Remediation Action Plan for the Parkburn Quarry at 922 Luggate-Cromwell Road (SH6), Cromwell

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1 Introduction

1.1 Background

JKCM Limited, trading as Insight Engineering (IE), was contracted by Fulton Hogan Land Development to prepare this Remediation Action Plan (RAP), including an assessment of available remedial options, for the property (herein referred to as 'the site', refer to Appendix 1) at 922 Luggate-Cromwell Road, Cromwell.

Potentially contaminated areas were identified by e3scientific Limited (e3) during completion of a preliminary environmental site investigation (PSI) in 2021[1]. Contamination impacts were then confirmed by IE during completion of a preliminary and detailed environmental site investigation (PSI/DSI) in 2026[2]. Although some information is summarised in this RAP, it is recommended that this document is read in conjunction with the PSI[1] and PSI/DSI[2] for completeness (Appendix 2).

Figure 1 indicates the location of The Project and Figure 2 highlights the areas requiring remediation. Additional figures provided in Appendix 1, prepared by LandPro, provide detailed designs of the containment cells.

1.2 Purpose

This purpose of this document is to assess and conclude on the suitability of various options available to remediate the impacted portions of the site, in accordance with the MfE *Contaminated Land Management Guideline No. 1: Reporting on Contaminated Sites in New Zealand*[3] (CLMG#1) and Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations[4] (herein referred to as the NES-CS) and then to provide procedures to enable implementation of the recommended remedial strategy / strategies.

1.3 Objectives

The RAP has the following specific objectives:

- Review past site investigation report(s) to assess contaminant distribution;
- Produce a report identifying the possible remedial options available, the method of risk reduction associated with each option, and the estimated positive and negative aspects associated with each remedial method;
- Recommend one, or several, methods that could adequately reduce the risk to human health at the site; and
- Provide procedures required to complete the remedial work in a safe and sustainable manner.

The limitations of this document are outlined in Section 10.

2 Site Description

The site information is summarised in Table 1.

Table 1: Summary of Site Information and Description

Location	922 Luggate-Cromwell Road (SH6), Cromwell
Legal Description	Part Sections 62-63 Block IV Wakefield Survey District, Part Section 63 Block IV Wakefield Survey District, Section 1 Survey Office Plan 365897, Section 4 Survey Office Plan 557380 and

Table 1 (cont.): Summary of Site Information and Description

Legal Description (cont.)	Sections 64-65 Block IV Wakefield Survey District.
Property Owner	Fulton Hogan Limited
Former Site Use	A large proportion of the property is used for gravel quarrying purposes. Other isolated parts of the site are used for administration (offices), a concrete plant, an asphalt plant, a glass recycling area, equipment storage areas and for storage of a large stockpile of imported cleanfill. The remainder of the site is not used.
Proposed Site Uses	Residential, commercial and recreation areas are proposed.
Property Area	Approximately 118 ha
Territorial Authorities	Central Otago District Council Otago Regional Council
Zoning	80.1 ha of Low Density Residential Zone, 10.1 ha of Medium Density Residential Zone, 4.7 ha of Business Resource Area 3, 2.3 ha of Industrial Resource Area 2, and 22.3 ha of Industrial Resource Area 3
Geology	The GNS New Zealand Geology Webmap[5] indicates that the site contains two geological units: The majority of the site is located within Late Pleistocene outwash deposits of Albert Town Advance, described as "*Unweathered to slightly weathered, loose, sandy to silty, well rounded gravel usually on large outwash plains*". A small area located near to the northern boundary is underlain by Holocene fan deposits, broadly described as "*Loose, commonly angular, boulders, gravel, sand, and silt forming alluvial fans; grades into scree (upslope) and valley alluvium*".
Hydrogeology	Information provided in support of Private Plan Change 21, prepared by e3Scientific[1], confirms that the site is located within the Pisa Groundwater Management Zone. Groundwater flows from the Holocene river deposits, west of the site, through the highly permeable Late Pleistocene river deposits, comprised of sandy gravel or sandy cobbles and gravel, underlying the site. Groundwater ultimately reaches Lake Dunstan, east of the site. ORC data[6] indicates that several water bores are located at and around the site. Groundwater depths in those wells ranged between 10.6 m below ground level (bgl) and 16.47 m bgl.

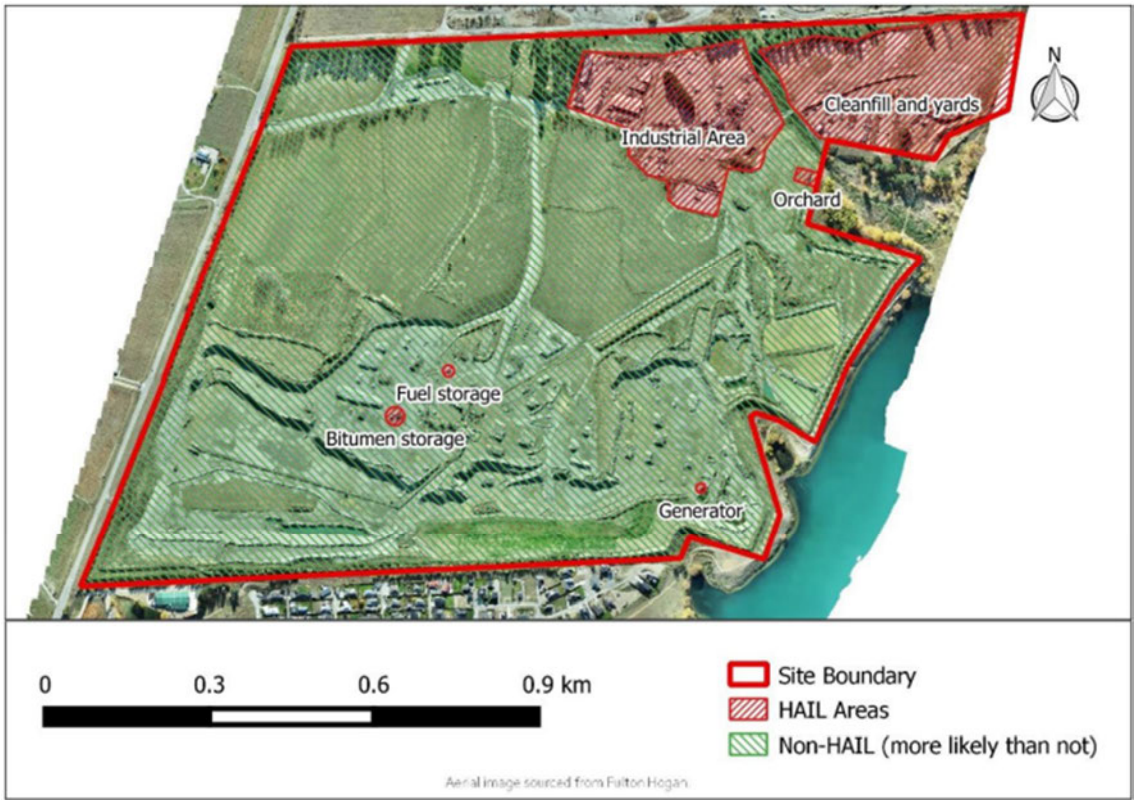
2.1 Contaminants of Concern

e3 identified[1] petroleum hydrocarbons, heavy metals and possible persistent pesticides as contaminants of concern in various isolated parts of the site.

2.2 Contaminant Distribution

Contamination impacts are primarily located within the north eastern portion of the site, in the vicinity of the asphalt plant, the concrete block manufacturing facility, equipment storage areas / yards and the cleanfill stockpile.

Additionally, isolated areas of potential impact were identified by e3 within the quarry area in the central and southern portions of the site.



The map above courtesy of e3 (Appendix 2) shows the areas within which contaminants are located. The locations of specific hazardous activities within the north eastern portion of the site are outlined in Figure 2.

2.3 Volume of Contaminated Soil

Cleanfill Stockpile

Due to the variability of the material observed by e3[1] and IE[2], a small percentage the cleanfill stockpile is conservatively considered to contain contaminants at concentrations marginally exceeding the relevant SCSs.

However, statistical analysis of laboratory results[2] confirmed that the 95% upper confidence limits for heavy metals concentrations are below the current background criteria for Otago and Southland[7].

The stockpile volume has been estimated by LandPro, based on survey data collected in December 2025, at approximately 130,800 m^3.

Asphalt plant

The volume of impacted material cannot be quantified until the plant and other operations on site have ceased. It is conservatively estimated that up to 100 m^3 could be impacted with various petroleum hydrocarbon products in the vicinity of the asphalt plant.

Fuel storage areas

Above-ground fuel storage activities generally result in negligible surface impacts from drips during refilling of machinery. However, underground fuel storage tanks and associated pipework can result in more significant impacts. Those impacts will only become apparent when removing the fuel tank(s).

It is conservatively anticipated that the volume of impacted soil associated with fuel storage areas could total up to 50 m^3.

Other areas

The contractors' yards, used for storing machinery and treated timber poles, are conservatively estimated to contain up to 100 m^3 of impacted material.

The former orchard area is considered unlikely to contain significant concentrations of persistent pesticides, due to the significant length of time since they could have been applied to the site. However, if present, the conservative estimate for the volume of impacted material is 70 m^3, based on impacts within the upper 100 mm across an area of approximately 700 m^2.

3 Assessment of Remedial Options

The following section identifies potential remedial options that are considered suitable for remediating soil contaminated with heavy metals, petroleum hydrocarbons and persistent pesticides that have been successfully conducted at field scale level and that have been documented at contaminated site case studies both nationally and internationally.

Table 2 provides a brief description of the remedial method and an assessment of whether this method is applicable to this site given its setting, proposed land use, contaminant volume, and distribution across the site and throughout the soil profile, as well as the required timeframe to complete the work.

Table 2: Assessment of Remedial Methods for Impacted Soil.

Remedial method	Description	Applicable and feasible at the site?
Electrokinetics	Electrokinetics is the application of low intensity current between electrodes placed in the soil (in-situ or ex-situ) to mobilise the contaminants towards the polarised electrodes thereby concentrating them and allowing their subsequent removal in a smaller volume of soil[8].	Not considered applicable or financially viable at the site given the nature of the majority of the contamination on site, which is not considered to be particularly mobile in soil.
Phytoremediation	Involves the planting of certain grasses and tress which uptake the contaminants from the soil root zone into above ground plant tissue. Plants are removed after a sufficient period and disposed of at an appropriate facility[8].	Not considered applicable or feasible at the site given the length of time taken to remediate the site compared with the available timeframe to enable residential development.

Table 2 (cont.): Assessment of Remedial Methods for Impacted Soil.

Solidification/ stabilisation	Solidification refers to a process that involves binding contaminated soil with a reagent such as lime or cement, thereby changing its physical properties by increasing the strength, decreasing its permeability and encapsulating the contaminants to form a solid material[9]. The stabilisation process refers to a chemical reaction that reduces the leachability of contaminated soil, immobilising the waste and reducing its solubility; thus making the soil less harmful or less mobile. Solidification/stabilisation treatment typically involves mixing a binding agent into the contaminated soil. These techniques are done either *in-situ*, by injecting the binder agent into the contaminated media, or *ex-situ* by excavating the materials and machine mixing them with the agent.	Remediation technique is considered applicable to the site, especially the material within the cleanfill stockpile, but the process requires specialised equipment to enable uniform mixing of the impacted material and the binding agent. The approach is therefore not considered to be economically viable.
Soil washing	This method would typically involve physical and chemical separation of the majority of the contaminants into a smaller volume which is then disposed of or treated further. The washed or processed soil is then returned to the site. Physical separation typically involves standard mineral processing equipment to remove the finer particles which are likely to contain the majority of the contaminants. Chemical washing involves transferring the contaminants from the soil into solution which is subsequently treated[10].	Given the time and associated costs to design and set up the soil washing process, this remedial approach is considered not a financially viable option. This option would also produce other waste streams (liquid reagents) that would require further treatment/disposal.
'Do nothing' approach	Continue with the residential development without undertaking any prior remedial activities.	Not considered applicable given the restrictions of the NES-CS which prohibit the residential use of sites that contain contaminants at concentrations that exceed the SCSs. Furthermore, earthworks are required for geotechnical purposes and the opportunity to re-work the impacted material therefore exists.
Offsite disposal	This involves the physical excavation of the contaminated soil and offsite disposal at an appropriate waste disposal facility.	Considered applicable, but given the total volume of impacted material to be removed the cost of disposal is considered a significantly limiting factor. However, off-site disposal is considered likely to be selected as the remedial option for the most significantly impacted material on site e.g. bituminous residue, or significant petroleum hydrocarbon impacts.

Table 2 (cont.): Assessment of Remedial Methods for Impacted Soil.

Containment / Encapsulation	This remedial approach would involve excavating the impacted soil identified at the site and placing within a containment cell. A suitable containment cell for the site could be positioned 1 m below finished ground level within the stormwater corridor in the central portion of The Project. Furthermore, space is available beneath 2 m of engineered fill within residential properties in north eastern portion of The Project.	Considered applicable given the abundance of available containment space in certain parts of The Project. The cleanfill stockpile is required to be moved to enable excavation of the underlying pea gravels which are not geotechnically suitable for use as engineered fill. Therefore, the opportunity to screen the cleanfill stockpile and remove large inclusions will be incorporated into the remediation works. The screened cleanfill can then be placed beneath the engineered fill layer in the stormwater channel in the central portion of The Project, as well as beneath a few residential properties in Stages 14 and 15 of The Project. Once all cleanfill stockpile material has been placed and compacted, back-filling to the finished design levels can continue, using clean material from other parts of the property. Once buried, the cleanfill would not interact with the environment to a measurable degree.
Capping	This remedial method involves capping the site with a sufficient thickness of clean soil.	The geotechnical constraints of the underlying pea gravel layer means that excavation of the pea gravel beneath the cleanfill stockpile is required to enable the construction of 'good ground' in that part of The Project, therefore the stockpile cannot be capped in its current state. However, the containment / encapsulation approach is proposed to be supplemented by capping the cleanfill with at least 1 m of clean engineered fill from other parts of the property.

Of the available options, on-site containment / encapsulation of the impacted material, supplemented by capping with at least 1 m of engineered fill, is considered to be the most effective way to eliminate risks to human, environmental and ecological health for small amount of contaminated material within the cleanfill stockpile.

Significantly contaminated material, such as petroleum hydrocarbon-impacted soil, will be disposed of off-site at an appropriate facility such as Victoria Flat landfill in Gibbston, or the Taiko Landfill near Timaru.

4 Discussion

Excavation, screening and encapsulation of the cleanfill stockpile can be easily achieved during the bulk site earthworks phase. Excavation of the cleanfill stockpile is required regardless of which

remediation method is selected, because the underlying pea gravels must be removed prior to back-filling with competent material for geotechnical purposes.

Once constructed, the potential for stormwater infiltration through the 1 m thick engineered fill crust, to be able to reach the marginally impacted pockets within the compacted cleanfill, is considered to be low under normal Central Otago climate conditions.

IE has undertaken a soakage test to estimate the rate of infiltration through a test layer of compacted crushed pea gravel that will form the engineered fill crust / encapsulation layer over the cleanfill. The results confirmed that stormwater infiltration is limited by the generally low hydraulic conductivity of the crust, which is assessed as ranging between 4 x 10^{-6} m/s and 5.5 x 10^{-6} m/s. Infiltration through the crust would require sustained moderate intensity rainfall for periods up to 20 hours (typically). Such rainfall events are rare at the site. Additionally, the fill within the containment cell is also to be compacted. While it was not possible to perform soakage testing on a representative sample of this material, the compaction is expected to reduce the hydraulic conductivity, further limiting the transmission of water through the fill.

If a significant rainfall event does occur, the generation of leachate from the small pockets of marginally impacted of soil within the compacted cleanfill layer is likely to be minimal even without the 1 m layer of engineered fill crust, due to the fact that contaminant concentrations are expected to be at, or below, background in the majority of the compacted cleanfill layer[2].

Off site disposal will be reserved for the most significantly contaminated material, due to the unsustainability of disposing of contaminated material at landfills intended for household refuse and industrial waste.

The encapsulation approach does result in minor risks to worker health or the wider environment, but only during the earthworks phase. Therefore, implementation of the approach should be under a remediation action plan (RAP) and environmental management plan (EMP) detailing the health and safety, environmental and regulatory considerations.

5 Remediation Methodology

5.1 Introduction

IE has developed the following methodology to complete the remediation of the impacts identified by e3[1].

5.2 Description of Remedial Works

The extent of the proposed remedial work is limited to the areas highlighted in Figure 2.

The remedial works will be undertaken in the following order:

- A site meeting will be held with the individuals responsible for physical works, to ensure that the methodology and requirements of this RAP have been communicated and understood;
- Physical works will be completed by the designated remediation contractor and periodically observed by IE staff;

The potential risks associated with the chosen remedial method to be employed at this site are considered negligible. However, to ensure that there are no adverse environmental effects beyond the immediate vicinity of the remediation areas, the earthwork activities shall be undertaken in

accordance with the protocols outlined in this RAP, as well as under a robust EMP to ensure stormwater, sediment and dust are controlled to the maximum possible extents.

Potential risks associated with contaminants identified on site relate to dermal contact, ingestion and inhalation of soil particles (dust). These risks will be kept to a minimum through the use of controlling site access, dust mitigation measures, and the control of stormwater. Information relating to minimising such risks is outlined in Section 6.0.

This RAP should not be used as a standalone document but should supplement the earthwork operators own health and safety protocols for their employees and contractors.

While some tasks may overlap during the remediation, the following outline indicates the proposed sequencing of works:

- Site establishment and kick-off meeting;
- Excavation and stockpiling of impacted material from the areas identified by e3[1];
- Confirmation of the significance of contamination impacts in material from the asphalt plant, fuel storage locations and former orchard area through laboratory testing;
- Screening of the cleanfill material to remove large inclusions, for geotechnical purposes;
- Placement and compaction of the cleanfill, and marginally impacted material from other parts of the site, beneath the stormwater corridor in the central portion of The Project and beneath residential properties in the north eastern corner of The Project;
- Capping the cleanfill material with at least 1 m of engineered fill generated by crushing pea gravel;
- Off-site disposal of the significantly impacted material (if any) from other parts of the site; and
- Production of a Works Completion Report, to summarise the remediation activities undertaken for each area identified by e3[1].

These works are described in further detail in the following sections.

5.3 Site Establishment

5.3.1 Procedures

Prior to the remedial works commencing at the site, the remediation supervisor will outline all relevant Health and Safety requirements to personnel working on site during the remediation works. Such requirements will be documented within a detailed Health and Safety Plan (HASP) which will be kept in the site file. In general, the following procedures will be adhered to, to ensure that the health and safety, and environmental measures are achieved:

- Personal safety equipment and procedures associated with the contaminants will be explained to the individuals responsible for physical works;
- The identification and marking out of the proposed remediation areas by the remediation supervisor prior to commencement of the remediation program. ‘Clean’ and ‘dirty’ areas will be identified.

5.3.2 Site Supervision

To provide control and validation of the proposed remedial works it is recommended that a designated, suitably trained site supervisor is present to oversee the works on a part-time basis. The site supervisor would address field changes as necessary should unanticipated conditions arise.

Prior to earthworks activities commencing, all employees and contractors associated with the remedial work shall also be briefed by the individuals responsible for physical works with respect to any potential hazards on the site relevant to their role.

5.3.3 Health and Safety

This RAP identifies potential hazards associated with the presence of contaminants in site soils and recommends procedures to mitigate these risks. Risks associated with elevated concentrations of petroleum hydrocarbons, heavy metals and persistent pesticides relate to dermal contact, ingestion and to inhalation of impacted soil particles during earthwork activities.

Prior to the commencement of the remediation works a HASP will be prepared for the proposed activities. All site personnel will be required to review this document. At the start of each day, a brief "tool box" meeting shall be held to review the HASP and the proposed work for the day, discuss potential perceived health and safety risks as well as environmental management procedures and communicate these issues to the remediation team.

To prevent the unintended transfer of any contamination off site, or to other areas within site boundaries, and to minimise exposure to site remediation workers the following risk mitigation measures will be followed:

- To minimise exposure to airborne dust, the excavator and truck driver shall keep cab windows closed and use air conditioning when excavating and loading soil during remediation earthworks;
- Contractors working outside shall wear a half face disposable mask or filter type particulate respirator, if dust is generated during completion of remedial works; and
- Eating, drinking, smoking, use of mobile phones and applying cosmetics / sunscreen should only occur outside of the remediation areas and after face and hands have been thoroughly washed with potable water.

5.4 Validation of Works

The extents of the encapsulation / containment cells will be professionally surveyed as part of the site development works. The relative levels and extents of the base, sides and top of the compacted layer of cleanfill material will be recorded. Furthermore, the survey data for the finished ground level above the encapsulated material will be recorded to confirm the thickness of the engineered fill crust.

5.4.1 Selection of Remedial Goals

The remedial goals are proposed to make the site suitable for residential use[4].

Given the fact that marginally impacted material will be encapsulated deep below the finished site surface, no laboratory testing of that material is considered necessary. Instead, periodic XRF scans will be undertaken to assess whether any heavy metals are present at concentrations that could be considered significant.

Furthermore, laboratory testing of material from areas used for asphalt production or fuel storage will be undertaken to quantify the significance of the impacts (if present).

For this site, significant contamination impacts are conservatively set at twice the applicable criteria for the protection of human health (such as SCSs, or equivalent) on residential land.

If any contaminants are identified to be present at concentrations exceeding the remedial goals, the material will be diverted away from the containment cells and will be disposed of off-site at an appropriately licensed facility.

5.4.2 Validation Methodology

IE will supervise the excavation and off-site disposal of material from significantly contaminated areas, where impacts are visually obvious, such as the areas covered with a bituminous product near to the asphalt plant and south east of the cleanfill stockpile.

Material surrounding the obviously contaminated areas, where petroleum hydrocarbons are present, will be screened on site using a photoionization detector (PID). If the vapour concentration exceeds 100 ppm, samples will be collected for laboratory analysis to confirm whether the material is suitable to be retained on site within the containment cells, or whether off-site disposal is required. If the vapour concentrations are below 100 ppm, no further excavation will be undertaken unless required for geotechnical purposes. Any excess spoil from those areas, with vapour concentrations below 100 ppm, will be placed into the containment cells prior to the cells being capped with clean material.

Validation samples will be collected from the residual material where impacts associated with engine oil stains and treated timber storage have been remediated.

If any material is required to be excavated from the former orchard area, it will be placed and compacted into the containment cells. Samples will be collected from the soil remaining in the former orchard area, after excavation works have been completed, for laboratory testing of persistent pesticide concentrations. If pesticides are found at concentrations above the laboratory limits of detection, additional excavation will be undertaken until the remaining soil does not contain detectable concentrations of persistent pesticides.

5.5 Timescales

It is expected that site development earthworks could continue for up to 10 years.

IE understands that the site development will be undertaken in a staged approach, with the north eastern portion of the site being developed last of all. That provides abundant time to ensure that the remediation works are completed well before bulk earthworks commence in that part of the site.

The remedial works are expected to take up to two years, for the excavation, screening, placement and compaction of the cleanfill stockpile. Remediation of the remaining areas could be completed within 3 months at any time during the site development process.

A Works Completion Report will be presented to CODC within three months following completion of all remediation earthworks.

5.6 Post Remediation

Other than areas of currently unknown sources of contamination, surface soil remaining at the site will not exceed criteria designed to be protective of human health during normal residential use.

It is not expected that disturbance of the compacted cleanfill material within the containment cells would be required in the future. However, if excavation depths reach that material it is conservatively recommended that a Contaminated Site Management Plan be prepared to control those works.

6 Assessment of Environmental Effects

6.1 Introduction

This section of the RAP details the potential environmental effects that could occur from conducting the remediation outlined previously. Table 3 summarises the potential effects associated with the proposed remedial works and the management measures that are recommended to mitigate these.

Table 3: Potential effects of remediation works and proposed mitigation measures.

Potential Effects	Receptor	Mitigation Measures
The potential for dust generation is high during the stockpiling and placement of soil on site.	Site workers and members of the public on neighbouring properties are the primary receptors.	When wind speed is high enough to cause visible dust, the site surface and excavations will be dampened to suppress dust generation. Stockpiles of soil will be covered or stabilised with dust suppressant spray, as necessary.
Excavator and truck noise will be generated during the remedial activities.	None, because surrounding residential properties are located over 800 m from the activities.	All work will be conducted during regular daytime business hours.
Contaminated surface water, stormwater and sediment discharge from site during rainfall events.	Neighbouring properties and Lake Dunstan / *Te Wairere*.	All works will be completed under a robust EMP to ensure that surface water, stormwater and sediment are controlled appropriately.
Exposure to impacted materials (direct contact with contaminated soil).	Site personnel.	Control site access, no public access to be allowed. Instruction on site rules and site induction to site workers. Appropriate dust suppression. Good hygiene practices (hand washing, no smoking). Use of appropriate PPE. Suitable decontamination procedures.

6.2 Dust Control

The inhalation of contaminated dust on site during earthworks is considered to be a hazard to earthwork contractors and staff present within the site.

The following activities may generate dust during the remedial works:

- Excavation of contaminated material.
- Placement of fill onto the containment cells.

It is recommended that the following control methods are implemented to ensure that dust levels generated by earthwork activities are kept to a minimum:

- Any material temporarily stockpiled should be covered as soon as possible.
- Avoid working or standing in areas down-wind of earthwork activities.
- Limit drop heights from excavator buckets.
- Keep windows / doors on excavators and trucks closed when parked in the earthworks area.
- Apply water by a cart or sprinkler prior to commencement of works. The site shall be regularly damped down to reduce any airborne dust. This should prevent visible dust emissions beyond the site boundary.

Weather reports will be checked at the beginning of each day and if high wind speeds are expected the above mitigation measures will be prepared. When wind speed exceeds such a level that dust is noted to be airborne, operations shall cease. The site health and safety officer or site foreman will be responsible for ensuring that the dust mitigation measures are implemented when necessary.

Site practices to reduce worker exposure to contaminated dust should also include the designation of exclusion zones, such as the excavation area(s), where the provision and use of particulate dust masks is required. Such controls should be outlined within the contractors HASP.

6.3 Noise

The following protocols will be employed to ensure that noise levels are kept to acceptable standards:

- Earthwork activities will be restricted to the hours of 7:00 am to 6:00 pm Monday to Friday and 7:30 am to 5:30 on Saturdays. No work shall be permitted on Sundays or Public Holidays.
- These remedial works will be required to comply with the New Zealand Standard NZS 6803: 1999 “Acoustics – Construction Noise”[11].

6.4 Stormwater Control

Where applicable, the site surface will be graded to divert stormwater away from site boundaries.

Any temporary stockpiled soil will not be placed adjacent to drainage areas and will not contain contaminated soils. Runoff from the stockpiles will be mitigated by covering stockpiles with tarpaulins, or other sediment management methods specified in the EMP.

6.5 Site Access

The remediation contractor will use appropriate means to ensure that members of the public are not able to enter the site during completion of remedial works. This may be through the use of fences, barrier tape, signs and / or personal observation and communication.

6.6 Decontamination

No decontamination of equipment is expected to be required upon completion of the remedial works within the containment cells.

Decontamination of equipment used to excavate petroleum hydrocarbon-impacted soil will be undertaken by rinsing excavator buckets with water in a way that the wash water is contained within the bed of the truck used to dispose of the material off-site.

If bitumen remains attached to the excavator bucket(s) or truck bed(s), those parts of the machines will be scrubbed using degreaser to dissolve the bitumen. The waste liquid will then be placed into the next load of contaminated material being disposed of off-site. Liquid from the final rise will be collected in an appropriate receptacle for off-site disposal, such as an empty 44 gallon drum that can be sealed for transport.

6.7 Unforeseen Conditions / Circumstances

Other potentially hazardous conditions which have not been identified may exist at the site, including discovery of additional contamination during remedial works. In the event of any unforeseen circumstances the remediation supervisor should be consulted. Assessment of the contamination will be determined using the remediation supervisors judgement and knowledge of industry best practise.

7 Reporting

At the completion of the remediation and validation works a Works Completion Report will be prepared outlining the remediation works undertaken and presenting the laboratory results of the soils tested during the remedial works.

8 Statutory considerations

8.1 Introduction

The Resource Management Act 1991 (RMA), and associated statutory planning documents, establish the framework for the management of all activities that utilise New Zealand's natural and physical resources. The remediation of the site is assessed against the requirements of these documents in the following sections of the RAP.

In relation to the proposed remediation, the relevant statutory documents are:

- Resource Management Act 1991 (RMA)[12].
- Central Otago District Plan and the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES-CS)[3].
- Regional Policy Statement for Otago 1998 (RPS)[13].
- Regional Plan: Waste for Otago 2022 (Waste Plan)[14].

Part 2 of the RMA outlines the purpose and principles of the RMA. Section 5 states:

> *"(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.*
>
> *(2) In this Act, "sustainable management" means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while –*
>
> *(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
>
> *(b) Safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
>
> *(c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment."*

The proposed remediation of the site is intended to ensure that the site can be used for residential purposes. The ability to use the land resource safely, into the future, means that people and communities can provide for their social, economic and cultural well-being. In relation to the land, water and air resources of the area, the proposed remediation approach will ensure that, except for a relatively small volume of soil impacted with petroleum hydrocarbons, valuable landfill space (land) will not be taken up by impacted material, the generation of dust and sediment discharge will be managed to minimise or eliminate the potential adverse effects on air and surrounding land / water.

Section 6 sets out the matters of national importance which shall be recognised and provided for while Section 7 identifies matters for which regard shall be had under the RMA. There are no section 6 matters which are considered to be of relevance to this proposal. However, the following section 7 matters are considered to be relevant:

"(b) the efficient use and development of natural and physical resources:

(c) the maintenance and enhancement of amenity values:

(f) maintenance and enhancement of the quality of the environment"

The proposed remediation method, as detailed in this RAP, will enable the efficient use of the land into the future, in so doing achieving the intent of Section 7(b)).

In addition, the management measures incorporated into the proposed remediation approach will ensure that the land, air and water resources of the area will not be adversely affected during the remediation process and into the future. This ensures that the quality of the surrounding environment is enhanced (section 7(f)), which in turn provides for enhancement of amenity values in the area (section 7(c)).

Section 8 of the RMA requires specific regard to be had to the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).

Lake Dunstan / Te Wairere is of significant cultural importance to mana whenua. Lake Dunstan / Te Wairere is a Statutory Acknowledgement Area and formally recognises the deep cultural, spiritual, historical, and traditional association of Ngāi Tahu with the lake and surrounding section of the Clutha River.

Given the above assessment, the proposed remediation approach, as outlined in this RAP, will promote the sustainable management of natural and physical resources and is therefore consistent with Part 2 of the RMA.

8.2 Central Otago District Plan and the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health

Land contamination is dealt with under the Central Otago District Plan through the implementation of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES-CS). All local territorial authorities (district and city councils) are required to give effect to and enforce the requirements of the NES-CS.

The NES-CS[4] came into effect on 1 January 2012. The objective of the NES-CS is to ensure that land affected by contaminants in soil is appropriately identified and assessed at the time of being developed and if necessary remediated, or the contaminants contained, to make the land safe for human use.

Regulation 5 sets outs the land and the activities to which the NES-CS applies. The NES-CS applies if it is on land described under Regulation 5(7), and if the activity proposed is described in any of subclauses (2) to (6) of Regulation 5.

Regulation 5(7), applies to any land on which an activity or industry described in the current edition of the Hazardous Activities and Industries List (HAIL) is being undertaken, is suspected to have been, or has been undertaken. Activities undertaken at the site are included on the HAIL (refer to the site investigation reports[1, 2]). Therefore, Regulation 5(7) applies.

The activities described in subclauses (2) to (6) of Regulation 5 include subdivision, land-use change, significant earthworks, soil sampling or removing fuel storage systems. The remedial approach involves disturbing the soil of the piece of land for a particular purpose, therefore the NES-CS applies to this activity.

The proposed remediation of the site does not meet the requirements of Regulation 8(3) and the remedial work can therefore not be undertaken as a Permitted Activity. The activity is not Controlled, being that it does not meet Regulations 9(1)(b) and 9(3)(b). As a result, the activity would, under normal circumstances, require consent under the NES-CS for a restricted discretionary activity pursuant to Regulations 10(1) and 10(2). However, given the fact that certain areas of contamination impact cannot be assessed while the site is operational, the activity would need to be undertaken as a Discretionary Activity pursuant to Regulation 11.

8.3 Regional Policy Statement for Otago

8.3.1 Overview

The RPS[13] became operative on 1 October 1998. Since becoming operative changes were notified in May 2015 and a decision was made in October 2016. Changes to the RPS went through an appeals process and a partially operative RPS was issued in 2019, including the changes resulting from the appeals process.

The RPS 1998 is now deemed to be only partially operative and the provisions of Chapter 13 – Wastes and Hazardous Substances in this version of the document have been fully revoked. Accordingly, for the purposes of this assessment, it is the provisions of the Partially Operative RPS 2019 in Part B Chapter 4, that address contaminated land that are relevant to the consideration of this proposal.

The RPS provides an overview of the resource management issues within the Otago region. It then developments a policy framework (i.e., objectives and policies), and associated methods for delivering on that policy, aimed at achieving integrated management of the region's natural and physical resources. Regional Plans, including the Waste Plan, and district plans cannot be inconsistent with the RPS.

8.3.2 Assessment of Relevant Objectives and Policies

Part B Chapter 4 of the Partially Operative RPS addresses issues, and develops an associated policy framework, in relation to 'hazardous substances, contaminated land and waste materials'. This includes contaminated sites. Therefore, the policy framework of relevance to the proposed remediation, as outlined in Section 13 of the RPS, is:

- *To minimise the risks, to people and the environment, arising from existing contaminated sites (Objective 13.4.4).*
- *To address the adverse effects from past waste disposal, including identified contaminated sites, by remedying and mitigating any adverse effects arising from such sites (Policy 13.5.7).*

The proposed remediation approach, as outlined in this RAP, has been developed to minimise the future risks to people and the environment. This is to be achieved by encapsulating and capping the contaminated soil within portions the property that are unlikely to be disturbed in the future. In so doing, the removal of the majority of impacted fill from the site is eliminated. On this basis, the proposed remediation approach is consistent with the relevant policy framework of the Partially Operative RPS.

8.4 Regional Plan: Waste for Otago

8.4.1 Overview

The Waste Plan[14] became operative on 9 July 2022.

The Waste Plan seeks to provide for the integrated management of waste (solid, liquid and gaseous) through the implementation of a waste strategy which addresses all stages of the waste life cycle.

Chapter 4 of the Waste Plan covers Waste Minimisation to enable the most efficient use of resources and energy.

Chapter 5 of the Waste Plan covers Contaminated Sites, and includes the discharge of hazardous substances or wastes onto or into land or water, and the issues associated with remedying or mitigating the adverse effects of those contaminant discharges. Therefore, Chapter 5 is of relevance to the proposed remediation of the site.

Chapter 7 of the Waste Plan covers Landfills, which includes the disposal of solid wastes onto or into land. As the remediation method eliminates the requirement to dispose of impacted material at a landfill, Chapter 7 is also of relevance to the proposed remediation.

8.4.2 Assessment of Relevant Objectives and Policies

The policy framework within Chapters 4 and 5 of relevance are:

- *To encourage, support and facilitate integrated waste management by minimising the effects on the environment by reducing the quantity and / or toxicity of material entering the waste stream; reusing materials, recycling materials, where practicable, that cannot be reused; recovering resources from materials in the waste stream and disposing of the residual waste in an environmentally safe manner (Objective 4.4.2).*
- *To avoid, remedy or mitigate any adverse effects of contaminated sites (Objective 5.3.1).*
- *To avoid further site contamination. (Objective 5.3.2).*
- *To contain and remediate contaminated sites, to the extent that is practicable, and having regard to the land's future use (Policy 5.4.3).*
- *To apply the Australia and New Zealand Conservation Council's "Guidelines for the Assessment and Management of Contaminated Sites" (January 1992) to determine, for a particular contaminated site, the most appropriate course of action (Policy 5.4.4).*

The proposed remediation of the site has been designed utilising the current relevant guidelines (i.e., guidelines that have superseded those specified in Policy 5.4.4 above), to ensure that the land can be utilised in a manner consistent with its proposed future use (i.e. residential land use). This means that the adverse effects of contamination at site will be avoided, remedied and mitigated as a result of the proposed remediation.

Given the above assessment, the proposed remediation approach is consistent with objectives 4.4.2, 5.3.1, 5.3.2 and policies 5.4.3 and 5.4.4 of the Waste Plan.

The policy framework within Chapter 7 – Landfills, is mostly relevant to typical landfills, and not the proposed remediation activity. However Objective 7.3.1 (*to avoid, remedy or mitigate the adverse environmental effects arising from the discharge of contaminants at and from landfills*) is of relevance to the remediation method, as disposal of the vast majority of impacted material is actively avoided by the on-site containment and encapsulation strategy. The potential negative effects that could occur, if impacted spoil was disposed of at a landfill, are therefore eliminated to the maximum practicable extent.

8.4.3 Assessment of rule applicability

The Waste Plan contains only one rule (Rule 5.6.1) covering activities in and around contaminated land as follows:

> *"5.6.1 Hazardous wastes at contaminated sites (discretionary activity).*
>
> 1. *The disturbance of land; or*
> 2. *The discharge of hazardous waste into water; or*
> 3. *The discharge of hazardous waste onto or into land in circumstances that may result in that hazardous waste (or any other hazardous waste emanating as a result of natural processes from that hazardous waste) entering water; or*
> 4. *The deposit of any hazardous waste, in , on or under land; or*
> 5. *The discharge of hazardous waste into air at or from a contaminated site;*
>
> *is a discretionary activity."*

The excavation, containment and encapsulation of the cleanfill stockpile and other marginally impacted soil requires the disturbance of land and a discharge of hazardous waste to land (within the containment / encapsulation area). As such, resource consent would be required for the proposed remediation pursuant to Rule 5.6.1.

The rules covering the discharges of waste onto or into land are contained in Section 7.6 of the Waste Plan and these will be applicable to the operator of the receptor site where some waste will be disposed of.

8.5 Summary of Statutory Considerations

Remediation of the site by excavation and on-site capping of marginally impacted soils, as well as off-site disposal of more significantly impacted soil, as outlined in this RAP, is consistent with the requirements of Part 2 of the RMA[12] and the policy framework of the relevant statutory plans (i.e., the RPS[13], the Waste Plan[14]).

Resource Consent is required from the ORC, according to Rule 5.6.1., as the remediation method results in a disturbance of land containing hazardous waste at a contaminated site[13]. Resource Consent is also required from CODC, under NES-CS Regulation 8(3)[4], to disturb soil on a site where hazardous activities or industries have occurred.

9 References

1. e3scientific Limited 2021: Parkburn Quarry Preliminary Site Investigation. Report reference #21085

2. Insight Engineering 2026: Preliminary and Detailed Environmental Investigation at 922 Luggate-Cromwell Road (SH6), Cromwell. Report reference 24019_3
3. Ministry for the Environment 2011: Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites in New Zealand.
4. Ministry for the Environment 2012: Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.
5. GNS Webmap Institute of Geological and Nuclear Sciences 2013: 1:250,000 Geology. Viewed at: http://data.gns.cri.nz/geology/
6. Otago Regional Council 2025: Otago Regional Council Resource Consent Database. Viewed at: https://maps.orc.govt.nz/OtagoMaps/
7. The New Zealand Institute for Bioeconomy Limited 2025: Determination and use of background concentrations of trace elements in soil in Otago and Southland.
8. US Environmental Protection Agency 1997: Recent Developments for In Situ Treatment of Metal Contaminated Soils. USEPA Contract Number: 68-W5-0055.
9. US Environmental Protection Agency 2009: Technology Performance Review: Selecting and Using Solidification / Stabilization Treatment for Site Remediation.
10. Contaminated Land: Applications in Real Environments 2007: Understanding Soil Washing, Technical bulletin TB13.
11. Standards New Zealand 1999: NZS 6803:1999 Acoustics – Construction Noise.
12. Ministry for the Environment 1991: Resource Management Act.
13. Otago Regional Council 1998: Regional Policy Statement for Otago.
14. Otago Regional Council 2022: Regional Plan: Waste for Otago.

10 Limitations

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

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

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

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

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

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on [redacted] if you require any further information. The author is a Certified Environmental Practitioners (CEnvP) under the Environment Institute of Australia and New Zealand (EIANZ) accreditation system.

