Ladies Mile Master Plan Preliminary Site Investigation

Candor3

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Ladies Mile Master Plan
Preliminary Site Investigation

Document Status

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Executive Summary

The Queenstown Lakes District Council (QLDC) is developing a Masterplan for the Ladies Mile Te Putahi Corridor between the Shotover River and Lake Hayes, Queenstown. The Masterplans area of focus identifies where most of the initiatives, projects and key activities will be located. This area includes undeveloped land to the north and south of SH6.

Candor3 has commissioned e3Scientific Limited (e3s) to undertake a Preliminary Site Investigation (PSI) of land within the Ladies Mile Te Putahi Masterplan area of focus in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No. 1 (Ministry for the Environment, 2003a).

The objective of this investigation is to identify any pieces of land within the Ladies Mile area of focus that are considered potentially contaminated due to previous hazardous substance use, storage or disposal and provide QLDC with an understanding of any requirements under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (the NESCS) associated with future development.

This document will support land use planning and decision making associated with potential development in accordance with the NESCS.

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

- Review of the existing physical environment.
- Review of broad-scale desktop information and site walkover of accessible properties to identify areas of potential contamination.
- Consideration of risks to human health, the need for any further investigation under the NESCS.
- Preparation of a Preliminary Site Investigation report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No. 1 (Ministry for the Environment, 2003a).

e3Scientific has conducted a systematic, broadscale review of multiple historic and contemporary sources of information to identify pieces of land within the investigation where it is more likely than not that activities or industries described in the HAIL have been undertaken. The location of these pieces of land are detailed in Table 1 and identified in Figure 22. Additionally, locations of buildings

with the potential to contain asbestos or lead based paints are detailed in Table 2 and identified in Figure 20 and Figure 21.

Potential contaminants associated with these HAIL activities include persistent pesticides, heavy metals, petroleum hydrocarbons, polychlorinated biphenyls and waste materials within landfill areas. There is also potential for lead paint and/or asbestos contamination in the vicinity of buildings constructed prior to 1980 and 2000, respectively.

Depending on the final development plans for the Ladies Mile corridor, it is conceivable that contaminants in soil at some of the locations identified could pose a risk to human health. As such, further investigation is recommended to assess the risk to human health under NESCS if activities listed under the NESCS are proposed within these areas. Additional investigation may also be required to determine appropriate disposal locations for soils associated with these areas.

Within the eastern portion of the site, beside Lake Hayes, there are Holocene lake deposits described as laminated micaceous silt, mud, and sand in old lake deposits. We note that elevated concentrations of geogenic arsenic have been observed in these deposits.

It is acknowledged that, despite a thorough site history review, it has not been possible to identify or accurately locate all HAIL activities within the site. As such, it will be important to implement an 'accidental discovery protocol' during development works to ensure that any unexpected contamination is appropriately managed.

1 Introduction

1.1 Purpose

The Queenstown Lakes District Council (QLDC) is developing a Masterplan for the Ladies Mile Te Putahi Corridor between the Shotover River and Lake Hayes, Queenstown. The Masterplans area of focus identifies where most of the initiatives, projects and key activities will be located. This area includes undeveloped land to the north and south of SH6.

Candor3 has commissioned e3Scientific Limited (e3s) to undertake a Preliminary Site Investigation (PSI) of land within the Ladies Mile Te Putahi Masterplan area of focus in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No. 1 (Ministry for the Environment, 2003a).

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This document will support land use planning and decision making associated with potential development in accordance with the NESCS.

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

1.2 Scope of Work

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

- Review of the existing physical environment.
- Review of broad-scale desktop information and site walkover of accessible properties to identify areas of potential contamination.
- Consideration of risks to human health, the need for any further investigation under the NESCS.

- Preparation of a Preliminary Site Investigation report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No. 1 (Ministry for the Environment, 2003a).

1.3 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 the area 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.

2 Site Location and Description

2.1 Site Location

The investigation area covers the Masterplan area of focus, which extends north and south of Ladies Mile (State Highway 6) between Lake Hayes and the Shotover River in Queenstown (see Figure 1). The investigation area covers approximately 170 hectares.

Neighbouring land uses include the Shotover Country, Lake Hayes, and Queenstown Country Club residential estates to the south, the Shotover River to the west, Slope Hill to the north and Lake Hayes to the east.

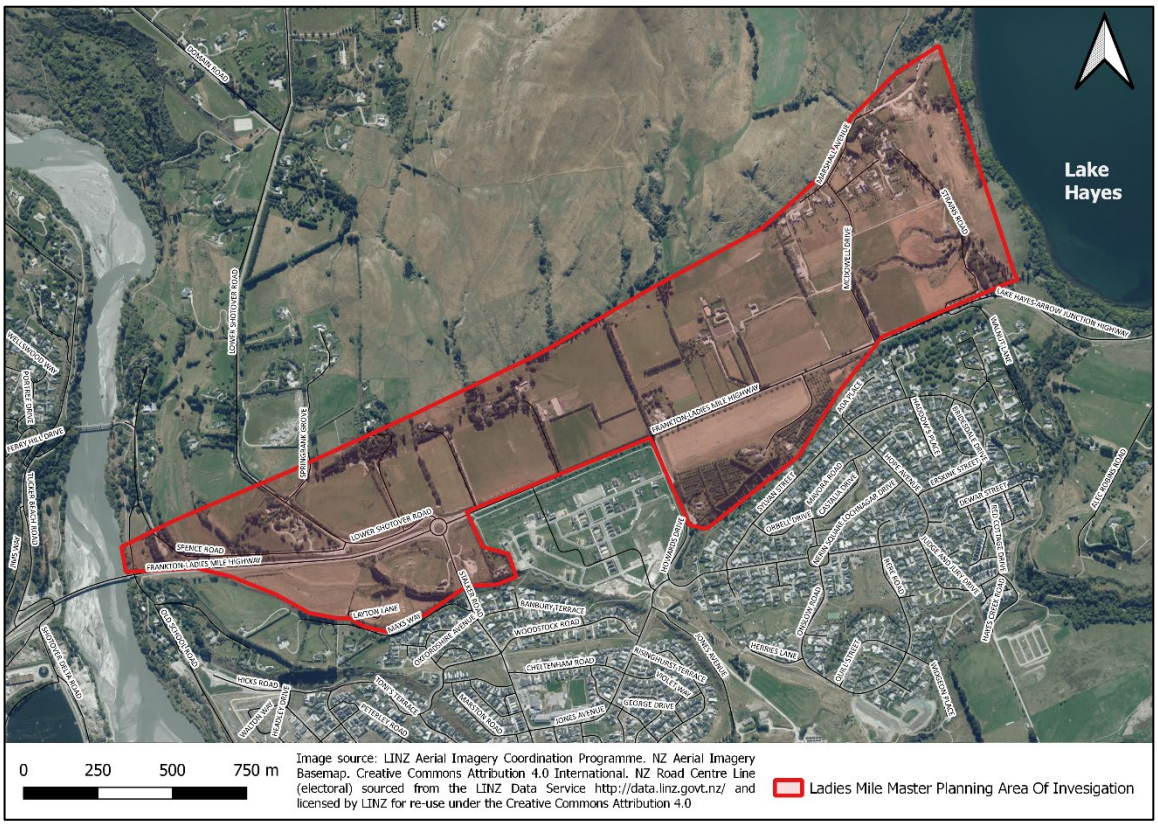


Figure 1: Investigation Area: Ladies Mile Indicative Master Plan Area of Focus

2.2 Geology

The 1:250,000 Geological Map of New Zealand identifies four geological formations within the investigation area (Figure 2).

Most of the site sits upon Holocene river deposits consisting of loose, commonly angular, boulders, gravel, sand, and silt forming alluvial fans; grading into scree (upslope) and valley alluvium (GNS Science, 2020).

West of the Lower Shotover Road intersection with State Highway 6, geology is described as late Pleistocene glacier deposits of generally unweathered, unsorted to sorted, loose sandy gravel silt and sand (till) in terminal and ground moraines (GNS Science, 2020).

Along the northern boundary of the site, there is an area of Aspiring lithologic association TZIV pelitic schist (Rakaia terrane), described as abundant laminated pelitic greyschist and subordinate psammitic greyschist; minor greenschist & metachert.

Within the eastern portion of the site, beside Lake Hayes, there are Holocene lake deposits described as laminated micaceous silt, mud, and sand in old lake deposits. We note that elevated concentrations of geogenic arsenic have been observed in these deposits.

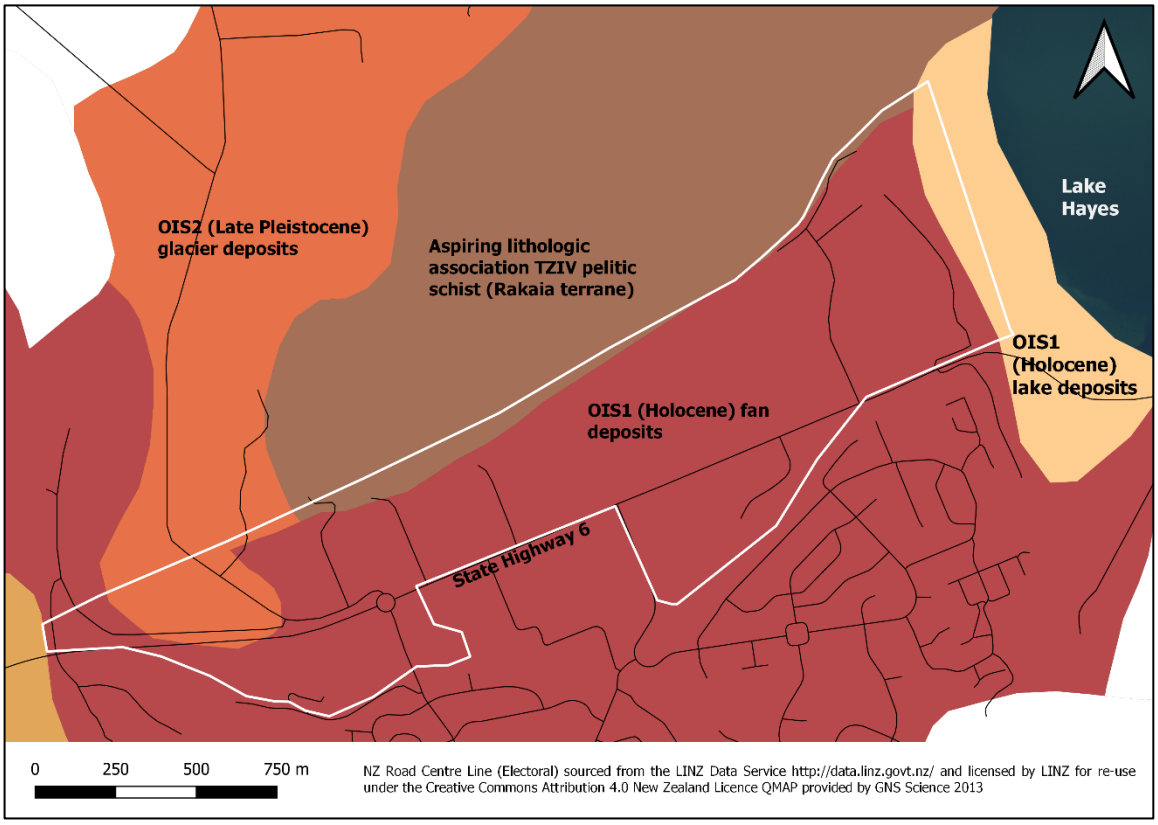


Figure 2: Geology

2.3 Groundwater

The area is located within the main terrace of the Windemere Aquifer. The Windemeer Aquifer comprises outwash and river terraces between Lake Hayes and the lower Shotover River. Groundwater within the aquifer is used for domestic supply and irrigation. The depth to the water table can be very deep in parts of the Windemeer Aquifer, sometimes up to 40 m (ORC, 2014)

2.4 Surface Water

The site is located between the Shotover River to the west and Lake Hayes to the east. The Kawerau River is located over one kilometre south (see Figure 3). Within the site, there are several ephemeral water courses and drains.

