# PRELIMINARY AND DETAILED SITE INVESTIGATION TO SUPPORT PROPOSED PLAN CHANGE 104 TOWNSEND ROAD AND 141 SOUTH BELT, WAIMAKARIRI, RANGIORA

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# PRELIMINARY AND DETAILED SITE INVESTIGATION TO SUPPORT PROPOSED PLAN CHANGE 104 TOWNSEND ROAD AND 141 SOUTH BELT WAIMAKARIRI, RANGIORA

**Report prepared for:** Summerset Villages (Rangiora) Limited

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**Date:** 15 October 2019

**Copies to:** Summerset Villages (Rangiora) Limited 1 electronic copy

Riley Consultants Ltd 1 copy

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| 1.0 | Preliminary and Detailed Site Investigation | 1 February 2019 |
| 2.0 | Preliminary and Detailed Site Investigation (Boundary Readjustment) | 7 August 2019 |
| 3.0 | Preliminary and Detailed Site Investigation (Plan Change) | 20 September 2019 |
| 4.0 | Preliminary and Detailed Site Investigation (Plan Change) | 15 October 2019 |

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# PRELIMINARY AND DETAILED SITE INVESTIGATION TO SUPPORT PROPOSED PLAN CHANGE 104 TOWNSEND ROAD AND 141 SOUTH BELT WAIMAKARIRI, RANGIORA

## 1.0 Introduction

Riley Consultants Ltd (RILEY) has been engaged by Summerset Villages (Rangiora) Limited to undertake a Preliminary and Detailed Site Investigation (PSI/DSI) on a 13.83ha greenfield site, located in south-west Rangiora at 104 Townsend Road and 141 South Belt.

This is an update of our previous PSI/DSI (RILEY Ref. 170743-B, 7 August 2019) which was prepared in support of a boundary readjustment for the site. This report has been prepared to support a private plan change to amend parts of the Waimakariri District Plan (WDP) pursuant to Section 73(2) and Clauses 21(1) and 22 of the First Schedule to the Resource Management Act 1991 (RMA).

A PSI/DSI was necessary to assess the potential for on-site soil contamination, as the proposed plan change will enable more intensive residential use of the land and thus requires consideration in accordance with the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES-CS).

This report has been reviewed by a suitably qualified and experienced practitioner in contaminated land as required by the NES-CS. This report meets the general requirements of a Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI) in accordance with the Ministry for the Environment (MfE)'s Contaminated Land Management Guidelines (CLMG) No. 1: Reporting on Contaminated Sites in New Zealand (revised 2011), the MfE's CLMG No. 5: Site Investigation and Management of Soils (revised 2011) and the NES-CS.

### *1.1 Summary*

Key outcomes from this report are as follows:

- Samples tested across the site contained heavy metals (mainly lead, chromium and zinc) at concentrations greater than regional background criteria.
- Apart from one minor lead exceedance, no sampling results across the site were found to exceed relevant human health or ecological protection criteria.
- A Restricted Discretionary Activity resource consent will be required to be applied for under the NES-CS prior to future site development works. The NES-CS consent status will reduce to Controlled Activity if a retirement village rather than residential end-use is intended.
- Subject to remediation or management of a small area of the site and in accordance with a development-specific Site Management Plan (SMP) for the site, all land subject to the plan change is considered to be suitable for residential development and use, based on testing information to date.

# 2.0 Site Description, Location and Current Land Use

The property is located on the corner of Townsend Road and South Belt, within a flat-lying rural area in the town of Rangiora, approximately 29km north of Christchurch Central Business District. The is legally described as (shown in Figure 1 below):

- Lot 1 DP 45826 and Lot 3 DP 73557.

**Figure 1: Plan Change Site Location**


Legal Lot boundaries are shown on RILEY Dwg: 170743-2 (Appendix G).

The site is located in the south-western area of Rangiora township, with the northern site boundary adjoining South Belt, and Townsend Road adjoining the western boundary. East of the site is Southbrook Park, and the southern boundary adjoins Southbrook Stream (which flows west to east). The site slopes down very gently from the north-west to south-east.

The majority of the site area is currently grassed, with a horse training track present at the northern end, adjacent to South Belt. There are two dwellings and numerous farm buildings located in the north-western corner of the site.

Medium density residential property is located to the north of the site, and a substantial new residential subdivision known as Townsend Fields is currently under construction to the north-west of the site. Southbrook Park is located to the east of the site, with the remainder of the site is bounded by rural land. Vehicle access to the site is via two access points; one on the western boundary from Townsend Road and one from South Belt.

Contours derived from publicly available Light Detection and Ranging (LiDAR) data (September 2011) indicate a maximum ground surface elevation of approximately RL 26.0m at the north-western boundary and a minimum elevation of approximately RL 22.0m at the south-eastern boundary (Lyttelton Vertical Datum).

From a development perspective, the site is located within an area designated by the Waimakariri District Council (WDC) Planning Map as Residential 4B. However, it is proposed to change the zoning of the land to Residential 2 which would enable typical residential dwellings to be constructed on the site.

### *2.1 Proposed Development*

With reference to the WDP, the site is currently zoned Residential 4B. It is proposed to change the zoning of the land to Residential 2 zone which would enable typical residential sections and dwellings to be constructed on the site. It is also proposed to incorporate within the zone some specific rules to provide for the construction of a retirement village. This would result in allowing a retirement village to be constructed on all or part of the site, or all or part of the site to be developed for typical residential dwellings (in accordance with the Residential 2 zone rules).

In its current status (Residential 4B), the site can be developed into approximately 13 sections comprising lifestyle blocks with dwellings. The proposed new provisions for the Residential 2 zone will allow for up to 150 sections (and dwellings).

The proposed plan change will enable residential and high-density residential land uses. Soil testing results will therefore be assessed against these health-based soil contaminant standards, in addition to outdoor worker (unpaved) land use during works, environmental discharge criteria and regional background concentrations (please refer to Section 6.2 of this report).

## 3.0 Geology and Hydrogeology

The published geological map of the area as described in the Institute of Geological and Nuclear Science (GNS) geological QMAP for the area (Geology of the Christchurch Urban Area, 1:250,000 Geological Maps, 2008), indicates the site has surface geology consisting of dominantly alluvial river deposits (brownish-grey river alluvium) belonging to the Yaldhurst Member of the Springston Formation.

A review of the contours of depth to groundwater in metres below ground level (m bgl) presented by Canterbury Maps, indicates the unconfined groundwater table is expected to be encountered between 1.0m and 2.5m bgl across the site. A total of 15 groundwater wells were identified on the Environment Canterbury (ECan) Geographic Information System (GIS) database as being located within a 500m radius of the property.

## 4.0 Preliminary Site Investigation

A PSI was undertaken by RILEY to assess the potential risk of soil contamination relating to past and current activities carried out on-site in accordance with the Ministry for the Environment's Contaminated Land Management Guidelines No. 1 (MfE CLMG No. 1): Reporting on contaminated sites in New Zealand (revised 2011), and the NES-CS.

The PSI includes the following:

- Review of historic aerial photographs;
- ECan Listed Land Use Register (LLUR) check;
- Search and review of WDC property files and previous site investigations;
- Site walkover.

## *4.1 Historic Aerial Photographs*

As part of the investigation, historic aerial photographs for the site have been reviewed from 1940 to 2015 using the ECan online GIS database. A summary of the aerial photograph search is provided below. All images have been included within Appendix A.

**1940 to 1944:**

- The majority of the site is rural grassed farmland, with shelterbelts and paddocks which are similar to today's land use (neighbouring land is currently farmland).
- The initial buildings appear to comprise a farmhouse, pig pens, a barn, and several smaller sheds.
- The Southbrook Stream, located along the southern property boundary, meanders significantly more than today: i.e. the watercourse has been straightened over time.

**1945 to 1959:**

- There are no historic aerial photographs available for the site.

**1960 to 1964:**

- Several of the abovementioned buildings and the pig pens located in the north-western corner of the site appear to have been removed.
- Several sheds and barns, and a steel-trussed chicken cage building (measuring approximately 70m in length and 5m in width) have been constructed in the north-western corner of the site.
- A driveway has been formed in the north-western corner of the site, providing access to South Belt.

**1965 to 1969:**

- A second steel-trussed chicken cage building has been constructed in the north-western corner of the site, adjacent to the existing chicken cage building. The two poultry sheds cover an area of approximately 900m$^2$.

**1970 to 1989:**

- A dirt horse track is now visible on the north-east part of the site with associated horse stalls nearby.

**1990 to 1999:**

- A second (smaller) dirt horse track is now visible inside the existing (larger) track at the northern end of the site.
- A residential dwelling has been constructed at the western end of the site, with a driveway providing access to Townsend Road.

**2000 to 2010:**

- Several horse stables, a shed, a barn, two residential dwellings and a large horse racecourse have now been established in the northern half of the site.

- A large shed (possibly used for packing/cooling) is located in the north-western end of the site. One of the two steel-trussed chicken cage buildings appears to have been removed.
- Most of the land appears to be being used for grazing horses, cattle and sheep.
- The land adjacent to the northern property boundary has been partially developed as a residential subdivision. No further significant change in land use is identified.

**2010 to 2015:**

- Both chicken cage buildings have now been removed. Concrete from the eastern shed remains.
- A burn pad appears to be present between the residential dwelling of 104 Townsend Road and the Southbrook between March 2010 and January 2011.
- A stockpile[1] is visible on the left bank of the watercourse.
- Most of the land still appears to be being used for grazing horses, cattle and sheep.
- Ongoing residential development is occurring on the land adjacent to the northern property boundary.

## *4.2 Waimakariri District Council Property Files*

The property files for the subject site were obtained from the WDC in January 2019. The files comprise the following documents:

- Ground Contamination Assessment, 141 South Belt and 104 Townsend Road, Rangiora (Eliot Sinclair & Partners Ltd, 15 October 2014);
- Infrastructure Servicing Assessment, 141 South Belt and 104 Townsend Road, Rangiora (Eliot Sinclair & Partners Ltd, October 2014);
- Correspondence with WDC regarding drainage, survey and land development proposals;
- Consent application documents and construction details for buildings and heating appliances.

A review of the files indicates a ground contamination assessment was undertaken by Eliot Sinclair & Partners Ltd (Eliot Sinclair) on 15 October 2014, in association with an application for a plan change, which would have resulted in a change in the land use from farmland to residential on the area between South Belt Road and the Southbrook River.

In summary, the Eliot Sinclair PSI identified caged chicken farming and a burn pad on-site. Consequently, a DSI was carried out by Eliot Sinclair targeting these two activities. Surficial soils in both these areas were tested for arsenic and heavy metals, with additional PAH[2] testing carried out for the burn pad and OCP[3] testing carried out for the caged chicken operation.

[1] The Eliot Sinclair ground contamination report identifies that this stockpile comprises excavation material from the Southbrook.
[2] Polycyclic aromatic hydrocarbons.
[3] Organochlorine pesticides.

- Results for the former caged chicken area showed arsenic, chromium and lead concentrations above regional background levels but below the NES-CS soil contaminant standard for residential land use (10% produce). Two low-level total DDT detects were also identified here. No remedial or management actions were recommended nor taken for this area.
- Results for the burn pad showed arsenic, chromium, copper and lead above regional background levels. One arsenic sample exceeded the relevant NES-CS soil contaminant standard (residential, 10% produce).

The report states that two sequences of removal/disposal of surface soils, each followed by validation testing programmes (July and September 2014) were undertaken thereafter, with contaminated soils disposed to the Kate Valley landfill. The final validation sampling regime from the remediated area confirmed that the concentration of arsenic was now below the relevant NES-CS soil contaminant standard, and that the land was considered suitable for residential zoning.

## *4.3 Environment Canterbury Listed Land Use Register*

An online search of ECan's LLUR has been undertaken as part of the PSI. The LLUR is a database containing contaminated and potentially contaminated sites where hazardous activities as detailed in the MfE's Hazardous Activities and Industries List (HAIL) have been identified by ECan to have occurred or to be currently occurring in the Canterbury region.

A review of ECan's LLUR indicates the site is registered as a HAIL site, specifically *Category A10 - Persistent pesticide bulk storage or use*. Furthermore, a land parcel located approximately 500m south-east (downgradient) of the site is recorded on the LLUR as having historical and current timber treatment and/or preservation and bulk storage of timber. RILEY considers that potential ground contamination from the timber treatment site is highly unlikely to have impacted soils at the subject site.

## *4.4 Previous Site Investigations*

As noted in Section 4.2, a limited DSI was undertaken by Eliot Sinclair on 15 October 2014 to support a proposed plan change. Soil types encountered in the upper layers were generally consistent across the site, comprising shallow topsoil to a maximum depth of 0.5m bgl, underlain by alluvium comprising clayey silt and sandy clayey silt to between 0.9m and 2m depth, in turn underlain by silty and sandy gravels where deeper testing with hand equipment became impractical.

Additionally, a geotechnical investigation was undertaken by RILEY and McMillan Drilling Limited (overviewed by RILEY) between 17 December and 21 December 2018, comprising a site walkover, buried services clearance check and completion of 29 subsurface tests. Subsurface investigations confirmed the presence of a surficial layer of topsoil, underlain by Quaternary aged alluvial river deposits belonging to the Yaldhurst Member of the Springston Formation across the site, comprising silt and clay mixtures to between 0.45m and 1.7m depth, in turn underlain by silty sandy gravel from between 0.45m and 1.7m bgl to a depth of at least 15.2m bgl. Fill was encountered within one of the shallow tests from between 0.2m and 0.4m depth and comprised dark brown (mottled) organic silt with trace gravel and rootlets.

## *4.5 Site Walkover and Interview*

A review by RILEY of the report "Ground Contamination Assessment, 141 South Belt and 104 Townsend Road, Rangiora (Eliot Sinclair & Partners Ltd, 15 October 2014)", which was prepared for an earlier residential plan change application, indicates an interview with Mr Clarke (current owner) was undertaken during the site inspection. The information from the site inspection and interview is summarised as follows:

- Mrs Clarke's father bought the land around 1946 from the previous farmer.
- In 2014, the land was then being used to graze approximately 30 horses, ten cattle and less than ten sheep. No goods are produced on the farm.
- Previous land uses (approximately 40-years ago) comprised cattle, horses, pig and chicken farming.
- A historical farm pit was situated on a now neighbouring parcel south-east of the site (Lot 2 DP73557). This land has been sold to WDC, and subsequent to the sale three stormwater detention and treatment ponds have been constructed.
- Silt and gravel were stockpiled on the true left bank of the Southbrook in 2011. The material is from deepening and straightening the watercourse.
- In 2014, horse manure and sawdust were stockpiled behind a horse stable. The material is regularly removed by a Rangiora Landscaping company and used for gardening.
- Mr Clarke stated that the farm was run on a low budget and grass grub was not treated in the 1960s and 1970s.
- Spraying (from 2014 onwards) is undertaken by a registered sprayer who also works for council and occurs mostly along the Southbrook.
- Mr Clarke advised that no friable asbestos or cement fibreboards in deteriorated condition were noticed on farm buildings during the 2014 site inspection.
- A burn pad is situated between the existing residential dwelling at 104 Townsend Road and the Southbrook.
- An above-ground storage tank (AST) is located amongst the horse stables. The tank was used to store diesel but has not been used for many years. The soil under the tank is densely vegetated with grass. No hydrocarbon stains were visible at the time of inspection.
- The two residential dwellings are serviced by septic wastewater systems.
- Two steel-trussed chicken cage buildings were located in the north-western part of the site and operated between 1965 and 1974. The buildings were constructed with steel frames and roofs but no walls, and the floor was unsealed, apart from two concrete strips to access the caged chicken.
- No bulk-storage of chemicals was identified on the land. Chemicals from the poultry operation were probably stored in the adjacent packing and cooling shed on concrete floor.

Additionally, a site walkover was undertaken by RILEY staff on 17 December 2018. The findings of the walkover have been summarised below, and the site photographs are appended (Appendix C).

- Sawdust has been imported to site and stockpiled next to a shed for use in the horse stables.

- Horse manure has been stockpiled next to horse stables.
- The AST has been moved from its original location and was not identified elsewhere on the site.
- A 3m diameter hole is present next to shed – possibly formerly utilised as a sump or septic tank.
- Two burn pads are present near the existing home/sheds – one larger (previously referenced in this report), and a smaller one: both have been used recently.
- An underground sewer main crosses site from north to south-east. Three on-site manholes indicate its approximate location. Signs of ground disturbance were observed near the south-east alignment.
- Approximately 20 sheep/lambs are grazing near the existing dwelling and approximately 12 horses are also visible on-site. No other animals (e.g. cattle, chickens) were observed at the time of inspection.
- No cropping is present on the site. Several patches of cracked bare earth were observed inside the horse training track, however, most of the site is pastureland with thistles and other weeds.
- The horse training track is used daily; machinery on-site to grade the track was visible.
- Southbrook flows along south boundary of site (west to east), flowing approximately 1 cumec at the time of assessment. The brook appears to have been straightened.

No further land uses or activities were observed during the site visits by Eliot Sinclair (2014) and RILEY (2018) that raised concerns regarding potential soil contaminant risks to human health or the environment.

### *4.6 HAIL Activities and PSI Conclusion*

Based on a review of the historical aerial photographs, council files and the aforementioned on-site observations, RILEY considers that several HAIL activities have been identified to have occurred on-site which have not been previously addressed in the ground contamination assessment undertaken by Eliot Sinclair in 2014.

Potential contaminants and sources are presented below in Table 1.

**Table 1: Potential Contamination Sources**

| Activity | Potential Contaminants | Likelihood of Contamination | HAIL Reference |
|---|---|---|---|
| Above-Ground Storage Tank (AST) | • Heavy metals<br>• Petroleum hydrocarbon contamination | Likely to occur via tank failure, poor maintenance or dispensing problems. The proposed development works would include ground disturbance and potential exposure of construction workers and future site end users to contaminants. This would complete a source-pathway-receptor link. | Activity A2:<br>Chemical manufacture, application or bulk storage. |
| Construction and demolition of farm buildings with potential asbestos-containing materials or lead-based paints | • Lead<br>• Asbestos | Likely to occur when older buildings (painted with lead-based paint) have being removed/demolished or when the building deteriorates (paint becomes flaky or powdery) and falls off. The proposed development works would include ground disturbance and potential exposure of construction workers and future site end-users to contaminants. This would complete a source-pathway-receptor link. | Activity I:<br>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. |
| Burn Pads | • Asbestos | Likely to occur if the buildings/materials incinerated had asbestos containing materials. The proposed development works would include ground disturbance and potential exposure of construction workers and future site end-users to contaminants. This would complete a source-pathway-receptor link. | Activity I:<br>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. |

A DSI is required to quantify the risks to construction workers and site end-users, as well as to assess the consenting activity status of ground disturbance associated with future development.

# 5.0 Detailed Site Investigation

A DSI was undertaken by RILEY on 17 December 2018, following the PSI. A total of 33 test locations (HA1 to HA23, BP1 to BP3, FT1 and HA-BH1 to HA-BH6) were hand excavated to visually assess the encountered material and to collect soil samples for analysis. The test locations are shown on RILEY Dwg: 170743-2 (Appendix G).

## *5.1 Sampling Methodology*

Soil sampling was undertaken in accordance with the MfE's CLMG No. 5: Site Investigation and Management of Soils (revised 2011).

Soil samples for analytical testing were collected according to the following procedure:

- Test locations were evenly spread across the site (within both the proposed development area and the balance land), including around the three burn pad areas and beneath where the AST was once located.
- Soil samples were collected within the near surface topsoil material (0m to 0.2m depth), and within natural soils at approximately 0.5m and 1m depth, where applicable.
- Standard sampling procedures such as changing gloves and decontamination of sampling equipment (hand auger) were observed.
- Samples were placed directly into glass jars, supplied by the laboratory (such that no headspace remained in the jar), and were sealed, labelled and placed in a non-transparent, chilly-bin filled with ice.
- Chain of custody documentation detailing the sample handling, transport procedures from the point of collection at the site to the laboratory, and instructions for the laboratory analysis was then completed and sent with the samples to the laboratory (via same-day courier).
- For most of the test locations, only the top two samples undertaken within topsoil at approximately 0.2m bgl and natural soil at approximately 0.5m bgl, were analysed initially, and it was proposed that if guideline values were exceeded, testing of the underlying natural soils, undertaken at approximately 1m bgl, would then be carried out.

Sampling locations are shown on RILEY Dwg: 170743-2 (Appendix G). All test locations across the site encountered topsoil to a maximum depth of 0.35m bgl, underlain by natural material.

All soil samples were logged on-site by a qualified engineering geologist in general accordance with the New Zealand Geotechnical Society Guidelines. The co-ordinates for all test locations were marked using a hand-held GPS.

The test logs from the on-site sample locations are presented in Appendix D and are representative of material encountered across the site. There were no signs of visual or olfactory contamination in any of the samples taken.

# 6.0 Laboratory Testing and Acceptance Criteria

A total of 70 soil samples were taken across the site. Of the 70 samples, 64 were analysed for heavy metals (arsenic, cadmium, chromium, copper, nickel, lead and zinc) and organochlorine pesticides (OCP); 62 samples were tested for polycyclic aromatic hydrocarbons (PAH). Additionally, two samples were tested for BTEX (benzene/toluene/ethylbenzene/xylene), and 21 samples were tested for asbestos (presence/absence).

The analytical results are discussed in Section 6.3 below, and are presented in Appendix E. The full laboratory transcripts are presented in Appendix F.

## *6.1 Data Quality*

A quality assurance and quality control (QA/QC) programme was implemented as part of field procedures to confirm that the soil analytical data was fit for purpose. The programme included:

- Transportation of samples with accompanying chain of custody documentation.
- Laboratory testing by an IANZ-accredited laboratory.
- Comparison of field and analytical data.
- Compliance with sample holding times.

Laboratory QA/QC reports are available on request.

## *6.2 Risk Assessment*

For the purposes of this report, a Tier 1 risk assessment was carried out by comparing the concentrations of the contaminants of concern against the following criteria:

1. Background Concentrations: ECan (Background Concentrations of Selected Trace Elements in Canterbury Soils, 2006.
2. NES-CS health-based soil contaminant standards for residential (10% produce), high-density residential, and outdoor worker (unpaved) land uses.
3. AUP-OP[4] Table E.30.6.1.4.1: Permitted Activity Soil Acceptance Criteria (environmental discharge).
4. Ministry for the Environment: Guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand, revised 2011.

## *6.3 Results*

A summary of the laboratory test results is provided in Appendix E, with full laboratory transcripts included in Appendix F.

### 6.3.1 Heavy Metals

The analytical results shown in Appendix E indicate that one lead reading at FT1 (223mg/kg) marginally exceeds the most sensitive NES-CS soil contaminant standard (residential, 10% produce land use - 210mg/kg criterion). No other heavy metal results were found to exceed this standard.

With the exception of HA-BH6 and HA21, all sampling locations contained various heavy metals at concentrations greater than regional background criteria.

### 6.3.2 Asbestos (presence/absence)

No asbestos was detected within any soil samples tested across the site.

### 6.3.3 TPH and BTEX

The soil underlying the AST was tested for total petroleum hydrocarbons (TPH) and BTEX (Benzene/Toluene/Ethylbenzene/Xylene) to assess whether poor maintenance or dispensing problems had resulted in contamination, and if so whether the fuel hydrocarbon concentrations recorded pose a potential risk to human health or the environment.

[4] Auckland Unitary Plan – Operative in Part, chapter E30.6, Table E30.6.1.4.1 - Permitted activity soil acceptance criteria. These have been referenced as the Canterbury LWRP does not currently specify soil criteria for environmental discharges.

A summary of the laboratory test results is provided in Table 3 and Table 4 below (soil samples), with full laboratory transcripts included in Appendix F.

**Table 3: Soil Analytical Results (TPH)**

| Sample IDs | Sample Depth (m) | Units | Total Petroleum Hydrocarbons | | |
|---|---|---|---|---|---|
| | | | C7-C9 | C10-C14 | C15-C36 |
| FT1_0.1 | 0.1 | mg/kg | <10 | <15 | 149 |
| FT1_0.3 | 0.3 | mg/kg | <10 | <15 | <25 |
| **Petroleum Guidelines Residential - INHALATION[1]** | | mg/kg | 2,700 | 3,200 | NA |
| **Petroleum Guidelines Residential - ALL PATHWAYS[2]** | | mg/kg | 2,700 | 560 | NA |

Notes: 1. Guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand, Tier 1 TPH soil acceptance criteria, residential use - inhalation pathways, silty clay surface (<1m).
2. Guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand, Tier 1 TPH soil acceptance criteria, residential use - all pathways, silty clay surface (<1m).

