Private Plan Change Request – Hughes Developments Limited
Appendix C – Preliminary and Detailed Site Investigations

ENGEO

Expect Excellence

Combined Preliminary and Detailed Site Investigation

1066 West Coast Road

West Melton

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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 1066 West Coast Road, West Melton (herein referred to as 'the site') situated on a 12.36 hectare property. The purpose of the assessment was to assess the property's suitability for a change of land use consent and subdivision under the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011* (NES) to satisfy the requirements of Selwyn District Council (SDC).

Figure 1 attached in Appendix 1 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 objectives of this assessment were to:

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

1.2 Approach

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

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

1.2.1 Review of Site Information

During this assessment, a number of sources of information were contacted for information relating to the site regarding its past and present uses. This included contacting Canterbury Regional Council (CRC) to determine if there were records on the Listed Land Use Register (LLUR) 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 9 July 2018 by Natalie Flatman of ENGEO.

2 Site Description and Setting

Site information is summarised in Table 1.

Table 1: Site Information

Item	Description
Location	1066 West Coast Road, West Melton
Legal Description	Lot 2 DP 34902
Property Owner	Property is under contract to Hughes Developments Limited
Current Land Use	Residential and Agricultural
Proposed Land Use	Residential
Site Area	12.36 ha
Building Construction	Main dwelling – concrete foundation, brick and timber cladding, metal roof. Various stables – concrete and open earth floors, breeze block, timber and metal walls, metal roofs.
Territorial Authority	Selwyn District Council

Table 2: Site Setting

Item	Description
Topography	The site is predominantly flat with slight undulations across the paddocks within the trotting track to the north of the site.
Local Setting	The surrounding area is a mix of agricultural, horticultural and residential.
Nearest Surface Water & Use	No surface water features were noted on-site or within 50 m of the site.
Geology	Late Quaternary unconsolidated to poorly consolidated mud, sand, gravel and peat of alluvial and colluvial origin.
Hydrogeology	The site is located over an unconfined / semiconfined gravel aquifer.
Groundwater Abstractions	There are no groundwater abstractions located on the site and seven within 100 m of the site: M35/1013: AR & JR Dunn, active well west of the site (28 m bgl) for domestic and stockwater. M35/9443: P & J Rowlands, active well east of the site (36 m bgl) for domestic and stockwater. M35/7353: PA & JM Lenton, active well east of the site (39 m bgl) for irrigation and domestic supply. M35/10753: Apex Industries (Christchurch) Limited, active well northwest of the site (42 m bgl) for domestic supply.
Discharge Consents	There are no active discharge consents located on the site and one active consent within 250 m of the site: CRC090354: DA Miller, active, discharge domestic sewage to ground.

3 Site History

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

3.1 Discussions with Site Owner

After the site walkover, discussions were had with the site occupier in regards to past and present uses of the site. It was confirmed that the 100 L blue containers near the pump shed were used for storage of stock water and that the large piles and bags of plastic along the tree line to the east of the stables were silage wraps and would be removed from site.

3.2 Selwyn District Council Property File

The property file for the site held by Selwyn District Council was reviewed on 10 July 2018 as part of the PSI. The below was identified in the property file search:

- 11 May 1978 Building Permit for residential dwelling;
- 29 July 1976 Building Permit for farm buildings;
- 23 December 1976 Building Permit for loose boxing buildings (stables);
- 28 July 1978 Building Permit for loose boxing buildings (stables);
- 21 May 1988 Building Permit for stable (south of dwelling); and
- 12 February 2014 Consent for two Solid Fuel Heaters (domestic dwelling).

3.3 Certificate of Title

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

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. 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 1 May 2018 for the site and is presented in Appendix 3. No areas of concern were identified on the CRC LLUR for the site.

3.5 Historical Aerial Photograph Review

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

Table 3: Aerial Photographs

Date	Source	Description
1940-1944	Canterbury Maps	The site appears to be used for agricultural grazing. There is a visible cluster of three buildings to the south of the site. The buildings appear to be farm buildings/garage. There are two rows of trees running east-west around the eastern most building. The surrounding area of the site is used for agricultural grazing. Halkett Road bounds the site to the north and West Coast Road bounds the site to the south.
1960-1964	Canterbury Maps	The site appears mainly unchanged. A small shed has been constructed near the other three buildings to the south of the site. There are some visible tracks through the paddocks, it is unclear what would have created these tracks but is presumed to be from machinery or animals. There is a large trotting track present on the site to the west, the remaining surrounding area remains unchanged.

