

Preliminary & Detailed Site Investigation

For

The Mt Cardrona Station Village

October 2016



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Preliminary & Detailed Site Investigation

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EXECUTIVE SUMMARY

Mt Cardrona Station is seeking resource consent for the inclusion of a golf course into the Mt Cardrona Station Village development. Historically, the site has operated as a pastoral station and as part of the Cardrona town Commonage.

Agrichemicals associated with farming operations are included on the Hazardous Activities and Industries List (HAIL). These activities include the storage and use of fertilisers and persistent pesticides that have the potential to impact soil quality. In addition, unexplained elevated arsenic levels, most likely of a geogenic source, have been encountered in the local district that exceed New Zealand soil contaminant standards for a range of landuse scenarios. Given the proposed development and the possibility that hazardous substances are present or have impacted soil quality, the site is subject to the provisions of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES).

In order to meet the requirements of the NES, Mt Cardrona Station commissioned Davis Consulting Group Limited (DCG) to undertake a combined Preliminary and Detailed Site Investigation (the Investigation) to review the landuse history of the site, identify any potential contaminant risks and consider the risk to human health from the establishment and long term use of the proposed development.

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

- Review of the site history, including review of historical aerial photography, a previous archaeological assessment of the site, and historical documentation sourced from the Queenstown Lakes District Council, Lakes Museum and Otago Regional Council;
- Completion of a site inspection to examine the condition of the site;
- Development of a soil sampling and analysis plan based on the land use history of the site;
- Collection of 12 soil samples from the site to characterise heavy metal concentrations in surface soils that may be associated broad acre application of fertilisers and background concentrations of arsenic;
- Based on research into the activities on the site and soil quality results, consideration of the risk to human health that may be associated with the proposed land use; and
- Preparation of a combined Preliminary and Detailed Site Investigation report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No. 1.

Based on the findings of the investigation, the following conclusions are made:

- Historically, the site has been used for agricultural purposes.
- There is no evidence that mineral processing activities or associated mine tailings are located on the study site.
- A review of historical records including aerial photography and council records has found no evidence that infrastructure associated with pesticide use or storage such as yards, dips and storage sheds have been located on the site under investigation.
- A systematic soil sampling program was undertaken across the site to characterise heavy metal concentrations in the surface soils of the site. The analytical results indicate the heavy metals are present at background concentrations, below the NES soil contaminant standards for all landuse scenarios set out in the NES.

In summary, the combined Preliminary and Detailed Site Investigation has identified historical land use activities that may have impacted the soil quality of the site. Based on the results of this Investigation, DCG concludes it is highly unlikely that there is a risk to human health associated with the proposed activities on the site.

1.0 INTRODUCTION

1.1 Purpose

The Mt Cardrona Station is seeking resource consent for the inclusion of a golf course into the Mt Cardrona Station Village development. Historically, the site has operated as a pastoral station and as part of the Cardrona town Commonage.

Agrichemicals associated with farming operations are included on the Hazardous Activities and Industries List (HAIL). These activities include the storage and use of fertilisers and persistent pesticides that have the potential to impact soil quality. In addition, unexplained elevated arsenic levels, most likely of a geogenic source, have been encountered in the local district that exceed New Zealand soil contaminant standards for a range of landuse scenarios. Given the proposed development and the possibility that hazardous substances are present or have impacted soil quality, the site is subject to the provisions of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES).

In order to meet the requirements of the NES, Mt Cardrona Station commissioned Davis Consulting Group Limited (DCG) to undertake a combined Preliminary and Detailed Site Investigation (the Investigation) to review the landuse history of the site, identify any potential contaminant risks and consider the risk to human health from the establishment and long term use of the proposed development.

DCG'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 site history, including review of historical aerial photography, a previous archaeological assessment of the site, and historical documentation sourced from the Queenstown Lakes District Council, Lakes Museum and Otago Regional Council;
- Completion of a site inspection to examine the condition of the site;
- Development of a soil sampling and analysis plan based on the land use history of the site;

- Collection of 12 soil samples from the site to characterise heavy metal concentrations in surface soils that may be associated broad acre application of fertilisers and background concentrations of arsenic;
- Based on research into the activities on the site and soil quality results, consideration of activity status of the proposed development under the NES and the risk to human health that may be associated with the proposed land use; and
- Preparation of a combined Preliminary and Detailed Site Investigation report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No. 1.