**Table 4: Soil Analytical Results (BTEX)**

| Sample IDs | Sample Depth (m) | Units | Total BTEX | | | |
|---|---|---|---|---|---|---|
| | | | Benzene | Toluene | Ethylbenzene | Xylenes |
| FT1_0.1 | 0.1 | mg/kg | <0.05 | 0.08 | <0.05 | <0.05 |
| FT1_0.3 | 0.3 | mg/kg | <0.05 | <0.05 | <0.05 | <0.05 |
| **Petroleum Guidelines Residential - INHALATION[1]** | | mg/kg | 1.7 | 210 | 110 | 160 |
| **Petroleum Guidelines Residential - ALL PATHWAYS[2]** | | mg/kg | 1.7 | 210 | 110 | 160 |

Notes: 1: Guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand, Tier 1 TPH soil acceptance criteria, residential use - inhalation pathways, silty clay surface (<1m).
2: Guidelines for assessing and managing petroleum hydrocarbon contaminated sites in New Zealand, Tier 1 TPH soil acceptance criteria, residential use - all pathways, silty clay surface (<1m).

Evaluation of the soil laboratory results indicates one heavy-end carbon fraction TPH reading at 149 mg/kg, and one low-level toluene detect at 0.08 mg/kg[5]. Neither reading exceeded the adopted human health acceptance criteria thresholds, as set out in the MfE Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (revised 2011).

### 6.3.4 Polycyclic Aromatic Hydrocarbons

Low-level detection of PAHs was found in six of the 64 samples (HA4, HA10, HA8, HA-BH3 and FT1), ranging from 0.01mg/kg to 0.09mg/kg. These detected levels are well below relevant NES-CS health-based soil contaminant standards and AUP-OP environmental discharge criteria.

### 6.3.5 Organochlorine Pesticides

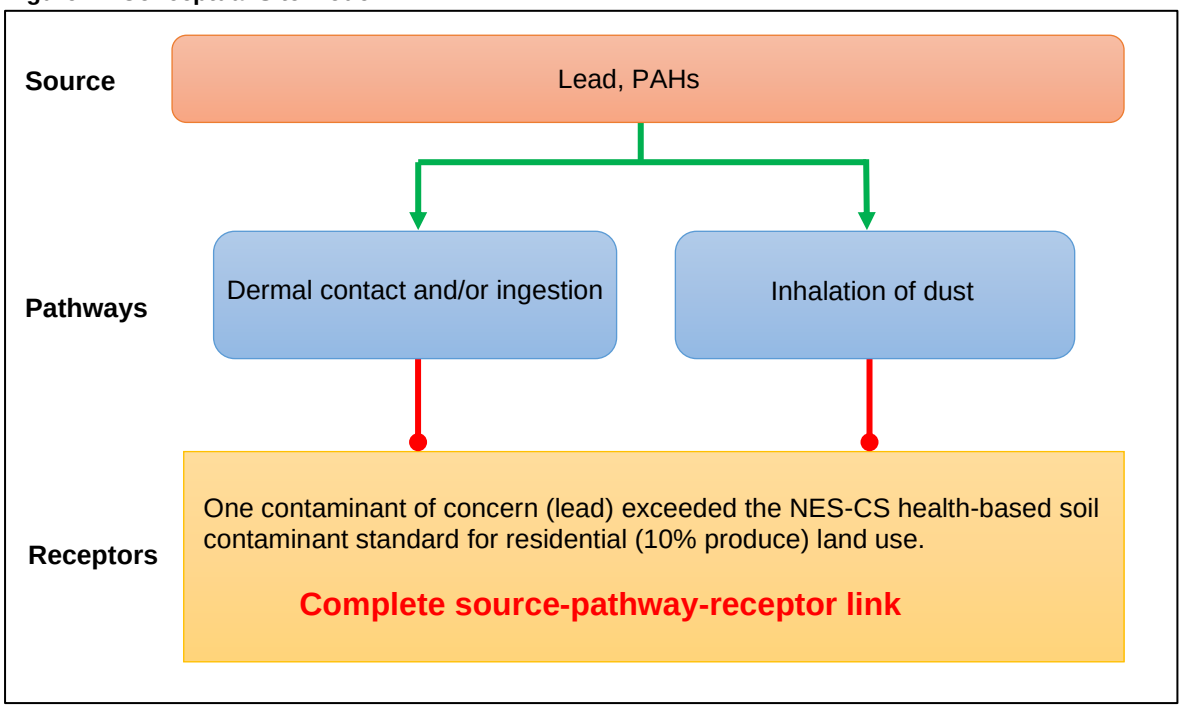
No OCP's were detected within any soil samples tested across the site.

[5] No published background levels are available for TPH nor BTEX.

# 7.0 Conceptual Site Model

A post-investigation conceptual site model (CSM) has been developed to summarise the sources of contamination at the site, the human receptors that may be exposed to those contaminants, and the potential pathways for exposure.

**Figure 2: Conceptual Site Model**




# 8.0 Regulatory Implications

The rules relating to the control of contaminated sites and potentially contaminated sites, specific to the protection of human health, are specified in the NES-CS.

## *8.1 NES-CS*

The NES-CS[6] came into effect on 1 January 2012. The NES-CS generally considers issues relating to land use and the protection of human health. The need, or otherwise, for contamination related resource consents for the proposed development has been evaluated against this regulatory requirement.

As one lead concentration exceeds the NES-CS soil contaminant standard for residential (10% produce) land use and several contaminants of concern exceed regional background concentrations, a Restricted Discretionary resource consent will be required under the NES-CS in relation to intended site development works if a standard residential subdivision is proposed once the zone is changed. In the event of standard residential subdivision not being undertaken in the future, i.e. if only a retirement village was intended for the site, then the NES-CS consent activity status would change from Restricted Discretionary activity to Controlled activity. A SMP will be required as part of consent conditions likely to be provided by (WDC), the responsible authority for issuing and regulating land use consents under the NES-CS.

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

It is considered that the most appropriate timing to develop a SMP and apply for resource consent under the NES-CS will be subsequent to the plan change, in association with a specific development proposal. The SMP will include methodologies to delineate, remediate or manage, and validate the minor localised exceedance of lead and will provide guidance to the civil works contractor regarding potential re-use of soils on-site. The NES-CS resource consent application and associated SMP would most appropriately be submitted for assessment and approval by WDC in conjunction with a future earthworks consent, residential subdivision application or land use consents, whichever comes first.

### *8.2 Environmental Implications*

A review of the Canterbury Land and Water Regional Plan (LWRP), Map 051, indicates the site is located within an area of semi-confined or unconfined aquifers, and within the Ashley Groundwater Allocation Zone.

The LWRP does not specify permitted activity soil acceptance criteria for discharges of contaminants into air, or into water, or onto or into land from land not used for rural production activities. The Auckland Unitary Plan – Operative in Part (AUP-OP) does specify soil assessment criteria for environmental discharges, as follows:

**Table 5: Environmental Discharges**

| Contaminant | Permitted Activity Criteria (mg/kg) |
|---|---|
| Arsenic | 100.0 |
| Benzo (a) pyrene (equivalent) | 20 |
| Cadmium | 7.5 |
| Chromium (total) | 400.0 |
| Copper | 325.0 |
| Total DDT | 12.0 |
| Lead | 250.0 |
| Mercury | 0.75 |
| Nickel | 105.0 |
| Zinc | 400.0 |

Note: Permitted activity soil acceptance criteria (AUP-OP, chapter E.30.6, Table E30.6.1.4.1)

Comparing these environmental discharge values with the analytical results for the site (Appendix E) demonstrates that the contaminant concentrations encountered across the site meet these criteria. It is therefore considered that soil disturbance associated with the proposed development is not reasonably likely to pose adverse effects to ecological receptors.

## 9.0 Soil Reuse and Disposal Options

All topsoil/underlying natural soils from the site are considered suitable for reuse on-site, with the exception of soils in the vicinity of the sole lead exceedance (sampling location FT1). The SMP to be developed in conjunction with a future NES-CS consent application (please refer to Section 8.1) will include delineation and validation testing to ensure soils in the vicinity of this area are appropriately remediated or managed.

Any other excavated topsoil and underlying natural material which is not required for reuse on-site, and with contamination concentrations exceeding background criteria, should be disposed of at an appropriately licensed managed fill facility. Approval from the nominated facility should be granted prior to removing surplus soils off-site.

# 10.0 Conclusion and Recommendations

The findings of the desktop review and intrusive soil testing regime described in the previous sections indicate the following:

- No obvious visual (e.g. staining) or olfactory (e.g. hydrocarbon odours) signs of ground contamination was noted during the intrusive investigation.
- No asbestos was encountered across the site.
- One lead sample marginally exceeded one of the health-based NES-CS soil contaminant standards, being residential (10% produce) land use.
- No soil samples exceeded relevant NES-CS health-based soil contaminant standards for high-density residential or outdoor worker (unpaved) land uses.
- No soil samples exceeded environmental discharge assessment criteria under the AUP-OP, indicating no ecological impacts from soil contamination are anticipated from disturbing surficial soils on-site.
- Samples tested across the site contained heavy metals (mainly lead, chromium and zinc) at concentrations greater than regional background criteria.
- A Restricted Discretionary Activity resource consent will be required to be applied for under the NES-CS prior to future site development works, as lead exceeds the most sensitive health-based soil contaminant standard in one location and several heavy metals exceed regional background criteria across most of the site. The NES-CS consent status will reduce to Controlled Activity if a retirement village rather than residential end-use is intended.
- A SMP will be required to be prepared in conjunction with an NES-CS consent application for future development works.
- With the exception of soils in the vicinity of the lead exceedance recorded, surficial soils are considered suitable for on-site reuse. Any excavated topsoil and underlying natural material which is not required for reuse on-site, and with contamination concentrations exceeding background criteria, should be disposed of at an appropriately licensed managed fill facility.
- Specific consents and management approaches to deal with these issues will be sought and undertaken as part of future land use change enablement.
- Subject to remediation or management of a small area of the site and in accordance with a WDC approved SMP for the site, all land subject to the plan change is considered to be suitable for residential development and use, based on soil testing information to date.

# 11.0 Limitation

This report has been prepared solely for the benefit of Summerset Villages (Rangiora) Limited as our client with respect to the brief and Waimakariri District Council in processing the consents. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

Riley Consultants Ltd has performed the services for this project in accordance with the standard agreement for consulting services and current professional standards for environmental site assessment. No guarantees are either expressed or implied.

The recommendations and opinions expressed are based on data from limited test positions. The nature and continuity of subsoil conditions away from the positions are inferred, and it must be appreciated that actual conditions could vary considerably from the assumed model.

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal or planning opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate advice. There is no investigation that is thorough enough to preclude the presence of materials at the site which presently, or in the future, may be considered hazardous. Because regulatory evaluation criteria are constantly changing, concentrations of contaminants present and considered to be acceptable may, in the future, become subject to different regulatory standards, which cause them to become unacceptable and require further remediation for this site to be suitable for the existing or proposed land use activities.

# *APPENDIX A*

## *Historical Aerial Photographs*

# 1940 to 1944



N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:18:28 a.m.

# 1960 to 1964



N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:21:25 a.m.

canterbury maps

# 1965 to 1969



N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:25:01 a.m.

# 1970 to 1974



N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:25:20 a.m.

# 1975 to 1979



N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:25:37 a.m.

# 1980 to 1984

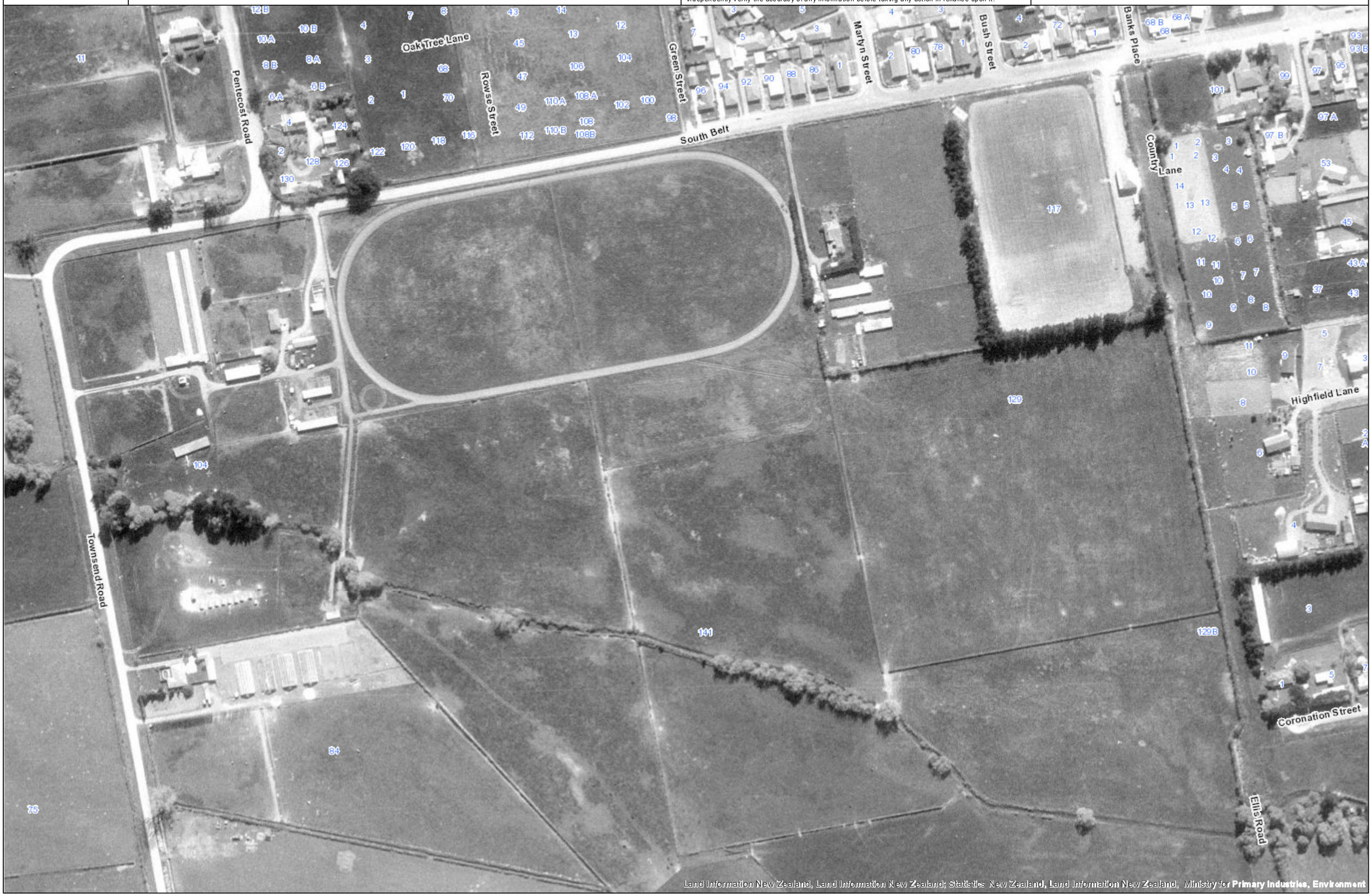


N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:25:57 a.m.



canterbury maps

# 1985 to 1989



N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:26:10 a.m.

# 1990 to 1994

Information has been derived from various organisations, including Environment Canterbury and the Canterbury Maps partners. Boundary information is derived under licence from LINZ Digital Cadastral Database (Crown Copyright Reserved). Environment Canterbury and the Canterbury Maps partners do not give and expressly disclaim any warranty as to the accuracy or completeness of the information or its fitness for any purpose.

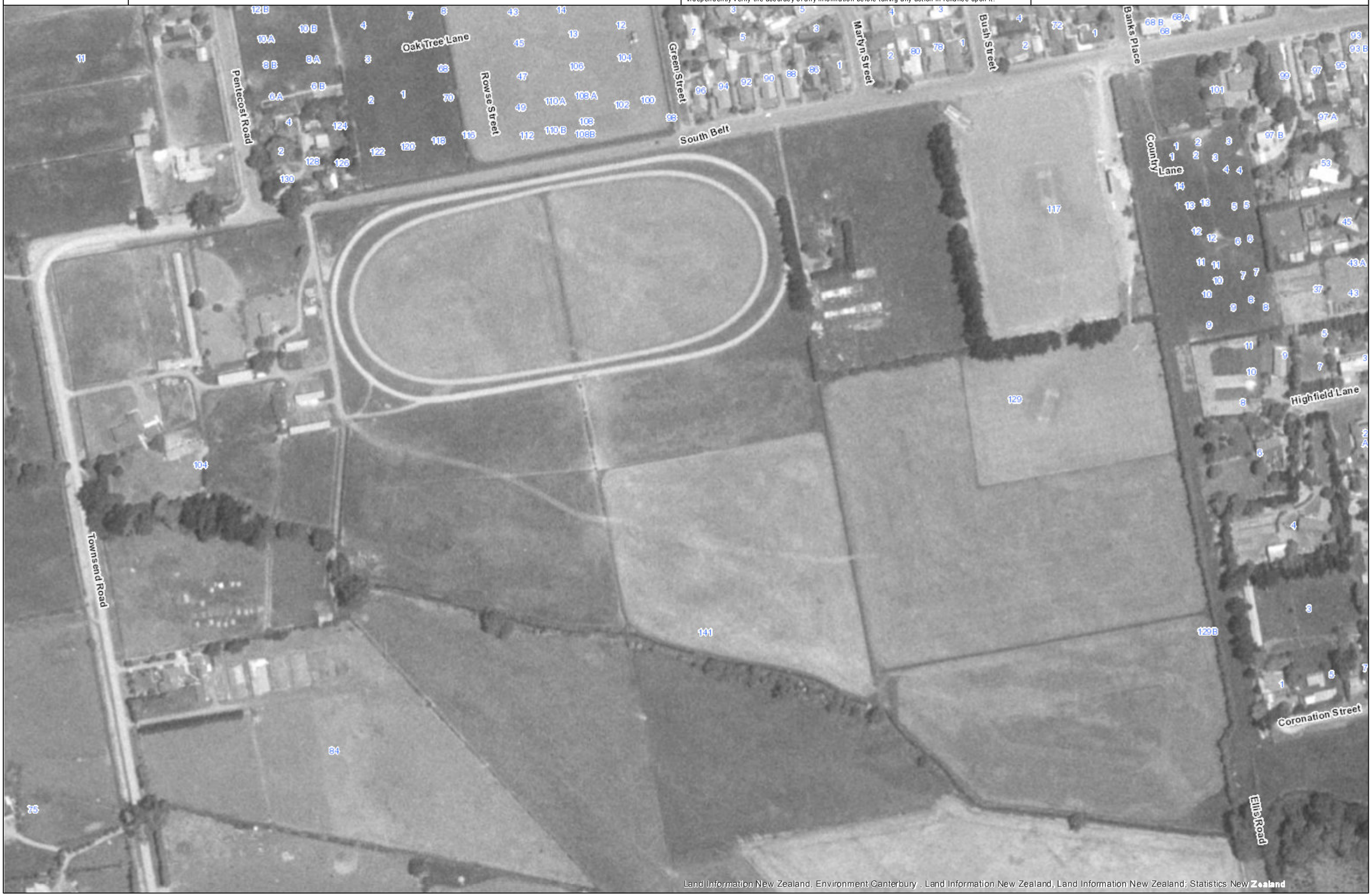
Information from this map may not be used for the purposes of any legal disputes. The user should independently verify the accuracy of any information before taking any action in reliance upon it.

N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:26:25 a.m.



canterbury maps

# 1995 to 1999

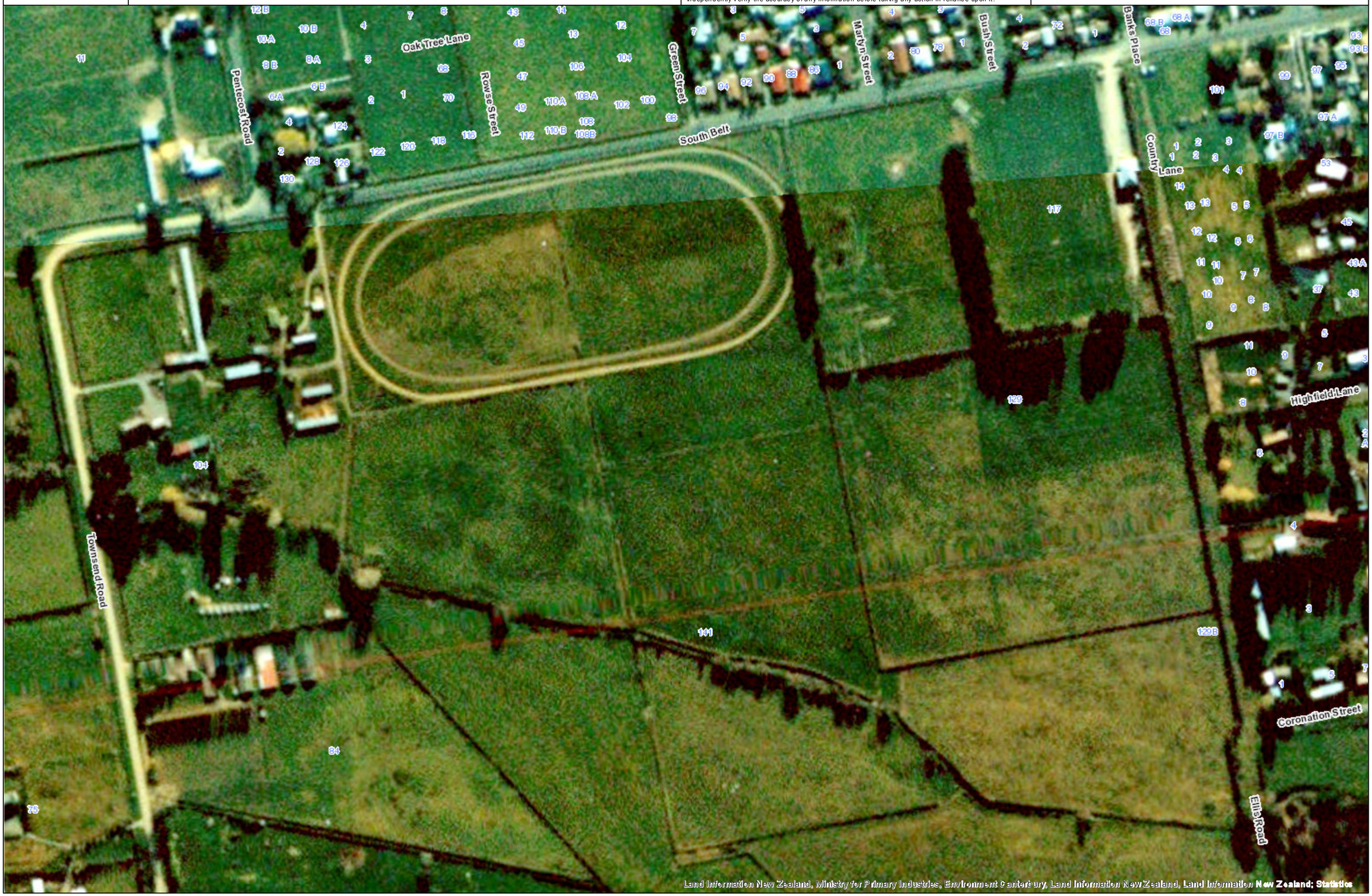


N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:26:37 a.m.



# 2000 to 2004



N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:26:52 a.m.

# 2004 to 2010



N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:27:14 a.m.

canterbury maps

# 2010 to 2015



N

0 0.03 0.06 0.09 0.12 Kilometres

Scale: 1:2,257 @A3

Map Created by canterburymaps.govt.nz on 9/01/2019 at 11:27:35 a.m.