Date	Source	Description
1965-1969	Canterbury Maps	The northern most building in the south of the site has been removed from site. The site appears to still be used for agricultural grazing – sheep are visible in most paddocks. The northern-most section of the site is missing from the photograph. The remainder of the surrounding area is unchanged.
1975-1979	Canterbury Maps	No changes from the previous aerial photograph.
1980-1984	Canterbury Maps	A trotting tack has been developed in the north section of the site. The farm buildings from the previous aerial photographs have been removed from the site along with the two tree lines running east-west near the buildings. A dwelling has been constructed near the west boundary line with stables or other farm buildings present southeast of the dwelling (in the same area as the previous buildings). One smaller building is present south of the dwelling. The surrounding area remains unchanged.
1990-1994	Canterbury Maps	The site remains mainly unchanged. The dwelling and stables from the previous aerial photographs are still present on-site. The south of the site is still used for agricultural grazing. The trotting track on the north of the site appears to be double tracked, two tracks running adjacent to another. A small shed appears to be present north of the dwelling. A residential dwelling has been constructed to the east of the site and one building has been constructed to the west. No other major changes are visible to the surrounding area.
2004-2010	Canterbury Maps	The site appears mainly unchanged. Glasshouses have been constructed to the east of the site (117 Halkett Road). Residential dwellings have also been constructed at 123 and 133 Halkett Road to the east. The site to the west remains mainly undeveloped.
2017	Canterbury Maps	The site remains mainly unchanged. The small shed to the north of the dwelling has either been removed or moved slightly to the east of its position from the 1990-1994 aerial photograph. The site to the west of 163 Halkett Road has been developed into a residential subdivision with numerous dwellings present.

4 Current Site Conditions

A site walkover investigation was undertaken on 9 July 2018 by Natalie Flatman of ENGEO. The information gathered is summarised in Table 4. Photographs taken during the site investigation are included in Appendix 4.

Table 4: Current Site Conditions

Site Condition	Comments
Visible signs of contamination	No visible signs of contamination were noted on site.
Surface water appearance	No surface water was observed on-site.
Local sensitive environments	No local sensitive environments were observed on site or within 50 m of the site boundary.
Visible signs of plant stress	No visible signs of plant stress were noted on-site.
Potential for on or off-site migration of contaminants	The potential for on or off-site migration is considered low.
Additional observations (if any)	Several 100 L blue drums were stored next to the pump shed – east of the dwelling. It was confirmed with the site occupier that these were used for water storage for stock on site. Three small 10 L containers for fertilizer were also noted behind the pump shed. They appeared to be old containers of Reaction liquid fertiliser – a nitrogen based fertiliser. Due to the small amount of containers stored, it is presumed that the fertiliser was used in a small scale. Paint storage was present in one of the storage sheds near the stables. The paint cans appeared to be sealed and no staining on the surrounding soils was noted. Large bags of plastic waste were noted in the tree line east of the stables. It was confirmed with the site occupier that these are left over from silage and would be removed from site. A large sump pit was noted in the middle of the trotting track along the eastern stretch. It was confirmed with the site occupiers that it was dug approximately 30 years ago as a drainage pit to try and dewater the north paddocks. It has not been used as a waste pit and was visually clear of contaminants. The areas where the former farm buildings were located are now encapsulated by gravel driveway areas and building footprints. No PACM was visually identified on the surface in these areas. Please refer to Figure 2 for the footprints of former buildings.

5 Potential HAIL Activities

Activities included on the HAIL trigger the requirement for a contaminated land investigation prior to development. While no activities have been identified on the LLUR for the site, the following observations noted during the site walkover included:

- E1: Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition; house was built prior to 2000 and may contain asbestos.
- I. Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.

Further information regarding the areas of potential concern have been summarised in Table 5 below:

Table 5: Potential HAIL Activities

Potential Source of Contamination	Contaminants of Concern	Possible extent of contamination	HAIL activity as defined by the NES (soil)
Main dwelling, stables, sheds and footprints of previous garages / farm buildings	Asbestos	Around main residential dwelling, stables, sheds and south of dwelling in gravel driveway area	E1: Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition
Trotting Track	Heavy metals PAH's Asbestos	Trotting track and soils directly adjacent to the track	I: Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.

There was no evidence on the remainder of the site of activities included on the HAIL having been undertaken.

6 Intrusive Investigation

Based on the review of the historical site uses, the potential COC's identified as a part of this investigation were heavy metals, polycyclic aromatic hydrocarbons and asbestos related with the trotting track and asbestos from previous and present buildings on site.

A total of four intrusive investigation samples were completed across the trotting track area. Soil samples were collected from each location to assess the potential risks to human health posed by the historical contamination sources, disposal options for soils removed during the redevelopment works and the suitability of the site for the intended long-term site usage (residential subdivision).

Please note that a visual inspection was made of the soils surrounding the dwelling to the north and south and to the north of the current stables, which are the areas of the former farm buildings. No potentially asbestos containing material (PACM) was observed on the surface soils, therefore no samples were taken from these areas. As a large portion of the former building footprints are currently encapsulated by current building footprints and gravel driveways, it is recommended that if these buildings are to be removed that after the demolition an asbestos soil investigation is undertaken in these three areas.

