



## REPORT

# Preliminary Fill Material Investigation

*Sunset Point, Hokitika*

Submitted to:

**Westland District Council**

36 Weld Street, Hokitika 7810

Submitted by:

**Golder Associates (NZ) Limited**

Level 1, 214 Durham Street, Christchurch 8011, New Zealand

+64 3 377 5696

19128146-7403-007-R-Rev0

September 2019



## Record of Issue

Company	Version	Date Issued	Review Status / Detail
Westland District Council	Rev0	10 September 2019	Rev0

# Table of Contents

<b>1.0 INTRODUCTION .....</b>	<b>1</b>
<b>2.0 SAMPLING METHODOLOGY .....</b>	<b>4</b>
<b>3.0 INVESTIGATION FINDINGS .....</b>	<b>4</b>
3.1 Subsurface Observations .....	4
3.2 Laboratory Analysis .....	5
3.3 Assessment Criteria .....	6
3.4 Analytical Results .....	6
<b>4.0 SUMMARY .....</b>	<b>7</b>
<b>5.0 LIMITATIONS .....</b>	<b>8</b>
<b>6.0 REFERENCES .....</b>	<b>9</b>

## TABLES

Table 1: Observed geology and field observations within test pits. ....	5
Table 2: Sampling and analytical schedule. ....	6

## FIGURES

Figure 1: Location Map .....	2
Figure 2: Sunset Point Landfill Site Plan .....	3

## APPENDICES

**APPENDIX A**  
Calibration Record

**APPENDIX B**  
Laboratory Reports

**APPENDIX C**  
Photographic Record

**APPENDIX D**  
Analytical Results

**APPENDIX E**  
Report Limitations

## 1.0 INTRODUCTION

Westland District Council (WDC) manages the closed Sunset Point Landfill (the Site), which is located on Sunset Point along Gibson Quay road, Hokitika (Figure 1). In August 2019, the WDC received a letter<sup>1</sup> from the West Coast Regional Council (WCRC) notifying of a complaint received regarding non-compliant earthworks and deposition of materials at the site.

In response to the complaint, WCRC undertook a site inspection during which earthworks, consisting of covering deposited materials with soil and sand, were observed within 50 metres (m) of the Coastal Marine Area (CMA). WCRC also noted that WDC was operating a portion of the Site as a clean fill operation; however, the materials being disposed of at the Site consisted of mainly demolition waste and were not defined as clean fill.

WDC provided written confirmation<sup>2</sup> acknowledging WCRC's notice of complaint and of earthworks undertaken within 50 m of the CMA, including filling and capping protection works for the Site in response to Cyclone Fehi in 2018 and direct erosion from the sea over the last 5 – 10 years. Materials used to raise the land by 1.5 m and to establish a hard-fill cover was provided by Birchfield Ross Mining. The estimated total volume of materials deposited was 14,500 cubic metres (m<sup>3</sup>), confined to areas with exposed coastline and areas of historic landfilling.

The area of the Site recently operated by WDC as a clean-fill operation is located at the western end of Gibson Quay and is adjacent to areas noted by WDC as capped with hard-fill. The area of demolition waste material, possibly being used for non-consented fly-tipping, is located within the northernmost portion of the clean fill area (Figure 2).

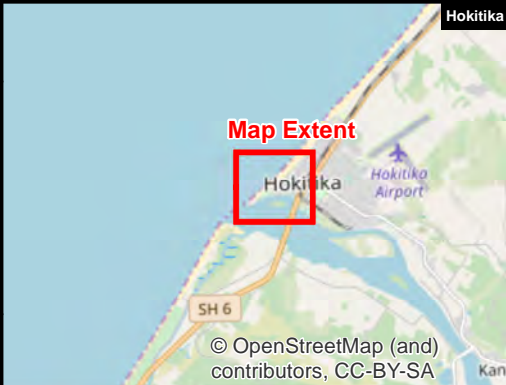
To better understand the extent and nature of the demolition material disposed of at the Site, WDC engaged Golder Associates (NZ) Limited (Golder) to undertake a preliminary investigation of the quality and composition of fill material within the area of potential fly-tipping (Figure 2). This report has been prepared to document the findings of the investigation and provides:

- A summary of the soil sampling methodology used for the investigation;
- A summary of on-site observations, including subsurface geology and the presence of demolition waste material;
- Analytical results of soil samples tested; and
- A photographic record of ground conditions encountered within the excavated test pits.

---

<sup>1</sup> WDC 2019. Unconsented Earth Works and Deposit of Materials at Sunset Point Hokitika. Letter Reference Number: REQ-2019-1526.

<sup>2</sup> WDC 2019. Acknowledgement of the WDC 2019 letter titled 'Unconsented Earth Works and Deposit of Materials at Sunset Point Hokitika' (REQ-2019-1526).



**LEGEND**

- Roads
- Approximate site boundary
- Modified land area

**NOTES**

- Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
- Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.
- Schematic only, not to be interpreted as an engineering design or construction drawing.

**COPYRIGHT**

Information contained in this drawing is the copyright of Golder Associates (NZ) Ltd. Unauthorised use or reproduction of this plan either wholly or in part without written permission infringes copyright. © Golder Associates (NZ) Ltd.