# *APPENDIX B*

## *Listed Land Use Register*

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**

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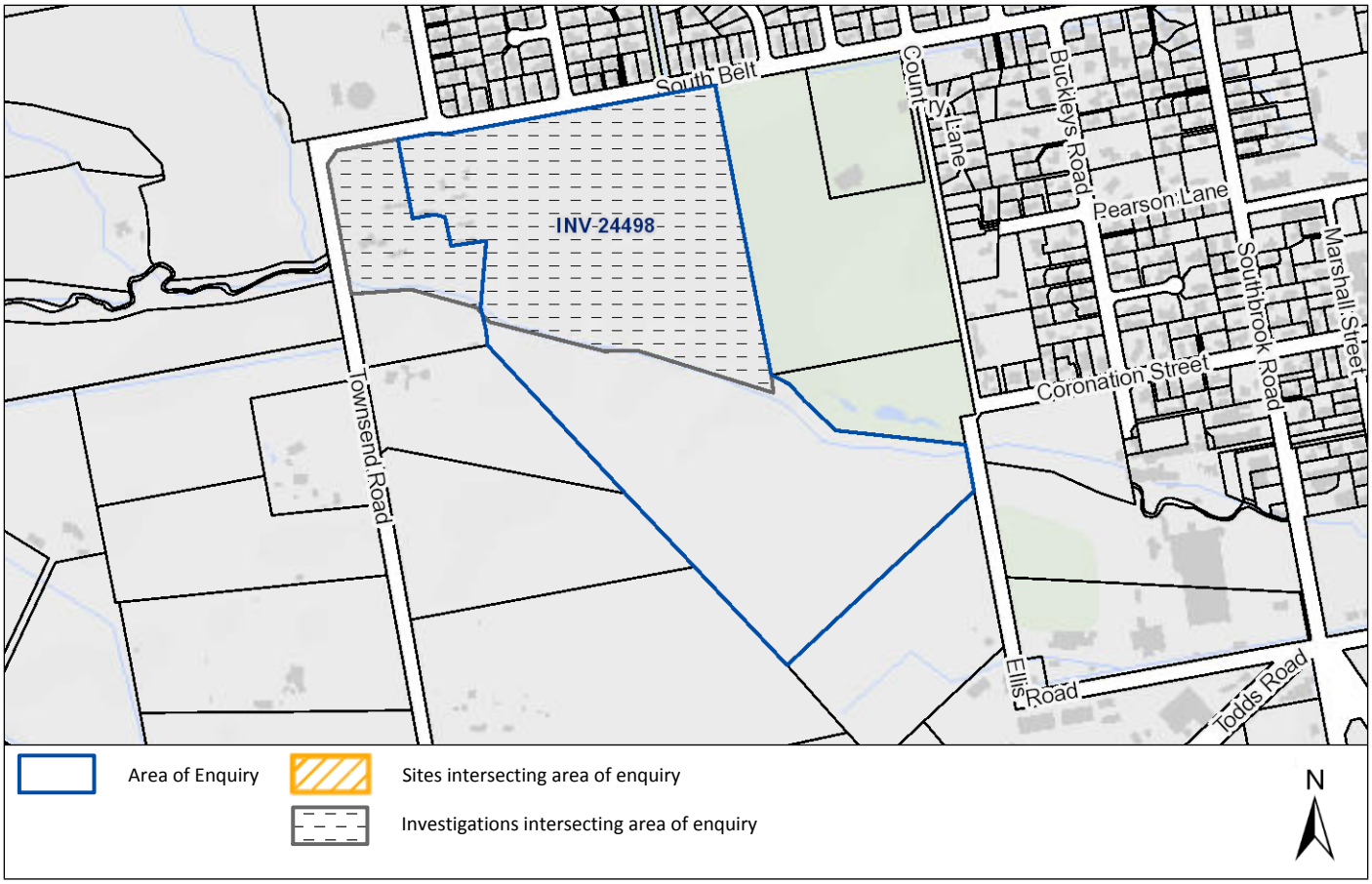
Christchurch 8140

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

**www.ecan.govt.nz**


| | | |
|---|---|---|
| **Date:** | 15 January 2019 | |
| **Land Parcels:** | Lot 3 DP 73557 | Valuation No(s): 2159120656 |




*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

**15 Oct 2014** **INV 24498: Ground Contamination Assessment: 141 South Belt & 104 Townsend Road, Rangiora** (Detailed Site Investigation)
Eliot Sinclair & Partners Ltd

**Summary of investigation(s):**

To facilitate a plan change from 'Residential 4B' to 'Residential 2' a detailed site investigation occurred at 141 South Belt and 104 Townsend Road, Rangiora. The farm had been in family ownership from 1946 to the present and had been used for grazing cattle and horses as well as pig and chicken farming. Chicken sheds were identified on the north of 104 Townsend Road and was opperational from 1965 to 1974 with an unsealed floor. A burn pad was also identified between the residence at 104 and the South Brook. An unused 400 litre above ground storage tank for diesel was located among the horse stalls on the west side of 141 South Belt. 6 soil samples were collected from the chicken shed area and analysed for a suite of metals and organochlorine pesticides with all results compliant with applicable standards. 2 soil samples were collected from the burn pad and analysed for a suite of metals. Arsenic was elevated in one of the samples. The surface 200 mm of soil from the burn pad was excavated and disposed of at Kate Valley. Validation samples of remaining soil complied with residential land use standards.

**For further information from Environment Canterbury, contact Customer Services and refer to enquiry number ENQ225559.**

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.

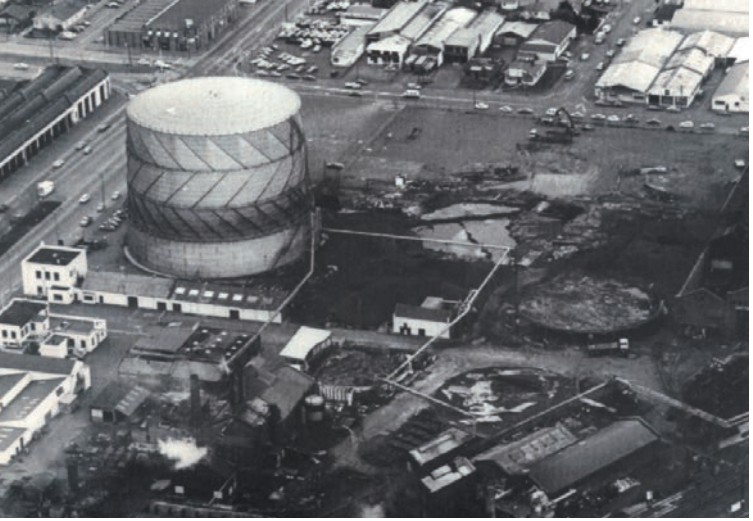
Please refer to the Site Categories and Definitions factsheet for further information.

## 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.

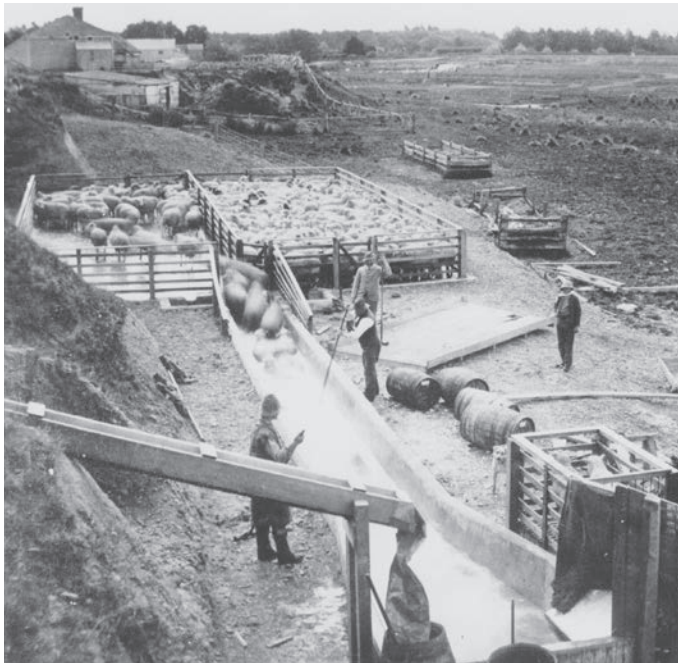
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Customer Services
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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

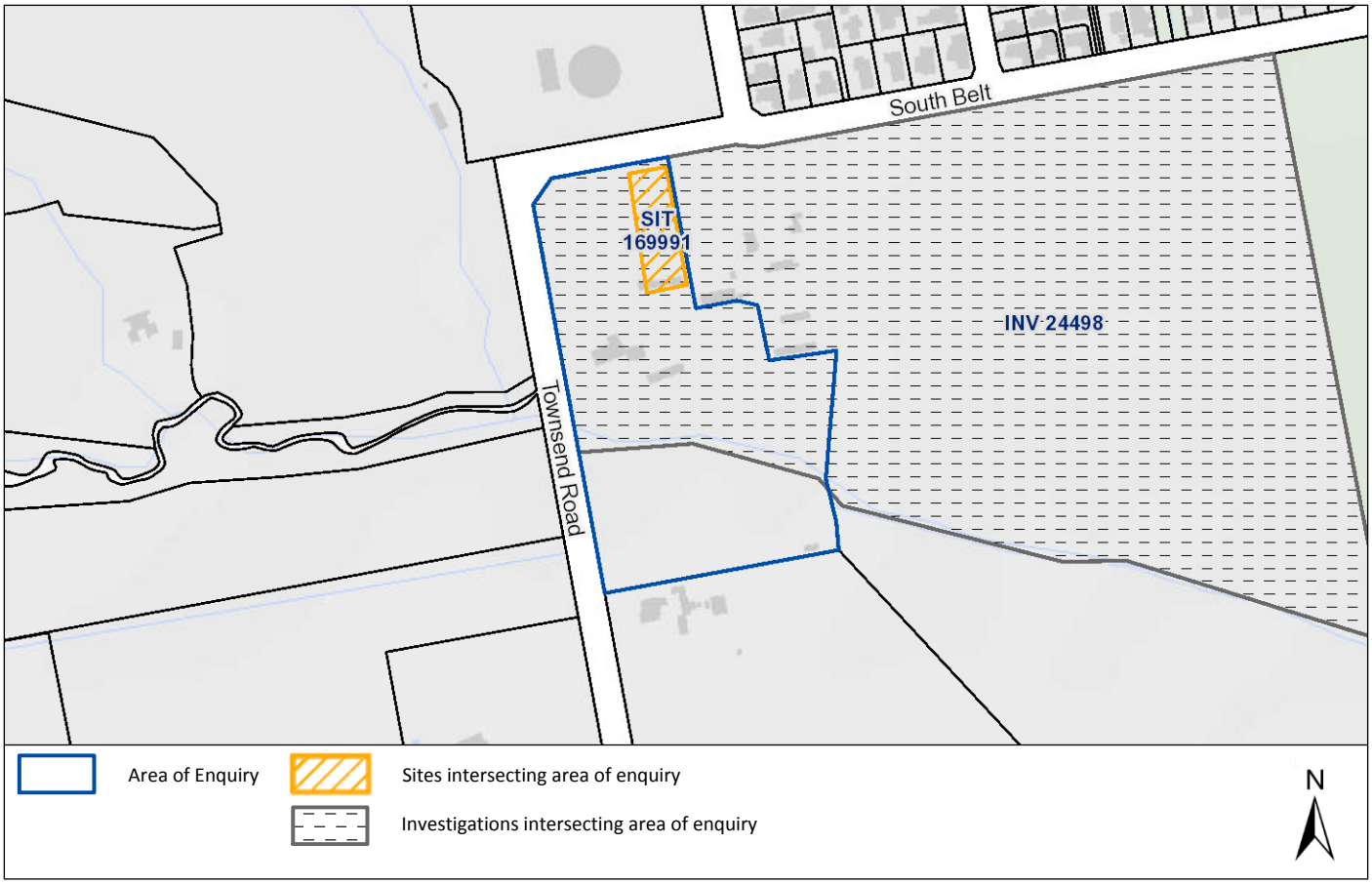
**Customer Services**
**P. 03 353 9007 or 0800 324 636**

PO Box 345
Christchurch 8140

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

**www.ecan.govt.nz**


| | |
|---|---|
| **Date:** | 15 January 2019 |
| **Land Parcels:** | Lot 1 DP 45826 Valuation No(s): 2159206901 |




*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 |
|---|---|---|---|---|
| 169991 | 104 Townsend Road, Rangiora | 104 Townsend Road, Rangiora | A10 - Persistent pesticide bulk storage or use; | Below guideline values - Residential |

*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 169991: 104 Townsend Road, Rangiora (Intersects enquiry area.)

| | |
|---|---|
| **Site Address:** | 104 Townsend Road, Rangiora |
| **Legal Description(s):** | Lot 1 DP 45826 |

| | |
|---|---|
| **Site Category:** | Below guideline values - Residential |
| **Definition:** | Investigation results demonstrate that hazardous substances present at the site, but below applicable guidelines. - Residential |

**Land Uses (from HAIL):**

| Period From | Period To | HAIL land use |
|---|---|---|
| 1973 | 1994 | Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds |

**Notes:**

**19 Dec 2016** This record was created as part of the Waimakariri District Council 2016 HAIL identification project.

**7 Jul 2017** Area defined from 1973 to 1994 aerial photographs. A10 - Horticultural activities, a poultry farm or sports turf were noted in aerial photographs reviewed.

**Investigations:**

**15 Oct 2014** **INV 24498: Ground Contamination Assessment: 141 South Belt & 104 Townsend Road, Rangiora** (Detailed Site Investigation)
Eliot Sinclair & Partners Ltd

**Summary of investigation(s):**

To facilitate a plan change from 'Residential 4B' to 'Residential 2' a detailed site investigation occurred at 141 South Belt and 104 Townsend Road, Rangiora. The farm had been in family ownership from 1946 to the present and had been used for grazing cattle and horses as well as pig and chicken farming. Chicken sheds were identified on the north of 104 Townsend Road and was opperational from 1965 to 1974 with an unsealed floor. A burn pad was also identified between the residence at 104 and the South Brook. An unused 400 litre above ground storage tank for diesel was located among the horse stalls on the west side of 141 South Belt. 6 soil samples were collected from the chicken shed area and analysed for a suite of metals and organochlorine pesticides with all results compliant with applicable standards. 2 soil samples were collected from the burn pad and analysed for a suite of metals. Arsenic was elevated in one of the samples. The surface 200 mm of soil from the burn pad was excavated and disposed of at Kate Valley. Validation samples of remaining soil complied with residential land use standards.

## 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 ENQ225563.

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.

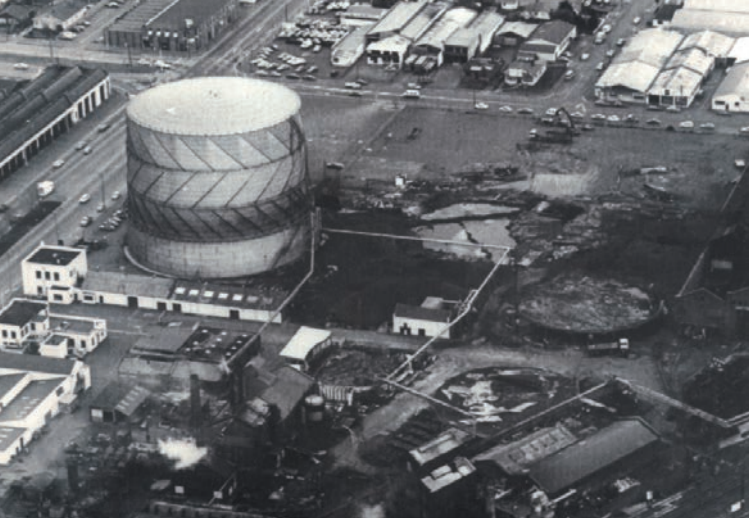
Please refer to the Site Categories and Definitions factsheet for further information.

## 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.

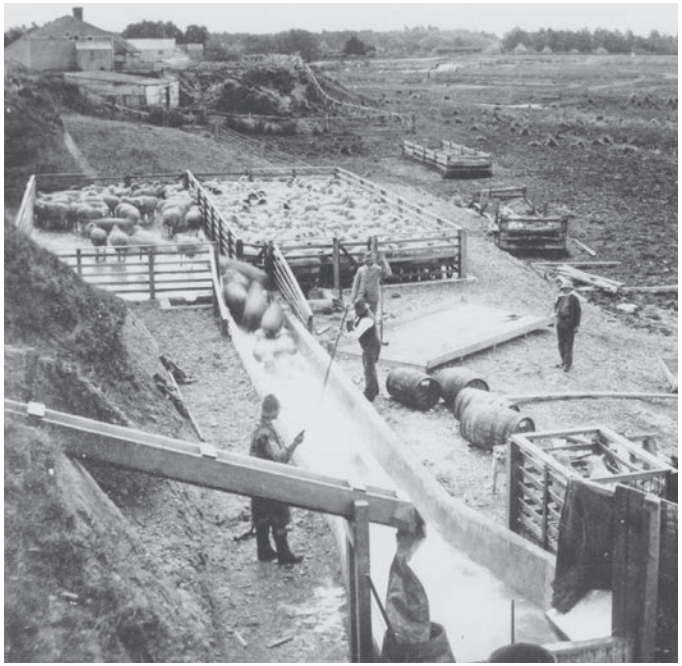
We may also use the information to prioritise sites for further investigation, remediation and management, to aid with planning, and to help assess resource consent applications. These are some of our other responsibilities under the RMA.

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.

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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 C*

## *Site Photographs*

# Site Photographs 1 to 8

**Photo 1: Site**

**Photo 2: South Brook Stream**

**Photo 3: Area where AST was once located**

**Photo 4: Horse manure stockpiled adjacent to horse stables**

**Photo 5: Sawdust manure stockpiled adjacent to shed**

**Photo 6: Burn pad 1**

**Photo 7: Burn pad 2**

**Photo 8: Hand auger excavations – example of subsurface soils encountered**

# *APPENDIX D*

## *Test Pit Logs*

RILEY CONSULTANTS

Christchurch:
22 Moorhouse Ave. Addington, Christchurch 8011
PO Box 4355, Christchurch 8140
Tel. 03 379 4402 Email: rileychch@riley.co.nz

Auckland:
4 Fred Thomas Drive, Takapuna, Auckland 0622
PO Box 100253, North Shore, Auckland 0745
Tel. 09 489 7872 Email: riley@riley.co.nz

# GEOTECHNICAL AND GEOLOGICAL INFORMATION

## SOIL TYPES AND SYMBOLS


FILL


TOPSOIL


SILT


SAND


GRAVEL


CLAY


PEAT


GROUNDWATER LEVEL


10,11,10

SCALA PENETROMETER
LAST 3 NUMBER OF BLOWS PER 50mm INCREMENT

## ROCK TYPES AND SYMBOLS


SANDSTONE


SILTSTONE


MUDSTONE


LIMESTONE


BASALT


TUFF


IGNIMBRITE


GREYWACKE

## SOIL STRENGTH CLASSIFICATION

FINE GRAINED COHESIVE SOILS

| TERM | FIELD IDENTIFICATION | UNDRAINED SHEAR STRENGTH (KPa) |
|---|---|---|
| Very Soft (Vs) | Exudes between fingers when squeezed. | <12 |
| Soft (S) | Easily indented by fingers. | 12 – 25 |
| Firm (F) | Indented only by strong finger pressure. | 25 – 50 |
| Stiff (St) | Indented by thumb pressure. | 50 – 100 |
| Very Stiff (VSt) | Indented by thumbnail. | 100 – 200 |
| Hard (H) | Difficult to indent by thumbnail. | 200+ |

## SPT & SCALA PENETROMETER RESULTS

| TERM | SPT VALUE No. of BLOWS/300mm | SCALA PENETROMETER No. of BLOWS/100mm |
|---|---|---|
| very dense | >50 | 17+ |
| dense | 30 – 50 | 7 – 17 |
| medium dense | 10 – 30 | 3 – 7 |
| loose | 4 – 10 | 1 – 3 |
| very loose | 0 – 4 | 0 – 2 |

## ROCK STRENGTH CLASSIFICATION

| TERM | | FIELD IDENTIFICATION | UNCONFINED UNIAXIAL COMPRESSIVE STRENGTH (MPa) |
|---|---|---|---|
| Extremely weak | (EW) | Indented by thumbnail. | < 1 |
| Very weak | (VW) | Crumbles under firm blows with point of geological hammer. Can be peeled with pocket knife. | 1 – 5 |
| Weak | (W) | Difficult to peel with pocket knife. | 5 – 20 |
| Moderately strong | (MS) | Cannot be scraped or peeled with pocket knife. | 20 – 50 |
| Strong | (S) | More than one blow of geological hammer to fracture. | 50 – 100 |
| Very strong | (VS) | Many blows of geological hammer to break. | 100 – 250 |
| Extremely strong | (ES) | Can only be chipped with geological hammer. | 250+ |

## MOISTURE CONDITION

| | |
|---|---|
| Dry (D) | Looks and feels dry; powdery and friable. |
| Moist (M) | Feels cool; darkened in colour; no free water when remoulded. |
| Wet (W) | Feels cool; darkened in colour; free water forms on hands. |
| Saturated (S) | Free water is present on sample. |

## SAMPLE TYPES


UNDISTURBED


MACHINE AUGER DISTURBED

D
HAND AUGER DISTURBED


STANDARD PENETRATION TEST (solid cone)


STANDARD PENETRATION TEST (hollow cone)

## DRILLING METHOD

| | |
|---|---|
| OB | OPEN BARREL |
| TT | TRIPLE TUBE |
| WB | WASH BORE |
| SH | UNDISTURBED SHELBY TUBE |
| RC | ROCK CORE |
| SPT | STANDARD PENETRATION TEST |

## FIELD TESTS

| | |
|---|---|
| V | SHEAR VANE (corrected to BS:1377) |
| R | REMOULDED STRENGTH |
| P | POCKET PENETROMETER |
| CH | CLEGG HAMMER |

INFORMATION BASED ON THE NZ GEOTECHNICAL SOCIETY INC. GUIDELINES FOR THE CLASSIFICATION AND DESCRIPTION OF SOIL AND ROCK FOR ENGINEERING PURPOSES

RILEY CONSULTANTS
Engineers and Geologists
Riley Consultants
22 Moorhouse Ave
Christchurch
Tel: +643 3794402
Fax: +643 3794403

# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | BP1-1 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 23.90 | E 1,566,301.9 N 5,203,431.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.40 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) 50 100 150 200 | Scala Penetrometer (blows / 50 mm) 3 6 9 12 15 | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +23.90 | | | | | | | | | | | |
| +23.75 | 0.15 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm to stiff"; moist; low plasticity; organics, rootlets, charcoal (TOPSOIL) | | | | | | ES0.1 | | |
| +23.50 | 0.40 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand and organics; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium; organics, charcoal (YALDHURST MEMBER, SPRINGSTON FORMATION) | | | | | | ES0.3 | | |
| | 1 | | EOH @ 0.40 m | | | | | | | | |

**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Hole located on edge of burn pad, undertaken for environmental sampling.
3. No strength testing; strength terms based on in-situ testing at nearby HA locations.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

RILEY CONSULTANTS
Engineers and Geologists
Riley Consultants
22 Moorhouse Ave
Christchurch
Tel: +643 3794402
Fax: +643 3794403

# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | BP1-2 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 23.50 | E 1,566,295.4 N 5,203,432.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.40 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) 50 100 150 200 | Scala Penetrometer (blows / 50 mm) 3 6 9 12 15 | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +23.50 | | | | | | | | | | | |
| +23.35 | 0.15 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm to stiff"; moist; low plasticity; organics, rootlets, charcoal (TOPSOIL) | | | | | | ES0.1 | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand and organics; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium; organics, charcoal (YALDHURST MEMBER, SPRINGSTON FORMATION) | | | | | | ES0.3 | | |
| +22.90 | 0.60 | | EOH @ 0.40 m | | | | | | | | |
| | 1 | | | | | | | | | | |

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Hole located on edge of burn pad, undertaken for environmental sampling.
3. No strength testing; strength terms based on in-situ testing at nearby HA locations.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

RILEY CONSULTANTS
Engineers and Geologists
Riley Consultants
22 Moorhouse Ave
Christchurch
Tel: +643 3794402
Fax: +643 3794403

# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | BP2-1 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 20-12-18 / 20-12-18 | 24.00 | E 1,566,324.2 N 5,203,479.5 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.60 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) 50 100 150 200 | Scala Penetrometer (blows / 50 mm) 3 6 9 12 15 | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +24.00 | | | | | | | | | | | |
| +23.85 | 0.15 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm to stiff"; moist; low plasticity; organics, rootlets, charcoal (TOPSOIL) | | | | | | | | |
| +23.60 | 0.40 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand and organics; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium; organics, charcoal (YALDHURST MEMBER, SPRINGSTON FORMATION) | | | | | | ES0.1<br>ES0.3 | | |
| | 1 | | EOH @ 0.60 m | | | | | | | | |

**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Hole located on edge of burn pad, undertaken for environmental sampling.
3. No strength testing; strength terms based on in-situ testing at nearby HA locations.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

RILEY CONSULTANTS
Engineers and Geologists
Riley Consultants
22 Moorhouse Ave
Christchurch
Tel: +643 3794402
Fax: +643 3794403

# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | FT1 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 20-12-18 / 20-12-18 | 24.70 | E 1,566,363.0 N 5,203,508.0 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.60 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) 50 100 150 200 | Scala Penetrometer (blows / 50 mm) 3 6 9 12 15 | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +24.70 | 1 | | | | | | | | | | |

**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Hole located adjacent to BH1, undertaken for environmental sampling.
3. No strength testing; strength terms based on nearby HA locations.

| All dimensions in metres | Contractor: | Rig/Plant Used: | Logged by: | Checked by: |
|---|---|---|---|---|
| Scale 1:10 | | Hand Auger 70 mm | AvD | CFC |

Riley Consultants
22 Moorhouse Ave
Christchurch
Tel: +643 3794402
Fax: +643 3794403

