one sample from the AGST (SS01) and one sample from the burn drum material (SS02) reported exceedances for lead, TPH and arsenic, cadmium and chromium, respectively, against the NES human health residential land use criteria. Samples collected from the waste pit are still being analysed at the laboratory. The sheep dip (HA08) area, AGST soils and burn drum soils all therefore require remediation prior to the sites' proposed redevelopment for residential land use.

Asbestos results collected from the waste pit reported that the PACM cement board was positive for chrysotile and amosite asbestos. One of the three soil samples collected returned concentrations of asbestos fines and fibres above the BRANZ guidelines. The other two samples were reported as not asbestos containing. Heavy metals were reported at concentrations above the site specific guideline values. No exceedances of heavy metals or PAHs were reported against the NES human health criteria.

Based on the current results, remediation of the soils in the areas of the burn drum, former sheep dip, waste pit and AGST should be undertaken. Works should be detailed in a Remedial Action Plan (RAP) which will also include the procedures for the handling, management and disposal of contaminated soils. Following remediation, a validation report will be required to indicate the sites are suitable for their intended end use.

Soils from the burn drum, sheep dip and AGST areas should be removed and properly disposed of prior to the redevelopment of the sites and remaining soils validated. The removal of these areas would be considered a permitted activity under Regulation 8(3) of Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulation 2011 due to the small volume to be removed.

A summary of the soil disturbance volumes anticipated for the earthworks is provided in Table 14. ENGEO does not know the full extent of soils to be remediated as a part of the site works.

Table 13: Comparison of Proposed Earthwork Volumes to NES

NES Regulation			Site Area	Permitted Site Disturbance / Removal Volumes	Proposed Earthwork Volumes
Clause	Description	Permitted Volume			
8.3c	Soil disturbance	25 m^3 per 500 m^2	308,360 m^2	15,418 m^2	50 m^3
8.3d	Soil removal	5 m^3 per 500 m^2 (per year)	308,360 m^2	3,083.6 m^3	50 m^3

The soils from the waste pit are suitable for disposal at Kate Valley Landfill as asbestos contaminated waste. The soils from the above ground storage tank and burn drum should be checked with Kate Valley to assess whether they will accept these soils. Additional TCLP analysis may be required to be undertaken.

If the buildings on site are to be refurbished or demolished, the presence of asbestos in these buildings should be identified by undertaking full asbestos demolition surveys. If identified on the outside of the buildings in a deteriorated state, the soils surrounding the buildings should also be tested.

10 References

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National Environmental Protection Council (1999). *National Environment Protection Measure Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater*.

11 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Ltd, 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.

ii. 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.

iii. 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.

iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.

v. 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

Natalie Flatman, BSc, IP402

Environmental Scientist

Report reviewed by

Dave Robotham, SC, CEnvP

Principal Environmental Scientist

FIGURES

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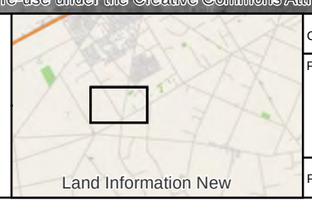

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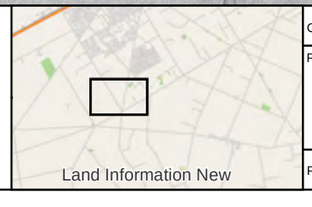

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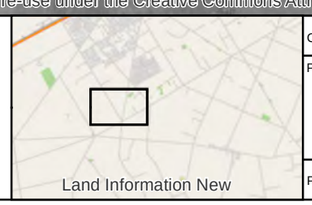

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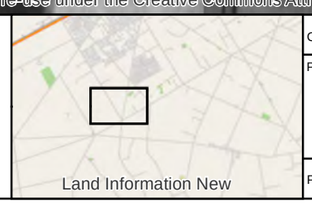

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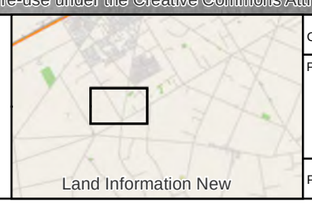

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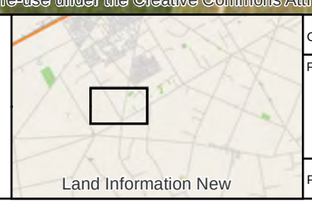

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Title:

Historical Aerial Photograph - 2010-2015

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: **1g**

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

DATE PLOTTED: 04 December 2019 8:45:39 am BY: NFlatman

1550000

N

Legend

Site boundary

0 10,000 20,000

Meters

Sourced from the LINZ Data Service and licensed for re-use under the Creative Commons Attribution 3.0 New Zealand licence

ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Current Aerial Photograph

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:5,000

Figure No: **1h**

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: \\nzfile\nz\Projects\12901 to 13000\12903 - Fairingdon South Subdivision\054_92 Dunns Crossing Road - Enviro\06 CAD-GIS & Figures\Fig01.mxd

Legend

- Site boundary
- Sample Locations

ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title: Sample location plan

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project: 92 Dunns Crossing Road
Rolleston
Canterbury

Proj No: 12903.000.000

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19
Scale: 1:400

Figure No: 2
Size: A3
Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

DATE PLOTTED: 06 December 2019 8:52:25 am BY: NFlatman

PATH: \\nz\file\ext\Projects\12901 to 13000\12903 - Farlington South Subdivision\054 92 Dunns Crossing Road - Enviro\06_CAD-GIS & Figures\Fig01.mxd

ENGEO
Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title: Sampling locations

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Land Information New

Client: Hughes Developments Ltd

Project: 92 Dunns Crossing Road
Rolleston
Canterbury

Designed: NF
Drawn: NF
Checked: XX
Date: Dec 19

Proj No: 12903.000.000

Scale: 1:641

Figure No: 3

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 1:

Certificates of Titles

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB33K/67**
Land Registration District	**Canterbury**
Date Issued	18 October 1990

Prior References
CB33F/774

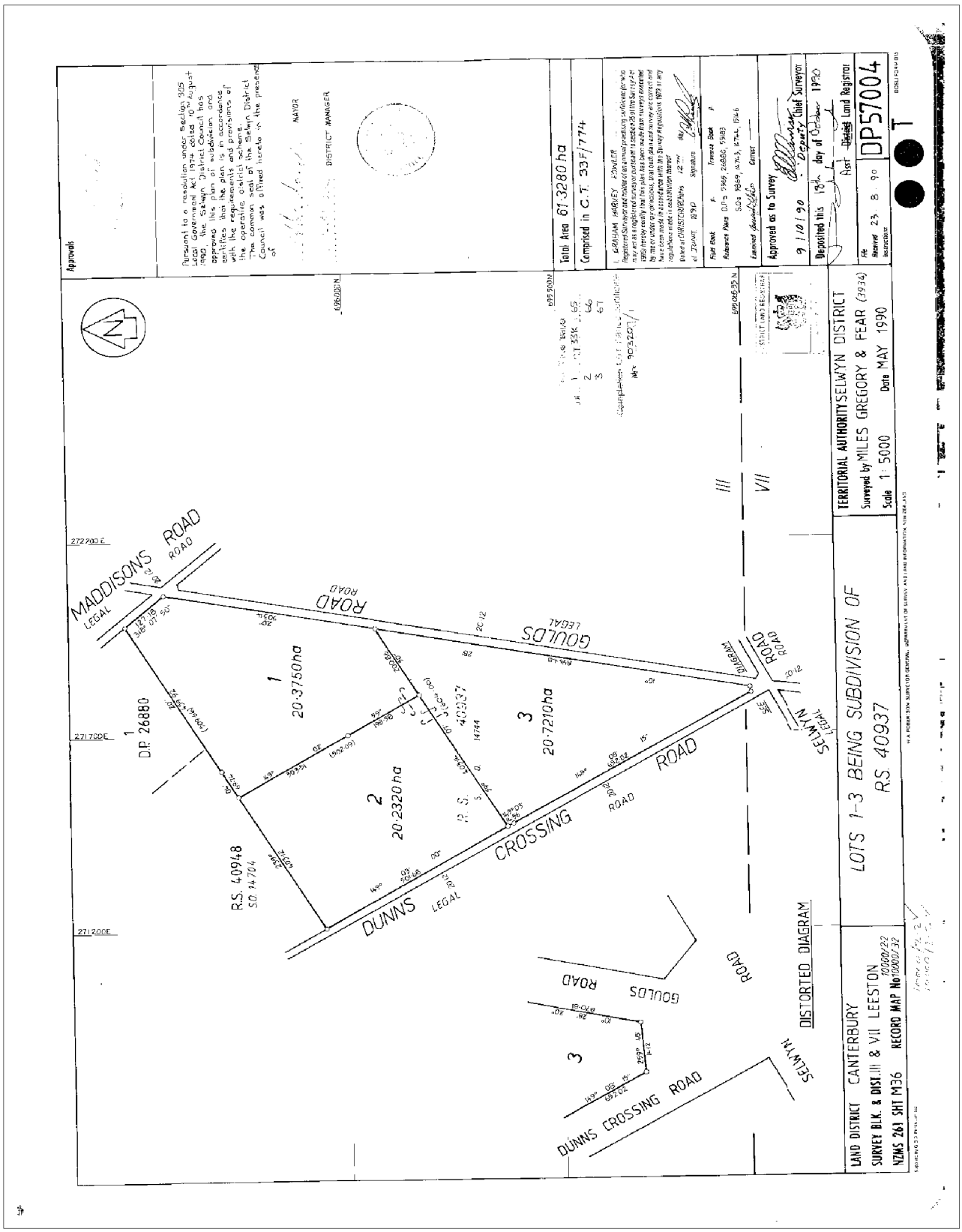
Estate	Fee Simple
Area	20.7210 hectares more or less
Legal Description	Lot 3 Deposited Plan 57004

Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Identifier **CB33K/67**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Historical Search Copy

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Identifier **CB33K/67**
Land Registration District **Canterbury**
Date Issued 18 October 1990

Prior References
CB33F/774

Estate	Fee Simple
Area	20.7210 hectares more or less
Legal Description	Lot 3 Deposited Plan 57004

Original Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

References
Prior C/T 33F/774

Transfer No.
N/C. Order No. 903207/4

Land and Deeds 69

REGISTER

No. 33K/67

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 19th day of October one thousand nine hundred and ninety under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that KELVIN ROYCE TAYLOR, Farmer and GILLIAN DOROTHY TAYLOR, Married Woman, both of Springston, Christchurch as tenants in common in equal shares are ---

is seised of an estate in fee-simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that parcel of land containing 20.7210 hectares or thereabouts being Lot 3 Deposited Plan 57004 ---

DISTRICT LAND REGISTRAR
CANTERBURY N.Z.
ASSISTANT LAND REGISTRAR

Subject to:

Part IVA Conservation Act 1987

A.L.R.

Transfer 912688/1 to Ivan George Robertson, Farmer and Dorothy Caroline Robertson, Housewife, both of Springston - 14.12.1990 at 11.35am

for A.L.R.

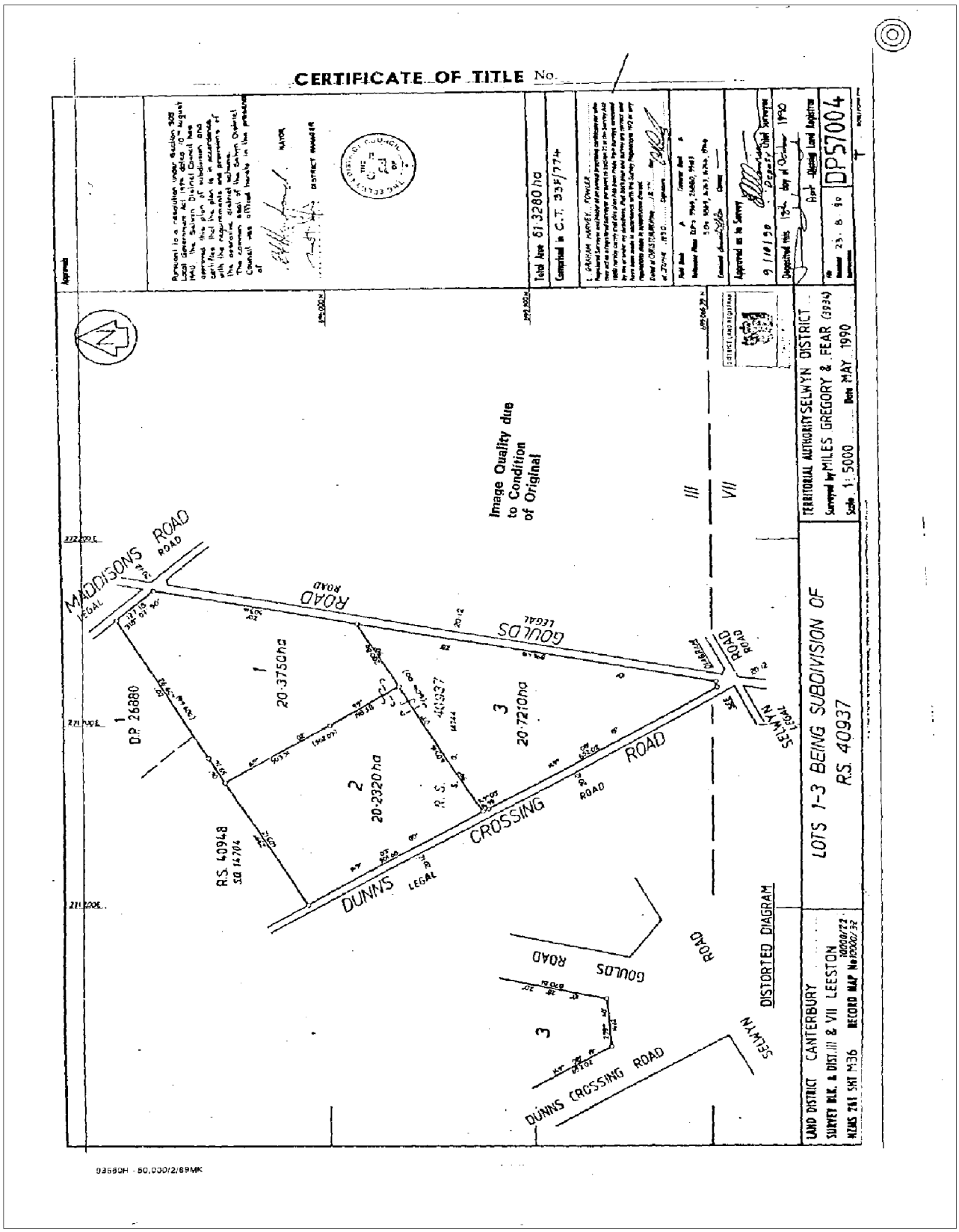
A466952.1 Transfer to Ivan George Robertson and Dorothy Caroline Robertson in equal shares - 19.7.2000 at 2.42

for RGL

No. 33K/67

Measurements are Metric

Identifier **CB33K/67**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB36C/247**
Land Registration District	**Canterbury**
Date Issued	29 October 1992