0 50 100 200  
METERS

REFERENCE SCALE: 1:6,500 (at A4)  
PROJECTION: NZGD 2000 New Zealand Transverse Mercator

CLIENT  
WESTLAND DISTRICT COUNCIL

PROJECT  
SUNSET POINT, HOKITIKA

TITLE  
**LOCATION MAP**

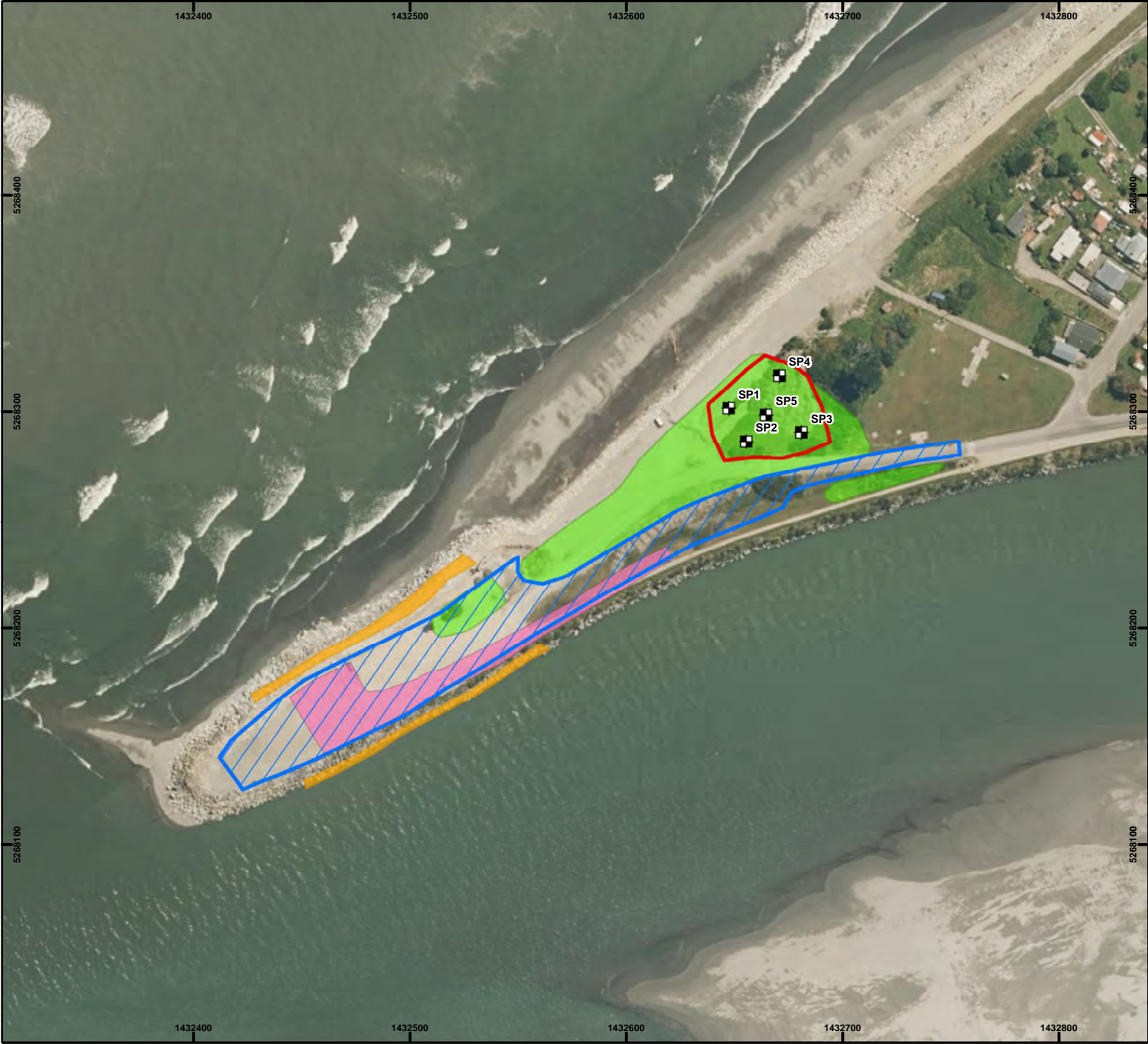
CONSULTANT	YYYY-MM-DD	2019-09-10
	PREPARED	BH
	REVIEWED	JG
	APPROVED	AH

PROJECT No. 19128146	REPORT 007	REV. 0	FIGURE <b>01</b>
-------------------------	---------------	-----------	---------------------

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM: ISO A4

25mm





LEGEND

- Test pit
- Approximate site boundary
- Compacted hard-fill capping
- Areas of improved armour
- Areas of clean fill
- Historic area of landfilling

NOTES

- Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
- Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.
- Schematic only, not to be interpreted as an engineering design or construction drawing.
- Layer boundaries: The West Coast Regional Council (REQ-2019-1526)

COPYRIGHT

Information contained in this drawing is the copyright of Golder Associates (NZ) Ltd. Unauthorised use or reproduction of this plan either wholly or in part without written permission infringes copyright. © Golder Associates (NZ) Ltd.