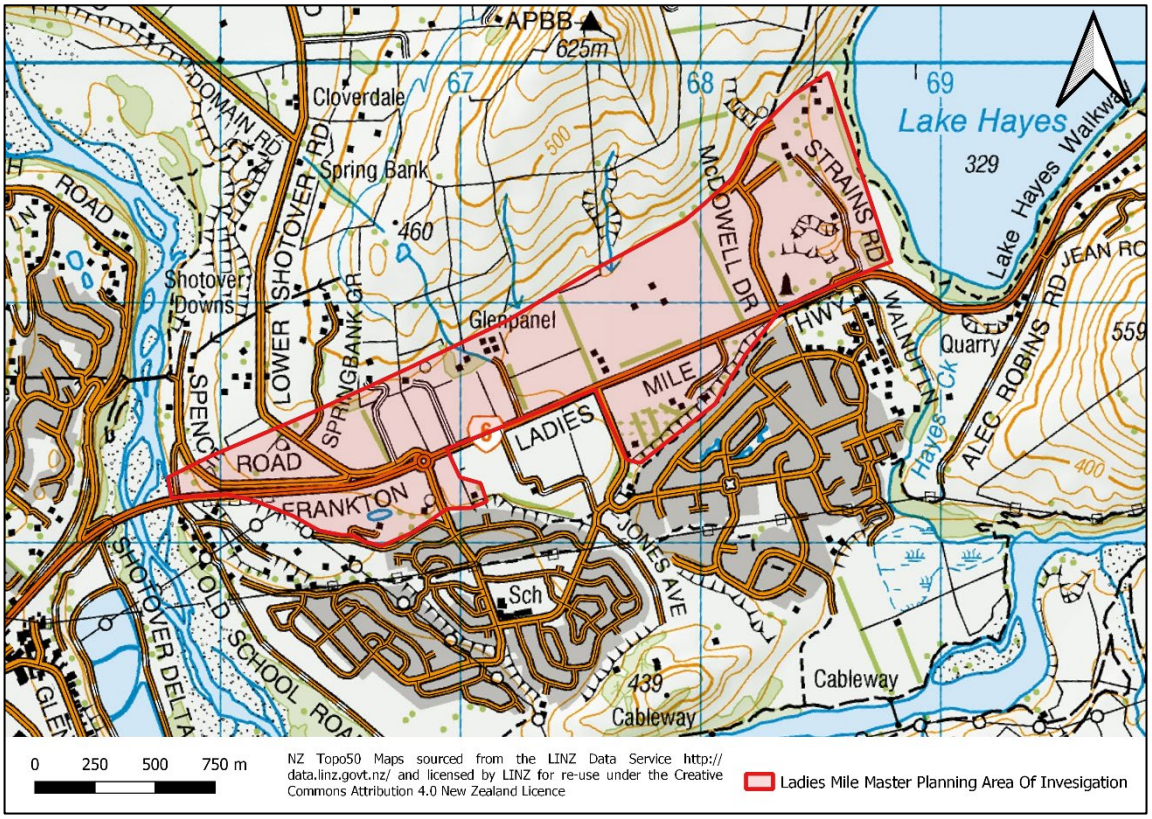


Figure 3: Local topography

3 Methodology

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. A copy of the HAIL is included in Appendix B.

e3Scientific conducted a systematic, broadscale review of site history information to identify pieces of land within the investigation area where it is more likely than not that activities or industries described in the HAIL have been undertaken. HAIL activities occurring on a commercial/industrial scale, or equivalent, were included within the scope of the investigation. For example, motor vehicle workshops are listed under category F4, but this would not include home garages where domestic quantities of hazardous substances might be stored, or occasional vehicle repair might occur.

Similarly, in this assessment, small scale on-site wastewater treatment systems have not been considered as being of sufficient size or risk to be interpreted as HAIL sites. Hazardous substances associated with wastewater effluent primarily come from commercial and industrial trade wastes that discharge hazardous substances 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.

Once the review of site history was completed, identified HAIL sites were digitised in Quantum GIS to outline the approximate spatial extent of the relevant 'piece of land.' Potential contaminants associated with the land uses were then identified, and risks associated with potential soil contamination were considered. Finally, the need for further investigation was considered, should development in these areas be required.

The sources of contemporary and historic information used in this investigation are described in the following sections.

3.1 Historical Aerial Imagery

Vertical aerial imagery was sourced from retrolens.nz and georeferenced using Quantum GIS. Image dates included 1956, 1959, 1964, 1976, 1984 and 2001. Aerials from 2004 onward were accessed from Google Earth © 2020 Planet.com, © CNES / Airbus and © 2020 Maxar Technologies. Oblique images from 1959 were accessed from Whites Aviation (https://natlib.govt.nz/items/22874066).

Historical aerial imagery is provided in Appendix C.

3.2 Queenstown Lakes District Council online databases

Online mapping information, including HAIL sites, natural hazards, services and the operative district plan, were examined in August and September 2020 via https://www.qldc.govt.nz/do-it-online/maps

Property file information for all properties within the investigation area was obtained from the QLDC via https://edocs.qldc.govt.nz/ on the 1st of September 2020.

3.3 Maps Past

Online maps of the area available from the 1929 to present day were accessed on the 9th September 2020 via http://www.mapspast.org.nz/. One historical map has been referenced in this report and is provided in Appendix D (Topography 1:50,000. Series: NZMS260 1996. Sheet F41).

3.4 National Library Cartographic Collection

Online available historical maps and images of the area available from the 1800's to present day were accessed on the 8th September 2020 via https://natlib.govt.nz/collections/a-z/cartographic-collection. Historical maps are provided in Appendix D and listed below:

- Block III Shotover S. D.. Surveyed by G. M . Barr August 1864.
- Map of Shotover Survey District in the Lake County and the Otago Mining District. 1924. Sourced from LINZ. Crown Copyright reserved.

- Map of Shotover Survey District in the Lake County and the Otago Mining District. 1939. Sourced from LINZ. Crown Copyright reserved.
- Shotover. Published by the Lands & Survey Dept. NZ. Under authority of R. G. Dick, Surveyor-General. 3rd Edition. 1st June 1955. Sourced from LINZ. Crown Copyright reserved.

3.5 Historical Newspaper Articles

Historical newspaper articles and advertisements, primarily from the Lake County Mail, Lake County Press, and Lake Wakatipu Mail, were reviewed on paperspast.natlib.govt.nz.

3.6 Queenstown Historical Society

Archived issues of the Queenstown Courier, the magazine of the Queenstown and District Historical Society, were accessed on 22nd September 2020 via https://www.queenstownhistoricalsociety.org.nz/page7.html.

3.7 Project documentation

Existing documents prepared for the Ladies Mile Te Putahi Masterplan Establishment Report prepared by Southern Planning Group, dated February 2020.

3.8 Archaeological Assessment

Origin Consultants provided e3s with a draft Heritage and Archaeological Values Assessment, dated 17th December 2020. This letter report provides an outline of heritage and archaeological values for the study area.

3.9 Otago Regional Council HAIL Register

The Otago Regional Council (ORC) maintains a database of properties where information is held regarding current or past land-uses that have the potential to contaminate land based on the Hazardous Activities and Industries List (HAIL). e3Scientific determined known HAIL sites within the area of focus from the ORC online map database. The database was accessed on the 31st August 2020 via

https://www.orc.govt.nz/managing-our-environment/waste-and-hazardous-substances/contaminated-land.

The ORC HAIL database 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.*'

3.10 Previous contaminated land investigations

Previous contaminated land investigations were obtained from the ORC and QLDC. Three pieces of land within the Ladies Mile area of focus have been investigated. These include the Threepwood farm hub, 429 Frankton-Ladies Mile Road, and Chestnut farm. Shotover Country, south of the area of focus was also investigated. These areas are shown in Figure 4.

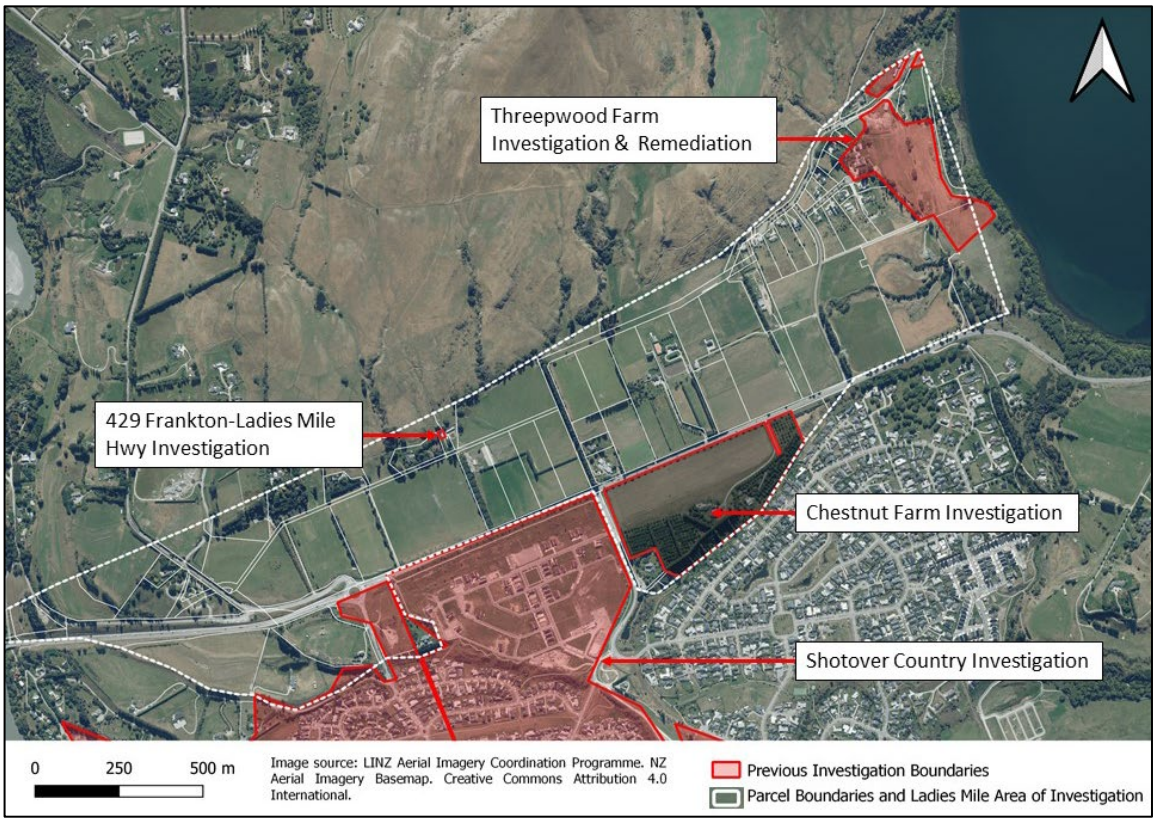


Figure 4: Location of completed contaminated land investigations.

3.11 Site Inspection

Site inspections were conducted through the areas marked in Figure 5. Several land parcels were not visited due to access restrictions at the time of the inspection.

Site inspections were conducted in accordance with the Contaminated land management guidelines No. 5: Site investigation and analysis of soils (revised 2011) (Ministry for the Environment, 2004).

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.