Prior References
CB33K/66

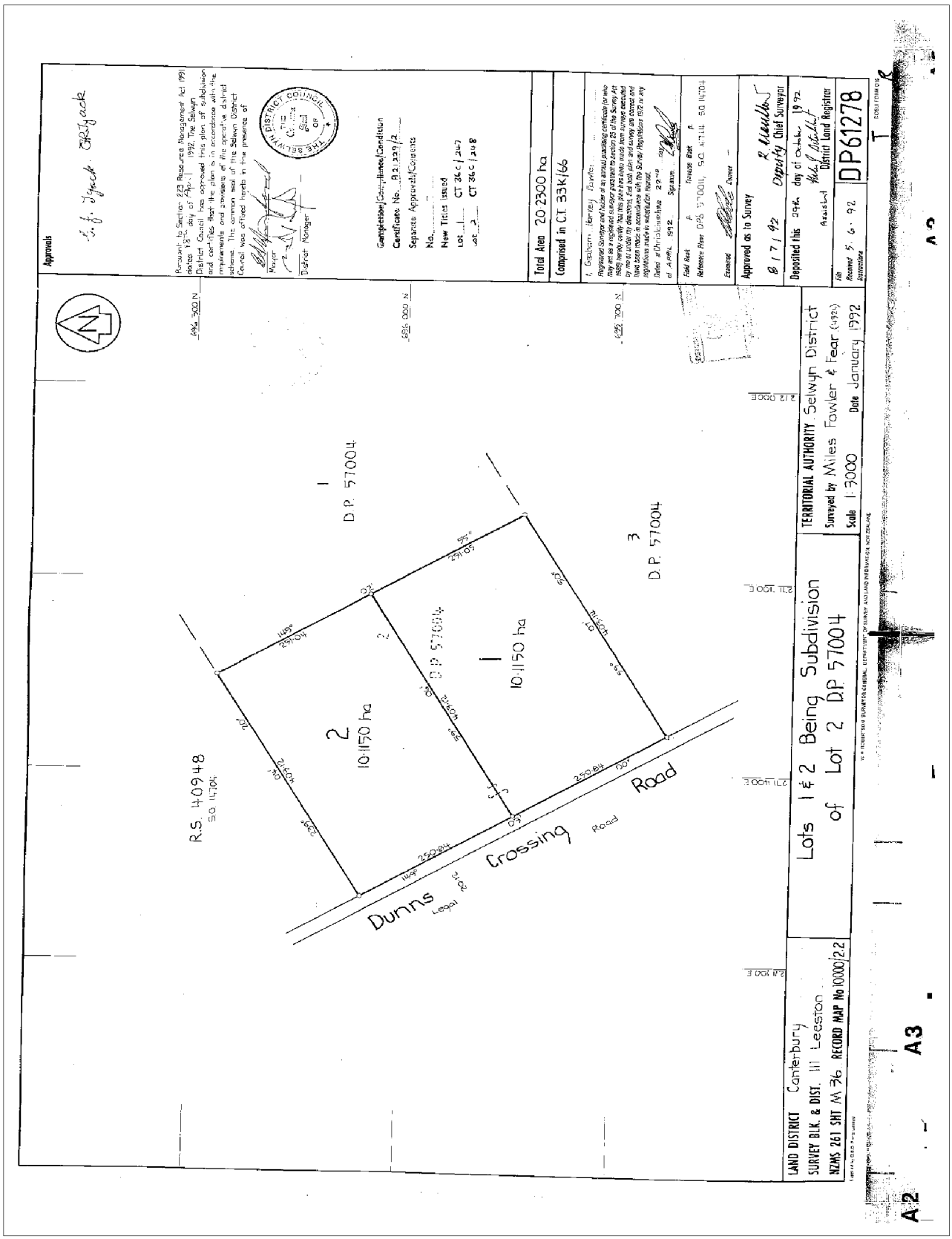
Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 1 Deposited Plan 61278

Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Identifier **CB36C/247**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Historical Search Copy

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Identifier **CB36C/247**
Land Registration District **Canterbury**
Date Issued 29 October 1992

Prior References
CB33K/66

Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 1 Deposited Plan 61278

Original Registered Owners
Ivan George Robertson as to a 1/2 share
Dorothy Caroline Robertson as to a 1/2 share

Interests

Subject to Part IV A Conservation Act 1987

Land and Deeds 69

References
Prior C/T 33K/66

Transfer No.
N/C. Order No. A21229/3

REGISTER

36C/247

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 29th day of October one thousand nine hundred and ninety-two under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that GREGORY JOSEPH TYACK, Extruder Operator and FLORENCE RUBY TYACK, Prison Officer both of Christchurch are ---

Is seised of an estate in fee-simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that parcel of land containing 10.1150 hectares or thereabouts being Lot 1 Deposited Plan 61278 ---

DISTRICT LAND REGISTRAR
ASSISTANT LAND REGISTRAR
CANTERBURY N.Z.

Subject to:

Part IVA Conservation Act 1987

Mortgage 912417/2 to Post Office Bank Limited - 13.12.1990 at 11.21am

DISCHARGED A156116/1

Mortgage A4582/2 to Charles Kerei Lane - 15.7.1992 at 3.46am

DISCHARGED A333SS

Mortgage A21229/1 to Bank of New Zealand - 29.10.1992 at 11.40am

DISCHARGED 22 FEB

A.L.R.

Transfer A221487/2 to Ivan George Robertson, Farmer and Dorothy Caroline Robertson, Housewife, both of Springston - 22.2.1996 at 11.23am

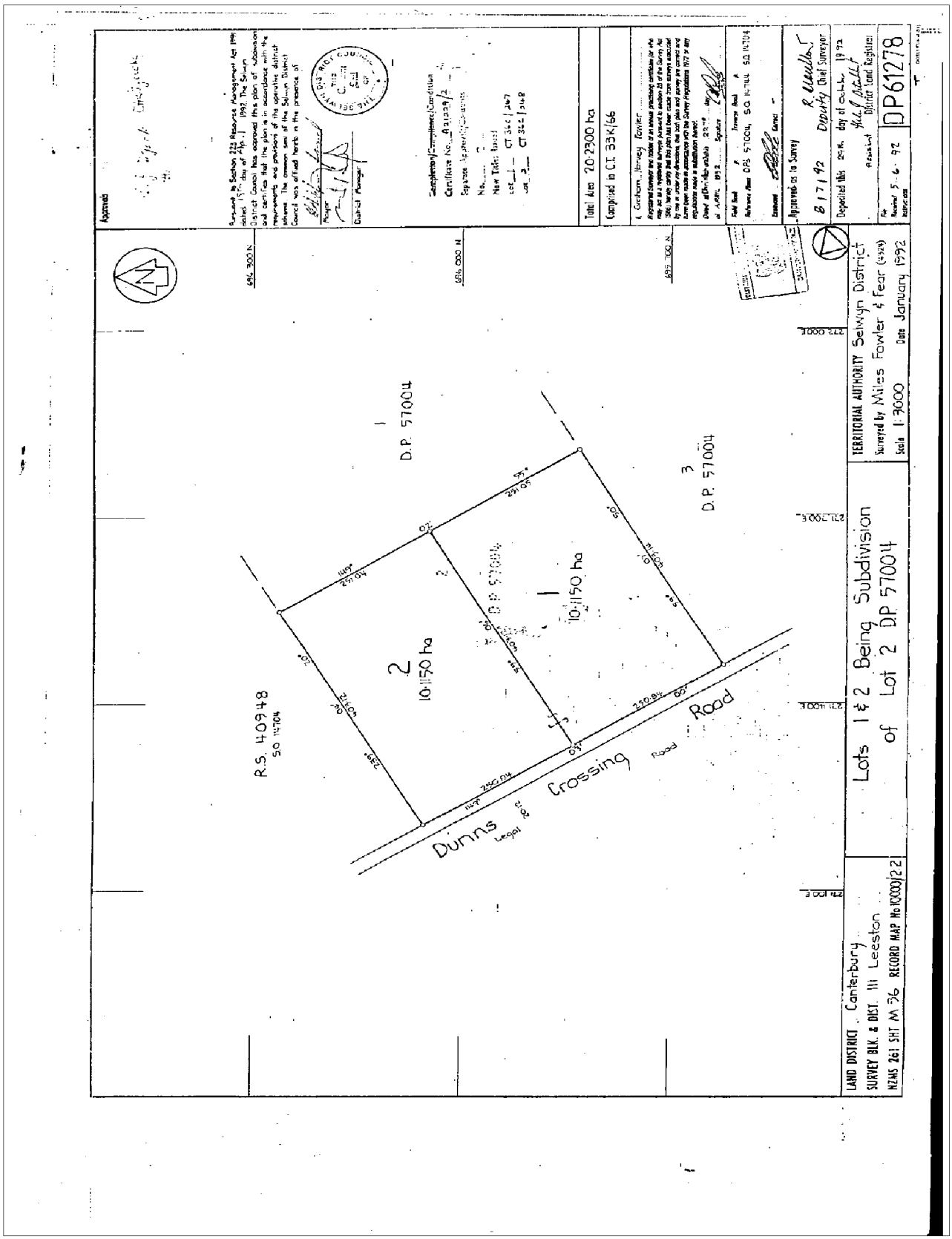
for A.L.R.

A466952.1 Transfer to Ivan George Robertson and Dorothy Caroline Robertson in equal shares - 19.7.2000 at 2.42

for RGL

No. 36C/247

Identifier **CB36C/247**



APPENDIX 2:

CRC LLUR Statement

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

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.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

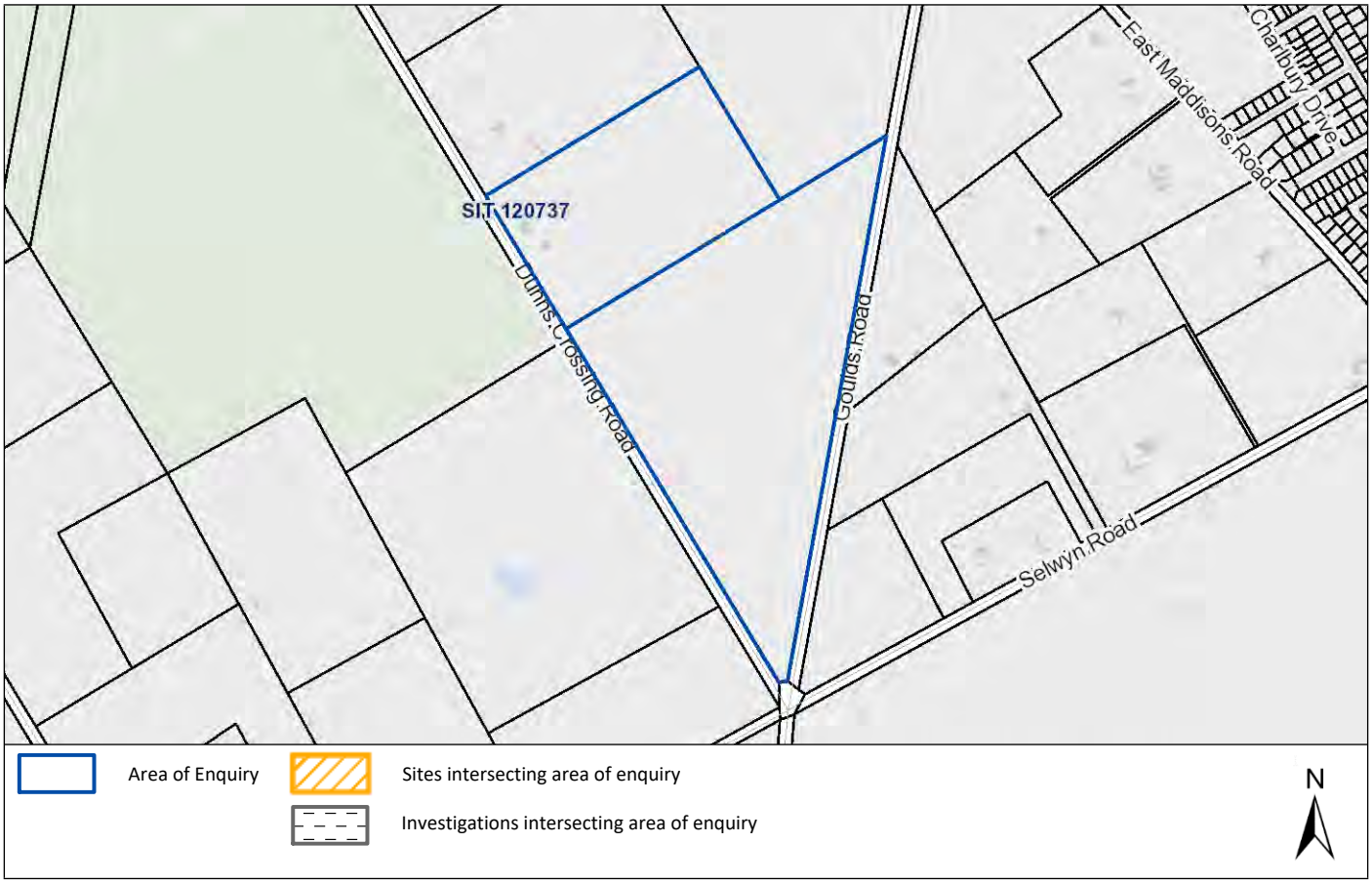
Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

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

www.ecan.govt.nz

Date:	08 November 2019	
Land Parcels:	Lot 3 DP 57004	Valuation No(s): 2405534300
	Lot 1 DP 61278	Valuation No(s): 2405538300



The information presented in this map is specific to the property you have selected. Information on nearby properties may not be shown on this map, even if the property is visible.