REFERENCE SCALE: 1:2,500 (at A4)

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

CLIENT


WESTLAND DISTRICT COUNCIL

PROJECT

SUNSET POINT, HOKITIKA

TITLE

SUNSET POINT LANDFILL SITE PLAN

 GOLDER	CONSULTANT	YYYY-MM-DD	2019-09-10
		PREPARED	BH
		REVIEWED	JG
		APPROVED	AH
PROJECT No.	REPORT	REV.	FIGURE
19128146	007	0	02



IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ISO A4

25mm

## 2.0 SAMPLING METHODOLOGY

On 22 August 2019 Golder completed an investigation of fill material using a 1.85 tonne excavator operated by Westroads Limited.

Five test pits (Figure 2) were excavated to a maximum depth of 2.1 m below ground level (bgl). The test pits were located within the clean fill operation area noted by WDC staff to contain demolition waste.

The investigation comprised the excavation of test pits, a visual observation of subsurface conditions, field screening for volatile organic compounds (VOCs) and the collection of soil samples for analysis. The soil sampling was undertaken using the following methodology:

- Freshly nitrile gloved hands were used to collect soil samples from excavated material.
- Samples collected for asbestos analysis were bagged in labelled re-sealable bags or 500 millilitre (mL) plastic containers.
- Samples collected for metals/metalloids and VOC analysis were placed immediately into 300 mL glass jars.
- On-site screening of VOCs in soil was completed using a calibrated photo-ionisation detector<sup>3</sup> (PID). The calibration certificate is included in Appendix A. PID screening was undertaken on disturbed soil samples collected in a re-sealable bag from excavated material.
- Soils were logged with reference to the NZ Geotechnical Society (NZGS 2005) “Guidelines for the Classification and Field Description of Soils and Rocks for Engineering Purposes”.
- Samples were submitted to R J Hill Laboratories Limited (Hills), under chain of custody (CoC) documentation. The CoC and laboratory results are included in Appendix B.

## 3.0 INVESTIGATION FINDINGS

### 3.1 Subsurface Observations

The generalised stratigraphy encountered in test pits comprised sandy silt interspersed with demolition waste material. A summary of subsurface observations is presented in Table 1. A photographic record of test pits is provided in Appendix C.

Fill material was observed across the surface of the investigation area and included metal, wood asphalt, brick, concrete, scattered fragments of potential asbestos containing material (PACM), plastic, wire, glass, and polystyrene.

Subsurface fill material was estimated to be less than 5 % by volume within test pits SP1, SP2, SP3, and SP5. Fill material was not encountered at location SP4.

Soil headspace VOC concentrations were measured up to a maximum of 5.0 parts per million (ppm) across the test pits.

---

<sup>3</sup> PID fitted with a 10.6 electron volt lamp and calibrated to 100 ppm isobutylene standard.

**Table 1: Observed geology and field observations within test pits.**

Location	Depth (m bgl)	VOCs (ppm)	Observed geology	Estimate of fill material (% by volume)	Additional observations
SP1	0.0 – 0.1	1.0	SAND and sandy SILT with gravel and cobbles, dark grey, moist, wood debris.	0 %	Bricks, concrete, trace wire observed at 1.3 m bgl.
	0.3 – 0.4	0.9		0 %	
	1.3 – 1.4	0.9		<5 %	
SP2	0.0 – 0.1	1.0	SAND and sandy SILT with gravel and cobbles, dark grey, moist.	0 %	Concrete block observed at 0.3 m bgl and decomposing organic matter observed at 1.3 m bgl.
	0.3 – 0.4	1.4		<5 %	
	1.3 – 1.4	5.0		0 %	
SP3	0.0 – 0.1	2.4	SAND and SILT with gravel and cobbles, dark grey, moist, wood debris.	0 %	Trace asphalt observed at 0.4 m bgl.
	0.4 – 0.5	2.1		<5 %	
	1.5 – 1.6	2.0		0 %	
SP4	0.0 – 0.1	1.6	SILT with trace gravels and organics, dark brown to pale grey, moist.	0 %	No additional observations noted.
	0.4 – 0.5	2.6		0 %	
	0.8 – 0.9	2.3		0 %	
	2.0 – 2.1	2.1		0 %	
SP5	0.0 – 0.1	1.9	Silty SAND with gravel and cobbles, dark grey, moist.	<5 %	Trace asphalt observed near surface.
	0.5 – 0.6	2.0		0 %	
	1.4 – 1.5	1.4		0 %	

**Notes:** m bgl – metres below ground level. ppm – parts per million.

## 3.2 Laboratory Analysis

A selection of samples collected during the investigation were submitted to RJ Hill Laboratories Limited for analysis. Hill Laboratories hold International Accreditation New Zealand (IANZ) accreditation for the analysis undertaken.

