ENGEO

Expect Excellence

Detailed Environmental Site Investigation

92 Dunns Crossing Road

Rolleston

Canterbury

Submitted to:

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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	
														Canterbury Regional	Residential - 10% produce	Industrial
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**	**-**	**-**	**-**			
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

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.

Forsyth, P.J.; Barrell, D.J.A; Jongens, R. (2008). *Sheet 16 - Geology of the Christchurch Area 1:250,000.* Institute of Geological and Nuclear Sciences, Lower Hutt.

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

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 (2011e). *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health.*

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.*

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

DATE PLOTTED: 04 December 2019 8:38:24 am BY: NFlatman

PATH: \\nzfile\nz\Projects\12901 to 13000\12903 - Farrington South Subdivision\054_92 Dunns Crossing Road - Enviro\09_CAD_GIS & Figures\Fig01.mxd

ENGEO

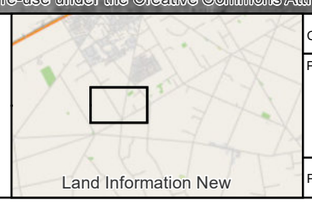
Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
Tel: 03 328 9012
www.engeo.co.nz

Title:

Historical Aerial Photograph - 1940-1944

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



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: **1a**

Size: A3

Revision: A

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DATE PLOTTED: 04 December 2019 8:30:12 am BY: NFlatman

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ENGEO

Christchurch Office
124 Montreal Street
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Title:

Historical Aerial Photograph - 1960-1964

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
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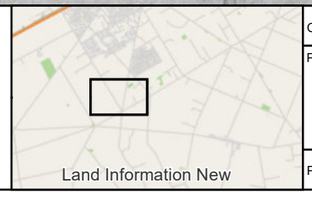
PROJECTION: NZGD 2000 New Zealand Transverse Mercator



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: **1b**

Size: A3

Revision: A

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ENGEO

Christchurch Office
124 Montreal Street
Sydenham, Christchurch 8023
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www.engeo.co.nz

Title:

Historical Aerial Photograph - 1970-1974

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

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: **1c**

Size: A3

Revision: A

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ENGEO

Christchurch Office
124 Montreal Street
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Title:

Historical Aerial Photograph - 1980-1984

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

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: **1d**

Size: A3

Revision: A

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ENGEO

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Title:

Historical Aerial Photograph - 1990-1994

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

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: **1e**

Size: A3

Revision: A

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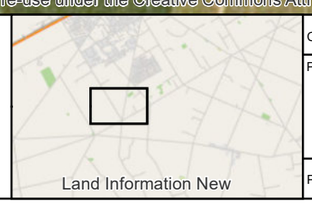
Title:

Historical Aerial Photograph - 2000-2004

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



Client: Hughes Developments Ltd

Project:
92 Dunns Crossing Road
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Canterbury

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

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Scale: 1:5,000

Figure No: **1f**

Size: A3

Revision: A

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Title:

Historical Aerial Photograph - 2010-2015

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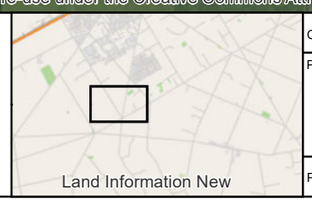
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator



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

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Legend

Site boundary

0 10,000 20,000

Meters

ENGEO

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Tel: 03 328 9012
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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

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HA07
HA06
HA03
HA01
HA05
HA02
HA04
HA16
HA17
HA10
HA13
SS01
HA14
HA15
HA08
HA11
HA12
HA09
SS02

N

0 10,000 20,000 Meters

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

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

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Scale: 1:400

Figure No: **2**

Size: A3

Revision: A

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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