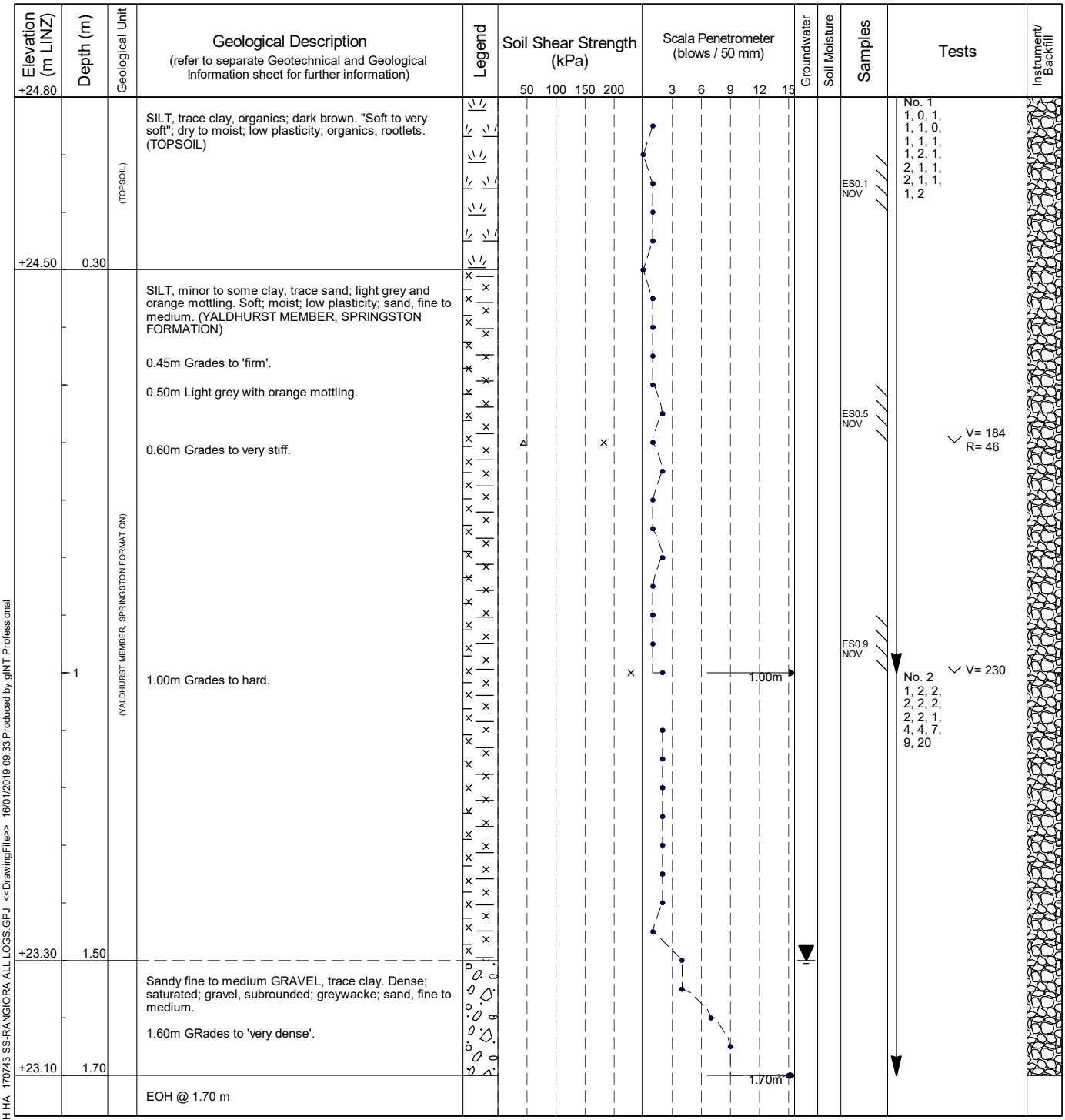
# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA01 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 24.80 | E 1,566,258.7 N 5,203,556.2 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.70 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +24.80 | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Soft to very soft"; dry to moist; low plasticity; organics, rootlets. (TOPSOIL) |
| +24.50 | 0.30 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; light grey and orange mottling. Soft; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.45m Grades to 'firm'.<br>0.50m Light grey with orange mottling.<br>0.60m Grades to very stiff.<br>1.00m Grades to hard. |
| +23.30 | 1.50 | | Sandy fine to medium GRAVEL, trace clay. Dense; saturated; gravel, subrounded; greywacke; sand, fine to medium.<br>1.60m GRades to 'very dense'. |
| +23.10 | 1.70 | | EOH @ 1.70 m |




## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA02 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 17-12-18 / 17-12-18 | 25.80 | E 1,566,352.6 N 5,203,576.7 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.70 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +25.80 | | | |
| | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Stiff"; dry to moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | | 0.15m Grades to include minor fine gravel, subrounded, greywacke. |
| +25.55 | 0.25 | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; light grey and orange mottling. Firm to stiff; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.45m Grades to 'stiff'. |
| | | | 0.60m Auger grating on inferred gravel (none recovered). |
| +25.10 | 0.70 | | |
| | | | EOH @ 0.70 m |
| | 1 | | |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

0.35m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1 3, 2, 2, 2, 2, 2, 1, 2, 2, 3, 2, 3, 2, 3, 12, 13, 14; V= 230

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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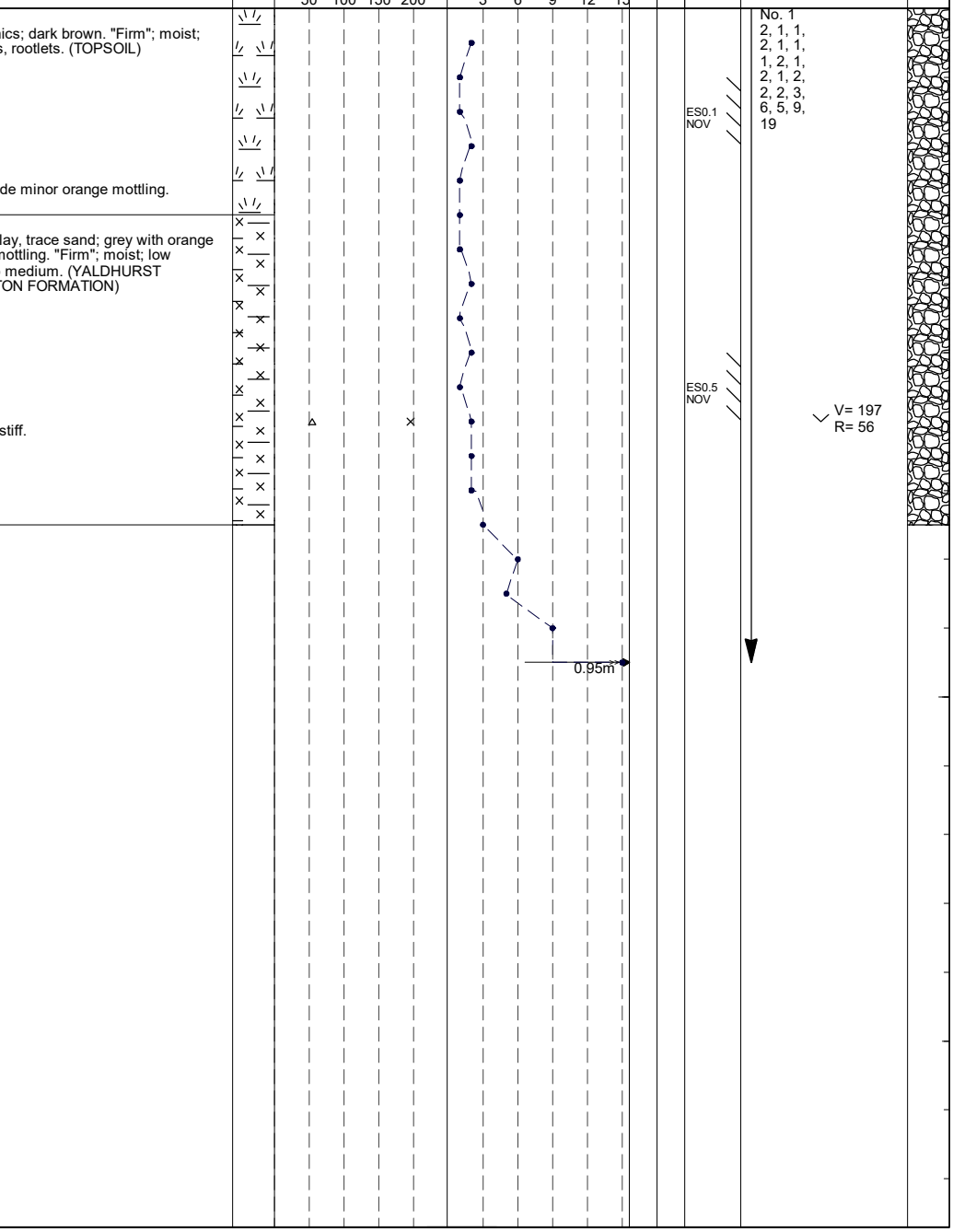
# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA03 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 24.40 | E 1,566,431.0 N 5,203,581.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.75 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +24.40 | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | | 0.25m Grades to include minor orange mottling. |
| +24.10 | 0.30 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Firm"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.60m Grades to very stiff. |
| +23.65 | 0.75 | | EOH @ 0.75 m |
| | 1 | | |




## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA04 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 17-12-18 / 17-12-18 | 23.70 | E 1,566,509.8 N 5,203,591.9 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.70 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +23.70 | | | |
| | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | | 0.20m Grades to 'stiff'. |
| +23.45 | 0.25 | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.60m Grades to hard. |
| +23.00 | 0.70 | | |
| | | | EOH @ 0.70 m |
| | 1 | | |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

0.80m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1
2, 1, 2,
1, 2, 3,
2, 3, 4,
3, 3, 3,
3, 4,
16, 20

V= 230

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA05 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 20-12-18 / 20-12-18 | 22.90 | E 1,566,584.7 N 5,203,613.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.95 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +22.90 | | | |
| | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Very stiff"; dry to moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | | 0.20m Grades to 'soft'. |
| +22.65 | 0.25 | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; light grey and orange mottling. "Soft" moist to wet; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.40m Grades to 'firm'. |
| | | | 0.80m Grades to 'stiff'. |
| | | | 0.90m Grades to include some gravel and sand; light grey with orange mottling; gravel, medium, subrounded, greywacke; sand, fine to medium. |
| +21.95 | 0.95 | | |
| | 1 | | EOH @ 0.95 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

0.95m

1.25m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV; ES0.9 NOV

Tests:
No. 1
0, 0, 1,
0, 1, 1,
1, 1, 2,
1, 1, 2,
2, 1, 2,
1, 2, 2,
4

No. 2
4, 6, 5,
9, 12,
17

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA06 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 20-12-18 / 20-12-18 | 21.30 | E 1,566,673.8 N 5,203,632.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.00 m | 1 of 2 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +21.30 | | | |
| +21.15 | 0.15 | (TOPSOIL) | SILT, trace clay, organics; greyish brown. "Very soft"; moist; low plasticity; organics, rootlets and roots (<2mm) (TOPSOIL) |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. Very soft; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.20m Grades to 'firm'.<br>0.55m Trace charcoal, black.<br>0.60m Grades to hard.<br>0.90m Trace fine to medium gravel, rounded, greywacke. |
| +20.30 | 1.00 | | EOH @ 1.00 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15; 1.00m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV; ES0.95 NOV

Tests:
No. 1
1, 0, 1,
0, 1, 1,
2, 1, 2,
1, 1, 2,
2, 1, 2,
2, 1, 2,
2, 8

V= 230

No. 2
6, 8,
10, 9,
10, 9,
6, 9, 8,
8, 9, 7,
5, 4, 7,
8, 6, 5,
6, 5

Instrument/ Backfill

**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA06 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 20-12-18 / 20-12-18 | 21.30 | E 1,566,673.8 N 5,203,632.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.00 m | 2 of 2 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) | Scala Penetrometer (blows / 50 mm) | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +19.53 | | | | | 50 100 150 200 | 3 6 9 12 15 | | | | | |
| | 2 | | | | | 2.00m | | | | | |
| | 3 | | | | | | | | | | |

**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA07 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 24.50 | E 1,566,267.9 N 5,203,478.6 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.25 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +24.50 | | | |
| +24.15 | 0.35 | (TOPSOIL) | SILT, trace clay, organics; greyish brown. "Very soft to soft"; moist; low plasticity; organics, rootlets (TOPSOIL) |
| +23.50 | 1.00 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Soft"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.50m Grades to 'firm'.<br>0.70m Grades to very stiff. |
| +23.25 | 1.25 | | Sandy gravelly SILT, trace clay; light greyish brown with orange mottling. Medium dense; moist; dilatant; gravel, fine to medium, subrounded, greywacke; sand, fine to coarse. |
| | | | EOH @ 1.25 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

1.00m

1.75m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 2, 1, 2, 1, 1, 2, 2, 3, 4, 5; V= 128 R= 43; No. 2 2, 3, 15, 7, 3, 2, 3, 3, 5, 11, 13, 8, 8, 12, 14

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [ ] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.
3. Located on tidy kept lawn.
4. Scala device wet below 1.25m on extraction.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA08 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 24.50 | E 1,566,360.3 N 5,203,503.7 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.70 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +24.50 | | | |
| +24.40 | 0.10 | (TOPSOIL) | SILT, trace clay, organics; greyish brown. "Very soft to soft"; wet; low plasticity; organics, rootlets. (TOPSOIL) |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, trace clay, trace sand; grey with orange and yellowish-brown mottling. "Soft"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.20m Grades to 'soft to firm'. Very stiff.<br>0.60m Grades to include minor fine to medium sand. |
| +23.80 | 0.70 | | EOH @ 0.70 m |
| | 1 | | |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

0.90m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1 — 0, 1, 1, 1, 2, 1, 2, 1, 1, 1, 1, 2, 1, 4, 9, 12, 14; V= 141 R= 59

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.
3. Located next to sawdust mound and near horse dung mounds.
4. First hand auger attempt near south end of gate abandoned due to encountering gravel (assumed fill).

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

RILEY AGS 3_1 NZ LIB 13.GLB Log RILEY CHCH HA 170743 SS-RANGIORA ALL LOGS.GPJ <<DrawingFile>> 16/01/2019 09:33 Produced by gINT Professional

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA09 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 17-12-18 / 17-12-18 | 24.30 | E 1,566,444.0 N 5,203,508.5 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.25 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +24.30 | | | |
| | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Soft"; dry; low plasticity; organics, rootlets. (TOPSOIL)<br>0.02m Grades to moist.<br>0.05m Grades to minor clay. |
| +24.00 | 0.30 | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Soft"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.50m Grades to 'firm'.<br>0.90m Grades to very stiff.<br>1.00m Grades to include minor gravel, fine to medium, subrounded, greywacke<br>1.15m Grades to include minor to some sand, trace gravel; non plastic; gravel, as above; sand, fine. |
| | 1 | | |
| +23.05 | 1.25 | | |
| | | | EOH @ 1.25 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

1.00m

1.45m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV; ES0.9 NOV

Tests: No. 1 2, 1, 0, 1, 1, 1, 1, 1, 1, 2, 2, 1, 2, 1, 2, 1, 0, 4

V= 164 R= 39

No. 2 4, 4, 4, 3, 4, 6, 11, 14, 14

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA10 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 17-12-18 / 17-12-18 | 24.00 | E 1,566,523.0 N 5,203,513.6 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.10 m | 1 of 2 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +24.00 | | | |
| | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| +23.75 | 0.25 | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Firm"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.40m Grades to "stiff". |
| | | | 0.60m Grades to hard. |
| | | | 0.80m Grades to light grey with orange mottling. |
| | 1 | | |
| +22.95 | 1.05 | | |
| +22.90 | 1.10 | | Sandy silty GRAVEL; light grey with orange mottling. Very dense; moist; gravel, fine to medium, subrounded, greywacke; sand, fine to coarse. |
| | | | EOH @ 1.10 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

1.00m

Groundwater

Soil Moisture

Samples

ES0.1 NOV

ES0.5 NOV

ES1.0 NOV

Tests

No. 1
1, 1, 2,
2, 1, 2,
2, 1, 2,
2, 2, 2,
2, 2, 2,
2, 2, 2,
2, 2

V= 203
R= 46

No. 2
9, 10,
7, 8, 7,
9, 7, 6,
9, 6, 7,
7, 5, 6,
5, 8, 9,
12, 20

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.
3. Located on tidy kept lawn.
4. Scala rod wet below 1.50m on extraction.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA10 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 17-12-18 / 17-12-18 | 24.00 | E 1,566,523.0 N 5,203,513.6 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.10 m | 2 of 2 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) | Scala Penetrometer (blows / 50 mm) | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +22.23 | | | | | 50 100 150 200 | 3 6 9 12 15 | | | | | |
| | 2 | | | | | 2.00m | | | | | |
| | 3 | | | | | | | | | | |

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.
3. Located on tidy kept lawn.
4. Scala rod wet below 1.50m on extraction.

| All dimensions in metres | Contractor: | Rig/Plant Used: | Logged by: | Checked by: |
|---|---|---|---|---|
| Scale 1:10 | | Hand Auger | RBW | CFC |

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA11 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 20-12-18 / 20-12-18 | 22.40 | E 1,566,607.1 N 5,203,537.7 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.80 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +22.40 | | | |
| +22.25 | 0.15 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Very soft to soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Soft"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.30m Grades to "stiff".<br>0.60m Grades to light grey with orange mottling. |
| +21.60 | 0.80 | | 0.75m Grades to include minor medium gravel, subrounded, greywacke. Very stiff. |
| | 1 | | EOH @ 0.80 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

0.95m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV; ES0.75 NOV

Tests: No. 1
0, 1, 1,
1, 1, 1,
2, 2, 2,
3, 2, 3,
2, 3, 3,
3, 8,
12, 15

V= 172
R= 43

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA12 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 20-12-18 / 20-12-18 | 21.50 | E 1,566,694.5 N 5,203,555.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.95 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +21.50 | | | |
| +21.35 | 0.15 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Very soft to soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Soft"; moist to wet (surface infiltration after rain); low to medium plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.60m Light grey with orange mottling. Very stiff. |
| +20.55 | 0.95 | | 0.90m Grades to include trace to minor fine to medium gravel, subrounded, greywacke. |
| | 1 | | EOH @ 0.95 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

1.00m

1.15m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV; ES0.9 NOV

Tests: No. 1 0, 0, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 2, 1, 1, 2, 2, 3, 8, 8

V= 167 R= 34

No. 2 11, 12, 10

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA13 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 23.20 | E 1,566,374.5 N 5,203,418.2 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.45 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +23.20 | | | |
| +23.05 | 0.15 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Stiff"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| +22.75 | 0.45 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Stiff"; moist; low to medium plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | Refusal on inferred cobble.<br><br>EOH @ 0.45 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

0.65m

Groundwater

Soil Moisture

Samples: ES0.1 NOV

Tests: No. 1 2, 2, 2, 2, 2, 3, 3, 3, 2, 9, 16, 13, 16

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA14 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 26.70 | E 1,566,464.6 N 5,203,422.0 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.65 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +26.70 | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Very soft to soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| +26.40 | 0.30 | | 0.25m Grades to "firm". |
| | | YALDHURST MEMBER, SPRINGSTON FORMATION | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Firm"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| +26.05 | 0.65 | | 0.60m Grades to include some clay and trace fine to medium sand. Very stiff. |
| | | | EOH @ 0.65 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

0.90m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1 0, 1, 1, 1, 0, 1, 2, 1, 2, 1, 2, 2, 1, 5, 12, 8, 8, 16; V= 134 R= 36

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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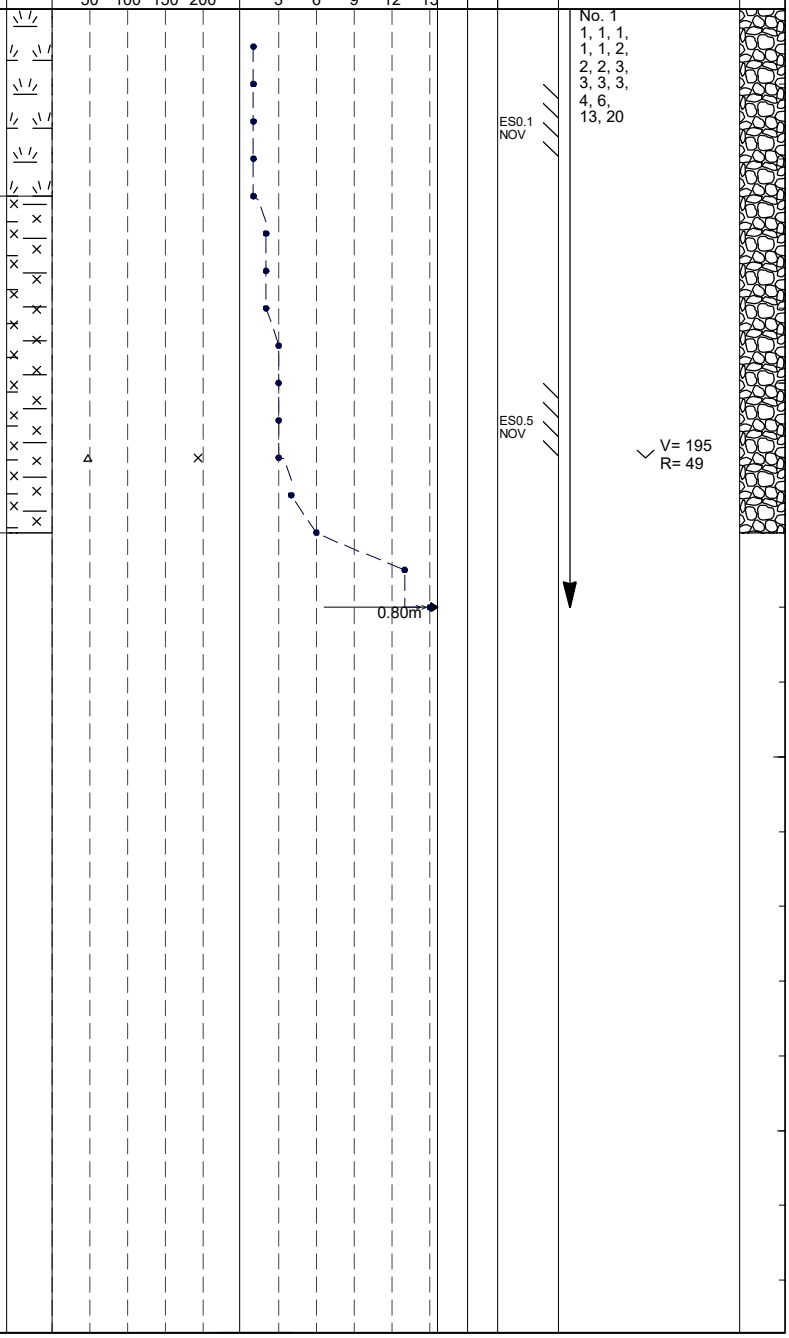
# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA15 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 24.70 | E 1,566,544.2 N 5,203,436.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.70 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +24.70 | | | |
| +24.45 | 0.25 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| +24.00 | 0.70 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Stiff"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.50m Grades to some clay.<br>0.60m Grades to very stiff. |
| | 1 | | EOH @ 0.70 m |




## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA16 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 20.90 | E 1,566,624.5 N 5,203,453.1 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.70 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +20.90 | | | |
| +20.65 | 0.25 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Very soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| +20.20 | 0.70 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Firm"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.45m Grades to "soft".<br>0.60m Very stiff.<br>0.65m Sand, fine. |
| | 1 | | EOH @ 0.70 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

0.60m

1.15m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1 1, 0, 1, 1, 0, 1, 2, 1, 2, 1, 0, 1, 1, 2, 4, 10, 10, 8, 7, 8; V= 136 R= 45; No. 2 10, 10, 11

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand-held GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.
3. Located near alignment of sewer mains. Initial hand auger attempt abandoned due to encountering gravel (assumed sewer pipe backfill).