6.1 Fieldwork Methodology

The following fieldwork methodology was undertaken:

- Completion of four sample locations across the trotting track area with soil samples taken from between 0.0 and 0.25 m bgl, depending on location. The depths were considered suitable to provide an indication of potential impacts from the former uses of the site and to assess potential impacts to future land users and disposal locations.
- All soil samples collected were placed in jars supplied by RJ Hill Laboratories (Hills), which were then capped, labelled with a unique identifier and placed in chilled containers (chilly bins) prior to transportation to the laboratory. Samples were transported to Hills under standard ENGEO chain of custody documentation provided in Appendix 5. Asbestos samples were placed in zip lock bags, double bagged and transported to Environmental and Industrial Analysis Group (EIAG) for semi-quantitative analysis for asbestos in soil.
- 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 the collection of each sample, the sampling equipment was decontaminated by washing with a solution of Decon90 and rinsing with tap water followed by deionised water.
- The intrusive samples were completed in accordance with ENGEO standard operating procedures with geological logging completed in general accordance with the New Zealand Geotechnical Society Inc. ‘Guidelines for the Field Classification of Soil and Rock for Engineering Purposes’ December 2005.
- All fieldwork and sampling was completed in general accordance with the procedures for the appropriate handling of potentially contaminated soils as described in the MfE *Contaminated Land Management Guidelines No.5: Site Investigation and Analysis of Soils*.
- Samples were collected from a hand trowel at each location and inspected for visual and olfactory indicators of contamination.

6.2 Quality Assurance and Quality Control

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

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

- Following receipt of the samples by Hills and EIAG, the soil samples were scheduled for analysis of the identified contaminants of concern.

7 Regulatory Framework and Assessment Criteria

7.1 NES

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

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

The NES requires the *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values* be used where a NES SCS is not available. The NES does not consider environmental receptors; accordingly, the application of guidelines relevant to environmental receptors shall be implemented according to the MfE CLMG No.2 and any relevant rules in the Regional Plan.

7.2 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 fill sites to licensed Class A and B Landfills. As outlined in the publication “A Guide to the Management of Clean Fills” (MfE, 2002), cleanfill is defined as:

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

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

7.3 Assessment Criteria

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

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

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

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

Where appropriate, the standard NES criteria, and other applicable guideline criteria, were adjusted according to the requirements for composite samples specified in the MfE (2011) *Contaminated Land Management Guidelines No.5 – Site Investigation and Analysis of Soils*.

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

The asbestos assessment criteria have been outlined in Section 7.4 below.

7.4 Asbestos in Soil

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

The BRANZ guideline criteria have been adopted as investigation criteria for this assessment and are presented in Table 2.

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				

Form of asbestos		Soil guideline values for asbestos (w/w)			
		Residential[1]	High-density residential[2]	Recreational[3]	Commercial and Industrial[4]
Depth[7]	Hard cap	No depth limitation, no controls – except for long-term management			
	Soft cap	≥0.5 m			≥0.2 m

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.

8 Results

8.1 Field Observations

A summary of the field observations is presented in Table 6.

Table 7: Summary of Ground Conditions

Location	Depth	Description
TTSS1, TTSS2, TTSS3, TTSS4	0.0-0.25	SILT with minor gravel and trace shell; brown
	0.25-0.4	SILT with trace sand; brown.

Soil analytical results and the adopted soil assessment criteria are presented in Table 7 and asbestos soil results are presented in Table 8. Certified laboratory reports are included in Appendix 5.

The analytical results can be summarised as follows:

- No exceedances of the Residential Land Use Guideline criteria were observed in the soil samples analysed.
- No exceedances of the Regional Background levels for the site were observed in the soil samples analysed.
- All polycyclic aromatic hydrocarbon samples returned below the laboratory detection limit.
- No asbestos fibres were identified in the samples submitted for semi-quantitative analysis.

Table 8: Laboratory Sample Analysis Results

Sample Name	TT SS1	TT SS2	TT SS3	TT SS4	Human Health Criteria – Residential Land Use ALL PATHWAYS[a]	Human Health Criteria – Commercial / Industrial Outdoor Worker (unpaved)[a]	Regional Background Criteria – Trace Elements (Level 2)[b]	
Soil Type	SILT	SILT	SILT	SILT				
Sample Depth, m	0.0-0.2	0.0 - 0.2	0.0 - 0.2	0.0-0.2				
Heavy Metals in soil, mg/kg								
Arsenic	3	3	3	2	20	70	12.58	6.35
Cadmium[c]	<0.10	<0.10	<0.10	<0.10	3	1,300	0.19	0.14
Chromium[d]	10	10	11	9	460	6,300	22.7	19.89
Copper	6	6	6	8	>10,000	>10,000	20.3	11.68
Lead	8.3	9.6	9.0	7.2	210	3,300	40.96	19.75
Nickel	8	9	10	8	400	6,000[c]	20.7	13.91
Zinc	29	33	33	26	7,400	400,000[c]	93.94	69.58

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

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

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

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

[c] Assumes soil pH of 5.

[d] Criteria for Chromium VI were conservatively selected.

Table 9: Asbestos Semi-quantitative Results

Sample Name	Depth (m)	Description of Asbestos Form	Asbestos as FA/AF (% w/w)
TTSS1	0.0-0.2	No asbestos detected	-
TTSS2	0.0-0.25	No asbestos detected	-
TTSS3	0.0-0.2	No asbestos detected	-
TTSS4	0.0-0.2	No asbestos detected	-

9 Conceptual Site Model

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

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

The potential source, pathway, receptor linkages at this subject site are provided in Table 10

Table 10: Conceptual Site Model Summary

Potential Sources	Contaminants of Concern	Exposure Route and Pathways	Receptors	Acceptable Risk? Do samples meet acceptance criteria?
Trotting track	Heavy metals PAHs Asbestos	Dermal contact with impacted soil, inhalation of dust / fibre and incidental ingestion during earthworks and long term use of the site.	Onsite redevelopment workers. Future subsurface maintenance workers. Future residential land users.	**Yes**. No exceedances of the guideline criteria observed in the soils sampled.
Former farm buildings	Asbestos	Dermal contact with impacted soil, inhalation of dust / fibre and incidental ingestion during earthworks and long term use of the site.	Onsite redevelopment workers. Future subsurface maintenance workers. Future residential land users.	**Yes.** Visual evidence suggests no ACM is present on site but large portions of previous building footprints are encapsulated. Investigation of these areas should be undertaken if they are to be disturbed.