Prepared by





Claude Midgley, CEnvP
Principal Environmental Scientist

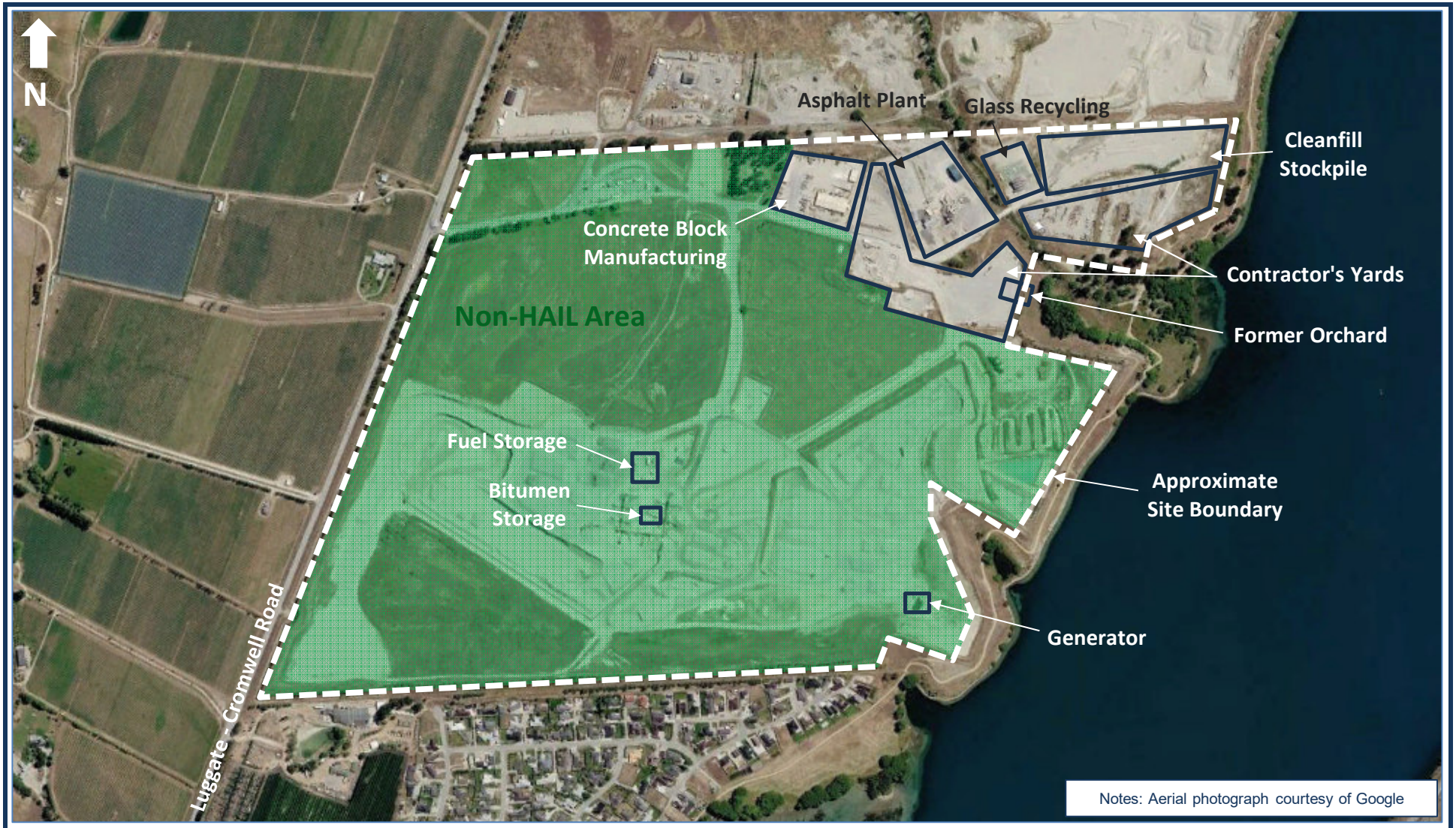
Appendix 1

Figures





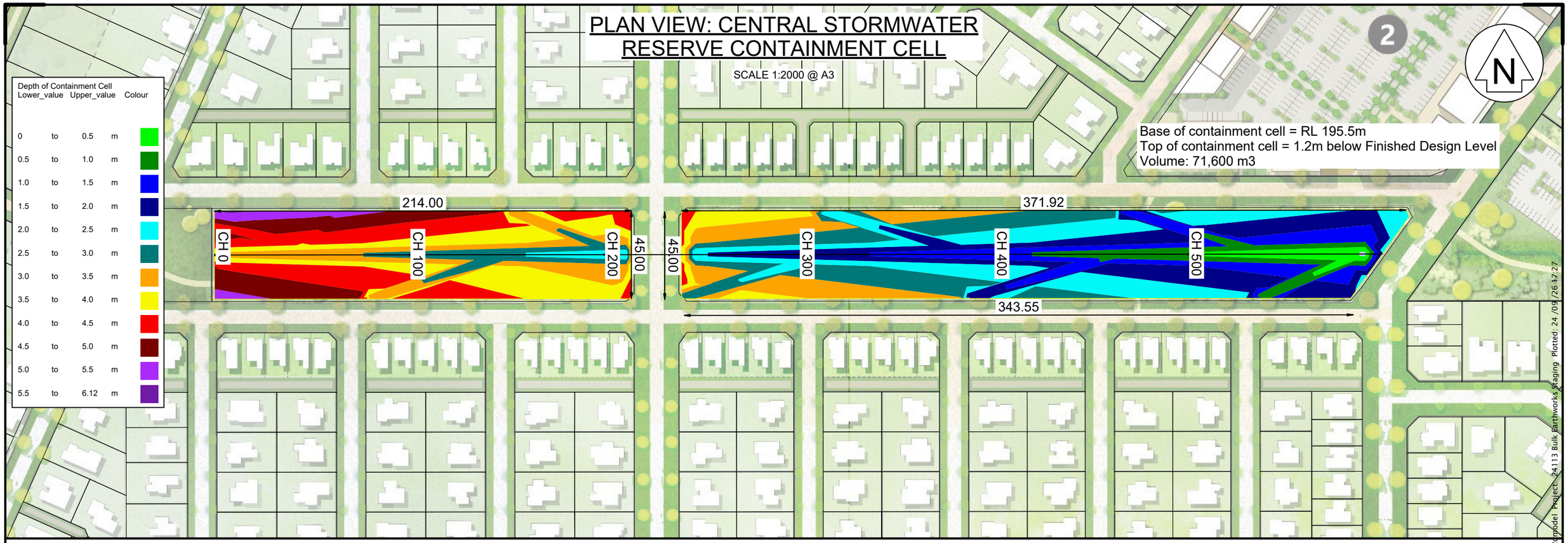
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Client	Fulton Hogan Land Development Limited c/- Tim James Limited	**Drawn by**	CM
Project Number	24019_RAP	**Approved by**	JK

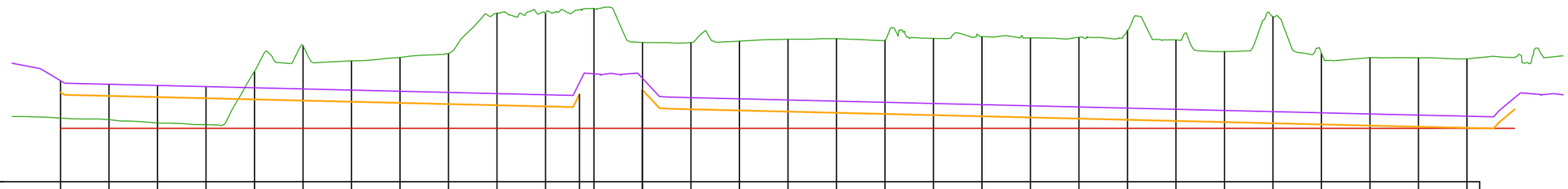


Description	Areas Potentially Requiring Remedation	**Figure Number**	2
Project	Remediation Action Plan for the Parkburn Quarry at 922 Luggate-Cromwell Road (SH6), Cromwell	**Date**	Sept-26
Client	Fulton Hogan Land Development Limited c/- Tim James Limited	**Drawn by**	CM
Project Number	24019_RAP	**Approved by**	JK

PLAN VIEW: CENTRAL STORMWATER RESERVE CONTAINMENT CELL

SCALE 1:2000 @ A3





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NATURAL GROUND SURFACE LEVEL	196.56	196.39	196.04	195.88	201.36	204.00	202.45	202.80	203.20	207.36	207.36	207.84	204.35	204.35	204.48	204.68	204.74	204.59	204.77	204.95	204.82	204.87	205.61	204.61	203.41	207.01	203.25	202.78	202.76	202.65	
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A3 SCALE: H 1:2000, V 1:500

LONGITUDINAL SECTION: CENTRAL STORMWATER RESERVE CONTAINMENT CELL

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CONTAINMENT CELL DETAIL - SHEET 1 OF 2

PARKBURN DEVELOPMENT PROJECT

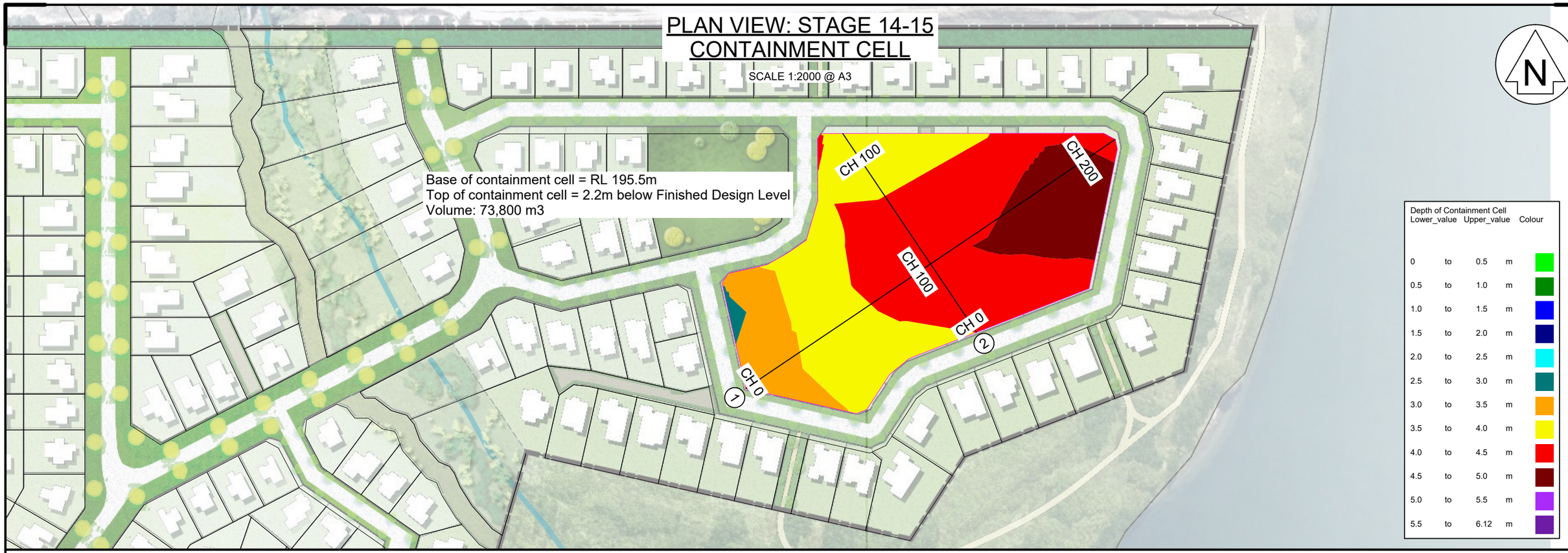
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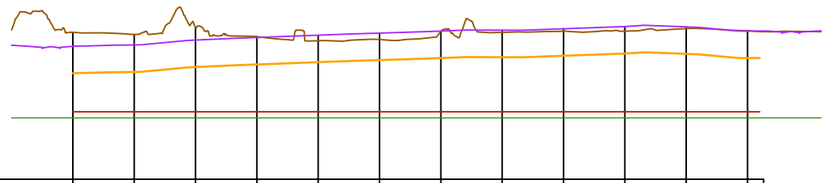
Rev.	Date	Revision Details	By

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Drawn: KA	Date: 09 2026	Scale: AS SHOWN	
Checked: NKA	Date: 09 2026	Datum & Level: LP2000 & NZVD16	Rev.: -

PLAN VIEW: STAGE 14-15 CONTAINMENT CELL

SCALE 1:2000 @ A3



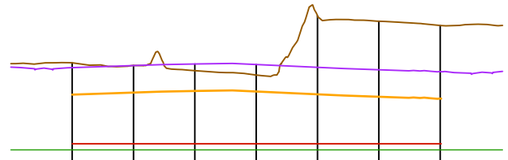


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DESIGN FINISHED SURFACE LEVEL	200.84	200.94	201.34	201.55	201.74	201.91	202.07	202.15	202.26	202.44	202.42	202.07	
NATURAL GROUND SURFACE LEVEL	195.00	195.00	195.00	195.00	195.00	195.00	195.00	195.00	195.00	195.00	195.00	195.00	
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A3 SCALE: H 1:2000, V 1:500

LONGITUDINAL SECTION 1: STAGE 14-15 CONTAINMENT CELL



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NATURAL GROUND SURFACE LEVEL	195.00	195.00	195.00	195.00	195.00	195.00	195.00
QUARRY MATERIAL SURFACE LEVEL	202.10	201.88	201.46	201.10	205.93	205.49	205.14
CHAINAGE	0	20	40	60	80	100	120

A3 SCALE: H 1:2000, V 1:500

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CONTAINMENT CELL DETAIL - SHEET 2 OF 2

PARKBURN DEVELOPMENT PROJECT

922 LUGGATE - CROMWELL ROAD

Rev.	Date	Revision Details	By

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Checked: NKA	Date: 09 2026	Datum & Level: LP2000 & NZVD16	Rev.: -

Appendix 2

Insight Engineering Preliminary and Detailed Site Investigation Report

Preliminary and Detailed Environmental Investigation at 922 Luggate-Cromwell Road (SH6), Cromwell

Prepared for:	Fulton Hogan Land Development
Date:	23/10/2026
Our Reference Number:	24019_3
Report prepared by:	Claude Midgley CEnvP, MSc.
Authorised by:	Jana Kruyshaar CMEngNZ, CPEng

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Melanie Foote (Town Planning Group	16/07/2026	Updated Final	1 (electronic)
Melanie Foote (Town Planning Group	24/09/2026	Updated Final	1 (electronic)
Melanie Foote (Town Planning Group	23/10/2026	Updated Final	1 (electronic)

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1 Introduction and Scope of Report

This assessment is an updated version to that which was lodged as part of the original Parkburn Substantive Application lodged 4 August 2026. It takes into account the revised scheme plan and incorporates peer review comments received from Local Authority expert/s to date along with a response to the peer review matters (Appendix 1).

JKCM Ltd, trading as Insight Engineering (IE), was requested to undertake a preliminary and detailed environmental site investigation (PSI and DSI) at the northern portion of 922 Luggate-Cromwell Road, Cromwell (herein referred to as 'the site'). IE understands that the report will form part of an application for subdivision and use of the land for urban development via the Fast Track Approvals Act 2024 process.

The Parkburn Development Project (herein referred to as 'the Project') involves the staged subdivision (Appendix 2) and development of land at 922 Luggate-Cromwell Road (State Highway 6), Cromwell, located approximately 8 kilometres north of the Cromwell township and adjoining Lake Dunstan / *Te Wairere*.

The property includes part of the existing Parkburn Quarry. The Project provides for the establishment of a mixed-use urban development, including quarry rehabilitation, residential development, supporting commercial and community activities, open space, and associated infrastructure. Works are also proposed within the State Highway 6 (SH6) road reserve.

Figure 1 (Appendix 3) indicates the location of the Project and the relevant portion of that property that was investigated as part of this report (herein referred to as 'the site').

Private Plan Change 21, approved in 2025, provides for future residential development over the majority of the Project. As part of that rezoning, the land in the northern portion of the Project (the site) was zoned for industrial land use. The proposed subdivision and development plans have since evolved and it is now proposed to undertake residential development at the site.

The purpose of this investigation was to assess the suitability of the site for residential subdivision, development and use, from the perspective of the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*) Regulations[1] (herein referred to as the NES-CS). This investigation was undertaken in general accordance with the Ministry for the Environment (MfE) *Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand* [2].

Potential risks to ecological receptors were assessed according to the criteria provided in the *Determination and use of background concentrations of trace elements in soil in Otago and Southland*[3].

2 Objectives of the Investigation

The objective was to determine if potentially contaminating historical activities pose an unacceptable risks to human health, or the health of ecological and environmental receptors, during and post site development.

2.1 Approach

IE completed the following scope of work to satisfy the investigation objectives:

2.1.1 Review of Site Information

Several sources were contacted for information relating to the past and present uses of the site and to identify any other environmental issues which may be on record. This consisted of:

- Review an existing PSI report[4] prepared by e3scientific as part of the 2022 Private Plan Change application, which was approved in 2025;
- Undertaking a site walkover to describe current site conditions and assess whether any visual or olfactory evidence of contamination is present;
- Review of publicly available data describing the local geology and hydrogeology;
- Review of the Otago Regional Council Selected Land Use Sites (SLUS) database to identify property specific records of hazardous activities or industries at the site and in the surrounding area;
- Reviewing the CODC NES Records Search statement to determine whether any records of contamination at the site are held in their database; and
- Reviewing publicly available historical aerial photographs and maps of the site and surrounding area.

2.1.2 Intrusive Investigation

The following scope of work was undertaken upon completion of the review of site information:

- Collect 8 soil samples from 8 locations within the cleanfill stockpile area;
- Visual and olfactory inspection of soil samples in the field;
- Submit 8 soil samples to Hill Labs for analysis of either a suite of common heavy metals (As, Cd, Cr, Cu, Pu, Ni and Zn) or a suite of common heavy metals and mercury;
- Collect 26 additional soil samples from 26 locations within the cleanfill stockpile area;
- Visual and olfactory inspection of soil samples in the field;
- Submit 26 soil samples to Hill Labs for analysis of a suite of common heavy metals (As, Cd, Cr, Cu, Pu, Ni and Zn) and asbestos presence / absence;
- Assess laboratory results for the soil samples against the adopted human health criteria for residential land use, as well as commercial / industrial land use, which serves as surrogate values for land development / excavation activities / future maintenance of underground services;
- Assess laboratory results for the soil samples against the expected naturally occurring concentrations, as well as the adopted ecological health criteria for residential land use; and
- Present a combined PSI and DSI report outlining the suitability of the site for land development earthworks and ongoing maintenance of underground services, as well as the post-development residential land use.

Site information is summarised in Table 1.

Table 1: Site Information

Location	922 Luggate-Cromwell Road (SH6), Cromwell
Legal Description	PT Secs 62 and 63 BLK IV WAKEFIELD SD and Sec 1 SO 365897

Table 1 (cont.): Site Information

Property Ownership	Fulton Hogan Limited
Current Site Use	Parts of the site are used for administration (offices), a concrete plant, an asphalt plant, a glass recycling area, equipment storage areas and a large stockpile of imported cleanfill. The remainder of the site is not used.
Proposed Site Use	Residential
Site Area	Approximately 24.280 ha (242,800 m²) refer to Appendix 3
Territorial Authorities	Central Otago District Council (CODC) Otago Regional Council (ORC)
Zoning	Industrial Area

3 Site Description

The site is located on the western side of Lake Dunstan / *Te Wairere* and is approximately 8 km north of Cromwell. Lake Dunstan / Te Wairere is of significant cultural importance to mana whenua. Lake Dunstan / Te Wairere is a Statutory Acknowledgement Area and formally recognises the deep cultural, spiritual, historical, and traditional association of Ngāi Tahu with the lake and surrounding section of the Clutha River.

The site is bound by horticultural (viticulture) and rural residential land towards the west (beyond SH6) and industrial land (quarry and contractors' yards) to the north. The land south of the site contains areas used for quarrying gravel, which was operational at the time of writing, as well as previously undisturbed, disused land vegetated with turf.

The quarry activities do not currently extend into the site and are limited to areas towards the north and south. However, the quarry areas are accessed by tracks extending through the site and it is understood that quarrying activities were historically undertaken within the site boundaries.

The Park Burn creek (herein referred to as the Park Burn) flows through the site in a roughly NW to SE direction. It discharges into Lake Dustan in the area directly south east of the site.

The site also contains offices for the quarry operators (Fulton Hogan Limited), a concrete plant, an asphalt plant, a glass recycling area, equipment storage areas and a large stockpile of imported cleanfill.

The remainder of the site can be referred to as a "greenfield" areas because no industrial activities have occurred there.

The site setting is summarised in Table 2.

Table 2: Site Setting

Nearest Surface Water & Use	The Park Burn flows through the site in a roughly NNW to SSE direction. It discharges into Lake Dustan in the area directly south east of the site. Lake Dunstan / *Te Wairere* is used as a source of potable water as well as for recreational and irrigation purposes, as well as for electricity generation.
Geology	The GNS New Zealand Geology Webmap[5] indicates that the site contains two geological units:

Table 2 (cont.): Site Setting

Geology (cont.)	The majority of the site is located within Late Pleistocene outwash deposits of Albert Town Advance, described as "*Unweathered to slightly weathered, loose, sandy to silty, well rounded gravel usually on large outwash plains*". The remainder of the site, located near to the northern boundary, is underlain by Holocene fan deposits, broadly described as "*Loose, commonly angular, boulders, gravel, sand, and silt forming alluvial fans; grades into scree (upslope) and valley alluvium*". According to a geotechnical investigation completed by Geotago[6], including test pits excavated in the cleanfill stockpile and the south eastern corner of the site, the cleanfill stockpile consists of uncontrolled fill described as "*Sandy silty GRAVELS with cobbles and occasional extraneous materials (wood, plastic, concrete)*" overlying "*sandy silt with roots, rootlets and decaying plant matter*" over a 1 m thick layer of pea gravel. Material in the south eastern corner of the site was described as topsoil overlying pea gravel. Both test pits were terminated at approximately 2 m below surface, due to the pea gravel causing the sides of the test pits to collapse.
Hydrogeology	Information provided in support of Private Plan Change 21, prepared by e3Scientific[4], confirms that the site is located within the Pisa Groundwater Management Zone. Groundwater flows from the Holocene river deposits, west of the site, through the highly permeable Late Pleistocene river deposits, comprised of sandy gravel or sandy cobbles and gravel, underlying the site. Groundwater ultimately reaches Lake Dunstan / *Te Wairere*, east of the site. ORC data[6] indicates that several water bores are located at and around the site. Groundwater depths in those wells ranged between 10.6 m bgl and 16.47 m bgl.
Groundwater Abstractions [7]	Three groundwater abstraction consents are active at, or within 250 m of the site: • Consent 2010.042.V1 was issued to HWR Property Limited to take and use groundwater from well number G41/0113 located approximately 1.5 km southeast of the intersection of the Luggate−Cromwell Road (State Highway 6) and Smiths' [sic] Way. The Consent was originally issued to Downer New Zealand Limited in April 2010 and was transferred to HWR Property Limited in August 2022. The Consent expires on 31 March 2030. • Consent RM14.064.01 was issued to Number 925 Water Company Limited to take and use ground water for the purpose of irrigation, stock water and domestic supply from a location approximately 2 kilometres north northeast of the intersection of Luggate−Cromwell Road (State Highway 6) and Pisa Moorings Road in May 2014. The Consent was transferred The Consent expires on 12 May 2044. • Consent RM17.106.01 was issued to Skeggs Group Limited to take and use groundwater for the purpose of vineyard irrigation and domestic supply from a location approximately 1965 metres north east of the intersection of the Luggate−Cromwell Road (State Highway 6) and Clark Road. The Consent was originally issued to Akarua Limited in May 2017 and was transferred to Skeggs Group Limited in June 2024. The Consent expires on 15 May 2052.

Table 2 (cont.): Site Setting

Discharge Consents [7]	Three discharge to land consents, and four discharge to air consents are active at, or within 250 m of the site: • Consent 99664 was issued to Fulton Hogan Limited – Alexandra to discharge solid fill to land within an operating gravel quarry beside Lake Dunstan / *Te Wairere* at the location where the Parkburn flows into the Lake for the purpose of backfill at a quarry site. The consent was issued on an unknown date and it expires on 6 November 2026. • Consent 2004.600 was issued to Fulton Hogan Limited – Alexandra to discharge dust to air for the purpose of quarrying, crushing and screening aggregate. The consent was issued on an unknown date and it expires on 31 March 2041. • Consent 2010.043.V1 was issued to HWR Property Limited to discharge water and contaminants to land for the purpose of gravel washing at a location approximately 1.5 km southeast of the intersection of the Luggate−Cromwell Road (State Highway 6) and Smiths' [sic] Way. The Consent was originally issued to Downer New Zealand Limited in April 2010 and was transferred to HWR Property Limited in July 2022 and reissued in August 2022. The Consent expires on 31 March 2030. • Consent RM15.050.01.V1 was issued to Downer New Zealand Limited to discharge contaminants to air for the purpose of an operating an asphalt plant from a location approximately 1.4 km south of the intersection of the Luggate−Cromwell Road (State Highway 6) and Smiths Way in April 2016. The discharge of total suspended particulate matter shall not exceed 50 milligrams per cubic metre of air. The Consent expires on 13 May 2050. • Consent RM15.108.02.V2 was issued to Fulton Hogan Limited to discharge silt, sediment and water to land for the purpose of aggregate washing, processing aggregate, asphalt and concrete, truck washing and dust suppression at the asphalt plant sediment ponds and soakage areas located within the eastern half of the site, as well as south of the south eastern portion of the site, in November 2015. The Consent expires on 13 November 2050. • Consent RM18.376.01.V2 was issued to Fulton Hogan Limited to discharge contaminants to air for the purpose of an operating an asphalt plant from a location approximately 1.6 km south of the intersection of the Luggate−Cromwell Road (State Highway 6) and Smiths Way in March 2019. The discharge of total suspended particulate matter must not exceed 50 milligrams per cubic metre of air and the discharge of arsenic, cadmium, chromium, lead, cobalt, manganese and nickel must not exceed 10 grams per hour (combined). The Consent expires on 6 March 2044. • Consent RM24.364.02 was issued to Southern Transport Company Limited to discharge contaminants to air for the purpose of operating a worm farm at 922A Luggate-Cromwell Road in July 2024. The Consent expires on 31 July 2039.

3.1 Current Site Conditions

Claude Midgley of IE completed a site walkover inspection on 6 November 2025. Observations made at that time are summarised in Table 3 and photographs are presented in Appendix 4.

Table 3: Current Site Conditions

Visible signs of contamination	Bitumen residue, engine oil stains and waste asphalt millings were observed in the eastern half of the site.
Surface water appearance	Water in the Park Burn was clear and free flowing, with no evidence of contamination impacts such as chemical odours, discolouration or hydrocarbon sheen.
Current surrounding land use	Horticultural, rural residential and industrial land surrounds the site.
Local sensitive environments	The Park Burn, Lake Dunstan / *Te Wairere* and the associated riparian zones are considered sensitive environments.
Visible signs of plant stress	No significant signs of plant stress were noted.

3.2 e3scientific Preliminary Site Investigation

e3scientific produced a PSI report[4] that was submitted as part of Private Plan Change 21 in 2022. Their scope of work included assessment of the site and the areas south of the site. The full report is included as Appendix 5, but this summary contains relevant information related only to the land within the current site boundaries.

Site History

Fulton Hogan acquired the lease for the site in December 1985, after Robert and Charles Perriam had leased the land for farming purposes earlier in 1985. Prior to that, the site was leased by several private individuals (unnamed) since Robert Davidson acquired the initial lease in 1894. Fulton Hogan obtained a mining license for the site and surrounding area towards the south by July 1987.

Regional Council information confirmed that an underground petroleum storage system (UPSS), associated with Z Energy, was removed and the removal was reported to ORC in 2015. The contamination investigation associated with the removal of the UPSS confirmed that the residual contamination was acceptable for commercial / industrial land use.

The report about the removal of the UPSS provides information related to the removal of a 10,000L underground kerosene storage tank and a 10,000L underground diesel storage tank, as well as the associated pipework from a single pit where the tanks had been positioned end to end, undertaken in October 2014. The results of laboratory analyses confirmed that residual petroleum hydrocarbon concentrations were below the human health criteria for commercial / industrial land use and for the protection of groundwater quality. A 7 m long section of pipeline and a fuel bowser within a building were not removed as part of the site works at that time. The former tanks were replaced with above-ground fuel storage tanks.

On-Site Observations

e3scientific completed a walkover assessment that included inspection of the general site conditions, including the condition of the buildings and the ground surface across the site. They noted visible signs of contamination such as stains associated with leaks or spills, odours, plant stress, areas of fill or stockpiled material / waste, ground disturbance, former building foundations, incineration areas, chemicals storage and discharges from those areas, as well as the locations of former buildings, processes or activities undertaken on site.

The site was found to contain three separate areas, referred to as the "*weighbridge and offices*", "*industrial area*" and "*cleanfill and yards*".

No evidence of hazardous substance use or storage was found in the "*weighbridge and offices*" area, but the "*industrial area*" was used for asphalt and concrete manufacturing activities. The following excerpts describe the specific findings associated with those activities:

"*The Firth Concrete block manufacturing facility is located on the western end of the industrial area. The gravel yard was generally tidy and well kept. A 10,000 L diesel tank is located to the east of the manufacturing building. An open storage shed is located along the western boundary of this area. A small, waste oil 'igloo' was present to the south of the open shed. There was no staining around the waste oil tanks. Several empty drums of concrete retardant (Sika Retarder) were stored behind (west of) the open shed. Hardfill, consisting of broken concrete tiles and blocks was deposited over the landscape bund, north of the factory.*

East of the Firth Concrete block manufacturing facility, an open yard is used as a parking area by Fulton Hogan Transport. An above ground diesel tank (4) associated with the nearby asphalt plant, was removed from the site in September 2021. Evidence of disturbed ground beneath the removed tank, including some soil on a plastic sheet, was still present. There was no evidence of staining or odour in this area. Underground fuel lines, running to the asphalt plant are reportedly still present.

The asphalt plant itself is located down an embankment to the east of the parking area. The plant is comprised of aggregate feeder bins, bitumen storage tanks, mixing drum, conveyor belt feeding, asphalt storage silos, a bag house and an operations office. The asphalt plant can produce up to 120 tonnes per hour (tph) of asphalt but will typically run at a production rate of approximately 80 tph. Bitumen and kerosene are stored in a bunded above ground tank at the base of the terrace. Bitumen is also stored in a shed near the plant. The ORC resource consent specifies that the plant can be run on used oil; however, to date only diesel fuel has been used.

The Allied Concrete batching plant is located on the opposite side of the main access road from the transport yard. The batching plant appears to be located at the repurposed weighbridge, where diesel fuel storage was noted in plans with several of the building consent applications. Immediately south of the batching plant, there is a gravel yard which was used by a company to produce concrete panels for the construction of the Frankton Marina in 2018. These areas appeared generally tidy.

A truck wash is located on the south side of the main access road. Run-off from the truck wash flows down the site of the access road into an infiltration pond. This is one of the discharge points authorised by ORC consent RM15.108.02. There was no oily sheens or hydrocarbon odour associated with the run-off water or sediment at the truck wash."

The "*cleanfill and yards*" area, located on the eastern side of the Park Burn, was described as a former quarry area that was repurposed for cleanfill disposal and for "*outdoor yards used by JCL Asphalt Limited and several divisions of Fulton Hogan."*

The following excerpts describe the specific findings associated with those activities:

"*A new shed, which will be used for crushing and storage of recycled glass, has been constructed. This building was consented under RC210112. During the site inspection, drainage work was being completed, but storage and crushing of glass had not yet commenced.*

Beyond the new glass processing shed, an excavation is used for disposal of surplus concrete. Further to the east, there are two active (1-2 m high) faces used for cleanfill disposal. A concrete bay just east of the weighbridge at the entrance to the site is used for drop-off of small loads of cleanfill by Fulton Hogan and their sub-contractors. This material is then relocated to the cleanfill face. Visible material was predominantly soil, rock, and gravel, with occasional loads of cured asphalt, and some scattered broken glass across the surface of the cleanfill. A separate area is used for disposal of

hardfill, including concrete, tile, bricks, and cured asphalt, as well as soil, gravel and rock. Disposal of material at the cleanfill is authorised by ORC resource consent 99664.

A Cleanfill Management Plan prepared by Fulton Hogan outlines the procedures required to achieve environmental best practice. Visual inspections of the quality of the fill material coming to the site are completed to ensure the material is consistent with resource consent requirements. If a non-complying load is identified, the cleanfill operator is to isolate the load and advise the Quarry Manager immediately. Signage is in place at the entrance to the cleanfill, providing a clear description of acceptable materials. Material is not to be accepted from any Hazardous Activities and Industries List (HAIL) sites unless it has been suitably analysed.

A partially buried skip is used for temporary storage of waste from high pressure water cutting used during roading maintenance work. The skip is covered and sealed, with waste periodically taken to landfill when full. To the east of the hardfill disposal area, finished areas of the cleanfill have been capped with gravel for use as open yards for other divisions of Fulton Hogan, as well as JCL Asphalt.

At the JCL Asphalt yard, there is a moveable above ground diesel tank located in the corner of the container shelter (1). Some soil staining was also visible. In this area, there were also 4 x 1,000 L IBC of concrete additive (Sika Viscacrete), with some visible product on the ground below the IBCs. The Fulton Hogan civil engineering and construction yards were predominantly used for the storage of building supplies and equipment. There were two small steel explosive storage containers (2) used by the Fulton Hogan geotechnical team. There was also a stack of CCA treated telephone poles (3) in the construction yard. Otherwise, there was no evidence of hazardous substance storage or use in these areas, and surface gravels were free of staining."

e3scientific used a portable X-Ray Fluorescent Spectrophotometer (XRF) to estimate the concentrations of heavy metals at 40 locations within the active faces of the cleanfill / hardfill disposal area. Additional scans were undertaken in a previously undisturbed part of the site, to compare the results from the fill with results representing natural ground conditions. The results indicated that one or more of the heavy metals concentrations in 14 of the 40 samples exceed the naturally occurring concentrations at the site, but 4 of those samples may have been included due to the precision level of the XRF. They concluded that "*three samples exceeded the Manaaki Whenua Landcare Research (2015) predicted background concentration by more than 35%, indicating that there is a higher likelihood that contaminants in excess of the local natural background were present in these samples*."

A preliminary conceptual site model was developed, to provide an overview of the potential interactions between contaminants and sensitive receptors. The following excerpts describe the potential risks associated with the relevant identified sources of contamination:

"Concrete manufacture - Commercial concrete manufacture has taken place on site since 2005. Contaminants associated with concrete manufacture may affect soil pH and stormwater quality; however, risks to human health are generally not considered significant.

In addition to the contaminants listed in Table 4, small quantities of concrete retarding admixture are used within the concrete block manufacturing plant. The active ingredient in this product is tetrapotassium pyrophosphate. Tetrapotassium pyrophosphate is a common food additive, and not considered particularly toxic. The material safety data sheet (MSDS) does not list any special environmental protections required and does not identify the product as toxic to people.

A 10,000 L diesel tank and waste oil igloo are also known to be present within the concrete block manufacturing facility, and it is suspected diesel storage also occurred at the Allied Concrete batching plant in the past.

Asphalt manufacture - The asphalt manufacturing plant has operated on site since 1987. Asphalt manufacture involves the storage and handling of petroleum hydrocarbons including diesel, kerosene, and bitumen. Once manufactured and cured, asphalt is relatively stable, and unlikely to leach significant quantities of contaminants.

Fuel storage - Outside of the asphalt and concrete block plants, there are four known areas of relatively small-scale fuel storage. These include a diesel tank, waste oil storage, and generator at the quarry plant and diesel storage at the JCL asphalt yard.

Treated timber storage - A relatively small area within the Fulton Hogan construction yard has been used for storage of treated timber poles. Although this activity has only occurred recently, and appears to be for relatively short duration, leaching of copper, chromium and arsenic from tanalised timber can impact soils directly under the poles. Although leaching from treated timber stacks can pose a risk to human health under residential land use, results from previous investigations suggest that exceedance of commercial/industrial soil contaminant standards is unlikely (Marlborough District Council, 2016).

Waste disposal to land - Backfilling of the north-eastern portion of the site with cleanfill has taken place since the 1980's.

This activity was consented by the Otago Regional Council in November 2000, and the cleanfill generally appears to be well managed. ORC compliance reports in 2009 and 2020 identified minor non-compliance associated with reporting, but both inspections found the site to be tidy with no evidence of unconsented fill types or adverse environmental effects. A cleanfill management plan for the Parkburn Quarry was prepared by Fulton Hogan in 2018. The management plan provides clear direction on consent and unconsented fill types and confirms that material from HAIL sites is not to be accepted without prior sampling.

Field readings of heavy metal concentrations with an X-Ray Fluorescent Spectrophotometer (XRF) indicates that heavy metal concentrations within most of the soil within the cleanfill surface and tipping faces are consistent natural background concentrations. A small number of readings returned results that indicate some contaminated fill material has been received."

The report provided the following conclusions related to contamination risks within the site boundaries:

"*Within the future industrially zoned area, the identified HAIL activities include concrete manufacturing and batching, asphalt production, fuel storage, persistent pesticide use, treated timber storage, and disposal of cleanfill. We consider that it is highly unlikely that contaminants in soil associated with concrete manufacture, persistent pesticide use, and treated timber storage would pose a risk to human under the proposed commercial/industrial land use.*

It is possible that contaminants associated with asphalt production, fuel storage and cleanfill disposal could result in soil contamination that could pose a risk to long term outdoor workers using the site in the future without appropriate investigation, remediation and/or management during development. The greatest risks are associated with hydrocarbon storage, particularly around any underground fuel storage infrastructure (e.g. fuel supply pipelines). Risks associated with the disposal of cleanfill appear relatively low; however, given the long history of filling, it is possible that localised areas of contaminated fill material may be present.

Given the on-going use of the site for these HAIL activities, it would be appropriate to complete additional investigation upon decommissioning of any potentially contaminating land uses. These investigations may also be better able to assess risks to human health as plans for the proposed development become more detailed."

It should be noted that e3scientific report includes assessment of the remainder of the Project area. Three other activities (fuel storage, bitumen storage and a generator) that could have resulted in contamination impacts were identified within the boundaries of the Project. Those areas could not be assessed as part of this report, due to the ongoing quarrying operations.

3.3 ORC Property Database

IE reviewed the ORC Hazardous Activities, Industries and Bore Search database[8] on 5 November 2025. The search confirmed that the site is not recorded on the database.

The site contains the only record (HAIL.00359.01) in the database within approximately 1.75 km of the site boundaries.

HAIL.00359.01 is recorded in the eastern portion of the site as the "*Fulton Hogan Asphalt Plant Parkburn*". The summary notes state "*Consented asphalt plant location. Z Energy tank removal report rec'd in 2015 confirmed residual contamination from diesel tank was acceptable.*"

The site is recorded as "*Partially Investigated*" for verified hazardous activities and industries list (HAIL)[9] Category E2 activities (Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant).

3.4 CODC NES Records Search

The CODC NES Records Search (Appendix 6) was prepared by Adam Vincent, Planning Officer – Consents, on 26 November 2025. The records search contained various records related to Building Consents and Resource Consents associated with the site.

The Resource Area is listed as Medium Density Residential Zone, Low Density Residential Zone, Industrial Resource Area (2), Industrial Resource Area (3), with the Industrial zoning being relevant to the site and the other zones relating to the remainder of the property towards the south.

The following Building Consents were issued for the site: Erect an office building at a quarry (1988), erect a bitumen storage shed (1990), relocate a storage building (1995), erect a new Portacom building (2004), erect all new buildings / platforms for a new industrial plant (2005), relocate a building onto site for staff facilities (2006), additions to an existing shed (2015), erect a new storage shed (2015), foundations and site works for relocated office / smoko room (2016), foundations and site works for relocated office (2018, 2019 and 2020), install a Smart Shelter container roof (2020), foundations, water supply, drainage and site works for unisex Portacom ablution block (2020), a new 20 mx 26 m storage shed (2021), foundations and site works for a relocated Portacom (2022), new foundations and construction of portal frame gantry (2022) and change in the location for the relocated Portacom (2022).

The following Resource Consents were issued for the site: Backfill against quarry pit faces with solid fill (2000), land use to build and operate a concrete block manufacturing plant (2005), land use to extract and convey sand aggregate from the upper terrace (2007), land use to establish Portacom offices (2019), change of conditions of a Resouce Consent to allow establishment of two further Portacoms (2020), land use to construct a shed to house a glass crushing plant (2021), land use to install 2 20,000L diesel fuel tanks to replace one diesel tank with was to be removed (2022), change of conditions of Consent to change a building location (2022) and change of conditions of a Consent to allow the installation of a Smart Shelter on site.

Council aerial photographs, dating back to 2006, confirmed that an asphalt plant and a concrete block plant was present in the eastern portion of the site. The outdoor storage of unknown materials was also confirmed to have occurred in the south eastern portion of the site.

The records search also confirmed that a preliminary environmental site investigation was undertaken at the site in support of Plan Change 23. Extracts of the e3scientific report[4], showing the locations of areas where hazardous activities were undertaken, are included in the records search.

HAIL[9] activities associated with Council's records are A17 (storage tanks or drums for fuel, chemicals or liquid waste), A18 (storage tanks or drums for fuel, chemicals or liquid waste), E2 (Asphalt or bitumen manufacture or bulk storage), E4 (commercial concrete manufacture or commercial cement storage), G4 (scrap yards) and G5 (waste disposal to land).

3.5 Review of Historical Maps and Aerial Photographs

Photographs in the Crown Collection[10] and Google Earth[11], as well as topomaps on the MapsPast[12] website, have been reviewed to obtain information on the past uses of the site. Aerial photographs taken between 1958 and 2024, as well as maps created between 1939 and 2019, have been reviewed.

Table 4 summarises the features visible in each image.

Table 4: Historical Maps and Aerial Photographs

1939 [12]	The site is part of a block of land that is split by two parallel lines representing a road in the north western corner. The road crosses through the site from just south of the north western corner to just east of the north western corner. The site is labelled with "9" and "148,1,17". An overland water flow path is marked with curved black lines from near to the centre of the northern site boundary, to the south eastern corner of the site. Two parallel dashed lines, representing a vehicle track, as well as a dashed line with a single dot between each dash, representing a walking track, are located along a south west / north east axis in the area beyond the eastern site boundary. Another smaller property is located beyond the eastern site boundary and the Clutha River / *Mata Au* is marked in blue at the eastern side of that property. No other significant features are visible on the map.
1949 [12]	No significant changes are visible at the site, or in the surrounding area, compared with the 1939 map.
1958 [10]	In the surrounding land, dwellings and border dykes are visible on the neighbouring property towards the west. A track extends along the southern site boundary, from Luggate – Cromwell Road to a small orchard on the southern bank of the Park Burn located just beyond the south eastern portion of the site. Another dwelling is visible towards the south east of that area. The remainder of the surrounding area appears to be used for agriculture in the same way as the site, with flood irrigation supplying water to various areas via water races. No other significant features are visible at the site or in the surrounding area.
1964 [10]	The majority of the site is visible, but the eastern edge of the site is not covered by this photograph. A few water races are visible in the western portion of the site, west of the Park Burn. The trees near to the centre of the site and in the eastern portion of the site have grown. A small rectangular object, surrounded by a roughly triangular portion of cleared land, is visible just west of the trees near to the centre of the site. In the surrounding land, linear features representing border dykes for flood irrigation purposes, arranged along a north east / south west orientation, are visible towards the north east and south west. A large stack of hay bales is visible south west of the stand of trees near to the centre of the site. No other significant changes are visible at the site, or in the surrounding area.

Table 4 (cont.): Historical Maps and Aerial Photographs

1968 [10]	Apart from a stack of hay bales is visible on the western bank of the Park Burn in the eastern portion of the site, the site remains unchanged compared to the 1964 photograph. In the surrounding land, new border dykes are visible in the south western corner and the eastern portion of the neighbouring property towards the north. No other significant changes are visible at the site or in the surrounding area.
1976 [10]	Apart from the stack of hay bales no longer being present in the eastern portion of the site, the site appears unchanged compared with the 1968 photograph. In the surrounding land, new border dykes have been constructed on the neighbouring property towards the north of the site. No other significant features are visible at the site or in the surrounding area.
1978 [10]	No significant changes are apparent at the site, or in the surrounding land.
1979 [12]	Symbols indicating the presence of trees are visible on the eastern side of the Park Burn near to the northern site boundary. Symbols indicating the presence of embankments or terraces are visible in the eastern portion of the site. The creek crosses through the eastern portion of the site and extends past a neighbouring property towards the east, which is labelled "*Rahoy*". Two blue lines with arrows pointing southwards indicate the presence of water races that cross through the central portion of the site and terminate just beyond the southern site boundary. The Clutha / *Mata Au* is marked in blue further east of the eastern site boundary. In the surrounding land, a track is marked along the southern site boundary from Luggate – Cromwell Road to the area marked "*Rahoy*". Symbols indicating the presence of a shelter belt are visible along the south western boundary of the neighbouring property towards the north. Black squares, representing buildings, are marked in the south west and east of the neighbouring property towards the north, as well as on the neighbouring properties towards the west, south and east. No other significant features are visible at the site or in the surrounding area.
1982 [10]	No significant changes are apparent at the site, or in the surrounding land.
1983 [10]	No significant changes are apparent at the site or in the surrounding land.
1984 [10]	With the exception of a new light-coloured, square-shaped object in the area west of the stand of trees near to the centre of the site, no significant changes are apparent at the site or in the surrounding land.
1989 [12]	No significant changes are apparent, compared with the 1979 map.
1999 [12]	A black circle is labelled "*Tank*" is visible in the area just south east of the eastern edge of the shelter belt marked along the north western site boundary. New water races that extend towards the south east and south are marked in the central portion of the site. Symbols indicating the presence of trees are visible in the central and eastern portions of the site. In the surrounding land, the black squares are no longer present on the neighbouring properties towards the north and south. The area east of the site now has alternating diagonal blue and white lines and the aera is labelled "*Bed of proposed Lake Dunstan*". No other significant changes are apparent, compared with the 1989 map.
2001 [10]	A large quarry has been established in the eastern half of the site. Two new buildings are visible in the western portion of the quarry area. A small dam is visible near to the north eastern corner of the site. In the surrounding land, the areas directly east and west of the Park Burn in the

Table 4 (cont.): Historical Maps and Aerial Photographs

2001 (cont.) [10]	southern half of the neighbouring property towards the north have been quarried and the ground surface in those areas is grey. Another area has been stripped of topsoil directly east of the eastern quarry area and the stripped topsoil appears to have been stockpiled further east of that area. Stripped topsoil from the eastern quarry appears to have been stockpiled at the eastern side of the main excavated area in that part of that property. Lake Dunstan / *Te Wairere* is visible at the eastern edge of the site. The buildings that had been present in the area labelled "*Rahoy*" have been removed and that area is now part of Lake Dunstan / *Te Wairere*. A vineyard appears to have been established on the neighbouring property towards the west. No other significant changes are apparent at the site or in the surrounding area.
2003 [10]	The quarry has been extended towards the south, beyond the south eastern site boundary. A new, larger dam is visible north east of the small dam in the north eastern corner of the site. Another dam is visible directly east of the large dam. In the surrounding land, quarried portions of the neighbouring property towards the north appear to cover the same footprints, with the exception of the eastern extent, which has extended towards the east in the area south east of the stockpile of stripped topsoil. Another relatively small area has been stripped of topsoil on the neighbouring property towards the south, in the area south west of the central portion of the site. No other significant changes are visible at the site or in the surrounding area.
2005 [11]	Only the eastern quarter of the site is covered by this image. The original small dam is no longer visible are visible in the north eastern corner of the site. Instead, the large dam appears to have been mostly filled in and only the south eastern corner remains. The dam directly east of that dam remains. In the surrounding area, the quarry has been extended towards the east in the area east of the stripped topsoil stockpile on the eastern side of the Park Burn on the neighbouring property towards the north. No other significant changes are visible at the site or in the surrounding area.
2007 [11]	Two large new buildings have been constructed in the western portion of the quarry area. Another small rectangular building has been constructed further west, between a parking area and the road that extends from Luggate – Cromwell Road to the quarry area. The dams in the north eastern corner of that property are no longer visible. No other significant changes are visible at the site or in the surrounding area. In the surrounding land, a large new quarry has been established in the southern portion of the neighbouring property towards the south. On the neighbouring property towards the north, the eastern quarry area has been extended towards the east in the area east of the stripped topsoil stockpile. The western topsoil stockpile area on that property has been stripped of topsoil and developed with three buildings, consisting of a large rectangular building in the north western portion of that area, as well as a small rectangular building east of the large building and an L-shaped building half-way along the western boundary of the newly stripped area.
2009 [12]	The water races are no longer marked on the site. Three black squares are visible in the eastern half of the site and the tank is no longer labelled, but the circular symbol remains. A quarry is labelled in the eastern portion of the site and the outline, marked as a dashed black line, extends across the south eastern portion of the neighbouring property towards the north. A small dam is marked in the area between the quarry and Lake Dunstan / *Te Wairere* in the north eastern corner of the site. Lake Dunstan / *Te Wairere* is now labelled as "Lake Dunstan" directly east of the

Table 4 (cont.): Historical Maps and Aerial Photographs

2009 (cont.) [12]	eastern site boundary. “Rahoy” is no longer labelled in the area south east of the site. Symbols indicating the presence of horticultural land are visible on the neighbouring properties towards the west of the site. No other significant changes are visible at the site or in the surrounding area compared with the 1999 map.
2011 to 2019 [11]	New stockpiles of dark grey material are visible near to the western bank of the Park Burn near to the northern site boundary. A new road connects the site to the south western portion of the neighbouring property towards the north. Three new relatively small new buildings have been constructed in the area east of the new road. A large new light-coloured structure is constructed in the area south of the original buildings located on that property. In the surrounding land, quarrying activities continue to extend towards the east, north and west in the southern portion of the neighbouring property towards the south. The new quarry eventually connects to the original quarry in the eastern portion of the site. Quarrying continues to extend towards the east on the neighbouring property towards the north and stripped topsoil from the new quarry areas is stockpiled along the north eastern boundary of that property. The western portion of the area south east of the Park Burn is slowly back-filled towards the east after 2015. Equipment and machines, as well as dark grey stockpiles of unknown material, are stored in the area west of the Park Burn. Additional buildings are constructed in the area west of the equipment storage area. No other significant changes are apparent at the site or in the surrounding area during this timeframe.
2019 [12]	A new track is marked in the western portion of the site and it extends from the existing track on site to the north western site boundary, where it continues towards the east. Another track extends southwards from the area near to the symbol representing a tank. Three additional black squares are marked in the central portion of the site. A new quarry area is visible on the neighbouring property towards the south. A black square is visible in the south western portion of the neighbouring property towards the north. No other significant changes are apparent compared with the 2009 map.
2021 to 2023 [11]	Bulk fill placement is visible in the north eastern corner of the site . The light-coloured structure is removed and a new dark grey structure is constructed in the area north east of the original buildings on the site. Two additional new structures are constructed east of that building, on the eastern side of the Park Burn and west of the bulk filling activities. One new building is removed from the area between the Park Burn and the area being filled. The area directly west of the stand of trees located near to the centre of the site has been stripped of topsoil. In the surrounding land, the quarry in the southern western portion of the neighbouring property towards the south also becomes back-filled and vegetation is established over that area. The quarry on the neighbouring property towards the north is extended towards the north east and the western side of the quarry is slowly back-filled. No other significant changes are apparent at the site or in the surrounding land.
2024 [11]	Bulk fill placement has continued in the north eastern corner of the site. In the surrounding land, quarrying activities continue to extend towards the north in the eastern portion of the neighbouring property towards the north, with topsoil still being stockpiled along the north eastern property boundary. A new area is stripped and developed with three new buildings in the south western corner of that property. No other significant changes are apparent at the site or in the surrounding land.

