28 January 2026
Springline Limited

Gibbons Development Limited

RE: 122 Morven Ferry Road – Preliminary Screening for Naturally Occurring Arsenic

Springline Limited (Springline) has been engaged by Gibbons Development Limited (the Client) to undertake a preliminary screening assessment for naturally occurring arsenic in soil at 122 Morven Ferry Road, Queenstown (the site).

This assessment has been completed to:

- Evaluate the applicability of the National Environmental Standard for Assessing and Managing Contaminants in Soil (NES-CS),
- Inform preliminary earthwork and disposal planning, and
- Identify the need for any further investigation.

Background and Previous Investigations

The previous Preliminary Site Investigation[1] (PSI) and Detailed Site Investigation[2] (DSI) identified elevated arsenic concentrations throughout multiple areas in the northern region of the site. The consistency of elevated arsenic levels across varied land uses suggests that the observed elevations above published background concentrations (PBCs) may be attributable to a geogenic origin rather than anthropogenic.

This interpretation is consistent with known regional soil characteristics associated with schist-derived parent materials in the Queenstown–Otago region, where naturally arsenic-rich sediments are common. In addition, arsenic enrichment may occur through mobilisation and redistribution under changing redox conditions at soil–groundwater interfaces associated with fluctuating groundwater levels, resulting in elevated concentrations in a range of soil types[3].

Regional Geogenic Arsenic Context

In 2017, the Ministry of Business, Innovation and Employment (MBIE) engaged GNS Science to undertake three geochemical baseline surveys over the Otago-northern Southland region. Both the Regional 8 km Survey and Shotover 4 km Survey analysed soil samples in general proximity to the site results from which are presented in Martin *et al.*[4] *(2018)* and record arsenic concentrations in soil ranging from 4.1 to 55.8 mg/kg.

Comparable results have been reported in silt deposits exposed in the Glenorchy delta area[3], where background arsenic concentrations range from approximately 4 to 45 mg/kg, reflecting natural variability associated with sediment provenance and depositional processes.

Preliminary Geogenic Arsenic Investigation

As part of this preliminary geogenic screening assessment, Springline collected limited samples across the site, outside of HAIL footprints and away from anthropogenic influence, targeting different soil groups

[1] Springline Limited (September 2025). Preliminary Site Investigation – 122 Morven Ferry Road. Report Ref: 25086
[2] Springline Limited (November 2025). Detailed Site Investigation – 122 Morven Ferry Road. Report Ref: 25086
[3] Craw & Druzbicka (2023) Geological controls on locally elevated arsenic in the Glenorchy area, Otago, New Zealand https://doi.org/10.1080/00288306.2023.2174147
[4] Martin, A.P. & Tamsen, Delia & Rattenbury, M. & Turnbull, Rose & Durance, Patricia & Stucker, V & Morgenstern, Regine. (2017). Soil geochemistry for mineral exploration in Otago-northern Southland.

identified within the Soil and Resource Report[5]. The purpose of this sampling was to provide indicative information on arsenic concentrations and depth distribution to inform early-stage development planning and guide any future investigation or soil management strategies.

Springline's soil investigation is summarised in Table 1 below. Sample location plans are included Figure 1 and Figure 2 in Attachment A.

Table 1: Soil Investigation Summary

Site Investigation	
Date	10 October 2025
Analyte	Arsenic
Sampling Design	• Eight hand-augers (HA01 – HA08) were advanced to maximum depths of 0.7 - 0.9 m bgl • A minimum of two soil samples were collected from each hand-auger location at multiple depths (17 samples total) • Sample locations were distributed across the site, targeting different soil groups and topographic settings • All 17 samples were analysed for heavy metals (including arsenic)
Process	• Samples were collected by a suitably qualified and experienced practitioner (SQEP) in general accordance with the MfE Contaminated Land Management Guidelines No. 5 (CLMG No. 5). • All sampling equipment was decontaminated between each test location using a phosphate free detergent. • Samples were placed in a chilled container and delivered to an IANZ accredited laboratory (Hill Laboratories) under appropriate chain of custody (CoC) documentation. • No field sampling errors, equipment issues, or indications of cross-contamination were observed during the investigation.

Summary of Analytical Results

A summary of Springline's soil analytical results is provided in Attachment B, with supporting laboratory documentation provided in Attachment C.