1.3 Limitations

The findings of this report are based on the Scope of Work outlined above. DCG 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, DCG'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 DCG 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 DCG personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, DCG assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside DCG, or developments resulting from situations outside the scope of this project.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Location

The site is located west of the Cardrona Valley Road within the Cardrona Valley, between Pringles Creek Road and the access road to the Cardrona Ski field (see Figure 1). The site under investigation was approximately 70 hectares in size, and includes the proposed Mt Cardrona Station village residence and golf course (see Figure 2). Legal descriptions for the site under investigation are:

- Lot 8 DP 446161 CT 561832
- Lot 7 DP 446161 CT 561831
- Lot 6 DP 446830 CT 561832
- Lot 5 DP 446161 CT 561829
- Lot 4 DP 446161 CT 561828
- Lot 2 DP 446161 CT 561826
- Lot 1 DP 446161 CT 561825
- Lot 3 DP 446161 CT 561827
- Lot 10 DP 446161 CT 680615
- Sec 6 SO 459975

Under the Queenstown Lakes District Council (QLDC) District Plan, the site is zoned as Mt Cardrona Special Zone.

Central coordinates for the site are: 5585627.421 N 2195059.373 E (NZMG)



Figure 1: Site Location

2.2 Site History

The history of the site and surrounding area has been determined from an assessment of historical aerial photography from 2004 to 2016; and a review of the archaeological study conducted by A Middleton in 2006 titled 'Mt Cardrona Station Archaeological Assessment of Study Area' submitted as a supporting document to the Queenstown Lakes District Council for Plan Change 18, Mount Cardrona.

Middleton's 2006 archaeological assessment describes the area being established as a pastoral run in the mid to late 1800's. The land that now constitutes Mt Cardrona Station was originally part of the South Wanaka Station, first issued to W. Mills in 1859 (run number 340). Gold was discovered in the Cardrona valley in 1862 and by 1863, 300 miners were working in the upper part of the Cardrona Valley. Middleton describes mine tailings spread over the valley floor, to the east of the Cardrona Valley Road. North of the area of investigation is the Cardrona Cemetery, established in the 1860's. The cemetery borders the homestead on the northern boundary of Mt Cardrona Station. After the end of the nineteenth century, land was broken into smaller lots and land east and north of the Cardrona Town was established as commonage under crown ownership

until subdivision into five blocks in 1921. Three of the northern blocks of the commonage fall within the study area. Middleton describes commonage as government land held for the use of gold miners in common for pasturing of livestock and gardening. The Mt Cardrona Station homestead and woolsheds were built by Eric Anderson prior to 1945. Mt Cardrona Station was known for a short time as Knuckle Peak Station in the 1970's. The Walter Little's water race was constructed in the early 1900's to work a hydraulic plant on a former dredge claim in the Cardrona river bed.

The location of the homestead, mine workings, Cardrona Valley Road and Cardrona Cemetery relative to the study area are shown in Figure 2. These are all located outside the area of investigation.