A total of six soil samples were selected for analysis (based on our understanding of the development sequence of the investigation area, field observations and results of PID screening). The samples were selectively analysed for potential contaminants of interest including:

- Asbestos based on AS 4694-2004, and in accordance with the Asbestos in Soil Guidelines (BRANZ 2017). Asbestos was reported with respect to the presence of asbestos containing materials (ACM), fibrous asbestos (FA) and asbestos fines (AF) on a percent weight for weight (% w/w) basis.
- Arsenic, cadmium, chromium (total), copper, lead, mercury, zinc and nickel.



- Polycyclic aromatic hydrocarbons (PAH).

The analytical schedule for the samples collected is presented in Table 2. The soil quality data is presented in full in Table D1 (Appendix D) with the laboratory analysis reports reproduced in Appendix B.

**Table 2: Sampling and analytical schedule.**

Sampling depth (m bgl)	Chemical analysis	Sample location
0.3 – 0.4	Asbestos (% w/w)	SP1, SP2
	Metals/Metalloids	
0.4 – 0.5	Asbestos (% w/w)	SP3, SP4
	Metals/Metalloids	
	PAH	SP3
0.5 – 0.6	Asbestos (% w/w)	SP5
	Metals/Metalloids	
1.3 – 1.4	Asbestos (% w/w)	SP2
	Metals/Metalloids	
	PAH	

**Notes:** m bgl – metres below ground level. % w/w – percentage weight-for-weight.

### 3.3 Assessment Criteria

The investigation findings have been assessed with respect to the intended use of the area as a clean-fill operation. The material deposited in a clean fill will typically be from construction and demolition activities, and will generally comprise soil, rock, concrete, bricks, and similar inert material. Waste acceptance criteria for clean fill sites (Class 5 Landfills), as described in 'A Guide to the Management of Cleanfills' (MfE 2002) and 'Technical Guidelines for Disposal to Land' (WasteMINZ 2018), includes the following:

- Virgin excavated natural material (VENM), including soil, clay, gravel, and rock;
- Maximum incidental inert manufactured materials (e.g., concrete, brick, tiles) to be no more than 5 % by volume per load;
- Maximum incidental or attached biodegradable materials (e.g., vegetation) to be no more than 2 % by volume per load;
- Material that is free of:
  - Hazardous substances;
  - Products or materials derived from hazardous waste treatment, hazardous waste stabilisation or hazardous waste disposal practices;

- Materials that may present a risk to human or animal health such as medical and veterinary waste, asbestos or radioactive substances; and
- Liquid waste.
- Maximum chemical contaminant limits are local natural background soil concentrations for inorganic elements and provide for trace concentrations of a limited range of organic compounds.

### 3.4 Analytical Results

The analytical results are presented in Appendix B and summarised in Table D1 (Appendix D). The results comprised:

- Asbestos was present in one sample analysed. Asbestos was present in the form of chrysotile but was not detected above the limit of reporting of 0.001 % w/w for ACM and FA+AF.
- Metals/metalloids were detected in the samples analysed with the exception of mercury.
- PAHs were detected above the laboratory limits of reporting (LOR). Two samples were analysed.

For preliminary comparison purposes, and to assist with understanding the suitability of the material as clean fill (as described in Section 3.3 above), published background criteria have been included in Table D1 (Appendix D) and estimated waste material (% by volume) have been compared to clean fill criteria targets. This approach is considered appropriate at this stage due to WDC's intent to continue to operate the Site as a clean fill operation.

Metals/metalloids were detected above published background soil concentrations, asbestos was noted to be present at levels below the laboratory LOR, and PAHs were detected at trace concentrations. Waste observed within the fill material at the Site was estimated to be <5 % by volume and biodegradable materials were noted as trace and considered to be <2 % by volume across the five test pits.

The presence of metals/metalloids above the background criteria and the presence of asbestos in soil suggests that the material within the investigated area does not meet the definition of clean fill.

## 4.0 SUMMARY

On 22 August 2019 Golder completed an investigation of fill material at Sunset Point Landfill. The purpose of the investigation was to provide an initial assessment of the composition and quality of the non-conforming demolition waste material noted within an area operating as a clean fill site.

The investigation included the excavation of five test pits, a visual observation of subsurface conditions, field screening for VOCs using a photo-ionisation detector (PID) and the collection of soil samples for analysis.

Based on subsurface observations, inert demolition waste material was observed in four of the five test pits and comprised brick, concrete, wire, and asphalt within a silt and sand matrix. Waste material was estimated to be <5 % by volume across test pits SP1, SP2, SP3, and SP5. Waste material was not encountered at location SP4 located at the northern end of the investigation area. Biodegradable material was estimated to be <2 % by volume across all five test pits.

The general composition of the fill material within the investigation area comprises a sandy silt geology between 0.0 – 2.1 m bgl.

Soil samples were collected from the fill material to depths of up to 2.1 m. Samples were analysed for metals/metalloids, asbestos, and PAH.

In summary:

- Asbestos was detected at location SP2 (0.3 – 0.4 m) however reported concentrations were below the LOR (<0.001 %w/w) for ACM and FA+AF;
- Metals/metalloids were detected above published background criteria; and
- Limited evidence of impact by organic contaminants (PAH) was detected based on the samples analysed.