Summary of sites:

Site ID	Site Name	Location	HAIL Activity(s)	Category
120737	92 Dunns Crossing Road, Rolleston	92 Dunns Crossing Road, Rolleston	A8 - Livestock dip or spray race operations;	Not Investigated

Please note that the above table represents a summary of sites and HAILs intersecting the area of enquiry only.

Information held about the sites on the Listed Land Use Register

Site 120737: 92 Dunns Crossing Road, Rolleston (Intersects enquiry area.)

Site Address:	92 Dunns Crossing Road, Rolleston
Legal Description(s):	Lot 1 DP 61278

Site Category:	Not Investigated
Definition:	Verified HAIL has not been investigated.

Land Uses (from HAIL):

Period From	Period To	HAIL land use
1961	1974	Livestock dip or spray race operations

Notes:

11 Jan 2016	This record was created as part of the Selwyn District Council 2015 HAIL identification project.
11 Jan 2016	Area defined from 1961 to 1974 aerial photographs. A livestock dip or spray race was noted in aerial photographs reviewed.

Investigations:

There are no investigations associated with this site.

Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ247142.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know

Everything is connected

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.

[1] The 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?

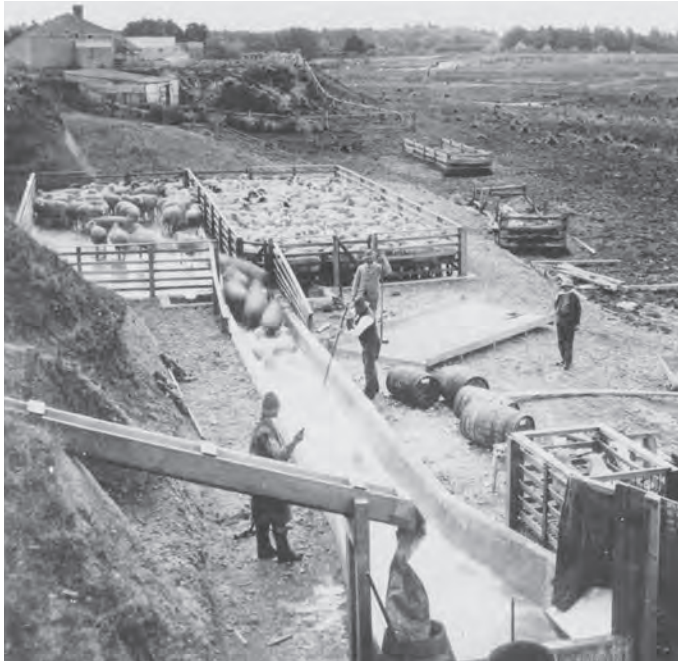
The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list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

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.)

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.

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)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

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.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

E13/102

APPENDIX 3:

Site Photographs

Photo 1: Area of former sheep dip

Photo 2: Stock loading - holding pen

Photo 3: 1000 L above ground storage tank near large barn

Photo 4: Staining below above ground storage tank

Photo 5: Storage of metal, wood and old appliances

Photo 6: Dwelling

ENGEO
Expect Excellence

Date taken	Dec 19	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**92 Dunns Crossing Road**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref.**	12903	**Appendix No.**	3a

Photo 7: Barn towards the north of the sheep dip area

Photo 8: Drum with burnt material to the east of the dwelling

Photo 9:Contents of burn drum

Photo 10: Paddocks to the east of the dwelling looking east

Photo 11: Paddocks to the north of the dwelling looking northeast

Photo 12: Paddocks to the north of the dwelling looking north

ENGEO
Expect Excellence

Date taken	Dec 19	**Client**	**Hughes Developments**		
Taken by		**Project**	**92 Dunns Crossing Road**		
Approved by		**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref.**	12903	**Appendix No.**	3b

Photo 13: Waste pit along eastern boundary at 92 Dunns Crossing Road

Photo 14: General waste pit material

Photo 15: Waste pit soil material

Photo 16: Extent of waste pit looking north

Photo 17: Paddocks to the north of the dwelling looking northeast

Photo 18: Radio tower in eastern paddock at Goulds Road Site

ENGEO
Expect Excellence

Date taken	Dec 19	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**92 Dunns Crossing Road**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	13 to 18	**ENGEO Ref.**	12903	**Appendix No.**	3c

APPENDIX 4:

Laboratory Analysis

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2282039 SPv1
Contact:	Natalie Flatman	**Date Received:**	27-Nov-2019
	C/- Engeo Limited	**Date Reported:**	29-Nov-2019
	PO Box 373	**Quote No:**	102457
	Christchurch 8140	**Order No:**	
		Client Reference:	12903.001.000_92D
		Submitted By:	Natalie Flatman

Sample Type: Soil

Sample Name:		HA01 @ 0.0-0.2 22-Nov-2019	HA02 @ 0.0-0.2 22-Nov-2019	HA03 @ 0.0-0.2 22-Nov-2019	HA04 @ 0.0-0.2 22-Nov-2019	HA05 @ 0.0-0.2 22-Nov-2019
Lab Number:		2282039.1	2282039.2	2282039.3	2282039.4	2282039.5
Individual Tests						
Dry Matter	g/100g as rcvd	86	81	89	77	84
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	7	6
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	10	11	14	13
Total Recoverable Copper	mg/kg dry wt	7	4	5	13	8
Total Recoverable Lead	mg/kg dry wt	19.8	19.4	16.6	20	18.3
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	7	6	7	8	7
Total Recoverable Zinc	mg/kg dry wt	56	46	51	117	62
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
alpha-BHC	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
beta-BHC	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
delta-BHC	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
gamma-BHC (Lindane)	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
cis-Chlordane	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
trans-Chlordane	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
4,4'-DDD	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
2,4'-DDE	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
4,4'-DDE	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
2,4'-DDT	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
4,4'-DDT	mg/kg dry wt	0.012	< 0.013	0.012	0.013	0.012
Total DDT Isomers	mg/kg dry wt	< 0.07	< 0.08	< 0.07	< 0.08	< 0.08
Dieldrin	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endosulfan I	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endosulfan II	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endosulfan sulphate	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endrin	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endrin aldehyde	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Endrin ketone	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Heptachlor	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Heptachlor epoxide	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Hexachlorobenzene	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012
Methoxychlor	mg/kg dry wt	< 0.012	< 0.013	< 0.012	< 0.013	< 0.012

Sample Type: Soil						
Sample Name:		HA01 @ 0.0-0.2 22-Nov-2019	HA02 @ 0.0-0.2 22-Nov-2019	HA03 @ 0.0-0.2 22-Nov-2019	HA04 @ 0.0-0.2 22-Nov-2019	HA05 @ 0.0-0.2 22-Nov-2019
Lab Number:		2282039.1	2282039.2	2282039.3	2282039.4	2282039.5
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Acetochlor	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Alachlor	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Atrazine	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Atrazine-desethyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Atrazine-desisopropyl	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Azaconazole	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Azinphos-methyl	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Benalaxyl	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Bitertanol	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Bromacil	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Bromopropylate	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Butachlor	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Captan	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Carbaryl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Carbofuran	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlorfluazuron	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlorothalonil	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlorpyrifos	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlorpyrifos-methyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Chlortoluron	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Cyanazine	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Cyfluthrin	mg/kg	< 0.07	< 0.08	< 0.07	< 0.08	< 0.07
Cyhalothrin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Cypermethrin	mg/kg	< 0.14	< 0.15	< 0.13	< 0.16	< 0.14
Deltamethrin (including Tralomethrin)	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Diazinon	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Dichlofluanid	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Dichloran	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Dichlorvos	mg/kg	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Difenoconazole	mg/kg	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Dimethoate	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Diphenylamine	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Diuron	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Fenpropimorph	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Fluazifop-butyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Fluometuron	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Flusilazole	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Fluvalinate	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Furalaxyl	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Haloxyfop-methyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Hexaconazole	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Hexazinone	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Kresoxim-methyl	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Linuron	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Malathion	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Metalaxyl (Mefenoxam)	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Methamidophos	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Metolachlor	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Metribuzin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Molinate	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Myclobutanil	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Naled	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Norflurazon	mg/kg	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12

Sample Type: Soil						
Sample Name:		HA01 @ 0.0-0.2 22-Nov-2019	HA02 @ 0.0-0.2 22-Nov-2019	HA03 @ 0.0-0.2 22-Nov-2019	HA04 @ 0.0-0.2 22-Nov-2019	HA05 @ 0.0-0.2 22-Nov-2019
Lab Number:		2282039.1	2282039.2	2282039.3	2282039.4	2282039.5
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Oxadiazon	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Oxyfluorfen	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Paclobutrazol	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Parathion-ethyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Parathion-methyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Pendimethalin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Permethrin	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pirimicarb	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Pirimiphos-methyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Prochloraz	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Procymidone	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Prometryn	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Propachlor	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Propanil	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Propazine	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Propiconazole	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyriproxyfen	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Quizalofop-ethyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Simazine	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Simetryn	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Sulfentrazone	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
TCMTB [2-(thiocyanomethylthio) benzothiazole,Busan]	mg/kg dry wt	< 0.11	< 0.12	< 0.11	< 0.13	< 0.12
Tebuconazole	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbacil	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbufos	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbumeton	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbuthylazine	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Terbuthylazine-desethyl	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Terbutryn	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Thiabendazole	mg/kg	< 0.3	< 0.3	< 0.3	< 0.4	< 0.3
Thiobencarb	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Tolylfluanid	mg/kg	< 0.03	< 0.03	< 0.03	< 0.04	< 0.03
Triazophos	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Trifluralin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06
Vinclozolin	mg/kg	< 0.06	< 0.06	< 0.06	< 0.07	< 0.06

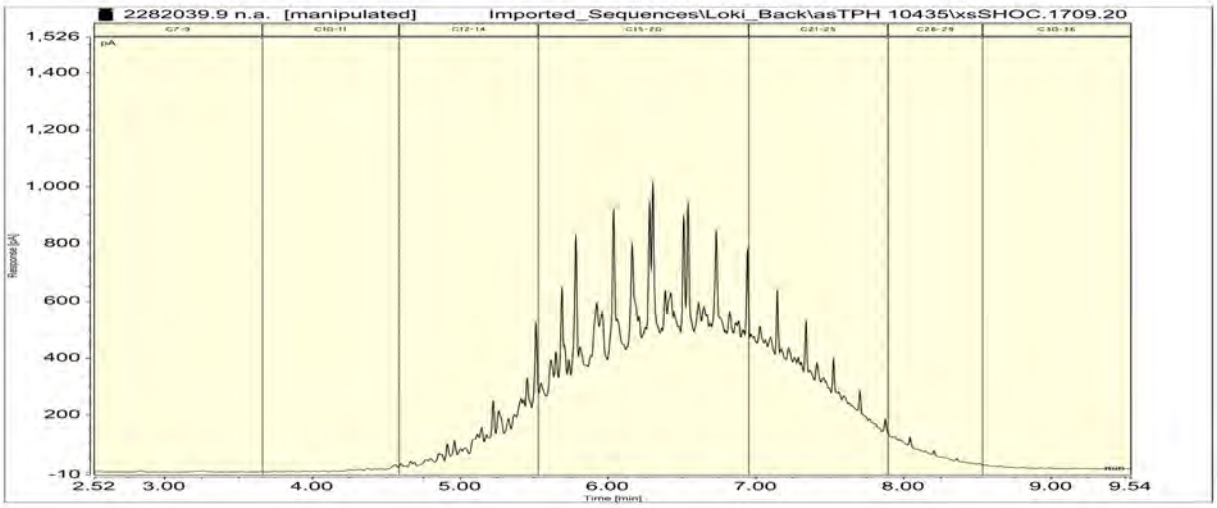
Sample Name:		HA06 @ 0.0-0.2 22-Nov-2019	HA07 @ 0.0-0.2 22-Nov-2019	HA08 @ 0.0-0.2 22-Nov-2019	SS01 @ 0.0 22-Nov-2019	SS02 @ 0.0 22-Nov-2019
Lab Number:		2282039.6	2282039.7	2282039.8	2282039.9	2282039.10
Individual Tests						
Dry Matter	g/100g as rcvd	80	84	78	75	77
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	10	1,470
Total Recoverable Cadmium	mg/kg dry wt	-	-	-	0.15	5.2
Total Recoverable Chromium	mg/kg dry wt	-	-	-	22	480
Total Recoverable Copper	mg/kg dry wt	-	-	-	68	1,630
Total Recoverable Lead	mg/kg dry wt	-	-	-	159	149
Total Recoverable Nickel	mg/kg dry wt	-	-	-	8	22
Total Recoverable Zinc	mg/kg dry wt	-	-	-	220	370
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	9	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.73	-	-
Total Recoverable Chromium	mg/kg dry wt	10	10	13	-	-
Total Recoverable Copper	mg/kg dry wt	4	4	35	-	-
Total Recoverable Lead	mg/kg dry wt	12.9	13.0	290	-	-

Sample Type: Soil						
Sample Name:		HA06 @ 0.0-0.2 22-Nov-2019	HA07 @ 0.0-0.2 22-Nov-2019	HA08 @ 0.0-0.2 22-Nov-2019	SS01 @ 0.0 22-Nov-2019	SS02 @ 0.0 22-Nov-2019
Lab Number:		2282039.6	2282039.7	2282039.8	2282039.9	2282039.10
Heavy Metals with Mercury, Screen Level						
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Nickel	mg/kg dry wt	6	7	10	-	-
Total Recoverable Zinc	mg/kg dry wt	42	45	1,530	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
alpha-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
beta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
delta-BHC	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
cis-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
trans-Chlordane	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	-	-
2,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
4,4'-DDD	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
2,4'-DDE	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
4,4'-DDE	mg/kg dry wt	0.012	0.100	0.023	-	-
2,4'-DDT	mg/kg dry wt	< 0.012	0.015	< 0.013	-	-
4,4'-DDT	mg/kg dry wt	0.020	0.046	0.019	-	-
Total DDT Isomers	mg/kg dry wt	< 0.08	0.16	< 0.08	-	-
Dieldrin	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endosulfan I	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endosulfan II	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endrin	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endrin aldehyde	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Endrin ketone	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Heptachlor	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Methoxychlor	mg/kg dry wt	< 0.012	< 0.012	< 0.013	-	-
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Acetochlor	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Alachlor	mg/kg	< 0.05	< 0.05	< 0.05	-	-
Atrazine	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Atrazine-desethyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Atrazine-desisopropyl	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Azaconazole	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Azinphos-methyl	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Benalaxyl	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Bitertanol	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Bromacil	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Bromopropylate	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Butachlor	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Captan	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Carbaryl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Carbofuran	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlorfluazuron	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlorothalonil	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlorpyrifos	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlorpyrifos-methyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Chlortoluron	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Cyanazine	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Cyfluthrin	mg/kg	< 0.08	< 0.07	< 0.08	-	-
Cyhalothrin	mg/kg	< 0.06	< 0.06	< 0.06	-	-