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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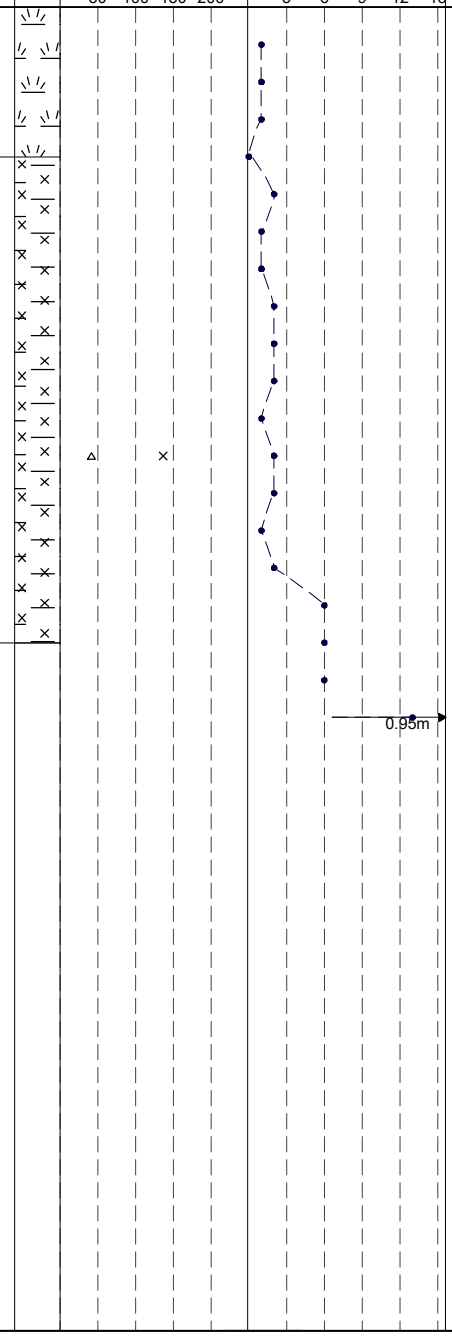
# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA17 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 22.10 | E 1,566,713.6 N 5,203,470.0 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.85 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +22.10 | | | |
| +21.90 | 0.20 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Firm"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.40m Grades to clayey.<br>0.60m Grades to very stiff.<br>0.70m Less mottled. |
| +21.25 | 0.85 | | EOH @ 0.85 m |
| | 1 | | |




**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA18 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 24.60 | E 1,566,478.5 N 5,203,362.3 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.65 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +24.60 | | | |
| | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | | 0.20m Grades to "firm". |
| +24.35 | 0.25 | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Firm"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.50m Grades to "stiff". |
| +23.95 | 0.65 | | 0.60m Grades to include trace to minor fine to medium sand. Very stiff. |
| | | | EOH @ 0.65 m |
| | 1 | | |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

1.00m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1
1, 1, 1,
0, 2, 1,
1, 1, 2,
1, 2, 3,
2, 3, 3,
2, 3, 7,
11, 22

V= 157
R= 46

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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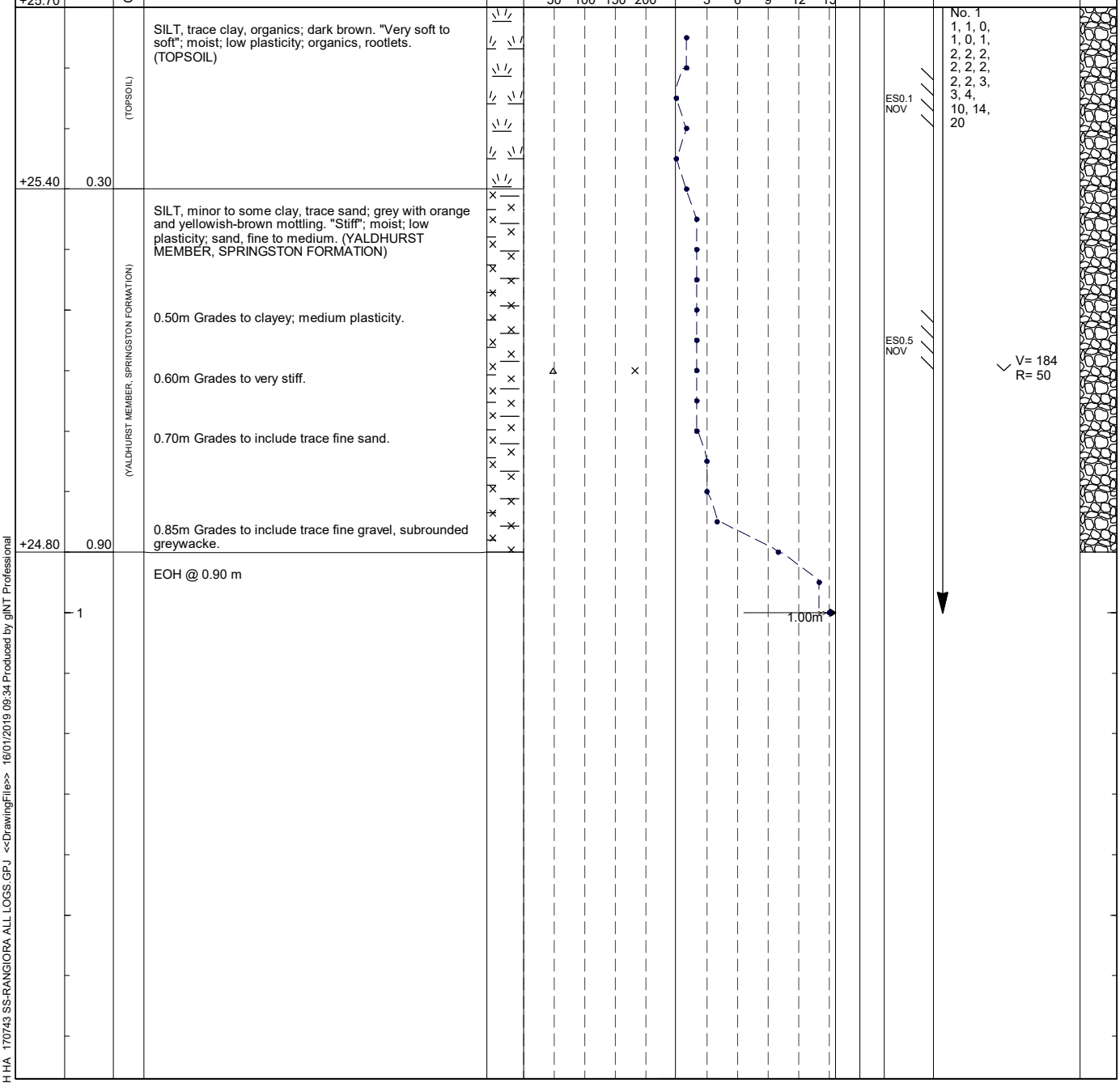
# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA19 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 25.70 | E 1,566,556.7 N 5,203,359.7 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.90 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +25.70 | | | |
| +25.40 | 0.30 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Very soft to soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Stiff"; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.50m Grades to clayey; medium plasticity. |
| | | | 0.60m Grades to very stiff. |
| | | | 0.70m Grades to include trace fine sand. |
| +24.80 | 0.90 | | 0.85m Grades to include trace fine gravel, subrounded greywacke. |
| | 1 | | EOH @ 0.90 m |




## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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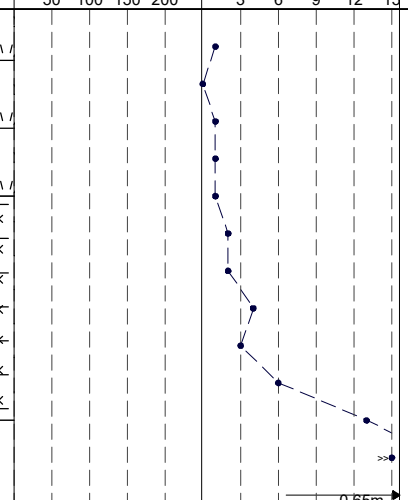
# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA20 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 20.50 | E 1,566,642.7 N 5,203,365.5 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.55 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend |
|---|---|---|---|---|
| +20.50 | | | | |
| +20.25 | 0.25 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Very soft to soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) | |
| +19.95 | 0.55 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. "Stiff"; moist; low plasticity; sand, fine to medium (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.45m Grades to "very stiff to hard". | |
| | | | EOH @ 0.55 m | |




Groundwater | Soil Moisture | Samples: ES0.1 NOV | Tests: No. 1 1, 0, 1, 1, 1, 2, 2, 4, 3, 6, 13, 19 | Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA21 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 21.70 | E 1,566,728.9 N 5,203,391.1 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.55 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +21.70 | | | |
| +21.50 | 0.20 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Very soft to soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| +21.15 | 0.55 | (FILL) | SILT, minor to some clay, trace sand, organics and gravel; grey with orange and yellowish-brown mottling. Firm to stiff; moist; low plasticity; sand, fine to medium; organics, fibrous; gravel, fine to medium, subrounded to subangular. (FILL)<br>0.45m Grades to gravelly; wet to saturated |
| | 1 | | Gravel grades medium to coarse.<br>EOH @ 0.55 m |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

1.00m

1.50m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1 1, 0, 1, 1, 1, 2, 1, 2, 4, 3, 3, 5, 7, 5, 3, 3, 2, 2, 1, 2

No. 2 2, 7, 3, 4, 7, 4, 3, 2, 3, 4

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

RILEY AGS 3_1 NZ LIB 13.GLB Log RILEY CHCH HA 170743 SS-RANGIORA ALL LOGS.GPJ <<DrawingFile>> 16/01/2019 09:34 Produced by gINT Professional

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA22 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 19.50 | E 1,566,653.5 N 5,203,321.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.10 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +19.50 | | (TOPSOIL) | SILT, trace clay, organics and gravel; dark brown. "Soft to firm"; moist; low plasticity; organics, rootlets; gravel, fine to medium, subrounded, greywacke (TOPSOIL) |
| | | | 0.25m Grades to include yellowish-brown mottling. |
| +19.20 | 0.30 | | |
| | | | Gravelly SILT, minor to some sand, trace gravel; grey with orange and yellowish-brown mottling. "Firm"; moist; low plasticity; sand, fine to medium; gravel, fine to medium, subrounded to rounded (YALDHURST MEMBER FORMATION). |
| +19.10 | 0.40 | | 0.35m 'Soft to very soft". |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor clay, trace organics; dark grey. "Soft to very soft"; moist; low plasticity; organics, fibrous to amorphous, weak odour. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.60m Grades to firm. |
| | | | 0.75m 50mm lenses of dark brown fibrous PEAT. |
| | 1 | | 1.00m Grades to include minor to some sand, and trace to minor fine gravel. |
| +18.40 | 1.10 | | |
| | | | EOH @ 1.10 m |

Soil Shear Strength (kPa): 50, 100, 150, 200

Scala Penetrometer (blows / 50 mm): 3, 6, 9, 12, 15

Groundwater: 1.00m; 1.50m

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1 — 1, 0, 2, 1, 2, 1, 2, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 1, 1, 1; V= 38 R= 10; No. 2 — 3, 9, 7, 6, 7, 8, 9, 10, 16, 11

Instrument/ Backfill

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [X] Rapid Inflow (depth 0.6 m )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA23 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 20.50 | E 1,566,746.4 N 5,203,300.2 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.80 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +20.50 | | | |
| | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Very soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| +20.25 | 0.25 | | 0.20m Grades to 'soft to very soft'. |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand, organics and gravel; grey with orange and yellowish-brown mottling. "Soft to firm; moist; low plasticity; sand, fine to medium; organics, fibrous; gravel, subrounded to subangular. (YALDHURST MEMBER, SPRINGSTON FORMATION) |
| | | | 0.60m Grades to clayey. Very stiff. |
| +19.70 | 0.80 | | 0.75m Minor orange mottling. |
| | | | EOH @ 0.80 m |
| | 1 | | |

Legend

Soil Shear Strength (kPa): 50 100 150 200

Scala Penetrometer (blows / 50 mm): 3 6 9 12 15

1.00m

1.15m

Groundwater

Soil Moisture

Samples: ES0.1 NOV; ES0.5 NOV

Tests: No. 1 0, 0, 1, 0, 1, 2, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 3, 4, 5, 4; V= 112 R= 36; No. 2 12, 14, 14

Instrument/ Backfill

**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture: D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:

- [ ] Target depth
- [X] Refusal
- [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

RILEY AGS 3_1 NZ LIB 13.GLB Log RILEY CHCH HA 170743 SS-RANGIORA ALL LOGS.GPJ <<DrawingFile>> 16/01/2019 09:34 Produced by gINT Professional

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA-BH1 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 23.70 | E 1,566,521.8 N 5,203,464.7 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.75 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) 50 100 150 200 | Scala Penetrometer (blows / 50 mm) 3 6 9 12 15 | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +23.70 | | | | | | | | | | | |
| +23.50 | 0.20 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm to stiff"; moist; low plasticity; organics, rootlets. (TOPSOIL) | | | | | | ES0.1 NOV | | |
| +22.95 | 0.75 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) | | | | | | ES0.5 NOV<br>ES0.7 NOV | | |
| | 1 | | EOH @ 0.75 m | | | | | | | | |

**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Hole located adjacent to BH1, undertaken for environmental sampling.
3. No strength testing; strength terms based on strength testing at nearby HA locations.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA-BH2 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 24.40 | E 1,566,561.3 N 5,203,517.3 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.90 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) 50 100 150 200 | Scala Penetrometer (blows / 50 mm) 3 6 9 12 15 | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +24.40 | | | | | | | | | | | |
| | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm to stiff"; moist; low plasticity; organics, rootlets. (TOPSOIL) | | | | | | ES0.1 NOV | | |
| +24.20 | 0.20 | | | | | | | | | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) | | | | | | ES0.5 NOV | | |
| | | | 0.70m Grades to grey and orange mottling. | | | | | | | | |
| | | | 0.80m Grades to include minor gravel, fine to medium, subrounded. | | | | | | ES0.8 NOV | | |
| +23.50 | 0.90 | | | | | | | | | | |
| | | | EOH @ 0.90 m | | | | | | | | |
| | 1 | | | | | | | | | | |

**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Hole located adjacent to BH1, undertaken for environmental sampling.
3. No strength testing; strength terms based on strength testing at nearby HA locations.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA-BH3 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 20-12-18 / 20-12-18 | 24.40 | E 1,566,367.4 N 5,203,588.3 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.05 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) |
|---|---|---|---|
| +24.40 | | | |
| +24.20 | 0.20 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Soft to very soft"; moist; low plasticity; organics, rootlets. (TOPSOIL) |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION)<br>0.35m Grades to 'firm to stiff'.<br>0.60m Grades to light grey with minor orange mottling. Very stiff. |
| +23.35 | 1.05 | | EOH @ 1.05 m |

Soil Shear Strength (kPa): 50, 100, 150, 200
Scala Penetrometer (blows / 50 mm): 3, 6, 9, 12, 15
Groundwater
Soil Moisture
Samples: ES0.1 NOV; ES0.5 NOV; ES1.0 NOV
Tests: No. 1 1, 1, 1, 0, 1, 1, 0, 1, 2, 1, 2, 2, 2, 2, 2, 1, 2, 2, 5, 7; V= 163 R= 36; No. 2 8, 11, 13, 11
Instrument/ Backfill

1.00m
1.20m

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[X] Target depth [ ] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Strength terms for cohesive soil layers are based on shear vane test where available. Where no shear vane, cohesive soil strength terms are based on correlation with Scala test results and indicated in quotation marks.
3. Located adjacent to BH3, undertaken for environmental sampling.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA-BH4 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 20-12-18 / 20-12-18 | 21.20 | E 1,566,660.3 N 5,203,611.3 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.95 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) 50 100 150 200 | Scala Penetrometer (blows / 50 mm) 3 6 9 12 15 | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +21.20 | | | | | | | | | | | |
| | | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm to stiff"; moist; low plasticity; organics, rootlets. (TOPSOIL) | | | | | | ES0.1 NOV | | |
| +21.00 | 0.20 | | | | | | | | | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) | | | | | | ES0.5 NOV | | |
| +20.25 | 0.95 | | 0.90m Grades to include some gravel, subrounded, greywacke. | | | | | | ES0.9 NOV | | |
| | 1 | | EOH @ 0.95 m | | | | | | | | |

## Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

## GROUNDWATER

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

## Remarks

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Hole located adjacent to BH1, undertaken for environmental sampling.
3. No strength testing; strength terms based on strength testing at nearby HA locations.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: AvD | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA-BH5 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 21-12-18 / 21-12-18 | 22.40 | E 1,566,694.2 N 5,203,361.3 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 0.60 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) 50 100 150 200 | Scala Penetrometer (blows / 50 mm) 3 6 9 12 15 | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +22.40 | | | | | | | | | | | |
| +22.20 | 0.20 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm to stiff"; moist; low plasticity; organics, rootlets. (TOPSOIL) | | | | | | ES0.1 NOV | | |
| +21.80 | 0.60 | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) | | | | | | ES0.5 NOV | | |
| | 1 | | EOH @ 0.60 m | | | | | | | | |

**Explanations:**

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

**GROUNDWATER**

- [X] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
[ ] Target depth [X] Refusal [ ] Collapse

**Remarks**

1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Hole located adjacent to BH1, undertaken for environmental sampling.
3. No strength testing; strength terms based on strength testing at nearby HA locations.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

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# HAND AUGER LOG

| Project: | Location: | Hole position: | No.: |
|---|---|---|---|
| Summerset Rangiora Due Diligence | Townsend Rd/South Belt, Rangiora | Refer to Site Plan. | HA-BH6 |

| Job No.: | Start Date: / Finish Date: | Ground Level (m LINZ): | Co-Ordinates (NZTM2000): |
|---|---|---|---|
| 170743 | 18-12-18 / 18-12-18 | 23.70 | E 1,566,308.8 N 5,203,425.4 |

| Client: | Hole Depth: | Sheet: |
|---|---|---|
| Welhom Developments Ltd | 1.10 m | 1 of 1 |

| Elevation (m LINZ) | Depth (m) | Geological Unit | Geological Description (refer to separate Geotechnical and Geological Information sheet for further information) | Legend | Soil Shear Strength (kPa) 50 100 150 200 | Scala Penetrometer (blows / 50 mm) 3 6 9 12 15 | Groundwater | Soil Moisture | Samples | Tests | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|---|---|---|
| +23.70 | | | | | | | | | | | |
| +23.50 | 0.20 | (TOPSOIL) | SILT, trace clay, organics; dark brown. "Firm to stiff"; dry to moist; low plasticity; organics, rootlets. (TOPSOIL) | | | | | | ES0.1 NOV | | |
| | | (YALDHURST MEMBER, SPRINGSTON FORMATION) | SILT, minor to some clay, trace sand; grey with orange and yellowish-brown mottling. Very stiff; moist; low plasticity; sand, fine to medium. (YALDHURST MEMBER, SPRINGSTON FORMATION) | | | | | | ES0.5 NOV | | |
| | | | 0.60m Grades to include trace gravel, fine to medium, subrounded, greywacke. | | | | | | | | |
| | 1 | | 1.00m Reduced orange mottling. | | | | | | | | |
| +22.60 | 1.10 | | EOH @ 1.10 m | | | | | | | | |

Explanations:

- Scala Penetrometer - blows/50mm
- Permeability Test
- Schmidt Hammer
- Insitu Vane Shear Strength (kPa) V=Peak, R=Residual, UTP=Unable to penetrate
- Small Disturbed Sample
- Large Disturbed Sample
- U100 Undisturbed Sample
- Water Strike (1st, 2nd ...)
- Water Rise (1st, 2nd ...) and Rise Time (minutes)

Soil Moisture:
D = dry; M = moist; W = wet; S = saturated

GROUNDWATER
- [ ] Not Encountered
- [ ] Slow Seep (depth )
- [ ] Rapid Inflow (depth )

HOLE TERMINATED DUE TO:
- [X] Target depth
- [ ] Refusal
- [ ] Collapse

Remarks
1. Coordinates and elevations based on hand hand GPS and subject to survey confirmation.
2. Hole located adjacent to BH1, undertaken for environmental sampling.
3. No strength testing; strength terms based on strength testing at nearby HA locations.

| All dimensions in metres Scale 1:10 | Contractor: | Rig/Plant Used: Hand Auger 70 mm | Logged by: RBW | Checked by: CFC |
|---|---|---|---|---|

# *APPENDIX E*

## *Results Table*

## TABLE 1: CONTAMINANT CONCENTRATIONS IN SOILS (mg/kg)

**104 Townsend Road & 141 South Belt, Rangiora**

| | Background Soils Concentrations | NES-CS | | | Sample Reference and Result | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | | | HA3 | HA3 | HA4 | HA4 | HA10 | HA10 | HA9 | HA9 | HA9 | HA2 | HA2 | |
| **Job Number** | **Gley Earth** | **Burwood Resource Recovery Park acceptance criteria** | **Residential (10% produce)** | **High-Density Residential** | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | UCL 95% |
| **Date** | | | | | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | |
| **Depth (m)** | | | | | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.9 | 0.1 | 0.5 | |
| **Geology** | | | | | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | |
| **Heavy Metals** | | | | | | | | | | | | | | | | |
| Arsenic | 11 | 80 | 20 | 45 | 6.36 | 5.97 | 7.43 | 5.64 | 7.54 | **29.5** | 6.31 | 8.99 | 6.18 | 7.71 | 4.64 | |
| Cadmium | 0.28 | 400 | 3 | 230 | 0.086 | 0.017 | 0.053 | 0.006 | 0.11 | 0.057 | 0.11 | 0.023 | 0.021 | 0.13 | 0.029 | |
| Chromium | 19.3 | 2,700 | 460 | 1,500 | 16.5 | **20.3** | 15.7 | **20.9** | 17.1 | **23.6** | 16.9 | **20.6** | **21** | 17 | **25.4** | |
| Copper | 16.4 | >10,000 | >10,000 | >10,000 | 8.06 | 5.59 | 6.82 | 10.7 | 8.01 | 10.3 | 9.65 | 6.6 | 12.1 | 15 | 11.3 | |
| Lead | 19.3 | 880 | 210 | 500 | **23.1** | **23.4** | **22.7** | **25.1** | **23.4** | **42.1** | **24.6** | **26.6** | **23.8** | **166** | **31.1** | |
| Nickel | 16.1 | 1,200 | - | - | 11.3 | 12.5 | 10.6 | 13.5 | 11.3 | 19.2 | 12.4 | 12.8 | 14.1 | 11 | 15.9 | |
| Zinc | 77.1 | 30,000 | - | - | **81.7** | 75.3 | 68.5 | 63.2 | **86.4** | **113** | **92.5** | **80.9** | 63.5 | **167** | **80.9** | |
| **Qualitative Asbestos** | | | | | | | | | | | | | | | | |
| Asbestos | | | | | ND | | | | ND | | | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | | | | | | | | |
| Acenaphthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Acenaphthylene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Chrysene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | **0.01** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Dibenz(a,h)anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | **0.03** | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Fluorene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Indeno(1,2,3-cd)pyrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | **0.01** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Naphthalene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Phenanthrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Pyrene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | 0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benz[a]anthracene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.024 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[a]pyrene (BAP) | | | | | **0.01** | <0.01 | **0.01** | <0.01 | **0.03** | **0.02** | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Benzo[b]&[j] fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | **0.04** | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[g,h,i]perylene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.024 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[k]fluoranthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Benzo[a]pyrene TEQ (LOR) | 0.922 | 40 | | 24 | 0.03 | 0.03 | 0.03 | 0.03 | **0.07** | **0.04** | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | |
| **Organochlorine Pesticides** | | | | | | | | | | | | | | | | |
| Total DDT | | | | 240 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| alpha-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Aldrin | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| beta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| cis-Chlordane | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| cis-Nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| delta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Dieldrin | | | | 45 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | |
| Endosulfan I | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Endosulfan II | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Endosulfan sulphate | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Endrin | | | | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | |
| Endrin aldehyde | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Endrin ketone | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| gamma-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Heptachlor | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Heptachlor epoxide | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Hexachlorobenzene | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Methoxychlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| trans-nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| trans-Chlordane | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Chlordane (sum) | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| TCMX (Surrogate) % | | | | | 92.9 | 87.8 | 85.4 | 85.9 | 82.4 | 80.9 | 81.5 | 88.4 | 90.4 | 82.5 | 93.6 | |

**NOTES:**

Contaminant concentrations in soil have been compared against selected acceptance guidelines as discussed in the report.

**Background concentrations** These concentrations are proposed in the 2007 Ecan report "Background concentrations of selected trace elements in Canterbury soils" - In this case "Level 2 Background" uses the maximum recorded

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

**55** - Bold where result exceeds background levels

55 - Underline numeral (and highlighted yellow) where result exceeds Burwood Resource Recovery Park acceptance criteria.

55 - Highlighted green where results exceed NES-CS residential 10% produce land use soil contaminant standards.