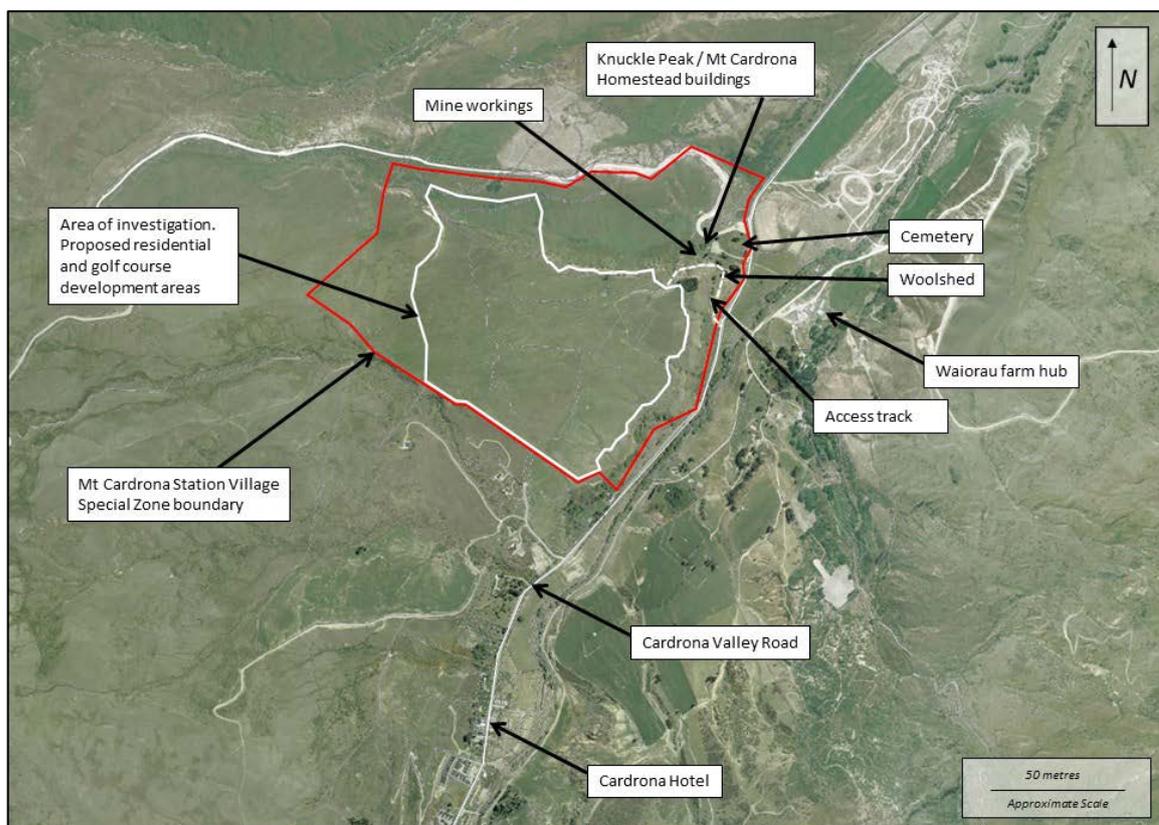


Figure 2: Site layout and surrounding land uses

2.2.1 Contaminants Commonly Associated with the Landuse

Hazardous substances that may be associated with farming operations on the site, include a range of organochlorine pesticides and trace metals associated with both pesticide and fertiliser storage and use. Furthermore, elevated arsenic levels have been found in soils in the district that exceed NES soil contaminant standards for a range of landuse scenarios. The source of the arsenic is unexplained but appears to occur naturally in some soils.

There is no evidence that mineral processing activities or associated mine tailings are located on the study site.

There is no evidence that infrastructure associated with pesticide use or storage such as yards, dips and storage sheds associated with past and present agricultural activities have been located on the site (see Section 2.2). We understand that stock was managed on adjacent farm hubs including the Waiorau farm hub (see Figure 2). Potential sources of agrichemicals are therefore limited to broadacre application of fertilisers and persistent pesticides. DCG has completed investigations across Otago and Southland and assessed the impact of the broadacre application of pesticides and fertilisers. The results of these investigations have shown that while heavy metal and persistent pesticide concentrations are often present, the concentrations are very low and below NES soil contaminant standards for all landuse scenarios. DCG has therefore ruled out the risk of this activity and detailed investigation is not required.

DCG considers the only outstanding matter that should be characterised is the arsenic levels in the soils to ensure the soils are suitable for the proposed landuse.

2.3 Additional Site Information

The CLMG No 1 requires information associated with fuel storage facilities, spill loss history, recorded discharges and onsite and offsite disposal locations. DCG requested a search of the Otago Regional Council (ORC) records for Landuse and Site Contamination Status, Resource Consents, and Resource Management Act (RMA) incidents for the site. The ORC advised that the site does not currently appear on the database. The Contaminated Land Enquiry letter is provided in Appendix B.

The following list provides a summary of additional information that the CLMG No. 1 (MfE, 2003a) indicates should be included in a PSI and DSI report:

- Presence of drums – No drums were observed during the site visit.
- Wastes – No waste materials were observed within the site under investigation.
- Fill materials – No fill materials were observed within the site under investigation.
- Odours – No odours were observed during the site investigation.
- Flood risk – The QLDC Hazard Maps show there is no flood hazard associated with the site.
- Site boundary condition – The site is largely wire and wood post fenced.
- Visible signs of contamination – There was no visible signs of contamination on site.

- Local sensitive environments – The Cardrona River is approximately 140 m to the east of the site boundary at the base of the Cardrona Valley. The site is bordered by ephemeral creeks to the north and south. The southern creek is called Pringles Creek. Both creeks run off Mt Cardrona toward the Cardrona River.

2.4 Site Condition and Surrounding Environment

The area investigated for the Mt Cardrona Station Village residence and golf course sites is located on the Mt Cardrona Station Village Terrace, an alluvial fan surface, gently sloping downward to the south-east (see Plate 1). The topography of the site is shown in Figure 3. An escarpment runs along the south-eastern boundary of the site with land dropping steeply toward the Cardrona Valley Road. The Littles Water Race runs along the north-western boundary of the site. The south eastern boundary of the site is aligned with Pringles Creek, flowing south-east toward the Cardrona River. The northern boundary of the site is also aligned with a south-easterly flowing ephemeral water course.

At the time of investigation, the site was under pasture and fenced into several paddocks. The land was being used for horse trekking tours. No waste or fill material was observed within the study area.