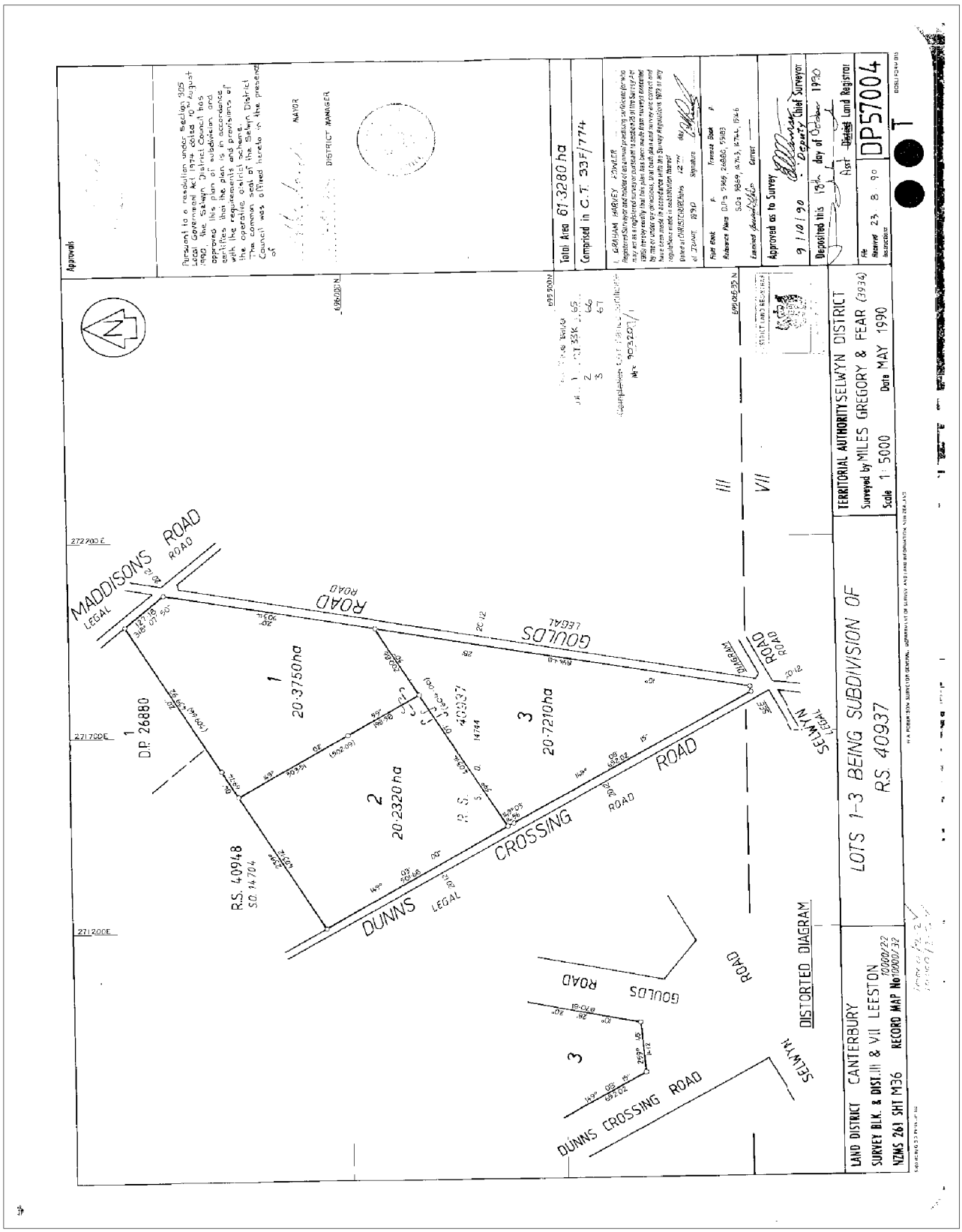
Estate	Fee Simple
Area	20.7210 hectares more or less
Legal Description	Lot 3 Deposited Plan 57004

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.