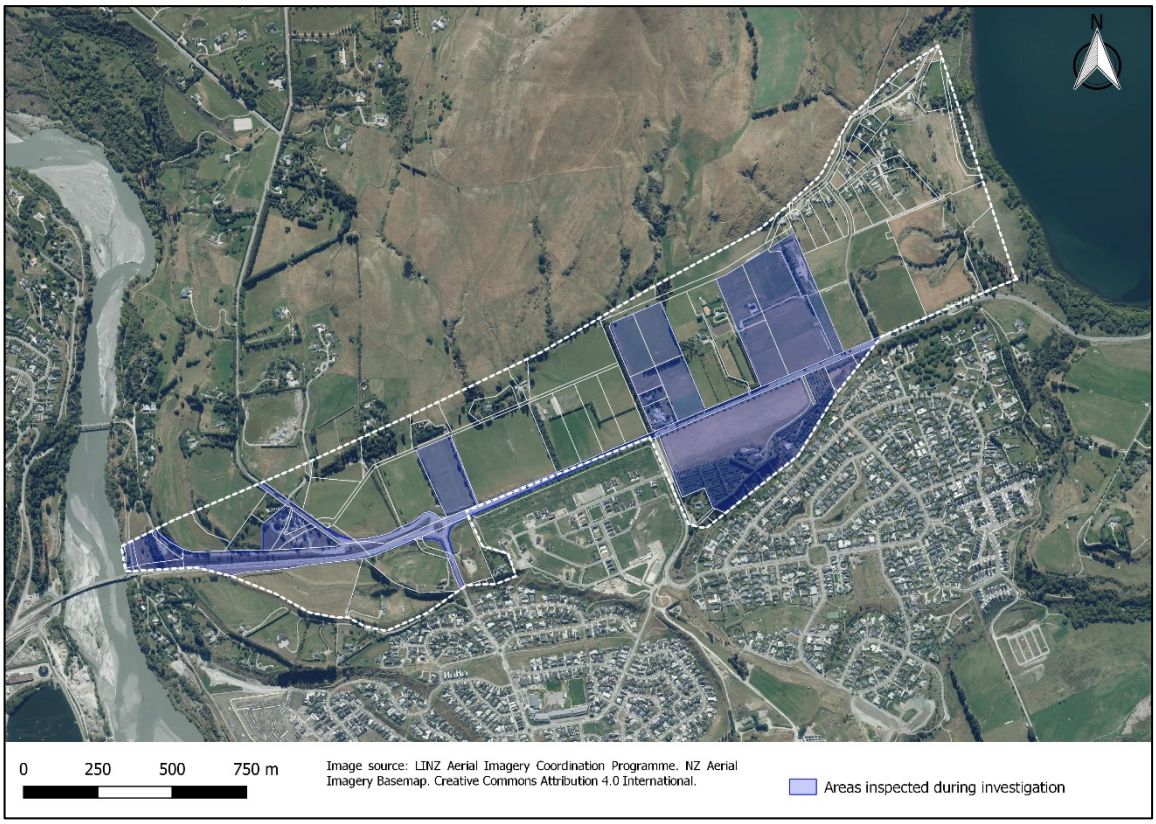


Figure 5: Areas where site inspections were undertaken.

4 Site History

The area was farmed as early as the 1860's (Origin Consultants, 2020) and was originally surveyed as part of sections that encompassed Block III, of the Shotover S.D. within 1864 survey map (SO1497) (Appendix D).

Two farms, Glenpanel and Threepwood, were established within the area of focus in the 1860's. The hubs for these farms are visible in the earliest available aerial photography available, dated 1959 (see Figure 6). Infrastructure within these hubs included yards, woolsheds, homesteads, and associated buildings.

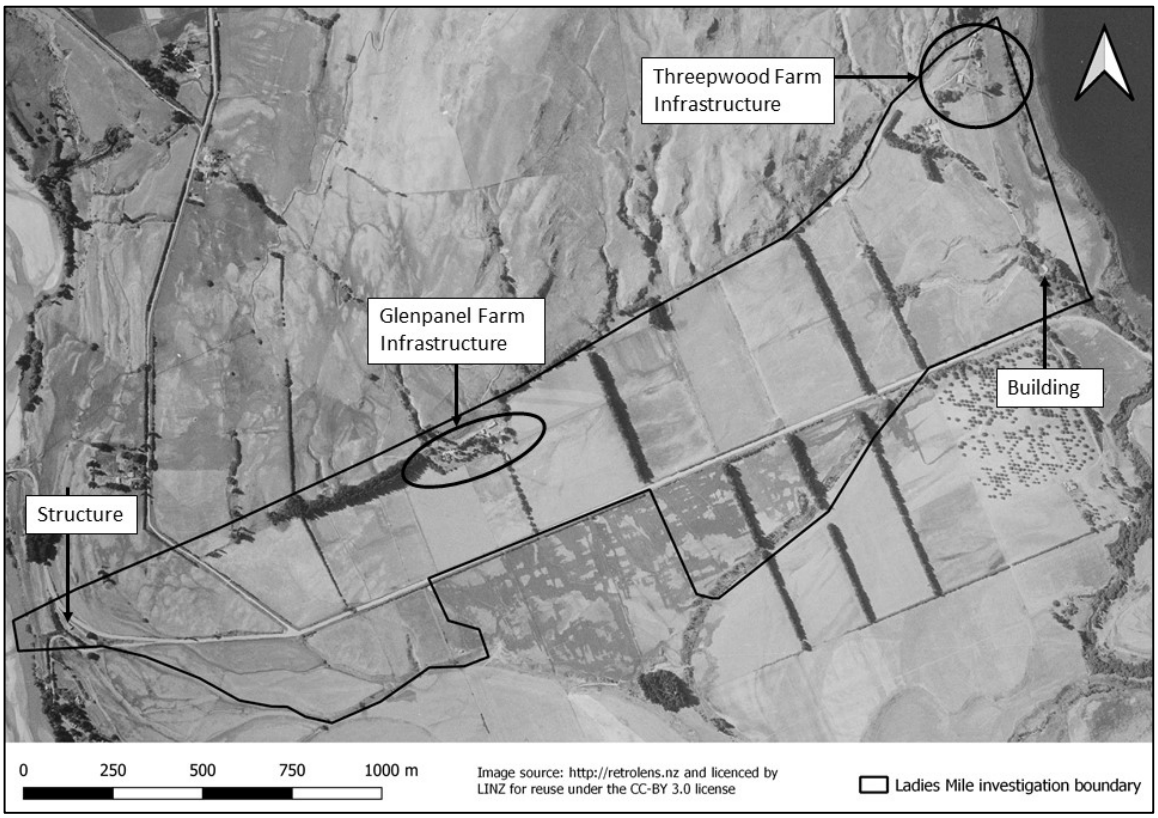


Figure 6: 1959 Aerial Photograph

Other than a veterinary clinic and kennel (known as the Ladies Mile Pet Lodge) established in the 1970's, the area of investigation has remained largely as production land, with several rural-residential properties developed from the 1970's onwards.

5 Results

5.1 Identified HAIL sites

The identified HAIL areas are discussed in the following sections.

5.1.1 Threepwood Historic Woolshed, Stables and Sheep Dip.

Early Threepwood station buildings included the woolshed (circa 1864), the stables (circa 1864), the cottage, (circa 1865), and the homestead (1909) (Origin Consultants, 2020). Prior to subdivision in the 1980's, there was a manager's cottage, garage and carport, and implement shed associated with the Threepwood farm. Modern aerials suggest that these buildings have been demolished and replaced by residential dwellings (Origin Consultants, 2020).

Site investigations completed by Kingett Mitchell Limited and Golder Associates between 2005 and 2007 identified arsenic, cadmium, lead and dieldrin (an organochlorine pesticide) contamination associated with a former sheep dip complex, dusting yard and historic stables near the woolshed. Davis Consulting Group Limited (Davis Consulting Group) completed a Detailed Site Investigation of this site in 2014. This investigation included a review of previous investigations undertaken on the site, and additional investigations across the site to further delineate horizontal and vertical extent of contamination. This investigation provided the basis for the consideration and development of a method to remediate the site.

In 2015, Threepwood Nominees Limited completed the remediation of impacted soils. Remediation was completed in accordance with a Remedial Action Plan prepared by Davis Consulting Group and the following regional and territorial authority consents:

- Otago Regional Council – Land Use Consent No. RM14.188.01.
- Queenstown Lakes District Council – Consent No. RM140541.

Within the historic stables, all waste material (drums, concrete posts and animal carcasses) was removed for off-site disposal. Approximately 3,500 kg DDT and cadmium impacted soils were removed and disposed of at A B Lime, a Class A landfill facility. A total of 20 m^3 of soil was excavated from immediately outside of

the stables and disposed of into the on-site encapsulation cell (Davis Consulting Group Limited, 2015).

The remediation of the sheep dip and dusting yard covered an area of 4,850 m^2 and the total volume of soil excavated from the remediation area was 2,836 m^3.

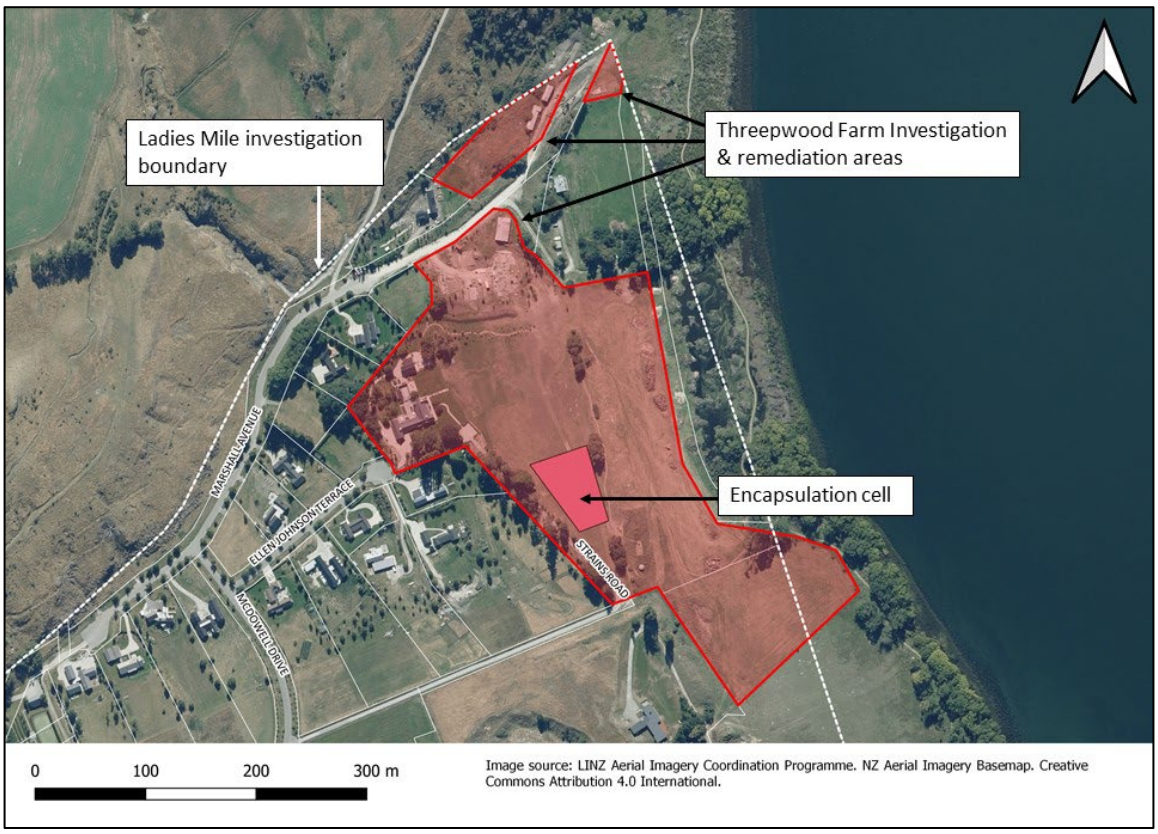


Figure 7: Threepwood investigation area and encapsulation cell

All excavations were backfilled with material recovered from the site. Backfilled soil was sampled and analysed to ensure heavy metal concentrations were consistent with background levels and organochlorine pesticides were below laboratory limits of reporting (Davis Consulting Group Limited, 2015).

Post-remediation validation investigations were completed by Davis Consulting Group, and are documented in a Site Validation Report, dated June 2015. The validation concluded that objectives of the remedial work were achieved and that the site was made suitable for rural residential land use (Davis Consulting Group Limited, 2015).

Rural residential land use is the most sensitive, generic land use for the protection of human health, and further investigation is not necessary in the vicinity of the woolshed and stables.