3.6 Summary of Identified Hazardous Activities and Industries

The following activities noted on the MfE HAIL[9] have been identified during review of the history of the site:

Category A2 – Chemical manufacture, formulation or bulk storage.

- This category is represented by the presence of waste oil tanks and bitumen storage tanks at the asphalt plant. The risks to human health from these sources are likely to be low, due to the chemicals being contained in tanks that did not show signs of leakage, except in the areas where bitumen residue was visible on the ground surface.

Category A17 – Storage tanks or drums for fuel, chemicals or liquid waste.

- This category is represented by the presence of above-ground fuel, kerosene, bitumen, waste oil, concrete additive and concrete retardant storage tanks or drums. The risks to human health are considered likely to be low, except in the areas where bitumen residue was visible on the ground surface.

Category A18 – Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside.

- This category is represented by the presence of stacks of treated timber telephone poles noted by e3scientific in the JCL Asphalt yard. The risks to human health from that area is considered likely to be significant from a residential land use perspective, due to the high toxicity of arsenic which leaches from the poles during rainfall events.

Category E2 – Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant).

- This category is represented by the presence of the asphalt plant which poses significant risks to human health in areas where bitumen residue is visible on the ground surface.

Category E4 – Commercial concrete manufacture or commercial cement storage.

- This category is represented by the presence of the concrete block manufacturing facility which is not considered likely to pose significant risks to human health.

Category G5 – Waste disposal to land.

- This category is represented by the cleanfill stockpile in the eastern portion of the site which consists of imported fill. Additionally, engine oil stains, waste asphalt and bitumen residue on the ground are considered to represent waste disposal to land. The risks to human health from engine oil, waste asphalt and bitumen residue in those areas are considered to be significant, but the risks to health from the cleanfill stockpile in the eastern part of the site are unknown.

Category F8 – Transport depots or yards including areas used for refuelling or the bulk storage of hazardous substances.

- This category is represented by the yards in the south eastern portion of the site. The risks to human health from oil stains and treated timber poles in those areas are considered to be significant.

According to Regulation 5 of the NES[1], the Regulations apply if a HAIL[9] activity has been undertaken, or currently is being undertaken on the property.

4 Intrusive Investigation

Under the NES-CS[1], the soil disturbance required for the proposed residential development of the site, as well as the subdivision and change of land use required to enable the development, are considered to meet the definitions provided under Regulations 5(4) disturbing the soil of the piece of land, 5(5) subdividing land and 5(6) changing the use of a piece of land that has had a HAIL[9] activity undertaken on it.

The Fast Track application does not require an exhaustive assessment of the extents of contamination impacts at the site, but rather a high-level assessment to identify activities that could have resulted in significant contamination impacts and conclusions related to the potential for the site to be made suitable for the proposed residential development and use.

Therefore, a limited detailed environmental investigation was undertaken to assess whether certain activities have resulted in unacceptable risks to human health. Where other activities have resulted in obvious contamination impacts that pose significant risks to human health, detailed assessment of the extents of those impacts are considered more appropriate to be undertaken when commercial / industrial activities at the site have concluded. This approach is consistent with the conclusions of the e3scientific PSI report[4].

Therefore, eight discrete soil samples were collected from the cleanfill stockpile in the eastern portion of the site, where the significance of contamination impacts (if any) could not be confirmed by visual observation. The samples were submitted to Hill Labs for analysis of a suite of common heavy metals (As, Cd, Cr, Cu, Pu, Ni and Zn). One sample (CF8) was also tested for mercury, in addition to the suite of common heavy metals.

Additional sampling was undertaken within the cleanfill stockpile area, based on a preliminary review of this DSI by CODC. Twenty-six samples were collected from the stockpile surface and submitted to Hill Labs for analysis of a suite of common heavy metals (As, Cd, Cr, Cu, Pu, Ni and Zn) and asbestos presence / absence.

Sample locations are displayed in Figure 2.

4.1 Data Quality Objectives

The data quality objectives (DQO) of this assessment were:

- To assess the presence and concentrations of contaminants in near surface and stockpiled soil; and
- To assess the risks to human health posed by contamination at the site.

4.2 Methodology

The following was undertaken during the soil sampling works:

- Samples were given individual names that corresponded to specific locations recorded on a site plan (refer to Figure 2);
- Visual and olfactory inspection of soil samples in the field;
- Collect 8 soil samples from 8 locations along the edge of the cleanfill stockpile. Samples were compressed directly into laboratory supplied containers using a new pair of nitrile gloves for each sample. Prior to sampling, the equipment (hand trowel) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water;
- Placement of samples into a chilly bin and transportation, under standard IE chain of custody procedures, to Hill Labs; and

- Request that Hill Labs analyse the samples for a suite of common heavy metals (As, Cd, Cr, Cu, Pu, Ni and Zn), or a suite of common heavy metals and mercury.
- Visual and olfactory inspection of soil samples in the field;
- Collect 26 additional soil samples from 26 locations at the surface of the cleanfill stockpile. Samples were compressed directly into laboratory supplied containers using a new pair of nitrile gloves for each sample. Prior to sampling, the equipment (hand trowel) was decontaminated using a triple wash procedure with potable water, Decon 90 solution and deionised water.;
- Placement of samples into a chilly bin and transportation, under standard IE chain of custody procedures, to Hill Labs; and
- Request that Hill Labs analyse the samples for a suite of common heavy metals (As, Cd, Cr, Cu, Pu, Ni and Zn) and asbestos presence / absence.

4.2.1 Quality Assurance / Quality Control

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

- Standard sample registers and chain of custody records have been kept for all samples;
- The use of Hill Labs, accredited by International Accreditation New Zealand (IANZ), to conduct laboratory analyses; and
- During the site investigation every attempt was made to ensure that cross contamination did not occur through the use of the procedures outlined within this document.

4.3 Investigation Criteria

4.3.1 Soil Criteria

The investigation criteria referenced in this report have been selected from the NES-CS to assess risks to human health. Where a soil contaminant standard (SCS) was not available, the hierarchy detailed in the MfE *Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values*[13] was used to select applicable criteria.

Human Health

SCSs[1], or other appropriate criteria for residential land use and commercial / industrial use have been presented to assess the risks to human health during the disturbance of soil associated with construction works required as part of the site development, as well as to assess the health risks during residential activities.

Ambient Concentrations of Contaminants

The New Zealand Institute for Bioeconomy Science Limited produced a report[3] for ORC and Environment Southland titled *Determination and use of background concentrations of trace elements in soil in Otago and Southland*.

The report provides new criteria that are proposed to be adopted as standardised background / ambient concentrations for Otago and Southland, because the current national database of predicted background concentrations is too variable and has resulted in an unnecessarily complex situation when determining whether soil can be reused at other sites.

Therefore, laboratory results below the proposed '*risk-based background concentrations or soil re-use criteria for the management of contaminated land and soil relocation*' can be considered to qualify as 'cleanfill' according to the MfE definition[14].

Ecological Health

Due to the standardisation of the background concentrations for heavy metals within Otago and Southland, criteria for the protection of ecological receptors (Eco-SVGs) are now standardised as well. For ease of use, the recently published report[3] includes Eco-SVGs that were calculated using the new background criteria.

Laboratory results below the Eco-SVGs provided in the report[3] are considered acceptable for the protection of ecological receptors at the site.

4.4 Results

4.4.1 Soil Encountered

Soil encountered in the cleanfill stockpile was extremely variable and included silty sandy gravel with bricks, metal, plastic, textile, waste asphalt millings and concrete inclusions. Compacted hardfill was present at the surface of the remainder of the potentially contaminated areas.

4.4.2 Laboratory Test Results

Table 5 compares soil contaminant concentrations in the samples with the adopted investigation criteria described in Section 4.3. The full analytical results are included in Appendix 7.

Table 5: Laboratory Results Compared with Human Health Criteria, Ecological Health Criteria and Background Concentrations

Analyte	Investigation Criteria				Investigation Results																
Land Use	Predicted Background Concentrations [A]	Ecological Soil Guideline [A] Residential	Soil Contaminant Standards (SCSs) [B] Residential	Soil Contaminant Standards (SCSs) [B] Commercial / Industrial (Excavation Activities)	CF1	CF2	CF3	CF4	CF5	CF6	CF7	CF8	PQA	PQB	PQC	PQD	PQE	PQF	PQG	PQH	PQI
Heavy Metals																					
Arsenic	12	20	20	70	***32***	8	7	7	10	13	9	5	9	10	8	5	11	***25***	7	13	8
Chromium	120	200	460 [C]	6,300	6	8	12	7	15	5	12	8	11	9	8	6	8	11	10	8	11
Copper	80	95	>10,000	>10,000	17	16	14	12	13	18	17	9	14	13	12	12	17	15	19	18	14
Lead	150	290	210	3,300	16	10	11	14	23	15	21	13	14.8	16.8	11.6	15.8	15.7	13	12.4	18.1	11
Nickel	30	200 [D]	400 [F]	6,000 [F]	11	10	12	8	13	9	14	7	11	8	8	8	11	11	10	10	11
Zinc	180	180	7,400 [F]	400,000 [F]	57	39	51	32	53	23	54	28	43	42	35	25	42	49	56	36	41
Heavy Metals					**PQJ**	**PQK**	**PQL**	**PQM**	**PQN**	**PQO**	**PQP**	**PQQ**	**PQR**	**PQS**	**PQT**	**PQU**	**PQV**	**PQW**	**PQX**	**PQY**	**PQZ**
Arsenic	12	20	20	70	6	10	11	7	9	8	6	8	9	5	6	8	6	9	9	7	8
Chromium	120	200	460 [C]	6,300	6	10	9	11	12	10	5	10	10	6	7	9	8	10	11	11	8
Copper	80	95	>10,000	>10,000	11	16	21	13	9	13	12	18	16	9	10	12	13	16	9	17	16
Lead	150	290	210	3,300	8.3	12.3	10.2	12.2	13.3	11.2	13.1	12.4	15.2	11.1	13.5	13.9	11.9	15.5	14.2	15	10.6
Nickel	30	200 [D]	400 [F]	6,000 [F]	7	11	12	10	11	10	7	11	11	7	6	9	9	12	10	8	9
Zinc	180	180	7,400 [F]	400,000 [F]	25	46	40	51	58	43	39	44	45	26	32	40	37	56	63	58	38

Notes:

All values in mg/kg. Only detected analytes are presented. Full laboratory certificates are included in Appendix 5.

Underlined text indicates concentration exceeds the background concentration[3].

Italics text indicates that the concentration exceeds the Ecological SGV for Residential Land Use [3].

Bold text indicates that the concentration exceeds the SCS for Residential land use[1].

Highlighted cell indicates that the concentration exceeds the SCS for Commercial / Industrial Land Use which serves a surrogate for excavation activities and maintenance of underground services[1].

- Indicates that the tests was not completed on the sample.

A The New Zealand Institute for Bioeconomy Limited: Determination and use of background concentrations of trace elements in soil in Otago and Southland[3].

B The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health[1].

C Criteria for Cr6 presented as criteria for Cr3 are non limiting[1].

D Australian National Environmental Protection Council (NEPC) National Environmental Protection (Assessment of Site Contamination) Measure Schedule B(1): Guideline on the investigation levels for soil and groundwater. Calculation: Added Contaminant Limited (ACL) for urban residential and public open space (CEC = 10) + background concentration[15].

E Australian National Environmental Protection Council (NEPC) National Environmental Protection (Assessment of Site Contamination) Measure Schedule B(1): Guideline on the investigation levels for soil and groundwater[15].

5 Discussion

The arsenic concentrations in sample CF1, located at the north eastern side of the cleanfill stockpile and sample PQF, located at the north eastern side of the stockpile surface, exceed the SCS for residential land use, as well as the expected background concentration and the Eco-SVG for residential land.

None of the concentrations of contaminants measured in other samples from the cleanfill stockpile pose significant risks to human health or ecological receptors. Furthermore, no asbestos was detected in the 26 additional samples.

IE calculated the 95% upper confidence limits (UCLs) for the heavy metals (n=34) and the results (refer to Table 6) were below the background concentrations of trace elements in soil in Otago and Southland[3].

Table 6: 95% UCLs for Heavy Metals Concentrations in the Cleanfill Stockpile

Analyte	Predicted Background Concentrations[3]	95% UCL (n=34)
Arsenic	12	11.2
Chromium	120	9.8
Copper	80	15.2
Lead	150	14.7
Nickel	30	10.4
Zinc	180	46.2

However, significant contamination impacts consisting of engine oil stains, soil beneath treated timber poles and spilled bitumen were visually confirmed at the site. Laboratory analysis of those impacts is not required, due to visual and olfactory confirmation of the significance of the impacts. The below-ground extents of those impacts can be ascertained during the site remediation process, when excavation and disposal of the impacted material is proposed to occur.

6 Conceptual Site Model

A contamination conceptual site model, presented in Table 7, consists of three primary components to allow the potential for risk to be determined. These are:

- Source of contamination;
- Pathway to allow the contamination to mobilise; and
- Sensitive receptors which may be impacted by the contamination.

Table 7: Conceptual Site Model

Source	Pathway	Receptor
Heavy metals (naturally occurring and treated timber posts), Petroleum hydrocarbons (underground and above-ground tanks, surface engine oil and bitumen spills), Polycyclic aromatic hydrocarbons (surface engine oil and bitumen spills).	Inhalation of dust; Dermal absorption (direct contact); Ingestion of soil and / or produce grown in the soil; Wind-blown dust; Sediment migration via stormwater; Leaching to groundwater via stormwater infiltration.	Maintenance / Excavation workers; Site workers; Future residents and visitors; Soil microbes; Soil invertebrates; Plants; Wildlife; Groundwater; Surface water.
Acceptable risk to human health	Earthworks Associated with Land Development Yes: The contamination impacts that could pose significant risks to human health are located in well defined areas and can be easily remediated prior to, or as part of the bulk subdivision earthworks. **Future Residential Land Use** No: Contamination impacts that pose significant risks to human health are located within the site boundaries. Remediation is required prior to residential development in those areas.	
Acceptable risk to ecological health	**Future Residential Land Use** No: Contamination impacts that pose significant risks to ecological receptors are located in the north eastern portion of the site	

7 Conclusions

Site History

Information obtained as part of this investigation (refer to Section 3) indicates that the site was used for agricultural purposes, likely as grazing for livestock and / or production of hay prior to establishment of a quarry and associated contractors' yards during the late 1980s.

Evidence was found that HAIL activities (refer to Section 3.6) have occurred in certain parts of the site. Soil samples were therefore collected from areas where significant contamination impacts could not be confirmed by visual or olfactory assessment. Soil samples were not required in areas where visual and olfactory indicators of contamination impacts were obvious, including engine oil stains, stacked treated timber poles and spilled bitumen.

Intrusive Investigation

Eight soil samples were collected from the eastern and southern sides of the cleanfill stockpile (Figure 2), then dispatched to Hill Labs under standard chain of custody documentation. IE requested that Hill Labs analyse the samples for a suite of common heavy metals and mercury was added to the suite of analyses at one sample location (CF8).

Additional sampling was undertaken within the cleanfill stockpile area, based on a preliminary review of this DSI by CODC. Twenty-six samples were collected from the stockpile surface and submitted to Hill Labs for analysis of a suite of common heavy metals (As, Cd, Cr, Cu, Pu, Ni and Zn) and asbestos presence / absence.

The arsenic concentrations in sample CF1, located at the north eastern edge of the cleanfill stockpile and sample PQF, located at the north eastern side of the stockpile surface, exceed the SCS for residential land use, as well as the expected background concentration and the Eco-SVG for residential land.

None of the concentrations of contaminants measured in other samples from the cleanfill stockpile pose significant risks to human health or ecological receptors. Furthermore, no asbestos was detected in the 26 additional samples.

Statistical analysis of the heavy metals concentrations confirmed that the 95% UCLs are below the background concentrations of trace elements in soil in Otago and Southland[3]. It is therefore considered likely that, even though small amounts of soil containing heavy metals exceeding the background concentrations may exist, the stockpile can be considered to qualify as cleanfill.

Significant Contamination Impacts

Visual and olfactory confirmation of significant contamination impacts in various parts of the eastern portion of the site are not considered suitable for residential use until the impacted areas have been remediated. Additional investigation of those areas is proposed to be undertaken upon decommissioning of the operational areas.

Remediation of the impacted areas is considered likely to be relatively straightforward[16] and the success of the remediation works would be validated upon completion, through laboratory analysis of the soil remaining in those areas.

This investigation has therefore confirmed that contaminants in soil, within the parts of the proposed residential use areas, pose significant risks to human health, environmental health or ecological health until such time that remediation earthworks are completed and validated.

Non-HAIL areas

No evidence of HAIL activities was found in the western portion of the site. The non-HAIL area is delineated in Figure 2.

NES Applicability

Contamination impacts identified in isolated parts of the Project confirm that the soil contamination exceeds the applicable standard in Regulation 7. Therefore, the proposed activities of subdividing land, changing land use and disturbing soil do not qualify as Controlled Activities pursuant to Regulation 9[1].

Consent will be required under the NES-CS for Restricted Discretionary Activities (Regulation 10) or Discretionary Activities (Regulation 11), to enable the remediation of the impacted areas prior to the change of land use, subdivision and development of the site for residential purposes.

8 Recommendations

It is recommended that this report be read in conjunction with the e3scientific PSI included as Appendix 5.

Furthermore, it is recommended that the soil contamination aspects of the Fast Track application be approved, because contamination impacts at the site appear to be relatively isolated and should be easily remediated prior to, or during bulk subdivision earthworks occurring.

Finally, it is recommended that the Remediation Action Plan (RAP)[16] provided as part of this application be accepted, to enable all parts of the Project to be made suitable for residential purposes.

These conclusions and recommendations are considered to be consistent with those presented by e3scientific[4].

9 References

1. Ministry for the Environment 2012: Users' Guide National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health
2. Ministry for the Environment 2021: Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites in New Zealand
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4. e3scientific Limited 2021: Parkburn Quarry Preliminary Site Investigation. Report reference #21085
5. GNS Webmap Institute of Geological and Nuclear Sciences 2013: 1:250,000 Geology. Viewed at: http://data.gns.cri.nz/geology/
6. Geotago Limited 2022: Junction Terraces (Parkburn Quarry), Mount Pisa Preliminary Geotechnical Assessment for Proposed Residential Development. Report Reference: GL21-022.1
7. Otago Regional Council 2026: Otago Regional Council Resource Consent Database. Viewed at: http://data.orc.govt.nz/
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9. Ministry for the Environment 2011: Ministry for the Environment Hazardous Activities and Industries List
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11. Google Earth v7.3.6.10441. Mount Pisa, Central Otago, New Zealand. -44.960981°lon, 169.253345° lat, Eye alt 1.87 km. http://www.earth.google.com. [November 2025]
12. Mapspast 2026: Current and Historical Topographic Maps (Topomaps) of New Zealand. Viewed at: http://www.mapspast.org.nz/
13. Ministry for the Environment 2011: Contaminated Land Management Guidelines No.2 - Hierarchy and Application in New Zealand of Environmental Guideline Values.
14. Ministry for the Environment 2002: A Guide to the Management of Cleanfills.
15. Australian National Environmental Protection Council 2013: National Environmental Protection (Assessment of Site Contamination) Measure Schedule B(1): Guideline on the investigation levels for soil and groundwater.
16. Insight Engineering 2026: Remediation Action Plan for 922 Luggate-Cromwell Road (SH6), Cromwell. Reference #24019_RAP

10 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Fulton Hogan Land Development Ltd C/- Tim James Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

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

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

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

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

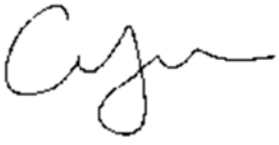
We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on [redacted] if you require any further information. The author is a Certified Environmental Practitioner (CEnvP) under the Environment Institute of Australia and New Zealand (EIANZ) accreditation system.

I, Claude Midgley of JKCM Limited, certify that this report meets the requirements of the Resource Management (National Environmental Standard for assessing and managing contaminants in soil to protect human health) Regulations (2011)[1], because it has been:

- Done by a suitably qualified and experienced practitioner (SQEP);
- Reported on in accordance with the current edition of Contaminated Land Management Guidelines No 1: Reporting on contaminated sites in New Zealand; and
- Certified by a SQEP.

Evidence of the qualifications and experience of the suitably qualified and experienced practitioner who has undertaken this investigation and certified this report is included in Appendix 8

Report prepared and certified by



Claude Midgley
CEnvP, MSc.
Principal Environmental Scientist

Appendix 1

Response to Peer Review Matters

Memorandum

From:	Claude Midgley (Insight Engineering)	Date:	25 September 2026
To:	Melanie Foote (Town Planning Group)	Project No.	24019
Cc:	Greg Dewe (Fulton Hogan) and Will Nicholson (LandPro)		
Subject:	Unresolved Issues Regarding the Remediation Action Plan for Parkburn Quarry		
Total Pages:	7		

1 Introduction

JKCM Ltd, trading as Insight Engineering (IE), was requested by Melanie Foote to provide comment on issues raised by CODC's peer reviewer regarding the approach to the site assessment and remediation required for the proposed subdivision at Fulton Hogan's Parkburn Quarry, located at 922 Luggate-Cromwell Road (SH6) directly north of Pisa Moorings.

Insight Engineering (IE) undertook a limited detailed site investigation (DSI) of the cleanfill stockpile at the site in 2025 and reported on the findings in 2026. IE also prepared a remediation action plan (RAP) to demonstrate how contamination impacts, identified visually by IE and e3Scientific, could be managed or removed from the site after the quarry operations and other industrial activities at the site had ceased.

The proposed approach, to "*complete additional investigation upon decommissioning or closure of any potentially contaminating land uses*" and "*develop a number of feasible strategies for remediation and/or site management if necessary*" was originally part of the conclusions reached by e3Scientific in their preliminary site investigation (PSI) completed in 2021. IE concurs with this approach.

2 Summary of Issues Raised

IE has been provided with the following list of issues to be resolved:

"*Overall, the expert review concludes that the documents are not sufficient to fully characterise contamination, assess risk, or justify the final remediation approach for residential development.*

The review recommends that the following additional information be obtained:

- *Investigation of all identified contaminant source areas, including further, more detailed, investigation of the cleanfill stockpile at depth, or justification as to why this is not considered necessary.*

  - *Additional contaminant testing (asbestos, PAHs, hydrocarbons and other HAIL-specific contaminants).*
  - *Updated risk assessment and conceptual site model incorporating additional investigation data.*
- *Off-site HAIL screening assessment.*
- *Better assessment of groundwater and surface water risks.*
- *Revised RAP based on improved site characterisation from additional DSI.*
- *Incorporation of laboratory-based validation into remediation strategy.*
- *Long-term containment and management controls including geotechnical assessment of retained fill and containment proposals.*

Further investigation is requested and refinement is required through consent conditions."

3 Detailed Response to Issues Raised

Initial statement

"*Overall, the expert review concludes that the documents are not sufficient to fully characterise contamination, assess risk, or justify the final remediation approach for residential development*"

The intent of the DSI was not to fully characterise the contamination. However, the locations of likely contamination impacts have been well established and full characterisation of the impacts is part of the proposed development strategy. This is consistent with the approach proposed by e3Scientific.

The final remediation approach, based on the assessment of available options in the proposed RAP, is limited to off-site disposal or on-site encapsulation of impacted soil.

- Where soil is demonstrated to exceed twice the residential soil contaminant standards, the impacted material will be disposed of at a facility licensed to accept it.
- All other material will be compacted and encapsulated beneath a crust of engineered fill that will provide a barrier between the future residents, visitors and workers at the site. The crust of engineered fill will also provide a barrier to stormwater infiltration, thereby significantly reducing the interaction between small pockets of impacted material within the cleanfill and the surrounding environment. The average concentration of contaminants within the encapsulation cells are expected to be below background, even if small amounts of contaminated soil exceeding the residential soil contaminant standards are included.

Further characterisation of the contamination impacts at this phase in the development does not change the fact that the, under the proposed RAP, the most contaminated material will no longer be present at the site and the remaining marginally impacted material will be isolated in a way that it effectively be inert.

Recommended Additional Information

"Investigation of all identified contaminant source areas, including further, more detailed, investigation of the cleanfill stockpile at depth, or justification as to why this is not considered necessary"

As stated in the introduction, it is not considered practicable to complete additional investigations in the majority of the operative areas at the site until they are decommissioned. However, those areas will be fully investigated as part of the proposed development strategy. A remediation plan has been prepared to demonstrate how the contamination impacts will be addressed, once fully characterised.

Further investigation of the cleanfill stockpile surface has been undertaken as part of the resolution of issues raised through the peer review process. However, samples were not collected at depth within the stockpile because it would interrupt the site operation and could lead to instability within the trafficked areas. Investigation at significant depth would require benching of the test pits, which could result in large areas of disturbance.

For a stockpile consisting of individual truckloads of imported material, the likelihood of uncovering significant unexpected contamination is considered to be very low due to the limitations on material that is allowed to be disposed of in the stockpile. The quarry manager (Matt Goulding *pers. comm.*) has provided the Contractors Agreement (Appendix 1) which formalises the type of material allowed to be placed in the cleanfill stockpile. Mr Goulding has also confirmed that the loads are inspected prior to acceptance into the quarry and that some have been rejected due to unsuitable material, such as organic inclusions, being identified in the fill.

Deeper layers in the stockpile were, at some point in the past, the former surface of the stockpile, therefore the visual indicators of unacceptable material would have been obvious to the site operator. Unsuitable material would have been removed at that time, therefore the material currently at the surface of the stockpile is considered to be sufficiently representative of the deeper layers because the method by which the stockpile has been created has not changed.

- ***Additional contaminant testing (asbestos, PAHs, hydrocarbons and other HAIL-specific contaminants).***

As stated, additional samples have been collected from the stockpile surface. No visual or olfactory indicators of PAHs or hydrocarbons that could interact with the environment were noted. Small amounts of asphalt millings were present, however the nature of that material is such that it can be considered inert even though PAHs are present. Laboratory testing is not considered necessary to confirm that asphalt millings contain PAHs and the results would not be representative of the risks to the environment.

Leaching tests have consistently confirmed that old asphalt millings remain well below hazardous waste and groundwater safety thresholds:
https://www.researchgate.net/publication/245336179_Leaching_of_Pollutants_from_Reclaimed_Asphalt_Pavement

https://faculty.eng.ufl.edu/timothy-townsend/wp-content/uploads/sites/210/2022/06/A-critical-analysis-of-leaching-and-environmental-risk-assessment.pdf

https://asphalt-materials.com/napa-helps-answer-what-is-the-environmental-impact-of-asphalt/

This is because volatile compounds (hydrocarbons) have long since evaporated, the bitumen binder has undergone oxidation that effectively locks the remaining hazardous compounds in place and PAHs are hydrophobic, which significantly reduces the potential for them to leach into groundwater via stormwater infiltration.

Real risks associated with PAHs from asphalt millings are associated with dust generation and sediment discharge via surface water flows. These pathways will not exist when the material has been encapsulated beneath a crust of engineered fill.

- ***Updated risk assessment and conceptual site model incorporating additional investigation data.***

The DSI has been updated to incorporate the results of additional stockpile samples. The findings can be summarised as: The 95% upper confidence limits for the concentrations of heavy metals are below the cleanfill criteria / background concentrations and no asbestos was detected in the samples.

- ***Off-site HAIL screening assessment.***

An off-site HAIL screening assessment is not considered practicable. The number of sites which have contributed to the cleanfill stockpile is considered likely to fall in the hundreds or even thousands. Fulton Hogan does not record the addresses of the source sites and contractors who have disposed of the loads are not likely to spend the time to provide this information.

What can be confirmed is that the contractors were aware that only cleanfill from non-HAIL sites may be disposed of at the facility (Appendix 1) and that it would not be in their financial best interests to dispose of contaminated material at the cleanfill stockpile.

- ***Better assessment of groundwater and surface water risks.***

The following risk matrix has been prepared to better demonstrate the likely risks to groundwater and surface water prior to, during and post remediation:

Risk Matrix

		Likelihood Level						
		Almost Certain	Very likely	Likely	Possible	Unlikely	Rare	Very Rare
Consequence Level	Catastrophic	Very High	Very High	Very High	High	Medium	Medium	Medium
	Major	Very High	Very High	High	High	Medium	Medium	Medium
	Moderate	High	High	High	Medium	Low	Low	Low
	Minor	Medium	Medium	Medium	Medium	Low	Low	Low
	Negligible	Low	Low	Low	Low	Low	Low	Low

The risks to groundwater and surface water are summarised in Table 1.

Table 1: Risk of contamination migration from source to receptor

	Before remediation	During remediation	After remediation
Surface water	Medium Uncontrolled releases of contaminated soil via surface water flow could reach the Park Burn. Bunding prevents this along the majority of the riparian zone. The occurrence is possible, but the consequence level is minor because the volume of sediment discharge is likely to me low. Had significant volumes of contaminated sediment been discharged during the quarry's operational lifespan, environmental impacts within the Park Burn would currently be evident.	Low Implementation of controls prescribed in the environmental management plan will ensure that surface water flows, which could contain contaminated soil, are diverted away from the Park Burn. The potential for contaminated sediment discharges is consider unlikely, but if they occurred the volumes would be low and the impacts would therefore be minor.	Low No contaminated soil will remain at the site surface, therefore the potential for uncontrolled discharges into the Park Burn are eliminated. The potential for contaminated sediment discharge is not possible once the material is encapsulated. In terms of the risk matrix, the occurrence would be rare and the consequence level minor.
Groundwater	High - Medium Stormwater infiltration through contaminated soil can currently result in discharge of contaminants to groundwater, the occurrence is almost certain. Natural soil at the site is characterised by high hydraulic conductivity, enabling contaminant migration through the soil column. Given the large volume of water flowing through the underlying aquifer, the consequence level is moderate to minor due to the likely dilution effect.	High - Medium Stormwater infiltration through contaminated soil could result in discharge of contaminants to groundwater. The occurrence is almost certain. Given the large volume of water flowing through the underlying aquifer, the consequence level is moderate to minor due to the likely dilution effect. Risk reduces with time as contaminated soil is removed from site or compacted within the containment cells.	Low The material within the encapsulation cells will be compacted for geotechnical stability, which will significantly limit the hydraulic conductivity. The material will be covered by a 1 to 2 m thick crust of engineered fill which also has significantly limited hydraulic conductivity, ensuring surface water does not reach the material within the containment cell, thereby reducing the potential for leaching of contaminants to groundwater to a high degree. The occurrence is therefore rare and the likely small volume of water results in negligible consequences.

- ***Incorporation of laboratory-based validation into remediation strategy.***

Laboratory-based validation was always part of the remediation strategy. Refer to Section 5.4.2 of the RAP. It is impossible to confirm whether material meets the threshold to be considered significant (twice the residential soil contaminant standards) or not, without laboratory-based validation.

The laboratory results obtained during the detailed investigation of the currently operative parts of the site will be used to inform the remediation of each area. Laboratory testing of the residual material will be undertaken to confirm that no contaminants remain at significant concentrations.

- ***Long-term containment and management controls including geotechnical assessment of retained fill and containment proposals.***

Geotechnical Controls

Geotechnical controls for the containment cell areas will vary slightly depending on the proposed end use of the land. Each of the containment cell areas will be capped by a layer of compacted engineered fill, likely to be comprised of crushed pea gravel. The intent is to form a stiff crust over the encapsulation cell that limits stormwater infiltration (through compaction) and meets the Geotechnical requirements for construction of NZS3604:2011 type dwellings.

Potential issues associated with the containment cell from a Geotechnical perspective are future differential settlements. For the containment area below the stormwater corridor, the fill will not support future structural loads. Therefore, a 1 m thick capping layer is considered to be sufficient from a Geotechnical perspective.

Where the containment area is within a future residential area, the capping layer is proposed to be 1 to 2 m thick. Additional Geotechnical measures, such as incorporation of geotextiles and geogrid reinforcement may be included within the containment cell material and capping material, subject to the type and condition of actual materials placed in the containment cell. Other measures that are proposed to be implemented include screening and exclusion of organic inclusions (e.g. timber, wood fragments and topsoil) from the containment cell. Settlement monitoring, also proposed to be incorporated as part of the greater bulk earthworks, are recommended to be carried out at the containment cell areas. Finally, subject to the condition, type and extent of compaction achieved, the containment cell area may be pre-loaded to express any unwanted settlement prior to allowing installation of services and building construction.

Quality control measures to verify compaction of the containment cell materials will likely need to be altered from the rest of the bulk earthworks, subject to the actual type of materials. Suitable methods of testing, such as nuclear densometer, Scala Penetrometer, Impact hammer, or a combination of these, may be used to verify compaction targets are achieved during fill placement.

The requirement for geotextiles and geogrids, preloading and testing methods are best assessed on site during construction by the Geotechnical Engineer, once the materials to be encapsulated are able to be assessed.

Long-term Management

The compaction of the cleanfill and engineered fill crust, described in the Geotechnical Controls, are expected to eliminate the requirement for long-term management, because the potential for stormwater infiltration and differential settlement is negligible.

IE has undertaken a soakage test (Appendix 2) to estimate the rate of infiltration through a test layer of compacted crushed pea gravel that will form the engineered fill crust / encapsulation layer over the cleanfill. The results confirmed that stormwater infiltration is limited by the generally low hydraulic conductivity of the crust, which is assessed as ranging between 4×10^{-6} m/s and 5.5×10^{-6} m/s. Infiltration through the crust would require sustained moderate intensity rainfall for periods up to 20 hours (typically). Such rainfall events are rare at the site. Additionally, the fill within the containment cell is also to be compacted. While it was not possible to perform soakage testing on a representative sample of this material, the compaction is expected to reduce the hydraulic conductivity, further limiting the transmission of water through the fill.

If a significant rainfall event does occur, the generation of leachate from the small pockets of marginally impacted of soil within the compacted cleanfill layer is likely to be minimal even without the 1 m layer of engineered fill crust, due to the fact that contaminant concentrations are expected to be at, or below, background in the majority of the compacted cleanfill layer[2].

Further investigation is requested and refinement is required through consent conditions

Limited further investigation has been undertaken, but the following Consent Conditions are proposed to ensure that the currently inaccessible portions of the site are investigated and remediated to the appropriate standard:

1. After the industrial activities at the quarry have permanently concluded, a supplementary detailed site investigation must be undertaken to investigate the parts of the site identified as being likely to contain contamination impacts by e3Scientific and Insight Engineering.

2. Applicability of the Remediation Action Plan, prepared by Insight Engineering, must be confirmed, based on the additional investigation results. The plan must be approved by the relevant territorial authority prior to commencement of remedial earthworks.

3. Remediation of the contamination impacts must be undertaken concurrently with the bulk subdivision earthworks, in accordance with the approved Remediation Action Plan.

4. A Site Validation Report must be prepared within 3 months of completion of the remediation earthworks. Details of the remediated areas, residual contamination concentrations, off-site disposal and on-site encapsulation works must be provided.

Appendix 1

Fulton Hogan Contractors Agreement including Fill Acceptance Criteria

CONTRACTORS FORMAL AGREEMENT

FILL ACCEPTANCE CRITERIA

Fulton Hogan requires that no contractor, or their sub-contractors shall deposit fill at their approved sites without having signed a formal agreement within the previous 12 months[1]. By signing this agreement, your business is confirming that the material being deposited meets the acceptance criteria outlined below:

Class 3 & 4[2] Fill Materials Restricted To:

- Glass (less than 1% by volume per load [e.g., incidental bottle]).
- Masonry Blocks
- Pavers, pipes and tiles that are made out of clay, concrete, and ceramic (nil asbestos content)
- Dry asphalt (cured)
- Bricks
- Ceramics
- Chip seal (cured)
- Concrete, un-reinforced (including dried concrete slurry)
- Concrete, reinforced (provided that there are no exposed reinforcing rods)
- Soils, rocks, gravel, sand, clay and other natural materials that are not virgin excavated natural materials, but are at or below local background concentrations at the disposal site.

AND

Class 5 Fill:

- Virgin excavated natural materials including soils, rocks, gravel, sand, clay and other natural material that are at or below local background concentrations at the disposal site.
- Inert manufactured materials (e.g., concrete, brick, tiles) less than 5% by volume per load.

No coal tar, road sweepings or hydro-excavated waste will be accepted

No material will be accepted that has been identified on Otago Regional Councils Land Use Register (https://maps.orc.govt.nz/portal/apps/MapSeries/index.html?appid=052ba04547d74dc4bf070e8d97fd6819) **as originating from a site where hazardous activities and industries have been located (HAIL).** This excludes any site where a detailed site investigation has been completed and reported which demonstrates that any contaminants in or on the site or the material to be deposited from that site, are at or below, background concentrations for the site at which the material is being deposited.

If it's discovered that material deposited is not listed on the acceptable materials list above, all testing and remediation costs will be passed back to the Contractor responsible.

This agreement requires annual renewal to allow continuation of this service.

Signed by (please print): _____ Date: _____

On behalf of: _____ Signature: _____

[1] This agreement has been developed to ensure compliance with Fulton Hogan's Resource Consents, and manage restrictions under the Waste Disposal Levy.

[2] Class descriptors in this document are as described by WasteMINZ Technical Guidelines for Disposal to Land – Revision 3.

Appendix 2

Fill Permeability Test Results

17 September 2026

Fulton Hogan Land Development Ltd
C/- Town Planning Group

Re: Fill Permeability Testing, Parkburn Development

Our Reference: 24019_7

1 Introduction and Scope of Report

JKCM Ltd, trading as Insight Engineering (IE), was requested to complete a permeability test within a test area of certified fill. The test was intended better understand the potential for stormwater to soak through fill to reach underlying layers.

This letter presents a brief description of the test and our calculations of the likely infiltration rate.

2 Soil Permeability Test

2.1 Objectives

Our brief was to assess the likely permeability of the future engineered fills that will be placed at the Parkburn Development, specifically fill that will overlie a future subsurface containment cell. This fill is to be comprised of crushed pea gravel.

Gravel crushing and compaction trials have been previously carried out to inform this aspect of the project, and these are described in detail in our Geotechnical Assessment Report dated 16 July 2026 (Version 4). Not all the information from our prior report will be reiterated herein, however one of the trials resulted in a fill pad being constructed at an earthworks site in Wanaka. This trial pad is considered to be representative of future fills at Parkburn and was a practical option for the permeability test.

2.2 Methodology

The soil permeability tests was completed on 14 September 2026. The test was completed within an area containing a trial pad constructed of crushed pea gravel fill. The trial pad was at least 1 m deep and was overlain by approximately 0.5 m of engineered fill sourced from local materials.

The test was carried out in a pit excavated using a 1.8T excavator, which extended through the local engineered fill and into approximately 200 mm into the crushed pea gravel pad. The sides and base of the test pit was squared and cleaned as much as practicable prior to filling with water.

The pit was filled with water to approximately 100-200 mm of the ground surface. The drop in water level was initially recorded every 5 minutes from a fixed point. The time intervals were gradually extended to 10, 20 and 30 minutes over a period of 4 hours as the water level dropped very slowly.

The test was terminated after a period of 4 hours and the observed drop in water level was 80 mm.

3 Results

Percolation/infiltration rates were calculated as per the attached worksheet.

Therefore, the calculated infiltration rates range between 4 x 10^{-6} m/s and 5.5 x 10^{-6} m/s (or 15 to 20 mm/hr).

4 Limitations

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

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

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

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

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

Report prepared by



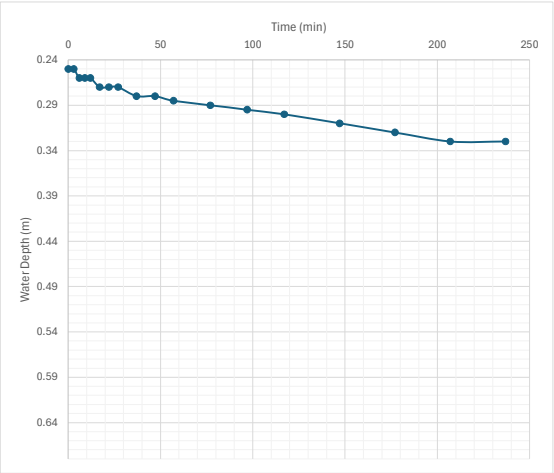
Jana Kruyshaar, CMEngNZ, MIPENZ
Principal Geotechnical Engineer

Attachment: Soil Permeability Calculation Worksheet

Measurements

Test 1

Time (min)	Difference in depth (m)
0	0.25
3	0.25
6	0.26
9	0.26
12	0.26
17	0.27
22	0.27
27	0.27
37	0.28
47	0.28
57	0.285
77	0.29
97	0.295
117	0.3
147	0.31
177	0.32
207	0.33
237	0.33



Calculations

Percolation Rate Calculation (Method 1):

$P = V_y/(AT \times X)$

Length pit	1.05	m
width pit	1	m
y*	0.01	m
d**	0.355	m
water vol V_y	0.0105	m^3
wall area A1	0.02	m^2
wall area A2	0.021	m^2
base area AB	1.05	m^2
total area AT	1.091	m^2
Percolation rate P	0.000321	m/min
Percolation rate P	0.321	mm/min
Percolation rate P	**19**	**mm/hr**
Percolation rate P	**5.35E-06**	**m/s**

*y is the depth difference btw the last 2 points
**d is the distance btw the midpoint of the last 2 readings and the base of the pit
X is the time interval between the last two points in minutes

BRE Digest Method:

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Length	1.05	m
Width	1	m
Depth	0.68	m
Area Base Abase	1.05	m^2
H eff storage depth	0.43	m
*V_{p75-25}	0.22575	m^3
75% depth	0.3225	m
25% depth	0.1075	m
50% depth	0.215	m
**A_{p50}	1.9315	m^2
***Tp75	237	min
****Tp25	unknown	min
T_{p75-25}	480	min
	28800	s
Infiltration rate f	**4.058E-06**	**m/s**
Infiltration rate f	**15**	**mm/hr**

*Vol lost btw 75% and 25% of effective depth
**Mean surface area at 50% depth (incl base)
***Time at 75% depth of effective depth
****Time at 25% depth of effective depth. This is unknown in this case.
T_{p75-25} is conservatively assumed to 8 hours i.e. double the total test time.

Steady State Percolation Rate (Empirical Curve-Flattening Method)
From Gemini:
20 mm/hr (base only)

Recommended Percolation Rate

Most conservative result:
5.5 x 10-6 m/s
20 mm/hr

Appendix 2

Figures



Note: Map and aerial photograph courtesy of Google



Description	Site Location Plan	**Figure Number**	1
Project	Preliminary and Detailed Site Investigation 922 Luggate-Cromwell Road, Cromwell	**Date**	Sept-26
Client	Fulton Hogan Land Development Limited c/- Tim James Limited	**Drawn by**	CM
Project Number	24019_3	**Approved by**	JK



Description	Sample Location Plan	**Figure Number**	2
Project	Preliminary and Detailed Site Investigation 922 Luggate-Cromwell Road, Cromwell	**Date**	Sept-26
Client	Fulton Hogan Land Development Limited c/- Tim James Limited	**Drawn by**	CM
Project Number	24019_3	**Approved by**	JK

Appendix 3

Proposed Subdivision Plan

NOTES:
- All roads to vest as legal road in the Central Otago District Council

AREAS AA-BR subject to Covenants

SUPER LOTS - See Sheet 6 Diagram A

SUPER LOTS - See Sheet 6 Diagram B

SUPER LOTS - See Sheet 6 Diagram C

Sheet 4

Sheet 5

Sheet 2

Sheet 3

LUGGATE - CROMWELL ROAD

A

B

C

Lake Dunstan
(Te Wairere)

N

Digital map data sourced from Land Information New Zealand (LINZ). Licensed under the Creative Commons Attribution 4.0 International licence https://creativecommons.org/licenses/by/4.0/ It is made available in good faith but its accuracy or completeness is not guaranteed. Landpro accepts no responsibility for incomplete or inaccurate information. If the information is relied on in support of a resource consent it should be verified independently.

ISSUED FOR CONSENT

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LANDPRO

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Client
FH LAND DEVELOPMENT LTD

NOTES
- All dimensions shown are in metres unless otherwise shown
- Copyright on this drawing is reserved
- Check any electronic data against the hardcopy plan to ensure it is the latest version
-If this plan is being used as part of sale and purchase agreement then it is done so on the basis that it is preliminary only, final dimensions and areas may vary on final survey

SCHEME PLAN- OVERVIEW - SHEET 1 OF 7
PARKBURN DEVELOPMENT PROJECT
922 LUGGATE - CROMWELL ROAD

Rev.	Date	Revision Details	By
A	16.09.26	Road Widths updated	SLM
B	23.10.26	All Road Widths updated to CODC Standard	SLM

Designed	Date	Job No.	Drawing No.
TJ	02.26	24113	100_01
Drawn	Date	Scale	
SLM	12.06.26	1:5000@ A3	
Checked	Date	Datum & Level	Rev.
NKA	12.06.26	LP 2000	B



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ISSUED FOR CONSENT

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Client

FH LAND DEVELOPMENT LTD

NOTES

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-If this plan is being used as part of sale and purchase agreement then it is done so on the basis that it is preliminary only, final dimensions and areas may vary on final survey

SCHEME PLAN - QUARRY AERIAL 2025 - SHEET 8 OF 8
PARKBURN DEVELOPMENT PROJECT
922 LUGGATE - CROMWELL ROAD

Rev.	Date	Revision Details	By
A	16.09.26	Road Widths updated	SLM
B	23.10.26	All Road Widths updated to CODC Standard	SLM

Designed	Date	Job No.	Drawing No.
TJ	02.26	24113	100_08
Drawn	**Date**	**Scale**	
SLM	12.06.26	1:5000 @ A3	
Checked	**Date**	**Datum & Level**	**Rev.**
NKA	12.06.26	LP 2000	B

Appendix 4

Site Photographs



Photo 1: Above-ground diesel storage tank at the asphalt plant.