Key findings are as follows:

- Arsenic concentrations ranged from 7 – 27 mg/kg, as compared to the PBC of 12.06 mg/kg
  - One sample (HA03 at 0.8 m bgl) recorded an arsenic concentration of 27 mg/kg, exceeding the NES-CS residential land use soil contaminant standards (SCSs) of 20 mg/kg
  - All remaining samples were below the SCSs for residential land use
  - A 95% Upper Confidence Level (UCL)[6] for arsenic, returned a result of 14.3 mg/kg
  - Arsenic concentrations exceed the adopted local cleanfill acceptance criteria in 11 of the 17 samples analysed.
- All remaining heavy metal concentrations were consistent with PBCs.

[5] Hanmore Land Management (2025). Soil and Resource Report for 122 Morven Ferry Road, Arrowtown.
[6] ProUCL Software - Version 5.2.0. Neptune and Company, Incorporated (2026)

Discussion

Elevated arsenic concentrations above PBCs were identified in three locations (HA01, HA02 and HA03), situated in topographically low-lying areas in the northern region of the site. The elevated arsenic concentrations were recorded in surficial topsoil and deeper underlying silts, with the highest concentration (27 mg/kg) recorded at 0.8 m bgl.

The persistence of arsenic detections across multiple soil horizons, their alignment with topographically lower-lying areas, and the absence of known anthropogenic sources, support the interpretation that the observed enrichment may be naturally occurring and geogenic in origin. The elevated concentrations identified in HA01 to HA03 are also generally consistent with the results reported in the DSI, reinforcing this interpretation.

Development Considerations

NES-CS Application

The preliminary results indicate that arsenic enrichment is naturally occurring background, and therefore does not trigger a change in the site's NES-CS consenting status as per Regulation 5(9).

Human Health Risks

Preliminary soil results returned a 95% Upper Confidence Level (UCL) for arsenic of 14.3 mg/kg, which is below the residential Soil Contaminant Standard (SCS) of 20 mg/kg. A single exceedance was identified (27 mg/kg at HA03, 0.8 m bgl).

Additionally, bioavailability testing has previously been undertaken on local silt deposits (approximately 10 km southwest of the site) that exhibit elevated geogenic arsenic[7]. Bioavailability testing assesses the proportion of arsenic that may be absorbed by the human body via ingestion – a factor not considered in the derivation of the residential SCS[8], which conservatively assumes 100% absorption.

The testing returned a relative bioavailability (RBA) of arsenic ranging from 7.4% to 16.7% for the silts with total arsenic concentrations between 19 and 51 mg/kg. These results were calculated to correspond to an adjusted, site-specific residential SCS of approximately 61 mg/kg.

Based on the single exceedance at depth, low relative bioavailability and the likely geogenic origin of the arsenic, the identified concentrations are considered unlikely to pose a risk to human health.

Soil Disposal Pathways

Based on the findings of the DSI and this preliminary geogenic screening assessment, the tested shallow soils within the lower-lying areas in the northern region of the site are currently unlikely to meet the acceptance criteria of local consented clean fill facilities; potentially requiring disposal to managed landfill at higher cost – if requiring off-site removal during future earthworks.

Additional Investigations

Given the limited sampling undertaken and the potential for cleanfill restrictions, further investigation is recommended. This should include systematic sampling across all soil types and topographic settings to delineate the spatial extent and depth of naturally enriched arsenic. The findings will support future earthworks planning and enable more informed decisions around soil classification, disposal, and reuse.

Conclusions & Recommendations

Based on the preliminary results, it is considered likely that naturally occurring geogenic arsenic is present at the site, potentially confined to the lower-lying areas in the northern regions of the site. To confirm this

[7] ENGEO Limited 2025. Preliminary Site Investigation and Detailed Site Investigation. 633 Frankton Road, Frankton, Queenstown.
[8] Ministry for the Environment (MfE) 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health

interpretation and reduce uncertainty associated with spatial variability, a separate assessment is recommended, including:

- Systematic soil sampling across the site to confirm arsenic concentrations and origin;
- Evaluation of spatial distribution and depth variability of naturally enriched soils;
- Delineation of soil management areas to inform appropriate off-site disposal or on-site reuse of surplus soils generated during development.

Yours faithfully,

James Jackson

Director

Springline | www.springline.co.nz

Max Nightingale-McMahon

Director

Springline | www.springline.co.nz

Limitations

This assessment has been prepared by Springline Limited for Gibbons Development Limited to inform preliminary soil management and disposal planning, with a specific focus on assessing potential naturally occurring arsenic. The investigation was limited in scope and is not intended to support NES-CS compliance or human health risk assessment.