**Benzo[a]pyrene (BAP) Toxic Equivalence Quotient (TEQ)** is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene,

1 Background Concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils Report No. R07/19, July 2007, compared to the mean concentration CCC.

| | Background Soils Concentrations | NES-CS | | | Sample Reference and Result | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | | | H-BH2 | H-BH2 | H-BH2 | H-BH1 | H-BH1 | H-BH1 | HA8 | HA8 | HA1 | HA1 | HA1 | |
| **Job Number** | | | | | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | |
| **Date** | **Gley Earth** | **Burwood Resource Recovery Park acceptance criteria** | **Residential (10% produce)** | **High-Density Residential** | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | UCL 95% |
| **Depth (m)** | | | | | 0.1 | 0.5 | 0.8 | 0.1 | 0.5 | 0.7 | 0.1 | 0.5 | 0.1 | 0.5 | 0.9 | |
| **Geology** | | | | | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | |
| **Heavy Metals (mg/kg dry wt)** | | | | | | | | | | | | | | | | |
| Arsenic | 11 | 80 | 20 | 45 | 8.51 | 4.63 | 3.58 | 5.29 | 3.98 | 4.67 | 6.46 | 3.06 | 5.14 | 7.9 | 3.89 | |
| Cadmium | 0.28 | 400 | 3 | 230 | 0.059 | 0.019 | 0.01 | 0.069 | 0.014 | 0.008 | 0.088 | 0.013 | 0.074 | 0.069 | 0.046 | |
| Chromium | 19.3 | 2,700 | 460 | 1,500 | 19.3 | **21.5** | **20.2** | 18 | **23.2** | 17.3 | 18 | **22.4** | 15.1 | **22.7** | **25.9** | |
| Copper | 16.4 | >10,000 | >10,000 | >10,000 | 7.14 | 12 | 9.75 | 7.18 | 8.96 | 7.44 | 11 | 8.9 | 6.42 | 7.37 | **17.9** | |
| Lead | 19.3 | 880 | 210 | 500 | **25.4** | **29** | **22** | **22.7** | **28.8** | **19.7** | **32.6** | **25.7** | **20.8** | **34.9** | **40.2** | |
| Nickel | 16.1 | 1,200 | - | - | 12.5 | 13.8 | 11.7 | 13.6 | 12.6 | 9.05 | 13.9 | 10.4 | 10 | 14.9 | **18.1** | |
| Zinc | 77.1 | 30,000 | - | - | **90.1** | 66.5 | 49 | **86.8** | 62.1 | 40.7 | **119** | 46.7 | 69 | **96.7** | **96.6** | |
| **Qualitative Asbestos** | | | | | | | | | | | | | | | | |
| Asbestos | | | | | | | | | | | ND | | ND | | | |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | | | | | | | | |
| Acenaphthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Acenaphthylene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Chrysene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | **0.03** | <0.01 | <0.01 | <0.01 | <0.01 | |
| Dibenz(a,h)anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.05** | <0.02 | <0.02 | <0.02 | <0.02 | |
| Fluorene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Indeno(1,2,3-cd)pyrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | **0.03** | <0.01 | <0.01 | <0.01 | <0.01 | |
| Naphthalene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Phenanthrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | **0.01** | <0.01 | <0.01 | <0.01 | <0.01 | |
| Pyrene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.05** | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benz[a]anthracene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.03** | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[a]pyrene (BAP) | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | **0.04** | <0.01 | <0.01 | <0.01 | <0.01 | |
| Benzo[b]&[j] fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.05** | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[g,h,i]perylene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[k]fluoranthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Benzo[a]pyrene TEQ (LOR) | 0.922 | 40 | | 24 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | **0.07** | 0.03 | 0.03 | 0.03 | 0.03 | |
| **Organochlorine Pesticides** | | | | | | | | | | | | | | | | |
| Total DDT | | | | 240 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| alpha-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Aldrin | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| beta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| cis-Chlordane | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| cis-Nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| delta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Dieldrin | | | | 45 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | |
| Endosulfan I | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Endosulfan II | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Endosulfan sulphate | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Endrin | | | | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | |
| Endrin aldehyde | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Endrin ketone | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| gamma-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Heptachlor | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Heptachlor epoxide | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Hexachlorobenzene | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Methoxychlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| trans-nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| trans-Chlordane | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Chlordane (sum) | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| TCMX (Surrogate) % | | | | | 82.1 | 92.7 | 97.6 | 91.2 | 88.4 | 87.3 | 93 | 96.7 | 85 | 78.7 | 80 | |

**NOTES:**
Contaminant concentrations in soil have been compared against selected acceptance guidelines as discussed in the report.
**Background concentrations** These concentrations are proposed in the 2007 Ecan report "Background concentrations of selected trace elements in Canterbury soils" - In this case "Level 2 Background" uses the maximum recorded
**NES-CS: Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.**
**55** - Bold where result exceeds background levels
55 - Underline numeral (and highlighted yellow) where result exceeds Burwood Resource Recovery Park acceptance criteria.
55 - Highlighted green where results exceed NES-CS residential 10% produce land use soil contaminant standards.
**Benzo[a]pyrene (BAP) Toxic Equivalence Quotient (TEQ)** is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene,
1 Background Concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils Report No. R07/19, July 2007, compared to the mean concentration CCC.

| | Background Soils Concentrations | NES-CS | | | Sample Reference and Result | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | | | H-BH6 | H-BH6 | H-BH6 | HA13 | HA7 | HA7 | H-BH3 | H-BH3 | HA11 | HA11 | HA5 | HA5 |
| **Job Number** | | | | | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 |
| **Date** | | | | | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| **Depth (m)** | | | | | 0.1 | 0.5 | 1 | 0.1 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 |
| **Geology** | **Gley Earth** | **Burwood Resource Recovery Park acceptance criteria** | **Residential (10% produce)** | **High-Density Residential** | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil |
| **Heavy Metals (mg/kg dry wt)** | | | | | | | | | | | | | | | | |
| Arsenic | 11 | 80 | 20 | 45 | 7.54 | 4.45 | 4.06 | 7.32 | 7.25 | 4.2 | 5.06 | 6.07 | 9.63 | **11.2** | 5.21 | 9.25 |
| Cadmium | 0.28 | 400 | 3 | 230 | 0.066 | 0.007 | 0.024 | 0.06 | 0.078 | 0.014 | 0.024 | 0.12 | 0.076 | 0.025 | 0.12 | 0.032 |
| Chromium | 19.3 | 2,700 | 460 | 1,500 | **19.7** | **19.8** | 14.4 | **19.5** | **20** | 16.6 | **19.4** | 17.9 | **19.6** | **22.2** | **22.1** | **25.2** |
| Copper | 16.4 | >10,000 | >10,000 | >10,000 | 9.93 | 6.37 | 7.43 | 10.5 | 11 | 4.79 | 8.57 | **35.9** | 6.55 | 9.64 | 10.3 | 14.3 |
| Lead | 19.3 | 880 | 210 | 500 | **27.9** | **21.6** | 14.4 | **25.8** | **26.8** | **21.1** | **29.2** | **121** | **25.3** | **28.9** | **31.5** | **32.5** |
| Nickel | 16.1 | 1,200 | - | - | 16.1 | 10.4 | 15.2 | 15.5 | 14.4 | 10.3 | 12.1 | 13.3 | 12.6 | 13.5 | 15.6 | **16.2** |
| Zinc | 77.1 | 30,000 | - | - | **83.5** | 46.9 | 51.1 | **81.4** | **83.5** | 58.6 | **76.4** | **145** | **85.4** | **82.6** | **102** | **85.2** |
| **Qualitative Asbestos** | | | | | | | | | | | | | | | | |
| Asbestos | | | | | | | | | | | ND | | | | ND | |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | | | | | | | | |
| Acenaphthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluorene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benz[a]anthracene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene (BAP) | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[a]pyrene TEQ (LOR) | 0.922 | 40 | | 24 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| **Organochlorine Pesticides** | | | | | | | | | | | | | | | | |
| Total DDT | | | | 240 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | | | | 45 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | | | | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| TCMX (Surrogate) % | | | | | 93.3 | 81.8 | 79.3 | 80.7 | 116.6 | 98.2 | 111.3 | 115.2 | 98 | 99.1 | 103.6 | 95.9 |

**NOTES:**

Contaminant concentrations in soil have been compared against selected acceptance guidelines as discussed in the report.

**Background concentrations** These concentrations are proposed in the 2007 Ecan report "Background concentrations of selected trace elements in Canterbury soils" - In this case "Level 2 Background" uses the maximum recorded

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

**55** - Bold where result exceeds background levels

55 - Underline numeral (and highlighted yellow) where result exceeds Burwood Resource Recovery Park acceptance criteria.

55 - Highlighted green where results exceed NES-CS residential 10% produce land use soil contaminant standards.

**Benzo[a]pyrene (BAP) Toxic Equivalence Quotient (TEQ)** is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene,

1 Background Concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils Report No. R07/19, July 2007, compared to the mean concentration CCC.

| | Background Soils Concentrations | NES-CS | | | Sample Reference and Result | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | | | HA6 | HA6 | H-BH4 | H-BH4 | HA12 | HA12 | FT1 | FT1 | HA14 | HA14 | HA18 | |
| **Job Number** | | | | | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | |
| **Date** | **Gley Earth** | **Burwood Resource Recovery Park acceptance criteria** | **Residential (10% produce)** | **High-Density Residential** | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | UCL 95% |
| **Depth (m)** | | | | | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.3 | 0.1 | 0.5 | 0.1 | |
| **Geology** | | | | | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | |
| **Heavy Metals (mg/kg dry wt)** | | | | | | | | | | | | | | | | |
| Arsenic | 11 | 80 | 20 | 45 | 5.54 | 2.89 | 4.44 | 3.38 | 7.28 | 5.16 | 59 | 6.76 | 4.51 | 4.03 | 7.83 | |
| Cadmium | 0.28 | 400 | 3 | 230 | 0.19 | 0.027 | 0.12 | 0.017 | 0.091 | 0.029 | 0.36 | 0.061 | 0.086 | 0.016 | 0.088 | |
| Chromium | 19.3 | 2,700 | 460 | 1,500 | 19 | **24.6** | 18.3 | **20.2** | **20** | **20.9** | **42.2** | **20.8** | 18.7 | **27.2** | **23.1** | |
| Copper | 16.4 | >10,000 | >10,000 | >10,000 | 9.02 | 13.9 | 6.77 | 9.58 | 6.69 | 9.54 | **62.2** | 7.65 | 10.8 | 14.3 | 9.86 | |
| Lead | 19.3 | 880 | 210 | 500 | **27.1** | **30.1** | **25.6** | **24.7** | **25.9** | **22.8** | **223** | **37.2** | **21.2** | **29.9** | **26.6** | |
| Nickel | 16.1 | 1,200 | - | - | 14.1 | 16.1 | 13 | 11.7 | 12.7 | 11.9 | 14.4 | 13.4 | 14.4 | 11.6 | **18.6** | |
| Zinc | 77.1 | 30,000 | - | - | **92.9** | **90** | 76.5 | 73.8 | **78.4** | 69.6 | **340** | **94.6** | **91.6** | 52.8 | **102** | |
| **Qualitative Asbestos** | | | | | | | | | | | | | | | | |
| Asbestos | | | | | | | ND | | ND | | ND | ND | ND | | | |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | | | | | | | | |
| Acenaphthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Acenaphthylene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Chrysene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | **0.06** | <0.01 | <0.01 | <0.01 | <0.01 | |
| Dibenz(a,h)anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.1** | <0.02 | <0.02 | <0.02 | <0.02 | |
| Fluorene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Indeno(1,2,3-cd)pyrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | **0.04** | <0.01 | <0.01 | <0.01 | <0.01 | |
| Naphthalene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Phenanthrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | **0.03** | <0.01 | <0.01 | <0.01 | 0.01 | |
| Pyrene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.09** | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benz[a]anthracene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.04** | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[a]pyrene (BAP) | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | **0.06** | <0.01 | <0.01 | <0.01 | <0.01 | |
| Benzo[b]&[j] fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.07** | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[g,h,i]perylene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.04** | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[k]fluoranthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.011 | <0.01 | **0.03** | <0.01 | <0.01 | <0.01 | <0.01 | |
| Benzo[a]pyrene TEQ (LOR) | 0.922 | 40 | | 24 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | **0.09** | 0.03 | 0.03 | 0.03 | 0.03 | |
| **Organochlorine Pesticides** | | | | | | | | | | | | | | | | |
| Total DDT | | | | 240 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | - | - | <0.02 | <0.02 | <0.02 | |
| alpha-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| Aldrin | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| beta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| cis-Chlordane | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| cis-Nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | - | <0.01 | <0.01 | <0.01 | |
| delta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| Dieldrin | | | | 45 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | - | <0.05 | <0.05 | <0.05 | |
| Endosulfan I | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| Endosulfan II | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | - | <0.01 | <0.01 | <0.01 | |
| Endosulfan sulphate | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| Endrin | | | | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | - | <0.05 | <0.05 | <0.05 | |
| Endrin aldehyde | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | - | <0.01 | <0.01 | <0.01 | |
| Endrin ketone | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| gamma-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| Heptachlor | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| Heptachlor epoxide | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| Hexachlorobenzene | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | - | - | <0.005 | <0.005 | <0.005 | |
| Methoxychlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | - | <0.01 | <0.01 | <0.01 | |
| trans-nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | - | <0.01 | <0.01 | <0.01 | |
| trans-Chlordane | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | - | <0.01 | <0.01 | <0.01 | |
| Chlordane (sum) | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | - | - | <0.02 | <0.02 | <0.02 | |
| TCMX (Surrogate) % | | | | | 106.7 | 107.8 | 96.6 | 123.6 | 86.4 | 91 | - | - | 91.1 | 111.5 | 115.6 | |
| **BTEX** | | | | | | | | | | | | | | | | |
| Benzene | | | | | | | | | | | <0.05 | <0.05 | | | | |
| Ethylbenzene | | | | | | | | | | | <0.05 | <0.05 | | | | |
| Toluene | | | | | | | | | | | 0.08 | <0.05 | | | | |
| m,p-xylene | | | | | | | | | | | <0.05 | <0.05 | | | | |
| o-xylene | | | | | | | | | | | <0.05 | <0.05 | | | | |

**NOTES:**
Contaminant concentrations in soil have been compared against selected acceptance guidelines as discussed in the report.

**Background concentrations** These concentrations are proposed in the 2007 Ecan report "Background concentrations of selected trace elements in Canterbury soils" - In this case "Level 2 Background" uses the maximum recorded
**NES-CS: Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.**
**55** - Bold where result exceeds background levels
55 - Underline numeral (and highlighted yellow) where result exceeds Burwood Resource Recovery Park acceptance criteria.
55 - Highlighted green where results exceed NES-CS residential 10% produce land use soil contaminant standards.
**Benzo[a]pyrene (BAP) Toxic Equivalence Quotient (TEQ)** is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene,
1 Background Concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils Report No. R07/19, July 2007, compared to the mean concentration CCC.

| | Background Soils Concentrations | NES-CS | | | Sample Reference and Result | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | | | HA18 | HA16 | HA16 | HA17 | HA17 | HA20 | HA23 | HA20 | HA21 | HA21 | HA15 | |
| **Job Number** | | | | | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | |
| **Date** | | | | | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | |
| **Depth (m)** | | | | | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | |
| **Geology** | **Gley Earth** | **Burwood Resource Recovery Park acceptance criteria** | **Residential (10% produce)** | **High-Density Residential** | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | UCL 95% |
| **Heavy Metals (mg/kg dry wt)** | | | | | | | | | | | | | | | | |
| Arsenic | 11 | 80 | 20 | 45 | 8.4 | 3.36 | 4.48 | 7.08 | 5.15 | 5.69 | 6.7 | 4.66 | 7.5 | 4.12 | 5.77 | |
| Cadmium | 0.28 | 400 | 3 | 230 | 0.019 | 0.015 | 0.1 | 0.12 | 0.012 | 0.089 | 0.11 | 0.008 | 0.068 | 0.044 | 0.071 | |
| Chromium | 19.3 | 2,700 | 460 | 1,500 | **25.8** | **23.4** | 18.5 | **21.5** | **23.2** | **21.1** | **20.4** | **19.5** | **22** | 17.3 | 18.9 | |
| Copper | 16.4 | >10,000 | >10,000 | >10,000 | 10.4 | 10.5 | 7.2 | 7.17 | 8.1 | 10.2 | 11.7 | 6.27 | 7.51 | 8.79 | 7.68 | |
| Lead | 19.3 | 880 | 210 | 500 | **25.3** | **25** | **22.5** | **24.3** | **26.5** | **24.2** | **24.3** | 18.9 | **25.3** | 16.8 | **23.3** | |
| Nickel | 16.1 | 1,200 | - | - | 14.4 | 12.3 | 13.3 | 14.7 | 13.5 | **17.5** | 14.9 | 12.1 | 14.1 | 12.6 | 12.7 | |
| Zinc | 77.1 | 30,000 | - | - | 60.3 | 58.8 | **91.7** | **97.3** | 72.2 | **87.3** | **79.7** | 49.8 | **93.1** | 59.6 | **92.7** | |
| **Qualitative Asbestos** | | | | | | | | | | | | | | | | |
| Asbestos | | | | | | ND | | | | | ND | | ND | | | |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | | | | | | | | |
| Acenaphthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Acenaphthylene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Chrysene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Dibenz(a,h)anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Fluorene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Indeno(1,2,3-cd)pyrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Naphthalene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Phenanthrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Pyrene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benz[a]anthracene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[a]pyrene (BAP) | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Benzo[b]&[j] fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[g,h,i]perylene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| Benzo[k]fluoranthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Benzo[a]pyrene TEQ (LOR) | 0.922 | 40 | | 24 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | |
| **Organochlorine Pesticides** | | | | | | | | | | | | | | | | |
| Total DDT | | | | 240 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| alpha-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Aldrin | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| beta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| cis-Chlordane | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| cis-Nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| delta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Dieldrin | | | | 45 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | |
| Endosulfan I | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Endosulfan II | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Endosulfan sulphate | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Endrin | | | | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | |
| Endrin aldehyde | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Endrin ketone | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| gamma-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Heptachlor | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Heptachlor epoxide | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Hexachlorobenzene | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | |
| Methoxychlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| trans-nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| trans-Chlordane | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | |
| Chlordane (sum) | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | |
| TCMX (Surrogate) % | | | | | 112 | 114.1 | 94.5 | 109.5 | 103.8 | 108.5 | 103.7 | 100.6 | 103.9 | 101.6 | 115.8 | |

**NOTES:**

Contaminant concentrations in soil have been compared against selected acceptance guidelines as discussed in the report.

**Background concentrations** These concentrations are proposed in the 2007 Ecan report "Background concentrations of selected trace elements in Canterbury soils" - In this case "Level 2 Background" uses the maximum recorded

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

**55** - Bold where result exceeds background levels

55 - Underline numeral (and highlighted yellow) where result exceeds Burwood Resource Recovery Park acceptance criteria.

55 - Highlighted green where results exceed NES-CS residential 10% produce land use soil contaminant standards.

**Benzo[a]pyrene (BAP) Toxic Equivalence Quotient (TEQ)** is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (benz(a)anthracene, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene,

1 Background Concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils Report No. R07/19, July 2007, compared to the mean concentration CCC.

| | Background Soils Concentrations | NES-CS | | | Sample Reference and Result | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | | | | | HA15 | HA19 | HA19 | H-BH5 | H-BH5 | HA22 | HA22 | HA23 | | | | |
| **Job Number** | | | | | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 | | | | |
| **Date** | **Gley Earth** | **Burwood Resource Recovery Park acceptance criteria** | **Residential (10% produce)** | **High-Density Residential** | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | | | | UCL 95% |
| **Depth (m)** | | | | | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.1 | 0.5 | 0.5 | | | | |
| **Geology** | | | | | Soil | Soil | Soil | Soil | Soil | Soil | Soil | Soil | | | | |
| **Heavy Metals (mg/kg dry wt)** | | | | | | | | | | | | | | | | |
| Arsenic | 11 | 80 | 20 | 45 | 2.43 | 7.05 | 4.4 | 7.39 | 9.6 | 4.74 | 4.15 | 5.04 | | | | |
| Cadmium | 0.28 | 400 | 3 | 230 | 0.019 | 0.11 | 0.013 | 0.11 | 0.023 | 0.074 | 0.082 | 0.008 | | | | |
| Chromium | 19.3 | 2,700 | 460 | 1,500 | **24.6** | **21.9** | **24.6** | **22.3** | **23.5** | 17.2 | 16.8 | **22.5** | | | | |
| Copper | 16.4 | >10,000 | >10,000 | >10,000 | 9.93 | 12 | 9.9 | 8.48 | 8.67 | 9.52 | 8.79 | 9.11 | | | | |
| Lead | 19.3 | 880 | 210 | 500 | **26.9** | **31.8** | **25.8** | **23.7** | **25.2** | **20.4** | **21.4** | **25.8** | | | | |
| Nickel | 16.1 | 1,200 | - | - | 12.5 | **17.5** | 12.9 | **16.9** | 12.5 | 11.4 | 11.7 | 11.8 | | | | |
| Zinc | 77.1 | 30,000 | - | - | 65.7 | **89.7** | 64.1 | **109** | **81.4** | 64 | 47.7 | 69.5 | | | | |
| **Qualitative Asbestos** | | | | | | | | | | | | | | | | |
| Asbestos | | | | | | ND | | | | | | | | | | |
| **Polycyclic Aromatic Hydrocarbons** | | | | | | | | | | | | | | | | |
| Acenaphthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Acenaphthylene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Chrysene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | **0.01** | <0.01 | | | | |
| Dibenz(a,h)anthracene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.03** | <0.02 | | | | |
| Fluorene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Indeno(1,2,3-cd)pyrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Naphthalene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Phenanthrene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 | | | | |
| Pyrene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | **0.03** | <0.02 | | | | |
| Benz[a]anthracene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | | | |
| Benzo[a]pyrene (BAP) | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | **0.01** | <0.01 | | | | |
| Benzo[b]&[j] fluoranthene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | | | |
| Benzo[g,h,i]perylene | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | | | |
| Benzo[k]fluoranthene | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Benzo[a]pyrene TEQ (LOR) | 0.922 | 40 | | 24 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | | | | |
| **Organochlorine Pesticides** | | | | | | | | | | | | | | | | |
| Total DDT | | | | 240 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | | | |
| alpha-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| Aldrin | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| beta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| cis-Chlordane | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| cis-Nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| delta-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| Dieldrin | | | | 45 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | | | |
| Endosulfan I | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| Endosulfan II | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Endosulfan sulphate | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| Endrin | | | | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | | | |
| Endrin aldehyde | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Endrin ketone | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| gamma-BHC | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| Heptachlor | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| Heptachlor epoxide | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| Hexachlorobenzene | | | | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | | | | |
| Methoxychlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| trans-nonachlor | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| trans-Chlordane | | | | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | | | | |
| Chlordane (sum) | | | | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | | | | |
| TCMX (Surrogate) % | | | | | 129.9 | 98.3 | 111.9 | 114.9 | 98.6 | 101.9 | 94.2 | 135.4 | | | | |

**NOTES:**

Contaminant concentrations in soil have been compared against selected acceptance guidelines as discussed in the report.

**Background concentrations** These concentrations are proposed in the 2007 ECan report "Background concentrations of selected trace elements in Canterbury soils" - In this case "Level 2 Background" uses the maximum recorded

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

**55** - **Bold** where result exceeds background levels

55 - Underline numeral (and highlighted yellow) where result exceeds Burwood Resource Recovery Park acceptance criteria.

55 - Highlighted green where results exceed NES-CS residential 10% produce land use soil contaminant standards.

1 Background Concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils Report No. R07/19, July 2007, compared to the mean concentration CCC.

ND - Not Detected

| | Background Soils Concentrations | NES-CS / BRANZ | | | Sample Reference and Result | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Gley Earth** | **Burwood Resource Recovery Park acceptance criteria** | **Residential (10% produce)** | **High-Density Residential** | BP1 | BP1 | BP2 | BP2 | BP3 | BP3 |
| **Job Number** | | | | | 170743 | 170743 | 170743 | 170743 | 170743 | 170743 |
| **Date** | | | | | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| **Depth (m)** | | | | | 0.1 | 0.3 | 0.1 | 0.3 | 0.1 | 0.3 |
| **Geology** | | | | | Soil | Soil | Soil | Soil | Soil | Soil |
| **Qualitative Asbestos** | | | | | | | | | | |
| Asbestos | ND | ND | | | ND | ND | ND | ND | ND | ND |

**NOTES:**
Contaminant concentrations in soil have been compared against selected acceptance guidelines as discussed in the report.
**Background concentrations** These
**NES-CS: Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.**
**BRANZ:** New Zealand Guidelines for Assessing and Managing Asbestos in Soil, Nov 2017
ND - Not Detected

# *APPENDIX F*

## *Laboratory Transcripts*

**Report Date:** 21 Dec 2018

**Certificate Number:** P1812201041

PRECISE
CONSULTING & LABORATORY

Analytica Laboratories
Ruakura Research Centre, 10 Bisley Road, Private Bag 3123

**Client Reference:** 18-38911

Dear Karla Chapman,

**Re: Asbestos Soil Identification Analysis – 18-38911**

8 sample(s) received on 20 Dec 2018 by Julie Saia.

The results of fibre analysis were performed by Georgina Jackson of Precise Consulting and Laboratory Ltd on 21 Dec 2018.

The sample(s) were stated to be from 18-38911.

Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with *AS4964-2004 Method for the qualitative identification of asbestos in soil samples.*

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

Should you require further information please contact Georgina Jackson.

Yours sincerely

Georgina Jackson

Georgina Jackson
**PRECISE LABORATORY IDENTIFIER**

# Sample Analysis Results

Certificate Number: P1812201041
Report Date: 21 Dec 2018
Site Location: 18-38911

PRECISE
CONSULTING & LABORATORY

**Note 1:** The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques.

**Note 2:** If mineral fibres of unknown type are detected (UMF), by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised.

**Note 3:** The samples in this report are "As Received". The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description. This document may not be reproduced except in full.