Photo 2: No evidence of petroleum hydrocarbons in the bunded area.



Photo 3: Above-ground bitumen storage tank at the asphalt plant.



Photo 4: Bitument disposed to ground near the asphalt plant.



Photo 5: Waste bitumen disposed to ground south east of the cleanfill stockpile, facing west.



Photo 6: Waste bitumen disposed to ground south east of the cleanfill stockpile, facing south.

Description	Site Photographs	**Photos**	1 to 6
Project	Preliminary and Detailed Site Investigation 922 Luggate-Cromwell Road, Cromwell	**Date Taken**	6/11/26
Client	Fulton Hogan Land Development Limited c/- Tim James Limited	**Taken by**	CM
Project Number	24019_2	**Approved by**	JK



Photo 7: Southern face of the cleanfill stockpile at the eastern end, viewed from the east facing west.



Photo 8: Relatively small stockpile in the cleanfill area at the north eastern corner of the site, facing south west.



Photo 9: Eastern face of the cleanfill stockpile, viewed from the east facing north west.



Photo 10: Example of non-soil inclusions in the cleanfill stockpile.



Photo 11: Southern face of the cleanfill stockpile at the western end, facing east.



Photo 12: Surface of the cleanfill stockpile, facing north east.

Description	Site Photographs	**Photos**	7 to 12
Project	Preliminary and Detailed Site Investigation 922 Luggate-Cromwell Road, Cromwell	**Date Taken**	6/11/26
Client	Fulton Hogan Land Development Limited c/- Tim James Limited	**Taken by**	CM
Project Number	24019_2	**Approved by**	JK

Appendix 5

e3scientific PSI Report

Parkburn Quarry Preliminary Site Investigation

Fulton Hogan Limited

December 2021

Arrow Lane Arrowtown 9302
www.e3scientific.co.nz

Parkburn Quarry
Preliminary Site Investigation

Document Status

Version	Purpose of Document	Prepared By	Reviewer	Review Date
0.1	Draft for internal review	L. Salemink Waldren & S. Beardmore	G. Davis	20/10/21
0.2	Draft for client review	S. Beardmore	G. Davis	20/10/21
1.0	FINAL	S. Beardmore	G. Davis	6/12/21

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Executive Summary

Fulton Hogan Limited (FHL) operate Parkburn Quarry, immediately north of Pisa Moorings. The quarry was developed by FHL in the 1980s and has been in operation since this time. The quarry produces a range of aggregates, from sealing chip to construction and concrete aggregates. As the site is nearing the end of its operational lifespan, Fulton Hogan are seeking a plan change to rezone the site so that it can be redeveloped for a range of future land uses upon closure.

Currently, a range of activities associated with quarry operation take place on site, including asphalt production, concrete batching and block manufacture, disposal of cleanfill, and fuel storage. These activities are listed on the Ministry for the Environment's Hazardous Activities and Industries List (HAIL) and therefore any subdivision, change of use, or soil disturbance where these activities occur will be subject to the provisions of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS).

To assist Fulton Hogan in managing the risks associated with contaminants in soil, e3Scientific has undertaken a Preliminary Site Investigation (PSI) to identify the areas of potential contamination within the site, consider the risks to human health associated with the proposed development, consider the activity status of the future development under the NESCS, and assess the need for further investigation.

Based on the review of site history information and a site inspection, six discrete HAIL activities were identified. HAIL activities identified during this investigation include commercial concrete manufacture, asphalt manufacture, fuel storage, persistent pesticide use associated with the orchard, bulk storage of treated timber and waste disposal to land associated with the cleanfill. These HAIL activities are predominantly located in the industrial area on the northern portion of the property. Within the quarry itself, fuel and bitumen storage were the only HAIL activities identified.

Based on the proposed plan change and eventual development of the site, there is potential for workers and residents to be exposed to contaminants associated with the existing HAIL activities.

Within the future residential area, the identified HAIL activities include relatively small-scale hydrocarbon storage associated with the bitumen spray plant, a diesel tank and waste oil storage, and a diesel generator. It is possible that these activities could leave localised areas of hydrocarbon contamination. Although topsoil will need to be imported to this part of this site, there is a relatively low risk that inhalation of volatile contaminants would remain an open exposure pathway. Any topsoil imported to the site should be certified as meeting the appropriate human health and environmental criteria.

Within the future industrially zoned area, the identified HAIL activities include concrete manufacturing and batching, asphalt production, fuel storage, persistent pesticide use, treated timber storage, and disposal of cleanfill. We consider that it is highly unlikely that contaminants in soil associated with concrete manufacture, persistent pesticide use, and treated timber storage would pose a risk to human under the proposed commercial/industrial land use.

It is possible that contaminants associated with asphalt production, fuel storage and cleanfill disposal could result in soil contamination that could pose a risk to long term outdoor workers using the site in the future without appropriate investigation, remediation and/or management during development. The greatest risks are associated with hydrocarbon storage, particularly around any underground fuel storage infrastructure (e.g. fuel supply pipelines). Risks associated with the disposal of cleanfill appear relatively low; however, given the long history of filling, it is possible that localised areas of contaminated fill material may be present.

Given the on-going use of the site for these HAIL activities, it would be appropriate to complete additional investigation upon decommissioning of any potentially contaminating land uses. These investigations may also be better able to assess risks to human health as plans for the proposed development become more detailed.

1 Introduction

1.1 Purpose

Fulton Hogan Limited (FHL) operate Parkburn Quarry, immediately north of Pisa Moorings. The quarry was developed by FHL in the 1980s and has been in operation since this time. The quarry produces a range of aggregates, from sealing chip to construction and concrete aggregates. As the site is nearing the end of its operational lifespan, Fulton Hogan are seeking a plan change to rezone the site so that it can be redeveloped for a range of future land uses upon closure.

Currently, a range of activities associated with quarry operation take place on site, including asphalt production, concrete batching and block manufacture, disposal of cleanfill, and fuel storage. These activities are listed on the Ministry for the Environment's Hazardous Activities and Industries List (HAIL) and therefore any subdivision, change of use, or soil disturbance where these activities occur will be subject to the provisions of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS).

To assist Fulton Hogan in managing the risks associated with contaminants in soil, e3Scientific has undertaken a Preliminary Site Investigation (PSI) to identify the areas of potential contamination within the site, consider the risks to human health associated with the proposed development, consider the activity status of future development under the NESCS, and assess the need for further investigation.

1.2 Proposed Development

Fulton Hogan are proposing to rezone the quarry through a private plan change. Draft concept plans provided by Fulton Hogan indicate that the site could potentially accommodate a wide range of uses, including residential (standard and high density), commercial, retail commercial, childcare / education, green space, and industrial (Figure 1).



Figure 1: Draft concept plans

The residential areas will be located towards the south of the property, where the current quarry operations are located, adjacent to the existing Pisa Moorings development. The residential areas could be located around man-made waterways and inlets, as found in the southern area of Pisa Moorings. The commercial and industrial areas will be located towards the northern boundary of the site, where these types of activities currently take place.

As the developed areas of the quarry have been stripped, topsoil for residential areas will need to be imported, either from off-site or from stockpiles of soil stripped during quarry operations.

1.3 Scope of Work

The scope of work completed during the investigation included the following:

- Review of land use history from historic aerial photographs, certificates of title, Central Otago District Plan (CODC) property files, and information available from the Otago Regional Council (ORC).
- Completion of a site inspection and review of existing physical environment.

- Development of a conceptual site model identifying potential contaminant sources, the possible routes of exposure to contaminants that may be present in soils on the site, and critical receptors.
- Consideration of risks to human health, the need for any further investigation, and the status of the development under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (the NESCS).
- Preparation of a Preliminary Site Investigation report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No. 1: Reporting on Contaminated Sites in New Zealand (Ministry for the Environment, 2021).

e3Scientific's experience in the provision of contaminated land services is provided in Appendix A.

1.4 Limitations

The findings of this report are based on the Scope of Work outlined above. e3Scientific Limited (e3s) performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental science profession. No warranties, express or implied, are made. Subject to the Scope of Work, e3s's assessment is limited strictly to identifying the risk to human health based on the historical activities on the site. The confidence in the findings is limited by the Scope of Work.

The results of this assessment are based upon site inspections conducted by e3s personnel, information from interviews with people who have knowledge of site conditions and information provided in previous reports. All conclusions and recommendations regarding the properties are the professional opinions of e3s personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, e3s assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside e3s, or developments resulting from situations outside the scope of this project.

Observations and assessments of the site are relevant to the time of inspection and the scope of this assessment. Investigations were limited to the site

investigation area. e3Scientific notes that the continued operation of the site could result in contamination that may alter the status of the site under the NESCS.

2 Site Location and Description

2.1 Site Location

The area under investigation (the site) is located at 922 and 922A Luggate-Cromwell Road (SH6) (see Figures 2 and 3). The site is situated between Lake Dunstan and the state highway, approximately 8 km north of Cromwell.

The property to the immediate north of the site is owned by Downer EDI Limited, and accommodates a quarry, associated support buildings and infrastructure associated with civil construction and road maintenance. Beyond the Downer EDI quarry, the land is primarily agricultural (pastoral) with some rural residential use. The southern boundary backs onto the Pisa Moorings residential housing development. The land west of the site, opposite SH6, is used for a combination of lifestyle, grazing and viticulture. Lake Dunstan lies immediately to the east of the site. A public walkway/cycleway traverses the lakeside marginal strip along the lake edge. From the southern boundary, the site extends approximately 980 m to the north and covers an area of approximately 120 ha.

The central coordinates of the site are E: 1304358 N: 5014130 (NZTM)

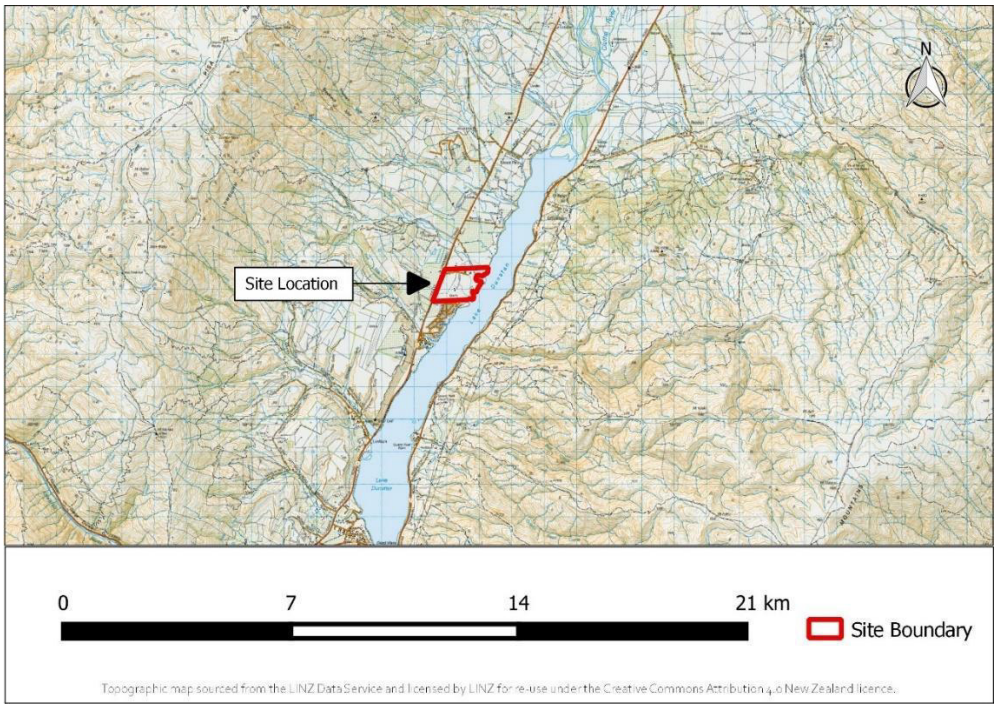


Figure 2: Site Location (topographic)

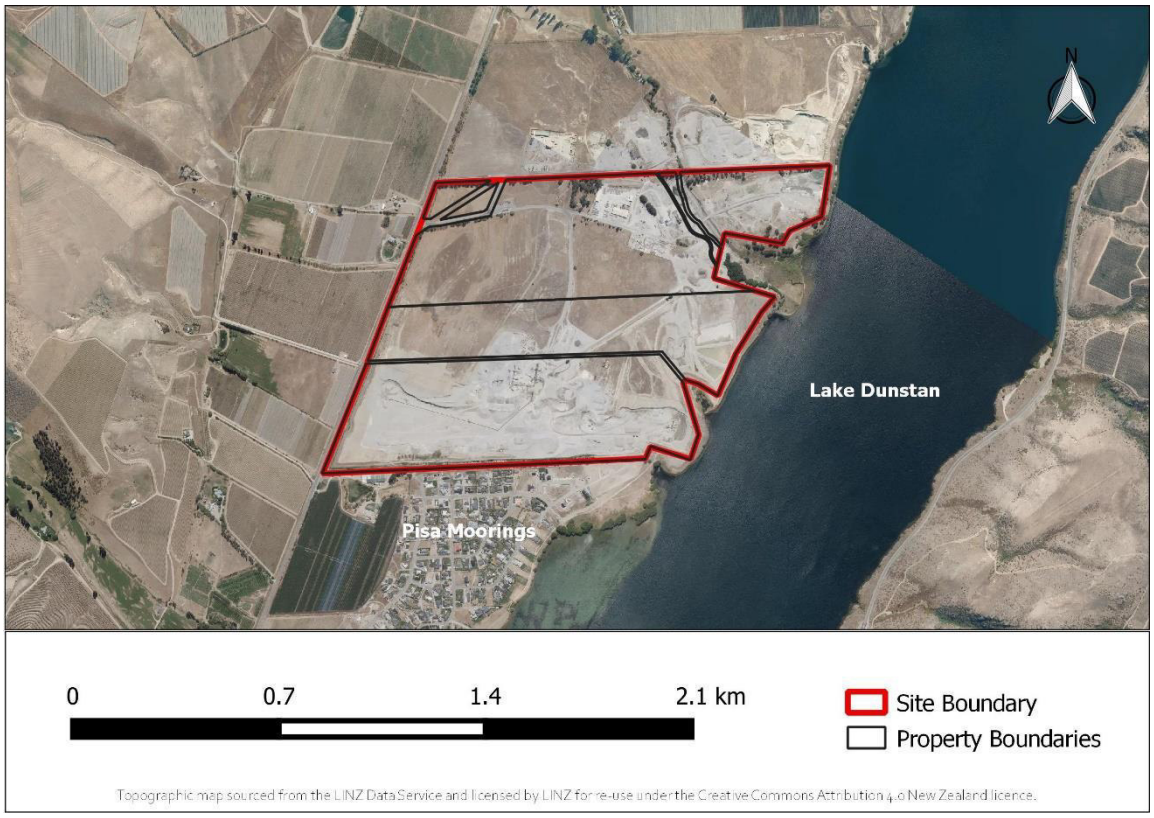


Figure 3: Site location (aerial)

The site is zoned Rural in Central Otago District Council District Plan, and eastern portion of the site is subject to Scheduled Activity notation SA25A – 'Gravel Pit Parkburn.'

2.2 Topography

Natural ground at the site slopes gently in a southward direction with an elevation 220 m above mean sea levels in the northwest corner to 199 m above mean sea level in the southeast corner. The local topography is highly influenced by the operation of the quarry, with active faces approximately 10 m high in the southern part of the site.

2.3 Geology

Based on the 1:250,000 Geological Map of New Zealand, the site is situated primarily on Late Pleistocene River deposits consisting of unweathered to slightly weathered, loose, sandy well-rounded gravel usually on the large outwash plains. There is a small section on the central northern boundary of the site that is situated on Holocene River deposits. These consist of loose commonly angular, boulders,

gravel, sand and silt forming alluvial fans; grades into scree (upslope)and valley alluvium (GNS Science, 2021).

2.4 Hydrogeology

The site overlies the Pisa Groundwater Management Zone. This zone is not identified in the current Regional Plan: Water or any of its schedules but has been identified in the draft/recommended aquifers on the ORC Water Allocation for Consultants webpage. The Groundwater Management Zone extends through the Late Pleistocene River deposits east of SH6 and Holocene river deposits that extend up the valleys of the foothills that run west of SH6. Groundwater beneath the site flows east through the alluvial terraces towards Lake Dunstan. The aquifer is unconfined with generally highly permeable sediments that are comprised of sandy gravel or sandy cobble gravel and is likely to be hydraulically connected to Lake Dunstan.

There are four bores on site, with reported depths to water ranging from 9.9 to 12.6 metres below ground level (mbgl). e3s examined the bore logs from nearby bores to assess the likely aquifer thickness and permeability. No basement rock was found in nearby bores; however, there was clay at the base of G41/0319 and clay-bound gravels at 30 mbgl in G41/0465 at 40 mbgl, which may function as the base of the aquifer. This indicates the saturated thickness of the aquifer may be 10-15 m.

There are 36 recorded bores within a 1km radius of the site's location (Figure 4). Of these bores, the primary usages are: 14 for Irrigation, 16 for domestic use, 3 for community supply, 2 for commercial/industrial, 1 for investigation, and 1 is unknown.

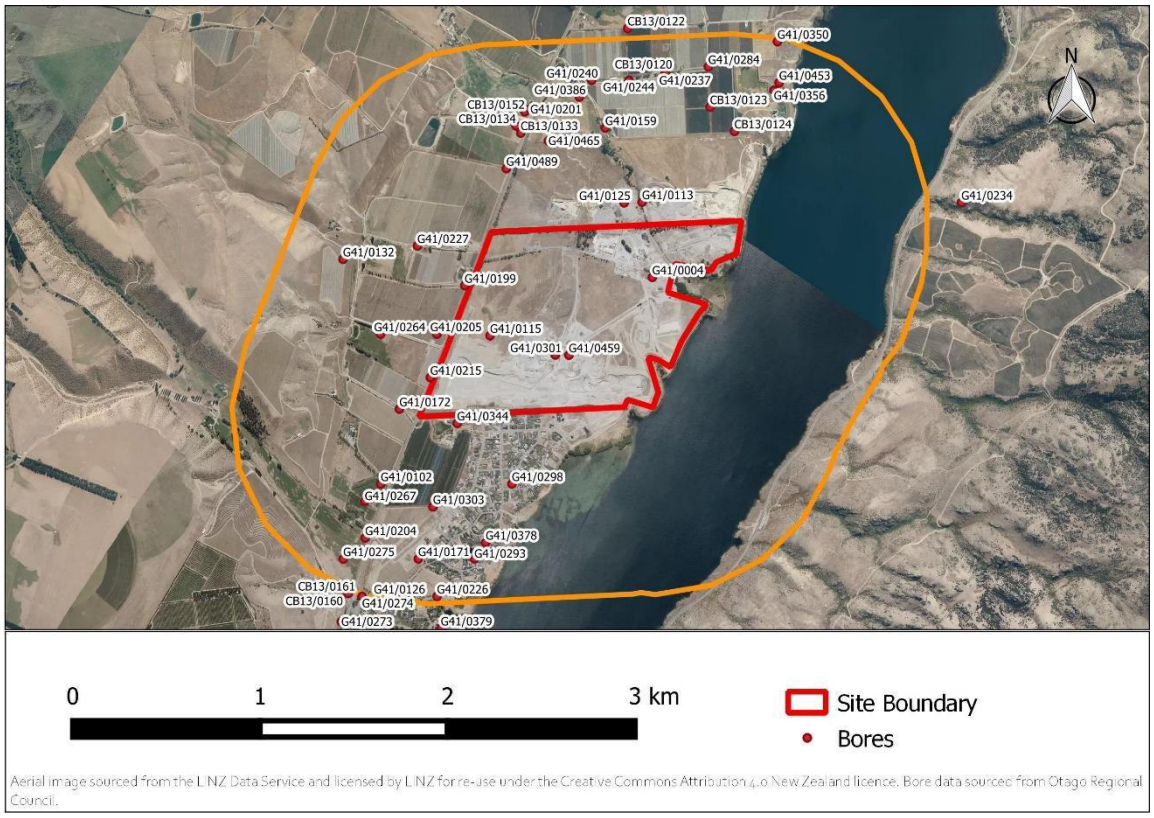


Figure 4: Registered bores within 1 km of the site

Lake Dunstan borders the site's eastern boundary. The lake is utilised for a wide range of water related pursuits including swimming, fishing and boating. To enable these pursuits, access is provided throughout the length of the Lake, including roads to the north and south of the Quarry. The Park Burn, and associated marginal strip, passes through the north-eastern corner of the site. Visible water races can be seen across the pastoral land in the north of the site. There are also several channels and ponds within the quarry site.

Table 1: Summary of Site Location and Description

Address	922 & 922A Luggate Cromwell road, Mount Pisa, 9393
Legal Descriptions	Section 64-65 Block IV Wakefield Survey District, Part Section 62-63 Block IV, Part Section 63 Block IV Wakefield survey District and Section 1 Survey Office Plan 365897.
Location	North of Pisa Moorings residential area, West of lake Dunstan, East of SH6 and approximately 1.5 km south of Smiths Way.
NZTM Coordinates	E: 1304358 N: 5014130 (NZTM)
Owners	Fulton Hogan Limited
Site area	120 ha
Surrounding Land Uses	North: Agricultural farming, commercial/industrial. East: Lake Dunstan South: Residential housing West: Viticulture
Regulatory Authorities	Regional Authority: Otago Regional Council Local Authority: Central Otago District Council
Zoning	Rural Resource Area
Topography	Sloping from south-east to the north-west corner, but heavily influenced by quarry operations
Geology	Late Pleistocene River deposits
Hydrogeology	Pisa Groundwater Management Zone
Nearest Surface water	Lake Dunstan directly to the east, Park Burn passing through the north-east corner and small water races running through the site.
Current Land Use	Industrial and commercial
Future Land Use	Residential, industrial, and commercial

3 Site History

3.1 Historical Certificates of Title, Maps and Surveys

Online available historical maps and images of the area available from the 1800's to present day were accessed via the National Library Cartographic Collection on 23 September 2021 and MapsPast.org.nz on 19 August 2021.

A perpetual lease for what is now Sections 62 and 63 was issued to Robert Davidson in 1894. The lease was transferred to a series of private owners (some of which are illegible on the scanned copy of the deed) in 1905, 1940, and 1947. In 1983, the eastern portion of the site was acquired by the Crown for electricity generation so that it could be inundated by Lake Dunstan. In 1985, the lease was transferred to Robert and Charles Perriam, farmers, and a new certificate of title (10B/738) was issued. In December 1985, the title was transferred to Fulton Hogan Limited, and a mining license commenced on 20 July 1987. In 2008, two sections were declared to be road and vested with Central Otago District Council, and an adjoining road was stopped and amalgamated with the adjoining land to create the current title (407414).

The land that is now Sections 64 and 65 was also appears to have been leased for agricultural use until it was transferred from the Perriams to Fulton Hogan Limited in 1985.

Historic surveys and certificates of title are provided in Appendix B.

3.2 Historic Aerial Photography

Aerial images sourced from retrolens.nz, the National Library, and from Google Earth Pro and Google maps street view have been reviewed. A summary of notable observations is presented in Table 2. Selected images are included in Appendix C.

The review of aerial photographs was completed using digital copies of the images, which provide higher resolution than those provided in the appendix.

Table 2: Summary of Aerial Images and Maps

Date	Source	Site Observations
07.03.1958	Retrolens	An unsealed driveway runs from SH6, approximately 150 m south of the northern site boundary, across the site, to a house, just beyond the eastern boundary of the site. A small orchard is visible between the driveway and the Park Burn. Most of this orchard lies outside of the site boundary to the east; however, approximately 1000 m^2 is within the site. The remainder site is flood irrigated pasture, with several farm tracks and water races visible. The Clutha Mata-Au is approximately 450 m east of the site.
01.03.1975	Retrolens	An irrigation pond has been created south of the orchard visible in the previous image. Four rectangular shapes/structures are visible on the site, two located together within the central parcel and two separated on the southern parcel. The balance of the site continues to be used for flood irrigated pasture. Stacks of felled trees are visible in the central northern portion of the site.
14.11.1976	Retrolens	The majority of the site is similar to the previous image. The rectangular structures visible in the previous image have been removed, with no sign of soil disturbance, suggesting these were most likely bales of hay/feed. Felled trees can still be seen in the central northern section of the site.
20.02.1978	Retrolens	There are no significant changes from the previous image.
17.02.1983	Retrolens	There are no significant changes from the previous image.
19.02.2001	Retrolens	Lake Dunstan has been filled, up to the eastern site boundary. Gravel extraction in the northern portion of the site, on both sides of the Park Burn, has commenced. Two structures associated with present day asphalt plant are visible to the west of Park Burn. There is a small pond visible in the north-east corner of the site. The southern portion of the site remains largely unchanged.
27.02.2003	Retrolens	Quarrying extends further south along the eastern site boundary. The ponds in the north-eastern corner of the site are much larger. The southern portion of the site remains largely unchanged.

Table 2 (continued)

Date	Source	Site Observations
02.2007	Google Earth (c)	A second area of quarrying along the southern boundary, connected to the main driveway by two haul roads, is visible. The ponds in the north-east corner of the site have been filled, and series of small ponds can be seen in pits on the eastern side of the site. In the centre of the northern section, two additional buildings, parking area, and material storage associated with the concrete block manufacturing plant has been established. A gate house and weighbridge has been established near the entrance to the site from SH6. South of the site, Pisa Moorings has been established, with several house and roading infrastructure in place.
10.2011	Google Earth (c)	The layout of the site remains largely the same as the previous image. The quarry to the south has been extended further east and west. The series of ponds in the central/eastern portion of the site have extended further south, and these are in various stages of being filled, with discrete loads of material visible in three of the ponds. The banks of the Park Burn have more vegetation.
12.2015	Google Earth (c)	The overall layout of the site remains unchanged, and the progression of quarrying and filling has continued through the site.
11.2019	Google Earth (c)	The overall layout of the site remains unchanged, and the progression of quarrying and filling has continued through the site. Two more locations have been setup as work yards with infrastructure in place. Both are within the north-eastern section of the site.
06.2021	Fulton Hogan	A recent drone image shows the site in its current configuration. Again, the overall layout of the site remains unchanged, and the progression of quarrying and filling has continued through the site. South of the site, Pisa Moorings is fully developed.

3.3 District Council Information

e3s was provided resource consent and building consent documentation for the site from the Central Otago District Council.

The following information was found in the property file:

- A 1988 building permit (F037756) to erect an office building at the existing weighbridge.

- A 1990 building permit (H056122) to erect a relocated bitumen storage shed. Plans provided with the application show diesel storage at the weighbridge and asphalt plant, and kerosene near the bitumen shed. The weighbridge is located approximately 120 m southeast of the asphalt plant.

- A 1995 building consent application (BC950406) and associated processing information for the installation a shed at the asphalt plant. Plans provided with the application show diesel storage at the weighbridge and asphalt plant.

- A 2004 building consent application (BC040935) and associated processing information for the installation of a prefabricated Portacom building near a new weighbridge, approximately 250 m from the site entrance. The Portacom building was used as an office and washroom and included a single chamber septic tank and wastewater disposal field.

- 2005 building consent and resource consent applications (BC050850 RC050211) and associated processing information for the construction of concrete block processing facility, capable of producing a range of concrete products including masonry, paving stones, landscaping, and other associated building products. The facility is constructed from pre-cast concrete block building and includes a single chamber septic tank and wastewater disposal field. Information in the file also indicates that a 10,000 L diesel tank is used to provide fuel for a boiler, and cement is stored in silo adjacent to the main building. Wash water is channelled into a collection area and settling ponds, after which the water is to be recycled or directed to a soak pit.

- A 2006 building consent application (BC060538) to relocate a Portacom for staff facilities at the weighbridge.

- A 2007 resource consent application (RC070216) and associated processing information for a land use consent to extract and convey sand and gravel. The purpose of the consent was to allow extraction outside of the Scheduled Area provided in the district plan, and to convey these products to the existing processing plant.

- A 2015 building consent application (BC150440) to add an extension to the side of a shed to allow for the installation of a 40,000 L vertical bitumen tank. Plans for the consent show the layout of the asphalt plant, including diesel and kerosene tanks, loading bins, and bitumen spray release.

- A 2015 building consent application (BC150689) and associated processing information for a single pitch storage shed at the concrete block processing facility.

- A 2016 building consent application (BC160880) and associated processing information for the installation of a transportable office on piles near the weighbridge.

- A 2018 building consent application (BC180636) and associated processing information for the foundations and site works for a Portacom office near the weighbridge.

- A 2019 resource consent application (RC190341) and associated processing information to construct three additional relocatable offices/amenities buildings near the weighbridge. The is consent was later amended (RC200046) to allow two further Portacom buildings to be established. There are three subsequent building consents (BC200395, BC190440, BC190726) associated with these structures.

- A 2020 resource consent application (RC210112) and associated processing information to build a commercial shed for a glass crushing plant. Power for the crushing plant is provided by a standalone generator. The fuel source for the generator is not described in the application. There is a subsequent building consent (BC210205) to install a recycled glass materials shed.

- A 2020 building consent application (BC200568) and associated processing information to install a Smart Shelter container roof.

- A 2020 building consent application (BC200771) and associated processing information for foundation and drainage works to install an ablution block. Wastewater is discharged to an existing septic tank.

- A 2021 resource consent application (RC210129) and associated processing information to install two 20,000 litre diesel fuel tanks to replace

one 30, 000 litre diesel fuel tank, located approximately 20 m WSW of the asphalt plant. The tank is noted to be scheduled to be removed mid-2021.

None of the Project Information Memoranda for the above consents identified the likely presence of any hazardous substances, and available plans did not specify the use of any asbestos containing materials (ACM). Supporting documentation from the district council is too large to append but can be provided upon request.

3.4 Regional Council Information

e3Scientific reviewed Otago Regional Council's Hazardous Activities and Industries List (HAIL) Register and consent information on 23 September 2021 and requested information on any Resource Management Act incidents or complaints related to the site.

Part of the site is currently recorded on the Otago Regional Council's HAIL database. This piece of land is registered as site number HAIL.00359.01, as verified HAIL site under the category E2: Asphalt or Bitumen Manufacture. The site is noted as a consented asphalt plant. An underground petroleum storage system (UPSS) removal report was received by the ORC from Z Energy in 2015. The investigation confirmed that residual contamination was acceptable for commercial/industrial land use. However, because of the on-going use as an asphalt plant and other areas of hazardous substance storage, this site is recorded with a contamination status of 'partially investigated.' The UPSS removal report is discussed further in section 3.5.

With regards to the balance of the site, the ORC notes that the database is continually under development and should not be regarded as a complete record of all properties in Otago. The absence of available information does not necessarily mean that the property is uncontaminated; rather no information exists on the database.

There are 25 resource consents associated with the site. Of these, thirteen are expired, five are surrendered, and six are current. Eight of the 25 consents are associated with construction of bores or groundwater takes, Seven are associated with discharges to air from an asphalt plant, six are associated with discharges of water, silt and/or sediment to land for processing aggregate, dust suppression, and truck washing, one is associated with a crossing over the Park

Burn, one is to discharge dust from the quarry operation, and one is to discharge solid fill to land for the purpose of backfilling the quarry.

The Otago Regional Council confirmed that there are four Resource Management Act incidents or complaints recorded for the site. Three of these are associated with dust. The fourth was a complaint regarding odour associated with stockpiles of broken glass.

Supporting documentation from the regional council is provided in Appendix D

3.5 Previous Investigation Reports

The only contaminated land investigation report available for the site is a 'Site Assessment for the Removal of an Underground Petroleum Storage System at the Fulton Hogan Asphalt Plant, Parkburn Quarry, 922 Luggate-Cromwell Road, Cromwell, Central Otago' prepared by Pattle Delamore Partners for Z Energy in 2015.

The report describes the results of soil benchmarking and Tier 1 risk assessment following the removal of a 10,000 L kerosene tank, 10,000 L diesel tank, and associated pipework in October 2014. The two tanks were located end to end in a single tank pit. All thirty samples collected from the tank pit, fuel pipelines and vent risers contained petroleum hydrocarbons below the relevant tier 1 soil acceptance criteria for commercial/industrial land use and for the protection of groundwater quality.

A dispenser within the bituminous emulsion manufacturing building and a 7 m section of pipeline were not removed at the time, and two new aboveground tanks replaced the removed UPSS.

4 Site Inspection

e3s staff conducted a site walkover on the 28th of September 2021. e3s staff were accompanied by Matt Goulding, Fulton Hogan's Central Quarries Operations Manager.

The site inspection was conducted in accordance with the Contaminated Land Management Guidelines No. 5: Site investigation and analysis of soils (revised 2021) (Ministry for the Environment, 2021).

Information gathered during site inspections included:

- General site condition, current use, local topography, and surrounding environmental setting.
- The condition of the buildings.
- The nature of the ground surface across the site.
- The location and condition of surface watercourses, drainage systems, and any groundwater wells.
- Visible signs of contamination or potential contamination, such as evidence of spills or leaks, surface staining, absent or stressed vegetation, and odours.
- Visible signs of areas of fill, stockpiled material, waste, ground disturbance, burnt areas, and former building foundations.
- The location of any chemical storage and transfer areas, bunding, waste storage areas, and discharges.
- The land use of neighbouring properties that have the potential to have an impact on the site or be affected by contamination from the site.
- The location of former buildings, processes or activities undertaken on the site.

The wider site layout is shown in Figure 55, and descriptions of the main parts of the site are provided in the following sections. Site photographs and observations are provided in Appendix E.



Figure 5: Site Layout

4.1 Weighbridge and offices

The weighbridge and site offices are located approximately 250 m from the SH6 entrance to the property.

There are five Portacom style buildings in addition to the weighbridge. All buildings appeared to be in good condition. The surface cover is predominantly hard stand, gravels, and landscaped areas (Figure 66).

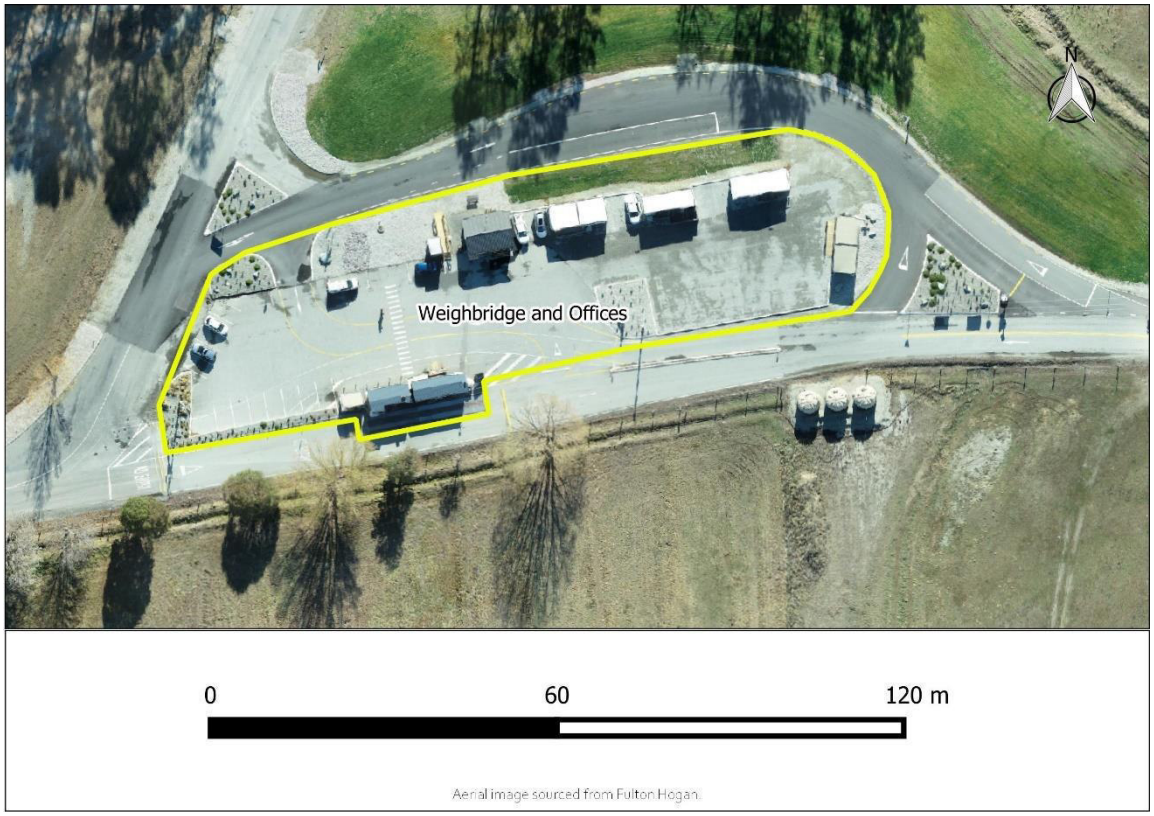


Figure 6: Weighbridge and offices

There was no evidence of any hazardous substance use or storage in this area.

4.2 Industrial Area

Approximately 200 m east of the weighbridge, approximately 7.5 ha of land is used for industrial activity, predominantly related to asphalt and concrete manufacturing.

Activities in this area include: the Firth Concrete block manufacturing facility, the Fulton Hogan asphalt plant, the Allied Concrete batching plant, a yard formerly

used for producing pre-cast concrete panels for the Frankton Marina, a truck wash, and truck parking area (Figure 77).

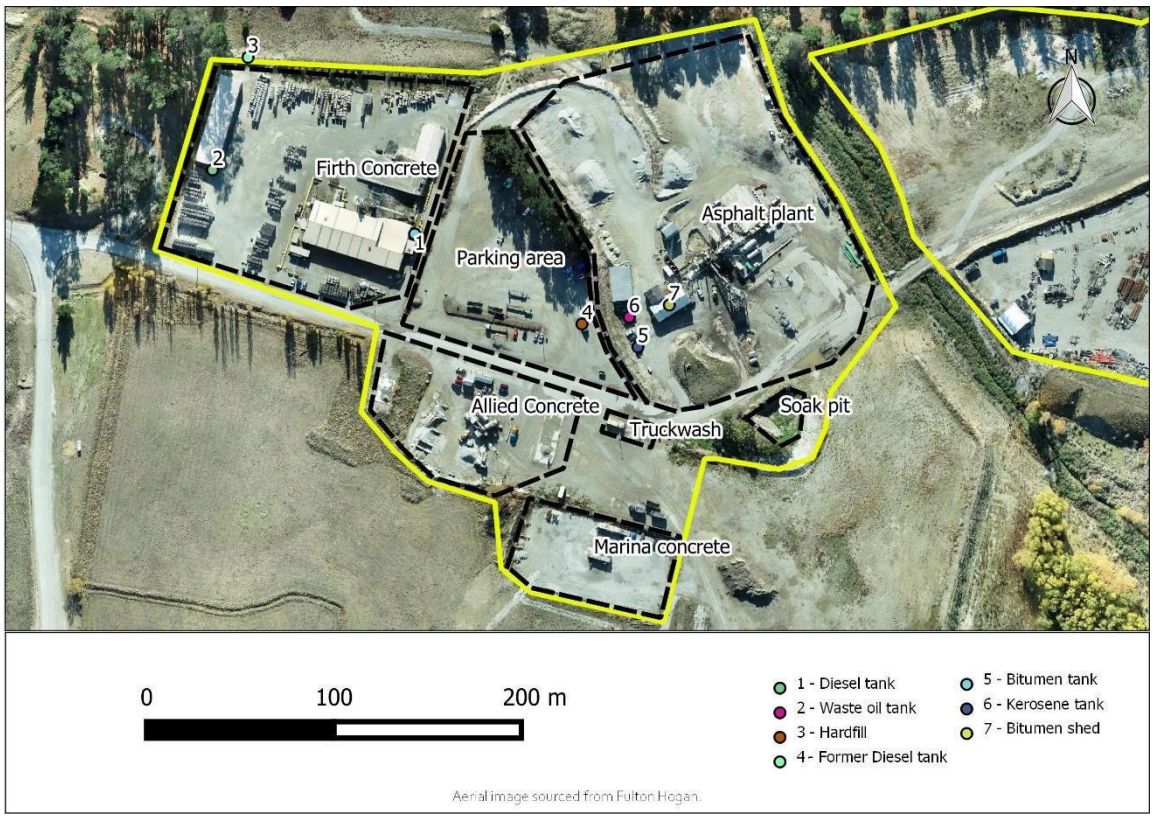


Figure 7: Industrial area activities

The Firth Concrete block manufacturing facility is located on the western end of the industrial area. The gravel yard was generally tidy and well kept. A 10,000 L diesel tank is located to the east of the manufacturing building (1). An open storage shed is located along the western boundary of this area. A small, waste oil 'igloo' was present to the south of the open shed (2). There was no staining around the waste oil tanks. Several empty drums of concrete retardant (Sika Retarder) were stored behind (west of) the open shed. Hardfill, consisting of broken concrete tiles and blocks was deposited over the landscape bund, north of the factory (3).

East of the Firth Concrete block manufacturing facility, an open yard is used as a parking area by Fulton Hogan Transport. An above ground diesel tank (4) associated with the nearby asphalt plant, was removed from the site in September 2021. Evidence of disturbed ground beneath the removed tank, including some soil on a plastic sheet, was still present. There was no evidence of staining or odour in this area. Underground fuel lines, running to the asphalt plant are reportedly still present.

The asphalt plant itself is located down an embankment to the east of the parking area. The plant is comprised of aggregate feeder bins, bitumen storage tanks, mixing drum, conveyor belt feeding, asphalt storage silos, a bag house and an operations office. The asphalt plant can produce up to 120 tonnes per hour (tph) of asphalt but will typically run at a production rate of approximately 80 tph. Bitumen and kerosene are stored in a bunded above ground tank at the base of the terrace. Bitumen is also stored in a shed near the plant. The ORC resource consent specifies that the plant can be run on used oil; however, to date only diesel fuel has been used.

The Allied Concrete batching plant is located on the opposite side of the main access road from the transport yard. The batching plant appears to be located at the repurposed weighbridge, where diesel fuel storage was noted in plans with several of the building consent applications. Immediately south of the batching plant, there is a gravel yard which was used by a company to produce concrete panels for the construction of the Frankton Marina in 2018. These areas appeared generally tidy.

A truck wash is located on the south side of the main access road. Run-off from the truck wash flows down the site of the access road into an infiltration pond. This is one of the discharge points authorised by ORC consent RM15.108.02. There was no oily sheens or hydrocarbon odour associated with the run-off water or sediment at the truck wash.

4.3 Cleanfill and Yards

On the opposite side of the Park Burn, an area of past quarrying is now used for cleanfill disposal and for outdoor yards used by JCL Asphalt Limited and several divisions of Fulton Hogan (Figure 8).

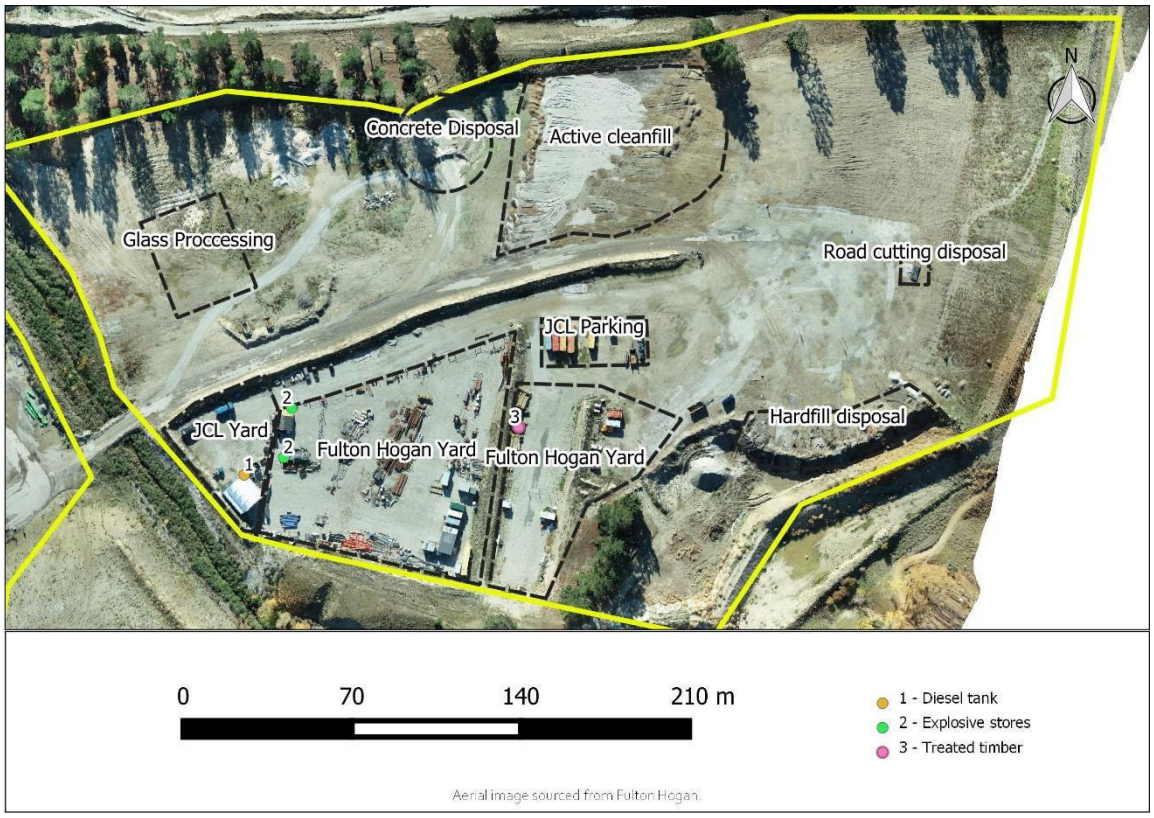


Figure 8: Cleanfill and yards area

A new shed, which will be used for crushing and storage of recycled glass, has been constructed. This building was consented under RC210112. During the site inspection, drainage work was being completed, but storage and crushing of glass had not yet commenced.