5.1.2 Threepwood Encapsulation Cell

The contaminated soils placed within the encapsulation cell at Threepwood were pre-treated with cement to reduce the leachability of contaminants. Once the deposition of material in the encapsulation cell was completed, the surface of the contaminated soil was surveyed. The encapsulation cell was lined with a 1 mm linear low-density polyethylene (LLDPE) geomembrane, installed to manufacturer specifications. The geomembrane covered the top and sides of the material to ensure that the material was free from any infiltration of surface water. Once the liner was in place, 0.5 m of clean fill was placed above the liner. The location of the containment cell is shown in Figure 7 and acknowledged by the ORC HAIL database as a 'managed' site.

Inspection of the encapsulation cell to assess its current condition was not permitted as part of the site investigation.

If development is proposed within the vicinity of the Threepwood encapsulation cell, guidance within the Site Management Plan and other information pertaining to the site should be strictly followed. Consents would be required under both the Regional Plan: Waste and the NESCS for any disturbance of the encapsulation cell.

5.1.3 Current Threepwood Farm Hub

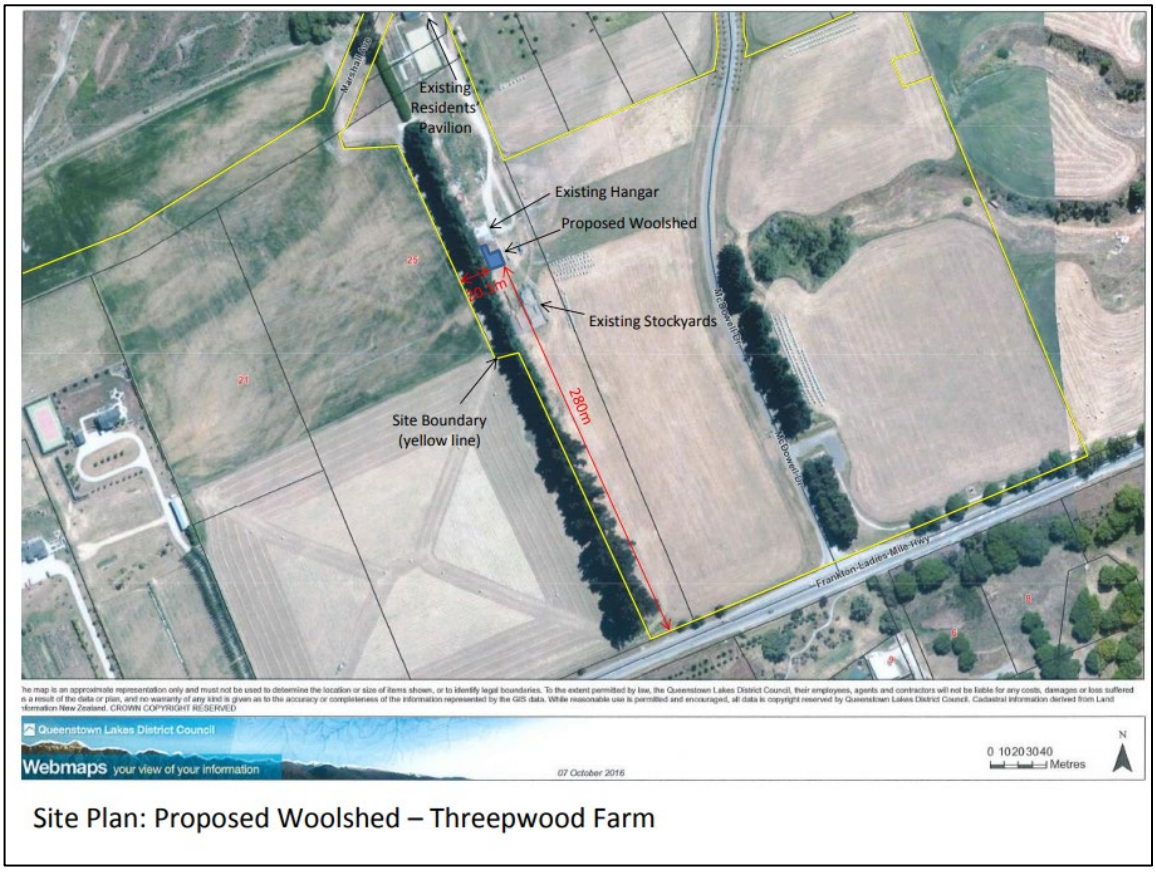
Between 2004 and 2010, stockyards were established at 28 Strains Road. Given the yards were established after 2004, it is highly unlikely that heavy metals or persistent organic pollutants are present at the site as a result of treating sheep. The Ministry for the Environment's 2006 guideline 'Identifying, Investigating and Managing Risks Associated with Former Sheep-dip Sites' (the Sheep-Dip Guidelines) describe recent chemicals (organophosphates and synthetic pyrethroids and insect growth regulators) as readily breaking down, and so are not identified as persistent chemicals of principal concern (Ministry for the Environment, 2006).

Figure 8: Stockyards at 28 Strains Road.

Figure 9: Workshop at 28 Strains Road.

Information from the QLDC property files describe an existing hangar, existing stockyards, and proposed woolshed (RM161019, decision issued 8/11/2016) (see Figure 10). We note that, based on aerial photography, this infrastructure was not present before 2004.

The hanger was associated with a rural airstrip, which is visible in the 1976 and 1979 historic aerial photographs, as well as the 1999 topographic map. Rural airstrips are commonly associated with bulk fertiliser storage for loading top dressing planes. If storage and handling of fertiliser was undertaken at the site for top dressing, it most likely took place near the hanger, within close proximity to road/track access.



Site Plan: Proposed Woolshed – Threepwood Farm

Figure 10: Site Plan, taken from RM161019, 28 Strains Road

Figure 11: Former hanger building at 28 Strains Road.

Figure 12: Current Threepwood Farm Hub at 28 Strains Road.

The 1999 topographic map depicts the airstrip within 20 and 22 Marshall Avenue (Lot 4 DP 407526 and Lot 3 DP 407526); however, contaminating activities are unlikely to be associated with the grass airstrip.

During the site inspection, the site was in active use as a farm hub. The hanger is present on site and used for equipment storage. The shed next to the existing hanger is used a general workshop for maintenance and repair of farm vehicles. An empty above ground fuel tank is stored along the western boundary of the site. Fuel is supplied from a mobile trailer. A 1000 L intermediate bulk container of waste oil was located outside of the hanger. There was no evidence of any animal dips or spray races at the stockyards, or bulk fertiliser storage associated with the previous use of the airstrip.

Contaminants associated with bulk fertiliser storage, vehicle workshops and storage tanks include calcium phosphate, calcium sulphate, copper chloride, sulphur, sulphuric and phosphoric acid, heavy metals, nitrates, and ammonia and petroleum hydrocarbons.

Further investigation is recommended to assess the risk to human health under the NESCS if land use change or soil disturbance are proposed in this area.

5.1.4 Glenpanel Farm Hub

Early Glenpanel station buildings included the homestead and three other buildings, two timber and one corrugated iron which were likely a shed, barn and stables (Origin Consultants, 2020). In the earliest available aerial photography available, dated 1959, the woolshed building is present with yards located to the north.

The Glenpanel woodshed and yards located within Lot 5 DP 463532 and adjoining property Lot 1 463532 were established prior to 1952.

Between 1984 and 2001 a large shed and yard structures were established south of the Glenpanel farm hub (Lot 4 DP 463532). Unidentifiable items are stored within a cleared area adjacent the shed. No information was available from the QLDC property files regarding these structures; however, given their proximity to a round pen and dressage arena, it is likely that they are associate with horse training and stables.

Inspection of the site was not permitted; however, the owner provided a Preliminary Environmental Site Investigation (PSI) of a small portion of 429 Frankton-Ladies Mile Highway to the west of the stockyards and woold shed. This report was prepared by JKCM Ltd, trading as Insight Engineering (IE) and included a site walkover and an interview with the current owner.

The investigation did not identify any activities included on the MfE Hazardous Activities and Industries List (HAIL) within the site (Insight Engineering, 2020). However, HAIL activities within the property included a likely livestock spray race / foot bath or plunge dip (including a 'Sheep Shower') located approximately 35 to 40 m north east of the site. IE observed that 'a concrete gully and sump were positioned to capture liquid sprayed into the 'Sheep Shower' and contamination impacts in that area (if any) were therefore considered unlikely to have been able to migrate to the site.' (Insight Engineering, 2020)

Based on the Ministry for the Environment's Sheep-Dip Guidelines, the chemicals that may be associated with infrastructure of this age include arsenic, zinc, copper, and organochlorines (DDT, lindane, dieldrin and aldrin), organophosphates, synthetic pyrethroids and insect growth regulators (Ministry for the Environment, 2006).

The IE investigation report noted that, after the current owner purchased the site in 2012 via a boundary adjustment, the building on site has been used for deer handling and that no fertilisers or other agrichemicals have been used or stored in or around the building (Insight Engineering, 2020).

Soil contamination associated with sheep dips can be significant, as treatment chemicals with high toxicity were often discharged to ground after dipping. Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.

5.1.5 Ladies Mile Pet Lodge

The Ladies Mile Pet Lodge was established prior to the mid 1970's. Historical documents available from the QLDC property files describe a veterinary clinic at 465-467 Frankton-Ladies Mile Highway (Lot 1 DP 12822). The original buildings are visible in the 1976 aerial photograph. Correspondence within the QLDC property file describes a residence, vet clinic, pet lodge, grooming clinic, pet supply sales, incinerator, and a burner for the disposal of veterinary and other rubbish and

waste. QLDC District Hazard map identifies the site as having a Dangerous Goods Licence for a 3C 2,000 litre underground fuel tank.

The Ladies Mile Pet Lodge is listed by the Otago Regional Council as HAIL.00475.01 for fuel storage. In 2005, an underground diesel tank was removed from the site. Sampling and analysis of soils remaining on site confirmed that contaminant concentrations met the Tier 1 soil acceptance criteria for residential land use. A second underground diesel tank used for heating remains on site, and the status of the site in the ORC HAIL register is 'partially investigated.'

5.1.6 Lower Shotover Cemetery

The Lower Shotover Cemetery is located on Spence Road. Land currently used for burial is located within Part Section 62 Block III Shotover SD, Part Section 888R Block III Shotover SD and Part Section 62 Block III Shotover SD.

Hazardous substances that may be associated with this land use include nitrates, lead, mercury, formaldehyde, and biological hazards. Although it is unlikely that the cemetery will change use as part of future development, further investigation may be required to assess the risk to human health if land use change on or adjacent to the site is proposed, as cemeteries can pose a risk to groundwater.

Figure 13: Lower Shotover Cemetery

5.1.7 Chestnut Farm

In the mid 1990's, 516 Frankton-Ladies Mile Highway (Lot 4 DP 22156), south the highway, was developed as a chestnut orchard. At that time, buildings and infrastructure were established, including horse stables, a shed, residence, septic tank, and associated disposal fields (e3Scientific Limited , 2019).

A Preliminary Site Investigation was undertaken on this site in January 2019 by e3Scientific. e3Scientific concluded that HAIL activities on the site included fuel storage at the shed and a septic tank system (waste disposal to land).

Although orchards are referenced in HAIL Category A10 for persistent pesticide use, based on the type and age of orchard, and the products known to have been used, e3s concluded that it was unlikely that the herbicides used on the orchard would be present in soil at levels that would present a risk to human health or at levels above laboratory reporting limits (e3Scientific Limited , 2019). e3scienfic confirmed that there was no evidence of HAIL activities occurring elsewhere on the site and it is unlikely HAIL activities on adjacent land had impacted the site via migration (e3Scientific Limited , 2019).

The report concluded that hazardous biological wastes associated with septic tanks are contained and are therefore unlikely to present a risk to human health, providing contractors do not excavate into the area. In the context of this investigation, the use of small scale domestic wastewater is not considered of sufficient scale to be a HAIL activity.