10 Conclusions and Recommendations

ENGEO Ltd was engaged by Hughes Developments Ltd to undertake a Preliminary and Detailed Site Investigation at a 12.36 ha site, situated at 1066 West Coast Road, West Melton, for a change in land use, subdivision and soil disturbance consent. Information was gathered and reviewed regarding the current and past uses of the site that could have resulted in releases or potential releases of hazardous substances to the subject property.

The review of information identified that the site has been used for agricultural grazing from circa 1940, and residential land use with a trotting track and various stables since 1980's.

During the review of the SDC property file the main dwelling was constructed in 1978, with several stables and farm buildings being constructed between 1976-1988. 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. ENGEO understands that the residential buildings are to remain on-site, however confirmation should be sought during redevelopment.

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

During the site walkover and the trotting track was sampled for impacted imported fill material. It was noted that the imported fill consisted of gravel and shells. The laboratory analysis of four samples from around the trotting track area were submitted for analysis for heavy metals, PAHs and asbestos semi-quantitative analysis. All four samples returned concentrations below the site specific regional background criteria and the applicable NES human health criteria. No asbestos fibres were detected in any of the four samples.

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

During the site walkover visual inspections were also made around the footprint areas of the former farm buildings. No visual PACM was noted during the visual inspection but as a large portion of the former footprints are currently encapsulated by the dwelling, gravel driveway and stables it is recommended that an asbestos soil investigation is undertaken after the demolition or removal of these buildings to ensure that no asbestos containing material is present within these areas.
At present these areas are highly unlikely to present a health issue to the site users as potential asbestos containing material is likely to be encapsulated under hard standing.

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.

11 References

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

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

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

12 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Developments Limited, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

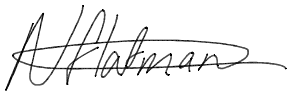
iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

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

v. This report is not to be reproduced either wholly or in part without our prior written permission.

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

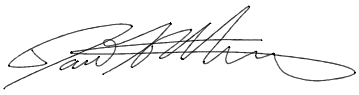
Report prepared by



Natalie Flatman

Environmental Scientist

Report reviewed by



Dave Robotham CEnvP, SC

Principal Environmental Consultant

APPENDIX 1:

Figures

ENGEO
Expect Excellence

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

Title: Location of Former Building Footprints

Client: Hughes Developments Limited

Project: 1066 West Coast Road
West Melton
Canterbury

Proj No: 15184.000.000

Designed:	NF
Drawn:	NF
Checked:	DR
Date:	Jul 18
Scale:	1:1,000

Figure No: 2

Size: A3

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

ENGEO
Expect Excellence

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

Title: Site Location and Sampling Locations

Client: Hughes Developments Limited

Project: 1066 West Coast Road
West Melton
Canterbury

Proj No: 15184.000.000

Designed: NF
Drawn: NF
Checked: DR
Date: Jul 18
Scale: 1:2,000

Figure No: 1
Size: A3
Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 2:

Certificate of Title

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**CB14A/1422**
Land Registration District	**Canterbury**
Date Issued	08 October 1974

Prior References
CB6D/871

Estate	Fee Simple
Area	12.3700 hectares more or less
Legal Description	Lot 2 Deposited Plan 34902