Sample Type: Soil						
Sample Name:		HA06 @ 0.0-0.2 22-Nov-2019	HA07 @ 0.0-0.2 22-Nov-2019	HA08 @ 0.0-0.2 22-Nov-2019	SS01 @ 0.0 22-Nov-2019	SS02 @ 0.0 22-Nov-2019
Lab Number:		2282039.6	2282039.7	2282039.8	2282039.9	2282039.10
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Cypermethrin	mg/kg	< 0.15	< 0.14	< 0.15	-	-
Deltamethrin (including Tralomethrin)	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Diazinon	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Dichlofluanid	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Dichloran	mg/kg	< 0.2	< 0.2	< 0.2	-	-
Dichlorvos	mg/kg	< 0.09	< 0.09	< 0.09	-	-
Difenoconazole	mg/kg	< 0.09	< 0.09	< 0.09	-	-
Dimethoate	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Diphenylamine	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Diuron	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Fenpropimorph	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Fluazifop-butyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Fluometuron	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Flusilazole	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Fluvalinate	mg/kg	< 0.05	< 0.05	< 0.05	-	-
Furalaxyl	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Haloxyfop-methyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Hexaconazole	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Hexazinone	mg/kg	< 0.03	< 0.03	< 0.03	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
Kresoxim-methyl	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Linuron	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Malathion	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Metalaxyl (Mefenoxam)	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Methamidophos	mg/kg	< 0.3	< 0.3	< 0.3	-	-
Metolachlor	mg/kg	< 0.05	< 0.05	< 0.05	-	-
Metribuzin	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Molinate	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Myclobutanil	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Naled	mg/kg	< 0.3	< 0.3	< 0.3	-	-
Norflurazon	mg/kg	< 0.12	< 0.12	< 0.12	-	-
Oxadiazon	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Oxyfluorfen	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Paclobutrazol	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Parathion-ethyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Parathion-methyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Pendimethalin	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Permethrin	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Pirimicarb	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Pirimiphos-methyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Prochloraz	mg/kg	< 0.3	< 0.3	< 0.3	-	-
Procymidone	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Prometryn	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Propachlor	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Propanil	mg/kg	< 0.2	< 0.2	< 0.2	-	-
Propazine	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Propiconazole	mg/kg	< 0.05	< 0.05	< 0.05	-	-
Pyriproxyfen	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Quizalofop-ethyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Simazine	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Simetryn	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Sulfentrazone	mg/kg	< 0.3	< 0.3	< 0.3	-	-
TCMTB [2-(thiocyanomethylthio) benzothiazole,Busan]	mg/kg dry wt	< 0.12	< 0.12	< 0.12	-	-
Tebuconazole	mg/kg	< 0.06	< 0.06	< 0.06	-	-

Sample Type: Soil						
Sample Name:		HA06 @ 0.0-0.2 22-Nov-2019	HA07 @ 0.0-0.2 22-Nov-2019	HA08 @ 0.0-0.2 22-Nov-2019	SS01 @ 0.0 22-Nov-2019	SS02 @ 0.0 22-Nov-2019
Lab Number:		2282039.6	2282039.7	2282039.8	2282039.9	2282039.10
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Terbacil	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Terbufos	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Terbumeton	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Terbuthylazine	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Terbuthylazine-desethyl	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Terbutryn	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Thiabendazole	mg/kg	< 0.3	< 0.3	< 0.3	-	-
Thiobencarb	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Tolylfluanid	mg/kg	< 0.03	< 0.03	< 0.03	-	-
Triazophos	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Trifluralin	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Vinclozolin	mg/kg	< 0.06	< 0.06	< 0.06	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	-	-	-	-	< 0.3
1-Methylnaphthalene	mg/kg dry wt	-	-	-	-	< 0.013
2-Methylnaphthalene	mg/kg dry wt	-	-	-	-	< 0.013
Acenaphthylene	mg/kg dry wt	-	-	-	-	< 0.013
Acenaphthene	mg/kg dry wt	-	-	-	-	< 0.013
Anthracene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[a]anthracene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	-	-	-	-	< 0.04
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	-	-	-	-	< 0.04
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[e]pyrene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	-	< 0.013
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	-	< 0.013
Chrysene	mg/kg dry wt	-	-	-	-	< 0.013
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	-	< 0.013
Fluoranthene	mg/kg dry wt	-	-	-	-	0.018
Fluorene	mg/kg dry wt	-	-	-	-	< 0.013
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	-	< 0.013
Naphthalene	mg/kg dry wt	-	-	-	-	< 0.07
Perylene	mg/kg dry wt	-	-	-	-	< 0.013
Phenanthrene	mg/kg dry wt	-	-	-	-	0.016
Pyrene	mg/kg dry wt	-	-	-	-	0.015
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	-	-	-	91	-
C10 - C14	mg/kg dry wt	-	-	-	10,200	-
C15 - C36	mg/kg dry wt	-	-	-	85,000	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	-	-	-	95,000	-

2282039.9
SS01 @ 0.0 22-Nov-2019
Client Chromatogram for TPH by FID



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%.	-	1-10
Total of Reported PAHs in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg dry wt	10
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	9-10
Heavy Metals with Mercury, 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	1-8
Organochlorine/nitro&phosphorus Pest.s Screen in Soils, GCMS	Sonication extraction, Dilution cleanup, GC-MS analysis. Tested on as received sample	-	1-8
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]	0.002 - 0.3 mg/kg dry wt	10
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	9
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	1-10
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.	0.002 mg/kg dry wt	10
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).	0.002 mg/kg dry wt	10

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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
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ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street, Hamilton 3204
Private Bag 3205
Hamilton 3240, New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Job No: **228 2039**

Date Recv: 27-Nov-19 05:55

Received by: Alpha Tan

3122820394

Quote No 102457
Primary Contact N Flatman
Submitted By N Flatman
Client Name ENGEO Ltd
Address 124 Montreal St
Christchurch *Postcode* 8014
Phone 03 3289012 *Mobile*
Email nflatman@engeo.co.nz
Charge To ENGEO
Client Reference 12903.001.000 - 92D
Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other

ADDITIONAL INFORMATION

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories *Date & Time:* 25/11/19 3:00
Name: N Flatman
☐ *Tick if you require COC to be emailed back* *Signature:*

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

Condition ☐ Room Temp ☐ Chilled ☐ Frozen *Temp:* 9.0

☐ Sample and Analysis details checked
Signature:

Priority ☐ Low ☑ Normal ☐ High
☐ Urgent (ASAP, extra charge applies, please contact lab first)

Requested Reporting Date:

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
1	HA01 @ 0.0-0.2	22/11/19		ES	Heavy metals incl Hg, OCPs & ONPs
2	HA02 @ 0.0-0.2				" "
3	HA03 @ 0.0-0.2				" "
4	HA04 @ 0.0-0.2				" "
5	HA05 @ 0.0-0.2				" "
6	HA06 @ 0.0-0.2				" "
7	HA07 @ 0.0-0.2				" "
8	HA08 @ 0.0-0.2				" "
9	SS01 @ 0.0				Heavy metals & TPH
10	SS02 @ 0.0				Heavy metals & PAHs
11	HA01 @ 0.4-0.5				COLD HOLD
12	HA02 @ 0.4-0.5				COLD HOLD

Continued on next page

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
13	HA03 @0.4-0.5	22/11/19		ES	HOLD COLD
14	HA04 @0.4-0.5	↓		↓	↓
15	HA05 @0.4 -0.5				
16	HA06 @0.4 -0.5				
17	HA07 @0.4 -0.5				
18					
19					
20					
21					
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40					

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

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E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2288278 SPv1
Contact:	Natalie Flatman C/- Engeo Limited PO Box 373 Christchurch 8140	**Date Received:**	06-Dec-2019
		Date Reported:	10-Dec-2019
		Quote No:	82742
		Order No:	
		Client Reference:	12903.000.000_92 DC
		Submitted By:	Natalie Flatman

Sample Type: Soil

Sample Name:		WP01 05-Dec-2019 9:10 am	WP02 05-Dec-2019 9:12 am	WP03 05-Dec-2019 9:15 am	HA09 05-Dec-2019 10:00 am	HA10 05-Dec-2019 10:05 am
Lab Number:		2288278.1	2288278.2	2288278.3	2288278.4	2288278.5
Individual Tests						
Dry Matter	g/100g as rcvd	94	95	95	-	-
Total Recoverable Lead	mg/kg dry wt	-	-	-	85	79
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	5	13	19	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.35	0.68	1.32	-	-
Total Recoverable Chromium	mg/kg dry wt	14	18	24	-	-
Total Recoverable Copper	mg/kg dry wt	10	340	640	-	-
Total Recoverable Lead	mg/kg dry wt	27	115	61	-	-
Total Recoverable Nickel	mg/kg dry wt	9	11	340	-	-
Total Recoverable Zinc	mg/kg dry wt	113	320	580	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.3	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Acenaphthene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Benzo[a]anthracene	mg/kg dry wt	0.011	< 0.011	< 0.011	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.015	< 0.011	< 0.011	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	0.03	< 0.03	< 0.03	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	0.03	< 0.03	< 0.03	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.014	< 0.011	< 0.011	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	0.012	< 0.011	< 0.011	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Chrysene	mg/kg dry wt	0.012	< 0.011	< 0.011	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Fluoranthene	mg/kg dry wt	0.019	< 0.011	< 0.011	-	-
Fluorene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.012	< 0.011	< 0.011	-	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	-	-
Perylene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	-	-
Phenanthrene	mg/kg dry wt	0.012	< 0.011	< 0.011	-	-
Pyrene	mg/kg dry wt	0.017	< 0.011	< 0.011	-	-

Sample Type: Soil						
Sample Name:		HA11 05-Dec-2019 10:10 am	HA12 05-Dec-2019 10:15 am	HA13 05-Dec-2019 10:20 am	HA14 05-Dec-2019 10:25 am	HA15 05-Dec-2019 10:30 am
Lab Number:		2288278.6	2288278.7	2288278.8	2288278.9	2288278.10
Individual Tests						
Total Recoverable Lead	mg/kg dry wt	57	42	67	43	39

Sample Name:		HA16 05-Dec-2019 10:35 am	HA17 05-Dec-2019 10:40 am			
Lab Number:		2288278.11	2288278.12			
Individual Tests						
Total Recoverable Lead	mg/kg dry wt	54	51	-	-	-

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%.	-	1-12
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	4-12
Total of Reported PAHs in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg dry wt	1-3
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	1-3
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]	0.002 - 0.3 mg/kg dry wt	1-3
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	1-3
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	4-12
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	4-12
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.	0.002 mg/kg dry wt	1-3
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).	0.002 mg/kg dry wt	1-3

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.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Hill Laboratories
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ANALYSIS REQUEST

R J Hill Laboratories Limited
28 Duke Street, Hamilton 3204
Private Bag 3205
Hamilton 3240, New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
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Job No: **228 8278**
Date Recv: 06-Dec-19 05:50
Received by: Alpha Tan
3122882786

Quote No
Primary Contact N Flatman
Submitted By N Flatman
Client Name ENGEO Ltd
Address 124 Montreal St
Christchurch *Postcode* 8023
Phone 027 3350114 *Mobile*
Email nflatman@engeo.co.nz
Charge To ENGEO
Client Reference 12903.000.000 - 92 DC
Order No

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☑ Email Primary Contact ☐ Email Submitter ☐ Email Client
☐ Email Other
☐ Other

ADDITIONAL INFORMATION

WP01, WP02 & WP03 may contain asbestos

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories
Date & Time: 5/12/19 3:30
Name: N Flatman
☐ *Tick if you require COC to be emailed back*
Signature:

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

Condition Temp: 8.1
☐ Room Temp ☐ Chilled ☐ Frozen
☐ Sample and Analysis details checked
Signature:

Priority ☐ Low ☑ Normal ☐ High
☐ **Urgent** (ASAP, extra charge applies, please contact lab first)

Requested Reporting Date:

No.	Sample Name	Sample Date	Sample Time	Sample Type	Tests Required (if not as per Quote)
1	WP01	5/12/19	9:10	ES	Heavy metals & PAHs
2	WP02	5/12/19	9:12		↓
3	WP03	5/12/19	9:15		
4	HA09	5/12/19	10:00		Lead
5	HA10	5/12/19	10:05		
6	HA11	5/12/19	10:10		
7	HA12	5/12/19	10:15		
8	HA13	5/12/19	10:20		
9	HA14	5/12/19	10:25		
10	HA15	5/12/19	10:30		
11	HA16	5/12/19	10:35		
12	HA17	5/12/19	10:40	↓	↓

Continued on next page

TERRA SCIENTIFIC

Terra Scientific Ltd

43a Moorhouse Avenue,
Addington,
Christchurch, 8011

P: 03 928 2256
E: admin@terrascientific.co.nz
W: www.terrasci.co.nz

IANZ ACCREDITED LABORATORY ACCREDITATION Nº: 1334

Version Number: 7 | Date Issued: November 2019 | Authorised By: TCH | Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T000897.2	**Total Samples Received:**	3
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference/Address:**	92 DC	**Date Received:**	5/12/2019
Client Reference:	12903.000.000			**Date Analysed:**	6/12/2019
Client Contact:	Natalie Flatman	**Key Technical Person:**	Marie Foxwell	**Date Reported:**	6/12/2019

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
T000897.2.1	WP01	Waste pit 01 , Soil											
		Layer 1: >10 mm	1931.65	998.90	Synthetic Mineral Fibres Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected
		Layer 2: 10 - 2 mm		486.16	Synthetic Mineral Fibres Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		498.73	Synthetic Mineral Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		51.61	Organic Fibres								
		Total sample weight:		1983.79	Total Combined:	0.00000	0.00000	0.00000					
T000897.2.2	WP02	Waste pit 02 , Soil											
		Layer 1: >10 mm	2037.33	767.18	Synthetic Mineral Fibres Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected
		Layer 2: 10 - 2 mm		493.67	Synthetic Mineral Fibres Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		703.02	Synthetic Mineral Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		55.34	Organic Fibres								
		Total sample weight:		1963.87	Total Combined:	0.00000	0.00000	0.00000					

TERRA SCIENTIFIC

Terra Scientific Ltd

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Addington,
Christchurch, 8011

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E: admin@terrascientific.co.nz
W: www.terrasci.co.nz

IANZ ACCREDITED LABORATORY ACCREDITATION Nº: 1334

Version Number: 7	Date Issued: November 2019	Authorised By: TCH	Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T000897.2	**Total Samples Received:**	3
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference/Address:**	92 DC	**Date Received:**	5/12/2019
Client Reference:	12903.000.000			**Date Analysed:**	6/12/2019
Client Contact:	Natalie Flatman	**Key Technical Person:**	Marie Foxwell	**Date Reported:**	6/12/2019

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
T000897.2.3	WP03	Waste pit 03, Soil											
		Layer 1: >10 mm	1991.10	844.16	Synthetic Mineral Fibres Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.02035%	0.00000%	0.02035%	
		Layer 2: 10 - 2 mm		486.78	**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** Organic Fibres Synthetic Mineral Fibres	N/A	0.39191	0.00000					
		Layer 3: <2 mm		594.88	Synthetic Mineral Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		52.18	Organic Fibres								
		Total sample weight:		1925.82	Total Combined:	0.00000	0.39191	0.00000					

Method References and Disclaimers

Samples were analysed in: 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.