Beyond the new glass processing shed, an excavation is used for disposal of surplus concrete. Further to the east, there are two active (1-2 m high) faces used for cleanfill disposal. A concrete bay just east of the weighbridge at the entrance to the site is used for drop-off of small loads of cleanfill by Fulton Hogan and their sub-contractors. This material is then relocated to the cleanfill face. Visible material was predominantly soil, rock, and gravel, with occasional loads of cured asphalt, and some scattered broken glass across the surface of the cleanfill. A separate area is used for disposal of hardfill, including concrete, tile, bricks, and cured asphalt, as well as soil, gravel and rock. Disposal of material at the cleanfill is authorised by ORC resource consent 99664.

A Cleanfill Management Plan prepared by Fulton Hogan outlines the procedures required to achieve environmental best practice. Visual inspections of the quality of the fill material coming to the site are completed to ensure the material is consistent with resource consent requirements. If a non-complying load is

identified, the cleanfill operator is to isolate the load and advise the Quarry Manager immediately. Signage is in place at the entrance to the cleanfill, providing a clear description of acceptable materials. Material is not to be accepted from any Hazardous Activities and Industries List (HAIL) sites unless it has been suitably analysed.

A partially buried skip is used for temporary storage of waste from high pressure water cutting used during roading maintenance work. The skip is covered and sealed, with waste periodically taken to landfill when full.

To the east of the hardfill disposal area, finished areas of the cleanfill have been capped with gravel for use as open yards for other divisions of Fulton Hogan, as well as JCL Asphalt.

At the JCL Asphalt yard, there is a moveable above ground diesel tank located in the corner of the container shelter (1). Some soil staining was also visible. In this area, there were also 4 x 1,000 L IBC of concrete additive (Sika Viscacrete), with some visible product on the ground below the IBCs. The Fulton Hogan civil engineering and construction yards were predominantly used for the storage of building supplies and equipment. There were two small steel explosive storage containers (2) used by the Fulton Hogan geotechnical team. There was also a stack of CCA treated telephone poles (3) in the construction yard. Otherwise, there was no evidence of hazardous substance storage or use in these areas, and surface gravels were free of staining.

4.3.1 Cleanfill and Hardfill XRF Results

An Olympus Vanta field portable X-Ray Fluorescent Spectrophotometer (XRF) was used to collect in-situ field readings of heavy metal concentrations at 40 locations within the active faces of the cleanfill and hardfill disposal area, and across the finished cleanfill surface. For comparison, 10 readings were also taken from undisturbed ground under the pine trees, north of the cleanfill area to provide an estimate of naturally occurring background concentrations. Although not as precise as laboratory analysis, use of an XRF enables a rapid screening-level assessment of soil contaminant concentrations. A table of XRF screening results is provided in Appendix F, and raw results exported from the instrument are available upon request.

XRF instrument checks were undertaken in accordance with e3Scientific's XRF standard operating procedure. These included checking the functionality of the XRF, performing an energy calibration and checking the calibration of the XRF with a certified reference material (NIST 2711a) and a silicon dioxide blank, monitoring analysis time, and ensuring the integrity and cleanliness of the XRF sampling window throughout the sampling.

To collect readings, samples were checked for large non-representative debris, e.g. large pebbles or roots, and these were removed from the sample prior to analysis with the XRF. Soil was gently tamped down to provide a uniform surface for the instrument window. One reading was taken from each location, using two beams, with analysis times of 30 seconds and 3 seconds.

All instrument blank readings returned results of 0.0 parts per million (ppm), with the exception of one zinc reading, which measured at 7.0 ppm. This reading may have been associated with dust within the instrument. Given the range of concentrations detected on site (53 to 385 ppm), this is not considered significant.

One or more heavy metals in 14 out of the 40 samples exceeded the background concentration established using the XRF; however, for 4 of these, the exceedance was by less than 35%, within the expected precision of the XRF. Three samples exceeded the Manaaki Whenua Landcare Research (2015) predicted background concentration by more than 35%, indicating that there is a higher likelihood that contaminants in excess of the local natural background were present in these samples.

4.4 Quarry Area

The active quarry occupies approximately 60 hectares over the southern half of the site. Extraction of sand and aggregate within the eastern two-thirds of the site is allowable under the Scheduled Activity designation in the district plan. Quarrying in the western third of the site is authorised by RC070216, which was issued in 2007. The current layout of the quarry is shown in Figure 99 below.

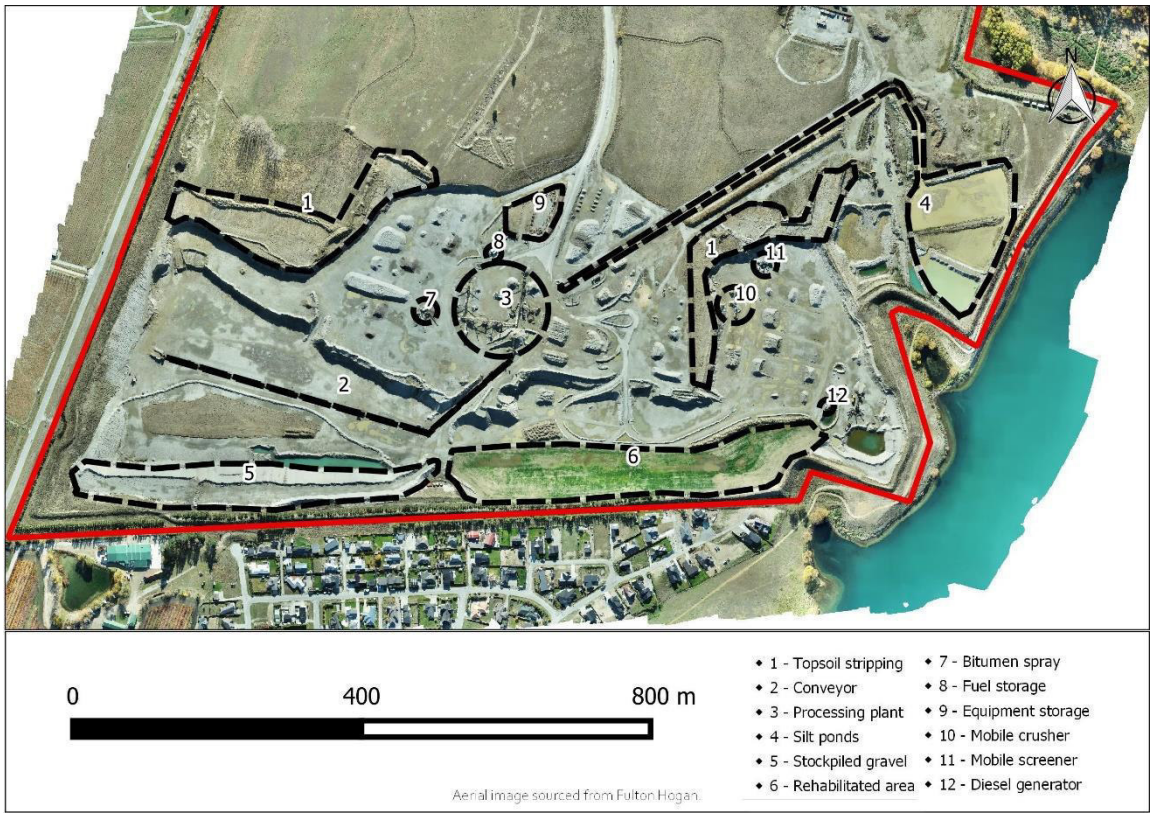


Figure 9: Quarry layout

Topsoil and overburden are stripped from the natural ground surface in advance of the active quarry faces (1). Within the consented quarry area, the extracted material is transported, using a conveyor belt system (2), to the crushing plant (3). Water is sprayed over aggregate as it passes through the plant on a screened conveyor. Debris and sediments are washed off the gravels, and wash water from the processing plant is discharged through a sludge channel to a series of silt ponds (4), which remove sediment from the water. No flocculants are used in this process. Water evaporates or infiltrates through gravels at the base of the ponds. After processing, the sorted material is stored at the site prior to dispatch.

Surplus pea gravel (4.5 to 8 mm gravels) from processing is used for reclamation within the quarry. These gravels are currently being used to form a 1V:3H batter along the southern face of the quarry (5). Topsoil stripped from the site is then placed over the pea gravels and grassed (6).

Roading chip produced at the processing plant is sprayed with a bitumen emulsion at a processing plant in the quarry (7). Bitumen is stored in a 30,000 L tank. The bitumen-coated chip is stored in separate stockpiles at the quarry.

North of the processing plant, there is a small fuel storage area, which includes a moveable double skinned diesel tank, and a bunded waste oil storage area (8). A storage area (9) near the shed is used for miscellaneous equipment and parts.

Mobile crushing (10) and screening (11) plants are used within the eastern portion of the quarry. These machines are periodically refuelled by a mobile diesel delivery service.

A small generator (12) with an in-built diesel tank is located within this part of the quarry. The diesel powers a generator used to supply power to pump for dust suppression. There was no evidence of soil staining or spills near the generator.

4.5 Balance of the site

The balance of the site is predominantly undeveloped pasture. The land is not currently grazed and there was no evidence of contaminating activities.

In the forested area to the west of the Firth Concrete plant, there was some old equipment and occasional surface litter, but not to the extent that soil contamination is likely.

The area occupied the orchard visible in the early aerial images was vacant land, and partially occupied by a bund. Topsoil from this area appeared to have been stripped in the past.

5 Summary of HAIL Activities

5.1 Identified HAIL Activities

The Ministry for the Environment's Hazardous Activities and Industries List (HAIL) is a compilation of activities and industries that have the potential to cause land contamination resulting from hazardous substance use, storage, or disposal. The HAIL is intended to identify most situations in New Zealand where use and storage of hazardous substances could cause, and in some cases have caused, land contamination.

Based on the review of site history information and a site inspection, several separate HAIL activities were identified. HAIL activities identified during this investigation include commercial concrete manufacture, asphalt manufacture, fuel storage, persistent pesticide use associated with the orchard, bulk storage of treated timber and waste disposal to land associated with the cleanfill. The identified HAIL activities are summarised in Table 3.

Table 3: Identified HAIL Activities

HAIL Activity	Dates	Comment	Likelihood
E4. Commercial concrete manufacture or commercial cement storage	2005 - present	Concrete block manufacturing facility	Certain
E2. Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant)	1987 - present	Asphalt plant	Certain
A17. Storage tanks or drums for fuel, chemicals or liquid waste	<1990-2004	Various fuel storage	Possible
A10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds	<1958-~1985	1000 m^2 of orchard	More likely than not
A18. Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside	~2020 - present	250 m^2 of treated timber storage	Certain
G5. Waste disposal to land (excluding where biosolids have been used as soil conditioners)	1987 - present	Cleanfill	Likely

5.2 Non-HAIL Areas

Based on a review of site history information and observations on site, it is more likely than not those activities listed on the HAIL have *not* been undertaken on the site outside of those areas identified in section 5.1.

There is no evidence of HAIL activities having occurred through the balance of pastoral land through the site. There is no evidence of stock yards, sheep dips, woolsheds, farm landfills or other rural HAIL activities on the site in any historic aerial photographs.

It is likely that routine applications of superphosphate and DDT would have occurred during the period of low intensity productive use as farmland. These agrichemicals were commonly used to fertilise soil and control pests such as grass grub. e3Scientific has assessed Organochlorine Pesticides (such as DDT) and

cadmium (a contaminant associated with superphosphate) concentrations in soils throughout Otago and Southland. In all investigations, contaminants have only been encountered at elevated concentrations approaching NESCS soil contaminant standards in the vicinity of sheep dips, sheep footbaths, dusting yards and areas of historic agrichemical storage. It is highly unlikely the broadacre application of agrichemicals over the farm have occurred at a rate and intensity that would result in an accumulation of contaminants in concentrations that could present a risk to human health or the environment. As such, this activity is not considered a HAIL activity.

It is known that several on-site wastewater treatment and disposal systems have been used to treat domestic-type effluent from small offices and ablution blocks. These small-scale systems are considered as being of sufficient size or risk to be interpreted as HAIL sites under category HAIL category *G6: Waste recycling or waste or wastewater treatment*. Hazardous substances associated with wastewater effluent primarily come from commercial and industrial trade wastes that discharge to the sewer network. The primary risk to human health from domestic wastewater is associated with biological hazards, such as viruses and bacteria. These pathogens fall outside the scope of hazardous substance and contaminated land regulation but should be considered a matter for worker health and safety if excavation into the disposal fields were to be necessary.

Although mining industries are listed under HAIL Category E7, gravel extraction is explicitly excluded from this category, and the extraction and processing of aggregate at the Parkburn Quarry is not considered a HAIL activity.

Within the Fulton Hogan civil engineering yard, two small steel containers were used for storing explosives. Although HAIL Category C1 includes '*explosive or ordinance production, maintenance, dismantling, disposal, bulk storage or re-packaging,'* we do not consider the quantity stored to be considered of sufficient scale to be considered a HAIL activity.

Although waste recycling is listed under HAIL Category G6, we consider that the storage and crushing of glass should not be considered a HAIL activity, as it does not involve the storage, use or disposal of hazardous substances.

Prior to the development of the quarry, the only identified HAIL activity was the presence of a small (1,000 m^2) orchard. Topsoil within the former orchard may have contained concentrations of organochlorine or heavy metal persistent

pesticides. Topsoil stripped from the site is typically used for reclamation and creating bunds on site, and it is possible that soil from the orchard has been reused or relocated on site. However, the volume of topsoil from this area, perhaps 200 m^3, is relatively small compared to the volume of soil that has been stripped throughout life of the quarry, perhaps 150,000 m^3. With incidental mixing of soils as they are stockpiled and moved around site prior to and during reclamation, we do not consider the reuse of topsoil to be a HAIL activity.

Outside the areas identified in Section 5.1, it is more likely than not that *no* activities or industries listed on the HAIL have occurred. The approximate spatial extents of HAIL and non-HAIL areas are shown in Figure 10.

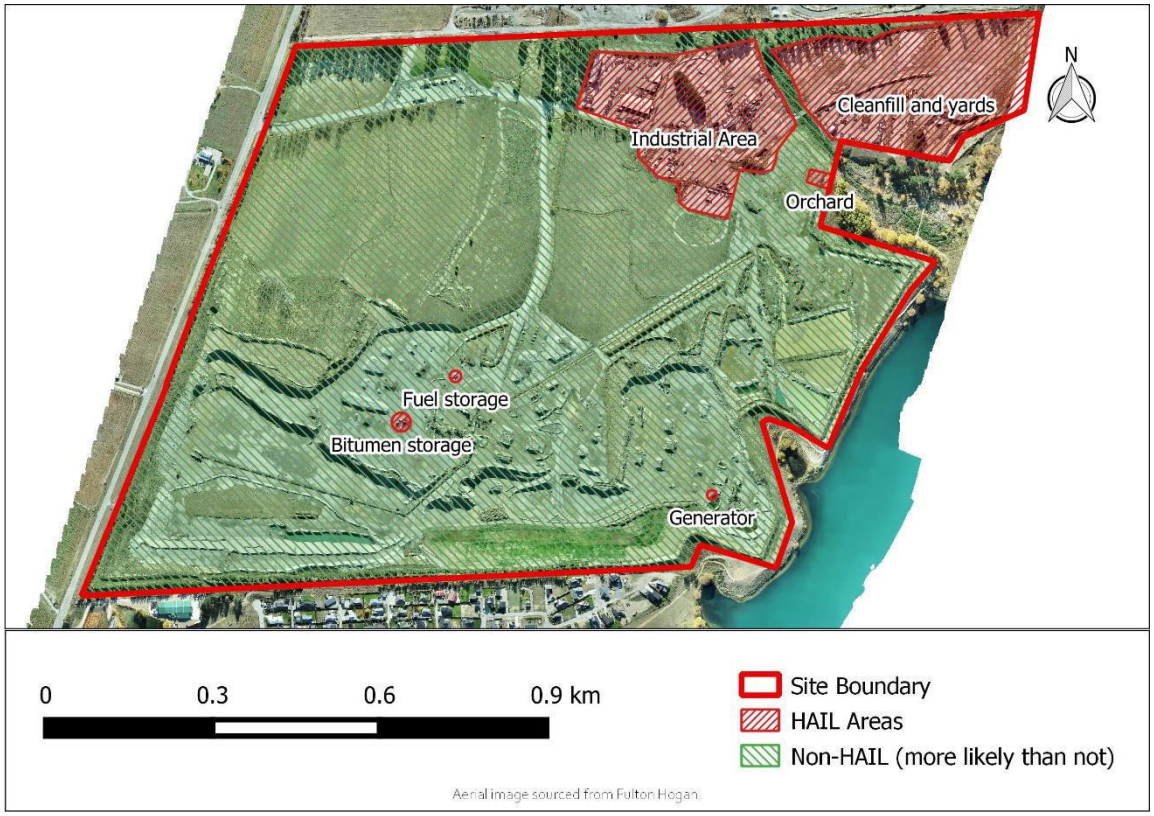


Figure 10: Approximate spatial extent of HAIL areas

5.3 Integrity Assessment

Overall, the established site history spans a period of approximately 120 years. Information obtained from the historic certificates of title and maps, historic aerial images (with a maximum interval of 18 years between 1983 and 2001), local authorities, and a site walkover has provided a reasonable understanding of the site history.

6 Preliminary Conceptual Site Model

A conceptual site model (CSM) for assessing site contamination provides an overview of the interaction between contaminants on site and potential receptors. Also referred to as the pollutant linkage model, the conceptual site model consists of three components (source-pathway-receptor), which if linked, indicate a risk may be present.

The following section sets out a preliminary conceptual site model. This preliminary conceptual site model is based on the collated information including an understanding of the possible contaminant sources, the possible routes of exposure to contaminants that may be present in soils on the site, and critical receptors.

6.1 Sources

A summary of the hazardous activities that have occurred on the site and the contaminants that may be associated with these activities is presented in Table 4 and described in the following sections. The contaminant list in Table 4 is based on site-specific observations and Appendix C of the NESCS User's Guide (Ministry for the Environment, 2012).

Table 4: HAIL activities and potential contaminants

HAIL Activity	Locations	Potential Contaminants
Concrete manufacture	Firth Concrete Block Plant Allied Concrete Batching Plant Frankton Marina Concrete Plant	Cement, calcium hydroxide, alkalis, ammonia, additives
Asphalt manufacture	Fulton Hogan Asphalt Plant	Total petroleum hydrocarbons (TPH) Polycyclic Aromatic Hydrocarbons (PAH)
Fuel storage	Diesel generator, bitumen spray, diesel and waste oil storage	Total petroleum hydrocarbons (TPH) Polycyclic Aromatic Hydrocarbons (PAH)

Persistent pesticide use	Former orchard	Heavy metals Organochlorine Pesticides
Treated timber storage	Fulton Hogan construction yard	Copper, chromium, arsenic
Waste disposal to land	Cleanfill area	Heavy metals

6.1.1 Concrete manufacture

Commercial concrete manufacture has taken place on site since 2005. Contaminants associated with concrete manufacture may affect soil pH and stormwater quality; however, risks to human health are generally not considered significant.

In addition to the contaminants listed in Table 4, small quantities of concrete retarding admixture are used within the concrete block manufacturing plant. The active ingredient in this product is tetrapotassium pyrophosphate. Tetrapotassium pyrophosphate is a common food additive, and not considered particularly toxic. The material safety data sheet (MSDS) does not list any special environmental protections required and does not identify the product as toxic to people.

A 10,000 L diesel tank and waste oil igloo are also known to be present within the concrete block manufacturing facility, and it is suspected diesel storage also occurred at the Allied Concrete batching plant in the past.

6.1.2 Asphalt manufacture

The asphalt manufacturing plant has operated on site since 1987. Asphalt manufacture involves the storage and handling of petroleum hydrocarbons including diesel, kerosene, and bitumen. Once manufactured and cured, asphalt is relatively stable, and unlikely to leach significant quantities of contaminants.

6.1.3 Fuel storage

Outside of the asphalt and concrete block plants, there are four known areas of relatively small-scale fuel storage. These include a diesel tank, waste oil storage, and generator at the quarry plant and diesel storage at the JCL asphalt yard.

6.1.4 Persistent pesticide use

Approximately 1,000 m^2 of orchard was present on the site from at least 1958 until 1985. During this period, organochlorine and heavy metal pesticides are likely to have been used on site. These contaminants typically bind strongly to soils and are not readily leached through the soil profile.

Topsoils from within the footprint of the former orchard were stripped as part of quarry development, and it is unlikely that pesticide residues are still present within this area. As discussed in section 5.2, topsoil stripped from the site is typically used for reclamation or creating bunds on site, and it is possible that soil from the orchard has been reused or relocated on site. However, the volume of topsoil from this area, perhaps 200 m^3, is relatively small compared to the volume of soil that has been stripped throughout life of the quarry, perhaps 150,000 m^3. With incidental mixing of soils as they are stockpiled and moved around site prior to and during reclamation, it is unlikely that detectable concentrations of pesticides could be found on site.

6.1.5 Treated timber storage

A relatively small area within the Fulton Hogan construction yard has been used for storage of treated timber poles. Although this activity has only occurred recently, and appears to be for relatively short duration, leaching of copper, chromium and arsenic from tanalised timber can impact soils directly under the poles. Although leaching from treated timber stacks can pose a risk to human health under residential land use, results from previous investigations suggest that exceedance of commercial/industrial soil contaminant standards is unlikely (Marlborough District Council, 2016)

6.1.6 Waste disposal to land

Backfilling of the north-eastern portion of the site with cleanfill has taken place since the 1980's.

This activity was consented by the Otago Regional Council in November 2000, and the cleanfill generally appears to be well managed. ORC compliance reports in 2009 and 2020 identified minor non-compliance associated with reporting, but both inspections found the site to be tidy with no evidence of unconsented fill types or adverse environmental effects. A cleanfill management plan for the Parkburn Quarry was prepared by Fulton Hogan in 2018.

The management plan provides clear direction on consent and unconsented fill types and confirms that material from HAIL sites is not to be accepted without prior sampling.

Field readings of heavy metal concentrations with an X-Ray Fluorescent Spectrophotometer (XRF) indicates that heavy metal concentrations within most of the soil within the cleanfill surface and tipping faces are consistent natural background concentrations. A small number of readings returned results that indicate some contaminated fill material has been received.

6.2 Receptors and Pathways

Based on the proposed plan change and eventual development of the site, potential receptors will vary throughout the site. Because HAIL activities have been identified in areas proposed to be used for industrial and residential purposes, potential receptors will include:

- Construction workers involved in the development of the site.
- Outdoor workers in the industrial or commercially zoned areas.
- Adults and children living on the site in the residential and childcare areas.

Exposure pathways for contaminants to these potential receptors include:

- Incidental ingestion of contaminated soil.
- Inhalation of contaminants entrained in dust or volatile contaminants.
- Dermal absorption of contaminants.
- Consumption of produce grown in soils on site.

6.3 Preliminary Risk Assessment

A conceptual site model, based on the identified sources, pathways and receptors above is described in Table 5.

Based on the proposed plan change and eventual development of the site, there is potential for workers and residents to be exposed to contaminants associated with the existing HAIL activities.

Within the future residential area, the identified HAIL activities include relatively small-scale hydrocarbon storage associated with the bitumen spray plant, a diesel tank and waste oil storage, and a diesel generator. It is possible that these activities could leave localised areas of hydrocarbon contamination. Although topsoil will need to be imported to this part of this site, there is a relatively low risk that inhalation of volatile contaminants would remain an open exposure pathway. Any topsoil imported to the site should be certified as meeting the appropriate human health and environmental criteria.

Within the future industrially zoned area, the identified HAIL activities include concrete manufacturing and batching, asphalt production, fuel storage, persistent pesticide use, treated timber storage, and disposal of cleanfill. We consider that it is highly unlikely that contaminants in soil associated with concrete manufacture, persistent pesticide use, and treated timber storage would pose a risk to human under the proposed commercial/industrial land use.

It is possible that contaminants associated with asphalt production, fuel storage and cleanfill disposal could result in soil contamination that could pose a risk to long term outdoor workers using the site in the future without appropriate investigation, remediation and/or management during development. The greatest risks are associated with hydrocarbon storage, particularly around any underground fuel storage infrastructure (e.g. fuel supply pipelines). Risks associated with the disposal of cleanfill appear relatively low; however, given the long history of filling, it is possible that localised areas of contaminated fill material may be present.

Given the on-going use of the site for these HAIL activities, it would be appropriate to complete additional investigation upon decommissioning of any potentially contaminating land uses. These investigations may also be better able to assess risks to human health as plans for the proposed development become more detailed.

Table 5: Preliminary conceptual site model

Area	Source	Exposure Pathway	Possible Receptor	Pathway Linkage Assessment
Future Industrial Zoned Areas	Contaminants associated with asphalt manufacture, fuel storage and disposal of cleanfill	Ingestion of contaminated soil	Long term Outdoor workers and Construction workers involved in development of the site	**Potentially complete** – Site remains to be occupied and utilised by various commercial/industrial businesses.
		Dermal contact with contaminated soil and dust		
		Inhalation of volatile contaminants or contaminated dust		
Future residential zoned areas	Contaminants associated with hydrocarbon storage	Ingestion of contaminated soil	Residents	**Incomplete** – Residential development will require topsoil to be imported, either from off-site or from stockpiles of soil stripped during quarry operations. As such, direction exposure is unlikely.
		Dermal contact with contaminated soil and dust		
		Consumption of home grown produce		
		Inhalation of volatile contaminants or contaminated dust		**Potentially complete (volatile contaminants)** – Inhalation of volatile contaminants may be a potentially complete pathway, even after topsoil has been imported.
		Ingestion of contaminated soil	Construction workers involved in development of the site	**Potentially complete** – Construction workers involved in earthworks on site may be exposed to contaminants associated with fuel storage.
		Dermal contact with contaminated soil and dust		
		Inhalation of volatile contaminants or contaminated dust		

7 Activity Status under the NESCS

Preliminary investigation of the site has identified areas of HAIL activity on discrete pieces of land throughout the site. As such, the NESCS will apply to subdivision, change of use, and soil disturbance associated with the development of the site if the plan change is approved.

7.1 Subdivision and Land Use Change

Regulation 8(4) of the NESCS states that subdividing land or changing the use of a piece of land is a permitted activity while the following requirements are met:

(a) A preliminary site investigation of the land or piece of land must exist

(b) The report on the preliminary site investigation must state that it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land.

(c) The report must be accompanied by a relevant site plan to which the report is referenced.

(d) The consent authority must have the report and the plan.

In this case, we do not consider that the requirements of Regulation 8(3) are currently fully met. We consider the proposed zoning associated with the plan change to be generally suitable; however, given the on-going use of the site for HAIL activities, it would be appropriate to complete additional investigation upon decommissioning of any potentially contaminating land uses. These investigations may also be better able to assess risks to human health as plans for the proposed development become more detailed.

7.2 Soil Disturbance and Removal

Regulation 8(3) states that disturbing the soil of the piece of land is a permitted activity while the following requirements are met:

a) Controls to minimise the exposure of humans to mobilised contaminants must:
   i) be in place when the activity begins.
   ii) be effective while the activity is done.
   iii) be effective until the soil is reinstated to an erosion-resistant state.

b) The soil must be reinstated to an erosion-resistant state within 1 month after the serving of the purpose for which the activity was done.

c) The volume of the disturbance of the soil of the piece of land must be no more than 25 m^3 per 500 m^2.
d) Soil must not be taken away in the course of the activity, except that,—
e) For the purpose of laboratory analysis, any amount of soil may be taken away as samples.
f) For all other purposes combined, a maximum of 5 m^3 per 500 m^2 of soil may be taken away per year.
g) Soil taken away in the course of the activity must be disposed of at a facility authorised to receive soil of that kind:
h) The duration of the activity must be no longer than 2 months:
i) The integrity of a structure designed to contain contaminated soil or other contaminated materials must not be compromised.

Based on disturbance over the entire area of HAIL activity (160,000 m^2) a maximum of 8000 m^3 could be disturbed in any one year, and 1600 m^3 can be removed.

Any soil disturbance or removal within the identified HAIL areas that do not meet the permitted activity criteria outlined in Regulation 8(3) would be a discretionary activity under Regulation 11 unless a Detailed Site Investigation (DSI) to quantify contaminant concentrations is completed.

8 Summary and Conclusions

Fulton Hogan Limited (FHL) operate Parkburn Quarry, immediately north of Pisa Moorings. The quarry was developed by FHL in the 1980s and has been in operation since this time. The quarry produces a range of aggregates, from sealing chip to construction and concrete aggregates. As the site is nearing the end of its operational lifespan, Fulton Hogan are seeking a plan change to rezone the site so that, upon closure, it can be redeveloped for a range of future land uses, including residential (standard and high density), commercial, retail commercial, childcare / education, green space, and industrial.

To assist Fulton Hogan in managing the risks associated with contaminants in soil, e3Scientific has undertaken a Preliminary Site Investigation (PSI) to identify the areas of potential contamination within the site, consider the risks to human health associated with the proposed development, consider the activity status of the future development under the NESCS, and assess the need for further investigation.

Based on a detailed review of site history information, HAIL activities identified during this investigation include commercial concrete manufacture, asphalt manufacture, fuel storage, persistent pesticide use associated with the orchard, bulk storage of treated timber and waste disposal to land associated with the cleanfill.

We consider that it is highly unlikely that contaminants in soil associated with concrete manufacture, persistent pesticide use, and treated timber storage would pose a risk to human under the commercial/industrial land use proposed for these areas.

It is possible that contaminants associated with asphalt production, fuel storage and cleanfill disposal could result in soil contamination that could pose a risk to long term outdoor workers using the site in the future without appropriate investigation, remediation and/or management during development. The greatest risks are associated with hydrocarbon storage, particularly around any underground fuel storage infrastructure (e.g. fuel supply pipelines). Risks associated with the disposal of cleanfill appear relatively low; however, given the

long history of filling, it is possible that localised areas of contaminated fill material may be present.

Given the on-going use of the site for these HAIL activities, it would be appropriate to complete additional investigation upon decommissioning or closure of any potentially contaminating land uses. At that stage, we consider that it would be appropriate to develop a number of feasible strategies for remediation and/or site management if necessary.

9 Report Certification

I, Simon Beardmore of e3Scientific, certify that:

1. This preliminary site investigation meets the requirements of the Resource Management (National Environmental Standard for assessing and managing contaminants in soil to protect human health) Regulations 2011 because it has been:
    a. done by a suitably qualified and experienced practitioner, and
    b. reported on in accordance with the current edition of Contaminated land management guidelines No 1 – Reporting on contaminated sites in New Zealand, and
    c. certified by a suitably qualified and experienced practitioner.

2. This preliminary site investigation does **not** conclude:
    a. it is highly unlikely that there will be a risk to human health if the subdivision and/or land use change described in Section 1.2 is done to the piece of land.

Evidence of the qualifications and experience of the suitably qualified and experienced practitioner(s) who have done this investigation and have certified this report is included in Appendix A.



Signed and dated: ……06/12/21……

10 References

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Ministry for the Environment. (2011). *Soil Contaminant Standards in the Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health.* Ministry for the Environment.

Ministry for the Environment. (2012). *Users' Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.* Wellington: Ministry for the Environment.

NEPC. (1999). National Environment Protection (Assessment of Site Contamination) Measure 1999, amended 2013.

US EPA. (2018). *Regional Screening Levels.* US Environmental Protection Agency.

Appendices

Appendix A:

e3Scientific Limited Contaminated Land Experience

Contaminated Land Services

e3Scientific Limited (e3Scientific) is a New Zealand owned and operated environmental science consultancy. Our team delivers technical, innovative science; practical solutions; and expert advice to assist our clients in the smart management of the environment.

e3Scientific provides a range contaminated land services, including:

- Due Diligence Investigations.
- Preliminary Site Investigations.
- Detailed Site Investigations.
- Soil and groundwater remedial advice and management.
- Peer review and regulator support.

Our Contaminated Land team has a sound understanding of New Zealand's regulatory environment with respect to the assessment and management of contaminated land and has been a major supplier of contaminated land services in Otago and Southland since 2012.

Simon Beardmore is the Technical Director of the Contaminated Land team at e3Scientific. Simon has over 12 years post graduate experience working as an Environmental Scientist, specialising in the investigation and management of contaminated land. Simon developed contaminated land management strategy and standard operating procedures at the Otago Regional Council and has completed and supervised the delivery of preliminary and detailed site investigations, and site remediation projects throughout Otago and Southland. Simon is responsible for technical oversight of projects and certifying contaminated land investigations as a suitably qualified and experienced practitioner. Simon is supported by Team Leader Fiona Rowley, Senior Environmental Scientists Carrie Pritchard, Jodi Halleux and Simon Bloomberg, and Environmental Scientist and Geospatial Specialist Jessie Lindsay.

The e3Scientific team has completed many Preliminary Site Investigations, Detailed Site Investigations and remedial projects across New Zealand and regularly provides peer review of site investigations for district and regional councils. Projects have involved investigations into the impact on soil quality associated with operational and historic timber treatment plants, fuel storage and distribution facilities, substations, sheep dips and yards, orchards, vineyards, agricultural activities, gasworks, service stations, and operational and closed landfills.

The following provides a summary of key contaminated land work e3Scientific is involved in or has completed:

- Hundreds of Preliminary Site Investigations and Detailed Site Investigations to support subdivision, landuse change and earthworks consent applications.
- Support Environment Southland's Selected Landuse Register including the identification of Hazardous Activities on properties across Southland and the registration of HAIL sites.
- Review of groundwater contamination associated with the former Invercargill gasworks site including the completion of a groundwater investigations and an environmental risk assessment to support a discharge consent application.
- Large scale remedial works of former timber treatment plants and sheep dips including the completion of detailed investigations to delineate the extent of contaminated soils, design of remedial action plans, project management of remedial works and completion of site validation and council close out reports.
- Investigations into an area of arsenic impacted soils in Frankton including the completion of detailed investigations to delineate the horizontal extent, consideration of the source of the arsenic, liaison with property owners and council.
- Project management of a bioavailability study of arsenic impacted soils in Gibbston Valley to support a Tier 2 risk assessment associated with a residential development.
- Oversight of the removal of multiple underground fuel storage systems for private residences, schools and oil and gas clients.

The e3Scientific team is committed to professional development, and employing new technologies in the prevention, assessment and remediation of contaminated land. e3Scientific is an active member of the Australasian Land & Groundwater Association and WasteMINZ.

Appendix B:

Historic Certificates of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **407414**

Land Registration District **Otago**

Date Issued 07 February 2008

Prior References

GN7705203.1 OT10B/738

Estate	Fee Simple
Area	50.1065 hectares more or less
Legal Description	Part Section 62-63 Block IV and Part Section 63 Block IV Wakefield Survey District and Section 1 Survey Office Plan 365897

Registered Owners

Fulton Hogan Limited

Interests

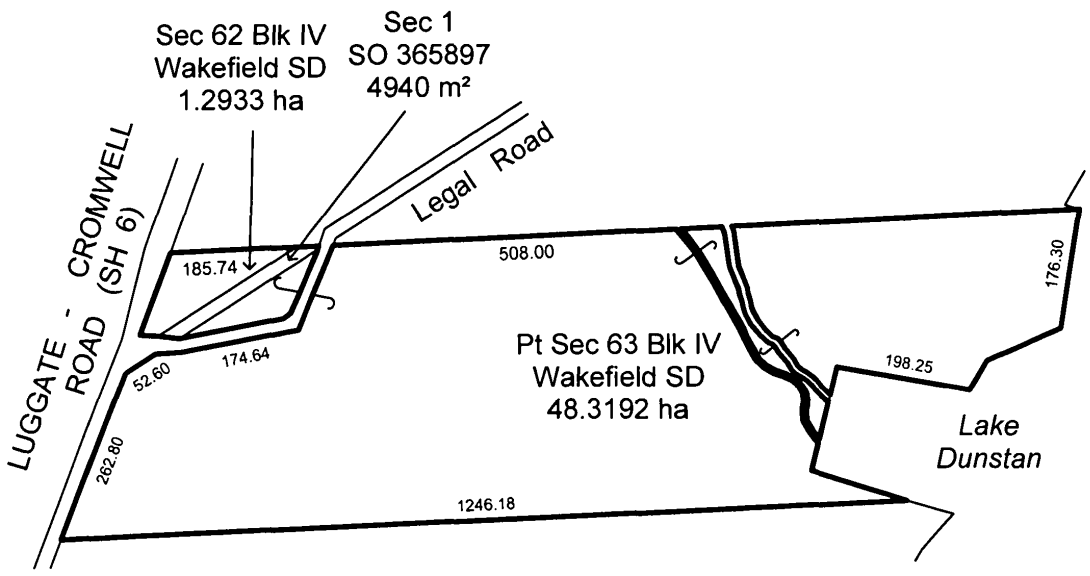
Subject to Section 8 Mining Act 1971(affects part formerly in CT OT10B/738)

Subject to Section 5 Coal Mines Act 1979(affects part formerly in CT OT10B/738)

5041663.1 Gazette Notice (2001/1044) declaring adjoining road (S.H.No. 6) to be limited access road - 11.5.2001 at 9:31 am

5057376.2 Notice pursuant to Section 91 Transit New Zealand Act 1989 - 10.7.2001 at 2:30 pm

Title Diagram ct 40741
Cpy – 01/01, Pgs – 001, 22/02/08, 09:06
DocID: 212144396



Total area: 50.1065 ha
For further dimensions see SO 365897 & SO 20808

L & S–B 1 NEW ZEALAND

Former Ref. Vol 179 fol 75
L & S Ref. No. RLF 1409

CANCELLED

Entered in the Register-book, the 23rd *day of* November *1984, at* 10.24 *o'clock*

REGISTER

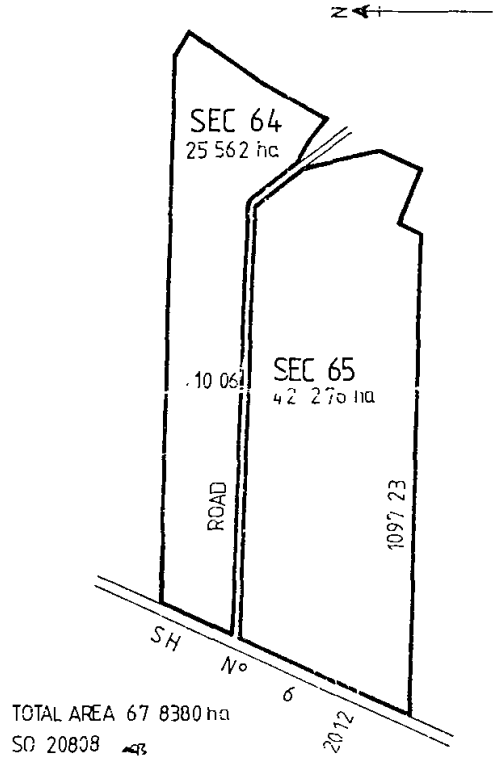
Land Registrar

No. 10A/748

Renewable Lease under the Land Act 1948

This Deed, made the 1st day of July 19 82, between HER MAJESTY THE QUEEN (hereinafter referred to as "the Lessor"), of the one part, and CHARLES ROBERT [illegible] of Lawrence Farmer

(hereinafter referred to as "the Lessee"), of the other part WITNESSETH that, in consideration of the rent hereinafter reserved, and of the covenants, conditions, and agreements herein contained and implied, and on the part of the Lessee to be paid, observed, and performed, the Lessor doth hereby demise and lease unto the lessee, all that parcel of land containing by admeasurement 67.8380 hectares more or less, situated in the Land District of Otago, and being Sections 64 and 65 Block IV Wakefield Survey District



as the same is more particularly delineated with bold black lines on the plan hereon, together with the rights, easements, and appurtenances thereto belonging. TO HOLD the said premises intended to be hereby demised unto the Lessee for the term of 33 years, commencing on the 1st day of July 19 82 ~~together with the period between the date of this Lease and the aforesaid 1st day of 19~~, YIELDING and paying therefor for the first 11 years of the said term unto the Department of Lands and Survey at Dunedin the annual rent of $ 792.00 calculated on a Rental Value of $ 17600.00 payable without demand by equal half-yearly payments in advance on the 1st day of January and the 1st day of July in each and every year during the said period of 11 years, and for the next two successive periods of 11 years of the said term a rent determined in respect of each of those periods in the manner provided in section 132A of the Land Act 1948. ~~AND also paying in respect of the improvements specified in the Schedule hereto the sum of $ by a deposit of $ (which has already been paid), together with interest thereon at the rate of =per centum per annum and thereafter by half-yearly instalments of $ =on the 30th day of June and the 31st day of December in each and every year subject to variation of the rate of interest and the amount of the half-yearly instalments in the manner hereinafter provided. The first such instalment shall be payable on the 31st day of December 1982. Interest on the balance of the purchase money from the =day of 19=, to the =day of 19=, shall be payable on the said =day of 19=~~

AND it is hereby declared and agreed (1) That these presents are intended to take affect as a renewable lease of Farm land under section 63 of the Land Act 1948 and of any enactments passed in amendment or substitution thereof and the provisions of the said Act and of the regulations made thereunder applicable to such leases shall be binding in all respects upon the parties hereto in the same manner as if such provisions had been fully set out herein.

~~(2) That the Land Settlement Board, pursuant to its powers under section 170B of the Land Act 1948, reserves the right to review the rate of interest payable by the Lessee in the respect of the improvements specified in the Schedule hereto for the second and each ensuring period of 5 years of the term hereof, and the provisions of that section shall apply to any such review, and any necessary adjustments to the instalments payable.~~

IN WITNESS whereof the Assistant Commissioner of Crown Lands for the said Land District, on behalf of the Lessor, has hereunto set his hand, and these presents have also been signed by the said Lessee

No. 10A/748

Signed by the said Assistant Commissioner, on behalf of the Lessor, in the presence of—

Witness ..... A. Clemo .....

Occupation Clerk, Dept. Lands & Survey

Address ..... Dunedin .....

J R Glaze

Assistant Commissioner of Crown Lands

Signed by the above-named Lessee in the presence of—

Witness: .....

Occupation: .....

Address: .....

C R Perriam

Lessee

Interests at date of Issue:

X20543 Irrigation Agreement under Part X1 of the Public Works Act 1928 with Her Majesty the Queen - 9.12.1958 at 2.40 pm.

DUPLICATE DESTROYED
11/3/1986

X20544 Irrigation Agreement under Part X1 of the Public Works Act 1928 with Her Majesty the Queen - 9.12.1958 at 2.41 pm.

394308 Mortgage to Bank of New Zealand - 2.11.1972 at 11.09 am.

506156 Compensation Certificate pursuant to Section 17 of the Public Works Amendment Act 1948 - 1.11.1978 at 11.59 am.

A.L.R.

638087/2 Transfer to Robert Stanley Perriam of Lowburn Farmer - 2.7.1985 at 10.37am

A.L.R.

638087/3 Mortgage to Charles Robert Perriam - 2.7.1985 at 10.37am

A.L.R.

648690)Cancelled and new C.T. 10B/1452
13.12.1985)issued for the within land

A.L.R.

DISTRICT LAND REGISTRAR
CANCELLED
OTAGO NEW ZEALAND

44578E—2,000/3/80 MK

10.24 23.NOV 84 626107

PARTICULARS ENTERED IN REGISTER L
LAND REGISTRY OTAGO

ASST. LAND REGISTRAR .....

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Historical Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **OT10B/738**

Cancelled

Land Registration District **Otago**

Date Issued 26 August 1985

Prior References
OT115/31

Estate Fee Simple

Area 50.2450 hectares more or less

Legal Description Section 62-63 Block IV Wakefield Survey District

Original Proprietors
Fulton Hogan Limited

Interests

Subject to Section 8 Mining Act 1971

Subject to Section 5 Coal Mines Act 1979

Mining Licence embodied in register 9D/212 - 3.8.1987 at 9.08 am

5041663.1 Gazette Notice (2001/1044) declaring adjoining road (S.H.No. 6) to be limited access road - 11.5.2001 at 9:31 am

5057376.2 Notice pursuant to Section 91 Transit New Zealand Act 1989 - 10.7.2001 at 2:30 pm

5879308.1 Expiry of Mining Permit 684068 - 29.1.2004 at 9:00 am

7705203.1 Gazette Notice (2008 page 360) declaring Section 3 SO 365897(317m2) and Section 4 SO 365897 (6009m2) to be road and vested in the Central Otago District Council on 31.1.2008 and stopping the adjoining road (Section 1 SO 365897 -4940m2) and amalgamating it with the within land CT 407414 issued- 7.2.2008 at 9:00 am

CANCELLED

Land and Deeds 72

Reference:
Certificate No. 641455
P.R. Vol. 115 Folio 31
Transfer No.

REGISTER

No. 10B/738

CERTIFICATE OF TITLE UNDER LAND TRANSFER ACT

This Certificate dated the 26th day of August one thousand nine hundred and eighty five under the seal of the District Land Registrar of the Land Registration District of O T A G O being a Certificate in lieu of Grant, **WITNESSETH** that ROBERT STANLEY PERRIAM of Lowburn, Farmer

is seised of an estate in fee simple (subject to such reservations, restrictions, encumbrances, liens, and interests as are notified by memorial underwritten or endorsed hereon) in the land hereinafter described, delineated with bold black lines on the plan hereon, be the several admeasurements a little more or less, which said land was originally acquired by the abovenamed

as from the 17th day of December one thousand nine hundred and eighty four
under Section 124A Land Act 1948
that is to say: All that parcel of land containing 50.2450 hectares more or less being Sections 62 and 63 Block IV WAKEFIELD DISTRICT

Interests at date of issue:

Subject to the reservations and conditions imposed by Section 8 Mining Act 1971 and Section 5 Coal Mines Act 1979

X20543 Irrigation Agreement under Part XI Public Works Act 1928 - 9.12.1958 at 2.40pm

DISCHARGED 12 JUN 1995 ALR.