The presence of metals/metalloids above published background criteria and the presence of asbestos suggest that the material in the investigated area does not meet the definition of clean fill.

## 5.0 LIMITATIONS

Your attention is drawn to the document, “Report Limitations”, Appendix E. The statements presented in that document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimise the risks to which this report relates which are associated with this project. The document is not intended to exclude or otherwise limit the obligations necessarily imposed by law on Golder Associates (NZ) Limited, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

## 6.0 REFERENCES

BRANZ 2017. New Zealand Guidelines for Assessing and Managing Asbestos in Soil. BRANZ Limited in association with Australasian Land and Groundwater (ALGA), November 2017.

NZGS 2005. Guidelines for the Classification and Field Description of Soils and Rocks for Engineering Purposes. New Zealand Geotechnical Society 2005.

Landcare Research 2015. Background soil concentrations of selected trace elements and organic contaminants in New Zealand 2015. Sourced from the Land Resource Information Systems Portal, <https://iris.scinfo.org.nz/>.

MfE 2002. A Guide to the Management of Cleanfills. Ministry for the Environment, Wellington, New Zealand.

MfE 2011a. Contaminated Land Management Guidelines No. 1 – Reporting on Contaminated Sites in New Zealand. Ministry for the Environment, Wellington, New Zealand.

MfE 2011b. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Ministry for the Environment, Wellington

MfE 2011c. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Ministry for the Environment, Wellington.

WasteMINZ 2018. Technical Guidelines for Disposal to Land. Waste Management Institute of New Zealand. ISBN 978-0-473-35718-4. August 2018.



**APPENDIX A**

# Calibration Record

## CERTIFICATE OF CALIBRATION

**Certificate No.**                      **0000058008**

<b>Account No:</b>	A08348	<b>Technician:</b>	Gift Manikela
<b>Account Name:</b>	Golder Associates (NZ) Ltd	<b>Calibration Date:</b>	19/08/2019
<b>Cust Order No:</b>		<b>Calibration Due Date:</b>	15/02/2020
<b>Serial No:</b>	QA116-017043	<b>Location:</b>	
<b>Description:</b>	GA Quattro [O2,LEL,CO,H2S] Gas Detector		
<b>Test Configuration:</b>	APC 4 GAS	<b>Overall Result :</b>	PASS
<b>Comments:</b>	Service, Calibration and Function Test.		

Test Name	Test	Result Description	Result
OXYGEN [O2]			PASS
METHANE [CH4]			PASS
CARBON MONOXIDE [CO]			PASS
HYDROGEN SULPHIDE [H2S]			PASS
AUDIBLE ALARM			PASS
VISUAL ALARM			PASS

Sensor	Alarm 1	Alarm 2	STEL	TWA
OXYGEN [O2]	19.5 % V/V	23.5 % V/V	-	-
METHANE [CH4]	5 % LEL	10 % LEL	-	-
CARBON MONOXIDE [CO]	25 PPM	200 PPM	50 PPM	25 PPM
HYDROGEN SULPHIDE [H2S]	10 PPM	15 PPM	15 PPM	10 PPM

### Calibration Gas

WO191511-16                      Calibration Gas 100ppm CO, 25ppm H2S, 50% LEL CH4, 18% O2

Service Charges	Quantity
480059                      Service Charge 1-4 Gas	1
481459                      Service Priority Charge	1

APC Techsafe certifies that the unit described above has passed calibration in accordance with the manufacturer's calibration procedures. Calibration and function tests have been done against a certified and traceable gas to ensure the test accuracy. APC Techsafe recommends function testing prior to use to ensure correct and accurate operation between calibration intervals.

Users are reminded that correct care, use and maintenance of the unit is required for proper operation. Refer to the product manual for details

**Certified Technician:** GIFT MANIKELA

**Signed**



## CERTIFICATE OF CALIBRATION

**Certificate No.**                      **0000058009**

<b>Account No:</b> A08348 <b>Account Name:</b> Golder Associates (NZ) Ltd <b>Cust Order No:</b> <b>Serial No:</b> 592-911248 <b>Description:</b> MiniRAE 3000 [PID] Gas Detector <b>Test Configuration:</b> APC PID <b>Comments:</b> Service, Calibration and Function Test.	<b>Technician:</b> Gift Manikela <b>Calibration Date:</b> 19/08/2019 <b>Calibration Due Date:</b> 15/02/2020 <b>Location:</b>  <b>Overall Result :</b> PASS
--	--

Test Name	Test	Result Description	Result
ISOBUTYLENE [C4H8]			PASS
AUDIBLE ALARM			PASS
VISUAL ALARM			PASS
PUMP			PASS

Sensor	Alarm 1	Alarm 2	STEL	TWA
ISOBUTYLENE [C4H8]	50 PPM	100 PPM	25 PPM	10 PPM

### Calibration Gas

1020204	Calibration Gas 100ppm Isobutylene, BAL Air
174810	Calibration Gas Zero Air, 20.9% O2

### Service Charges

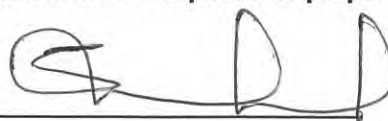
	Quantity
481459                      Service Priority Charge	1
480068                      Service Chg MiniRAE/ppbRAE/UltraRAE	1

APC Techsafe certifies that the unit described above has passed calibration in accordance with the manufacturer's calibration procedures. Calibration and function tests have been done against a certified and traceable gas to ensure the test accuracy. APC Techsafe recommends function testing prior to use to ensure correct and accurate operation between calibration intervals.