Analysis Conducted By:

Marie Foxwell
Laboratory Manager

Reviewed By:

Jessica Campbell
Managing Director

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

Marie Foxwell
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IANZ ACCREDITED LABORATORY ACCREDITATION Nº: 1334

Version Number: 5 | Date Issued: August 2019 | Authorised By: TCH | Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T000897.1	**Total Samples Received:**	1
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	92 DC	**Date Received:**	5/12/2019
Client Reference:	12903.000.000			**Date Analysed:**	6/12/2019
Client Contact:	Natalie Flatman	**Key Technical Person:**	Marie Foxwell	**Date Reported:**	6/12/2019

ASBESTOS ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description		Results	Comments
T000897.1.1	PACM1	Waste pit, Cement board		**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** Organic Fibres	
		White painted cement sheeting			
		Sample Weight:	33.70 g		

Method References and Disclaimers

Samples were analysed in accordance with: AS4964-2004 Australian Standard - Method for Qualitative Identification of Asbestos in Bulk Samples

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.

Disclaimers:
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The detection limit is 0.1g/1kg as stated in the AS4964-2004.
This report shall not be reproduced, except in full, without the written consent of the Key Technical Person assigned to this report.

Analysis Conducted By:

Sarah Giles
Laboratory Assistant

Reviewed By:

Marie Foxwell
Laboratory Manager

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

Marie Foxwell
Laboratory Manager
Key Technical Person

ENGEO

Celebrating 10 YEARS IN NZ

Combined Preliminary and Detailed Site Investigation

597 Maddisons Road

Rolleston

Canterbury

Submitted to:

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Merivale
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ENGEO Document Control:

Report Title	Combined Preliminary and Detailed Site Investigation - 597 Maddisons Road, Rolleston			
Project No.	12903.003.000	Doc ID	05	
Client	Hughes Development Ltd	Client Contact	Kelvin Back	
Distribution (PDF)	Hughes Development Ltd			
Date	Revision Details/Status	WP	Author	Reviewer
03/09/2020	Issued to Client	DF	NF/SF	DR

1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a combined preliminary and detailed site investigation of the property at 597 Maddisons Road, Rolleston, Canterbury (herein referred to as 'the site'). Figure 1 attached indicates the location of the property. The purpose of the assessment was to assess the property's suitability for a change of land use consent and subdivision under the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES) and to satisfy the requirements of Selwyn District Council (SDC).

This investigation 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*.

1.1 Objectives of the Assessment

The objective of this Combined PSI / DSI was to assess conditions indicative of releases and threatened releases of hazardous substances on, at, in or to the subject property and report on the potential risk posed to future site users.

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; and
- 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 substances to the subject property.

1.2.1 Review of Site Information

During this assessment, a number of sources of information were contacted for information relating to the site regarding its past and present uses. This included contacting Canterbury Regional Council (CRC) to determine if there were records on the Listed Land Use Register (LLUR), reviewing records held by Selwyn District Council (SDC) including the property file, and obtaining the certificate of titles for the property from Land Information New Zealand (LINZ). A review of a number of historical and current aerial photographs was also undertaken using images from Canterbury Maps and Google Earth.

1.2.2 Site Inspection

A site walk over was undertaken on 28 august 2020 by ENGEO staff. Photographs collected from site have been included in Appendix 1.

2 Site Description and Setting

Site information is summarised in Table 1 below.

Table 1: Site Information

Name	Description
Location	597 East Maddisons Road, Rolleston
Legal Description	Lot 1 DP 57004
Site Area	Approximately 20.4 ha
Property Owner	Property is under contract to Hughes Developments Limited.
Current Land Use	Residential and Agricultural Land
Proposed Land Use	Standard residential subdivision, for single dwelling sites with gardens, including home-grown produce consumption (10%).
Building Construction	Dwelling – concrete foundation, brick cladding, metal roof. Various sheds – timber and metal cladding, metal roofs.
Territorial Authority	Selwyn District Council
Zoning	Inner Plains / Living Z / Rural

The site setting is summarised in Table 2 below.

Table 2: Site Setting

Item	Description
Topography	The site is predominantly flat
Local Setting	The surrounding area is a mix of agricultural and residential.
Nearest Surface Water & Use	Two marked drains (ECAN GIS) are present, one on the north eastern boundary of the site (Drain ID 20877) and one on the south eastern side of the property on the far side of Goulds Road (Drain ID 20881).

Item	Description
Geology (GNS Science)	Late Quaternary alluvium and colluvium. Unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin
Hydrogeology (ECan GIS)	The site is located over an unconfined / semiconfined gravel aquifer. The on-site well does not record ground water level, however wells directly west (M36/5041) and directly east (M36/4891) record depth of groundwater at 6.8 and 7.38 meters below ground level respectively. Groundwater is presumed to flow from the northwest to the southeast towards Lake Ellesmere.
Groundwater Abstractions (ECan GIS)	There is one groundwater abstraction located on the site and eight within 250 m of the site: M36/4346: Main M. R, active well (26.8 m) for domestic supply onsite. M36/5041: Kajens Trading Development Ltd, active well (32.0 m) for domestic supply to the northwest of the site. M36/5268: Macdonald, K, active well (37.0 m) for domestic supply to the north of the site. M36/3041: Quinton, K. R, active well (24.0 m) for domestic supply to the north of the site. M36/3721: Wilson, N. L, active well (19.0 m) for domestic supply to the north of the site. M36/0038: M. W. B, active well (27.1 m) for domestic supply to the north of the site. M36/20602: Mr David Foskett, active well (36.7 m) for domestic and stockwater supply to the north of the site. M36/4891: Mr & Ms BN & JA Stevens & Gray, active well (25.25 m) for domestic and stockwater supply to the east of the site.
Discharge Consents (ECan GIS)	There are no active discharge consents located on the site, and three active consent within 250 m of the site: CRC052128: Mr & Ms KP & DM Graham, active discharge consent to discharge domestic sewage tank effluent into ground to the north of the site. CRC082098: Brian & Louise Smart & Wilkinson, active discharge consent to discharge domestic sewage effluent into land to the north of the site. CRC190197: BENZ 2007 Limited, active discharge consent to discharge stormwater to land to the north of the site.

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 Discussions with Site Owners

Discussions were had with the current site owners in regards to the past and present uses of the site. The current owners have owned the property since the 1990's when the site was open grazing land. The owner mentioned the offal pit in the far south corner of the site and that is was used for disposing of offal and hardfill. The owner also mentioned the burn pile behind the house where domestic rubbish has been burnt. The remainder of the site has been used for grazing of horses and cattle since it was purchased. The owner cannot recall any other waste pits or burn piles when the land was transferred to them.

3.2 Selwyn District Council Property File

The property file for the site, held by Selwyn District Council, was reviewed on 28 August 2020 as part of the DSI

- 17 February 1994 – Building consent for residential dwelling
- 29 November 1994 – Building consent for garage
- 18 October 1995 – Building consent for implement shed
- 1 November 1999 – Building consent, new / relocated implement shed

The property file information did not indicate asbestos containing materials having being used in the construction of the buildings. Because of the age of the buildings (constructed pre-2000) a full asbestos demolition survey is required; this is to ensure that asbestos materials are identified prior to demolition works so that they can be removed in a safe manner.

3.3 Certificate of Title

A review of the certificate of title was completed with no information related to potential contaminating activities identified. The Certificates of Title are attached in Appendix 2.

3.4 Listed Land Use Register (LLUR)

Potentially hazardous activities are defined on the Ministry for the Environmental (MfE) Hazardous Activities and Industries List (HAIL). Canterbury Regional Council (CRC) maintains a Listed Land Use Register (LLUR) of past and current land uses within the Canterbury region which have potentially had an activity included on the HAIL undertaken on them. Under the NES, the listing of the property on the LLUR triggers the requirement for a contaminated land assessment prior to development.

The CRC LLUR property statement was requested by ENGEO on 28 August 2020 for the site and is presented in Appendix 3. The provided LLUR indicates no recorded information for potentially and / or contaminating activities associated with the site.

3.5 Historical Aerial Photography Review

Aerial photographs dating from 1940 to 2016 have been reviewed. The relevant visible features are summarised in Table 3.

Table 3: Aerial Photography

Date	Source	Site Description	Surrounding Area
1940-1944	Canterbury Maps	The site is a part of a larger block of land which appears to be grassed and likely used for grazing. A fence line is present running along the current fence line in the north west. No buildings are visible on the site.	The surrounding area appears to also be undeveloped and used for grazing or cropping. Forestry is observed to the southeast of the site.
1960-1964	Canterbury Maps	The site has no significant changes from the previous photograph.	The surrounding area remains mainly unchanged from the previous photograph. Some small land disturbance (earth clearance) is observed along the north western boundary of the site however it is unknown what this is associated with.
1970-1974	Canterbury Maps		The surrounding area is mainly unchanged from the previous photograph. New structures (likely residential dwellings and sheds) are observed to the north west and east of the site
1980-1984	Canterbury Maps	No significant changes observed on the site, boundary fences corresponding with the current property boundaries are now present along the south west and south east boarders of the site	The surrounding area is mainly unchanged from the previous photograph.
1990-1994	Canterbury Maps	Multiple small structures are now present on the northern section of the site (likely corresponding with development of a garage and dwelling). Otherwise no significant changes from the previous photograph.	A horse training/race track is observed directly south west of the site in addition to new structures to the south west and east of the site. The majority of the surrounding area still appears to be undeveloped and used for agricultural purposes

Date	Source	Site Description	Surrounding Area
2000-2004	Canterbury Maps	Multiple additional structures are now visible in the northern portion of the site (likely corresponding with development of additional garages and implement sheds). A large white spot is noted on the eastern boundary, cause unknown.	Further residential development is noted on all sides of the site. The former training/race track observed in the preceding photography has been removed and another has been constructed to the west of the site. The site located directly west has been split into grids and appears to have horticultural activities taking place.
2010-2015	Canterbury Maps	A small area of earth disturbance is noted on the western portion of the site (corresponding with a small soakage/wetland area), otherwise no significant changes from earlier photography noted.	Further residential development in the surrounding area, however no significant changes observed.
2017	Canterbury Maps	No significant changes observed on site	Further minor residential development observed to the south, west and north. Significant residential development has occurred to the east of the site.

Table 4 below describes the site conditions during the site walkover on 28 August 2020. Photographs taken during the site walk over have been included in Appendix 1.

Table 4: Current Site Conditions

Site Conditions	Comments
Visible signs of contamination	A burn pile is observed to the south of the dwelling and associated sheds. The material in the burn pile is described as ashy with metal, charcoal and potential asbestos containing material. The burn pile is approximately 5 m in diameter. An offal and waste pit is observed in the southern corner of the site. The pit was approximately 3 m depth. The material observed in the pit was offal, plastics and hardfill including bricks and breeze blocks.
Surface water appearance	The surface water in the stream that feeds into the wetland area and the wetland area was clear.
Current surrounding land use	The majority of the surrounding land is mixed use residential and agricultural.
Local sensitive environments	The wetland area on site and the stream along the western boundary line of the site.
Visible signs of plant stress	No signs of plant stressed observed on the site.

Site Conditions	Comments
Additional observations	A large amount of stored vehicles, machinery and 205 L drums containing domestic house hold rubbish were observed along the southern boundary line of the site. This storage of waste is unlikely to have impacted the underlying soils as it is contained in the drums. The machinery and vehicles have recently been relocated from another site and there was no visual impacts to suggest the underlying soils have been impacted from these stored goods. A few vehicles were stored in the paddock to the south of the dwelling. The soils below the vehicles were visually clear from staining. A large barn to the south of the dwelling had deteriorated paint on the exterior cladding.

4 Potential HAIL Activities

Activities included on the Hazardous Activities and Industries List (HAIL) trigger the requirement for a contaminated land investigation prior to redevelopment. Following the site walkover and review of the desktop information, it is considered that the following HAIL activities are or have been present at the site.

Table 5: Potential HAIL Activities

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES
Waste pit/offal pit	Heavy metals Polycyclic aromatic hydrocarbons	Soils within waste pit	G5: Waste disposal to land
Stockpiled soil near offal pit	Heavy metals Polycyclic aromatic hydrocarbons	Stockpiled soil only	G5: Waste disposal to land
Burn pile to south of the dwelling	Heavy metals Polycyclic aromatic hydrocarbons Asbestos	Burn pile and surrounding soils	G5: Waste disposal to land

Potential Source of Contamination	Contaminants of Concern	Possible Extent of Contamination	HAIL Activity as defined by the NES
Lead based paint – shed to south of the dwelling	Lead	Soils around the shed	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 risk to human health or the environment

Note: Due to the age of the site buildings (constructed in the late 1990's), there is potential for asbestos products to have been used in their construction. Based on experience, asbestos is often present beneath the subfloor of a building or in the upper soil horizon around the halo of a building as a result of cutting of asbestos-containing building material (e.g. for service installation) and weathering of exterior building material. No damaged potential asbestos containing materials were observed around the house during the walkover.