X20544 Irrigation Agreement under Part XI Public Works Act 1928 - 9.12.1958 at 2.41pm

DISCHARGED 12 JUN 1995 ALR.

638087.3 Mortgage to Charles Robert Perriam - 2.7.1985 at 10.37am

A.L.R.

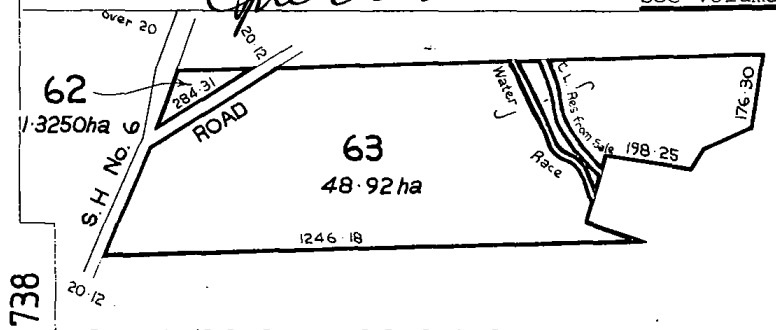
ASSISTANT LAND REGISTRAR

649433 Transfer to Fulton Hogan Limited - 23.12.1985 at 1.43pm

A.L.R.

684068 Mining Licence under the Mining Act 1971 affecting part of the within land in favour of Fulton Hogan Limited for a term of 21 years commencing on 20 July 1987 - 3.8.1987 at 9.08 am
See Volume 9D Folio 212

A.L.R.



Scale 1 : 12500 S.O. 20808
Total Area : 50·2450ha
Measurements are Metric

10B/738

Register copy for L. & D. 69, 71, 72

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General of Land

Identifier **OT10B/1452**

Land Registration District **Otago**

Date Issued 13 December 1985

Prior References
OT10A/748

Estate Fee Simple

Area 67.8380 hectares more or less

Legal Description Section 64-65 Block IV Wakefield Survey District

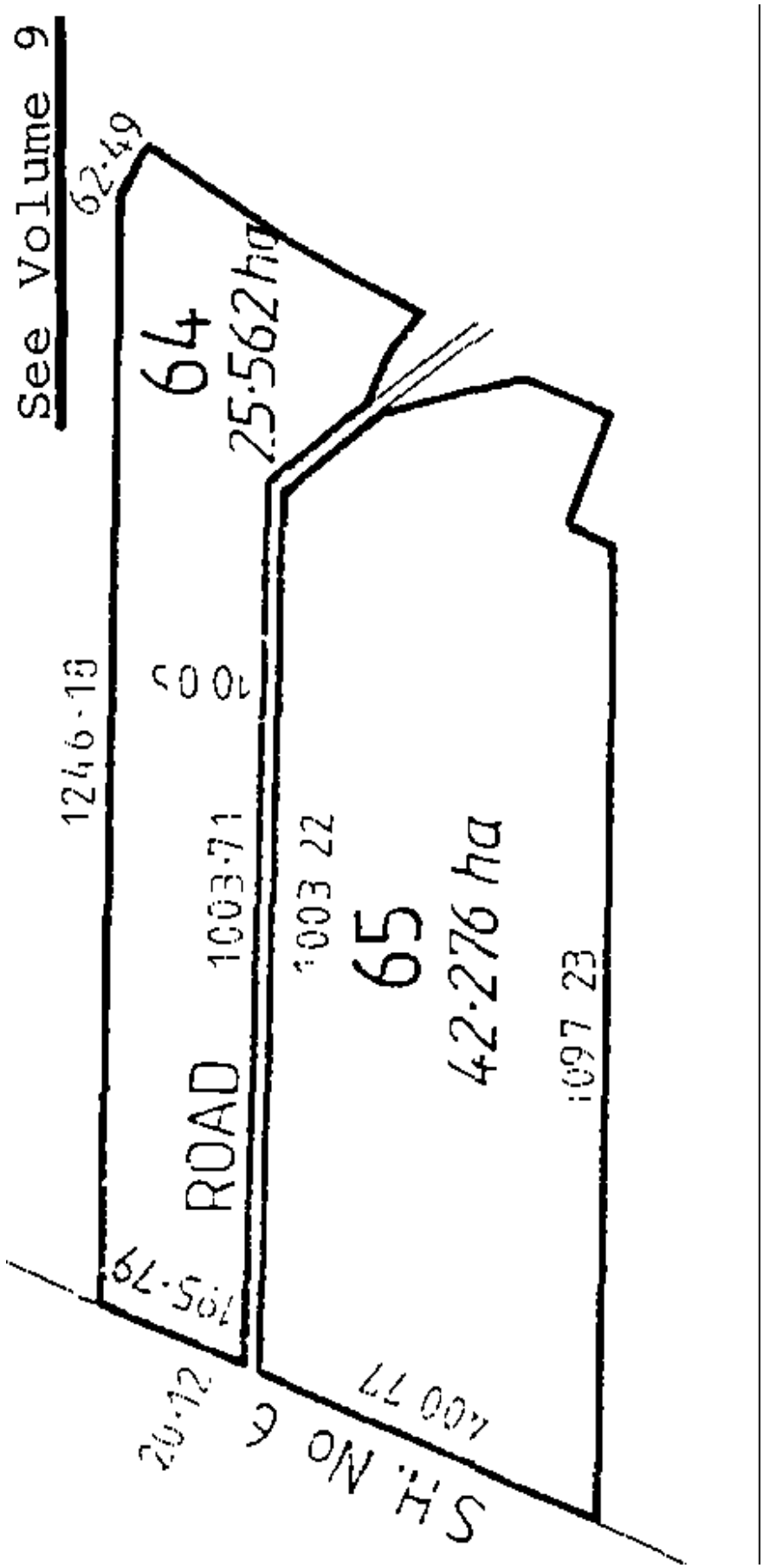
Registered Owners
Fulton Hogan Limited

Interests

Subject to Section 8 Mining Act 1971

Subject to Section 5 Coal Mines Act 1979

5041663.1 Gazette Notice (2001/1044) declaring adjoining road (S.H.No. 6) to be limited access road - 11.5.2001 at 9:31 am


See Volume 9
62.49
64
25.562ha
1246·13
1003·71
1003 22
65
42.276 ha
1097 23
ROAD
195·79
20·12
S.H. No 6
400 77

NEW ZEALAND.

CANCELLED

(Crown Lands Form No. 542

Register-book.

Vol. 115 *fol.* 31

Application No.

115/31

Reference to old Sq.

Image Quality due to Condition of Original

Clutha LAND DISTRICT.

LEASE IN PERPETUITY UNDER PART III. OF "THE LAND ACT, 1892," AND SECTION 7 OF "THE MINING ACT AMENDMENT ACT (No. 2), 1893."

No. 829.

This Deed, made the 6th day of October, 1897, between Her Majesty the Queen (who with her heirs and successors is hereinafter termed "the Lessor"), of the one part, and Robert Davidson of Lawrence Ferry in the Land District of Clutha in the Colony of New Zealand (hereinafter, with his executors, administrators, and permitted assigns, referred to as and included in the term "the Lessee"), of the other part, Witnesseth that, in consideration of the rent hereinafter reserved, and of the covenants, conditions, and agreements herein contained and implied and on the part of the Lessee to be paid, observed, and performed, the Lessor doth hereby demise and lease unto the Lessee All that piece or parcel of land, containing by admeasurement One hundred and Ninety nine (199) acres roods and twenty five (25) perches, a little more or less, situated in the Land District of Clutha aforesaid, and being Sections numbered 9 and 16, Block IV, Survey District of Wakefield, as the same is more particularly delineated and described in the plan drawn hereon, and therein coloured red in outline; together with the rights, easements, and appurtenances to the same belonging: To hold the said several premises intended to be hereby demised unto the Lessee for the term of nine hundred and ninety-nine years, commencing from the 1st day of January next Yielding and paying therefor unto the Receiver of Land Revenue for the said District of Clutha the annual rent of Three pounds nineteen shillings and eight pence (£ 3 : 19 : 8), payable half-yearly in advance on the 1st day of January and 1st day of July in each and every year during the said term, free from all deductions whatsoever.

Block IV Wakefield District

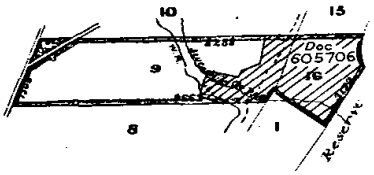
199 acres 25 perches

EQUIVALENT METRIC AREA IS 80·5957 ha

605706 31·4080 ha

49·1877 ha

611 832/4 50·2450 ha



Scale: 30 chains to an inch.

And it is hereby declared and agreed that these presents are intended to take effect as a lease in perpetuity under Part III. of "The Land Act, 1892"; and the provisions of that statute applicable to such leases, so far as the same apply to the term, estate, or interest hereby granted or created, and to the relations between the Lessor and Lessee from time to time, shall, subject to the provisions of section 7 of "The Mining Act Amendment Act (No. 2), 1893," be binding in all respects upon the parties hereto in the same manner as if such provisions had been fully set out herein: And it is hereby further declared that if any dispute or disagreement shall arise between the parties hereto touching the construction of these presents, or in anywise relating hereto, such dispute or disagreement shall be referred to arbitration in the manner set forth in section 79 of the said Act; and neither of the said parties shall take or cause to be taken any steps or proceedings to set aside or call in question any award or decision which may have been given upon any such reference as final:

In Witness whereof the Commissioner of Crown Lands for the Land District of Clutha on behalf of the Lessor, hath hereunto set his hand, and these presents have been also executed by the said Lessee,

Signed by the said Commissioner, on behalf of the said Lessor, in the presence of—

Jno. de Mar Jones
Clerk
Lawrence

C. J. Smithers

Signed by the above-named Robert Davidson as Lessee, in the presence of—

A. Allan Pringle
Lawrence Ferry
Farmer

Robert Davidson

C.T. 115/31

Transfer No 40562 Robert Davidson to Donald Macpherson of Lowburn Farmer Entered 2nd September 1905 at 11 o'c

Abstract A.S.L. 1/

Transmission No 13211 to Susan Hill Macpherson of Wanaka Road, Lowburn, Widow Entered 2nd February 1926 at 10 o'c

H.C. Mowbray A.R.

Mortgage No 56614 Susan Hill Macpherson to The Otago Advances Corporation Limited produced 8th DISCHARGED 1931 at 10 o'c ft

Memorandum of Lease No 77692 to Ernest Jolly of Cromwell Merchant as Executor Entered 26th June 1940 at 11.30 o'c

Transfer 132214 Ernest Jolly to William Henry Pearson and Charles Robert Pearson both of Lowburn Farmers produced 1st November 1940 at 11 o'c

Mortgage 109136 William Henry Pearson and Charles Robert Pearson to the Bank of New Zealand DISCHARGED produced 1st November 1940 at 12 o'c

Transfer No 155697 William Henry Pearson of his interest in Charles Robert Pearson to the Grantee Charles Robert Pearson produced 30th May 1947 at 11 o'c

X20563 Irrigation Agreement under Part XX of the Public Works Act 1928 between Her Majesty the Queen and Charles Robert Pearson entered 9th December 1958 at 2 p.m.

X20564 Irrigation Agreement under Part XX of the Public Works Act 1928 between Her Majesty the Queen and Charles Robert Pearson entered 9th December 1958 at 2 p.m.

394308 Mortgage to Bank of New Zealand - DISCHARGED 2-11-1972 at 10.09 a.m. A.L.R.

503342 Certificate as to Charge under Section 280(1) Public Works Act 1928 - 13.9.1978 at 11.42 pm A.L.R.

506156 Compensation Certificate pursuant to section 17 of the Public Works Amendment Act 1948 - 1.11.1978 at 11.59 am A.L.R.

115/31

605706 Gazette Notice declaring parts of Sections 9 (7.95 ha, 2.42 ha, 4800 m²) and 16 (205580 ha) shown hatched black on the diagram hereon are acquired for the generation of electricity and shall vest in the Crown from and after the 27th day of October 1983 - 21.11.1983 at 10.56 am A.L.R.

The within land is now known as Sections 62 (1.3250 ha) and 63 (48.92 ha) Block IV Wakefield S.D. - 20.3.1984 at 11.51 am See Re-appellation 611832/4 A.L.R.

626107/1 Certificate of alteration with effect from 27.10.1984 reducing the rental value to $118.94 and annual rent to $4.76 - 23.11.1984 at 10.24 am. A.L.R.

of balance 638087/2 Transfer to Robert Stanley Perriam of Lowburn Farmer - 2.7.1985 at 10.37am A.L.R.

of balance 638087/3 Mortgage to Charles Robert Perriam - 2.7.1985 at 10.37am A.L.R.

641455) 26.8.1985) Cancelled and new C.T. 103/738 issued. A.L.R.

THIS REPRODUCTION (ON A REDUCED SCALE) CERTIFIED TO BE A TRUE COPY OF THE ORIGINAL REGISTER FOR THE PURPOSES OF SECTION 215A LAND TRANSFER ACT 1952. A.L.R.

DISTRICT LAND REGISTRAR CANCELLED OTAGO NEW ZEALAND

DUPLICATE DESTROYED 9 19 1985

No. 829.

DATED 6th October 1897.

Her Majesty the Queen

to

Robert Davidson

Otago Land District.

LEASE

Of Section 5 9 & 16, Block II

Wakefield Survey District.

Under "The Land Act, 1892."

Nine hundred and ninety-nine years from 1st January 1898.

Entered at 10 o'clock on the 22nd day of October, 1897.

District Land Registrar.

SECTIONS 141 TO 147 OF "THE LAND ACT, 1892."

Compulsory Residence.

141. Residence on any land, not being land purchased for cash, selected under this Part of this Act shall be compulsory, and shall commence in bush-lands or on swamp-lands within four years, and in open or partly open land within one year, from the date of selection; and thereafter such residence shall be continuous—

(1.) On lands occupied with right of purchase, for six years on bush-lands or on swamp-lands, and for seven years on open or partly open land:

(2.) On lease-in-perpetuity lands, for a term of ten years.

But these conditions of residence shall not apply to any person who has acquired an interest in any lease or license under an intestacy or by virtue of a will.

142. The Board may dispense with residence if the lessee or licensee reside and continue to reside on lands contiguous to the lands held under lease or license. Lands shall be deemed to be contiguous to each other if only separated by a road or stream, or by such interval of space as the Board may determine in each case.

The Board may also dispense with residence for four years after the commencement of the term where residence is otherwise compulsory in cases where the lessees or licensees are youths or unmarried women living within the land district, and residing with their parents or near relatives.

In case of the death of either or both parents of a child or children, residence may be dispensed with until such child or one of such children respectively attain the age of seventeen years.

143. Personal residence may also be dispensed with by the Board in the cases hereinafter mentioned:—

(1.) Whenever any two persons, being licensees with right of purchase or lessees in perpetuity, have lawfully intermarried at some period not sooner than twelve months after the issue of the last of such licenses or leases, such persons may reside on such one of the selections of land made by them as they may think fit.

(2.) Whenever any two persons, one of whom has become a selector of land with right of purchase or a lessee in perpetuity, and the other is an owner or occupier of freehold land, have lawfully intermarried at some period not sooner than twelve months from the issue of the license or lease held by such selector, such selector may reside on such freehold.

(3.) Residence on such selection or on such freehold, as may be the case, shall be deemed a compliance with the conditions of section one hundred and forty-one in respect of residence by such several persons.

(4.) The Board, however, shall have a discretionary power to dispense with personal residence on sufficient and satisfactory grounds being shown for non-residence.

Improvements.

144. Every selector of lands under this Part of this Act, whether for occupation with right of purchase or for lease in perpetuity, shall put on the land comprised in his license or lease, as the case may be, substantial improvements—

(*a.*) Within one year from the date of his license or lease, to a value equal to ten per centum of the price of the land;

(*b.*) Within two years from the date of his license or lease, to a value equal to another ten per centum of the price of the land;

(*c.*) And thereafter, but within six years from the date of his license or lease, to a value equal to another ten per centum of the price of the land;

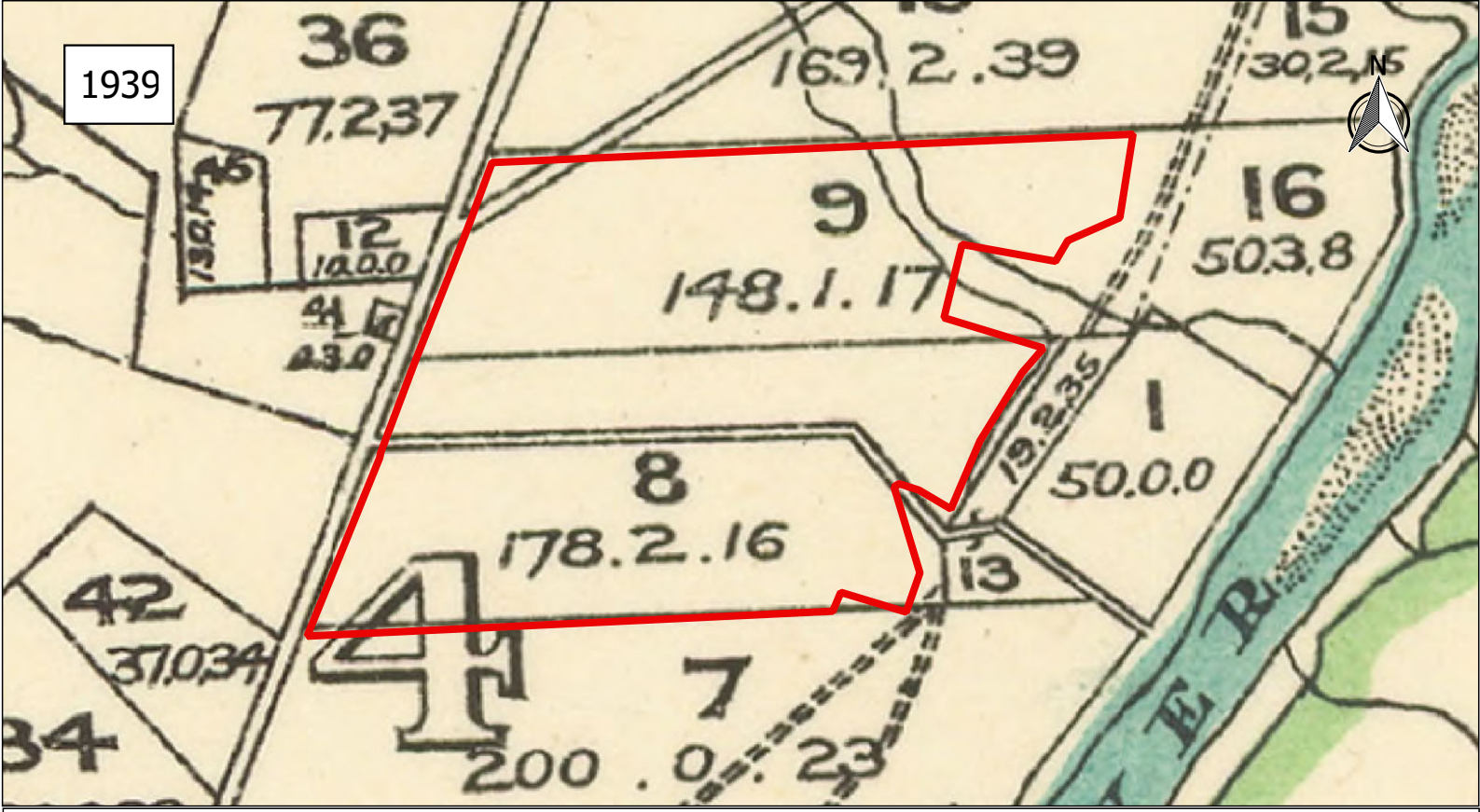
And in addition thereto shall, within six years from the date of his license or lease, put substantial improvements of a permanent character on first-class land to the value of one pound for every acre of such land, and on second-class land to an amount equal to the net price of every acre of such land: Provided that in no case shall the additional improvements required on second-class land be more than ten shillings per acre.

And every selector shall be bound at any time when so required by the Board to make and sign a statutory declaration as to his fulfilment of the conditions of occupation and improvement of the land in his occupation up to the time of making the said declaration.

145. Any holder of bush-lands or swamp-lands on deferred payments under section one hundred and fourteen of "The Land Act, 1885," or in any special settlement under regulations made before the twenty-seventh day of February, one thousand eight hundred and ninety-one, under Part V. of such Act, and any holder of a perpetual lease of any land under section one hundred and forty-eight of such Act, shall be deemed to have complied with the requirements of section twenty-one of "The Land Act Amendment Act, 1887," if within six years from the date of his license or lease he has brought or shall bring into cultivation twice the amount of land required by the herein first above-mentioned sections or regulations respectively, and in addition thereto has put or shall put substantial improvements of a permanent character on the land in his occupation to the value of one pound for every acre of such land.

146. In the case of suburban lands the Board in its discretion may dispense with conditions as to improvements of special monetary value, where such substantial improvements have been effected as in the opinion of the Board are reasonable in the circumstances.

147. The Board, on compliance with the provisions of section eighty-three, or on their being satisfied by a statutory declaration that the transferor is unable or not in a condition to make the improvements on the land required by this Act, may sanction a transfer, either by way of mortgage or otherwise, of land other than such land, or of any interest in such land, held under this Part of this Act, at any time after the first selection thereof, to any person not disqualified who shall make the declaration under the particular system under which the land is held, as given in the Schedules to this Act.

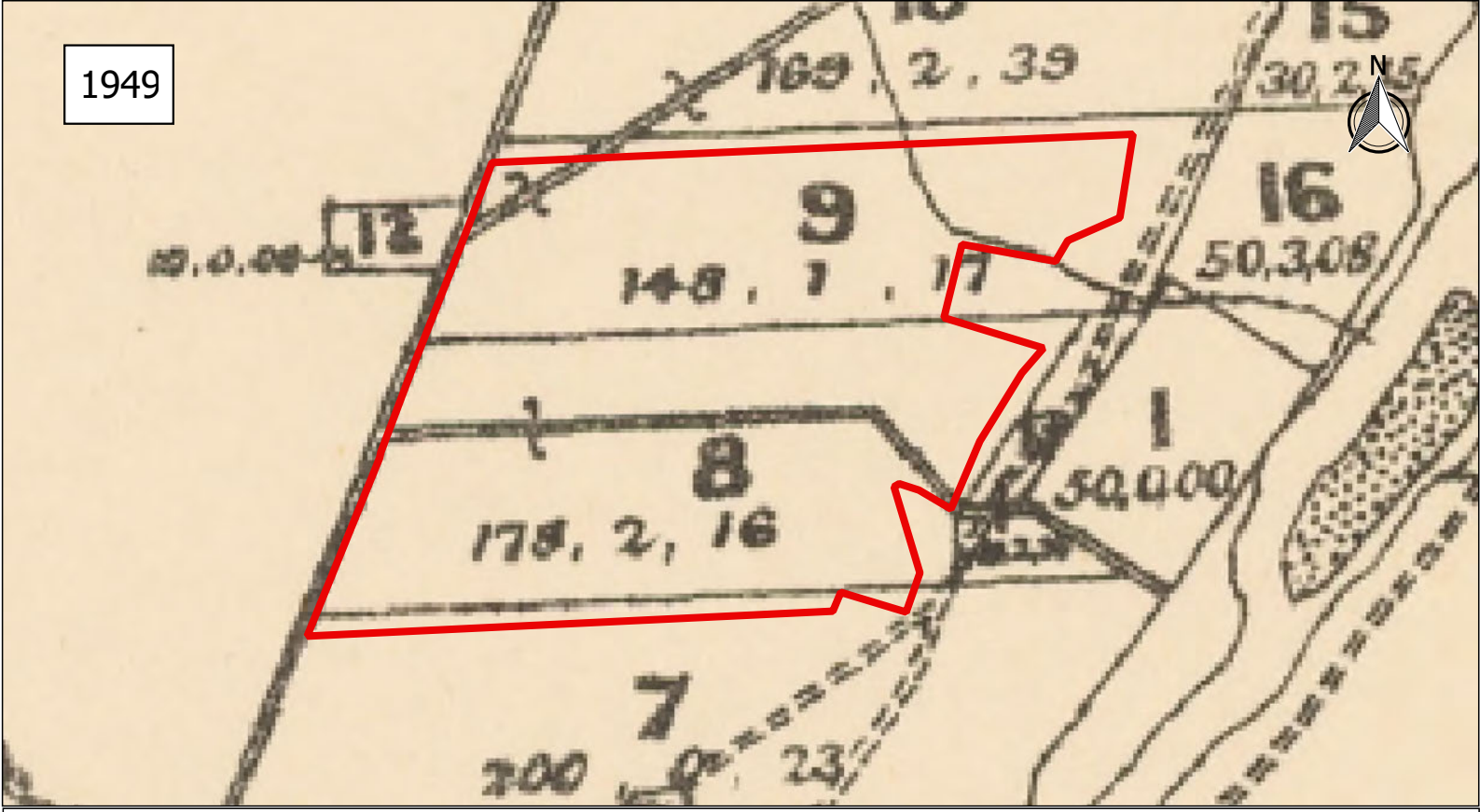


e3 Scientific

0 500 1000 1500 m

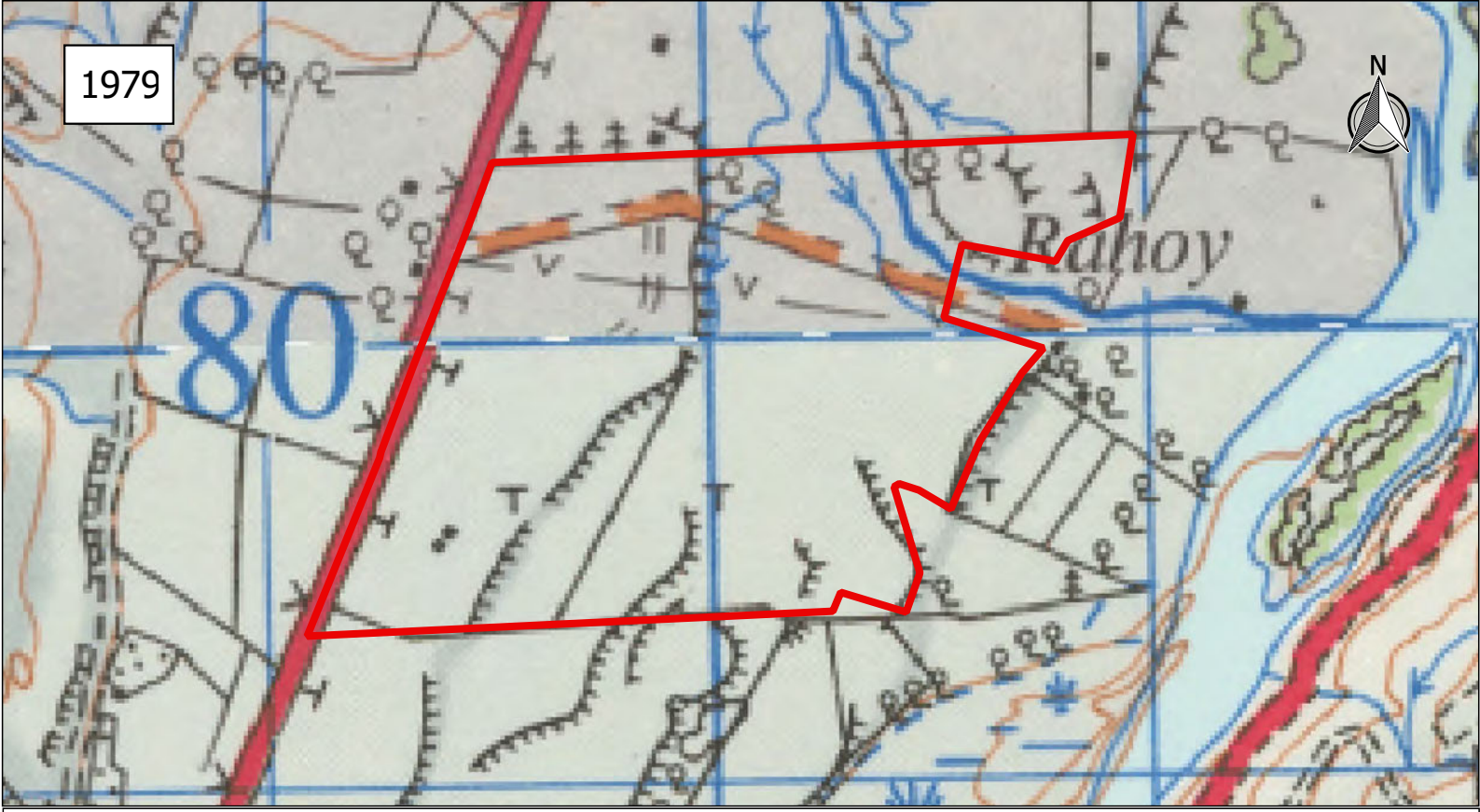
Site Boundary

Cartography sourced from http://mapspast.org.nz which includes data licensed by LINZ for reuse under the CC-BY 3.0 license.



e3 Scientific

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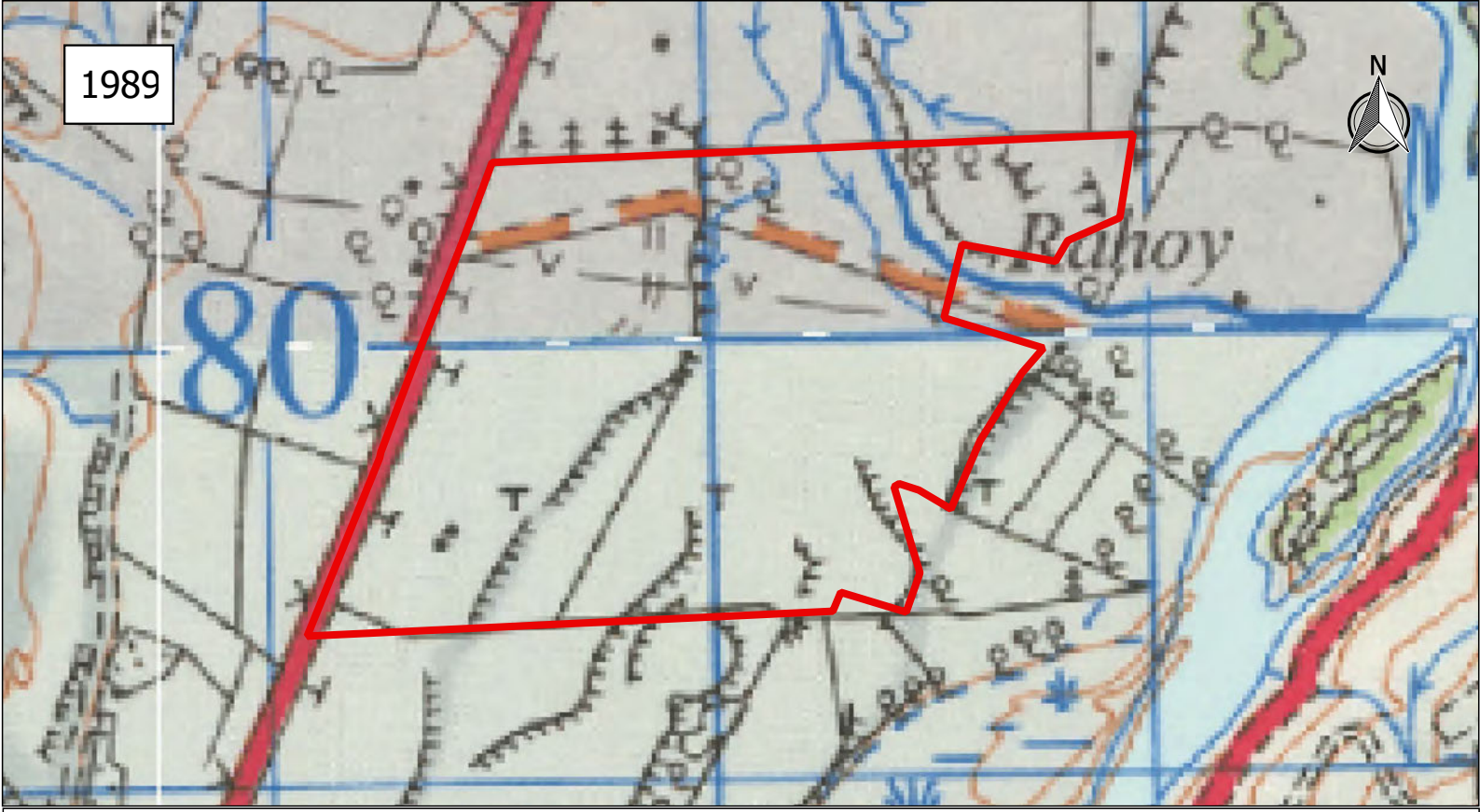


e3 Scientific

0 500 1000 1500 m

Site Boundary

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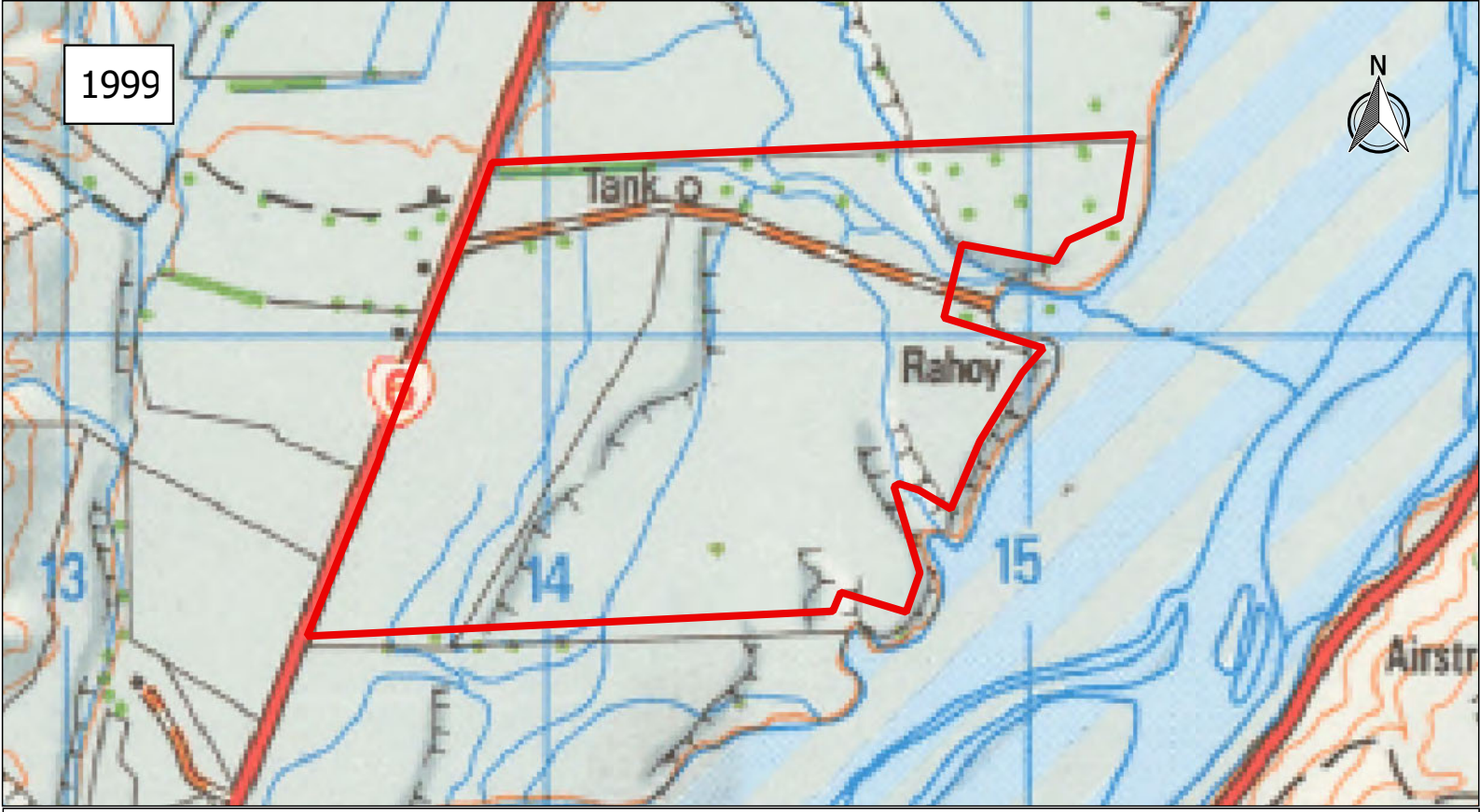


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Site Boundary

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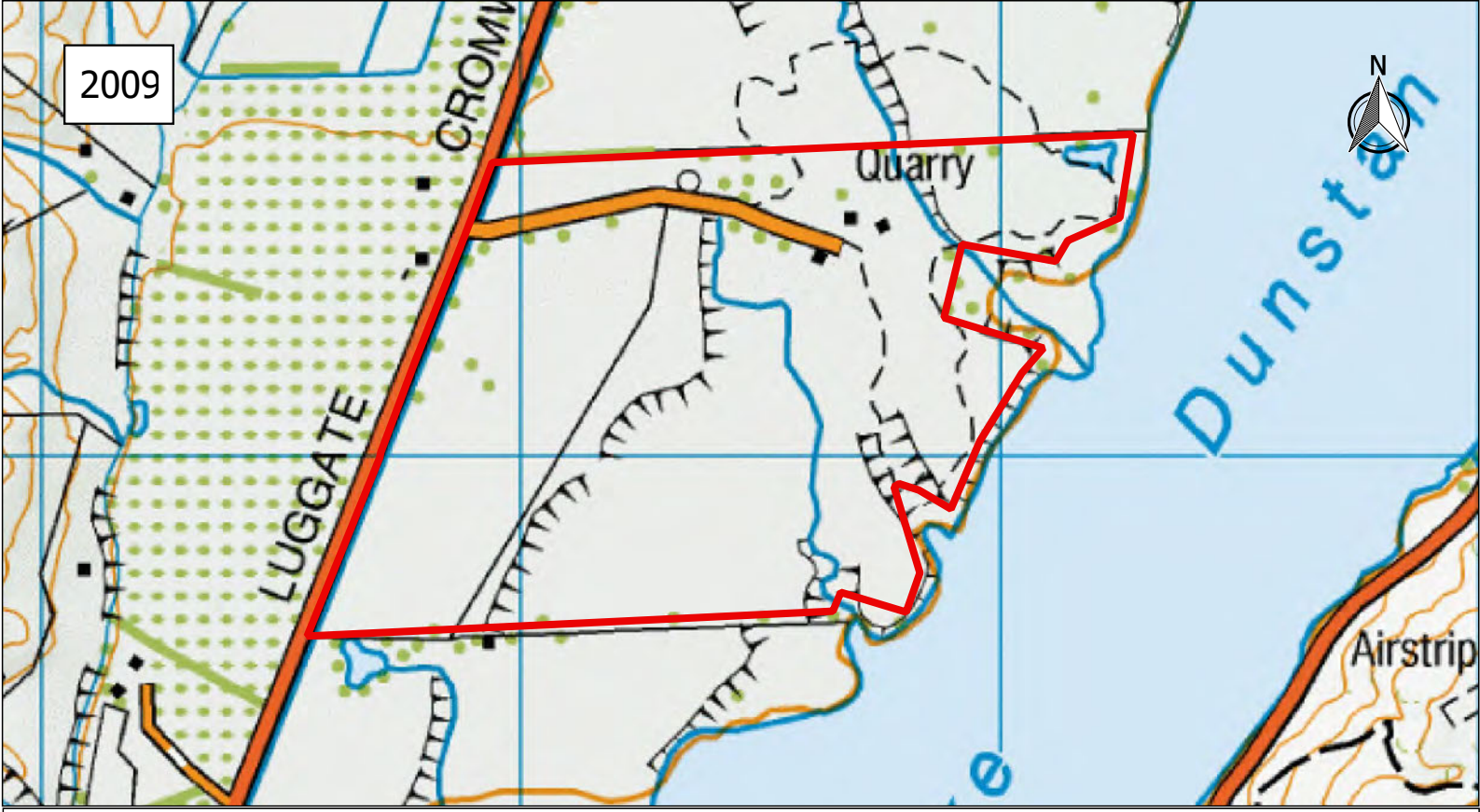


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Site Boundary

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Site Boundary

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Appendix C:

Historic Aerials



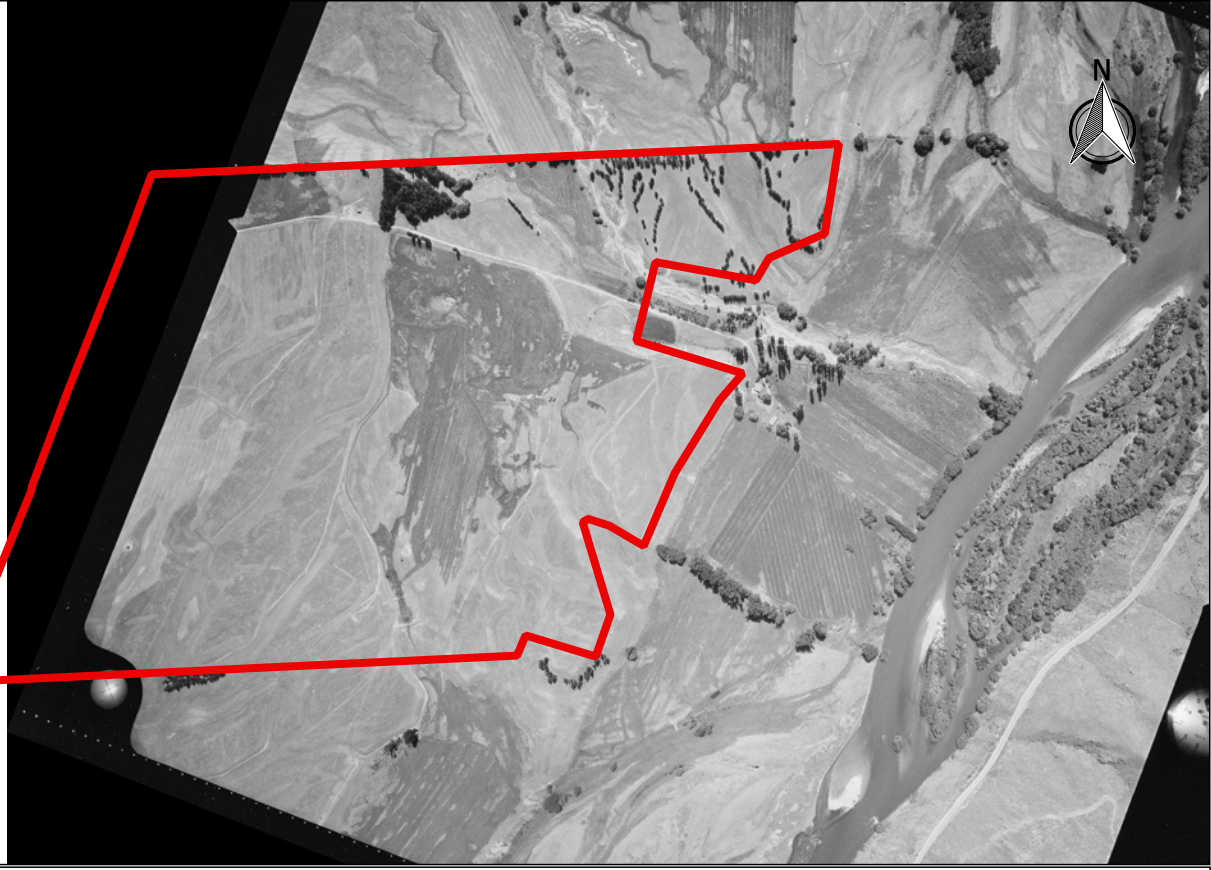
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Site Boundary

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1975



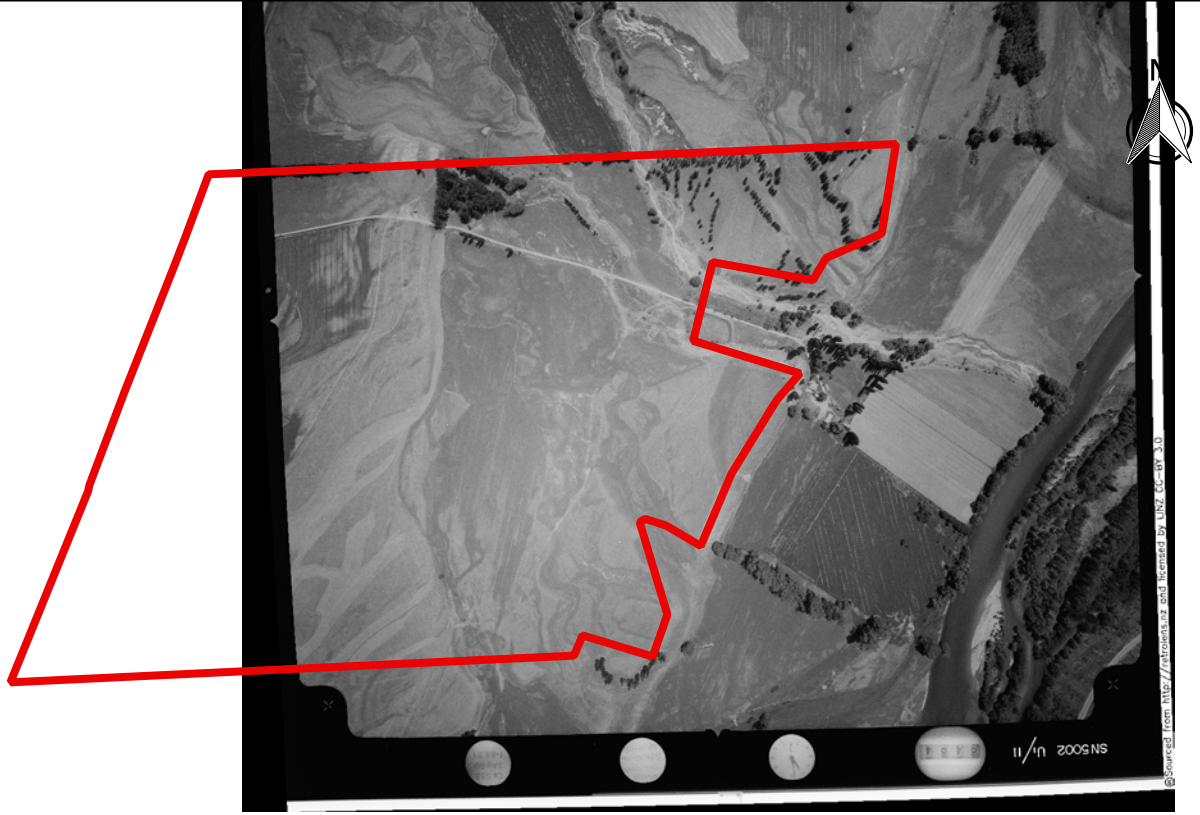
e3 Scientific

0 400 800 1200 m

Site Boundary

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1976



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0 400 800 1200 m

Site Boundary

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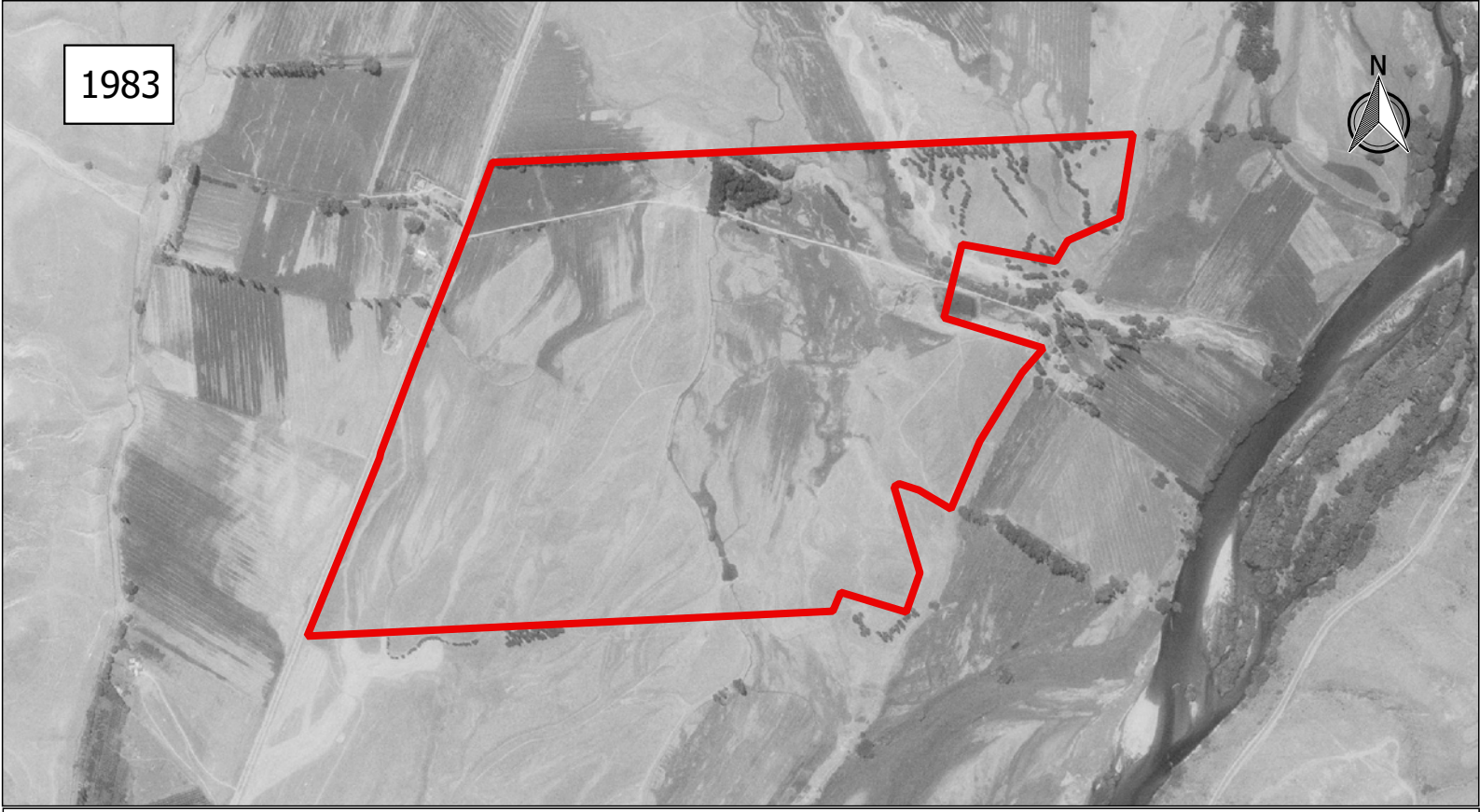


e3 Scientific

0 400 800 1200 m

Site Boundary

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Site Boundary

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Site Boundary

Aerial image sourced from Google Earth Pro, Maxar technologies.