Generally, pastoral land uses surround the site. To the south-west there are several residence along Pringles Creek Road. The Cardrona Valley Road runs along the base of the escarpment beyond the eastern boundary of the site. The Cardrona woolshed is located north-east of the site, along the access road (see Figure 2). At the time of the site investigation, this woolshed was operating as an office for horse riding tours operating across the station. The closed Cardrona Cemetery, Mt Cardrona Station homestead and associated buildings are located to the north-east of the study area, north of the access road at the base of the escarpment (see Plate 2 and Figure 2). At the time of investigation, the storage sheds and land surrounding were being used as offices and storage for non-hazardous materials. Several horses were maintained in a fenced paddock. The Cardrona cemetery is closed and is presently maintained as a heritage site. Some of the rubble from the destroyed Mt Cardrona Station homestead was still present. Material within the rubble included cement board, charred wood, iron and concrete. A closed septic system remained adjacent the rubble from the homestead (see Figure 2).

A small abandoned mine tunnel was observed within the escarpment, south of the Cardrona homestead (see Figure 2).

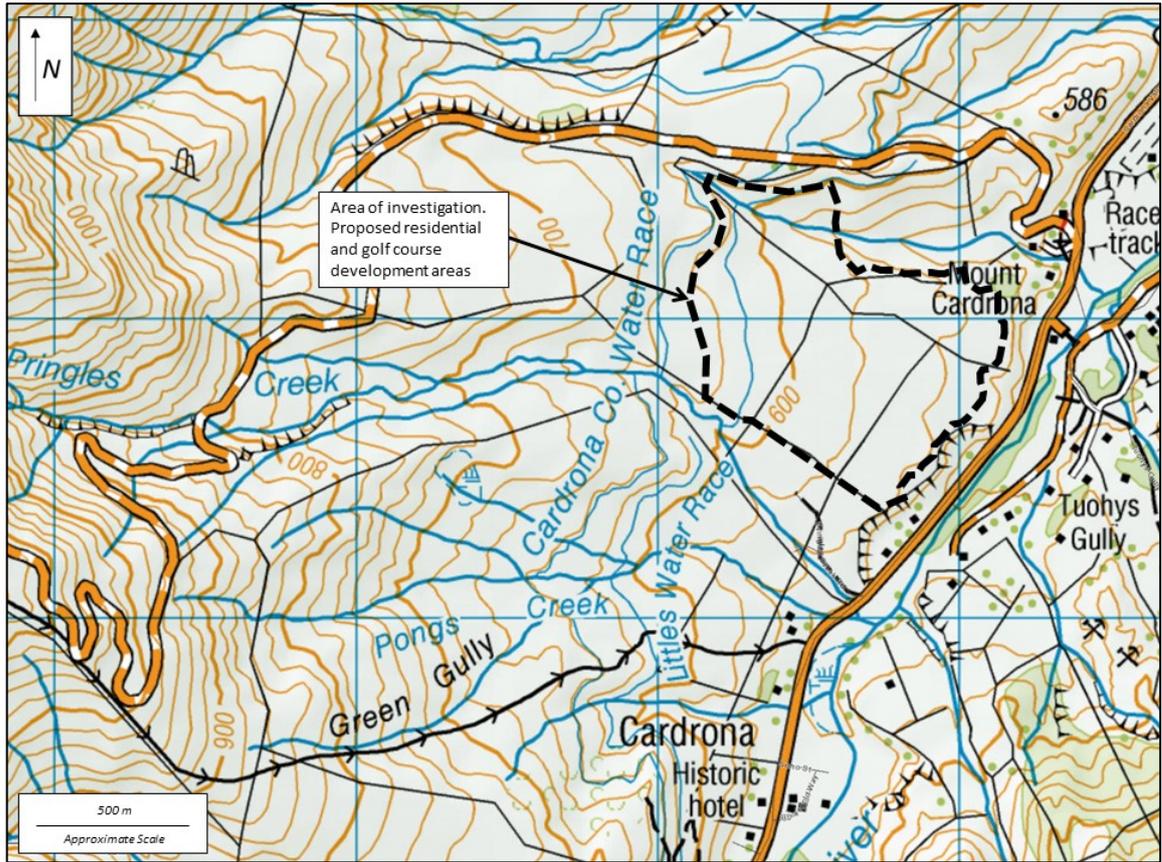


Figure 3: Topography of the project area

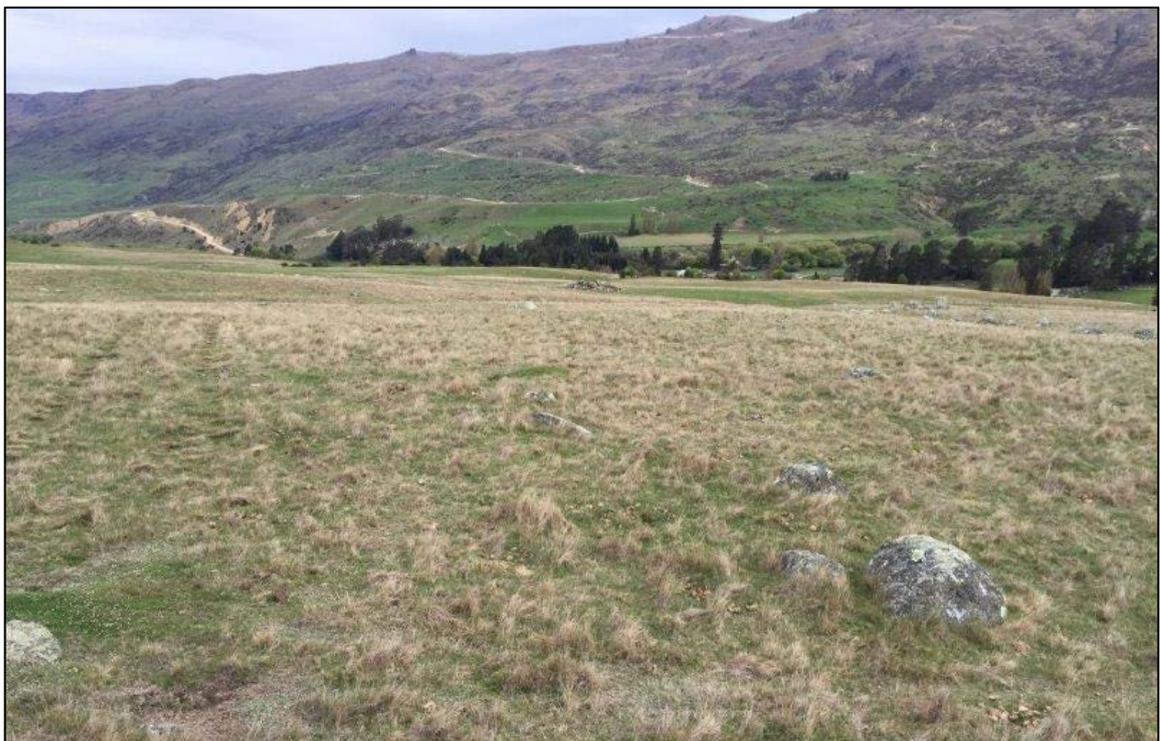


Plate 1: View of the site, looking north-east

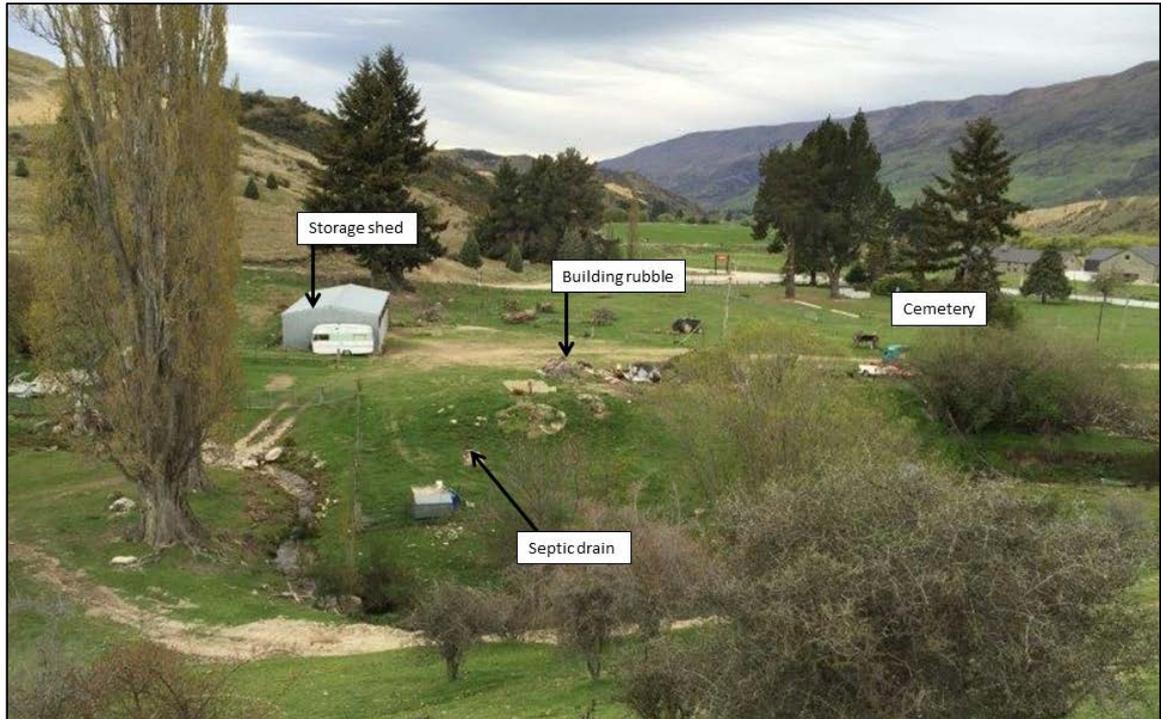


Plate 2: Mt Cardrona Station buildings

2.5 Geology

The geology of the site is described as undifferentiated Pleistocene – Holocene fan deposits of variably weathered, unsorted, locally derived, angular to rounded, sand gravel in relatively older alluvial fans (GNS, 2016).

2.6 Hydrogeology