Users are reminded that correct care, use and maintenance of the unit is required for proper operation. Refer to the product manual for details

**Certified Technician:** GIFT MANIKELA

**Signed** \_\_\_\_\_



**APPENDIX B**

# Laboratory Reports





## Certificate of Analysis

Page 1 of 3

<b>Client:</b>	Westland District Council	<b>Lab No:</b>	2230675	A2Pv1
<b>Contact:</b>	Jack Grinsted C/- Golder Associates (NZ) Limited PO Box 2281 Christchurch Mail Centre Christchurch 8140	<b>Date Received:</b>	27-Aug-2019	
		<b>Date Reported:</b>	02-Sep-2019	
		<b>Quote No:</b>	100971	
		<b>Order No:</b>	108821 Sunset Point Testing	
		<b>Client Reference:</b>	19128146 Sunset Point	
		<b>Add. Client Ref:</b>	108821 Sunset Point Testing	
		<b>Submitted By:</b>	Jack Grinsted	

### Sample Type: Soil

Sample Name:	SP1_0.0-0.1 26-Aug-2019 9:00 am	SP2_0.3-0.4 26-Aug-2019 9:45 am	SP2_1.3-1.4 26-Aug-2019 10:05 am	SP3_0.0-0.1 26-Aug-2019 10:10 am	SP4_0.4-0.5 26-Aug-2019 11:30 am
Lab Number:	2230675.1	2230675.5	2230675.6	2230675.7	2230675.10
Asbestos Presence / Absence	Asbestos NOT detected.	Chrysotile (White Asbestos) detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.
Description of Asbestos Form	-	Loose Fibres	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w < 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w < 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w < 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Asbestos as Asbestos Fines as % of Total Sample*	% w/w < 0.001	< 0.001	< 0.001	< 0.001	< 0.001
As Received Weight	g 1,317.0	1,250.0	860.2	1,375.3	1,075.9
Dry Weight	g 1,172.5	1,100.2	740.3	1,264.8	943.7
Ashed Weight	g 1,152.2	1,055.1	640.7	1,232.3	779.4
Moisture	% 11	12	14	8	12
Sample Fraction >10mm	g ashed wt 68.4	191.6	5.3	176.7	30.0
Sample Fraction <10mm to >2mm	g ashed wt 121.3	236.6	128.6	165.4	56.7
Sample Fraction <2mm	g ashed wt 961.2	624.7	505.1	888.4	690.5
<2mm Subsample Weight	g ashed wt 56.3	53.6	57.9	57.1	54.3
Weight of Asbestos in ACM (Non-Friable)	g ashed wt < 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt < 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt < 0.00001	0.00004	< 0.00001	< 0.00001	< 0.00001

Sample Name:	SP5_0.5-0.6 26-Aug-2019 12:30 pm				
Lab Number:	2230675.15				
Asbestos Presence / Absence	Asbestos NOT detected.	-	-	-	-
Description of Asbestos Form	-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w < 0.001	-	-	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w < 0.001	-	-	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w < 0.001	-	-	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w < 0.001	-	-	-	-
As Received Weight	g 1,545.1	-	-	-	-



Sample Type: Soil						
Sample Name:		SP5_0.5-0.6 26-Aug-2019 12:30 pm				
Lab Number:		2230675.15				
Dry Weight	g	1,394.5	-	-	-	-
Ashed Weight	g	1,286.5	-	-	-	-
Moisture	%	10	-	-	-	-
Sample Fraction >10mm	g ashed wt	416.5	-	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt	370.8	-	-	-	-
Sample Fraction <2mm	g ashed wt	496.1	-	-	-	-
<2mm Subsample Weight	g ashed wt	51.7	-	-	-	-
Weight of Asbestos in ACM (Non-Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g ashed wt	< 0.00001	-	-	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g ashed wt	< 0.00001	-	-	-	-

Please refer to the **BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil**.  
<https://www.branz.co.nz/asbestos>

The following assumptions have been made:

1. Asbestos Fines in the <2mm fraction, after homogenisation, is evenly distributed throughout the fraction
2. The weight of asbestos in the sample is unaffected by the ashing process.

Results are representative of the sample provided to Hill Laboratories only.