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e3 Scientific

0 400 800 1200 m

Site Boundary

Aerial image sourced from Google Earth Pro, Maxar technologies.



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Site Boundary

Aerial image sourced from Google Earth Pro, Maxar technologies.



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Site Boundary

Aerial image sourced from Google Earth Pro, Maxar technologies.

2021



N

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Site Boundary

Aerial image sourced from Fulton Hogan

Appendix D:

Otago Regional Council Supporting Information

From:	Contaminated Land
To:	Simon Beardmore
Subject:	RE: Parkburn Quarry
Date:	Friday, 10 September 2021 3:04:07 PM
Attachments:	image002.png image001.png image003.jpg CURRENT - Annual Works Programme - Parkburn Quarry - Updated June 20.docx

Hi Simon,

No problem, find attached the cleanfill's Annual Works Programme.

There are five incidents on file for Parkburn Quarry, these being:

- **IN17.0186** (01/04/2017) – Complaint about dust at Pisa Moorings as it was windy from the North. ORC contacted Fulton Hogan and informed them of the complaint and that they need to check their water system.

- **IN16.0790** (22/07/2016) – Complaint the quarry was stockpiling broken glass and glass bottles in the yard and there was a strong smell associated with it. Complainant was concerned it might cause something to leach into the lake.

- **IN16.0406** (07/04/2016) – Complaint about clouds of dust coming from the quarry on a windy day (wind coming from the north). The complainant informed ORC they couldn't see over the bund but felt that dust mitigation should always be employed when the weather conditions are windy.

- **IN15.1172** (30/11/2015) – Complaint about dust coming from the quarry and hours that the crushing plant should be working. The complainant informed ORC that the crushing plant has been operating all day up to 10:30pm and starting up again at 4:30am. Complainant was wanting to know whether there was a constraint on the crushing plant working hours.

- **IN08.0001** (12/07/2008) – Burn off by Works Infrastructure.

Let me know if you need any further information.

Have a great weekend.

Thanks,
Shannen

Shannen Barns
ENVIRONMENTAL OFFICER

P 0800 474 082 | M [redacted]

[redacted]
www.orc.govt.nz

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From: Simon Beardmore <[redacted]>
Sent: Thursday, 9 September 2021 4:07 p.m.
To: Contaminated Land <contaminated.land@orc.govt.nz>
Subject: RE: Parkburn Quarry

Awesome – thanks so much. Two hopefully quick additional queries:

Can you provide a copy of the cleanfill's annual work programme (A1418462)/

Can you check if there have been any RMA incidents recorded for the site?

Thanks again,

Simon Beardmore

From: Contaminated Land <contaminated.land@orc.govt.nz>
Sent: Thursday, 9 September 2021 11:01 AM
To: Simon Beardmore <simon.beardmore@e3scientific.co.nz>
Subject: RE: Parkburn Quarry

Hi Simon,

Lastly, find attached the photos from the 2020 audit reports for 99664, 2004.600, RM15.108.01-.02 and RM18.376.01.V1.

As mentioned, if you require any specific PM information please get in touch.

Kind regards,
Shannen

Shannen Barns
ENVIRONMENTAL OFFICER

P 0800 474 082 | M [redacted]
[redacted]
www.orc.govt.nz

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From: Simon Beardmore <[redacted]>
Sent: Wednesday, 1 September 2021 10:11 a.m.
To: Contaminated Land <contaminated.land@orc.govt.nz>
Cc: Liam Salemink Waldren <[redacted]>
Subject: Parkburn Quarry

Good morning,

Hope you are doing well on this fine Level 3 morning.

We are preparing a preliminary site investigation for Fulton Hogan's Parkburn Quarry.

Would you be able to provide copies of information relating to HAIL.00359.01, including tank pull report and any correspondence

And consents information (application, recommending report, any performance monitoring results, and ORC audit reports) for:

- 99664
- 2004.600
- RM18.376.01.V1
- RM15.108.01-.02
- RM17.359.01 and .03

Thanks very much,

Simon Beardmore
Technical Director - Contaminated Land
d. [redacted] **m.** [redacted] **w.** e3scientific.co.nz

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Well Number	Status	Type	Take Consent	Depth	Diameter	Depth To Water	Drill Date	Owner	Location	Driller	Drawdown	Pump Rate	Pump Duration	Use1	Use2	Screen From	Screen To	Bore Consent Number
G41/0465	Completed	Borehole		30.92	0.15	20.07	11/04/2016	Penturen Estates Limited	Luggate-Cromwell Road	McNeill	24.04	1512	150	Irrigation		27.92	30.92	RM16.015.01
G41/0459	Completed	Borehole		30.17	0.4	9.86	18/11/2015	Fulton Hogan Limited	Cromwell	McNeill	22.99	0	0	Commercial	Industrial	24.17	30.17	RM15.310.01
G41/0453	Completed	Borehole		22.8	0.15	12.6	12/08/2015	A G Affleck, A M Affleck & C A Affleck	Cromwell	McNeill	0.35	717.12	120	Irrigation		21.3	22.8	RM15.167.01
G41/0489	Completed	Borehole		28.67	0.15	20.29	2/11/2017	Moonshine Cherries Limited	Adjacent to Luggate Cromwell Road approximately 1,380 metres West of Lake Dunstan	SouthDrill	0.21	0	138.24	Domestic		27.67	28.67	RM17.150
G41/0298				20	0.15	0	1/07/2003	J Bisset	Pisa North development adjacent to Lake Dunstan.		0	0	0	Community Supply		0	0	2003.571
G41/0293				10	0.125	0	5/01/2003	Hope A C Hope A C	Adjacent to Lake Dunstan at Pisa Moorings, Lowburn		0	71.7	0	Domestic		80.2	81.3	2003.255
G41/0284	Completed	Borehole	RM13.445.01	31.33	0.15	15.45	3/08/2001	Opiki Cropping Ltd	Parkburn Rd, Lowburn-Luggate Rd	McNeill	3	1166.4	0	Irrigation		28.58	31.33	2002.524
G41/0275	Completed	Borehole		34.59	0.15	12.95	24/06/2002	Perriam B	Clarks Rd - Lowburn	McNeill	3.74	432	0	Irrigation		31.65	34.59	2002.339
G41/0267	Completed	Borehole	RM15.093.01	25.06	0.15	14.5	13/09/2002	Mallet J & M	Pisa Moorings	McNeill	2.35	1814	0	Domestic	Irrigation	22.36	25.06	2002.243
G41/0303	Completed	Borehole	RM17.138.01	25	0.3	0	10/01/2003	Pisa Village Development	approximately 475 metres east of State Highway 6,		0	2592	0	Domestic		81.68	82.5	2003.757
G41/0302	Completed	Borehole	RM17.138.01	25	0.03	0	10/01/2003	Pisa Village Development	approximately 475 metres east of State Highway 6,		0	2592	0	Domestic		29.75	30.45	2003.755
G41/0301	Completed	Borehole	RM15.108.01.V1	30	0.3	0	9/01/2003	Fulton Hogan Ltd	Adjacent State Highway 6, Mount Pisa		0	3456	0	Unknown		0	0	2003.718
G41/0356	Completed	Borehole		23.34	0.15	13	13/12/2007	Justin Wade/Apple Bomb Trust	State Highway 6 Cromwell	McMillan	0.07	183	90	Domestic	Irrigation	21.84	23.34	2007.504
G41/0350	Completed	Borehole		29.92	0.15	13.23	26/09/2007	Lindsay Grey - Linita Trust	Smiths Way	McNeill	0.04	115.2	120	Domestic		0	0	2007.397
G41/0344	Completed	Borehole	RM11.237.01	27.63	0.3	12.97	16/09/2005	Peszynski J B	Lowburn Cromwell	McNeill	0.71	2764	240	Irrigation		0	0	2005.395
G41/0386	Completed	Borehole	RM16.002.01	27.88	0.125	20.92	22/12/2010	Penturen Estates Ltd	Cromwell Luggate Highway	McNeill	0.26	108	60	Domestic	Stockwater	26.88	27.88	RM10.418
G41/0378	Completed	Borehole	2009.478	19	0.2	3.76	3/02/2010	Pisa Moorings Utilities Society Inc.	Revival Lane and Ferry Lane, Cromwell	SouthDrill	6.05	1382.4	240	Domestic		16	19	2009.478
G41/0159				25	0.1	0	1/04/1997	JOHNSTON A		McNeill	0	95	0	Domestic	Stockwater	0	0	97218
G41/0201				35	0.15	0	27/08/1999	GREENER CAPITAL LTD	SITE B - S SIDE PARK BURN ADJ (W SIDE) SH6	McNeill	0	0	0	Irrigation	Domestic	0	0	99331
G41/0199	Completed	Borehole	RM14.064.01	27.95	0.15	16.42	25/11/1999	Hawker W & J	Pisa Range Estate, Lowburn-Wanaka Rd	McNeill	2.05	1296	0	Domestic	Irrigation	26.66	27.95	99033
G41/0172	Completed	Borehole	RM17.254.01	28.66	0.15	15.42	12/07/1998	Lawrence A	Chard Farm, Lowburn-Wanaka Rd	McNeill	1.67	1123.2	0	Domestic	Irrigation	26.57	28.66	97663
G41/0171			RM17.155.01	12	0.1	0		PISA MOORINGS LTD		McNeill	0	285.1	0	Irrigation		0	0	97607
G41/0227	Completed	Borehole		25	0.31	0	2/03/2001	S Hawker	behind #925 SH6		0	777.6	0	Irrigation		42.6	43.6	2001.162
G41/0226	Completed	Borehole		12.15	0.125	4.38	26/01/2001	Pisa Moorings Ltd c/- Begg I	Adjacent to Lake Dunstan - Cromwell	McNeill	0.02	112.32	0	Domestic		11.05	12.15	2001.064
G41/0215	Completed	Borehole	2000.549	28.44	0.15	15.47	5/05/2000	Thompson	SH6	McNeill	4.74	1987.2	0	Irrigation		25.28	28.44	2000.094
G41/0205			RM19.253.01	52	0.15	0	27/08/1999	QUIDER Q	W OF SH 6 ADJ TO ROAD	McNeill	0	1728	0	Irrigation		0	0	99422
G41/0204	Completed	Borehole	2002.326.V1	25.44	0.15	13.44	12/08/1999	Jones David Hall	Clarks Road adjacent to SH6, Cromwell-Wanaka Rd - Lowburn	McNeill	3.16	777.6	0	Community Supply	Irrigation	23.8	25.44	99383
G41/0244	Completed	Borehole		31	0.15	18.82	5/10/2001	Ramsay D & F	East of State Highway, north of Parkburn Creek. Wanaka Rd	McNeill	6.8	1900	0	Irrigation		27.9	31	2001.821
G41/0240	Completed	Borehole	2001.A47.V1	29.92	0.15	21	6/08/2001	John and Jennifer Dunbar	North of Park Burn Creek, Cromwell - Wanaka Highway	McNeill	3.2	950.4	0	Domestic	Irrigation	28.32	29.92	2001.67
G41/0237	Completed	Borehole	2001.82	31.33	0.15	15.45	3/08/2001	Nemarosa Estate	SH6 Wanaka Rd	McNeill	3	1166.4	0	Irrigation		28.23	31.33	2001.525
G41/0102	Completed	Borehole		27.8	0.15	13.25	17/01/1996	Horrell K	Wanaka Rd - Lowburn	McNeill	0	182.4	0	Domestic		24.68	27.8	94552
G41/0004	Abandoned	Borehole		205	0	0	1/10/1978	NZ Geological Survey DL-23			0	0	0	Investigation		0	0	
G41/0132				30	0.1	0	10/07/1996	NEILSON A J		McNeill	0	121	0	Domestic		0	0	96358
G41/0126	Completed	Borehole		11.16	0.15	3.65	12/09/1995	Pisa Moorings Incorporated	Wanaka Rd - Wanaka	McNeill	2.3	1373.8	0	Community Supply		9.02	11.04	95705
G41/0125				10	0.8	0		BITUMIX LTD		McNeill	0	51.8	0	Irrigation		0	0	
G41/0115	Completed	Borehole		23.485	0.2	12.6	6/01/1994	Peszynski J	Wanaka Rd - Cromwell	McNeill	1.2	976.3	0	Irrigation		20.6	23.45	93517
G41/0113	Completed	Borehole	2010.042.V1	24.9	0.2	16.74	10/08/1992	Downer EDi Works (was Bitumix)	#940 SH6	McNeill	0	2160	0	Commercial		0	0	

Easting	Northing	Consent Number	Consent Type	Consent Status	Consent Holder	Postal Address	Consent Expiry Date	Purpose
1304551	5014468	3978	Discharge to Air Permit	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	31/03/1993	To discharge to air from the operation of a mobile asphalt plant with main base at Parkburn, Cromwell
1304751	5014568	95546	General/Structure Land Use Consent	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	1/08/1996	To construct a crossing over the Parkburn Creek for the purpose of facilitating access to an industrial activity
1304551	5014468	4187	Discharge to Air Permit	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	1/04/1998	To discharge to air from the operation of a hot-mix asphalt plant at Parkburn, Cromwell
1304551	5014468	HD/1158/90	Discharge to Air Permit	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	1/04/1998	To discharge to air from the operation of a hot-mix asphalt plant at Parkburn, Cromwell (current consent no as at 15 September 1995 - No. 4187)
1304851	5014268	3353	Groundwater Take Permit	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	1/06/1998	To take 145,000 litres per hour from a bore for gravel washing at Parkburn, Cromwell
1304851	5014268	3353B	Discharge to Land Permit	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	1/06/1998	to discharge 145,000 litres per hour onto land
1304351	5013967	2003.718	Bore Construction Consent	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	4/09/2005	To construct a bore for the processing of roading aggregate for an unlimited term.
1304551	5014568	96273	Discharge to Air Permit	Expired	Bitumix Limited	1 Parry Street, Dunedin 9016	31/10/2006	To discharge to air contaminants produced when manufacturing up to 40 tonnes per hour of asphalt, including the products of diesel oil at the Bitumix Parkburn Quarry, Cromwell
1304551	5014267	98117	Discharge to Air Permit	Expired	Fulton Hogan Limited - Christchurch	PO Box 277, Alexandra 9340	30/04/2013	To discharge contaminants to air for the purpose of operating an asphalt plant. Location of activity: Parkburn quarry, SH 6, Cromwell
1304851	5014268	98127	Groundwater Take Permit	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	1/06/2018	To take 31,680,000 litres per month at a maximum rate of 144,000 litres per hour from a bore for the purpose of gravel washing, asphalt plant, mobile concrete plant, truck washing, domestic and irrigation - Parkburn Quarry.
1304551	5014267	98130	Discharge to Land Permit	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	1/06/2018	To discharge 23,760,000 litres per wash water per month at a maximum rate of 108,000 litres per hour, to land from settling ponds for the purpose of gravel, sand and crushed aggregate washing at Parkburn Quarry
1304551	5014267	98129	Groundwater Take Permit	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	1/06/2018	To take 23,760,000 litres of water per month at a maximum rate of 108,000 litres per hour, from open pits for the purpose of gravel, sand and crushed aggregate washing at Parkburn quarry
1304951	5014368	98128	Discharge to Land Permit	Expired	Fulton Hogan Limited	PO Box 277, Alexandra 9340	1/06/2018	To discharge up to 31,680,000 litres of quarry wash water per month at a maximum rate of 144,000 litres per hour, to land from settling ponds. See 98127 for groundwater take.
1305051	5014468	99664	Discharge to Land Permit	Current	Fulton Hogan Limited - Alexandra	PO Box 277, Alexandra 9340	6/11/2026	To discharge solid fill to land within an operating gravel quarry beside Lake Dunstan at the location where the Parkburn flows into the Lake for the purpose of backfill at a quarry site.
1304351	5013967	2003.719.V1	Groundwater Take Permit	Surrendered	Fulton Hogan Limited (Use for Consents)	Private Bag 1962, Fairfield, Dunedin 9054	10/09/2028	To take and use groundwater for the purpose of processing roading aggregate.
1304551	5014267	2004.6	Discharge to Air Permit	Current	Fulton Hogan Limited - Christchurch	PO Box 277, Alexandra 9340	31/03/2041	To discharge dust to air for the purpose of quarrying, crushing and screening aggregate.
1304756	5014503	RM18.376.01.V1	Discharge to Air Permit	Current	Fulton Hogan Limited - Alexandra	PO Box 277, Alexandra 9340	6/03/2044	To discharge contaminants to air for the purpose of operating an asphalt plant
1304756	5014503	RM12.385.01	Discharge to Air Permit	Surrendered	Fulton Hogan Limited - Alexandra	PO Box 277, Alexandra 9340	21/11/2047	To discharge contaminants to air for the purpose of operating an asphalt plant.
1304857	5014082	RM15.108.02.V1	Discharge to Land Permit	Current	Fulton Hogan Limited - Alexandra	PO Box 277, Alexandra 9340	1/11/2050	To discharge silt, sediment and water to land for the purpose of aggregate washing, processing aggregate, asphalt and concrete, truck washing and dust suppression.
1304286	5013958	RM15.108.01.V1	Groundwater Take Permit	Current	Fulton Hogan Limited - Alexandra	PO Box 277, Alexandra 9340	1/11/2050	To take and use groundwater for the purpose of processing aggregate, asphalt and concrete, truck washing, domestic use, irrigation and dust suppression.
1304784	5014492	RM17.359.01	Discharge to Land Permit	Surrendered	Fulton Hogan Limited (Use for Consents)	Private Bag 1962, Fairfield, Dunedin 9054	12/01/2053	To discharge water to land for the purpose of processing aggregate, asphalt and concrete, truck washing and dust suppression
1304855	5014046	RM17.359.03	Discharge to Land Permit	Surrendered	Fulton Hogan Limited (Use for Consents)	Private Bag 1962, Fairfield, Dunedin 9054	12/01/2053	To discharge water to land for the purpose of processing aggregate and dust suppression.
1304175	5013704	RM17.359.04	Groundwater Take Permit	Surrendered	Fulton Hogan Limited (Use for Consents)	Private Bag 1962, Fairfield, Dunedin 9054	12/01/2053	To take and use groundwater for the purpose of processing aggregate, irrigation and dust suppression
1304340	5013960	RM15.310.01	Bore Construction Consent	Current	Fulton Hogan Limited - Alexandra	PO Box 277, Alexandra 9340		To construct a bore for the purpose of accessing groundwater

Appendix E:

Site Photographs



Figure 1: Working face of quarry.



Figure 2: Stockpiled pea gravel for reclamation.



Figure 3: Reclaimed area at southern end of quarry.

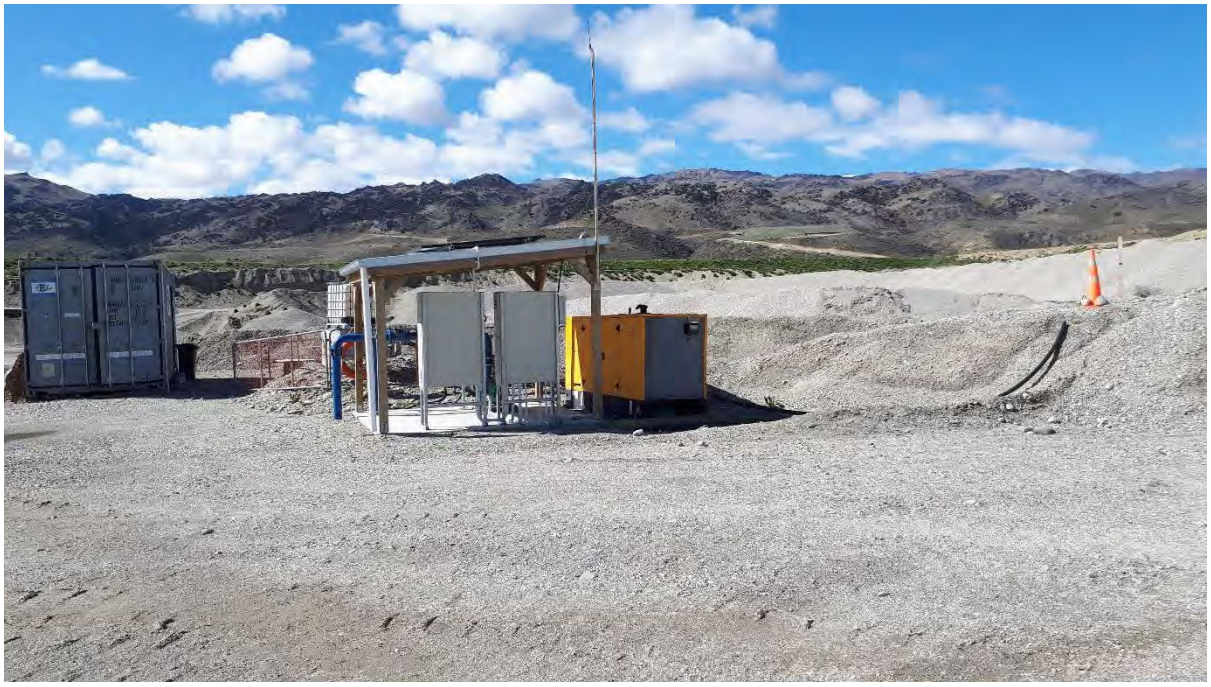


Figure 4: Diesel generator with in-built fuel tank in quarry.



Figure 5: Mobile crusher within Schedule Activity portion of quarry.



Figure 6: Bitumen spray plant within quarry.



Figure 7: Fuel and waste oil storage within quarry.



Figure 8: Silt ponds for treatment and disposal of quarry plant wash water.

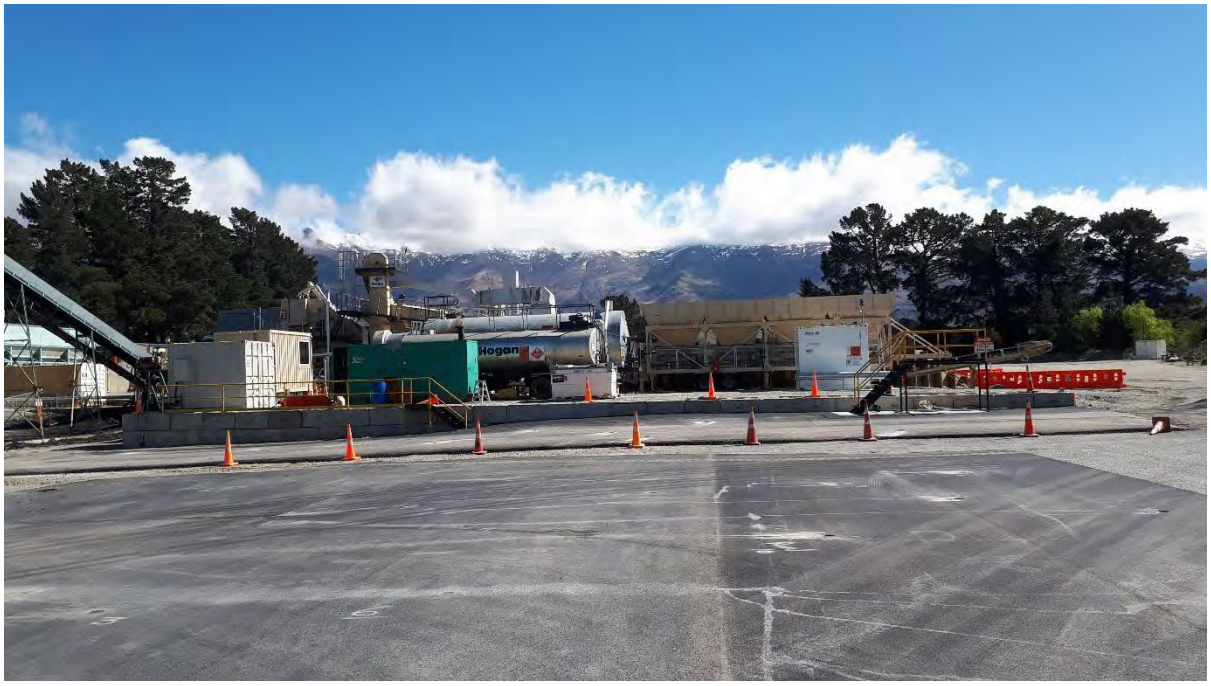


Figure 9: Asphalt plant



Figure 10: Bitumen storage at the asphalt plant.



Figure 11: Former diesel tank location.



Figure 12: Firth concrete block plant, with concrete silo (white) and diesel tank (yellow) in background.



Figure 13: Allied concrete batching plant.



Figure 14: Truck wash.



Figure 15: Signage at entrance to cleanfill.



Figure 16: Cleanfill face.



Figure 17: Road cutting waste storage.



Figure 18: Hardfill face.



Figure 19: New glass processing building.



Figure 20: JCL Asphalt yard, with diesel tank (white) at entrance to container shelter.



Figure 21: Two explosive storage containers (white) at Fulton Hogan yard.

Appendix F:

XRF Screening Results

Table 1: XRF background readings (ppm)

Sample ID	Depth (m)	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
background 1	0.0-0.05	14	<LOD	<LOD	31	26	31	99
background 2	0.0-0.05	8	<LOD	<LOD	17	19	15	58
background 3	0.0-0.05	10	<LOD	<LOD	11	16	19	70
background 4	0.0-0.05	6	<LOD	<LOD	17	20	11	65
background 5	0.0-0.05	8	<LOD	<LOD	16	20	17	56
background 6	0.0-0.05	9	<LOD	<LOD	19	26	16	76
background 7	0.0-0.05	7	<LOD	<LOD	12	20	18	53
background 8	0.0-0.05	9	<LOD	<LOD	17	19	14	63
background 9	0.0-0.05	11	<LOD	<LOD	18	18	22	67
background 10	0.0-0.05	7	<LOD	75	19	19	16	70
Local Background Minimum		6	<LOD	<LOD	11	16	11	53
Local Background Maximum		15	<LOD	75	31	26	38	99
Predicted Background Concentration[1]		12	0.34	80	43	44	45	182

[1] 95 %ile predicted background concentration for Gravel (Manaaki Whenua Landcare Research, 2015)

< Denotes concentration is below laboratory detection limits

Table 2: XRF Screening results (ppm)

Sample ID	Depth (m)	Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
cleanfill 01	0.0-0.05	13	<LOD	48	22	19	27	95
cleanfill 02	0.0-0.05	10	<LOD	<LOD	12	13	<LOD	62
cleanfill 03	0.0-0.05	9	<LOD	44	<LOD	19	18	62
cleanfill 04	0.0-0.05	7	<LOD	<LOD	11	12	<LOD	38
cleanfill 05	0.0-0.05	14	<LOD	83	21	15	19	62
cleanfill 06	0.0-0.05	11	<LOD	95	26	59	26	78
cleanfill 07	0.0-0.05	9	<LOD	55	22	58	14	63
cleanfill 08	0.0-0.05	10	<LOD	<LOD	8	12	<LOD	74
cleanfill 09	0.0-0.05	9	<LOD	52	12	10	15	41
cleanfill 10	0.0-0.05	16	<LOD	<LOD	25	21	26	54
cleanfill 11	0.0-0.05	10	<LOD	76	21	42	22	70
cleanfill 12	0.0-0.05	7	<LOD	75	<LOD	27	17	32
cleanfill 13	0.0-0.05	11	<LOD	124	22	38	19	55
cleanfill 14	0.0-0.05	5	<LOD	<LOD	<LOD	5	<LOD	64
cleanfill 15	0.0-0.05	7	<LOD	90	16	43	13	58
cleanfill 16	0.0-0.05	7	<LOD	70	14	43	23	52
cleanfill 17	0.0-0.05	13	<LOD	<LOD	22	19	16	50
cleanfill 18	0.0-0.05	9	<LOD	<LOD	14	18	<LOD	55
cleanfill 19	0.0-0.05	6	<LOD	98	14	8	17	51
cleanfill 20	0.0-0.05	18	<LOD	48	19	367	13	385
cleanfill 21	0.0-0.05	10	<LOD	43	13	11	<LOD	38
cleanfill 22	0.0-0.05	18	<LOD	<LOD	23	19	16	63
cleanfill 23	0.0-0.05	8	<LOD	40	14	12	12	49
cleanfill 24	0.0-0.05	8	<LOD	<LOD	17	21	14	45
cleanfill 25	0.0-0.05	10	<LOD	<LOD	13	14	14	60
cleanfill 26	0.0-0.05	11	<LOD	<LOD	11	16	11	59
cleanfill 27	0.0-0.05	10	<LOD	<LOD	16	21	12	36
cleanfill 28	0.0-0.05	12	<LOD	<LOD	16	22	14	40
cleanfill 29	0.0-0.05	11	<LOD	54	7	12	14	58
cleanfill 30	0.0-0.05	12	<LOD	<LOD	19	19	11	50
hardfill 31	0.0-0.05	9	<LOD	<LOD	14	22	14	61
hardfill 32	0.0-0.05	11	<LOD	<LOD	27	21	17	96
hardfill 33	0.0-0.05	11	<LOD	72	19	23	16	59
hardfill 34	0.0-0.05	10	<LOD	48	18	95	11	188
hardfill 35	0.0-0.05	16	<LOD	65	30	23	26	93
hardfill 36	0.0-0.05	14	<LOD	<LOD	20	22	18	57
hardfill 37	0.0-0.05	11	<LOD	<LOD	16	13	15	57
hardfill 38	0.0-0.05	10	<LOD	47	8	14	<LOD	45
hardfill 39	0.0-0.05	9	<LOD	<LOD	10	18	14	68
hardfill 40	0.0-0.05	7	<LOD	69	11	15	<LOD	51
Local Background Minimum[1]		6	<LOD	<LOD	11	16	11	53
Local Background Maximum[1]		15	<LOD	75	31	26	38	99
Predicted Background Concentration[5]		12	0.34	80	43	44	45	182

[1] Based on 10 XRF readings from an undisturbed part of the site

[2] 95 %ile predicted background concentration for Gravel (Manaaki Whenua Landcare Research, 2015)

< Denotes concentration is below laboratory detection limits

Orange shading denotes exceedance of local background maximum

Appendix 6

CODC NES Records Search

NES RECORD SEARCH

Application

JKCM Limited PO Box 456, Cromwell 9342	Number NES250014 Application date 12/11/25 Phone Mobile [redacted] Email [redacted]

Property

Valuation No.	2842114401
Location	922 Luggate-Cromwell Road (State Highway 6), Cromwell
Legal Description	Part Section 63 Block IV Wakefield SD
Area (hectares)	48.3192

Resource consents

Resource Area: Medium Density Residential Zone, Low Density Residential Zone, Industrial Resource Area (2), Industrial Resource Area (3)

Consents:

17/02/2023 RC 220339V1: Change conditions of RC220339 to allow for the installation of one `smart shelter` on site

Information provided with the application indicates the presence of an asphalt plant and concrete block manufacturing plant. Asphalt manufacture or bulk storage and commercial concrete manufacture are items E2 and E4 on the HAIL and may trigger NES-CS requirements.

Further, the application suggests that the site has been used for motor vehicle maintenance and repair (Associated with quarry operations). Motor vehicle workshops are Item F4 on the HAIL and may trigger NES-CS requirements if undertaken on the site.

Note: This application was cancelled and superseded by RC 220443.

01/11/2022 RC 200046V1: Change of conditions to change building location

Information provided with the application indicates the presence of an asphalt plant and concrete block manufacturing plant. Asphalt manufacture or bulk storage and commercial concrete manufacture are items E2 and E4 on the HAIL and may trigger NES-CS requirements.

07/09/2022 RC 220268: Install three portacoms for temporary Aurora Energy depot

Information provided with the application indicates the presence of a glass crushing plant. Waste recycling is item G6 on the HAIL and may trigger NES-CS requirements.

16/08/2021 RC 210129: Land use consent to install two 20,000L diesel fuel tanks to replace one diesel tank which is to be removed

Information provided with the application indicates the presence of fuel storage tanks, and an asphalt plant. Fuel storage and asphalt manufacture and bulk storage are items A17 and E2 on the HAIL and may trigger NES-CS requirements.



Figure One: Extract from application for RC 210129 showing location of pre-existing and proposed fuel tanks.

09/06/2021 RC 210112: Land use consent to construct a shed to house a glass crushing plant

Information provided with the application indicates the presence of a glass crushing plant. Waste recycling is item G6 on the HAIL and may trigger NES-CS requirements.

24/04/2020 RC 200046: Change condition 1 of RC 190641 to allow establishment of two further portacoms

Information provided with the application indicates the presence of an asphalt plant and concrete block manufacturing plant. Asphalt manufacture or bulk storage and commercial concrete manufacture are items E2 and E4 on the HAIL and may trigger NES-CS requirements.

01/11/2019 RC 190341: Land use consent to establish portacom offices

Information provided with the application, indicates the presence of a concrete block manufacturing plant. Commercial concrete manufacture is item E4 on the HAIL and may trigger NES-CS requirements.

05/11/2007 RC 070216: Land use consent to extract and convey sand aggregate from the Upper Terrace

Information provided with the application, indicates the presence of a concrete block manufacturing plant. Commercial concrete manufacture is item E4 on the HAIL and may trigger NES-CS requirements.

01/09/2005 RC 050211: Land use consent to build and operate concrete block manufacturing plant

Information provided with the application indicates the presence of an asphalt plant and concrete block manufacturing plant. Asphalt manufacture or bulk storage and commercial concrete manufacture are items E2 and E4 on the HAIL and may trigger NES-CS requirements.

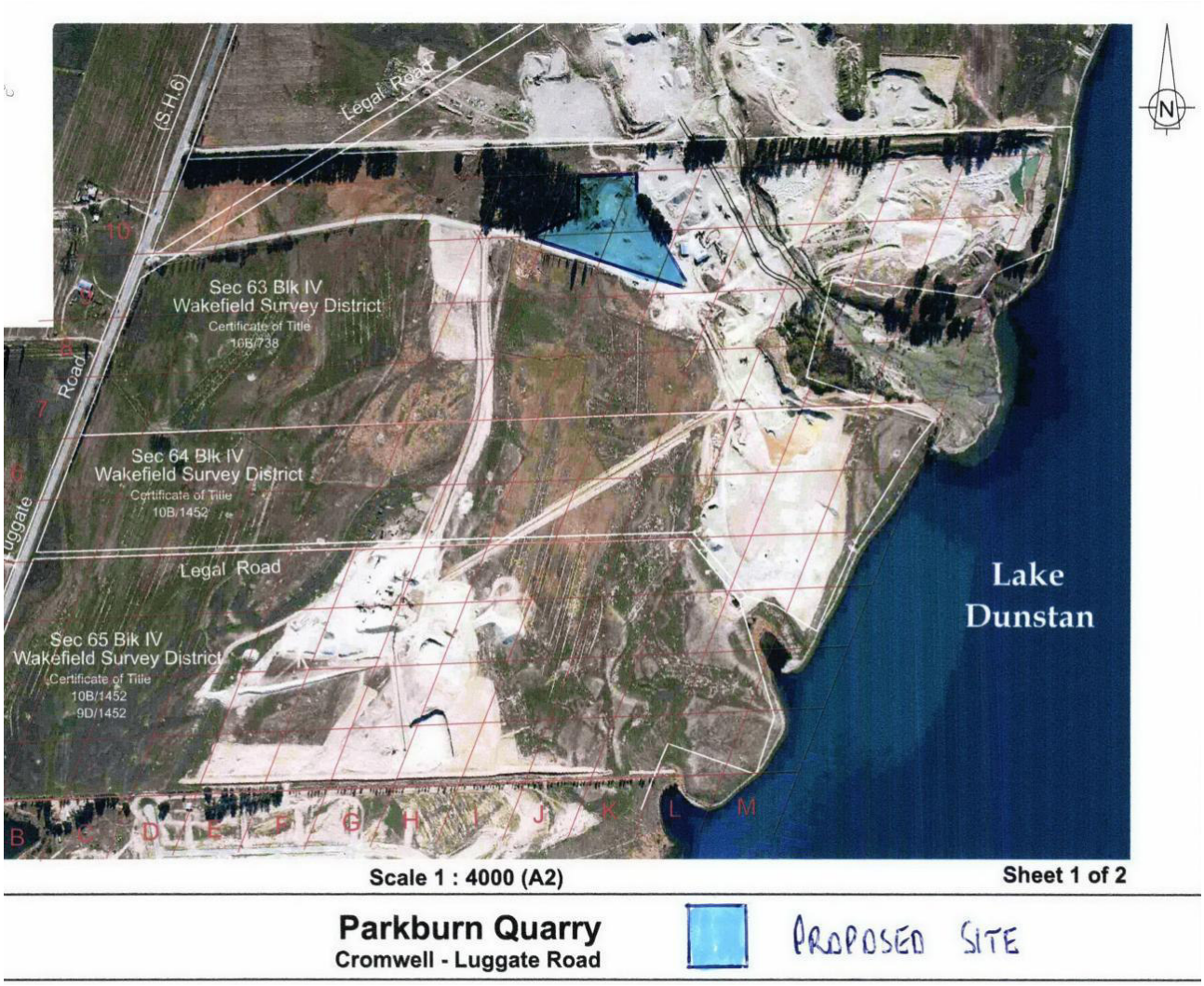


Figure Two: Extract from application showing location of concrete block plant.

19/06/2000 RC 990155: Backfill against quarry pit faces with solid fill

Information provided in support of this application indicates a bitumen storage area. Asphalt or bitumen manufacture or bulk storage is Item E2 on the HAIL and may trigger NES-CS requirements.

Note: This application was withdrawn before any decisions were made on it.

Building

Consents/Permits/Compliance Schedules:

13/10/22 BC 220462A: Change in Site Location for BC 220462

No information in relation to HAIL activities could be found on this record.

5/10/22 BC 220703: New foundations and construction of portal frame gantry

Information provided in support of this application indicates presence of diesel storage tanks and bitumen storage. Tanks for fuel and bitumen bulk storage are Items A17 and E2 on the HAIL respectively, and may trigger NES-CS requirements.