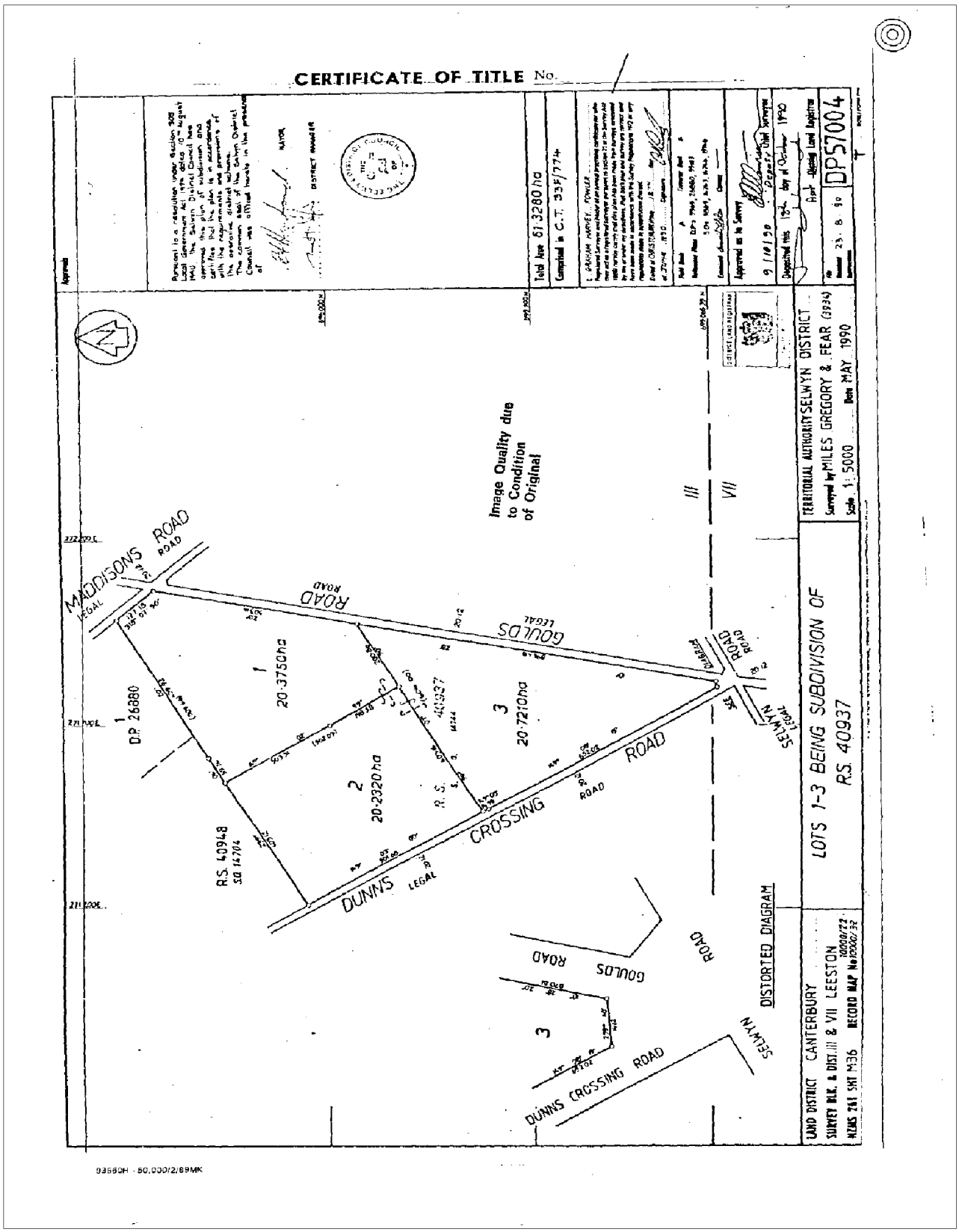
A466952.1 Transfer to Ivan George Robertson and Dorothy Caroline Robertson in equal shares - 19.7.2000 at 2.42