A small above ground fuel tank was removed from beside the main shed around 2017, and small volumes of fuel were stored within the shed. Contaminants of concern associated with this activity included hydrocarbons. Based on the small volumes of fuel stored at the shed, any hydrocarbon impacts to soil would most likely be limited to small drips and spills. However, further investigation is recommended to assess the risk to human health under NESCS in this location if activities listed under the NESCS are proposed, and to confirm requirements for off-site disposal, if required.

5.1.8 Farm Landfill

During the site inspection, a farm landfill was identified within Part Section 46 Block III Shotover Survey District. The landfill contained treated timber, cardboard,

plastic, and wiring. There was evidence of the contents having been previously burned.

Figure 14: Farm landfill on Pt Sec 46 Blk III Shotover SD.

Contaminants of concern include heavy metals, petroleum hydrocarbons, and pesticides. Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.

5.1.9 Unconfirmed Fill

Four areas of unconfirmed fill were identified from the aerial images and the site inspection. The source of fill material in these areas has not been confirmed, and it is possible that contaminants may be present if these materials originated from HAIL sites.

Pt Sec 50 Blk III Shotover SD - A raised mound covering approximately 900 m^2 was located directly north of the Ladies Mile Pet Lodge property. The mound was covered in pasture. Occasional pieces of concrete and weather asphalt were visible protruding from the surface in places, indicating the mound was not constructed from virgin excavated natural material (VENM).

Pt Sec 45 Blk III Shotover SD - A raised mound covering approximately 500 m^2 was located at the northern end of Pt Sec 45 Blk III Shotover SD. The mound was covered in pasture. Occasional pieces of concrete and weather asphalt were visible protruding from the surface in places, indicating the mound was not constructed from virgin excavated natural material (VENM).

Sec 159 Blk III Shotover SD – Sec 159 Blk III Shotover SD, located on Spence Road, is currently used an aggregate and topsoil storage area. During the site inspection, it was observed that, within the pines, there had been filling over the embankment and some areas of illegal dumping.

Lot 4 DP 325561 – In aerial images along the southern boundary of Lot 4 DP 325561, approximately 2000 m^3 of fill material is visible, deposited in discrete piles

A wide of range of potential contaminants can be associated with uncontrolled fill. To characterise uncontrolled fill, a broad analytical suite is recommended, including heavy metals, asbestos and petroleum hydrocarbons.

Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in these areas.

Figure 15: Raised mound located on Pt Sec 50 Blk III Shotover SD.

Figure 16: Raised mound located on Pt Sec 50 Blk III Shotover SD.

Figure 17: Stockpiles of material within Sec 159 Blk III Shotover SD.

Figure 18: Stockpiles of material within Lot 4 DP 325561.

5.1.10 Transformers

Based on the QLDC services web map, eleven pole and ground mounted transformers are located within the study area. Contaminants of concern include hydrocarbons, and heavy metals, including mercury. Polychlorinated biphenyls (PCB) may be present, depending on transformer age.

Any impacts to soil from transformer oils is likely to be highly localised, resulting from small drips and spills. Furthermore, the potential contaminants present generally bind strongly to soils and are highest in concentration within the surface soils. It is therefore unlikely that contaminants associated with transformers would impact soils within neighbouring areas and if transformers require removal, it is feasible that soils immediately surrounding the structure could be removed.

Further investigation is not recommended if development is proposed within the vicinity of transformers, provided correct procedures are followed during transformer removal. However, further investigation may be required to determine an appropriate disposal location of soils associated with transformers.

The location of transformers within the investigation area are shown in Figure 19.

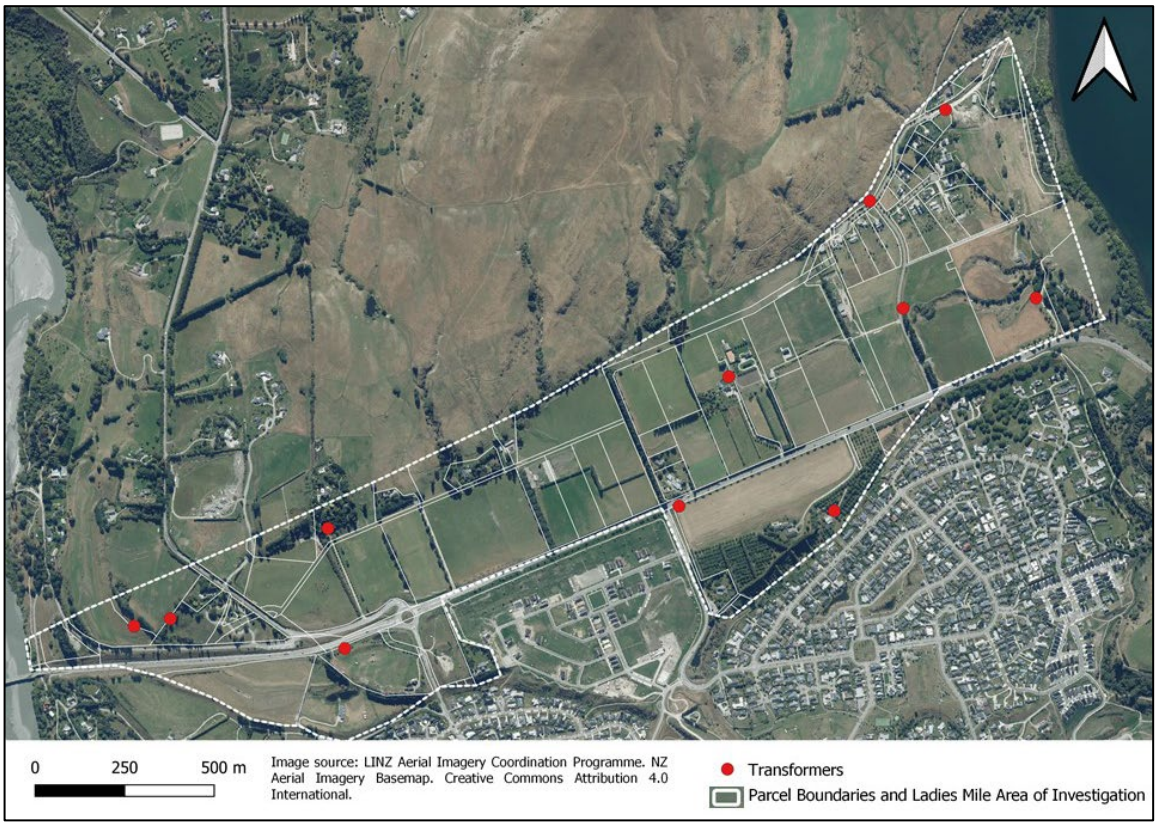


Figure 19: Electrical transformers

5.1.11 Small Scale Fuel Storage

e3Scientific identified the location of fuel storage facilities from the Otago Regional Council HAIL database, property file information, including building consents, available from the QLDC, and observations during the site inspection.

One residential above ground fuel storage tank was identified within the project area on Lot 1 DP 359142. Given the small volumes stored for residential heating, it is highly unlikely that there have been more than minor impacts to soils within these sites.

Contaminants of concern associated with small-scale fuel storage include TPH, polycyclic aromatic hydrocarbons (PAH), aromatic volatile organic compounds (eg BTEX), and heavy metals.

Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.

One mobile fuel tank (in addition to the one described in section 5.1.3) during the site inspection in Lot 2 DP 457308. Given the small volumes of fuel stored, and the temporary nature of storage, this activity is not considered of sufficient scale to be considered a HAIL activity.

5.2 Possible HAIL sites

5.2.1 Diffuse contamination associated with building products – Lead-based paints

Although the use or presence of lead-based paint is not explicitly listed as an item on the Hazardous Activities and Industries List, category I includes, '*Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment.*'

This category is intended as a 'catch-all' category to ensure that all contaminated land is reflected in the Hazardous Activities and Industries List.

When lead paint is sanded or peels from exterior cladding, it has the potential to contaminate soils, typically within a short distance from the building footprint. As some lead paints were up to 50% lead, it is possible in some cases for soil contaminant standards (SCS) for human health to be exceeded. Although lead is the most common contaminant associated with paints, other heavy metals such as arsenic, chromium, copper, cadmium, lead, nickel and zinc may have been present in primers/paints and other building products, such as galvanised steel or treated timber.

Investigations conducted by e3s on soils surrounding historical buildings have identified that impacts from lead-based paints and building products are limited to the immediate vicinity of buildings (with in a meter) and at a shallow depth, provided there has not been soil disturbance or substantial sanding of paint.

The use of lead-based paint on housing exteriors was common until the 1980's. The outlines of buildings constructed prior to 1984 (the nearest aerial photograph

to 1980) were used as a conservative cut-off for the potential presence of lead paint. Buildings were identified by cross referencing the NZ Building Outlines GIS layer from the LINZ data service, with 1959, 1976, 1984 and 2001 aerial photographs. Small temporary buildings present during rural land use that were most likely hay sheds were excluded.

Potential lead management areas are marked in Figure 20.

In many cases, the identified buildings will not contain lead painted exteriors (for example, brick houses), and these sites do not meet the 'more likely than not' threshold to be considered HAIL. However, if development is proposed within these areas, including change of land use, or earthworks, further assessment should be completed to determine likelihood of lead impacts to soil in sufficient concentration to pose a risk to human health.

Figure 20: Lead Management Areas

5.2.2 Diffuse contamination associated with building products - Asbestos

HAIL category E1 includes: *Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition*.

New Zealand guidance on asbestos in soil considers that buildings constructed prior to 2000 should be considered to have the potential to contain asbestos building products unless a building survey has been completed (BRANZ Ltd, 2017). There is the potential for asbestos to impact soils surrounding the building when a structure is refurbished or demolished or when a building is in a deteriorated condition.

The outlines of buildings constructed prior to 2001 (the nearest aerial photograph to 2000) were used as a conservative cut-off for the potential presence of asbestos. Buildings were identified by cross referencing the NZ Building Outlines GIS layer from the LINZ data service, with 1959, 1976, 1984 and 2001 aerial photographs. Small temporary buildings present during rural land use that were most likely hay sheds, constructed from timber, have been omitted.
Pre 2001 buildings are marked in Figure 21.

Figure 21: Pre-2001 Buildings

In many cases, the identified buildings will not contain asbestos in a deteriorated condition and these sites do not meet the 'more likely than not' threshold to be considered HAIL. However, if development is proposed within these areas, including change of land use, or earthworks, further assessment should be completed to determine likelihood of asbestos impacts to soil.

Buildings identified for demolition should be assessed for asbestos containing material. If asbestos building materials are present, development within these areas will require management in accordance with the Health and Safety at Work (Asbestos) Regulations 2016. Management measures during building removal or demolition should include the management of asbestos in soil.

5.2.3 Category H: Adjacent Sites

HAIL category H includes: *Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment.*

An evaluation of the potential for migration of hazardous substances from contaminated sites typically requires a more detailed site-specific assessment. Migration from sediment and stormwater runoff or groundwater transport may be possible at some sites; however, based on the nature of potential contaminants the risk of contaminant migration is low.

5.3 Balance of the Investigation Area

Given the long history of use, it is possible that other unidentified HAIL activities may be present within the investigation area.

For example, historic farm landfills or offal pits, particularly near Glenpanel Farm Hub, may be present. Offal pits are generally contained within a small area and identified by mounding and/or a concrete lid. The primary risk to human health from offal pits is associated with biological hazards, such as viruses and bacteria. Contaminants associated with farm landfill include heavy metal, petroleum hydrocarbons and pesticides.

As such, it will be important to implement an 'accidental discovery protocol' to during development works to ensure that any unexpected contamination is appropriately managed.

6 Review of Contaminant Risk

A broad-scale review of activities occurring within the study area has identified locations where it is considered more likely than not that HAIL activities have occurred. The location of these pieces of land are detailed in Table 1 and identified in Figure 22.

Additionally, locations of buildings with the potential to contain asbestos or lead based paints are detailed in Table 2 and identified in Figure 20 and Figure 21.

Potential contaminants associated with these HAIL activities include persistent pesticides, heavy metals, petroleum hydrocarbons, polychlorinated biphenyls and waste materials within landfill areas. There is also potential for lead paint and/or asbestos contamination in the vicinity of buildings constructed prior to 1980 and 2000, respectively.