5 Intrusive Investigation

An intrusive investigation was developed to investigate the surface soils around the burn pile, the surface soils within the offal pit and the surface soils near the large shed to the south of the dwelling.

The soils were sampled to assess the suitability of the land (from a contamination / human health perspective) for residential use, and to assess the human health risks posed to site works under the commercial / outdoor worker scenario. The results can also be used to indicate whether there is a likely impact to the surrounding environment.

5.1 Methodology

The following was undertaken during the soil sampling works:

- Collection of three soil samples from the offal/waste pit area in the surface soils (S1-S3). These samples were analysed for heavy metals and polycyclic hydrocarbons (PAHs);
- Collection of three soil samples from the stockpiled topsoil near the waste pit (S4-S6). These samples were analysed for heavy metals and polycyclic hydrocarbons (PAHs);
- Collection of five soil samples (S7-S11) from around the burn pile to the south of the dwelling with analysis for heavy metals and PAHs (PAHs from middle sample only);
- Collection of one PACM cement board from the southern extent of the burn pile;
- Collection of five asbestos soil samples from around the cement board sample with analysis for asbestos semi-quantitative analysis. Additional samples are on hold at the laboratory and may be analysed for delineation purposes;
- Collection of one soil sample from adjacent to the large barn to the south of the dwelling with analysis for lead (S12);
- Each sample was inspected for visual and olfactory indicators of contamination;
- All soil samples collected were placed in jars, which were then sealed, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to RJ Hill Laboratories (Hills) and Terra Scientific (Terra) under the standard ENGEO chain of custody documentation provided in Appendix 4;
- To reduce the potential for 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 scrubbing 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;
- All fieldwork and sampling was undertaken 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; and
- On receipt of the analytical results, an assessment of the soil concentrations for contaminants of concern with applicable standards and soil acceptance criteria for the protection of human health and the environment was undertaken.

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 Hill Laboratories, ISO/IEC 17025 and IANZ accredited laboratory, to conduct all laboratory analysis. To maintain their International Accreditation, Hill Laboratories undertakes rigorous cross checking and routine duplicate sampling testing to ensure the accuracy of their results;
- Prior to sampling the equipment (hand auger) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water; and
- During the site investigation every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

6 Regulatory Framework and Assessment Criteria

The regulatory frameworks and rules relating to the management and control of contaminated sites in the Canterbury Region are specified in two documents: the NES and the ECan Regional Plan. A summary of each and its implications for the site is provided in Sections 6.1-6.2.

6.1 NES

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

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 ECan's online GIS – Trace Level 2 concentrations.

6.2 Disposal Criteria

An assessment of potential off-site disposal options for excess soil generated during site development works has been conducted. Dependent on the condition of the spoil, off-site disposal options range from disposal to "cleanfill" sites to managed fill sites. As outlined in the publication Waste Management Institute of New Zealand Technical Guidelines for Disposal to Land (August 2018) definition of cleanfill which states:

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

- Combustible, putrescible, degradable or leachable components;
- Hazardous substances or material (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."

6.3 Assessment Criteria

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

- Residential land use (10% produce); and
- Commercial / industrial land use (based on an outdoor worker scenario) (for redevelopment workers).

The land use scenarios are relevant to the likely future use of the site and are 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.

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

6.4 Asbestos Criteria

The field work and reporting for this site have been done in accordance with the New Zealand Guidelines for Assessing and Managing Asbestos in Soil released on 6 November 2017. The BRANZ Asbestos (2017) Guidelines have been developed based on the WA DOH Guidelines but with the New Zealand regulatory environment in mind.

The BRANZ guideline criteria have been adopted as investigation criteria for this assessment and are presented in Table 6 below.

Table 6: 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 of the BRANZ Guideline (≥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 of the BRANZ guideline 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 of the BRANZ guideline). 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 of the BRANZ guideline). Two forms of capping are typically used:

a. 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.
b. 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 Results

7.1 Soil Encountered

Please refer to Table 7 for a summary of subsurface soils encountered.

The burn pile material is described as ash with charcoal, metal, timber, plastic and PACM.

Table 7: Summary of Subsurface Soils

Depth	Soil Description
0.0-0.3	Fine to medium SAND with trace gravel and rootlets; brown.
0.3-0.5	Sand fine to coarse GRAVEL with minor cobbles.

7.2 Analytical Results

The analytical results from the ENGEO investigation can be summarised as follows:

- All samples collected from the waste pit have returned concentrations below the NES residential land use criteria. Sample S3 has reported concentrations of lead and cadmium slightly above the site specific regional background levels;
- All samples collected from the stockpiled soil have returned concentrations below the NES residential land use criteria and site specific regional background levels;
- Sample S7, S8, S9 and S10 have reported concentrations of heavy metals above the NES residential land use criteria. All samples from the burn pile are also reported above the site specific regional background levels. PAHs were reported as elevated in S7 but are below the NES residential standards and background levels;
- The cement board sample collected from the burn pile was reported positive for chrysotile, amosite and crocidolite asbestos;
- Asbestos soil sample 1 from the burn pile reported asbestos fines and fibres above the BRANZ guidelines. Asbestos soil sample 5 reported cement board in the soil sample above the BRANZ guidelines. Asbestos soil sample 7 reported asbestos fines and fibres below the BRANZ guidelines; and

Please refer to Appendix 4 for the full laboratory certificate and results. Only detectable concentrations of analytes are shown in Table 8 and 9 below.

Table 8: Asbestos Semi-quantitative Analysis Results

Sample Name	Sample Depth	Asbestos Type	ACM weight	AF and FA as % w/w of total sample
Sample 1	0.0	Chrysotile, Amosite and Crocidolite	-	**0.07805**
ASS04	0.0	No asbestos detected	-	-
ASS05	0.0	Chrysotile, Amosite and Crocidolite	**0.01884**	-
ASS06	0.0	No asbestos detected	-	-
ASS07	0.0	Chrysotile	-	0.00083

Table 9: Sample Analysis Results

Sample Name	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	Human health criteria – Residential Land Use	Human health criteria - Commercial / industrial outdoor worker (unpaved)[a]	Regional background - Trace Elements (Level 2)[b]
Soil Type	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT	SILT			
Sample Depth, m	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1	0.0-0.1			
Heavy Metals in soil, mg/kg															
Arsenic	4	4	5	3	3	4	**790**	**149**	**77**	**37**	14	-	20	70	6.35
Cadmium[c]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	22	7.6	19.6	2.5	0.47	-	3	1,300	0.14
Chromium[d]	14	13	18	12	10	14	260	118	50	22	17	-	460	6,300	19.89
Copper	8	5	11	5	4	4	990	350	191	66	34	-	>10,000	>10,000	11.68
Lead	16.2	15	22	14.2	10.4	14.6	**340**	**550**	107	**1780**	47	**1620**	210	3,300	19.75
Nickel	12	10	14	8	8	10	36	18	13	89	8	-	400[c]	6,000[c]	13.91
Zinc	60	46	78	47	34	49	3,000	1,610	420	430	108	-	7,400[c]	400,000[c]	69.58
Polycyclic aromatic hydrocarbons in soil, mg/kg															
BaP eq.	0.03	0.03	0.03	0.03	0.03	0.03	0.36	-	-	-	-	-	10	35	0.922

[a] Human health criteria from the NES except where noted.
Bold text indicates that the concentration exceeds the Residential land use criterion.
Italics indicates that the concentration exceeds the Commercial/industrial land user criterion.
[b] ECan (2007) Background Concentrations of Selected Trace Elements in Canterbury Soils. Exceedances are underlined.
[c] Assumes soil pH of 5.
[d] Criteria for Chromium VI were conservatively selected.

8 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; and
- An exposure route, where the sensitive receptor 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 10.

Table 10: Conceptual Site Model

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Waste pile/offal pit	Heavy metals PAHs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers. Future site users.	**Yes.** All samples collected are below the NES residential land use criteria.
Stockpiled soils near waste pit	Heavy metals PAHs	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers. Future site users.	**Yes.** All samples collected are below the NES residential land use criteria.

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? So samples meet acceptance criteria?
Burn pile	Heavy metals PAHs Asbestos	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers. Future site users.	**No.** Asbestos was detected above BRANZ guidelines and arsenic and lead are reported above the NES residential land use criteria.
Lead based paint on southern shed	Lead	Dermal contact with the impacted soil, incidental ingestion and inhalation of dust during earthworks	On-site redevelopment workers. Future subsurface maintenance workers. Future site users.	**No.** A sample collected from the soils around the shed are reported above the NES residential land use criteria.

9 Conclusions

ENGEO Ltd were engaged by Hughes Developments Limited to undertake an environmental assessment of a site situated at 597 East Maddisons Road in Rolleston for change in land use, subdivision and soil disturbance consent. Information was gathered and reviewed regarding the potential releases of hazardous substances to the subject property.

A review of information identified that the site had been used for grazing since circa 1940 and residential land use since 1994.

The site is not listed on the Canterbury Regional Council's Listed Land Use Register as being associated with a HAIL related activity. The property file was obtained from Selwyn District Council and Certificate of Titles obtained by Land Information New Zealand and these files contained no information related to potentially hazardous activities having occurred at the site.

During the site walkover, three areas of concern were observed on the site.

- An offal and waste pit was observed in the southern boundary of the site. Three soil samples were collected from the base of the pit and all samples returned concentrations below the NES residential and use criteria. One sample, S3, reported slightly elevated concentrations of zinc and lead which are considered likely due to natural variances in the site soils. An area of stockpiled soils were observed near the offal pit. No visual contamination was observed in the stockpiled soils. Three soil samples were collected from the stockpiled soils and all samples reported concentrations of heavy metals below the NES residential land use criteria and site specific background levels for heavy metals.

- A burn pile was identified towards the south of the dwelling. Four samples collected from the middle of the burn pile and surrounding area reported concentrations of heavy metals above the NES residential land use criteria. Asbestos cement board was also identified in the burn pile and reported positive for chrysotile, amosite and crocidolite. One soil sample (ASS01) collected for asbestos semi-quantitative analysis reported concentrations of fines and fibres above the BRANZ guidelines. Sample (ASS07) collected from the middle of the burn pile reported asbestos fines and fibres below the BRANZ guidelines.
- A large shed was identified to the south of the dwelling which had presumed lead paint in a deteriorated condition. One soil sample was collected in the surface soils from around the shed with concentrations of lead above the NES residential land use criteria.

The burn pile area and soils around the large shed to the south of the dwelling are required to be remediated prior to development of the site.

The remainder of the site is considered highly likely to be suitable for its intended residential end use.

As the redevelopment of the whole site involves a change of land use, subdivision and soil disturbance, it is possible that the identified impacted area can be removed as a permitted activity under Regulation 8(3) of Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulation 2011 due to the small volume in relation to the soil disturbance across the site.

Remediation works should be detailed in a Remedial Action Plan (RAP) which will also include the procedures for the handling, management and disposal of contaminated soils. Following remediation, a validation report will be required to indicate the site is suitable for its intended end use.

The soils from the burn pile are suitable for disposal at Kate Valley Landfill as asbestos contaminated waste. The soils from around the shed should be checked with Kate Valley to assess whether they will accept them. Additional TCLP analysis may be required to be undertaken.

If the buildings on site are to be refurbished or demolished, the presence of asbestos in these buildings should be identified by undertaking full asbestos surveys. If identified on the outside of the buildings in a deteriorated state, the soils surrounding the buildings should be tested.

10 References

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.

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

MfE (2011b). *Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites*.

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.*

11 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Development Ltd, 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.

ii. 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.

iii. 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.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. 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

Natalie Flatman

Environmental Scientist

Sean Freeman

Environmental Scientist

Report reviewed by

Dave Robotham, CEnvP SC

Principal Environmental Consultant

FIGURES

DATE PLOTTED: 01 September 2020 4:59:49 pm BY: NFlatman

Legend

Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

0 50 100
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Christchurch Office
124 Montreal Street Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title:
Site Location Plan

Client: Hughes Developments		Figure No: 1
Project: 597 East Maddisons Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Sep 20	Size: A3
Proj No: 12903.000.005	Scale: 1:3,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: Z:\Projects\12901 to 13000\12903 - Farrington South Subdivision\59_597 East Maddisons Road\05_GIS\Fig01.mxd

DATE PLOTTED: 03 September 2020 2:08:16 pm BY: NFlatman

Legend

- Sample locations
- Approximate extent of waste pit
- Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Christchurch Office
124 Montreal Street Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title: Waste pit locations

Client: Hughes Developments		Figure No: 2
Project: 597 East Maddisons Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Sep 20	Size: A3
Proj No: 12903.000.005	Scale: 1:250	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

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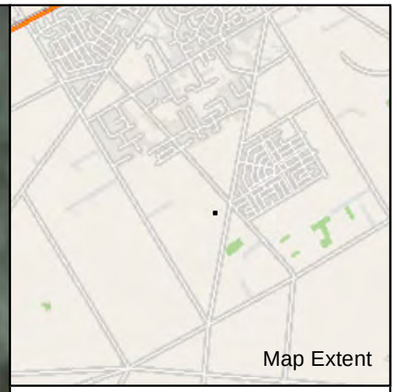
DATE PLOTTED: 03 September 2020 2:14:57 pm BY: NFlatman



Legend

- Sample locations
- Approximate extent of waste pit
- Site boundary

Aerial: LINZ and Eagle Technology, CC BY 4.0.
Map image: Eagle Technology.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Christchurch Office
124 Montreal Street Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title: Burn pile sample locations

Client: Hughes Developments		Figure No: 3
Project: 597 East Maddisons Road Rolleston	Designed: NF Drawn: NF Checked: DRAFT Date: Sep 20	Size: A3
Proj No: 12903.000.005	Scale: 1:80	Revision: A

PATH: Z:\Projects\12901 to 13000\12903 - Farringdon South Subdivision\59_597 East Maddisons Road\05_GIS\Fig01.mxd

APPENDIX 1:

Site Photography

Photo 1: Offal/waste pit in southern corner of the site

Photo 2: Mounded topsoil near offal pit in southern corner of the site

Photo 3: Stored machinery and vehicles along southern boundary

Photo 4: 205 L drums containing domestic rubbish

Photo 5: Southern paddocks

Photo 6: Northern paddocks

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**597 East Maddisons Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	1 to 6	**ENGEO Ref.**	12903	**Appendix No.**	1a