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

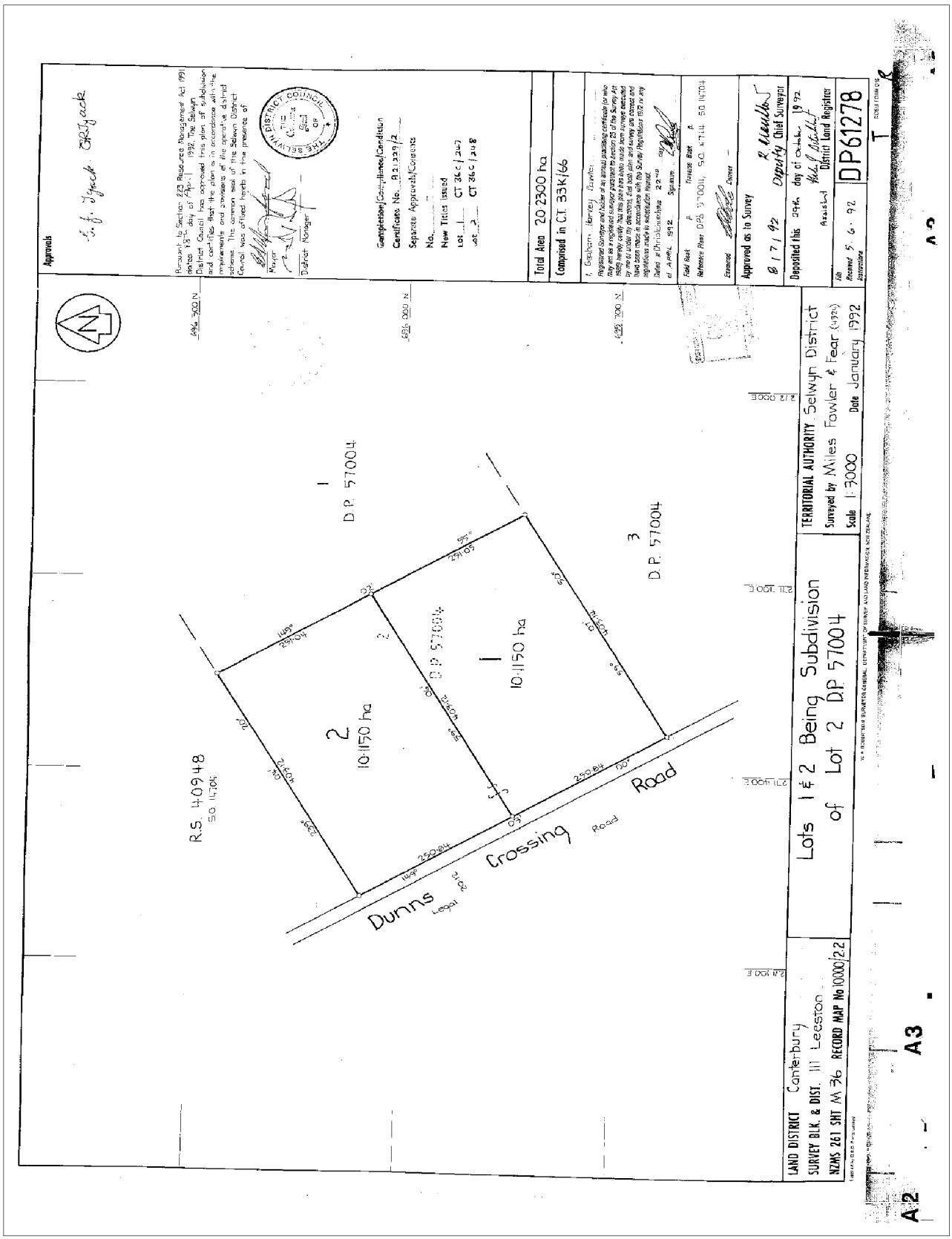
Estate	Fee Simple
Area	10.1150 hectares more or less
Legal Description	Lot 1 Deposited Plan 61278