While arsenic concentrations have been compared against NES-CS soil contaminant standards, this has been done for context only. The presence of arsenic identified through this screening is considered geogenic in nature and does not trigger additional NES-CS consenting requirements.

The findings are based on limited sampling and should be considered indicative only. Results may not fully capture site-wide variability or the presence of isolated elevated concentrations. Further investigation is recommended to support detailed earthwork planning and surplus soil management.

Attachment A

Site Plans

SPRINGLINE

TITLE

Figure 1: Site Plan

PROJECT

122 Morven Ferry Road

CLIENT

Gibbons Development Limited

LEGEND

Approximate Site Boundary

Hand Auger Location

SPATIAL REFERENCE

0 80 200 400

N

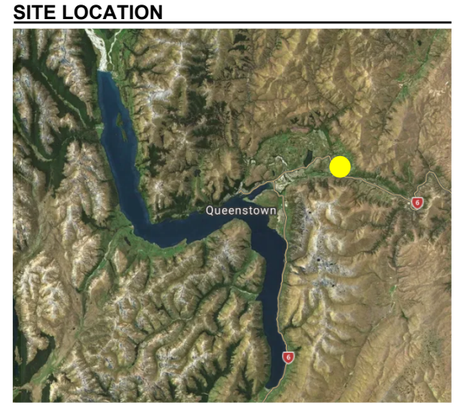
PROJECT MANAGEMENT

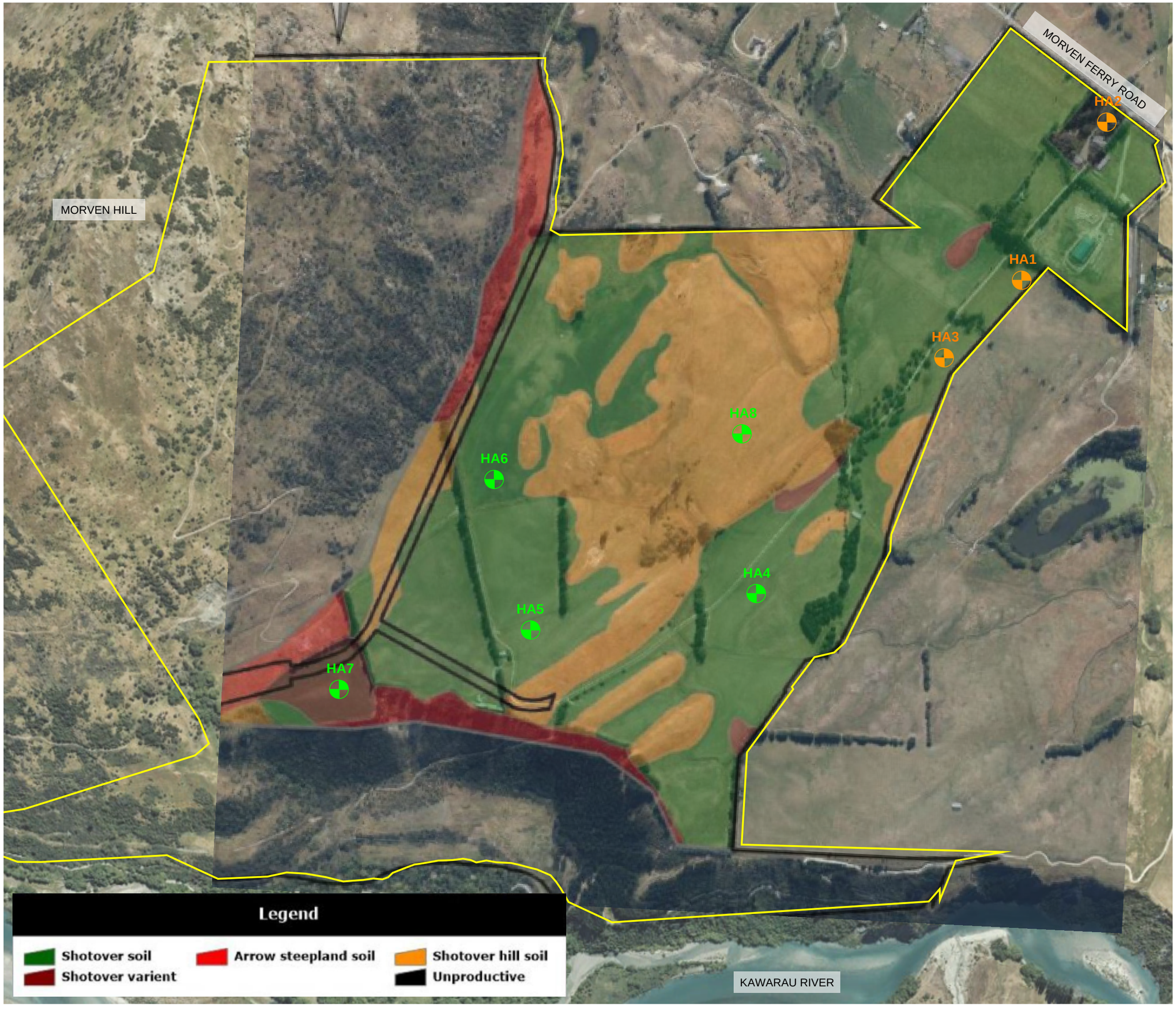
Approved	MN	Date	19.01.2026
Checked	JJ	Date	19.01.2026
Drawn	NN	Date	19.01.2026