The site investigation did not include a groundwater assessment. ORC holds records for 4 wells located within 1 km of the subject site. A total of 4 bores have been drilled within one kilometre of the site. The location of bores is provided in Appendix B. Bore uses are recorded as 3 for domestic use and 1 for scheme water.

2.7 Hydrology

The Cardrona River is around 140 m to the east of the site boundary at the base of the Cardrona Valley. The site is bordered by ephemeral creeks to the north and south. The southern creek is called Pringles Creek. Both creeks run off Mt Cardrona toward the Cardrona River (see Figure 3). During the site visit there was no surface water on site.

3.0 SOIL SAMPLING AND ANALYSIS

3.1 Data Quality Objectives

The data quality objective (DQOs) of the DSI was to systematically characterise heavy metal concentrations in the surface soils to support an assessment of risk to human health associated with the proposed development activities on the site.

3.2 Sampling Rationale

The sampling rationale was designed to consider the levels of heavy metals in soil, in particular the arsenic concentrations. Surface sampling was considered appropriate as an indicator of potential geogenic sources of heavy metals.

A total of 12 surface samples (0-0.1m) were collected across the site. Samples were submitted to the laboratory to be analysed as composites of 3 samples. The locations of soil samples collected across the site are presented in Figure 4 and a summary of soil samples and analysis is provided in Table 1.

Soil descriptions are provided in Appendix D.

3.3 Analytical Parameters

This analysis was determined by DCG's assessment of contaminants commonly associated with the landuse (see Section 2.2.1) and the assessment of the site condition (see Section 2.4). Laboratory analytical methods are detailed in the 'Summary of Methods' provided in Appendix C.



Figure 4: Sample locations