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

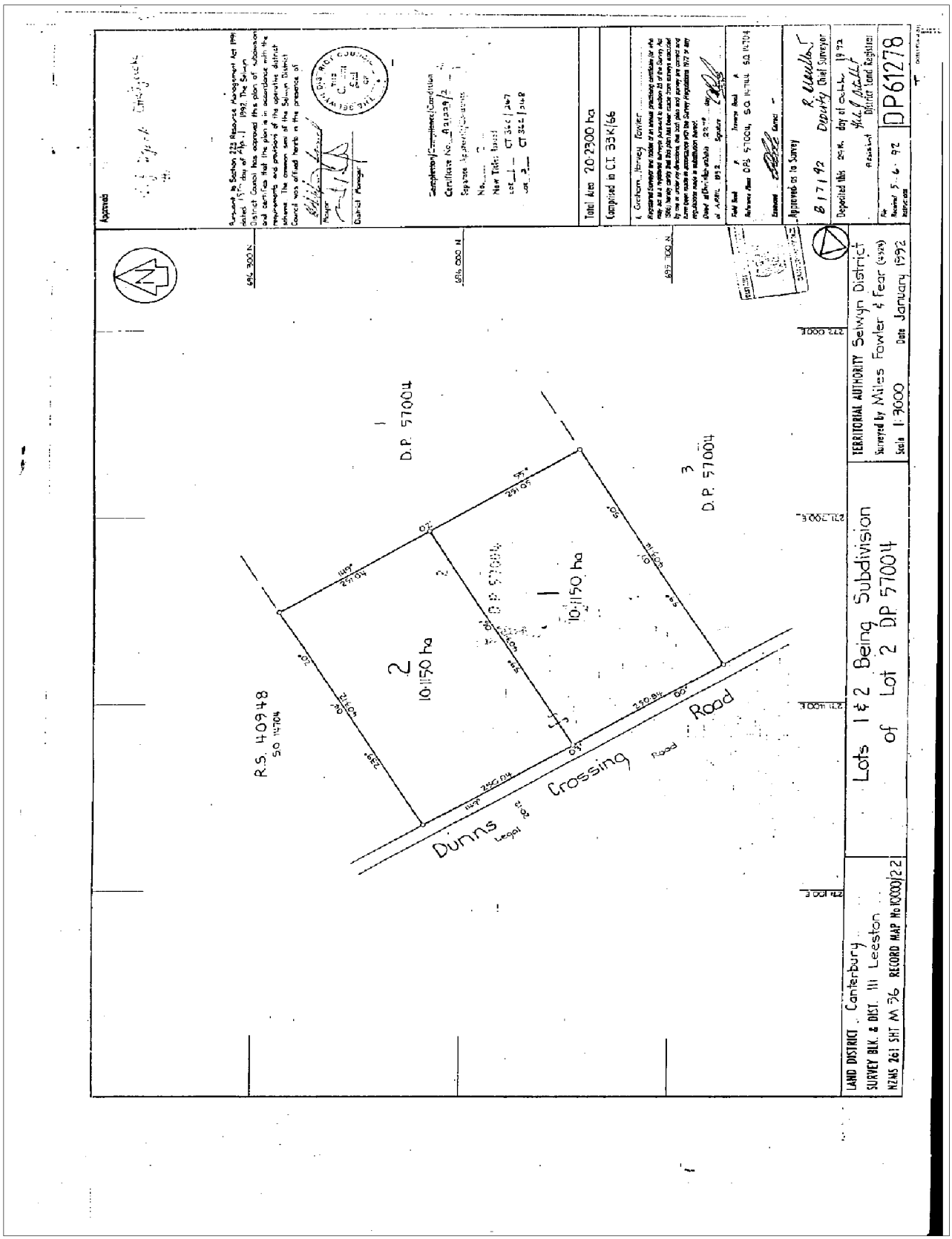
for A.L.R.