ISSUE / REVISION

A	19.01.2026	Final

SITE LOCATION





SPRINGLINE

TITLE

Figure 2: Soil Type Overlay

PROJECT

122 Morven Ferry Road

CLIENT

Gibbons Development Limited

LEGEND

- Approximate Site Boundary
- Arsenic < Background
- Arsenic > Background

NOTES

Soil type image overlay and legend have been sourced from the Soil and Resource Report (Hanmore Land Management, 2025)

Locations are approximate

SPATIAL REFERENCE

0 80 200 400 N

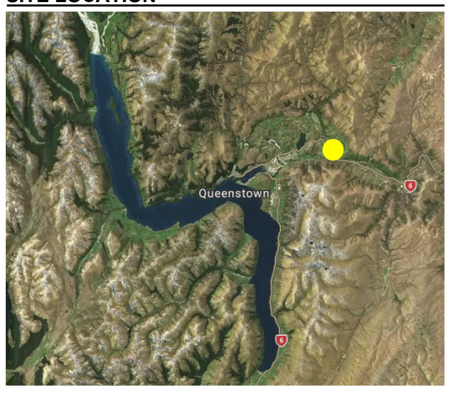
PROJECT MANAGEMENT

Approved	MN	Date	19.01.2026
Checked	JJ	Date	19.01.2026
Drawn	NN	Date	19.01.2026

ISSUE / REVISION

A	19.01.2026	Final

SITE LOCATION



Attachment B

Results Table

SPRINGLINE

Soil Analytical Results

122 Morven Ferry Road
Project Ref: 25086

Table 1(a)

Soil Sample Results													Assessment Criteria				Disposal Criteria		
Sample Location	**HA01**			**HA02**	**HA03**				**HA04**		**HA05**								
Depth (m bgl)	0.2	0.5	0.7	0.6	0.1	0.3	0.5	0.8	0.5	0.9	0.4	0.7							
Soil Type	TOPSOIL	SILT, trace sand	SILT	SILT, trace sand	TOPSOIL	SILT, trace clay	SILT, trace sand	Gravelly SAND	SILT, trace clay	Gravelly SAND	SILT	Gravelly SAND	Site-Specific Background[1]	**Eco-SGV[2]**	Residential SCS[3]	Commercial SCS[3]	**Shotover Quarry Cleanfill[5]**	**Luggate Quarry Cleanfill[6]**	**Taiko Landfill[7] -** *Total Concentrations*
Heavy Metals																			
Arsenic	16	18	19	18	13	11	11	27	10	7	8	7	12.06	**60**	20	70	9.97	12.06	70
Cadmium	0.14	< 0.10	< 0.10	< 0.10	0.19	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.34	**12**	2	1,300	0.33	0.34	10
Chromium	20	22	21	15	12	13	14	13	13	10	10	9	80.15	**390**	460	6,300	56.88	80.15	150
Copper	18	21	25	13	14	10	10	13	15	13	7	6	42.85	**120**	>10,000	>10,000	48.14	42.85	280
Lead	15.2	15.7	17.5	12.7	17.9	19	18.8	19.9	16.3	10.9	11.4	10.5	44.34	**900**	210	3,300	25.83	44.34	460
Nickel	18	21	21	15	13	14	13	12	14	11	9	9	44.96	**-**	400[4]	4,000[4]	35.15	44.96	320
Zinc	67	62	66	52	88	70	60	42	63	43	47	37	182.8	**130**	8,000[4]	400,000[4]	97.97	182.8	1,200

Notes

"-" denotes analyte not tested or no soil guideline value/acceptance criteria available BDL = Below [laboratory] detection limits

References

[1] Manaaki Whenua Landcare Research Limited Predicted background soil concentrations - 95%ile values for gravel soil group (Landcare Research Manaaki Whenua).