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 5-7, 10, 15
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 5-7, 10, 15
Ashed Weight	Sample ashed at 400°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 5-7, 10, 15
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1, 5-7, 10, 15
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 5-7, 10, 15
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 5-7, 10, 15
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1, 5-7, 10, 15
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1, 5-7, 10, 15
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 5-7, 10, 15
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 5-7, 10, 15
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 5-7, 10, 15

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 5-7, 10, 15
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 5-7, 10, 15
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g ashed wt	1, 5-7, 10, 15
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 5-7, 10, 15
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 5-7, 10, 15

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

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

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



John Keneth Paglingayen  
Bachelor of Applied Science  
Laboratory Technician - Asbestos



## Certificate of Analysis

Page 1 of 2

<b>Client:</b>	Westland District Council	<b>Lab No:</b>	2230677	SPv1
<b>Contact:</b>	Jack Grinsted C/- Golder Associates (NZ) Limited PO Box 2281 Christchurch Mail Centre Christchurch 8140	<b>Date Received:</b>	27-Aug-2019	
		<b>Date Reported:</b>	30-Aug-2019	
		<b>Quote No:</b>	100971	
		<b>Order No:</b>	108821 Sunset Point Testing	
		<b>Client Reference:</b>	19128146 Sunset Point	
		<b>Add. Client Ref:</b>	108821 Sunset Point Testing	
		<b>Submitted By:</b>	Jack Grinsted	

### Sample Type: Soil

Sample Name:	SP1_0.3-0.4 22-Aug-2019 9:10 am	SP2_0.3-0.4 22-Aug-2019 9:45 am	SP2_1.3-1.4 22-Aug-2019 10:05 am	SP3_0.4-0.5 22-Aug-2019 10:20 am	SP4_0.4-0.5 22-Aug-2019 11:30 am
Lab Number:	2230677.1	2230677.3	2230677.4	2230677.6	2230677.8

#### Individual Tests

Dry Matter	g/100g as rcvd	-	-	77	70	-
------------	----------------	---	---	----	----	---

#### Heavy Metals with Mercury, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	6	5	-	5	2
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.19	-	< 0.10	0.12
Total Recoverable Chromium	mg/kg dry wt	22	18	-	25	10
Total Recoverable Copper	mg/kg dry wt	22	19	-	16	14
Total Recoverable Lead	mg/kg dry wt	27	85	-	37	136
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	-	< 0.10	< 0.10
Total Recoverable Nickel	mg/kg dry wt	15	14	-	12	4
Total Recoverable Zinc	mg/kg dry wt	49	189	-	55	83

#### Polycyclic Aromatic Hydrocarbons Screening in Soil

Total of Reported PAHs in Soil	mg/kg dry wt	-	-	0.8	0.4	-
1-Methylnaphthalene	mg/kg dry wt	-	-	< 0.013	< 0.015	-
2-Methylnaphthalene	mg/kg dry wt	-	-	< 0.013	< 0.015	-
Acenaphthylene	mg/kg dry wt	-	-	< 0.013	< 0.015	-
Acenaphthene	mg/kg dry wt	-	-	< 0.013	< 0.015	-
Anthracene	mg/kg dry wt	-	-	< 0.013	< 0.015	-
Benzo[a]anthracene	mg/kg dry wt	-	-	0.038	0.025	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	0.064	0.044	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt	-	-	0.09	0.06	-
Benzo[a]pyrene Toxic Equivalence (TEF)	mg/kg dry wt	-	-	0.09	0.06	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	0.071	0.039	-
Benzo[e]pyrene	mg/kg dry wt	-	-	0.044	0.026	-
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	0.044	0.029	-
Benzo[k]fluoranthene	mg/kg dry wt	-	-	0.030	0.018	-
Chrysene	mg/kg dry wt	-	-	0.062	0.025	-
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	< 0.013	< 0.015	-
Fluoranthene	mg/kg dry wt	-	-	0.133	0.049	-
Fluorene	mg/kg dry wt	-	-	< 0.013	< 0.015	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	0.049	0.031	-
Naphthalene	mg/kg dry wt	-	-	< 0.07	< 0.08	-
Perylene	mg/kg dry wt	-	-	0.013	< 0.015	-
Phenanthrene	mg/kg dry wt	-	-	0.095	< 0.015	-
Pyrene	mg/kg dry wt	-	-	0.116	0.049	-





Sample Type: Soil						
<b>Sample Name:</b>		SP5_0.5-0.6 22-Aug-2019 12:30 pm				
<b>Lab Number:</b>		2230677.11				
Heavy Metals with Mercury, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	3	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	15	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	12	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	19.2	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	11	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	43	-	-	-	-

## Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1, 3, 6, 8, 11
Total of Reported PAHs in Soil	Sonication extraction, SPE cleanup, GC-MS SIM analysis.	0.3 mg/kg dry wt	4, 6
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1, 3, 6, 8, 11
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.002 - 0.3 mg/kg dry wt	4, 6
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	4, 6
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	4, 6
Benzo[a]pyrene Toxic Equivalence (TEF)	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	4, 6