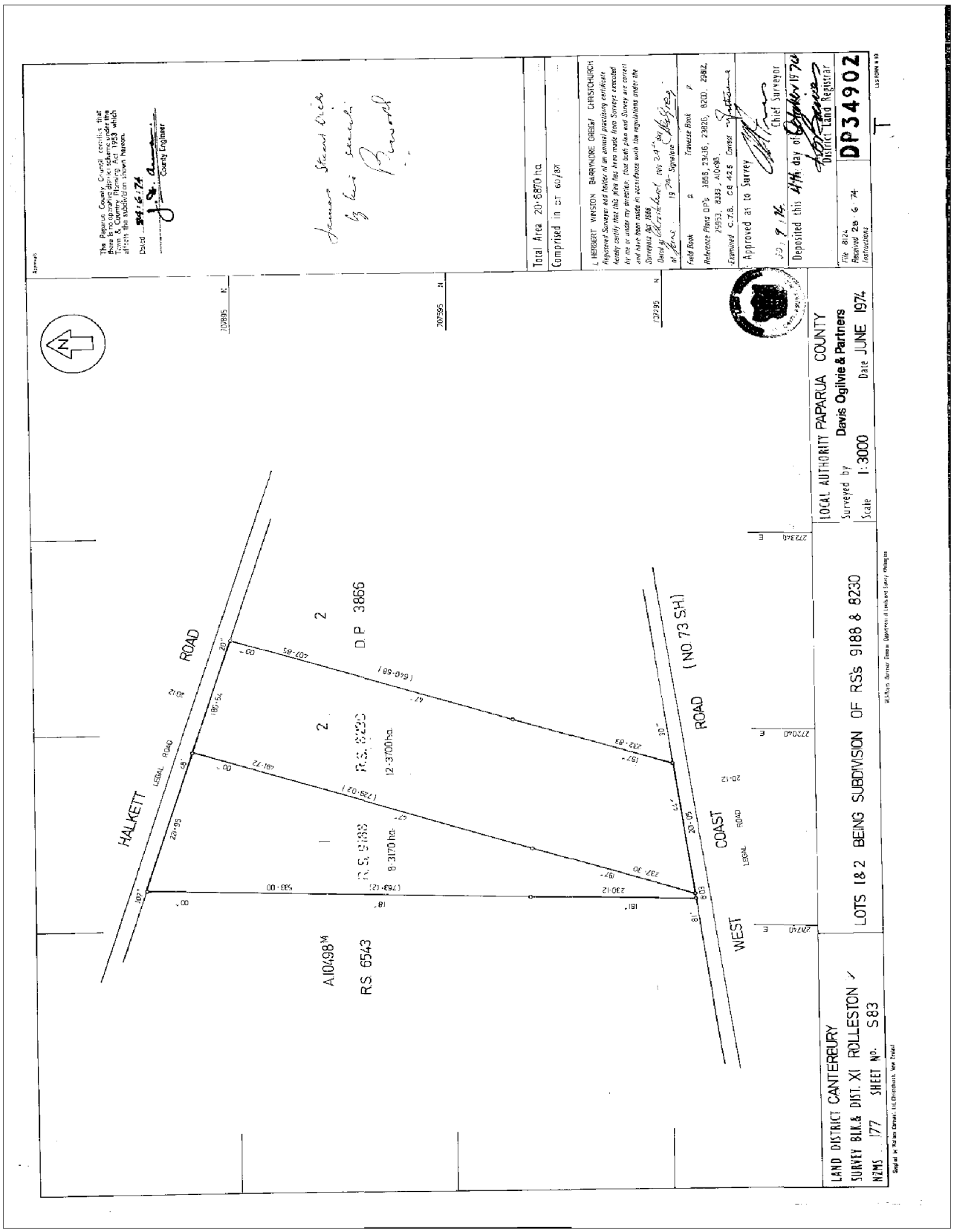
Proprietors
Margaret Patricia Dunn

Interests

723687 Notice declaring the State Highway adjoining the above land to be a limited access road - 30.10.1967 at 9.01 am

10007681.2 Mortgage to Westpac New Zealand Limited - 18.12.2015 at 12:38 pm

Identifier **CB14A/1422**



APPENDIX 3:

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

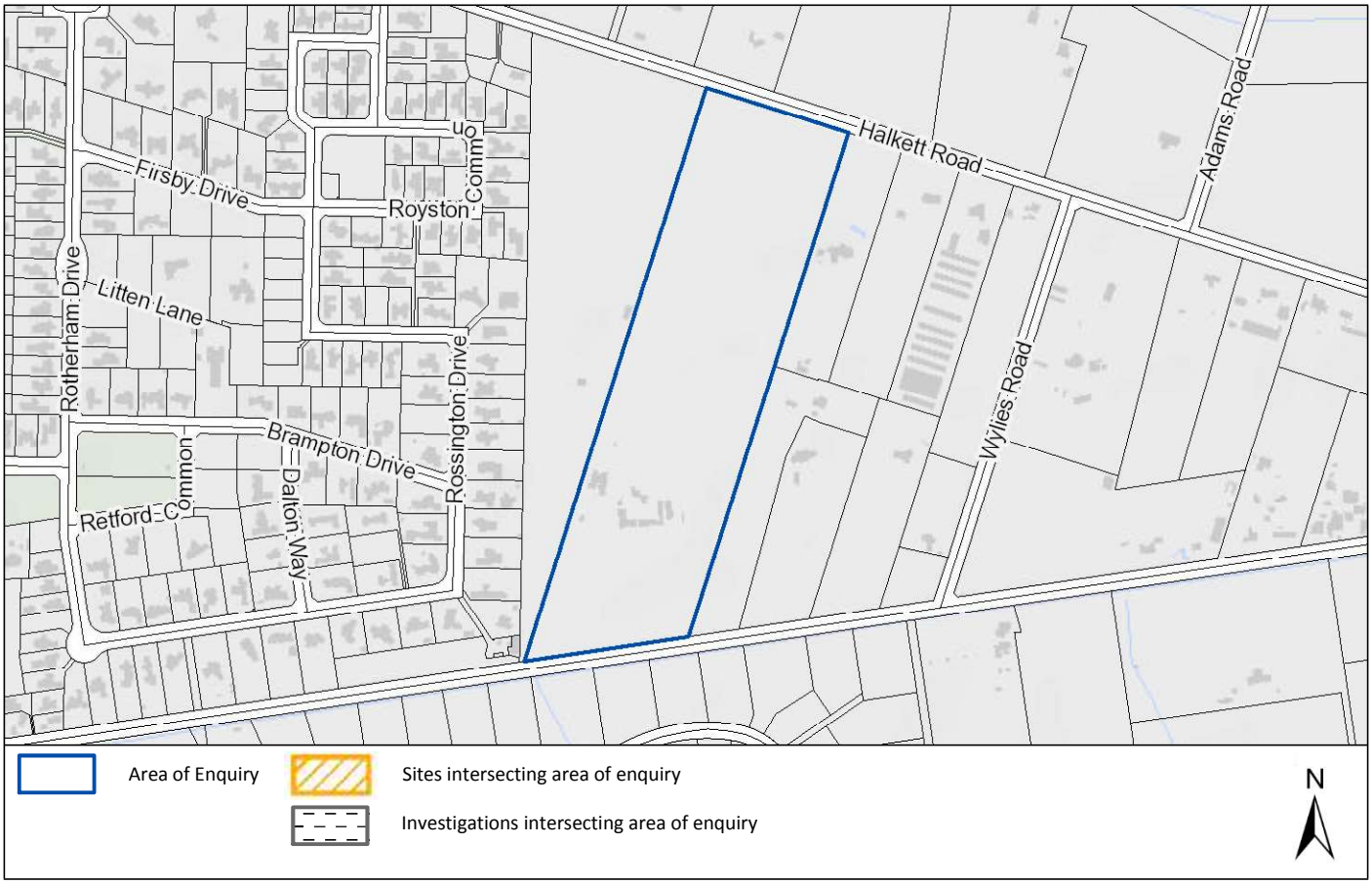
Customer Services
P. 03 353 9007 or 0800 324 636