Table 1: Soil Sample Summary Table

Sample ID	Sample Depth (m)	Laboratory Analysis
CV01	0-0.1	Composite, Heavy Metals
CV02	0-0.1	
CV03	0-0.1	
CV04	0-0.1	Composite, Heavy Metals
CV05	0-0.1	
CV06	0-0.1	
CV07	0-0.1	Composite, Heavy Metals
CV08	0-0.1	
CV09	0-0.1	
CV10	0-0.1	Composite, Heavy Metals
CV011	0-0.1	
CV012	0-0.1	
DUP1	0-0.1	Composite, Heavy Metals
DUP2	0-0.1	
DUP3	0-0.1	

3.4 Soil Sampling Methodology

Soil sampling was undertaken with the use of a spade. The following procedures were applied during the soil sampling process to gain representative samples:

- Field personnel wore a fresh pair of nitrile gloves between sampling events.
- Soil samples were transferred to 250 mL glass jars with Teflon lids as supplied by Hills Laboratories.
- All soil samples were unambiguously marked in a clear and durable manner to permit clear identification of all samples in the laboratory.
- All samples were immediately placed in a cooled chilly bin.

3.5 Soil Sample Field and Laboratory QA/QC

The field QA/QC procedures performed during the soil sampling are listed as follows:

- Use of standardised field sampling forms and methods;
- Samples were transferred under chain of custody procedures;
- All samples were labelled to show point of collection, project number, and date;
- Headspace in sample jars was avoided;
- All samples were stored in a cooled chilly bin containing ice while in the field.

All soil samples were couriered to Hills Laboratories within a day of collection. Hills have IANZ accreditation for the analysis of heavy metals. Hills conduct internal QA/QC in accordance with IANZ requirements.

3.6 Guideline Values

Soil guideline values (SGVs) selected for application on this project are provided in Table 2. The selection of these guidelines is consistent with the principles of the Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2003b).