Photo 7: Dwelling

Photo 8: Garages to south of dwelling

Photo 9: Barn to south of dwelling

Photo 10: Disused pool near dwelling

Photo 11: Burn pile in paddock south of dwelling

Photo 12: Asbestos cement board in burn pile material

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**597 East Maddisons Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	7 to 12	**ENGEO Ref.**	12903	**Appendix No.**	1b

Photo 13: Stream towards western boundary line

Photo 14: Wetland area

Photo 15: Stream feeding into wetland area

Photo 16: Material stored in large barn in paddock south of dwelling

Photo 17: Stored vehicle in paddock south of dwelling

Photo 18: Sleepout near dwelling

ENGEO
Expect Excellence

Date taken	Aug 2020	**Client**	**Hughes Developments**		
Taken by	NF	**Project**	**597 East Maddisons Road, Rolleston**		
Approved by	DR	**Description**	**Site Photographs**		
Photo No.	13 to 18	**ENGEO Ref.**	12903	**Appendix No.**	1c

APPENDIX 2:

Certificate of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Historical Search Copy

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Identifier **CB33K/65**
Land Registration District **Canterbury**
Date Issued 18 October 1990

Prior References
CB33F/774

Estate	Fee Simple
Area	20.3750 hectares more or less
Legal Description	Lot 1 Deposited Plan 57004

Original Registered Owners
Malcolm Richard Main and Philippa Ruth Main

Interests

Subject to Part IV A Conservation Act 1987

A21096.5 Mortgage to Trust Bank Canterbury Limited - 28.10.1992 at 2.32 pm and varied 30.10.1996 at 9.36 am

5798897.2 Transfer to Malcolm Richard Main, Philippa Ruth Main and Graeme Charles Main - 13.11.2003 at 9:00 am

5798897.3 Variation of Mortgage A21096.5 - 13.11.2003 at 9:00 am

7095691.1 Application pursuant to Section 99A Land Transfer Act 1952 vesting Mortgage A21096.5 in Westpac New Zealand Limited - 2.11.2006 at 9:00 am

8556170.1 Transfer to Malcolm Richard Main and Philippa Ruth Main - 29.7.2010 at 3:14 pm

8577235.1 Variation of Mortgage A21096.5 - 25.8.2010 at 5:05 pm

References
Prior C/T 33F/774

Transfer No.
N/C. Order No. 903207/2

Land and Deeds 69

REGISTER

No. 33K/65

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 18th day of October one thousand nine hundred and ninety under the seal of the District Land Registrar of the Land Registration District of CANTERBURY

WITNESSETH that KELVIN ROYCE TAYLOR, Farmer and GILLIAN DOROTHY TAYLOR, Married Woman, both of Springston, Christchurch as tenants in common in equal shares are ---

is seised of an estate in fee-simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, that is to say: All that parcel of land containing 20.3750 hectares or thereabouts being Lot 1 Deposited Plan 57004 ---

ASSISTANT LAND REGISTRAR

Subject to:

Part IVA Conservation Act 1987

A.L.R.

Transfer A21096/4 to Malcolm Richard Main of Christchurch, Scientist and Philippa Ruth Main his wife - 28.10.1992 at 2.32pm

for A.L.R.

Mortgage A21096/5 to Trust Bank Canterbury Limited - 28.10.1992 at 2.32pm

for A.L.R.

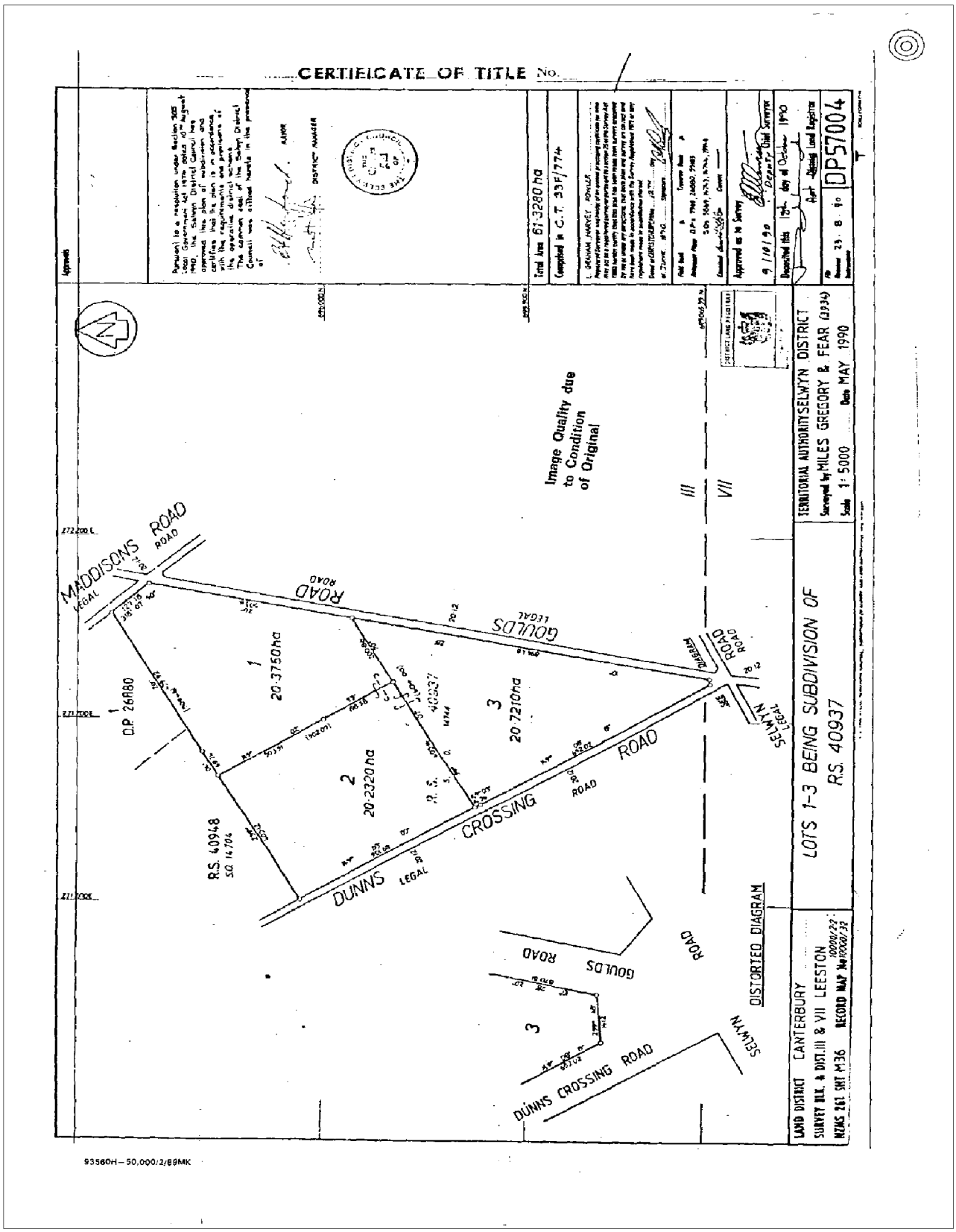
Variation of Mortgage A21096/5 - 30.10.1996 at 9.36am

for A.L.R.

No. 33K/65

Measurements are Metric

Identifier **CB33K/65**



RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD
Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB33K/65**
Land Registration District	**Canterbury**
Date Issued	18 October 1990

Prior References
CB33F/774

Estate	Fee Simple
Area	20.3750 hectares more or less
Legal Description	Lot 1 Deposited Plan 57004

Registered Owners
Malcolm Richard Main and Philippa Ruth Main

Interests

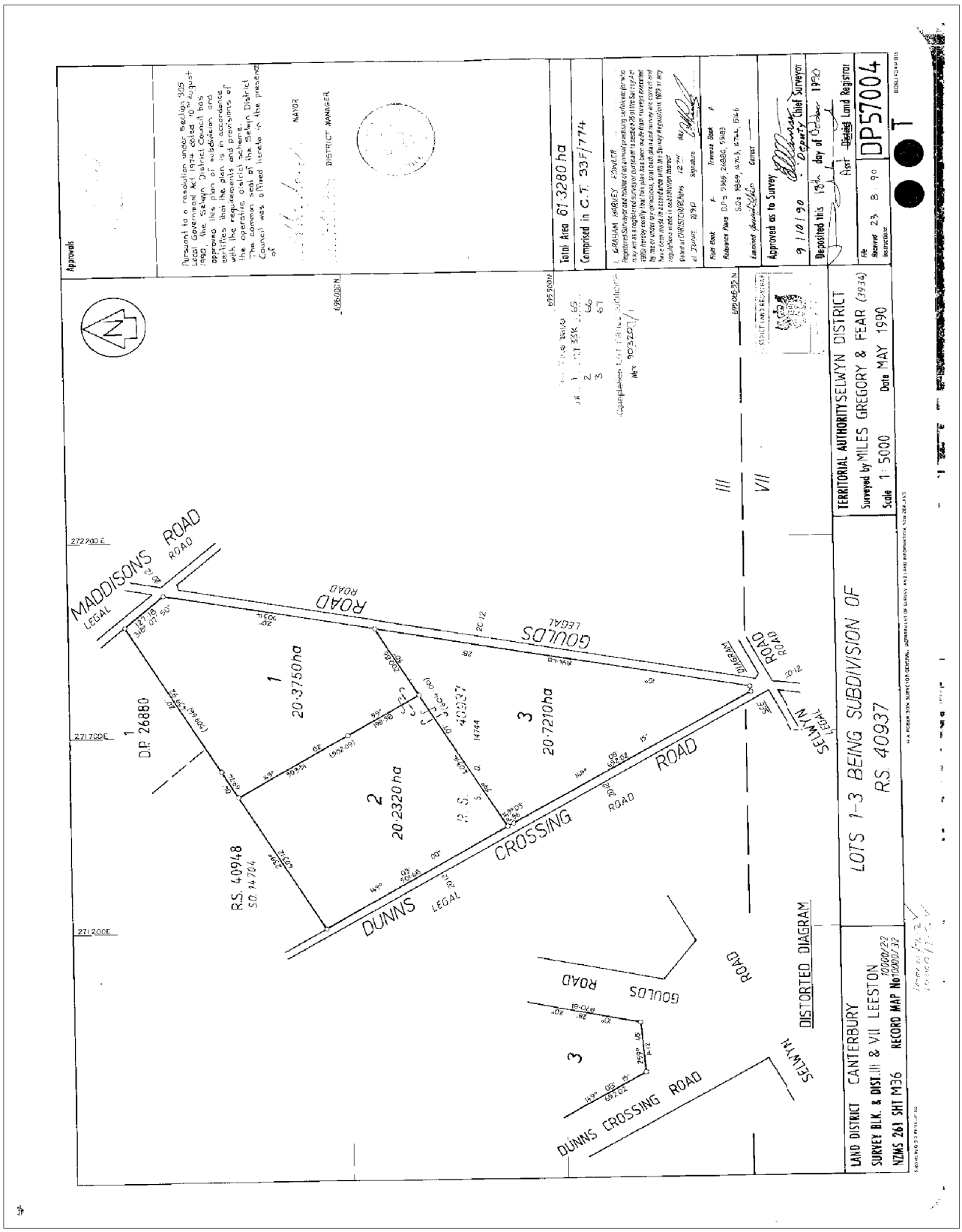
Subject to Part IV A Conservation Act 1987

A21096.5 Mortgage to (now) Westpac New Zealand Limited - 28.10.1992 at 2.32 pm and varied 30.10.1996 at 9.36 am

5798897.3 Variation of Mortgage A21096.5 - 13.11.2003 at 9:00 am

8577235.1 Variation of Mortgage A21096.5 - 25.8.2010 at 5:05 pm

Identifier **CB33K/65**



APPENDIX 3:

LLUR Statement

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

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.

Environment Canterbury
Regional Council
Kaunihera Taiao ki Waitaha

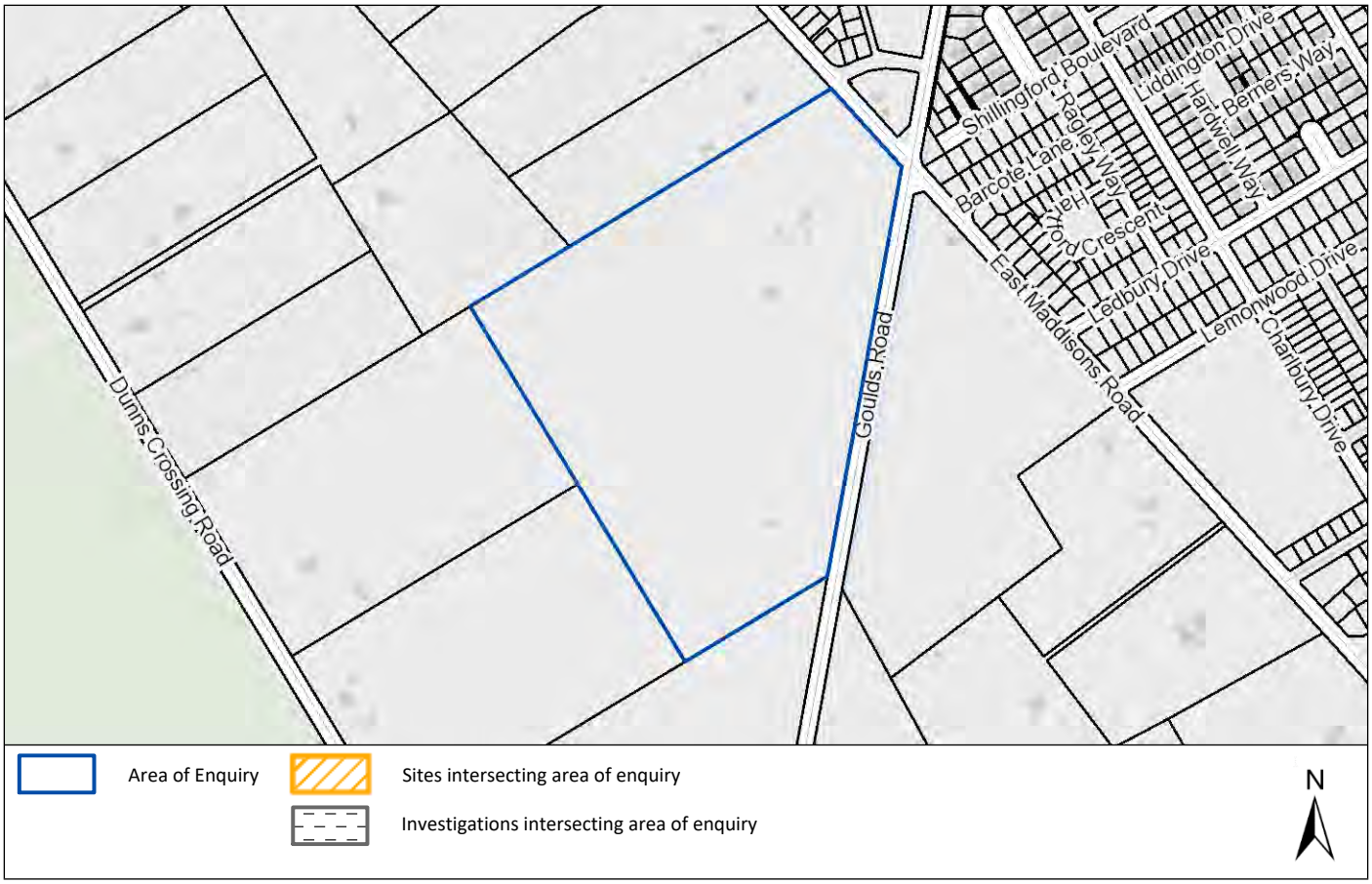
Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

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

www.ecan.govt.nz

Date:	28 August 2020	
Land Parcels:	Lot 1 DP 57004	Valuation No(s): 2405534400



The information presented in this map is specific to the property you have selected. Information on nearby properties 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

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ262291.