PO Box 345
Christchurch 8140

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

www.ecan.govt.nz

Date:	28 June 2018
Land Parcels:	Lot 2 DP 34902 Valuation No(s): 2354113000



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

Summary of sites:

There are no sites associated with the area of enquiry.

Information held about the sites on the Listed Land Use Register

There are no sites associated with the area of enquiry.

Information held about other investigations on the Listed Land Use Register

For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ207234.

Disclaimer:

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

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

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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Listed Land Use Register

What you need to know

Everything is connected

What is the Listed Land Use Register (LLUR)?

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

Why do we need the LLUR?

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

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

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

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

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

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

We have two main ways of identifying HAIL sites:

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

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

How does Environment Canterbury classify sites on the LLUR?

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

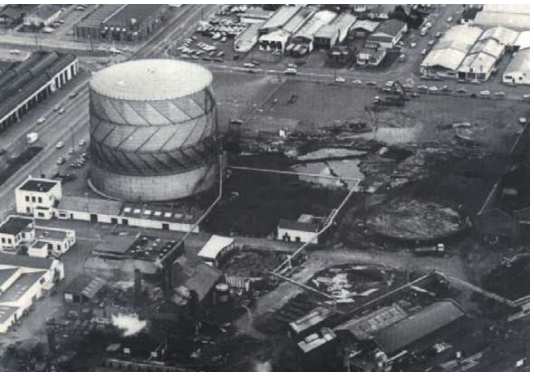
Please refer to the Site Categories and Definitions factsheet for further information.

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

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

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

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



IMPORTANT!

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

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

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

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

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

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

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

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

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

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

Contact us

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

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

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

Contact Environment Canterbury:

Email: ecinfo@ecan.govt.nz

Phone:
Calling from Christchurch: (03) 353 9007
Calling from any other area: 0800 EC INFO (32 4636)

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Everything is connected

Promoting quality of life through balanced resource management.

www.ecan.govt.nz E13/101

Listed Land Use Register

Site categories and definitions

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

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

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

Not investigated:

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

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

At or below background concentrations:

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

Below guideline values for:

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

Managed for:

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

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

Partially investigated:

The site has been partially investigated. Results:

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

Significant adverse environmental effects:

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

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

Contaminated:

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

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

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

Verified non-HAIL:

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

Please contact Environment Canterbury for further information:

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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

E13/102

APPENDIX 4:

Site Photographs

Photo 1: Dwelling

Photo 2: Eastern stables

Photo 3: Southern stables

Photo 4: Inside of stables

Photo 5: Plastic storage in stables

Photo 6: Paint storage in stables

ENGEO
Expect Excellence

Date taken	July 2018	**Client**	**Hughes Developments Ltd**
Taken by	NF	**Project**	**1066 West Coast Road, West Melton**
Approved by	DR	**Description**	**Site Photographs**
Photo No.	1 to 6	**ENGEO Ref.**	**15184.000.000**

Photo 7: Waste Area east of stables

Photo 8: Waste on trailer - east of stables

Photo 9: Plastic storage in treeline east of stables

Photo 10: Silage south of trotting track

Photo 11: 100L water storage containers near pump shed

Photo 12: Fertiliser containers north of pump shed

ENGEO
Expect Excellence

Date taken	July 2018	**Client**	**Hughes Developments Ltd**
Taken by	NF	**Project**	**1066 West Coast Road, West Melton**
Approved by	DR	**Description**	**Site Photographs**
Photo No.	7 to 12	**ENGEO Ref.**	**15184.000.000**