[2] Manaaki Whenua Landcare Research. UPDATED Development of soil guideline values for the protection of ecological receptios (Eco-SGVs: Technical document. June 2019) & An implementation framework for ecological soil guideline values (2023, Envirolink C09X2206).

[3] Ministry for the Environment (2011). National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil to Protect Human Health.

[4] Australian National Environmental Protection (Assessment of Site Contamination) Measure (1999, revised 2013). Guideline on Investigation Levels for Soil and Groundwater. Schedule B1.

[5] Fulton Hogan Shotover Delta Quarry, Fill Acceptance Criteria. Local background concentrations taken from: Landcare Research Limited Predicted background soil concentrations - 95%ile values for mudstone Pakahi soils.

[6] Fulton Hogan Luggate Quarry, Fill Acceptance Criteria (dated: 30.03.2023). Local background concentrations taken from: Landcare Research Limited Predicted background soil concentrations - 95%ile values for gravel soils.

[7] Taiko Landfill. Material that meets the levels in the Taiko T&C Requirments V2 is considered low level, as advised by GHC Consulting Ltd November 2025

Table 1(b)

Soil Sample Results													Assessment Criteria				Disposal Criteria		
Sample Location	**HA06**	**HA07**		**HA08**		-	-	-	-	-	-	-							
Depth (m bgl)	0.5	0.3	0.6	0.4	0.6	-	-	-	-	-	-	-							
Soil Type	Gravelly SAND	SILT	Gravelly SAND	SILT	Silty SAND	-	-	-	-	-	-	-	Site-Specific Background[1]	**Eco-SGV[2]**	Residential SCS[3]	Commercial SCS[3]	**Shotover Quarry Cleanfill[5]**	**Luggate Quarry Cleanfill[6]**	**Taiko Landfill[7] -** *Total Concentrations*
Heavy Metals																			
Arsenic	7	11	10	9	9	-	-	-	-	-	-	-	12.06	**60**	20	70	9.97	12.06	70
Cadmium	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	-	-	-	-	-	-	-	0.34	**12**	2	1,300	0.33	0.34	10
Chromium	6	10	8	10	9	-	-	-	-	-	-	-	80.15	**390**	460	6,300	56.88	80.15	150
Copper	10	9	9	9	11	-	-	-	-	-	-	-	42.85	**120**	>10,000	>10,000	48.14	42.85	280
Lead	13.2	12.8	11.8	11.1	11.8	-	-	-	-	-	-	-	44.34	**900**	210	3,300	25.83	44.34	460
Nickel	8	11	9	10	11	-	-	-	-	-	-	-	44.96	**-**	400[4]	4,000[4]	35.15	44.96	320
Zinc	39	49	40	48	44	-	-	-	-	-	-	-	182.8	**130**	8,000[4]	400,000[4]	97.97	182.8	1,200

Notes

"-" denotes analyte not tested or no soil guideline value/acceptance criteria available BDL = Below [laboratory] detection limits

References

[1] Manaaki Whenua Landcare Research Limited Predicted background soil concentrations - 95%ile values for gravel soil group (Landcare Research Manaaki Whenua).

[2] Manaaki Whenua Landcare Research. UPDATED Development of soil guideline values for the protection of ecological receptios (Eco-SGVs: Technical document. June 2019) & An implementation framework for ecological soil guideline values (2023, Envirolink C09X2206).

[3] Ministry for the Environment (2011). National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil to Protect Human Health.

[4] Australian National Environmental Protection (Assessment of Site Contamination) Measure (1999, revised 2013). Guideline on Investigation Levels for Soil and Groundwater. Schedule B1.

[5] Fulton Hogan Shotover Delta Quarry, Fill Acceptance Criteria. Local background concentrations taken from: Landcare Research Limited Predicted background soil concentrations - 95%ile values for mudstone Pakahi soils.