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

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

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



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

**APPENDIX C**

# Photographic Record





**Photo 1. Test Pit SP1 showing wood debris in sandy silt matrix.**



**Photo 2. Test Pit SP1 showing demolition waste (bricks, concrete, wire) at depth (1.3 – 1.4 m bgl).**





**Photo 3. Test Pit SP2 showing organic matter and groundwater at depth (1.3 – 1.4 m bgl).**



**Photo 4. Concrete block encountered at Test Pit SP2 at 0.3 m bgl.**





**Photo 5. Test Pit SP3.**



**Photo 6. Close up of Test Pit SP3. Trace asphalt observed at 0.4 m bgl.**





**Photo 7. Test Pit SP4.**



**Photo 8. Close up of Test Pit SP4. No demolition waste material was observed.**





**Photo 9. Test Pit SP5.**



**Photo 10. Close up of Test Pit SP5. Trace asphalt observed near surface.**

**APPENDIX D**

# Analytical Results

Table D1: Tier 1 Soil Quality Assessment

						Asbestos		Metals/Metalloids										PAH																		
						Presence / Absence	Asbestos as ACM (% w/w)	Asbestos as AF+FA (% w/w)	Asbestos	Antimony	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Acenaphthene	Acenaphthylene	Acenaphthene	Anthracene	Benzo(a)anthracene	Benzo(b)fluorene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Benzo(e)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Dibenz(a,h)anthracene equivalent (BAP) eq. <sup>2</sup>	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	
							<LOR	<LOR	12.67	0.28	60.5	40.17	30.68	32.58	101.8	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	
Background concentrations <sup>1</sup>						<LOR	<LOR	12.67	0.28	60.5	40.17	30.68	32.58	101.8	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	
Location Code	Field ID	Soil Type	Sample Depth	Sampled Date	Sample Codes																															
SP1	SP1_0.3-0.4	Sandy SILT	0.3-0.4	22/08/2019	2230677.1	Asbestos NOT detected	<0.001	<0.001	6	<0.10	22	22	27	<0.10	15	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SP2	SP2_0.3-0.4	Sandy SILT	0.3-0.4	22/08/2019	2230677.3	Chrysotile (White Asbestos) detected	<0.001	<0.001	5	0.19	18	19	65	<0.10	14	189	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SP2	SP2_1.3-1.4	Sandy SILT	1.3-1.4	22/08/2019	2230677.4	Asbestos NOT detected	<0.001	<0.001	-	-	-	-	-	-	-	-	-	<0.013	<0.013	<0.013	0.038	0.064	0.071	0.044	0.030	0.062	<0.013	0.09	0.133	<0.013	0.049	<0.07	0.095	0.116	-	
SP3	SP3_0.4-0.5	SILT	0.4-0.5	22/08/2019	2230677.6	Asbestos NOT detected	<0.001	<0.001	5	<0.10	25	16	37	<0.10	12	55	<0.015	<0.015	<0.015	0.025	0.044	0.039	0.029	0.018	0.025	<0.015	0.06	0.049	<0.015	0.031	<0.08	<0.015	0.049	-		
SP4	SP4_0.4-0.5	SILT	0.4-0.5	22/08/2019	2230677.8	Asbestos NOT detected	<0.001	<0.001	2	0.12	10	14	13	<0.10	4	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SP5	SP5_0.5-0.6	Silty SAND	0.5-0.6	22/08/2019	2230677.11	Asbestos NOT detected	<0.001	<0.001	3	<0.10	15	12	19.2	<0.10	11	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**Notes**

Soil concentrations expressed in units of milligram per kilogram dry weight (mg/kg) except asbestos (%w/w).

<sup>1</sup> Land Resource Information Systems Portal, Background soil concentrations of selected trace elements and organic contaminants in New Zealand, 95th percentile estimates (Landcare Research, 2015).

<sup>2</sup> Interim Benzo(a)pyrene equivalence Class 5 (Clean fill) Waste Acceptance Criteria (WasteMINZ 2018).

Shading represents exceedance of background concentrations.

Grey represents concentrations below the laboratory limit of reporting.

- denotes sample not analysed

LOR - Limit of reporting

**APPENDIX E**

# Report Limitations



## Report Limitations

This Report/Document has been provided by Golder Associates (NZ) Limited ("Golder") subject to the following limitations:

- i) This Report/Document has been prepared for the particular purpose outlined in Golder's proposal and no responsibility is accepted for the use of this Report/Document, in whole or in part, in other contexts or for any other purpose.
- ii) The scope and the period of Golder's Services are as described in Golder's proposal, and are subject to restrictions and limitations. Golder did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Report/Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Golder in regards to it.
- iii) Conditions may exist which were undetectable given the limited nature of the enquiry Golder was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Report/Document. Accordingly, if information in addition to that contained in this report is sought, additional studies and actions may be required.
- iv) The passage of time affects the information and assessment provided in this Report/Document. Golder's opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed Golder to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.
- v) Any assessments, designs and advice made in this Report/Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Report/Document.
- vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Golder for incomplete or inaccurate data supplied by others.
- vii) The Client acknowledges that Golder may have retained subconsultants affiliated with Golder to provide Services for the benefit of Golder. Golder will be fully responsible to the Client for the Services and work done by all of its subconsultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from Golder and not Golder's affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against Golder's affiliated companies, and their employees, officers and directors.
- viii) This Report/Document is provided for sole use by the Client and is confidential to it. No responsibility whatsoever for the contents of this Report/Document will be accepted to any person other than the Client. Any use which a third party makes of this Report/Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Report/Document.



**[golder.com](http://golder.com)**