Photo 13: Paddocks towards the south of the site

Photo 14: West of trotting track looking north

Photo 15: Paddocks in the middle of trotting track

Photo 16: Paddocks in middle of trotting tack, looking north

Photo 17: Typical soil profile below trotting track

Photo 18: Drainage sump on east stretch of trotting track

ENGEO
Expect Excellence

Date taken	July 2018	**Client**	**Hughes Developments Ltd**
Taken by	NF	**Project**	**1066 West Coast Road, West Melton**
Approved by	DR	**Description**	**Site Photographs**
Photo No.	13 to 18	**ENGEO Ref.**	**15184.000.000**

APPENDIX 5:

Laboratory Certificates

Hill Laboratories
TRIED, TESTED AND TRUSTED

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

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

Certificate of Analysis

Client:	Engeo Limited	**Lab No:**	2012758	SPv1
Contact:	Natalie Flatman	**Date Received:**	10-Jul-2018	
	C/- Engeo Limited	**Date Reported:**	13-Jul-2018	
	PO Box 373	**Quote No:**	82742	
	Christchurch 8140	**Order No:**		
		Client Reference:	15148.000.000	
		Submitted By:	Natalie Flatman	

Sample Type: Soil

Sample Name:		TT SS1 @ 0.0-0.2 09-Jul-2018 12:00 pm	TT SS2 @ 0.0-0.25 09-Jul-2018	TT SS3 @ 0.0-0.2 09-Jul-2018	TT SS4 @ 0.0-0.2 09-Jul-2018	
Lab Number:		2012758.1	2012758.2	2012758.3	2012758.4	
Individual Tests						
Dry Matter	g/100g as rcvd	94	93	90	93	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	2	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	10	10	11	9	-
Total Recoverable Copper	mg/kg dry wt	6	6	6	8	-
Total Recoverable Lead	mg/kg dry wt	8.3	9.6	9.0	7.2	-
Total Recoverable Nickel	mg/kg dry wt	8	9	10	8	-
Total Recoverable Zinc	mg/kg dry wt	29	33	33	26	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
1-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
2-Methylnaphthalene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Perylene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	-
Acenaphthylene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Acenaphthene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Benzo[a]anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Benzo[e]pyrene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Chrysene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Fluoranthene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Fluorene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Naphthalene	mg/kg dry wt	< 0.06	< 0.06	< 0.06	< 0.06	-
Phenanthrene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-
Pyrene	mg/kg dry wt	< 0.011	< 0.011	< 0.011	< 0.011	-

Analyst's Comments

Appendix No.1 - Chain of Custody

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-4
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 - 0.05 mg/kg dry wt	1-4
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1-4
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1-4
Benzo[a]pyrene Toxic Equivalence (TEF)	BaP Toxic Equivalence calculated from Benzo(a)anthracene x 0.1 + BaP x 1 + Benzo(b)fluoranthene x 0.1 + Benzo(k) fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.1 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1-4

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

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

Ara Heron BSc (Tech)
Client Services Manager - Environmental

Job No: 201 2758 Date Recv: 10-Jul-18 06:34

Received by: Kayley Steel

3120127582

ENVIRONMENTAL Analysis Request Form

Hill Laboratories

R J Hill Laboratories Limited — accredited by International Accreditation NZ

1 Clyde Street, Telephone: +64 (7) 858-2000
Private Bag 3205, Facsimile: +64 (7) 858-2001

Hill Laboratories

CLIENT

Name ENGEO Ltd. [160117]
PO Box 373
Christchurch 8140

Phone: 03 328 9012 Fax:

Client Reference: 15148.000.000 (Project Code)

Quote Number: Order No: (Cost Centre)

Hill Laboratories office use only:
Date In Job # No. of Samples

Submitted By Natalie Hatman

Charge To: ENGEO. [160117]

RESULTS TO ☐ Mail Client ☐ Mail Submitter

☐ Fax Results
X Email Results nHatman@engeo.co.nz

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

Additional Information

May Contain Asbestos

Chain of Custody Record

Delivered to Hill Laboratories (Depatched by)	Date & Time: N Hatman 9/7/2018 Name: Signature:
Received at Hill Laboratories	Date & Time: Name: Signature:
Condition ☐ Ambient Temp ☑ Chilled 6.9 °C	

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

Sample types

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

Site ID	Sample type	Tests required	Comments
TT SS1 @ 0.0-0.2	ES	Heavy metals & PAHs	
TT SS2 @ 0.0-0.25	ES	" "	
TT SS3 @ 0.0-0.2	ES	" "	
TT SS4 @ 0.0-0.2	ES	" "	

Date: Wednesday 11th July 2018

Client Reference: 15148.000.000

ENGEO
124 Montreal Street
Sydenham
Christchurch, 8023

EIAG Reference No: F10033

For the Attention of: Natalie Flatman

Dear Natalie,

Re: 15148.000.000

Test Method – EIAG001: Polarised light microscopy including dispersion staining in accordance with the Australian Standard AS4964-2004 "Method for the qualitative identification of asbestos in bulk samples".

Where material weights passed through a 2mm sieve and are greater than 100g, representative sub samples of 50g were taken by cone and quartering using EIAG's in house method in accordance with the Australian Standard AS4964-2004.

Asbestos is reported as weight (g) found in each sample/sub sample. Where asbestos has been identified it has been broken down into three categories.