[6] Fulton Hogan Luggate Quarry, Fill Acceptance Criteria (dated: 30.03.2023). Local background concentrations taken from: Landcare Research Limited Predicted background soil concentrations - 95%ile values for gravel soils.

[7] Taiko Landfill. Material that meets the levels in the Taiko T&C Requirments V2 is considered low level, as advised by GHC Consulting Ltd November 2025

Attachment C

Laboratory Certification

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

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

Certificate of Analysis

Client:	Springline Limited	**Lab No:**	4007114 SPv1
Contact:	James Jackson	**Date Received:**	13-Oct-2025
	C/- Springline Limited	**Date Reported:**	17-Oct-2025
	PO Box 26001	**Quote No:**	136462
	North Avon	**Order No:**	25086
	Christchurch 8148	**Client Reference:**	Ridgeburn
		Submitted By:	James Jackson

Sample Type: Soil

	Sample Name:	HA01 0.2 10-Oct-2025	HA01 0.5 10-Oct-2025	HA01 0.7 10-Oct-2025	HA02 0.6 10-Oct-2025	HA03 0.1 10-Oct-2025
	Lab Number:	4007114.1	4007114.2	4007114.3	4007114.4	4007114.5
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	16	18	19	18	13
Total Recoverable Cadmium	mg/kg dry wt	0.14	< 0.10	< 0.10	< 0.10	0.19
Total Recoverable Chromium	mg/kg dry wt	20	22	21	15	12
Total Recoverable Copper	mg/kg dry wt	18	21	25	13	14
Total Recoverable Lead	mg/kg dry wt	15.2	15.7	17.5	12.7	17.9
Total Recoverable Nickel	mg/kg dry wt	18	21	21	15	13
Total Recoverable Zinc	mg/kg dry wt	67	62	66	52	88

	Sample Name:	HA03 0.3 10-Oct-2025	HA03 0.5 10-Oct-2025	HA03 0.8 10-Oct-2025	HA04 0.5 10-Oct-2025	HA04 0.9 10-Oct-2025
	Lab Number:	4007114.6	4007114.7	4007114.8	4007114.9	4007114.10
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	11	11	27	10	7
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	13	14	13	13	10
Total Recoverable Copper	mg/kg dry wt	10	10	13	15	13
Total Recoverable Lead	mg/kg dry wt	19.0	18.8	19.9	16.3	10.9
Total Recoverable Nickel	mg/kg dry wt	14	13	12	14	11
Total Recoverable Zinc	mg/kg dry wt	70	60	42	63	43

	Sample Name:	HA05 0.4 10-Oct-2025	HA05 0.7 10-Oct-2025	HA06 0.5 10-Oct-2025	HA07 0.3 10-Oct-2025	HA07 0.6 10-Oct-2025
	Lab Number:	4007114.11	4007114.12	4007114.13	4007114.14	4007114.15
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	8	7	7	11	10
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	10	9	6	10	8
Total Recoverable Copper	mg/kg dry wt	7	6	10	9	9
Total Recoverable Lead	mg/kg dry wt	11.4	10.5	13.2	12.8	11.8
Total Recoverable Nickel	mg/kg dry wt	9	9	8	11	9
Total Recoverable Zinc	mg/kg dry wt	47	37	39	49	40

	Sample Name:	HA08 0.4 10-Oct-2025	HA08 0.6 10-Oct-2025
	Lab Number:	4007114.16	4007114.17
Heavy Metals, Screen Level			
Total Recoverable Arsenic	mg/kg dry wt	9	9
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	10	9
Total Recoverable Copper	mg/kg dry wt	9	11
Total Recoverable Lead	mg/kg dry wt	11.1	11.8

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil			
Sample Name:		HA08 0.4 10-Oct-2025	HA08 0.6 10-Oct-2025
Lab Number:		4007114.16	4007114.17
Heavy Metals, Screen Level			
Total Recoverable Nickel	mg/kg dry wt	10	11
Total Recoverable Zinc	mg/kg dry wt	48	44

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Labs, 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%. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed).	-	1-17
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required. US EPA 200.2 (modified), APHA 3125 B: Online Edition.	0.10 - 4 mg/kg dry wt	1-17

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

Testing was completed between 14-Oct-2025 and 17-Oct-2025. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

Martin Cowell - BSc
Client Services Manager - Environmental