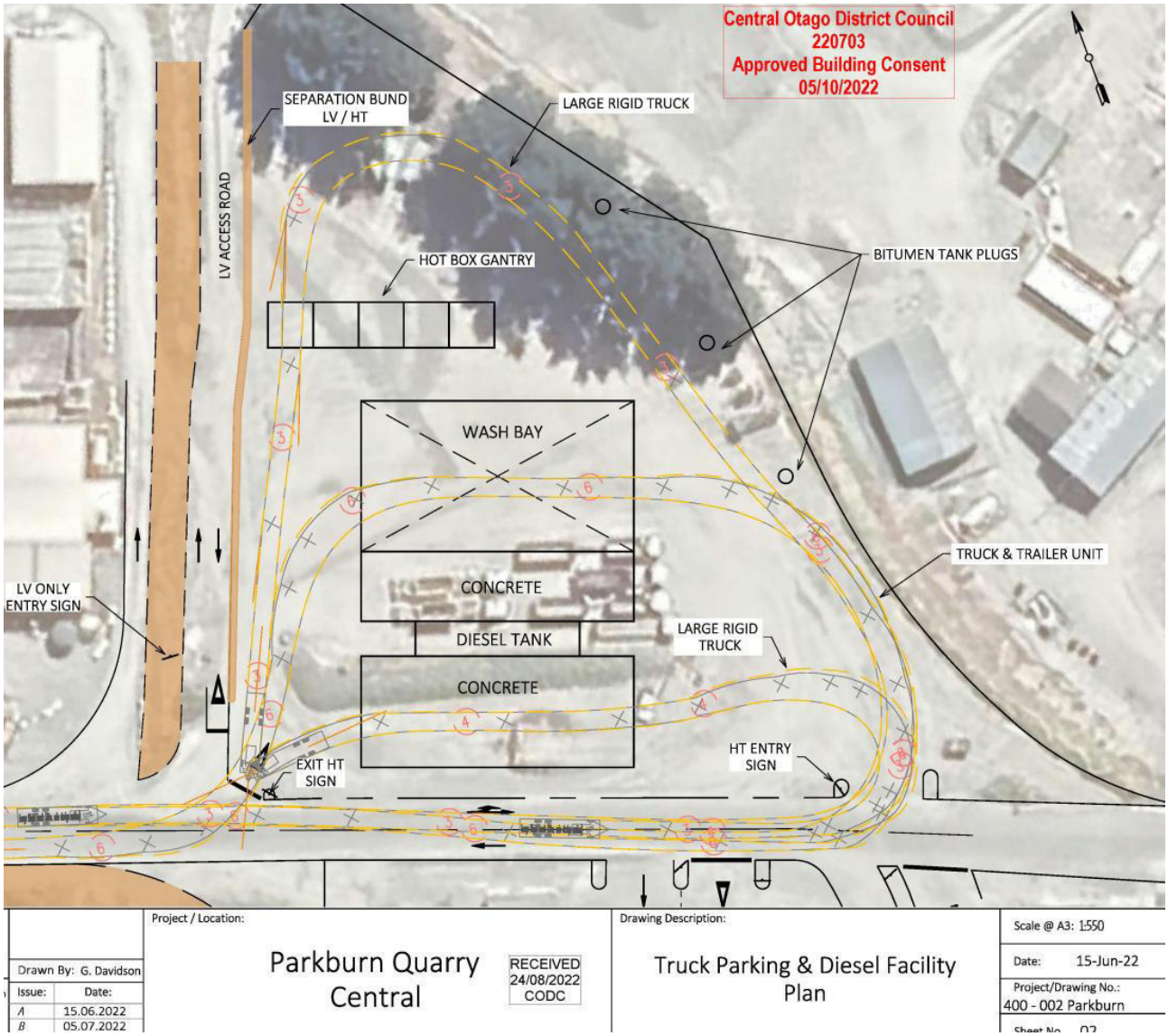
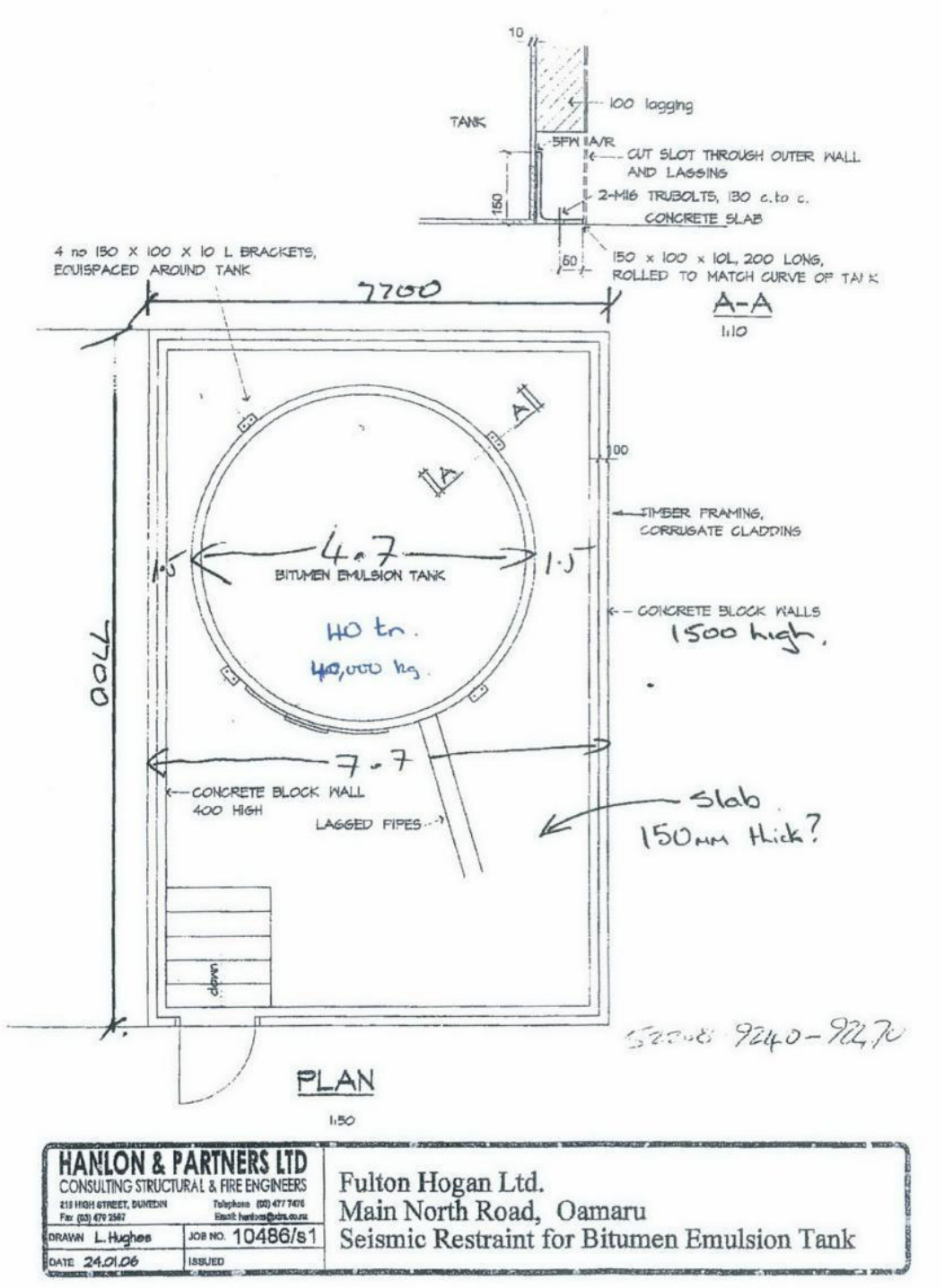


Figure Three: Extract from application showing location of diesel and bitumen tanks.

21/07/22	BC 220462: Foundations and site works for relocated Portacom
	No information in relation to HAIL activities could be found on this record.
18/05/21	BC 210205: New 20m x 16m storage shed
	Information provided with the application indicates the presence of a glass crushing plant. Waste recycling is item G6 on the HAIL and may trigger NES-CS requirements.
9/12/20	BC 200771: Foundations, water supply, drainage & site works for unisex portacom ablution block
	No information in relation to HAIL activities could be found on this record.
1/09/20	BC 200568: Install 1x Smart Shelter container roof
	Information provided with the application indicates the presence of an asphalt plant. Asphalt manufacture or bulk storage is item E2 on the HAIL and may trigger NES-CS requirements.
26/06/20	BC 200395: Foundations and site works for relocated office (portacom)
	No information in relation to HAIL activities could be found on this record.
27/09/19	BC 190726: Foundations & site works for relocated office (portacom)
	No information in relation to HAIL activities could be found on this record.
10/07/19	BC 190440: Foundations & site works for relocated office (portacom)
	No information in relation to HAIL activities could be found on this record.
12/11/18	BC 180636: Foundations & site works for relocated office (portacom)
	No information in relation to HAIL activities could be found on this record.

9/11/16	BC 160880: Foundations & site works for relocated office/smoko room *No information in relation to HAIL activities could be found on this record.*
30/11/15	BC 150689: Erect a new storage shed *No information in relation to HAIL activities could be found on this record.*
30/07/15	BC 150440: Additions to existing shed *Information provided in support of this application indicates the presence of bulk bitumen storage tanks and above ground fuel tanks. Asphalt or bitumen manufacture or bulk storage and fuel storage tanks are Items E2 and A17 on the HAIL respectively and may trigger NES-CS requirements.*



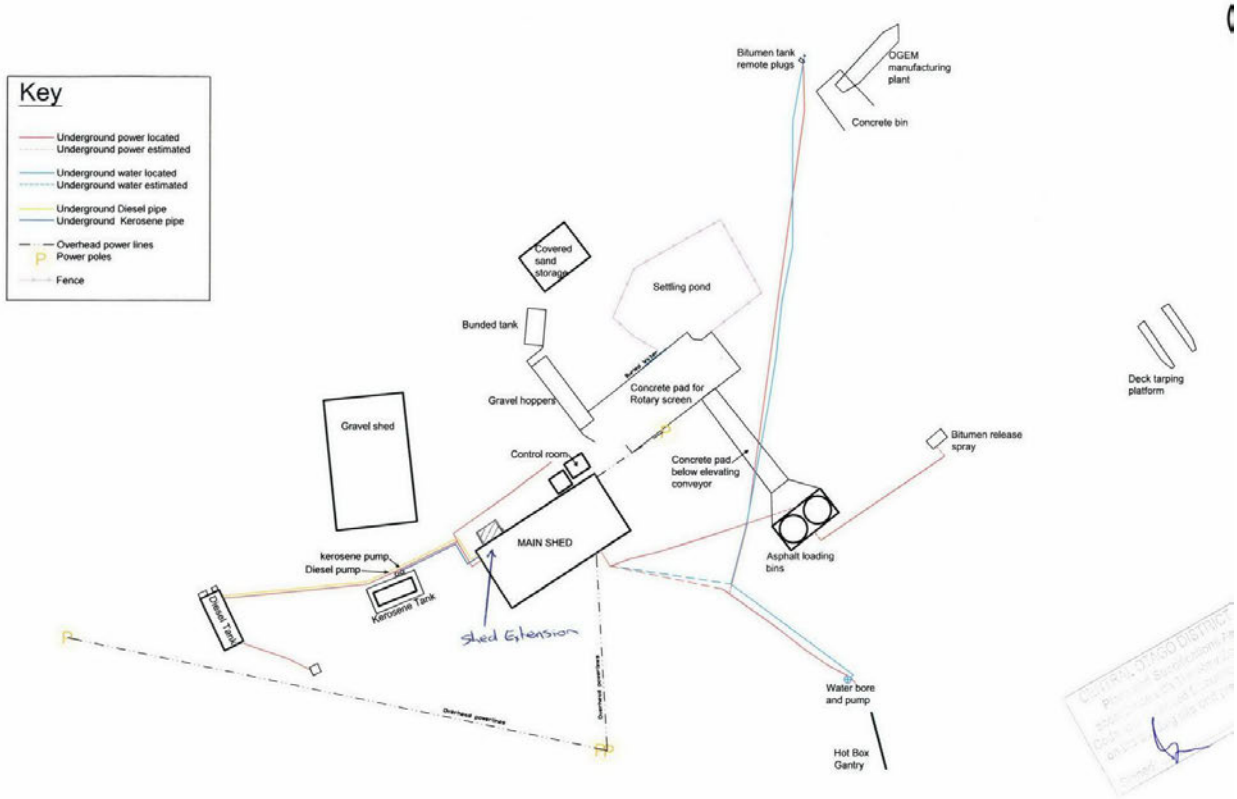


Figure Four: Extracts from application showing bitumen and fuel tanks

14/08/06 BC 060538: Relocate building onto site for staff facilities

No information in relation to HAIL activities could be found on this record.

7/12/05 BC 050850: Erect all new buildings/platforms for new industrial plant

Information provided with the application indicates the presence of a concrete block manufacturing plant. Commercial concrete manufacture is item E4 on the HAIL and may trigger NES-CS requirements.

25/11/04 BC 040935: Erect a new Portacom building

No information in relation to HAIL activities could be found on this record.

31/07/95 BC 950406: Relocate storage building

Information provided in support of this application indicates the presence of bulk bitumen storage tanks and above ground fuel tanks. Asphalt or bitumen manufacture or bulk storage and fuel storage tanks are Items E2 and A17 on the HAIL respectively and may trigger NES-CS requirements.

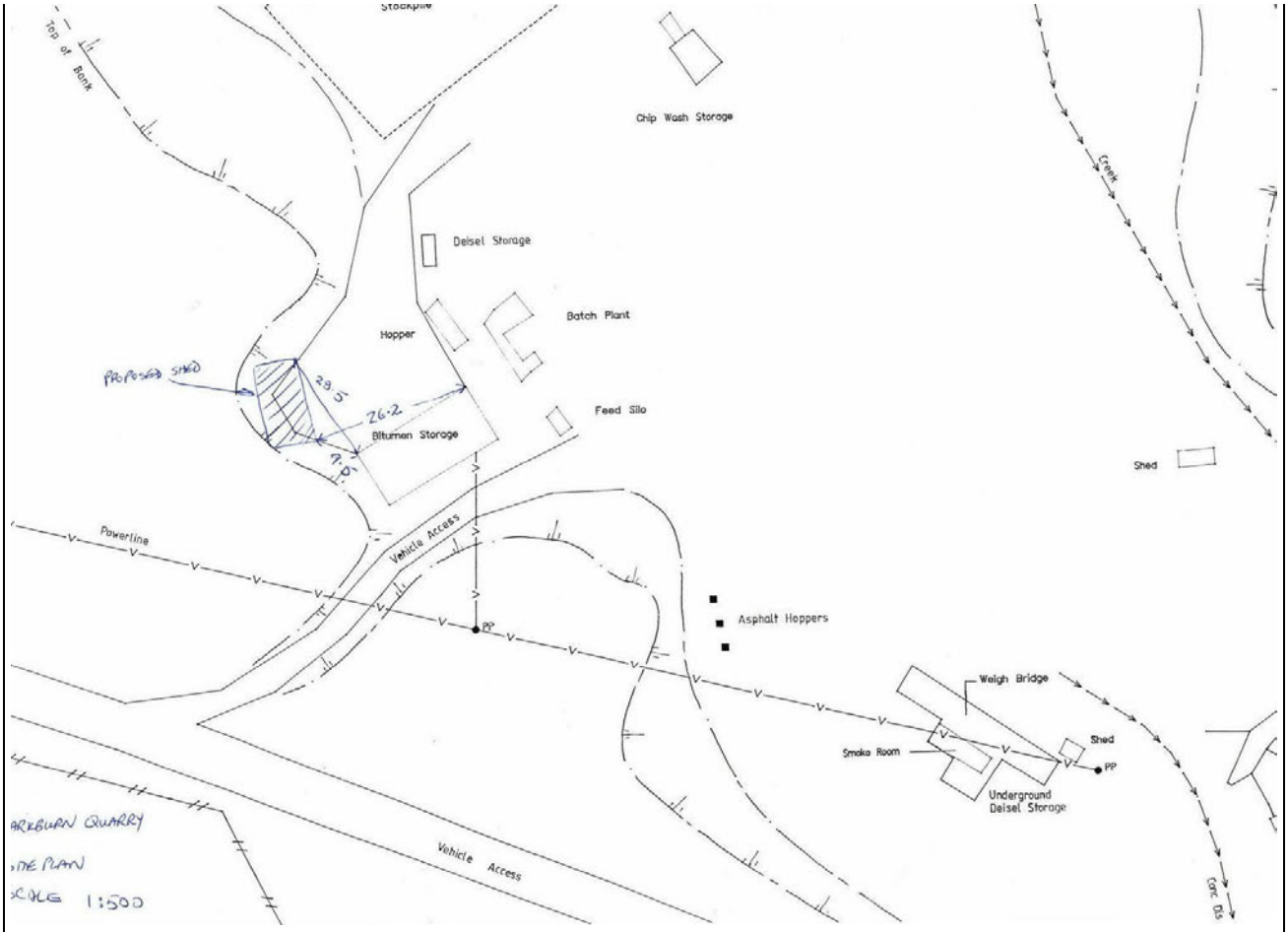


Figure Five: Extract from application showing bitumen storage and fuel tanks

21/12/1990 Building Permit H056122: Erect a Bitumen storage shed (relocated)

Information provided in support of this application indicates the presence of bulk bitumen storage tanks and above ground fuel tanks. Asphalt or bitumen manufacture or bulk storage and fuel storage tanks are Items E2 and A17 on the HAIL respectively and may trigger NES-CS requirements.

23/11/1988 Building Permit F037756: Erect office building at quarry

No information in relation to HAIL activities could be found on this record.

Preliminary Site Investigations and Detailed Site Investigations

A preliminary site investigation was undertaken for the site in support of Plan Change 23. The PSI identified the following HAIL activities as having occurred on different parts of the site.

Table 3: Identified HAIL Activities

HAIL Activity	Dates	Comment	Likelihood
E4. Commercial concrete manufacture or commercial cement storage	2005 - present	Concrete block manufacturing facility	Certain
E2. Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant)	1987 - present	Asphalt plant	Certain
A17. Storage tanks or drums for fuel, chemicals or liquid waste	<1990-2004	Various fuel storage	Possible
A10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds	<1958-~1985	1000 m^2 of orchard	More likely than not
A18. Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside	~2020 - present	250 m^2 of treated timber storage	Certain
G5. Waste disposal to land (excluding where biosolids have been used as soil conditioners)	1987 - present	Cleanfill	Likely

The below figures are from the PSI, showing different activities on the site.

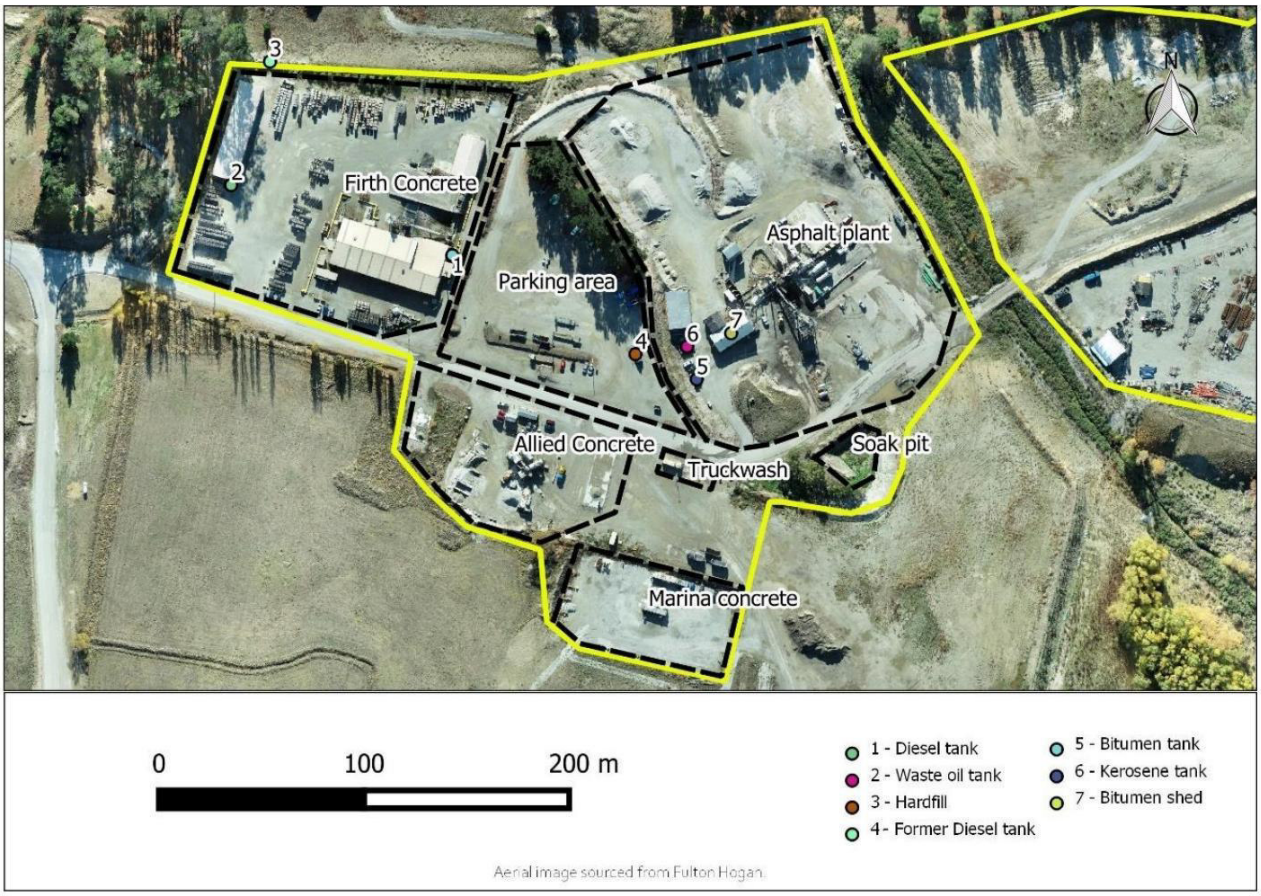


Figure Six: Extract from PSI showing activities in the industrial area of the site.

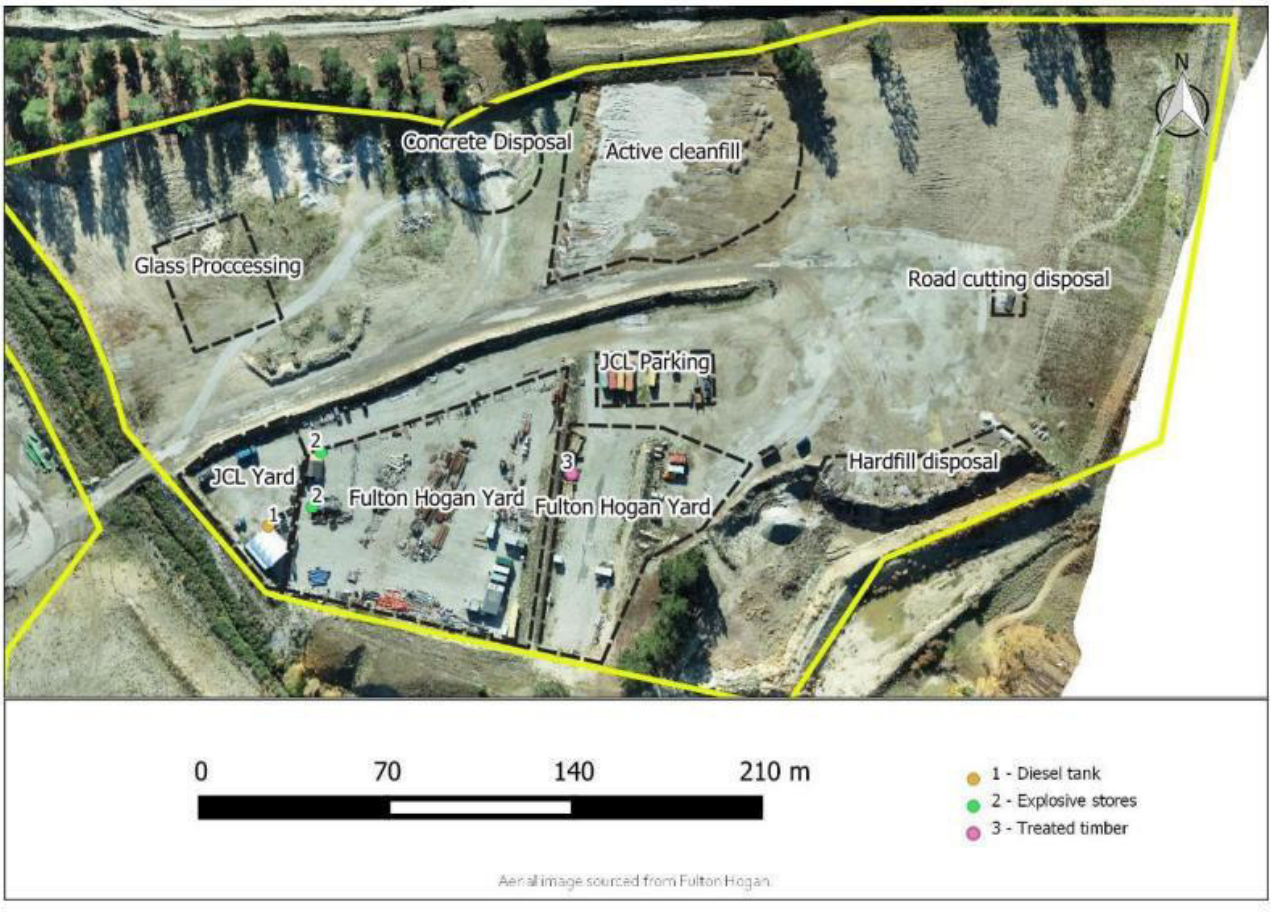


Figure Seven: Extract from PSI showing activities in the cleanfill and yards area of the site.

Further, the PSI notes that the following activities have occurred on the site, but did not consider them to constitute HAIL activities:

Several on-site wastewater treatment and disposal systems treating domestic-type effluent from offices and ablution blocks on the site

Gravel extraction – Exempted from HAIL under Item E7.

Explosives storage in two steel containers in the Fulton Hogan Yard area. This was not considered to be bulk storage in terms of Item C1 on the HAIL.

The storage and crushing of glass was not considered to constitute waste recycling under Item G6 as it does not involve the storage use or disposal of hazardous substances.

The below extract from the PSI indicates the areas considered likely to contain HAIL Activities:

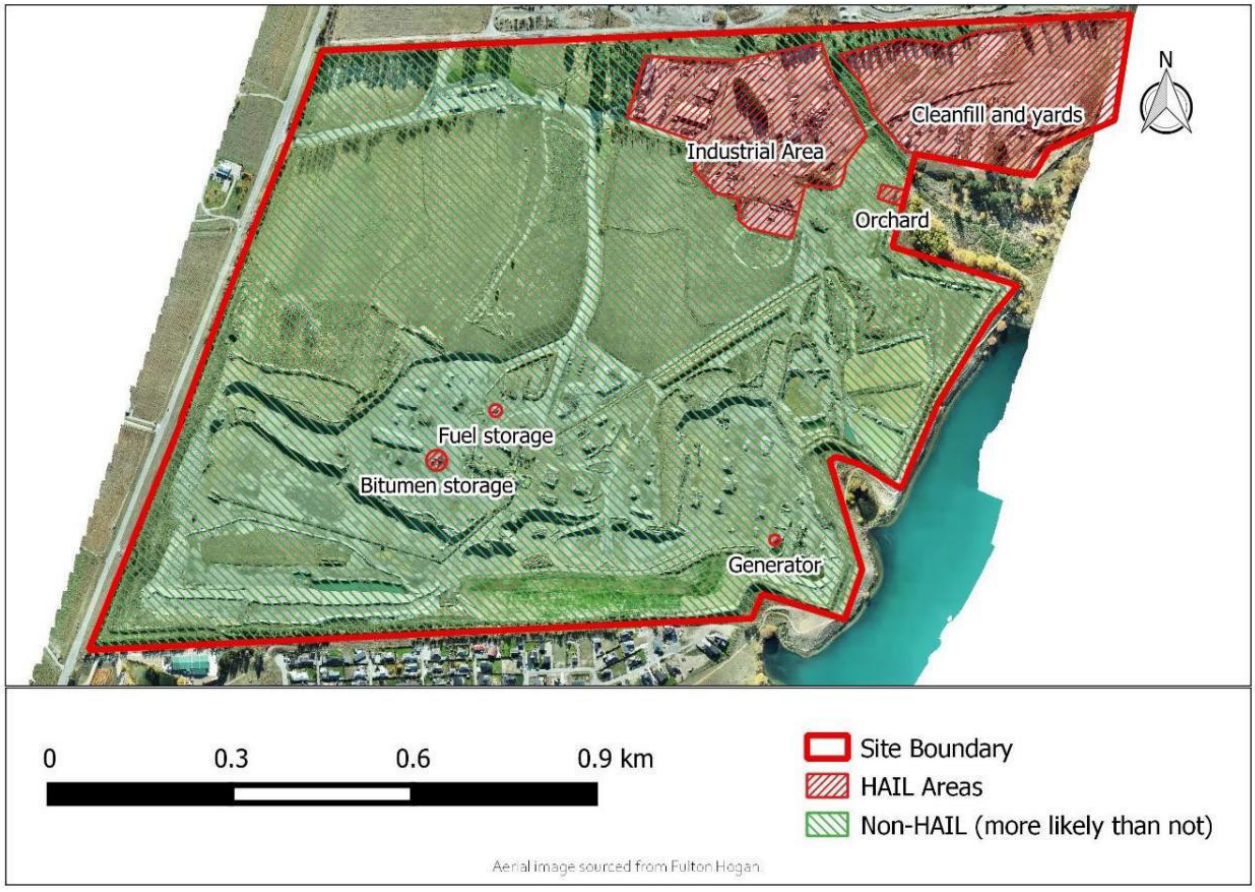


Figure Eight: Extract from PSI showing areas considered likely to contain HAIL activities.

The PSI concluded that it was unlikely that contaminants in soil associated with concrete manufacture, persistent pesticide use, and treated timber storage would pose a risk to human under the commercial/industrial land use proposed for these areas as part of the plan change. It recommended that additional investigation upon decommissioning or closure of any potentially contaminating land uses, Given the on-going use of the site for many of these HAIL activities.

Aerial Photographs

Council's aerial photographs of the site date back to 2006. Aerial photographs indicate the presence of the following HAIL activities, which may trigger NES-CS requirements:

Asphalt Plant. Asphalt or bitumen manufacture or bulk storage is Item E2 on the HAIL.



Figure Nine: Aerial photo dated 2025 showing location of asphalt plant.



Figure 10: Aerial photograph dates 2006 showing the location of the asphalt plant.

Concrete Block Manufacturing Plant. Commercial concrete manufacture or commercial cement storage is Item E4 on the HAIL



Figure 11: Aerial photograph dated 2025 showing location of concrete block plant.

Outdoor storage of unknown materials. HAIL activities that can be associated with material storage can include storage tanks or drums for fuel, chemicals or liquid waste (Item A18), scrap yards (Item G4), or waste disposal to land (Item G5)



Figure 12: Aerial photograph dated 2025 showing material storage on the site.



Figure 13: Aerial photograph dated 2019 showing material storage on the site.

Other Land Features

No information in relation to the above could be found on Council's records.

Disclaimer: The Council does not hold records directly relating to activities on the Hazardous Activities and Industries List (HAIL). In the event some information is available it cannot be guaranteed as correct or complete and therefore may not satisfy your request. We therefore recommend you undertake further investigation to determine whether any HAIL activities exist on the site.

Prepared by

Adam Vincent
Planning Officer - Consents
Date: 26 November 2025

Appendix 7

Laboratory Results and Chain of Custody Documentation

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:	Insight Engineering	**Lab No:**	4027551	SPv1
Contact:	Claude Midgley	**Date Received:**	10-Nov-2025	
	C/- Insight Engineering	**Date Reported:**	12-Nov-2025	
	PO Box 456	**Quote No:**	137281	
	Cromwell 9384	**Order No:**		
		Client Reference:	24019	
		Submitted By:	Claude Midgley	

Sample Type: Soil

		Sample Name:	CF1	CF2	CF3	CF4	CF5
		Lab Number:	4027551.1	4027551.2	4027551.3	4027551.4	4027551.5
Heavy Metals, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		32	8	7	7	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		6	8	12	7	15
Total Recoverable Copper	mg/kg dry wt		17	16	14	12	13
Total Recoverable Lead	mg/kg dry wt		15.6	10.4	11.4	14.3	23
Total Recoverable Nickel	mg/kg dry wt		11	10	12	8	13
Total Recoverable Zinc	mg/kg dry wt		57	39	51	32	53

		Sample Name:	CF6	CF7	CF8
		Lab Number:	4027551.6	4027551.7	4027551.8
Heavy Metals, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt		13	9	-
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt		5	12	-
Total Recoverable Copper	mg/kg dry wt		18	17	-
Total Recoverable Lead	mg/kg dry wt		15.4	21	-
Total Recoverable Nickel	mg/kg dry wt		9	14	-
Total Recoverable Zinc	mg/kg dry wt		23	54	-
Heavy Metals with Mercury, Screen Level					
Total Recoverable Arsenic	mg/kg dry wt		-	-	5
Total Recoverable Cadmium	mg/kg dry wt		-	-	< 0.10
Total Recoverable Chromium	mg/kg dry wt		-	-	8
Total Recoverable Copper	mg/kg dry wt		-	-	9
Total Recoverable Lead	mg/kg dry wt		-	-	12.7
Total Recoverable Mercury	mg/kg dry wt		-	-	< 0.10
Total Recoverable Nickel	mg/kg dry wt		-	-	7
Total Recoverable Zinc	mg/kg dry wt		-	-	28

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).	-	1-8

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			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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	1-7
Heavy Metals with Mercury, 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	8

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

Testing was completed between 10-Nov-2025 and 12-Nov-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.

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



Kim Harrison MSc
Client Services Manager - Environmental

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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:	Insight Engineering	**Lab No:**	4305422 SPv1
Contact:	Claude Midgley	**Date Received:**	03-Sept-2026
	C/- Insight Engineering	**Date Reported:**	08-Sept-2026
	PO Box 456	**Quote No:**	147534
	Cromwell 9384	**Order No:**	
		Client Reference:	
		Submitted By:	Claude Midgley

Sample Type: Soil

Sample Name:		PQA 26-Aug-2026	PQB 26-Aug-2026	PQC 26-Aug-2026	PQD 26-Aug-2026	PQE 26-Aug-2026
Lab Number:		4305422.1	4305422.2	4305422.3	4305422.4	4305422.5
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	9	10	8	5	11
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	9	8	6	8
Total Recoverable Copper	mg/kg dry wt	14	13	12	12	17
Total Recoverable Lead	mg/kg dry wt	14.8	16.8	11.6	15.8	15.7
Total Recoverable Nickel	mg/kg dry wt	11	8	8	8	11
Total Recoverable Zinc	mg/kg dry wt	43	42	35	25	42

Sample Name:		PQF 26-Aug-2026	PQG 26-Aug-2026	PQH 26-Aug-2026	PQI 26-Aug-2026	PQJ 26-Aug-2026
Lab Number:		4305422.6	4305422.7	4305422.8	4305422.9	4305422.10
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	25	7	13	8	6
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	11	10	8	11	6
Total Recoverable Copper	mg/kg dry wt	15	19	18	14	11
Total Recoverable Lead	mg/kg dry wt	13.0	12.4	18.1	11.0	8.3
Total Recoverable Nickel	mg/kg dry wt	11	10	10	11	7
Total Recoverable Zinc	mg/kg dry wt	49	56	36	41	25

Sample Name:		PQK 26-Aug-2026	PQL 26-Aug-2026	PQM 26-Aug-2026	PQN 26-Aug-2026	PQO 26-Aug-2026
Lab Number:		4305422.11	4305422.12	4305422.13	4305422.14	4305422.15
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	10	11	7	9	8
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	11	12	10
Total Recoverable Copper	mg/kg dry wt	16	21	13	9	13
Total Recoverable Lead	mg/kg dry wt	12.3	10.2	12.2	13.3	11.2
Total Recoverable Nickel	mg/kg dry wt	11	12	10	11	10
Total Recoverable Zinc	mg/kg dry wt	46	40	51	58	43

Sample Name:		PQP 26-Aug-2026	PQQ 26-Aug-2026	PQR 26-Aug-2026	PQS 26-Aug-2026	PQT 26-Aug-2026
Lab Number:		4305422.16	4305422.17	4305422.18	4305422.19	4305422.20
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	8	9	5	6
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	5	10	10	6	7
Total Recoverable Copper	mg/kg dry wt	12	18	16	9	10
Total Recoverable Lead	mg/kg dry wt	13.1	12.4	15.2	11.1	13.5

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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:		PQP 26-Aug-2026	PQQ 26-Aug-2026	PQR 26-Aug-2026	PQS 26-Aug-2026	PQT 26-Aug-2026
Lab Number:		4305422.16	4305422.17	4305422.18	4305422.19	4305422.20
Heavy Metals, Screen Level						
Total Recoverable Nickel	mg/kg dry wt	7	11	11	7	6
Total Recoverable Zinc	mg/kg dry wt	39	44	45	26	32

Sample Name:		PQU 26-Aug-2026	PQV 26-Aug-2026	PQW 26-Aug-2026	PQX 26-Aug-2026	PQY 26-Aug-2026
Lab Number:		4305422.21	4305422.22	4305422.23	4305422.24	4305422.25
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	8	6	9	9	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	9	8	10	11	11
Total Recoverable Copper	mg/kg dry wt	12	13	16	9	17
Total Recoverable Lead	mg/kg dry wt	13.9	11.9	15.5	14.2	15.0
Total Recoverable Nickel	mg/kg dry wt	9	9	12	10	8
Total Recoverable Zinc	mg/kg dry wt	40	37	56	63	58

Sample Name:		PQZ 26-Aug-2026
Lab Number:		4305422.26
Heavy Metals, Screen Level		
Total Recoverable Arsenic	mg/kg dry wt	8
Total Recoverable Cadmium	mg/kg dry wt	< 0.10
Total Recoverable Chromium	mg/kg dry wt	8
Total Recoverable Copper	mg/kg dry wt	16
Total Recoverable Lead	mg/kg dry wt	10.6
Total Recoverable Nickel	mg/kg dry wt	9
Total Recoverable Zinc	mg/kg dry wt	38

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).	-	1-26
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	1-26

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

Testing was completed between 04-Sept-2026 and 08-Sept-2026. 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.

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



Ara Heron BSc (Tech)
Client Services Manager - Environmental

R J Hill Laboratories Limited
1/17 Print Place
Middleton
Christchurch 8024 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:	Insight Engineering	**Lab No:**	4305423	A2Pv1
Contact:	Claude Midgley	**Date Received:**	03-Sept-2026	
	C/- Insight Engineering	**Date Reported:**	07-Sept-2026	
	PO Box 456	**Quote No:**	147534	
	Cromwell 9384	**Order No:**		
		Client Reference:		
		Submitted By:	Claude Midgley	

Sample Type: Soil

Sample Name	Lab Number	As Received Weight Presence / Absence Testing (g)	Dry Weight Presence / Absence Testing (g)	<2mm Subsample Weight Presence / Absence Testing (g dry wt)	Asbestos Presence / Absence from Presence / Absence Testing	Description of Asbestos Form Presence / Absence Testing
PQA 26-Aug-2026	4305423.1	45.0	38.4	19.4	Asbestos NOT detected.	-
PQB 26-Aug-2026	4305423.2	46.4	40.9	17.9	Asbestos NOT detected.	-
PQC 26-Aug-2026	4305423.3	75.8	68.3	21.0	Asbestos NOT detected.	-
PQD 26-Aug-2026	4305423.4	92.2	82.7	52.4	Asbestos NOT detected.	-
PQE 26-Aug-2026	4305423.5	73.1	65.0	23.3	Asbestos NOT detected.	-
PQF 26-Aug-2026	4305423.6	97.7	84.0	38.2	Asbestos NOT detected.	-
PQG 26-Aug-2026	4305423.7	60.5	52.6	17.8	Asbestos NOT detected.	-
PQH 26-Aug-2026	4305423.8	99.4	90.0	22.0	Asbestos NOT detected.	-
PQI 26-Aug-2026	4305423.9	54.6	45.7	21.4	Asbestos NOT detected.	-
PQJ 26-Aug-2026	4305423.10	105.9	98.3	55.4	Asbestos NOT detected.	-
PQK 26-Aug-2026	4305423.11	89.0	74.5	32.6	Asbestos NOT detected.	-
PQL 26-Aug-2026	4305423.12	99.1	89.4	33.5	Asbestos NOT detected.	-
PQM 26-Aug-2026	4305423.13	70.6	61.0	27.7	Asbestos NOT detected.	-
PQN 26-Aug-2026	4305423.14	61.0	48.9	23.6	Asbestos NOT detected.	-
PQO 26-Aug-2026	4305423.15	102.0	88.8	39.9	Asbestos NOT detected.	-
PQP 26-Aug-2026	4305423.16	82.1	72.9	28.5	Asbestos NOT detected.	-
PQQ 26-Aug-2026	4305423.17	95.0	83.4	40.5	Asbestos NOT detected.	-
PQR 26-Aug-2026	4305423.18	82.0	70.3	28.9	Asbestos NOT detected.	-
PQS 26-Aug-2026	4305423.19	79.9	73.4	56.1	Asbestos NOT detected.	-
PQT 26-Aug-2026	4305423.20	58.8	54.4	38.3	Asbestos NOT detected.	-
PQU 26-Aug-2026	4305423.21	177.4	164.6	53.6	Asbestos NOT detected.	-
PQV 26-Aug-2026	4305423.22	104.0	93.0	53.0	Asbestos NOT detected.	-
PQW 26-Aug-2026	4305423.23	113.2	97.9	47.7	Asbestos NOT detected.	-
PQX 26-Aug-2026	4305423.24	126.6	101.5	52.3	Asbestos NOT detected.	-
PQY 26-Aug-2026	4305423.25	178.0	160.4	54.9	Asbestos NOT detected.	-
PQZ 26-Aug-2026	4305423.26	127.1	112.3	53.0	Asbestos NOT detected.	-

Glossary of Terms

- Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
- ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
- Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
- Trace - Trace levels of asbestos, as defined by AS4964-2004.

For further details, please contact the Asbestos Team.

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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**
Asbestos in Soil			
As Received Weight Presence / Absence Testing	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch.	0.1 g	1-26
Dry Weight Presence / Absence Testing	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch.	0.1 g	1-26
<2mm Subsample Weight Presence / Absence Testing	Sample dried at 100 to 105°C, weight of <2mm sample fraction taken for asbestos identification if less than entire fraction. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch.	-	1-26
Asbestos Presence / Absence from Presence / Absence Testing	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; Unit 1, 17 Print Place, Middleton, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1-26
Description of Asbestos Form Presence / Absence Testing	Description of asbestos form and/or shape if present.	-	1-26

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

Testing was completed between 04-Sept-2026 and 07-Sept-2026. 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.

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Dexter Paguirigan Dip Chem Engineering Tech
Laboratory Technician - Asbestos

Job No: 402 7551 Date Recv: 10-Nov-25 06:44

ENVIRONMENTAL Analysis Request Form

Hill Laborat

RJ Hill Laboratories Limited — accred
Accreditation NZ

Received by: Nathaniel Sue

CLIENT

Name: **Insight Engineering** [229068]

PO Box 456

Cromwell 9342

1 Clyde Street, Telephone
Private Bag 3205, Facsimile

3140275514

Hill Laboratories office use only.

Date In *Job #* *No. of Samples*

Phone: 021 556 549 Fax:

Client Reference: 24019 (Project Code)

Quote Number: 137281 **Order No:** (Cost Centre)

Submitted By **Claude Midgley** [228982]

Charge To: **Insight Engineering** [229068]

RESULTS TO

☐ Mail Client ☐ Mail Submitter

☐ Fax Results

X Email Results [redacted]

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

Additional Information

Chain of Custody Record

Delivered to Hill Laboratories (Depatched by)	Date & Time: 07/11/2025 15:00 Name: Claude Midgley Signature:
Received at Hill Laboratories	Date & Time: Name: Signature:
Condition ☐ Ambient Temp ☐ Chilled 22-6°C	

PRIORITY ☐ **Normal** (up to 10 days) ✠ **High** (approx 5 days) ☐ **Urgent** (MUST be pre-arranged)

Results required by: .....

Sample types

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

Site ID	Sample type	Tests required	Comments
CF1	ES	HMsSoil	
CF2	ES	HMsSoil	
CF3	ES	HMsSoil	
CF4	ES	HMsSoil	
CF5	ES	HMsSoil	
CF6	ES	HMsSoil	
CF7	ES	HMsSoil	
CF8	ES	HMsSoil + Hg	

KB Item: Version: 1

ANALYSIS REQUEST

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

Job No: 430 5422
Date Recv: 03-Sep-26 11:02
Received by: Gabriel De Leon
3143054227

Quote No	147534	
Primary Contact	Claude Midgley	228982
Submitted By	Claude Midgley	228982
Client Name	Insight Engineering	229068
Address	PO Box 456 Cromwell 9384	
Phone	*Mobile*	
Email	[redacted]	
Charge To	Insight Engineering	229068
Client Reference		
Additional Client Ref		
Order No		

Results To *Reports will be emailed to Primary Contact by default. Additional Reports will be sent as specified below.*

☑ *Email Primary Contact* ☐ *Email Submitter* ☐ *Email Client*

☐ *Email Other* _____

☐ *Other* _____

Dates of testing are not routinely included in the Certificates of Analysis. Please inform the laboratory if you would like this information reported.

CHAIN OF CUSTODY RECORD

Sent to Hill Labs
☑ *Tick if you require COC to be emailed back*
Date & Time: 2/9/2026 15:15
Name: Claude Midgley
Signature:

Received at Hill Labs
Date & Time:
Name:
Signature:

Condition ☐ *Room Temp* ☐ *Chilled* ☐ *Frozen*
Temp: 16.9

☐ **Sample & Analysis details checked**
Signature:

ADDITIONAL INFORMATION / KNOWN HAZARDS

Priority ☐ **Low** ☐ **Normal** ☑ **High**
☐ **Urgent** (ASAP, *extra charge applies, please contact lab first*)

Requested Reporting Date: _____

Quoted Sample Types

Soil (Soil)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	PQA to PQZ	26/8/2026	ES	MSHMs + Asbestos presence/absence
2				
3				
4				
5				
6				
7				
8				
9				

Appendix 8

Qualifications and Experience

Claude Midgley

Principal Environmental Scientist

Education

Master of Science 2004
Bachelor of Science Honours 2002
Bachelor of Science 2001

Additional Training

Environmental Impact Assessment (EIA) Project Management, The Centre for Science and Industrial Research (CSIR), Stellenbosch, South Africa
Project Management, University of Auckland School of Business, Auckland, New Zealand
RAB QSA Certified Environmental Management Systems (ISO14001) Implementation course, Andsam Training, Auckland, New Zealand
HSNO Advanced Training Course, Responsible Care New Zealand Inc. Christchurch, New Zealand
St John First Aid – Level Two Course (Unit Standard 26552 (V2), Christchurch, New Zealand
New Zealand Red Cross Comprehensive First Aid Course, Auckland, New Zealand
Operating a Four Wheel Drive Vehicle in an Off Road Environment, DECA Training, Auckland, New Zealand
Site Safe BUILDING CONSTRUCTION, CIVIL Passport and CONSULTANT Passport Auckland and Christchurch, New Zealand
OSHA 24 Hour HAZWOPER certified (certificate 121122264382), Safety Unlimited Inc, Simi Valley, California
Conduct asbestos assessment associated with removal (Course Code CPCCBC5014A), AlertForce, Australia
Field Portable Analytical Radiation Apparatus – Radiation Safety Course (Certificate of Training No 7772, March 2024, Evident Australia)
NZ Ministry of Health License to Use Ionising Radiation (License No. 31470, valid until 10 July 2027)

Claude is a Principal Environmental Scientist specialised in contaminated land and groundwater assessment since 2005.

He has diverse experience and capability in contamination assessment, gained through involvement in projects for oil and gas, mining, waste, council, industry and land development clients across New Zealand, as well as in Australia, The Federated States of Micronesia, The Republic of Palau and The Republic of the Marshall Islands.

Claude became a Certified Environmental Practitioner in 2013 and has maintained that certification by completing over 50 hours of continuing professional development, focussed entirely on contamination assessment, per year.

Claude has lived in Central Otago since 2016 and is passionate about promoting sustainable practices in land development. He has undertaken hundreds of contaminated site assessments, with highlights including:

- **The Christchurch-wide identification of hazardous activities and industries between the 1940s and the 2010s for Environment Canterbury;**
- **Physically surveying three Pacific Island nations to identify asbestos-containing building materials in each country for SPREP;**
- **Establishment of artificial wetlands to treat and reduce landfill leachate for the Otago Polytechnic;**
- **Groundwater and ground vapour assessment across the Wynyard Quarter in the Auckland waterfront for Auckland Regional Council.**
- **Groundwater monitoring at 15 closed landfills across Central Otago for Central Otago District Council.**

Since 2024, Claude has held a license to use ionising radiation which enables him to operate a portable X-ray Fluorescence analyser (XRF) to rapidly identify areas impacted with certain priority heavy metals.