The risk to human health from contaminants in soil is based on the toxicity and concentrations of the contaminant and the likely exposure to the contaminants. Depending on the final development plans for the Ladies Mile corridor, it is conceivable that contaminants in soil at some of the locations identified in Tables 1 and 2 could pose a risk to human health. As such, further investigation is recommended to assess the risk to human health under NESCS if activities listed under the NESCS are proposed within these areas. Additional investigation may also be required to determine appropriate disposal locations for soils associated with these areas.

Many of the identified HAIL activities involve relatively small-scale hazardous substance storage or use, e.g. single transformers or fuel storage tanks, and the likelihood of contamination on a significant scale is low. Of the identified activities, the farm landfill on Pt Sec 46 Blk III Shotover SD and the sheep dip at the Glenpanel Farm Hub have the greatest likelihood of causing soil contamination. The farm landfill occupies a relatively small piece of land, and removal of the landfill and contaminated soil if necessary is likely to be feasible method for site remediation. The scale of any contamination at the Glenpanel farm hub is likely to be more significant given the nature of the activity and high toxicity of sheep dip chemicals such as arsenic and dieldrin. Remedial works in this location have the potential to be more significant.

It is also acknowledged that, despite a thorough site history review, it has not been possible to identify or accurately locate all HAIL activities within the site. As such, it will be important to implement an 'accidental discovery protocol' to during development works to ensure that any unexpected contamination is appropriately managed.

Table 1: Summary of HAIL Areas

Number	Name	Legal description / Address	HAIL Category	Contaminants of concern	Recommendations
1	Historic Threepwood Farm Hub	Lot 2 DP 495771 and Lot 22 DP 378242	A8. Livestock dip or spray race operations	NA – site has been remediated.	No additional investigation is necessary.
2	Threepwood Encapsulation Cell	Lot 2 DP 495771	G3. Landfill sites	Arsenic, cadmium, and dieldrin	If development is proposed within the vicinity of the Threepwood encapsulation cell, guidance within the Site Management Plan and other information pertaining to the site should be strictly followed.
3	Current Threepwood Farm Hub	28 Strains Road Lot 2 DP 475308 [1]	A6. Fertiliser manufacture or bulk storage A17. Storage tanks or drums for fuel, chemicals or liquid waste F4. Motor vehicle workshops	Calcium phosphate, calcium sulphate, copper chloride, sulphur, sulphuric and phosphoric acid, molybdenum, selenium, iron, cadmium, nitrates, and ammonia, heavy metal, petroleum hydrocarbons	Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.
4	Glenpanel farm hub	Lot 5 DP 463532 & Lot 1 463532	A8. Livestock dip or spray race operations	Arsenic, zinc, copper, and organochlorines (DDT, lindane, dieldrin and aldrin), organophosphates, synthetic pyrethroids and insect growth regulators	Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.
5	Ladies Mile Pet Lodge	465 – 467 Frankton-Ladies Mile Hwy Lot 1 DP 12822	A17. Storage tanks or drums for fuel, chemicals or liquid waste	TPH, polycyclic aromatic hydrocarbons (PAH), aromatic volatile organic compounds (eg BTEX), and heavy metals	Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.
6	Lower Shotover Cemetery	Pt Sec 62 and 888R Blk III Shotover SD	G1. Cemeteries	Nitrates, lead, mercury, formaldehyde, and biological hazards	Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.
7	Chestnut Farm	516 Frankton-Ladies Mile Hwy Lot 4 DP 22156	A17. Storage tanks or drums for fuel, chemicals or liquid waste	TPH, polycyclic aromatic hydrocarbons (PAH), aromatic volatile organic compounds (eg BTEX), and heavy metals	Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.
8	Farm Landfill	Pt Sec 46 Blk III Shotover SD	G3. Landfill sites	Heavy metals, petroleum hydrocarbons, pesticides	Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.
9	Uncontrolled Fill	Pt Secs 45, 50, 159 Blk III Shotover SD and Lot 4 DP 325561	G3. Landfill sites	Heavy metals and petroleum hydrocarbons	Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.
10	Transformers	Transformer locations	B2. Electrical transformers including the manufacturing, repairing or disposing of electrical transformers or other heavy electrical equipment	Hydrocarbons, and heavy metals, including mercury. Polychlorinated biphenyls (PCB) may be present, depending on transformer age.	Further investigation is not recommended if development is proposed within the vicinity of transformers, provided correct procedures are followed during transformer removal.
11	Small Scale Fuel Storage	Lot 1 DP 539142		TPH, polycyclic aromatic hydrocarbons (PAH), aromatic volatile organic compounds (eg BTEX), and heavy metals	Further investigation is recommended to assess the risk to human health under NESCS if land use change or soil disturbance are proposed in this area.

Table 2: Potential lead-based paint and asbestos containing buildings

Legal description / Address	HAIL Category	Contaminants of concern	Recommendations
Spence Road (*Section 159 Block III Shotover SD*) 33 Lower Shotover Road (*Lot 1 DP 17388*) Glenpanel Farm Hub (*Lot 1 DP 20162, Lot 5 DP 463532, Lot 2 DP 463532, Lot 4 DP 463532*) Ladies Mile Pet Lodge 465 – 467 Frankton-Ladies Mile Hwy (*Lot 1 DP 12822 & Lot 16 DP 12921*) 28 Strains Road (*Lot 2 DP 475308*) Threepwood farm buildings (*Lot 1 DP 542712, Lot 100 DP 542712, Lot 22 DP 378242, Lot 2 DP 388976*)	I. Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment	Lead and other heavy metals	Further investigation may be required to assess the risk to human health under NESCS if activities listed under the NESCS are proposed.
Spence Road (*Section 159 Block III Shotover SD*) 33 Lower Shotover Road (*Lot 1 DP 17388*) Glenpanel Farm Hub (*Lot 1 DP 20162, Lot 5 DP 463532, Lot 2 DP 463532, Lot 4 DP 463532*) Ladies Mile Pet Lodge 465 – 467 Frankton-Ladies Mile Hwy (*Lot 1 DP 12822 & Lot 16 DP 12921*) 28 Strains Road (*Lot 2 DP 475308*) Threepwood farm buildings (*Lot 1 DP 542712, Lot 100 DP 542712, Lot 22 DP 378242, Lot 2 DP 388976*) 396 Frankton-Ladies Mile Hwy (*Lot 1 DP 27866*) 399 Frankton-Ladies Mile Hwy (*Lot 1 DP 22874*) 466 Frankton-Ladies Mile Hwy (*Lot 2 DP 536321*)	E1. Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition	Asbestos	Further investigation may be required to assess the risk to human health under NESCS if activities listed under the NESCS are proposed. Buildings identified for demolition should be assessed for asbestos containing material. If asbestos building materials are present, development within these areas will require management in accordance with the Health and Safety at Work (Asbestos) Regulations 2016. Management measures during building removal or demolition should include the management of asbestos in soil.

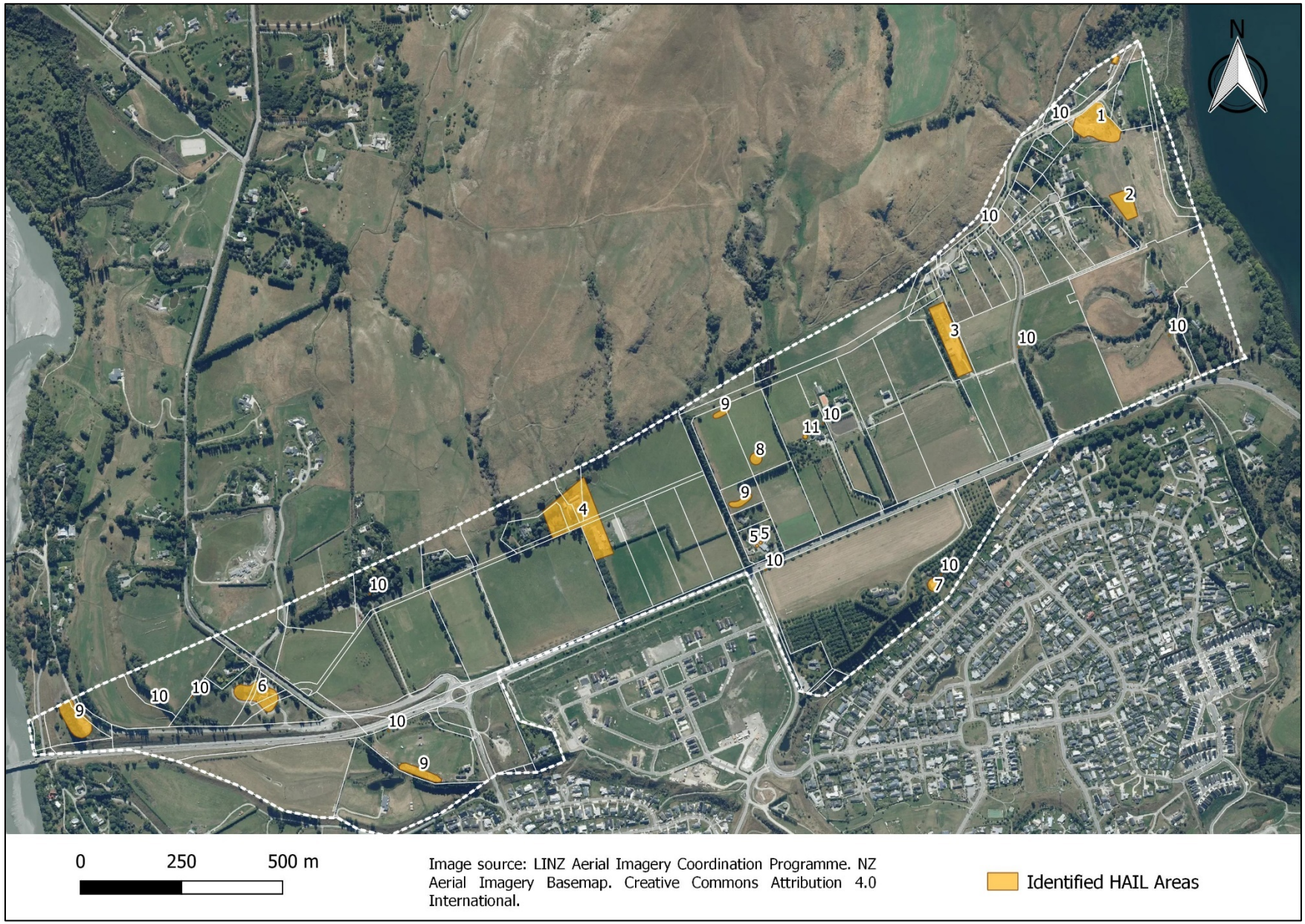


Figure 22: Identified HAIL sites

7 Conclusions and Recommendations

e3Scientific has conducted a systematic, broadscale review of multiple historic and contemporary sources of information to identify pieces of land within the investigation where it is more likely than not that activities or industries described in the HAIL have been undertaken. The location of these pieces of land are detailed in Table 1 and identified in Figure 22. Additionally, locations of buildings with the potential to contain asbestos or lead based paints are detailed in Table 2 and identified in Figure 20 and Figure 21.

Potential contaminants associated with these HAIL activities include persistent pesticides, heavy metals, petroleum hydrocarbons, polychlorinated biphenyls and waste materials within landfill areas. There is also potential for lead paint and/or asbestos contamination in the vicinity of buildings constructed prior to 1980 and 2000, respectively.

Depending on the final development plans for the Ladies Mile corridor, it is conceivable that contaminants in soil at some of the locations identified could pose a risk to human health. As such, further investigation is recommended to assess the risk to human health under NESCS if activities listed under the NESCS are proposed within these areas. Additional investigation may also be required to determine appropriate disposal locations for soils associated with these areas.

Within the eastern portion of the site, beside Lake Hayes, there are Holocene lake deposits described as laminated micaceous silt, mud, and sand in old lake deposits. We note that elevated concentrations of geogenic arsenic have been observed in these deposits.