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.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know

Everything is connected

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.

[1] The 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?

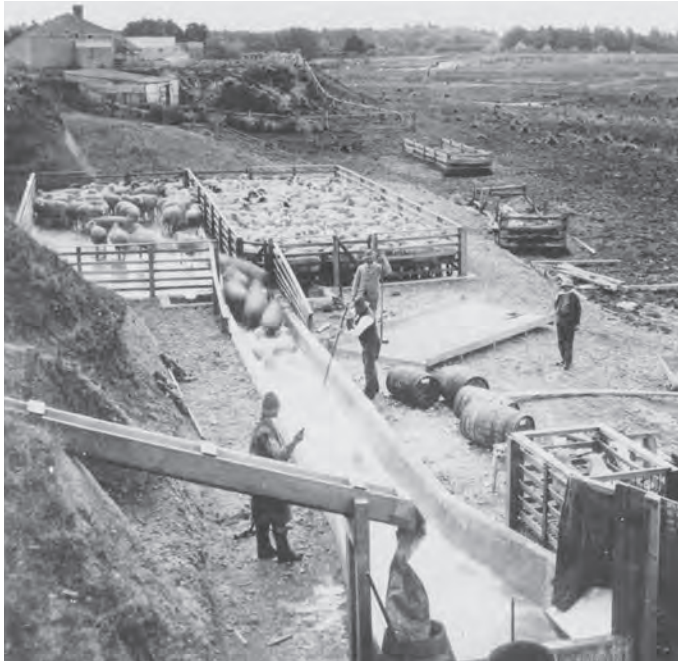
The LLUR is available online at www.llur.ecan.govt.nz. We mainly receive enquiries from potential property buyers and environmental consultants or engineers working on sites. An inquirer would typically receive a summary of any information we hold, including the category assigned to the site and a list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

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.)

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.

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)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

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.

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

E13/102

APPENDIX 4:

Laboratory reports

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2428499 SPv2
Contact:	Natalie Flatman	**Date Received:**	01-Sep-2020
	C/- Engeo Limited	**Date Reported:**	03-Sep-2020
	PO Box 373	**Quote No:**	82742
	Christchurch 8140	**Order No:**	
		Client Reference:	12903.000.005
		Submitted By:	Natalie Flatman

Sample Type: Soil

Sample Name:		597_S1 28-Aug-2020	597_S2 28-Aug-2020	597_S3 28-Aug-2020	597_S4 28-Aug-2020	597_S5 28-Aug-2020
Lab Number:		2428499.1	2428499.2	2428499.3	2428499.4	2428499.5
Individual Tests						
Dry Matter	g/100g as rcvd	84	97	86	84	90
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	4	5	3	3
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	14	13	18	12	10
Total Recoverable Copper	mg/kg dry wt	8	5	11	5	4
Total Recoverable Lead	mg/kg dry wt	16.2	15.0	22	14.2	10.4
Total Recoverable Nickel	mg/kg dry wt	12	10	14	8	8
Total Recoverable Zinc	mg/kg dry wt	60	46	78	47	34
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
2-Methylnaphthalene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Acenaphthylene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Acenaphthene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[a]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	< 0.011	0.014	< 0.012	< 0.011
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[e]pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Chrysene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Fluoranthene	mg/kg dry wt	< 0.012	< 0.011	0.019	< 0.012	< 0.011
Fluorene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Perylene	mg/kg dry wt	< 0.012	< 0.011	< 0.012	< 0.012	< 0.011
Phenanthrene	mg/kg dry wt	< 0.012	< 0.011	0.014	< 0.012	< 0.011
Pyrene	mg/kg dry wt	< 0.012	< 0.011	0.021	< 0.012	< 0.011

Sample Type: Soil						
Sample Name:		597_S6 28-Aug-2020	597_S7 28-Aug-2020	597_S8 28-Aug-2020	597_S9 28-Aug-2020	597_S10 28-Aug-2020
Lab Number:		2428499.6	2428499.7	2428499.8	2428499.9	2428499.10
Individual Tests						
Dry Matter	g/100g as rcvd	88	68	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	790	149	77	37
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	22	7.6	19.6	2.5 #1
Total Recoverable Chromium	mg/kg dry wt	14	260	118	50	22
Total Recoverable Copper	mg/kg dry wt	4	990	350	191	66
Total Recoverable Lead	mg/kg dry wt	14.6	340	500	107	1,780
Total Recoverable Nickel	mg/kg dry wt	10	36	18	13	89 #2
Total Recoverable Zinc	mg/kg dry wt	49	3,000	1,610	420	430 #3
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.3	3.9	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.012	0.076	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.012	0.080	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.012	0.074	-	-	-
Acenaphthene	mg/kg dry wt	< 0.012	< 0.015	-	-	-
Anthracene	mg/kg dry wt	< 0.012	0.063	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.012	0.27	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.012	0.24	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.03	0.36	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.03	0.36	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	mg/kg dry wt	< 0.012	0.60	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.012	0.36	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.012	0.112	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.012	0.171	-	-	-
Chrysene	mg/kg dry wt	< 0.012	0.22	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.012	< 0.015	-	-	-
Fluoranthene	mg/kg dry wt	< 0.012	0.28	-	-	-
Fluorene	mg/kg dry wt	< 0.012	0.101	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.012	0.126	-	-	-
Naphthalene	mg/kg dry wt	< 0.06	0.42	-	-	-
Perylene	mg/kg dry wt	< 0.012	0.051	-	-	-
Phenanthrene	mg/kg dry wt	< 0.012	0.38	-	-	-
Pyrene	mg/kg dry wt	< 0.012	0.31	-	-	-

Sample Name:		597_S11 28-Aug-2020	597_S12 28-Aug-2020			
Lab Number:		2428499.11	2428499.12			
Individual Tests						
Total Recoverable Lead	mg/kg dry wt	-	1,620	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	14	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.47	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	17	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	34	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	47	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	8	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	108	-	-	-	-

Analyst's Comments

#1 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Rep 1 = 2.5 mg/Kg Rep 2 = 1.7 mg/Kg

#2 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Rep 1 = 89 mg/Kg Rep 2 = 9.6 mg/Kg

#3 It should be noted that the replicate analyses performed on this sample as part of our in-house Quality Assurance procedures showed greater variation than would normally be expected. This may reflect the heterogeneity of the sample. Rep 1 = 430 mg/Kg, Rep 2 = 259 mg/Kg

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 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%.	-	1-12
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation May contain a residual moisture content of 2-5%.	-	12
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1-7
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	1-11
Polycyclic Aromatic Hydrocarbons Screening in Soil*	Sonication extraction, GC-MS analysis. Tested on as received sample. In-house based on US EPA 8270.	0.002 - 0.05 mg/kg dry wt	1-7
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	1-7
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	12
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	12
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.	0.002 mg/kg dry wt	1-7
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).	0.002 mg/kg dry wt	1-7

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

Testing was completed between 02-Sep-2020 and 03-Sep-2020. 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.

Kim Harrison MSc
Client Services Manager - Environmental

TERRA SCIENTIFIC

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ACCREDITED IANZ TESTING LABORATORY Nº 1334

Version Number: 7 | Date Issued: August 2020 | Authorised By: JC | Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T002740.1	**Total Samples Received:**	1
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	EM - 12903.000.000	**Date Received:**	31/08/2020
Client Reference:	12903.000.000			**Date Analysed:**	31/08/2020
Client Contact:	Natalie Flatman	**Analyst:**	Lisa Bullock	**Date Reported:**	31/08/2020

ASBESTOS ANALYSIS REPORT

Laboratory Sample Number	Client Sample Number	General Description		Results	Comments
T002740.1.1	1	Burn pile PACM 1, Cement board		**Chrysotile (White Asbestos)** **Amosite (Brown Asbestos)** **Crocidolite (Blue Asbestos)** Organic Fibres	
		Yellow painted cement			
		Sample Weight:	33.25 g		

Method References and Disclaimers

Samples were analysed in accordance with: AS4964-2004 Australian Standard - Method for Qualitative Identification of Asbestos in Bulk Samples

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 as stated in the AS4964-2004.
- 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

Terra Scientific Ltd

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ACCREDITED IANZ TESTING LABORATORY Nº 1334

Version Number: 10	Date Issued: August 2020	Authorised By: JC	Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T002740.2	**Total Samples Received:**	1
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	EM - 12903.000.000	**Date Received:**	31/08/2020
Client Reference:	12903.000.000			**Date Analysed:**	1/09/2020
Client Contact:	Natalie Flatman	**Analyst:**	Jessica Campbell	**Date Reported:**	1/09/2020

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
T002740.2.1	1	Burn pile - sample 1, Soil											
		Layer 1: >10 mm	893.91	17.30	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.06923%	0.00882%	0.07805%	
		Layer 2: 10 - 2 mm		28.43	**Chrysotile (White Asbestos) Amosite (Brown Asbestos) Crocidolite (Blue Asbestos)** Organic Fibres	N/A	0.46908	0.00000					
		Layer 3: <2 mm		631.85	**Chrysotile (White Asbestos) Amosite (Brown Asbestos) Crocidolite (Blue Asbestos)** Organic Fibres	N/A	0.00000	0.05974					
		Layer 3 sub sampled weight:		50.24									
		Total sample weight:		677.58	Total Combined:	0.00000	0.46908	0.05974					

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.

Jessica Campbell
Managing Director
Key Technical Person

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ACCREDITED IANZ TESTING LABORATORY Nº 1334

Version Number: 10 | Date Issued: August 2020 | Authorised By: JC | Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T002772	**Total Samples Received:**	7
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	597 EM	**Date Received:**	2/09/2020
Client Reference:	12903.000.005			**Date Analysed:**	3/09/2020
Client Contact:	Natale Flatman	**Analyst:**	Lisa Bullock	**Date Reported:**	3/09/2020

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
T002772.1	3	ASS04 @ 0.0, Soil											
		Layer 1: >10 mm	854.07	19.66	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected QA/QC Reviewed
		Layer 2: 10 - 2 mm		67.99	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		538.92	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		53.71	Synthetic Mineral Fibres								
		Total sample weight:		626.57	Total Combined:	0.00000	0.00000	0.00000					
T002772.2	4	ASS05 @ 0.0, Soil											
		Layer 1: >10 mm	1065.38	120.68	**Chrysotile (White Asbestos) Amosite (Brown Asbestos) Crocidolite (Blue Asbestos)** Organic Fibres	1.05348	0.00000	0.00000	0.01884%	0.00000%	0.00000%	0.00000%	
		Layer 2: 10 - 2 mm		23.31	Organic Fibres Synthetic Mineral Fibres	N/A	0.00000	0.00000					
		Layer 3: <2 mm		694.81	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		51.97	Synthetic Mineral Fibres								
		Total sample weight:		838.80	Total Combined:	1.05348	0.00000	0.00000					
T002772.3	5	ASS06 @ 0.0, Soil											
		Layer 1: >10 mm	1342.34	105.13	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00000%	0.00000%	0.00000%	No Asbestos Detected QA/QC Reviewed
		Layer 2: 10 - 2 mm		107.00		N/A	0.00000	0.00000					
		Layer 3: <2 mm		860.08		N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		50.08									
		Total sample weight:		1072.21	Total Combined:	0.00000	0.00000	0.00000					

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ACCREDITED IANZ TESTING LABORATORY Nº 1334

Version Number: 10 | Date Issued: August 2020 | Authorised By: JC | Controlled Document

Client Name:	ENGEO Christchurch	**Job Number:**	T002772	**Total Samples Received:**	7
Client Address:	124 Montreal Street, Sydenham, Christchurch, 8023	**Site Reference / Address:**	597 EM	**Date Received:**	2/09/2020
Client Reference:	12903.000.005			**Date Analysed:**	3/09/2020
Client Contact:	Natale Flatman	**Analyst:**	Lisa Bullock	**Date Reported:**	3/09/2020

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
T002772.4	6	ASS07 @ 0.0, Soil											
		Layer 1: >10 mm	741.38	54.82	Organic Fibres	0.00000	0.00000	0.00000	0.00000%	0.00083%	0.00000%	0.00083%	
		Layer 2: 10 - 2 mm		112.04	**Chrysotile (White Asbestos)** Organic Fibres Synthetic Mineral Fibres	N/A	0.00405	0.00000					
		Layer 3: <2 mm		321.09	Organic Fibres	N/A	0.00000	0.00000					
		Layer 3 sub sampled weight:		54.29	Synthetic Mineral Fibres								
		Total sample weight:		487.95	Total Combined:	0.00000	0.00405	0.00000					

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

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Sarah Giles
Laboratory Analyst
Key Technical Person