Identified by:

Georgina Jackson

Approved Identifier: Georgina Jackson

Reviewed by:

Georgina Jackson

Key Technical Person: Georgina Jackson

| Sample ID | Client Sample ID | Sample Location/Description/Dimensions | Analysis Results |
|---|---|---|---|
| S001 | HA3 S0.1 | -<br>Non-Homogeneous Soil<br>68.5g | No Asbestos Detected<br>Organic Fibres |
| S002 | HA10 S0.1 | -<br>Non-Homogeneous Soil<br>68.0g | No Asbestos Detected<br>Organic Fibres |
| S003 | HA8 S0.1 | -<br>Non-Homogeneous Soil<br>77.0g | No Asbestos Detected<br>Organic Fibres |
| S004 | HA1 S0.1 | -<br>Non-Homogeneous Soil<br>64.0g | No Asbestos Detected<br>Organic Fibres |
| S005 | BP1 S0.1 | -<br>Non-Homogeneous Soil<br>52.0g | No Asbestos Detected<br>Organic Fibres |
| S006 | BP1 S0.3 | -<br>Non-Homogeneous Soil<br>99.0g | No Asbestos Detected<br>Organic Fibres |
| S007 | BP2 S0.1 | -<br>Non-Homogeneous Soil<br>112.5g | No Asbestos Detected<br>Organic Fibres |
| S008 | BP2 S0.3 | -<br>Non-Homogeneous Soil<br>44.5g | No Asbestos Detected<br>Organic Fibres |


Precise Consulting & Laboratory Limited
Unit 1, 30 Greenpark Road, Penrose, Auckland 8023

P: 09 282 3886 W: www.preciseconsulting.co.nz

IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

# Appendix 1: Soil Analysis Raw Data

Certificate Number: P1812201041
Report Date: 21 Dec 2018
Site Location: 18-38911

PRECISE
CONSULTING & LABORATORY

| Sample ID | Client Sample ID | Total Sample Weight (g) | ACM Approximate Dimensions (g)* | Form | Trace Asbestos Detected** |
|---|---|---|---|---|---|
| S001 | HA3 S0.1 | 68.5 | - | - | N |
| S002 | HA10 S0.1 | 68.0 | - | - | N |
| S003 | HA8 S0.1 | 77.0 | - | - | N |
| S004 | HA1 S0.1 | 64.0 | - | - | N |
| S005 | BP1 S0.1 | 52.0 | - | - | N |
| S006 | BP1 S0.3 | 99.0 | - | - | N |
| S007 | BP2 S0.1 | 112.5 | - | - | N |
| S008 | BP2 S0.3 | 44.5 | - | - | N |

* The reporting limit for this standard is 0.1g/kg
** Trace asbestos present is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased
*** Asbestos weights listed in this table are indicative only and are outside of IANZ accreditation and is therefore not endorsed by IANZ.


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# Certificate of Analysis

Riley Consultants Ltd
12 Moorhouse Ave
Christchurch
Attention: Leanne Sutherland
Phone: 03 3794402
Email: ccameron@riley.co.nz

Lab Reference: 18-38911
Submitted by: AVD,Fy,RW
Date Received: 19/12/2018
Date Completed: 10/01/2019
Order Number:
Reference: 170743

Sampling Site: 141 South Belt, Rangiora

## Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.

### Heavy Metals in Soil

| | | Client Sample ID | HA3 S0.1 0.1 | HA3 S0.5 0.5 | HA4 S0.1 0.1 | HA4 S0.5 0.5 | HA10 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | | Date Sampled | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-1 | 18-38911-2 | 18-38911-3 | 18-38911-4 | 18-38911-5 |
| Arsenic | mg/kg dry wt | *0.125* | 6.36 | 5.97 | 7.43 | 5.64 | 7.54 |
| Cadmium | mg/kg dry wt | *0.005* | 0.086 | 0.017 | 0.053 | 0.006 | 0.11 |
| Chromium | mg/kg dry wt | *0.125* | 16.5 | 20.3 | 15.7 | 20.9 | 17.1 |
| Copper | mg/kg dry wt | *0.075* | 8.06 | 5.59 | 6.82 | 10.7 | 8.01 |
| Lead | mg/kg dry wt | *0.05* | 23.1 | 23.4 | 22.7 | 25.1 | 23.4 |
| Nickel | mg/kg dry wt | *0.05* | 11.3 | 12.5 | 10.6 | 13.5 | 11.3 |
| Zinc | mg/kg dry wt | *0.05* | 81.7 | 75.3 | 68.5 | 63.2 | 86.4 |

### Heavy Metals in Soil

| | | Client Sample ID | HA10 S0.5 0.5 | HA9 S0.1 0.1 | HA9 S0.5 0.5 | HA9 S0.9 0.9 | HA2 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | | Date Sampled | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-6 | 18-38911-7 | 18-38911-8 | 18-38911-9 | 18-38911-10 |
| Arsenic | mg/kg dry wt | *0.125* | 29.5 | 6.31 | 8.99 | 6.18 | 7.71 |
| Cadmium | mg/kg dry wt | *0.005* | 0.057 | 0.11 | 0.023 | 0.021 | 0.13 |
| Chromium | mg/kg dry wt | *0.125* | 23.6 | 16.9 | 20.6 | 21.0 | 17.0 |
| Copper | mg/kg dry wt | *0.075* | 10.3 | 9.65 | 6.60 | 12.1 | 15.0 |
| Lead | mg/kg dry wt | *0.05* | 42.1 | 24.6 | 26.6 | 23.8 | 166 |
| Nickel | mg/kg dry wt | *0.05* | 19.2 | 12.4 | 12.8 | 14.1 | 11.0 |
| Zinc | mg/kg dry wt | *0.05* | 113 | 92.5 | 80.9 | 63.5 | 167 |

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation, with the exception of tests marked *, which are not accredited.

## Heavy Metals in Soil

| Client Sample ID | | | HA2 S0.5 0.5 | H-BH2 S0.1 0.1 | H-BH2 S0.5 0.5 | H-BH2 S0.8 0.8 | H-BH1 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| Date Sampled | | | 17/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-11 | 18-38911-12 | 18-38911-13 | 18-38911-14 | 18-38911-15 |
| Arsenic | mg/kg dry wt | *0.125* | 4.64 | 8.51 | 4.63 | 3.58 | 5.29 |
| Cadmium | mg/kg dry wt | *0.005* | 0.029 | 0.059 | 0.019 | 0.010 | 0.069 |
| Chromium | mg/kg dry wt | *0.125* | 25.4 | 19.3 | 21.5 | 20.2 | 18.0 |
| Copper | mg/kg dry wt | *0.075* | 11.3 | 7.14 | 12.0 | 9.75 | 7.18 |
| Lead | mg/kg dry wt | *0.05* | 31.1 | 25.4 | 29.0 | 22.0 | 22.7 |
| Nickel | mg/kg dry wt | *0.05* | 15.9 | 12.5 | 13.8 | 11.7 | 13.6 |
| Zinc | mg/kg dry wt | *0.05* | 80.9 | 90.1 | 66.5 | 49.0 | 86.8 |

## Heavy Metals in Soil

| Client Sample ID | | | H-BH1 S0.5 0.5 | H-BH1 S0.7 0.7 | HA8 S0.1 0.1 | HA8 S0.5 0.5 | HA1 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| Date Sampled | | | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-16 | 18-38911-17 | 18-38911-18 | 18-38911-19 | 18-38911-20 |
| Arsenic | mg/kg dry wt | *0.125* | 3.98 | 4.67 | 6.46 | 3.06 | 5.14 |
| Cadmium | mg/kg dry wt | *0.005* | 0.014 | 0.008 | 0.088 | 0.013 | 0.074 |
| Chromium | mg/kg dry wt | *0.125* | 23.2 | 17.3 | 18.0 | 22.4 | 15.1 |
| Copper | mg/kg dry wt | *0.075* | 8.96 | 7.44 | 11.0 | 8.90 | 6.42 |
| Lead | mg/kg dry wt | *0.05* | 28.8 | 19.7 | 32.6 | 25.7 | 20.8 |
| Nickel | mg/kg dry wt | *0.05* | 12.6 | 9.05 | 13.9 | 10.4 | 10.0 |
| Zinc | mg/kg dry wt | *0.05* | 62.1 | 40.7 | 119 | 46.7 | 69.0 |

## Heavy Metals in Soil

| Client Sample ID | | | HA1 S0.5 0.5 | HA1 S0.9 0.9 | H-BH6 S0.1 0.1 | H-BH6 S0.5 0.5 | H-BH6 S1.0 1.0 |
|---|---|---|---|---|---|---|---|
| Date Sampled | | | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-21 | 18-38911-22 | 18-38911-23 | 18-38911-24 | 18-38911-25 |
| Arsenic | mg/kg dry wt | *0.125* | 7.90 | 3.89 | 7.54 | 4.45 | 4.06 |
| Cadmium | mg/kg dry wt | *0.005* | 0.069 | 0.046 | 0.066 | 0.007 | 0.024 |
| Chromium | mg/kg dry wt | *0.125* | 22.7 | 25.9 | 19.7 | 19.8 | 14.4 |
| Copper | mg/kg dry wt | *0.075* | 7.37 | 17.9 | 9.93 | 6.37 | 7.43 |
| Lead | mg/kg dry wt | *0.05* | 34.9 | 40.2 | 27.9 | 21.6 | 14.4 |
| Nickel | mg/kg dry wt | *0.05* | 14.9 | 18.1 | 16.1 | 10.4 | 15.2 |
| Zinc | mg/kg dry wt | *0.05* | 96.7 | 96.6 | 83.5 | 46.9 | 51.1 |

## Heavy Metals in Soil

| Client Sample ID | | | HA14 S0.1 0.1 | HA7 S0.1 0.1 | HA7 S0.5 0.5 |
|---|---|---|---|---|---|
| Date Sampled | | | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-30 | 18-38911-31 | 18-38911-32 |
| Arsenic | mg/kg dry wt | *0.125* | 7.32 | 7.25 | 4.20 |
| Cadmium | mg/kg dry wt | *0.005* | 0.060 | 0.078 | 0.014 |
| Chromium | mg/kg dry wt | *0.125* | 19.5 | 20.0 | 16.6 |
| Copper | mg/kg dry wt | *0.075* | 10.5 | 11.0 | 4.79 |
| Lead | mg/kg dry wt | *0.05* | 25.8 | 26.8 | 21.1 |
| Nickel | mg/kg dry wt | *0.05* | 15.5 | 14.4 | 10.3 |
| Zinc | mg/kg dry wt | *0.05* | 81.4 | 83.5 | 58.6 |

## Organochlorine Pesticides - Soil

| | Client Sample ID | | HA3 S0.1 0.1 | HA3 S0.5 0.5 | HA4 S0.1 0.1 | HA4 S0.5 0.5 | HA10 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-1 | 18-38911-2 | 18-38911-3 | 18-38911-4 | 18-38911-5 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | 92.9 | 87.8 | 85.4 | 85.9 | 82.4 |

## Organochlorine Pesticides - Soil

| | Client Sample ID | | HA10 S0.5 0.5 | HA9 S0.1 0.1 | HA9 S0.5 0.5 | HA9 S0.9 0.9 | HA2 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-6 | 18-38911-7 | 18-38911-8 | 18-38911-9 | 18-38911-10 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA10 S0.5 0.5 | HA9 S0.1 0.1 | HA9 S0.5 0.5 | HA9 S0.9 0.9 | HA2 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 80.9 | 81.5 | 88.4 | 90.4 | 82.5 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA2 S0.5 0.5 | H-BH2 S0.1 0.1 | H-BH2 S0.5 0.5 | H-BH2 S0.8 0.8 | H-BH1 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 17/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-11 | 18-38911-12 | 18-38911-13 | 18-38911-14 | 18-38911-15 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 93.6 | 82.1 | 92.7 | 97.6 | 91.2 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | H-BH1 S0.5 0.5 | H-BH1 S0.7 0.7 | HA8 S0.1 0.1 | HA8 S0.5 0.5 | HA1 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-16 | 18-38911-17 | 18-38911-18 | 18-38911-19 | 18-38911-20 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 88.4 | 87.3 | 93.0 | 96.7 | 85.0 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA1 S0.5 0.5 | HA1 S0.9 0.9 | H-BH6 S0.1 0.1 | H-BH6 S0.5 0.5 | H-BH6 S1.0 1.0 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-21 | 18-38911-22 | 18-38911-23 | 18-38911-24 | 18-38911-25 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA1 S0.5 0.5 | HA1 S0.9 0.9 | H-BH6 S0.1 0.1 | H-BH6 S0.5 0.5 | H-BH6 S1.0 1.0 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 78.7 | 80.0 | 93.3 | 81.8 | 79.3 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA14 S0.1 0.1 | HA7 S0.1 0.1 | HA7 S0.5 0.5 |
|---|---|---|---|---|---|---|
| | | | Date Sampled | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-30 | 18-38911-31 | 18-38911-32 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 80.7 | 116.6 | 98.2 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA3 S0.1 0.1 | HA3 S0.5 0.5 | HA4 S0.1 0.1 | HA4 S0.5 0.5 | HA10 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-1 | 18-38911-2 | 18-38911-3 | 18-38911-4 | 18-38911-5 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.024 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | 0.01 | <0.01 | 0.01 | <0.01 | 0.03 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | 0.04 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.024 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | 0.03 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.024 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | 0.03 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 | 0.03 | 0.07 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | 0.01 | <0.01 | 0.01 | <0.01 | 0.04 |
| Anthracene-d10 (Surrogate) | % | *1* | | 97.5 | 97.8 | 97.5 | 98.2 | 97.6 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA10 S0.5 0.5 | HA9 S0.1 0.1 | HA9 S0.5 0.5 | HA9 S0.9 0.9 | HA2 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-6 | 18-38911-7 | 18-38911-8 | 18-38911-9 | 18-38911-10 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | 0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA10 S0.5 0.5 | HA9 S0.1 0.1 | HA9 S0.5 0.5 | HA9 S0.9 0.9 | HA2 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | 0.02 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 96.9 | 97.6 | 96.3 | 96.2 | 96.3 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA2 S0.5 0.5 | H-BH2 S0.1 0.1 | H-BH2 S0.5 0.5 | H-BH2 S0.8 0.8 | H-BH1 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 17/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-11 | 18-38911-12 | 18-38911-13 | 18-38911-14 | 18-38911-15 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 96.7 | 95.6 | 91.4 | 90.9 | 92.9 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | H-BH1 S0.5 0.5 | H-BH1 S0.7 0.7 | HA8 S0.1 0.1 | HA8 S0.5 0.5 | HA1 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-16 | 18-38911-17 | 18-38911-18 | 18-38911-19 | 18-38911-20 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | 0.03 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | 0.04 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | 0.05 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | 0.02 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | 0.03 | <0.01 | <0.01 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | H-BH1 S0.5 0.5 | H-BH1 S0.7 0.7 | HA8 S0.1 0.1 | HA8 S0.5 0.5 | HA1 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | 0.05 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | 0.03 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | 0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | 0.05 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.07 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | 0.06 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 94.9 | 94.9 | 96.0 | 95.6 | 96.1 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA1 S0.5 0.5 | HA1 S0.9 0.9 | H-BH6 S0.1 0.1 | H-BH6 S0.5 0.5 | H-BH6 S1.0 1.0 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-21 | 18-38911-22 | 18-38911-23 | 18-38911-24 | 18-38911-25 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 96.3 | 95.7 | 94.7 | 94.7 | 91.6 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA14 S0.1 0.1 | HA7 S0.1 0.1 | HA7 S0.5 0.5 |
|---|---|---|---|---|---|---|
| | | | Date Sampled | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-30 | 18-38911-31 | 18-38911-32 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA14 S0.1 0.1 | HA7 S0.1 0.1 | HA7 S0.5 0.5 |
|---|---|---|---|---|---|---|
| | | | Date Sampled | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 95.0 | 98.6 | 97.6 |

## Moisture Content

| | | | Client Sample ID | HA3 S0.1 0.1 | HA3 S0.5 0.5 | HA4 S0.1 0.1 | HA4 S0.5 0.5 | HA10 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-1 | 18-38911-2 | 18-38911-3 | 18-38911-4 | 18-38911-5 |
| Moisture Content | % | *1* | | 24 | 19 | 22 | 19 | 71 |

## Moisture Content

| | | | Client Sample ID | HA10 S0.5 0.5 | HA9 S0.1 0.1 | HA9 S0.5 0.5 | HA9 S0.9 0.9 | HA2 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 | 17/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-6 | 18-38911-7 | 18-38911-8 | 18-38911-9 | 18-38911-10 |
| Moisture Content | % | *1* | | 23 | 25 | 20 | 20 | 19 |

## Moisture Content

| | | | Client Sample ID | HA2 S0.5 0.5 | H-BH2 S0.1 0.1 | H-BH2 S0.5 0.5 | H-BH2 S0.8 0.8 | H-BH1 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 17/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-38911-11 | 18-38911-12 | 18-38911-13 | 18-38911-14 | 18-38911-15 |
| Moisture Content | % | *1* | | 19 | 23 | 21 | 21 | 18 |

### Moisture Content

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Client Sample ID | | H-BH1 S0.5 0.5 | H-BH1 S0.7 0.7 | HA8 S0.1 0.1 | HA8 S0.5 0.5 | HA1 S0.1 0.1 |
| | Date Sampled | | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-16 | 18-38911-17 | 18-38911-18 | 18-38911-19 | 18-38911-20 |
| Moisture Content | % | *1* | 19 | 16 | 20 | 21 | 23 |

### Moisture Content

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Client Sample ID | | HA1 S0.5 0.5 | HA1 S0.9 0.9 | H-BH6 S0.1 0.1 | H-BH6 S0.5 0.5 | H-BH6 S1.0 1.0 |
| | Date Sampled | | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-21 | 18-38911-22 | 18-38911-23 | 18-38911-24 | 18-38911-25 |
| Moisture Content | % | *1* | 22 | 22 | 22 | 18 | 13 |

### Moisture Content

| | | | | | |
|---|---|---|---|---|---|
| | Client Sample ID | | HA14 S0.1 0.1 | HA7 S0.1 0.1 | HA7 S0.5 0.5 |
| | Date Sampled | | 18/12/2018 | 18/12/2018 | 18/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-38911-30 | 18-38911-31 | 18-38911-32 |
| Moisture Content | % | *1* | 22 | 27 | 21 |

## Method Summary

**Elements in Soil** Acid digestion followed by ICP-MS analysis. (US EPA method 200.8).

**OCP in Soil** Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS.(In-house procedure).
(Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor)

**Total DDT** Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)

**PAH in Soil** Solvent extraction, silica cleanup, followed by GC-MS analysis.
**Benzo[a]pyrene TEQ (LOR)**: The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.
**Benzo[a]pyrene TEQ (Zero)**: The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.
Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011.

**Moisture** Moisture content is determined gravimetrically by drying at 103 °C.

Elizabeth Fitzgerald, B.Sc.
Inorganics Team Leader

Terry Cooney, Ph.D.
Signatory

**Report Date:** 07 Jan 2019

**Certificate Number:** P1901070830

PRECISE
CONSULTING & LABORATORY

Analytica Laboratories
Ruakura Research Centre, 10 Bisley Road, Private Bag 3123

**Client Reference:** 18-39303

Dear Karla Chapman,

**Re: Asbestos Soil Identification Analysis – 18-39303**

13 sample(s) received on 07 Jan 2019 by Jesse Bryant.

The results of fibre analysis were performed by Alice Knowles of Precise Consulting and Laboratory Ltd on 07 Jan 2019.

The sample(s) were stated to be from 18-39303.

Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with *AS4964-2004 Method for the qualitative identification of asbestos in soil samples.*

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

Should you require further information please contact Alice Knowles.

Yours sincerely

Alice Knowles
**PRECISE LABORATORY IDENTIFIER**

# Sample Analysis Results

Certificate Number: P1901070830
Report Date: 07 Jan 2019
Site Location: 18-39303

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**Note 1:** The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques.

**Note 2:** If mineral fibres of unknown type are detected (UMF), by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised.

**Note 3:** The samples in this report are "As Received". The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description. This document may not be reproduced except in full.

Identified by:

Approved Identifier: Alice Knowles

Reviewed by:

Key Technical Person: Alice Knowles

| Sample ID | Client Sample ID | Sample Location/Description/Dimensions | Analysis Results |
|---|---|---|---|
| S001 | HABH3 S0.1 | -<br>Non-Homogeneous Soil<br>86.00g | No Asbestos Detected<br>Organic Fibres |
| S002 | HA5 S0.1 | -<br>Non-Homogeneous Soil<br>74.02g | No Asbestos Detected<br>Organic Fibres |
| S003 | HBH4 S0.1 | -<br>Non-Homogeneous Soil<br>65.57g | No Asbestos Detected<br>Organic Fibres |
| S004 | HA12 S0.1 | -<br>Non-Homogeneous Soil<br>77.47g | No Asbestos Detected<br>Organic Fibres |
| S005 | FT1 S0.1 | -<br>Non-Homogeneous Soil<br>55.38g | No Asbestos Detected<br>Organic Fibres |
| S006 | FT1 S0.3 | -<br>Non-Homogeneous Soil<br>84.56g | No Asbestos Detected<br>Organic Fibres |
| S007 | BP3 S0.1 | -<br>Non-Homogeneous Soil<br>89.46g | No Asbestos Detected<br>Organic Fibres |
| S008 | BP3 S0.3 | -<br>Non-Homogeneous Soil<br>94.59g | No Asbestos Detected<br>Organic Fibres |


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IANZ ACCREDITED LABORATORY
All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

# Sample Analysis Results

Certificate Number: P1901070830
Report Date: 07 Jan 2019
Site Location: 18-39303

PRECISE
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| Sample ID | Client Sample ID | Sample Location/Description/Dimensions | Analysis Results |
|---|---|---|---|
| S009 | HA15 S0.1 | -<br>Non-Homogeneous Soil<br>91.75g | No Asbestos Detected<br>Organic Fibres |
| S010 | HA17 S0.1 | -<br>Non-Homogeneous Soil<br>96.69g | No Asbestos Detected<br>Organic Fibres |
| S011 | HA24 S0.1 | -<br>Non-Homogeneous Soil<br>87.73g | No Asbestos Detected<br>Organic Fibres |
| S012 | HA22 S0.1 | -<br>Non-Homogeneous Soil<br>82.53g | No Asbestos Detected<br>Organic Fibres |
| S013 | HA20 S0.1 | -<br>Non-Homogeneous Soil<br>95.38g | No Asbestos Detected<br>Organic Fibres |


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# Appendix 1: Soil Analysis Raw Data

Certificate Number: P1901070830
Report Date: 07 Jan 2019
Site Location: 18-39303

PRECISE
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| Sample ID | Client Sample ID | Total Sample Weight (g) | ACM Approximate Dimensions (g)* | Form | Trace Asbestos Detected** |
|---|---|---|---|---|---|
| S001 | HABH3 S0.1 | 86.00 | - | No Asbestos Detected | N |
| S002 | HA5 S0.1 | 74.02 | - | No Asbestos Detected | N |
| S003 | HBH4 S0.1 | 65.57 | - | No Asbestos Detected | N |
| S004 | HA12 S0.1 | 77.47 | - | No Asbestos Detected | N |
| S005 | FT1 S0.1 | 55.38 | - | No Asbestos Detected | N |
| S006 | FT1 S0.3 | 84.56 | - | No Asbestos Detected | N |
| S007 | BP3 S0.1 | 89.46 | - | No Asbestos Detected | N |
| S008 | BP3 S0.3 | 94.59 | - | No Asbestos Detected | N |
| S009 | HA15 S0.1 | 91.75 | - | No Asbestos Detected | N |
| S010 | HA17 S0.1 | 96.69 | - | No Asbestos Detected | N |
| S011 | HA24 S0.1 | 87.73 | - | No Asbestos Detected | N |
| S012 | HA22 S0.1 | 82.53 | - | No Asbestos Detected | N |
| S013 | HA20 S0.1 | 95.38 | - | No Asbestos Detected | N |

* The reporting limit for this standard is 0.1g/kg
** Trace asbestos present is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased
*** Asbestos weights listed in this table are indicative only and are outside of IANZ accreditation and is therefore not endorsed by IANZ.


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10 Bisley Road
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sales@analytica.co.nz
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# Certificate of Analysis

Riley Consultants Ltd
12 Moorhouse Ave
Christchurch
Attention: Leanne Sutherland
Phone: 03 379 4402
Email: ccameron@riley.co.nz

Lab Reference: 18-39303
Submitted by: AvD, FY, RW
Date Received: 27/12/2018
Date Completed: 9/01/2019
Order Number:
Reference: 170743

Sampling Site: 141 South Belt, Rangiora

## Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.