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

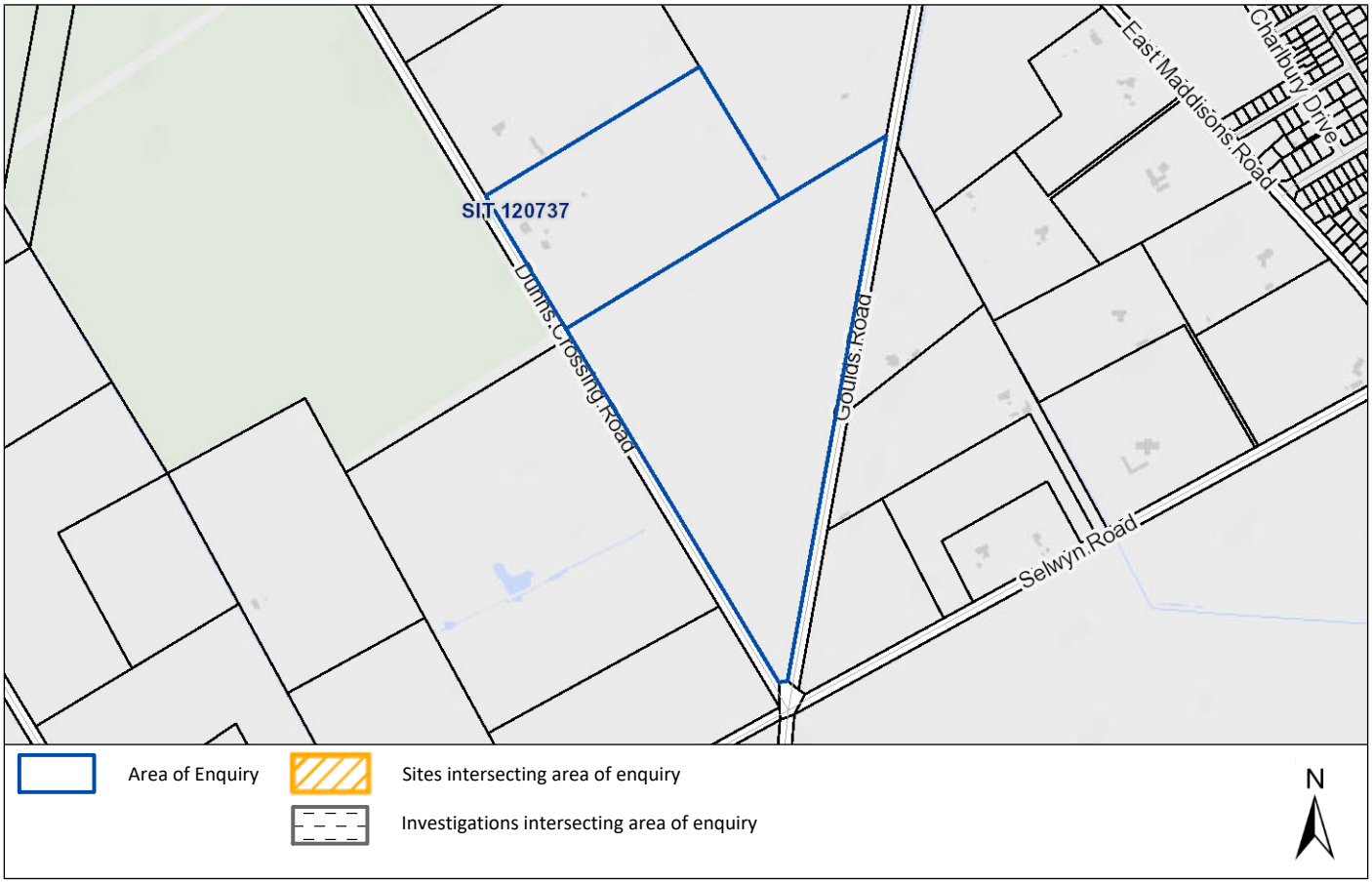
Customer Services
P. 03 353 9007 or 0800 324 636

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.

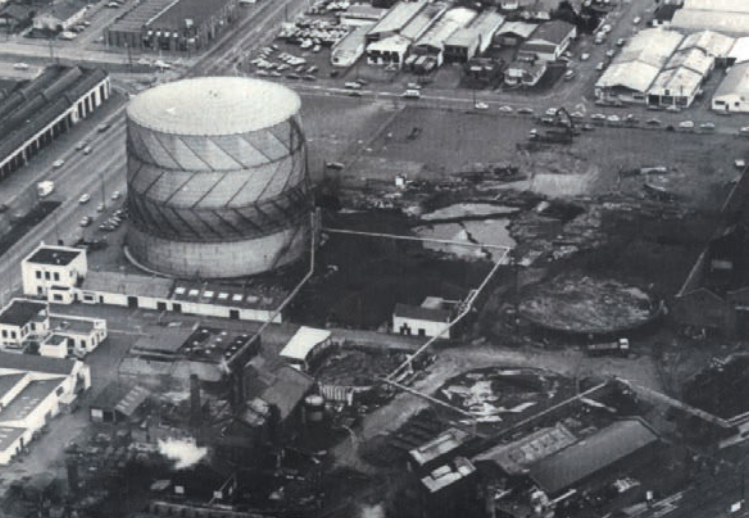
Please refer to the Site Categories and Definitions factsheet for further information.

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.