It is acknowledged that, despite a thorough site history review, it has not been possible to identify or accurately locate all HAIL activities within the site. As such, it will be important to implement an 'accidental discovery protocol' during development works to ensure that any unexpected contamination is appropriately managed.

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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 deliver 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.

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 the contaminated land National Environmental Standard (NES) took effect in January 2012.

Glenn Davis is the Managing Director of the e3Scientific Contaminated Land team and has over 20 years post graduate experience working as an Environmental Scientist. Glenn has completed preliminary site investigations, soil and groundwater investigations, detailed site investigations, and remediation projects for the oil and gas industry, transport, agricultural and land development industries and local and national governments in New Zealand, Australia, Asia, the United Kingdom and Ireland. Glenn is responsible for technical oversite of projects and sign off of contaminated land investigations and is supported by Fiona Rowley, Carrie Pritchard, Simon Beardmore, Simon Bloomberg (Senior Environmental Scientists, specialising in Contaminated Land Investigation and Remedial Work) and Alexandra Badenhop (Principal Hydrogeologist).

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 e3scientic 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:

Hazardous Activities and Industries List

Ministry for the Environment
Manatū Mō Te Taiao

Hazardous Activities and Industries List (HAIL)

October 2011

A Chemical manufacture, application and bulk storage

1. Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application
2. Chemical manufacture, formulation or bulk storage
3. Commercial analytical laboratory sites
4. Corrosives including formulation or bulk storage
5. Dry-cleaning plants including dry-cleaning premises or the bulk storage of dry-cleaning solvents
6. Fertiliser manufacture or bulk storage
7. Gasworks including the manufacture of gas from coal or oil feedstocks
8. Livestock dip or spray race operations
9. Paint manufacture or formulation (excluding retail paint stores)
10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds
11. Pest control including the premises of commercial pest control operators or any authorities that carry out pest control where bulk storage or preparation of pesticide occurs, including preparation of poisoned baits or filling or washing of tanks for pesticide application
12. Pesticide manufacture (including animal poisons, insecticides, fungicides or herbicides) including the commercial manufacturing, blending, mixing or formulating of pesticides
13. Petroleum or petrochemical industries including a petroleum depot, terminal, blending plant or refinery, or facilities for recovery, reprocessing or recycling petroleum-based materials, or bulk storage of petroleum or petrochemicals above or below ground
14. Pharmaceutical manufacture including the commercial manufacture, blending, mixing or formulation of pharmaceuticals, including animal remedies or the manufacturing of illicit drugs with the potential for environmental discharges
15. Printing including commercial printing using metal type, inks, dyes, or solvents (excluding photocopy shops)
16. Skin or wool processing including a tannery or fellmongery, or any other commercial facility for hide curing, drying, scouring or finishing or storing wool or leather products
17. Storage tanks or drums for fuel, chemicals or liquid waste
18. Wood treatment or preservation including the commercial use of anti-sapstain chemicals during milling, or bulk storage of treated timber outside

B Electrical and electronic works, power generation and transmission

1. Batteries including the commercial assembling, disassembling, manufacturing or recycling of batteries (but excluding retail battery stores)

2. Electrical transformers including the manufacturing, repairing or disposing of electrical transformers or other heavy electrical equipment
3. Electronics including the commercial manufacturing, reconditioning or recycling of computers, televisions and other electronic devices
4. Power stations, substations or switchyards

C Explosives and ordinances production, storage and use

1. Explosive or ordinance production, maintenance, dismantling, disposal, bulk storage or re-packaging
2. Gun clubs or rifle ranges, including clay targets clubs that use lead munitions outdoors
3. Training areas set aside exclusively or primarily for the detonation of explosive ammunition

D Metal extraction, refining and reprocessing, storage and use

1. Abrasive blasting including abrasive blast cleaning (excluding cleaning carried out in fully enclosed booths) or the disposal of abrasive blasting material
2. Foundry operations including the commercial production of metal products by injecting or pouring molten metal into moulds
3. Metal treatment or coating including polishing, anodising, galvanising, pickling, electroplating, or heat treatment or finishing using cyanide compounds
4. Metalliferous ore processing including the chemical or physical extraction of metals, including smelting, refining, fusing or refining metals
5. Engineering workshops with metal fabrication

E Mineral extraction, refining and reprocessing, storage and use

1. Asbestos products manufacture or disposal including sites with buildings containing asbestos products known to be in a deteriorated condition
2. Asphalt or bitumen manufacture or bulk storage (excluding single-use sites used by a mobile asphalt plant)
3. Cement or lime manufacture using a kiln including the storage of wastes from the manufacturing process
4. Commercial concrete manufacture or commercial cement storage
5. Coal or coke yards
6. Hydrocarbon exploration or production including well sites or flare pits
7. Mining industries (excluding gravel extraction) including exposure of faces or release of groundwater containing hazardous contaminants, or the storage of hazardous wastes including waste dumps or dam tailings

F Vehicle refuelling, service and repair

1. Airports including fuel storage, workshops, washdown areas, or fire practice areas
2. Brake lining manufacturers, repairers or recyclers
3. Engine reconditioning workshops
4. Motor vehicle workshops
5. Port activities including dry docks or marine vessel maintenance facilities

6. Railway yards including goods-handling yards, workshops, refuelling facilities or maintenance areas
7. Service stations including retail or commercial refuelling facilities
8. Transport depots or yards including areas used for refuelling or the bulk storage of hazardous substances

G Cemeteries and waste recycling, treatment and disposal

1. Cemeteries
2. Drum or tank reconditioning or recycling
3. Landfill sites
4. Scrap yards including automotive dismantling, wrecking or scrap metal yards
5. Waste disposal to land (excluding where biosolids have been used as soil conditioners)
6. Waste recycling or waste or wastewater treatment

H Any land that has been subject to the migration of hazardous substances from adjacent land in sufficient quantity that it could be a risk to human health or the environment

I Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment

Appendix C:

Historical Aerial Photographs

0 250 500 750 1,000 m

Image source: http://retrolens.nz and licenced by LINZ for reuse under the CC-BY 3.0 license

1959

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Ladies Mile investigation boundary

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Ladies Mile investigation boundary

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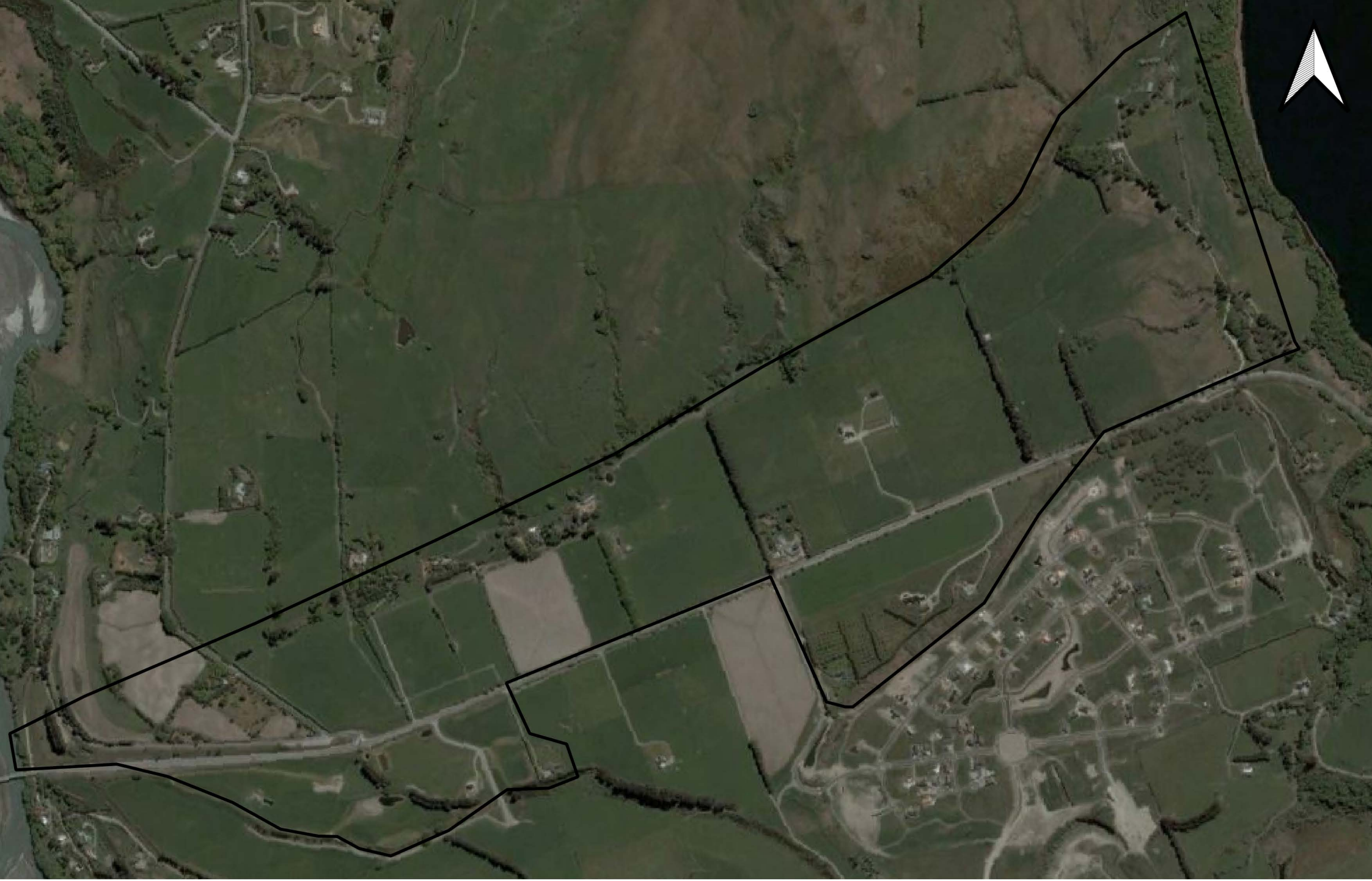
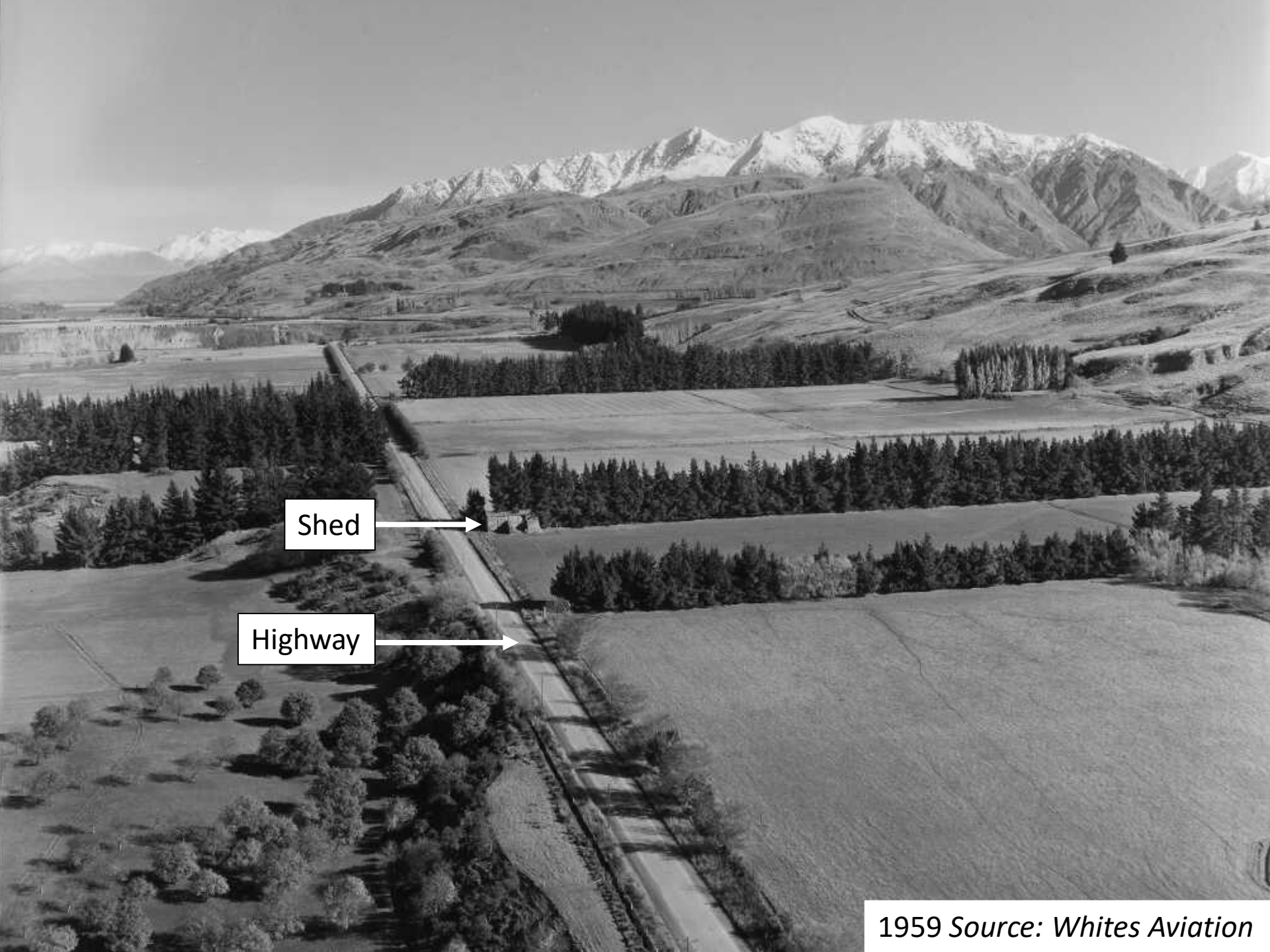
2001