Identified asbestos is reported as either
ACM- Asbestos Containing Material
FA- Fibrous Asbestos
AF- Asbestos Fines

The samples in this report are reported 'As Received'. The Environmental and Industrial Analysis Group does not take responsibility for the sampling procedure or accuracy of sample location description as these have been provided by the client.

Four samples were received on Tuesday 10th July 2018. The samples were taken from 15148.000.000

The fibre identification analysis results are presented in the appended table.

Should you require further information please contact Belinda Hughes.

Yours sincerely

BHughes

…….
Belinda Hughes
Key Technical Person
ENVIRONMENTAL AND INDUSTRIAL ANALYSIS GROUP

IANZ ACCREDITED LABORATORY ACCREDITATION Nº: 1115

EIAG ENVIRONMENTAL & INDUSTRIAL ANALYSIS GROUP

ASBESTOS ANALYSIS REPORT

Wednesday 11th July 2018 **Reference No: F10033**

Laboratory Reference No.	Client Sample No.	Sampling Address/Sampling Location/Description/Dimensions	Fibre Identification Analysis Results
F10033.1	SS1	15148.000.000 TTSS1 @0.0-0.2, Soil	
		>10 mm Sample weight: N/A	
		10-2 mm Sample weight: 250.75 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 541.88 g) Sub sample weight: 51.41 g	Organic Fibres No Asbestos Detected
		Total sample weight: 792.63 g	
F10033.2	SS2	15148.000.000 TTSS2 @0.0-0.25, Soil	
		>10 mm Sample weight: N/A	
		10-2 mm Sample weight: 215.93 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 400.47 g) Sub sample weight: 51.17 g	Organic Fibres No Asbestos Detected
		Total sample weight: 616.40 g	
F10033.3	SS3	15148.000.000 TTSS3 @0.0-0.2, Soil	
		>10 mm Sample weight: N/A	
		10-2 mm Sample weight: 241.04 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 496.13 g) Sub sample weight: 52.09 g	Organic Fibres No Asbestos Detected
		Total sample weight: 737.17 g	

IANZ ACCREDITED LABORATORY ACCREDITATION Nº: 1115

EIAG ENVIRONMENTAL & INDUSTRIAL ANALYSIS GROUP

ASBESTOS ANALYSIS REPORT

Wednesday 11th July 2018 **Reference No: F10033**

Laboratory Reference No.	Client Sample No.	Sampling Address/Sampling Location/Description/Dimensions	Fibre Identification Analysis Results
F10033.4	SS4	15148.000.000 TTSS4 @0.0-0.2, Soil	
		>10 mm Sample weight: N/A	
		10-2 mm Sample weight: 305.17 g	Organic Fibres No Asbestos Detected
		<2mm (Sample weight: 600.50 g) Sub sample weight: 52.64 g	Organic Fibres No Asbestos Detected
		Total sample weight: 905.67 g	

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

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

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

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Identified By:

……

Holly Eeg BA (ERSc & Anth)
Laboratory Technician

Reviewed By:

……

Jessica Campbell BSc (Geol & Geog)
Laboratory/ Quality Manager

Form No: QLA001 – A	CONTROLLED DOCUMENT
CHAIN OF CUSTODY FORM – ENGEO	Version Number: 1 Issue Date: August 2016 Authorised By: Jessica Campbell *Document is Uncontrolled When Printed*
EIAG Contact Name:	**Receiving Laboratory:** Please complete sample receipt details below and email copy of COC to EIAG contact
EIAG Contact Email:	
Client Business Name: ENGEO	
Contact Name:	**Received By:**
Company Address: 124 Montreal Street	**Date & Time:**
Contact No: Natalie Flatman	**Signature:**
Report Email: nflatman@engeo.co.nz	**ENGEO Ref. #:** 151.48,000.000
Account Email:	**Client Ref. #:**
Sample Details: VFC – Vinyl Floor Covering IB – Insulation Board S/C – Skim Coat T/C – Textured Coating VFT – Vinyl Floor Tile w PB – With Paper Backing	**COC emailed to EIAG: Yes / No** *(Circle)* **Turn Around time Requested** *(Circle)* 3 - 5 Business days (48 Hour) ~~24 Hour~~
Site Reference: 151148.000.000	**Analysis Required**
Accessibility:	**Sampled By:** NF
Time & Date: 9/7/18	**AS RECEIVED**

Lab. Sample Number	Client Sample Number	Product	Sample Location: *(Provide the information you require on the analysis report)*	Bulk ID	Fibre. C	SG Bulk	Bulk	Tape	Dust	Soil/Ore
	SS1	Soil	TP SS1 @ 0.0-0.2			✓				
	SS2	Soil	TP SS2 @ 0.0-0.25			✓				
	SS3	Soil	TP SS3 @ 0.0-0.2			✓				
	SS4	Soil	TP SS4 @ 0.0-0.2			✓				

Number of Samples Received: 4	Date required: 12.07.18
Date/Time Received: 10.07.18 9:13 am	Results to be sent to client by:
Name: Jane Pankhurst	Email ☑ Post ☐
Signature:	
Job Number: 710 033	
WFM UPDATED WITH SAMPLE AMOUNT AND COSTS: YES / NO	

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