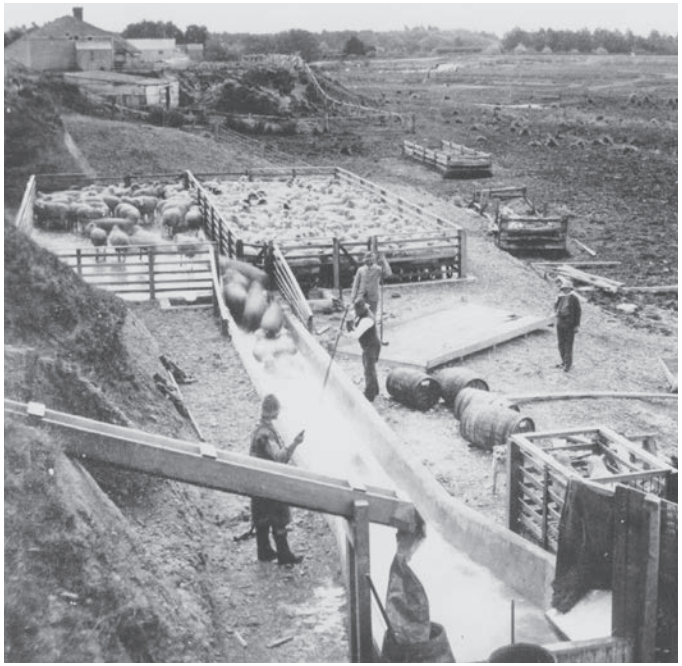
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

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
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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:

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

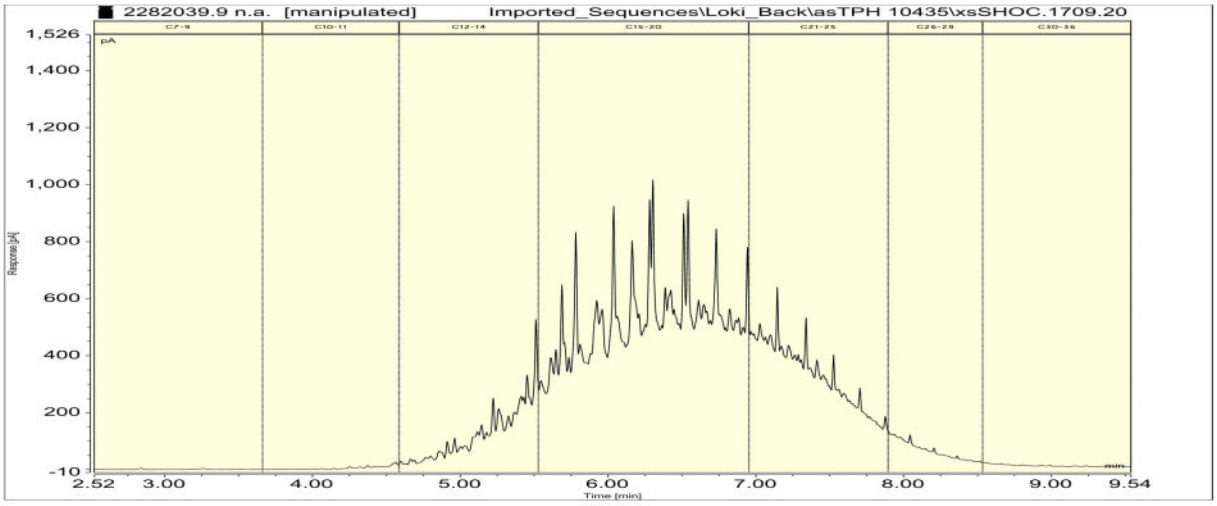
Sample Name:		HA06 @ 0.0-0.2 22-Nov-2019	HA07 @ 0.0-0.2 22-Nov-2019	HA08 @ 0.0-0.2 22-Nov-2019	SS01 @ 0.0 22-Nov-2019	SS02 @ 0.0 22-Nov-2019
Lab Number:		2282039.6	2282039.7	2282039.8	2282039.9	2282039.10
Individual Tests						
Dry Matter	g/100g as rcvd	80	84	78	75	77
Heavy Metals, Screen Level						
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
TRIED, TESTED AND TRUSTED

ANALYSIS REQUEST

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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					
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37					
38					
39					
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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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

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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

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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					

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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
Laboratory Manager
Key Technical Person

TERRA SCIENTIFIC

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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:
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.

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