0 250 500 750 1,000 m

Image source: google earth Image © 2020 Maxar Technologies

2004



1959 *Source: Whites Aviation*

1959 *Source: Whites Aviation*

Appendix D:

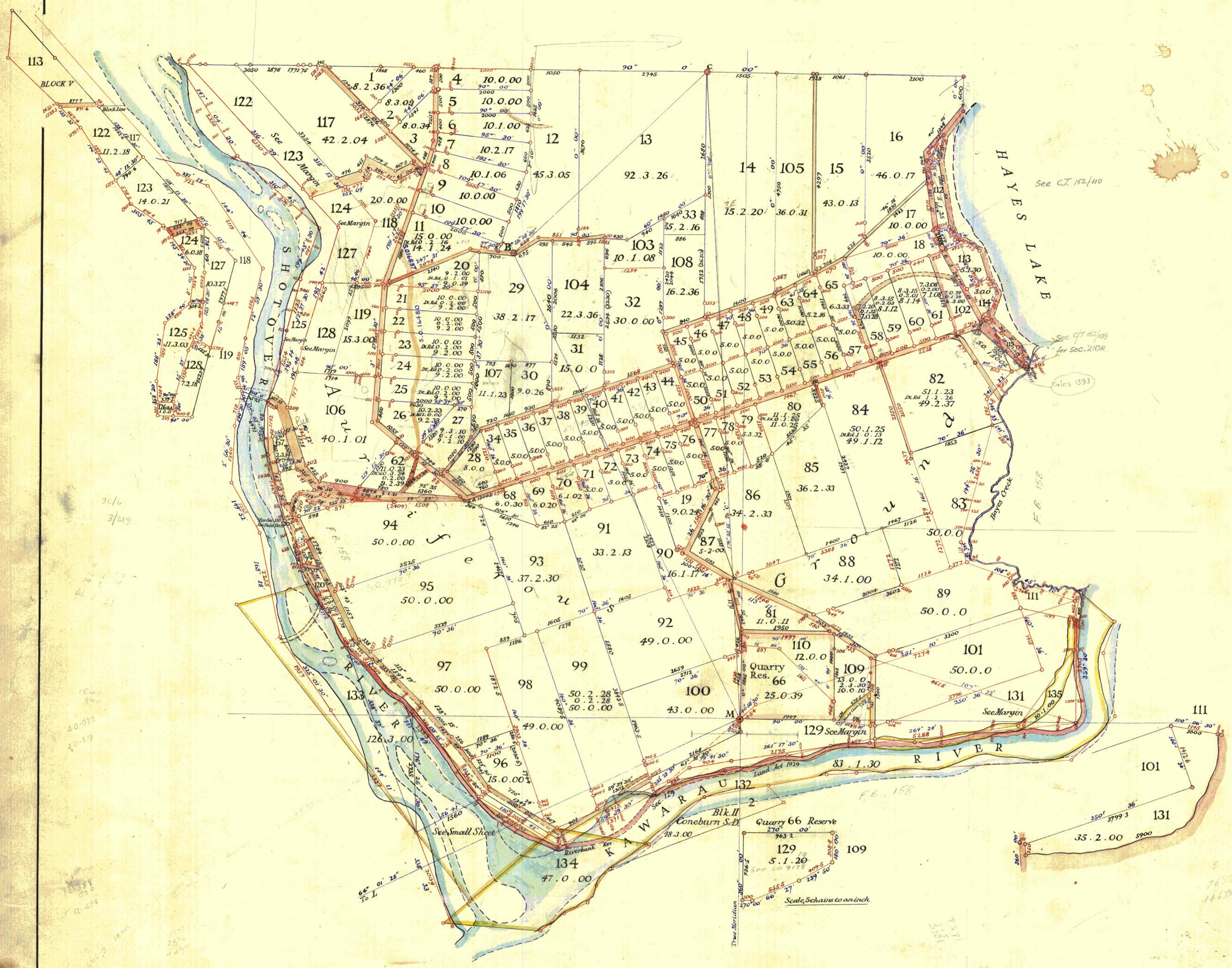
Historical Maps

0 250 500 750 1000 m

Image source: Maps Past http://www.mapspast.org.nz/
NZMS260_1999 Topography

Ladies Mile investigation boundary

1497



BLOCK III
SHOTOVER S.D.

Surveyed by G.M. Barr Aug. 1864

Scale, 10 chains to an inch

This is a correct copy of the original Plan of Block III Shotover S.D.

H. Adams

Chief Surveyor
11.7.1950.

1497

1497

H. E. WALSHE, CHIEF DRAUGHTSMAN, HEAD OFFICE, LANDS AND SURVEY DEPARTMENT, WELLINGTON

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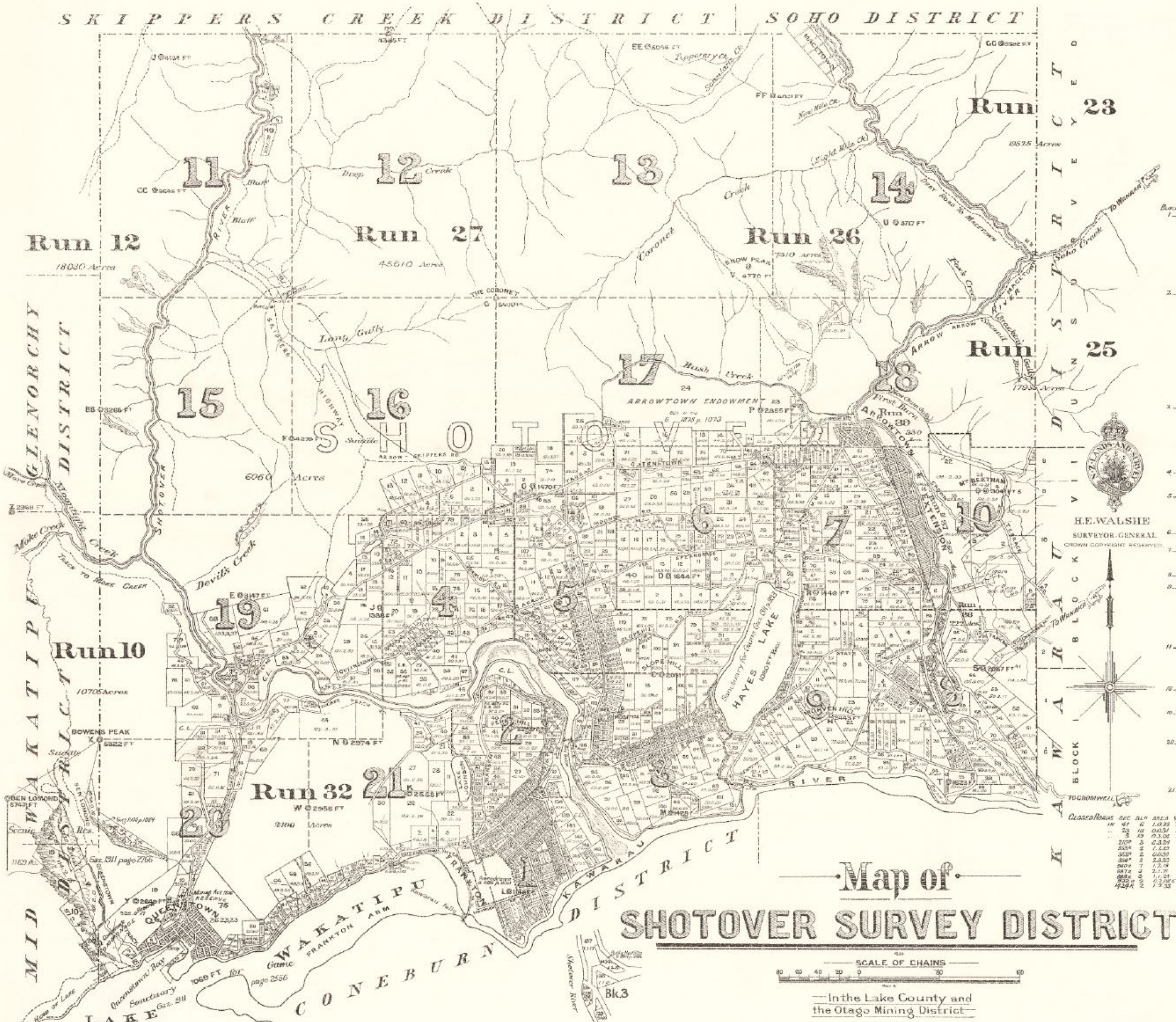
Map of
SHOTOVER SURVEY DISTRICT
In the Lake County and the Otago Mining District
SCALE OF CHAINS
SKIPPERS CREEK DISTRICT
SOHO DISTRICT
GLENORCHY DISTRICT
MID WAKATIPU DISTRICT
CONEBURN DISTRICT
KAWARAU DISTRICT
UNSURVEYED DISTRICT
SHOTOVER
Run 12
18030 Acres
Run 27
45610 Acres
Run 26
7310 Acres
Run 23
Run 25
Run 10
10705 Acres
Run 32
2100 Acres
6060 Acres
ARROWTOWN ENDOWMENT
HAYES LAKE
LAKE WAKATIPU
FRANKTON ARM
QUEENSTOWN
FRANKTON
ARROWTOWN
THE CORONET
SNOW PEAK
BOWENS PEAK
BEN LOMOND
Queenstown Bay
Sanctuary for Game
KAWARAU
RIVER
SHOTOVER RIVER
Skippers
Long Gully
Coronet Creek
Bush Creek
Devil's Creek
Moke Creek
Moonlight Creek
Soho Creek
Arrow River
Macetown
To Wanaka
To Cromwell
To Head of Lake
Bk.3
H.E. WALSHE
SURVEYOR-GENERAL
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N.Z. LANDS AND SURVEY

N.Z. CADASTRAL MAP—SURVEY DISTRICT SERIES
1: 63,360 (1 Mile to 1 inch)

SHOTOVER

OTAGO (OT)59

N.Z.M.S. 13
OTAGO (OT) 59

REFERENCE

Boundaries of Survey Districts shown thus
Boundaries of Survey Blocks shown thus
Boundaries of Runs shown thus
Trig. Stations with heights in feet

SCALE

Chains
Miles

ABBREVIATIONS.

D.P. Deposited plan
C.L. Crown Land
Cem. Res. Cemetery Reserve

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