The heavy metal soil guideline values adopted for the site assessment were based on either the soil contaminant standards developed for the NES or the National Environment Protection (Assessment of Site Contamination) Measure, an Australian guideline.

Guidelines for residential landuse have been adopted for this site investigation, based on DCG's understanding of the proposed Mt Cardrona Station Village proposal.

Table 2: Soil Guidelines

Analytes	Guideline
Heavy Metals	<ol style="list-style-type: none">1. Soil Contaminant Standards in New Zealand 'Users' Guide: NES for Assessing & Managing Contaminants in Soil to Protect Human Health 2012 (MfE, 2012).2. Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater in National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC, 2013).

3.7 Soil Analytical Result Review

Following the receipt of laboratory data, a detailed review of the data was performed to determine its accuracy and validity. All laboratory data were checked for analytical and typographical errors.

Once the data quality was established the soil data was checked against the Sampling Program DQOs.

A composite field duplicate soil sample was collected during the site investigation and analysed to review the reproducibility of the soil sampling and laboratory analysis. Acceptable percentage difference between duplication samples is discussed in Section 4.2.1.

4.0 INVESTIGATION RESULTS

4.1 Analytical Results

The Laboratory Analysis Report is provided in Appendix C. The heavy metal results are summarised below:

- Total recoverable arsenic concentrations ranged from 6 mg/kg to 7 mg/kg. All arsenic concentrations detected in the soil samples were below the NES soil contaminant standard of 20 mg/kg;
- Total recoverable cadmium concentrations were all below laboratory limits of detection (0.10 mg/kg) and were therefore below the NES soil contaminant standard of 3 mg/kg;
- Total recoverable chromium concentrations ranged from 15 mg/kg to 18 mg/kg. All chromium concentrations detected in the soil samples were below the NES soil contaminant standard of >10,000 mg/kg;
- Total recoverable copper concentrations ranged from 12 mg/kg to 14 mg/kg. All copper concentrations detected in the soil samples were below the NES soil contaminant standard of 10,000 mg/kg;
- Total recoverable lead concentrations ranged from 11.6 mg/kg to 13.4 mg/kg. All lead concentrations detected in the soil samples were below the NES soil contaminant standard of 210 mg/kg;
- Total recoverable nickel concentrations ranged from 12 mg/kg to 15 mg/kg. All nickel concentrations detected in the soil samples were below the NEPM guideline value of 400 mg/kg;
- Total recoverable zinc concentrations ranged from 44 mg/kg to 51 mg/kg. All zinc concentrations detected in the soil samples were below the NEPM guideline value of 7,400 mg/kg.

Given the consistency of the results and the possible sources of heavy metals the practice of adjusting the guideline value for composite samples is not required as it is highly unlikely contaminant hotspots are present.

The relatively low and consistent concentrations of arsenic, chromium, copper, lead and nickel indicate these heavy metals are present at background levels.

4.2 QA/QC Results

4.2.1 Field Duplicates

A composite field duplicate was collected during the site investigation and analysed to review the reproducibility of the laboratory analysis. The duplicate and the corresponding sample results are presented in Table 3 below.

Table 3: Percentage Difference

	CV01, CV02, CV03 (mg/kg)	DUP1, DUP2, DUP3 (mg/kg)	% Difference
Arsenic	6	7	15.4
Cadmium	< 0.10	< 0.10	0
Chromium	15	17	12.5
Copper	12	13	8
Lead	11.6	12.4	6.7
Nickel	12	14	15.4
Zinc	44	51	14.7

An acceptable percentage difference between duplication samples is less than 30 to 50 % (MfE, 2011). The highest relative percentage difference was 15.4 % (for arsenic and zinc), which is considered acceptable for soil analysis.

The QA/QC analysis indicates the sampling and analysis undertaken was reproducible.

4.2.2 Laboratory Procedures

Methods used by Hills Laboratories for laboratory analysis are summarised in the analysis report provided in Appendix C. Hill Laboratories did not complete specific in-house QA/QC analysis.

5.0 CONCLUSIONS

Based on the findings of the investigation, the following conclusions are made:

- Historically, the site has been used for agricultural purposes.
- There is no evidence that mineral processing activities or associated mine tailings are located on the study site.
- A review of historical records including aerial photography and council records has found no evidence that infrastructure associated with pesticide use or storage such as yards, dips and storage sheds have been located on the site under investigation.
- A systematic soil sampling program was undertaken across the site to characterise heavy metal concentrations in the surface soils of the site. The analytical results indicate the heavy metals are present at background concentrations, below the NES soil contaminant standards for all landuse scenarios set out in the NES.