### Heavy Metals in Soil

| | Client Sample ID | | HABH3 S0.1 0.1 | HABH3 S0.5 0.5 | HA11 S0.1 0.1 | HA11 S0.5 0.5 | HA5 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-1 | 18-39303-2 | 18-39303-4 | 18-39303-5 | 18-39303-7 |
| Arsenic | mg/kg dry wt | *0.125* | 5.06 | 6.07 | 9.63 | 11.2 | 5.21 |
| Cadmium | mg/kg dry wt | *0.005* | 0.024 | 0.12 | 0.076 | 0.025 | 0.12 |
| Chromium | mg/kg dry wt | *0.125* | 19.4 | 17.9 | 19.6 | 22.2 | 22.1 |
| Copper | mg/kg dry wt | *0.075* | 8.57 | 35.9 | 6.55 | 9.64 | 10.3 |
| Lead | mg/kg dry wt | *0.05* | 29.2 | 121 | 25.3 | 28.9 | 31.5 |
| Nickel | mg/kg dry wt | *0.05* | 12.1 | 13.3 | 12.6 | 13.5 | 15.6 |
| Zinc | mg/kg dry wt | *0.05* | 76.4 | 145 | 85.4 | 82.6 | 102 |

### Heavy Metals in Soil

| | Client Sample ID | | HA5 S0.5 0.5 | HA6 S0.1 0.1 | HA6 S0.5 0.5 | HBH4 S0.1 0.1 | HBH4 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-8 | 18-39303-10 | 18-39303-11 | 18-39303-13 | 18-39303-14 |
| Arsenic | mg/kg dry wt | *0.125* | 9.25 | 5.54 | 2.89 | 4.44 | 3.38 |
| Cadmium | mg/kg dry wt | *0.005* | 0.032 | 0.19 | 0.027 | 0.12 | 0.017 |
| Chromium | mg/kg dry wt | *0.125* | 25.2 | 19.0 | 24.6 | 18.3 | 20.2 |
| Copper | mg/kg dry wt | *0.075* | 14.3 | 9.02 | 13.9 | 6.77 | 9.58 |
| Lead | mg/kg dry wt | *0.05* | 32.5 | 27.1 | 30.1 | 25.6 | 24.7 |
| Nickel | mg/kg dry wt | *0.05* | 16.2 | 14.1 | 16.1 | 13.0 | 11.7 |
| Zinc | mg/kg dry wt | *0.05* | 85.2 | 92.9 | 90.0 | 76.5 | 73.8 |

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation, with the exception of tests marked *, which are not accredited.

## Heavy Metals in Soil

| | | Client Sample ID | HA12 S0.1 0.1 | HA12 S0.5 0.5 | FT1 S0.1 0.1 | FT1 S0.3 0.3 | HA15 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-15 | 18-39303-16 | 18-39303-19 | 18-39303-20 | 18-39303-23 |
| Arsenic | mg/kg dry wt | *0.125* | 7.28 | 5.16 | 59.0 | 6.76 | 4.51 |
| Cadmium | mg/kg dry wt | *0.005* | 0.091 | 0.029 | 0.36 | 0.061 | 0.086 |
| Chromium | mg/kg dry wt | *0.125* | 20.0 | 20.9 | 42.2 | 20.8 | 18.7 |
| Copper | mg/kg dry wt | *0.075* | 6.69 | 9.54 | 62.2 | 7.65 | 10.8 |
| Lead | mg/kg dry wt | *0.05* | 25.9 | 22.8 | 223 | 37.2 | 21.2 |
| Nickel | mg/kg dry wt | *0.05* | 12.7 | 11.9 | 14.4 | 13.4 | 14.4 |
| Zinc | mg/kg dry wt | *0.05* | 78.4 | 69.6 | 340 | 94.6 | 91.6 |

## Heavy Metals in Soil

| | | Client Sample ID | HA15 S0.5 0.5 | HA19 S0.1 0.1 | HA19 S0.5 0.5 | HA17 S0.1 0.1 | HA17 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-24 | 18-39303-25 | 18-39303-26 | 18-39303-27 | 18-39303-28 |
| Arsenic | mg/kg dry wt | *0.125* | 4.03 | 7.83 | 8.40 | 3.36 | 4.48 |
| Cadmium | mg/kg dry wt | *0.005* | 0.016 | 0.088 | 0.019 | 0.015 | 0.10 |
| Chromium | mg/kg dry wt | *0.125* | 27.2 | 23.1 | 25.8 | 23.4 | 18.5 |
| Copper | mg/kg dry wt | *0.075* | 14.3 | 9.86 | 10.4 | 10.5 | 7.20 |
| Lead | mg/kg dry wt | *0.05* | 29.9 | 26.6 | 25.3 | 25.0 | 22.5 |
| Nickel | mg/kg dry wt | *0.05* | 11.6 | 18.6 | 14.4 | 12.3 | 13.3 |
| Zinc | mg/kg dry wt | *0.05* | 52.8 | 102 | 60.3 | 58.8 | 91.7 |

## Heavy Metals in Soil

| | | Client Sample ID | HA18 S0.1 0.1 | HA18 S0.5 0.5 | HA21 S0.1 0.1 | HA24 S0.1 0.1 | HA21 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-29 | 18-39303-30 | 18-39303-32 | 18-39303-33 | 18-39303-34 |
| Arsenic | mg/kg dry wt | *0.125* | 7.08 | 5.15 | 5.69 | 6.70 | 4.66 |
| Cadmium | mg/kg dry wt | *0.005* | 0.12 | 0.012 | 0.089 | 0.11 | 0.008 |
| Chromium | mg/kg dry wt | *0.125* | 21.5 | 23.2 | 21.1 | 20.4 | 19.5 |
| Copper | mg/kg dry wt | *0.075* | 7.17 | 8.10 | 10.2 | 11.7 | 6.27 |
| Lead | mg/kg dry wt | *0.05* | 24.3 | 26.5 | 24.2 | 24.3 | 18.9 |
| Nickel | mg/kg dry wt | *0.05* | 14.7 | 13.5 | 17.5 | 14.9 | 12.1 |
| Zinc | mg/kg dry wt | *0.05* | 97.3 | 72.2 | 87.3 | 79.7 | 49.8 |

## Heavy Metals in Soil

| | | Client Sample ID | HA22 S0.1 0.1 | HA22 S0.5 0.5 | HA16 S0.1 0.1 | HA16 S0.5 0.5 | HA20 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-35 | 18-39303-36 | 18-39303-37 | 18-39303-38 | 18-39303-39 |
| Arsenic | mg/kg dry wt | *0.125* | 7.50 | 4.12 | 5.77 | 2.43 | 7.05 |
| Cadmium | mg/kg dry wt | *0.005* | 0.068 | 0.044 | 0.071 | 0.019 | 0.11 |
| Chromium | mg/kg dry wt | *0.125* | 22.0 | 17.3 | 18.9 | 24.6 | 21.9 |
| Copper | mg/kg dry wt | *0.075* | 7.51 | 8.79 | 7.68 | 9.93 | 12.0 |
| Lead | mg/kg dry wt | *0.05* | 25.3 | 16.8 | 23.3 | 26.9 | 31.8 |
| Nickel | mg/kg dry wt | *0.05* | 14.1 | 12.6 | 12.7 | 12.5 | 17.5 |
| Zinc | mg/kg dry wt | *0.05* | 93.1 | 59.6 | 92.7 | 65.7 | 89.7 |

## Heavy Metals in Soil

| | Client Sample ID | | HA20 S0.5 0.5 | HBH5 S0.1 0.1 | HBH5 S0.5 0.5 | HA23 S0.1 0.1 | HA23 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-40 | 18-39303-41 | 18-39303-42 | 18-39303-43 | 18-39303-44 |
| Arsenic | mg/kg dry wt | *0.125* | 4.40 | 7.39 | 9.60 | 4.74 | 4.15 |
| Cadmium | mg/kg dry wt | *0.005* | 0.013 | 0.11 | 0.023 | 0.074 | 0.082 |
| Chromium | mg/kg dry wt | *0.125* | 24.6 | 22.3 | 23.5 | 17.2 | 16.8 |
| Copper | mg/kg dry wt | *0.075* | 9.90 | 8.48 | 8.67 | 9.52 | 8.79 |
| Lead | mg/kg dry wt | *0.05* | 25.8 | 23.7 | 25.2 | 20.4 | 21.4 |
| Nickel | mg/kg dry wt | *0.05* | 12.9 | 16.9 | 12.5 | 11.4 | 11.7 |
| Zinc | mg/kg dry wt | *0.05* | 64.1 | 109 | 81.4 | 64.0 | 47.7 |

## Heavy Metals in Soil

| | Client Sample ID | | HA24 S0.5 0.5 |
|---|---|---|---|
| | Date Sampled | | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-45 |
| Arsenic | mg/kg dry wt | *0.125* | 5.04 |
| Cadmium | mg/kg dry wt | *0.005* | 0.008 |
| Chromium | mg/kg dry wt | *0.125* | 22.5 |
| Copper | mg/kg dry wt | *0.075* | 9.11 |
| Lead | mg/kg dry wt | *0.05* | 25.8 |
| Nickel | mg/kg dry wt | *0.05* | 11.8 |
| Zinc | mg/kg dry wt | *0.05* | 69.5 |

## Organochlorine Pesticides - Soil

| | Client Sample ID | | HABH3 S0.1 0.1 | HABH3 S0.5 0.5 | HA11 S0.1 0.1 | HA11 S0.5 0.5 | HA5 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-1 | 18-39303-2 | 18-39303-4 | 18-39303-5 | 18-39303-7 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HABH3 S0.1 0.1 | HABH3 S0.5 0.5 | HA11 S0.1 0.1 | HA11 S0.5 0.5 | HA5 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 111.3 | 115.2 | 98.0 | 99.1 | 103.6 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA5 S0.5 0.5 | HA6 S0.1 0.1 | HA6 S0.5 0.5 | HBH4 S0.1 0.1 | HBH4 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-8 | 18-39303-10 | 18-39303-11 | 18-39303-13 | 18-39303-14 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 95.9 | 106.7 | 107.8 | 96.6 | 123.6 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA12 S0.1 0.1 | HA12 S0.5 0.5 | HA15 S0.1 0.1 | HA15 S0.5 0.5 | HA19 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-15 | 18-39303-16 | 18-39303-23 | 18-39303-24 | 18-39303-25 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA12 S0.1 0.1 | HA12 S0.5 0.5 | HA15 S0.1 0.1 | HA15 S0.5 0.5 | HA19 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 21/12/2018 | 21/12/2018 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 86.4 | 91.0 | 91.1 | 111.5 | 115.6 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA19 S0.5 0.5 | HA17 S0.1 0.1 | HA17 S0.5 0.5 | HA18 S0.1 0.1 | HA18 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-26 | 18-39303-27 | 18-39303-28 | 18-39303-29 | 18-39303-30 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA19 S0.5 0.5 | HA17 S0.1 0.1 | HA17 S0.5 0.5 | HA18 S0.1 0.1 | HA18 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 112.0 | 114.1 | 94.5 | 109.5 | 103.8 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA21 S0.1 0.1 | HA24 S0.1 0.1 | HA21 S0.5 0.5 | HA22 S0.1 0.1 | HA22 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-32 | 18-39303-33 | 18-39303-34 | 18-39303-35 | 18-39303-36 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 108.5 | 103.7 | 100.6 | 103.9 | 101.6 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA16 S0.1 0.1 | HA16 S0.5 0.5 | HA20 S0.1 0.1 | HA20 S0.5 0.5 | HBH5 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-37 | 18-39303-38 | 18-39303-39 | 18-39303-40 | 18-39303-41 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HA16 S0.1 0.1 | HA16 S0.5 0.5 | HA20 S0.1 0.1 | HA20 S0.5 0.5 | HBH5 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 115.8 | 129.9 | 98.3 | 111.9 | 114.9 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HBH5 S0.5 0.5 | HA23 S0.1 0.1 | HA23 S0.5 0.5 | HA24 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-42 | 18-39303-43 | 18-39303-44 | 18-39303-45 |
| 2,4'-DDD | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| 2,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDD | mg/kg dry wt | *0.003* | | <0.003 | <0.003 | <0.003 | <0.003 |
| 4,4'-DDE | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| 4,4'-DDT | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| Total DDT | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 |
| alpha-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| Aldrin | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| beta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Chlordane | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| cis-Nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 |
| delta-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| Dieldrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 |
| Endosulfan I | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| Endosulfan II | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 |
| Endosulfan sulphate | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| Endrin | mg/kg dry wt | *0.05* | | <0.05 | <0.05 | <0.05 | <0.05 |
| Endrin aldehyde | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 |
| Endrin ketone | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| gamma-BHC | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| Heptachlor | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |

## Organochlorine Pesticides - Soil

| | | | Client Sample ID | HBH5 S0.5 0.5 | HA23 S0.1 0.1 | HA23 S0.5 0.5 | HA24 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Heptachlor epoxide | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| Hexachlorobenzene | mg/kg dry wt | *0.005* | | <0.005 | <0.005 | <0.005 | <0.005 |
| Methoxychlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-nonachlor | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 |
| trans-Chlordane | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 |
| Chlordane (sum) | mg/kg dry wt | *0.02* | | <0.020 | <0.020 | <0.020 | <0.020 |
| TCMX (Surrogate) | % | *1* | | 98.6 | 101.9 | 94.2 | 135.4 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HABH3 S0.1 0.1 | HABH3 S0.5 0.5 | HA11 S0.1 0.1 | HA11 S0.5 0.5 | HA5 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-1 | 18-39303-2 | 18-39303-4 | 18-39303-5 | 18-39303-7 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 98.6 | 97.9 | 99.1 | 98.2 | 97.0 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA5 S0.5 0.5 | HA6 S0.1 0.1 | HA6 S0.5 0.5 | HBH4 S0.1 0.1 | HBH4 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-8 | 18-39303-10 | 18-39303-11 | 18-39303-13 | 18-39303-14 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA5 S0.5 0.5 | HA6 S0.1 0.1 | HA6 S0.5 0.5 | HBH4 S0.1 0.1 | HBH4 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 98.6 | 98.0 | 98.5 | 98.6 | 98.7 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA12 S0.1 0.1 | HA12 S0.5 0.5 | FT1 S0.1 0.1 | FT1 S0.3 0.3 | HA15 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-15 | 18-39303-16 | 18-39303-19 | 18-39303-20 | 18-39303-23 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | 0.04 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | 0.06 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | 0.07 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | 0.04 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | 0.03 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | 0.06 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | 0.10 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | 0.04 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.011 | <0.01 | 0.03 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | 0.09 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.09 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | 0.08 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 100.3 | 99.1 | 100.0 | 99.8 | 100.0 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA15 S0.5 0.5 | HA19 S0.1 0.1 | HA19 S0.5 0.5 | HA17 S0.1 0.1 | HA17 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-24 | 18-39303-25 | 18-39303-26 | 18-39303-27 | 18-39303-28 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 99.0 | 96.2 | 97.6 | 99.0 | 99.6 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA18 S0.1 0.1 | HA18 S0.5 0.5 | HA21 S0.1 0.1 | HA24 S0.1 0.1 | HA21 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-29 | 18-39303-30 | 18-39303-32 | 18-39303-33 | 18-39303-34 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA18 S0.1 0.1 | HA18 S0.5 0.5 | HA21 S0.1 0.1 | HA24 S0.1 0.1 | HA21 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 99.9 | 99.0 | 98.5 | 99.4 | 100.1 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA22 S0.1 0.1 | HA22 S0.5 0.5 | HA16 S0.1 0.1 | HA16 S0.5 0.5 | HA20 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-35 | 18-39303-36 | 18-39303-37 | 18-39303-38 | 18-39303-39 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 99.0 | 100.3 | 96.7 | 98.0 | 96.6 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA20 S0.5 0.5 | HBH5 S0.1 0.1 | HBH5 S0.5 0.5 | HA23 S0.1 0.1 | HA23 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-40 | 18-39303-41 | 18-39303-42 | 18-39303-43 | 18-39303-44 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA20 S0.5 0.5 | HBH5 S0.1 0.1 | HBH5 S0.5 0.5 | HA23 S0.1 0.1 | HA23 S0.5 0.5 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | 0.03 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 | <0.02 | <0.02 | <0.02 | 0.03 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 97.7 | 98.3 | 95.6 | 97.8 | 99.8 |

## Polycyclic Aromatic Hydrocarbons - Soil

| | | | Client Sample ID | HA24 S0.5 0.5 |
|---|---|---|---|---|
| | | | Date Sampled | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-45 |
| 1-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 |
| 2-Methylnaphthalene | mg/kg dry wt | *0.01* | | <0.01 |
| Acenaphthene | mg/kg dry wt | *0.01* | | <0.01 |
| Acenaphthylene | mg/kg dry wt | *0.01* | | <0.01 |
| Anthracene | mg/kg dry wt | *0.01* | | <0.01 |
| Benz[a]anthracene | mg/kg dry wt | *0.02* | | <0.02 |
| Benzo[a]pyrene | mg/kg dry wt | *0.01* | | <0.01 |
| Benzo[b]&[j] fluoranthene | mg/kg dry wt | *0.02* | | <0.02 |
| Benzo[g,h,i]perylene | mg/kg dry wt | *0.02* | | <0.02 |
| Benzo[k]fluoranthene | mg/kg dry wt | *0.01* | | <0.01 |
| Chrysene | mg/kg dry wt | *0.01* | | <0.01 |
| Dibenz(a,h)anthracene | mg/kg dry wt | *0.01* | | <0.01 |
| Fluoranthene | mg/kg dry wt | *0.02* | | <0.02 |
| Fluorene | mg/kg dry wt | *0.01* | | <0.01 |
| Indeno(1,2,3-cd)pyrene | mg/kg dry wt | *0.01* | | <0.01 |
| Naphthalene | mg/kg dry wt | *0.01* | | <0.01 |
| Phenanthrene | mg/kg dry wt | *0.01* | | <0.01 |
| Pyrene | mg/kg dry wt | *0.02* | | <0.02 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg dry wt | *0.01* | | 0.03 |
| Benzo[a]pyrene TEQ (Zero) | mg/kg dry wt | *0.01* | | <0.01 |
| Anthracene-d10 (Surrogate) | % | *1* | | 100.0 |

## Moisture Content

| | | | Client Sample ID | HABH3 S0.1 0.1 | HABH3 S0.5 0.5 | HA11 S0.1 0.1 | HA11 S0.5 0.5 | HA5 S0.1 0.1 |
|---|---|---|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | | 18-39303-1 | 18-39303-2 | 18-39303-4 | 18-39303-5 | 18-39303-7 |
| Moisture Content | % | *1* | | 19 | 25 | 26 | 22 | 27 |

## Moisture Content

| | Client Sample ID | | HA5 S0.5 0.5 | HA6 S0.1 0.1 | HA6 S0.5 0.5 | HBH4 S0.1 0.1 | HBH4 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-8 | 18-39303-10 | 18-39303-11 | 18-39303-13 | 18-39303-14 |
| Moisture Content | % | *1* | 25 | 31 | 22 | 24 | 18 |

## Moisture Content

| | Client Sample ID | | HA12 S0.1 0.1 | HA12 S0.5 0.5 | FT1 S0.1 0.1 | FT1 S0.3 0.3 | HA15 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 | 20/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-15 | 18-39303-16 | 18-39303-19 | 18-39303-20 | 18-39303-23 |
| Moisture Content | % | *1* | 30 | 24 | 38 | 26 | 25 |

## Moisture Content

| | Client Sample ID | | HA15 S0.5 0.5 | HA19 S0.1 0.1 | HA19 S0.5 0.5 | HA17 S0.1 0.1 | HA17 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-24 | 18-39303-25 | 18-39303-26 | 18-39303-27 | 18-39303-28 |
| Moisture Content | % | *1* | 23 | 23 | 22 | 21 | 27 |

## Moisture Content

| | Client Sample ID | | HA18 S0.1 0.1 | HA18 S0.5 0.5 | HA21 S0.1 0.1 | HA24 S0.1 0.1 | HA21 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-29 | 18-39303-30 | 18-39303-32 | 18-39303-33 | 18-39303-34 |
| Moisture Content | % | *1* | 25 | 20 | 26 | 31 | 16 |

## Moisture Content

| | Client Sample ID | | HA22 S0.1 0.1 | HA22 S0.5 0.5 | HA16 S0.1 0.1 | HA16 S0.5 0.5 | HA20 S0.1 0.1 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-35 | 18-39303-36 | 18-39303-37 | 18-39303-38 | 18-39303-39 |
| Moisture Content | % | *1* | 24 | 16 | 24 | 21 | 24 |

## Moisture Content

| | Client Sample ID | | HA20 S0.5 0.5 | HBH5 S0.1 0.1 | HBH5 S0.5 0.5 | HA23 S0.1 0.1 | HA23 S0.5 0.5 |
|---|---|---|---|---|---|---|---|
| | Date Sampled | | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-40 | 18-39303-41 | 18-39303-42 | 18-39303-43 | 18-39303-44 |
| Moisture Content | % | *1* | 20 | 25 | 19 | 26 | 29 |

## Moisture Content

| | Client Sample ID | | HA24 S0.5 0.5 |
|---|---|---|---|
| | Date Sampled | | 21/12/2018 |
| Analyte | Unit | *Reporting Limit* | 18-39303-45 |
| Moisture Content | % | *1* | 23 |

### Total Petroleum Hydrocarbons - Soil

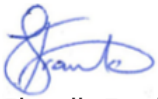
| | | | Client Sample ID | FT1 S0.1<br>0.1 | FT1 S0.3<br>0.3 |
|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 |
| Analyte | | Unit | *Reporting Limit* | 18-39303-19 | 18-39303-20 |
| C7-C9 | | mg/kg dry wt | *10* | <10 | <10 |
| C10-C14 | | mg/kg dry wt | *15* | <15 | <15 |
| C15-C36 | | mg/kg dry wt | *25* | 149 | <25 |
| C7-C36 (Total) | | mg/kg dry wt | *50* | 149 | <50 |

### BTEX in Soil

| | | | Client Sample ID | FT1 S0.1<br>0.1 | FT1 S0.3<br>0.3 |
|---|---|---|---|---|---|
| | | | Date Sampled | 20/12/2018 | 20/12/2018 |
| Analyte | | Unit | *Reporting Limit* | 18-39303-19 | 18-39303-20 |
| Benzene | | mg/kg dry wt | *0.05* | <0.05 | <0.05 |
| Ethylbenzene | | mg/kg dry wt | *0.05* | <0.05 | <0.05 |
| Toluene | | mg/kg dry wt | *0.05* | 0.08 | <0.05 |
| m,p-xylene | | mg/kg dry wt | *0.05* | <0.05 | <0.05 |
| o-xylene | | mg/kg dry wt | *0.05* | <0.05 | <0.05 |
| Benzene-d6 (Surrogate) | | % | *1* | 101.5 | 104.1 |

## Method Summary

| | |
|---|---|
| **Elements in Soil** | Acid digestion followed by ICP-MS analysis. (US EPA method 200.8). |
| **OCP in Soil** | Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS.(In-house procedure).<br>(Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor) |
| **Total DDT** | Sum of DDT, DDD and DDE (4,4' and 2,4 isomers) |
| **PAH in Soil** | Solvent extraction, silica cleanup, followed by GC-MS analysis.<br>**Benzo[a]pyrene TEQ (LOR)**: The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.<br>**Benzo[a]pyrene TEQ (Zero)**: The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.<br>Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. |
| **Moisture** | Moisture content is determined gravimetrically by drying at 103 °C. |
| **TPH in Soil** | Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36) |
| **BTEX in Soil** | Solvent extraction, followed by Headspace GC-MS analysis. US EPA method 5021A. |



Sharelle Frank, B.Sc. (Tech)
Technologist

Tom Featonby, M.Sc.
Technologist

# *APPENDIX G*

## *Drawing*


## LEGEND

- HA1 — HAND AUGER BOREHOLE LOCATION
- BP1 — BURN PAD
- FT1 — ABOVE GROUND FUEL TANK
- 0.5 — DEPTH OF SAMPLING
- PROPOSED DEVELOPMENT AREA
- LEGAL LOT BOUNDARY

20 0 40 80m

SCALE 1:2000

NOTES:

1. PHOTO SOURCED FROM WAIMAKARIRI URBAN AERIAL PHOTOS (2013–2014), LINZ.
2. PARCELS SOURCED FROM LINZ.
3. HOLE/TEST LOCATIONS APPROXIMATE ONLY AND SUBJECT TO SURVEY CONFIRMATION.

NOT FOR CONSTRUCTION

| REV | DATE | ISSUE | BY |
|---|---|---|---|
| 2 | 07.08.19 | SITE HATCH | LS |
| 1 | 31.07.19 | REPORT ISSUE | RBT |

| DESIGN | DES CHECK | APPROVED FOR ISSUE |
|---|---|---|
| AVD | LAK | B. BLACK |
| DRAWN | CAD CHECK | |
| FY | FY | |
| DATE DRAWN | | ISSUE DATE |
| 20.11.18 | | 7 / 8 / 19 |

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| CLIENT | SUMMERSET VILLAGES (RANGIORA) LIMITED |
| ADDRESS | 104 TOWNSEND ROAD & 141 SOUTH BELT, RANGIORA |
| PROJECT | SUMMERSET RANGIORA |
| SHEET TITLE | PRELIMINARY / DETAILED SITE INVESTIGATION LOCATION PLAN |

ACENZ ISO 9001 CERTIFIED GCS

| CADFILE | |
|---|---|
| 170743–2 | |
| SCALE (A3) | ORIG. SHEET SIZE |
| 1:2000 | A3 |
| DRAWING No. | REV. |
| 170743-2 | 2 |