In summary, the combined Preliminary and Detailed Site Investigation has identified historical land use activities that may have impacted the soil quality of the site. Based on the results of this Investigation, DCG concludes it is highly unlikely that there is a risk to human health associated with the proposed activities on the site.

6.0 REFERENCES

GNS Science (2016) New Zealand Geology Web Map. Accessed 08/10/2016
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QLDC E Document Viewer. Accessed 08/10/2016 <https://edocs.qldc.govt.nz/>

Appendices

Appendix A:

Davis Consulting Group Contaminated Land Experience



Davis Consulting Group Contaminated Land Experience

Glenn Davis is the director of Davis Consulting Group and has over 15 years post graduate experience working as an Environmental Scientist. Glenn has accumulated a significant volume of work experience in the contaminated land field undertaking preliminary site investigations (PSIs), detailed site investigations (DSIs) and remediation projects in New Zealand, Australia, Asia, the United Kingdom and Ireland. The following provides a summary of Glenn Davis's experience.

Davis Consulting Group (2007 – present): Principal Environmental Scientist – completed multiple preliminary and detailed site investigations in Otago and Southland predominantly for the land development industry. In addition to undertaking investigation and remedial work DCG advises the Southland Regional Council on contaminated land matters including the review of consultant reports and consent applications. Key projects DCG has undertaken include:

- Review of groundwater contamination associated with the former Invercargill gasworks site including the completion of a groundwater investigation and completion of an environmental risk assessment report to support a discharge consent application;
- Completion of site investigations on former landfills in Invercargill to consider the suitability of the sites for commercial/industrial development;
- Management of the removal of an underground fuel tank in Gore and subsequent groundwater investigation; and
- Completion of a number of detailed site investigations in the Te Anau area to consider the suitability of former farm land for residential development.

RPS Australia (2003 – 2006): Supervising Environmental Scientist managing multiple detailed site investigations in the land development industrial and operated as an environmental specialist for Chevron on Barrow Island monitoring and managing a number of large contaminated groundwater plumes.

URS Ireland (2001 – 2003): - Senior Environmental Scientist undertaking multiple PSIs and DSIs on services stations and train station throughout Ireland. Glenn was also involved in the design and operation of a number of large scale remediation projects, predominantly associated with the removal of hydrocarbon contaminated soil and recovery of hydrocarbons impacting groundwater.

ERM Australia (1998 – 2000) – Working as a project level environmental scientist Glenn completed in excess of 30 detailed site investigations and remedial projects on service stations, concrete batching plants, and transport depots.

Appendix B:
ORC supporting information

11 October 2016

Dear Carrie,

Thank you for your enquiry regarding information that the Otago Regional Council may hold regarding potential soil contamination at the properties indicated below:

Address	Legal Description or Valuation Number
Cardrona Valley Road	Various

The Otago Regional Council maintains a database of properties where information is held regarding current or past land-uses that have the potential to contaminated land. Land-uses that have the potential to contaminate land are outlined in the [Ministry for the Environment's Hazardous Activities and Industries List \(HAIL\)](#).

Where investigation has been completed, results have been compared to relevant soil guideline values. 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. You may also wish to examine the property file at the relevant City or District Council to check if there is any evidence that activities occurring on the HAIL have taken place.

I can confirm that:

The above land does not currently appear on the database.

If your enquiry relates to a rural property, please note that many current and past activities undertaken on farms may not be listed on the database, as they can be more difficult to identify. Activities such as use, storage, formulation, and disposal of pesticides, offal pits, landfills, animal dips, and fuel tanks have the potential to contaminated land.

Similarly, the long-term use of lead-based paints on buildings can, in some cases, cases cause soil contamination. The use of lead-based paint is generally not recorded on the database.

Please feel free to contact me if you have any other enquires, or you would like to discuss the matter further.

Regards,



Tracey Diack
Environmental Officer

The enclosed/attached information is derived from the Otago Regional contaminated land register and is being disclosed to you pursuant to the Local Government Official Information and Meetings Act 1987. This information reflects the Otago Regional Council's current understanding of this site, which is based solely on the information obtained by the Council and held on record. It is disclosed only as a copy of those records and is not intended to provide a full, complete or entirely accurate assessment of the site. Accordingly, the Otago Regional Council is not in a position to warrant that the



information is complete or without error and accepts no liability for any inaccuracy in, or omission from, this information. Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

Details Add Basemap Save Share Print Directions Measure Bookmarks Cardrona valley road

Map showing Cardrona Valley Rd and surrounding terrain. The map features a network of roads, water bodies, and green shaded areas. A scale bar in the bottom left indicates 0, 0.2, and 0.4 km. The map is powered by Esri and sourced from the LINZ Data Service.

0 0.2 0.4km

Powered by esri

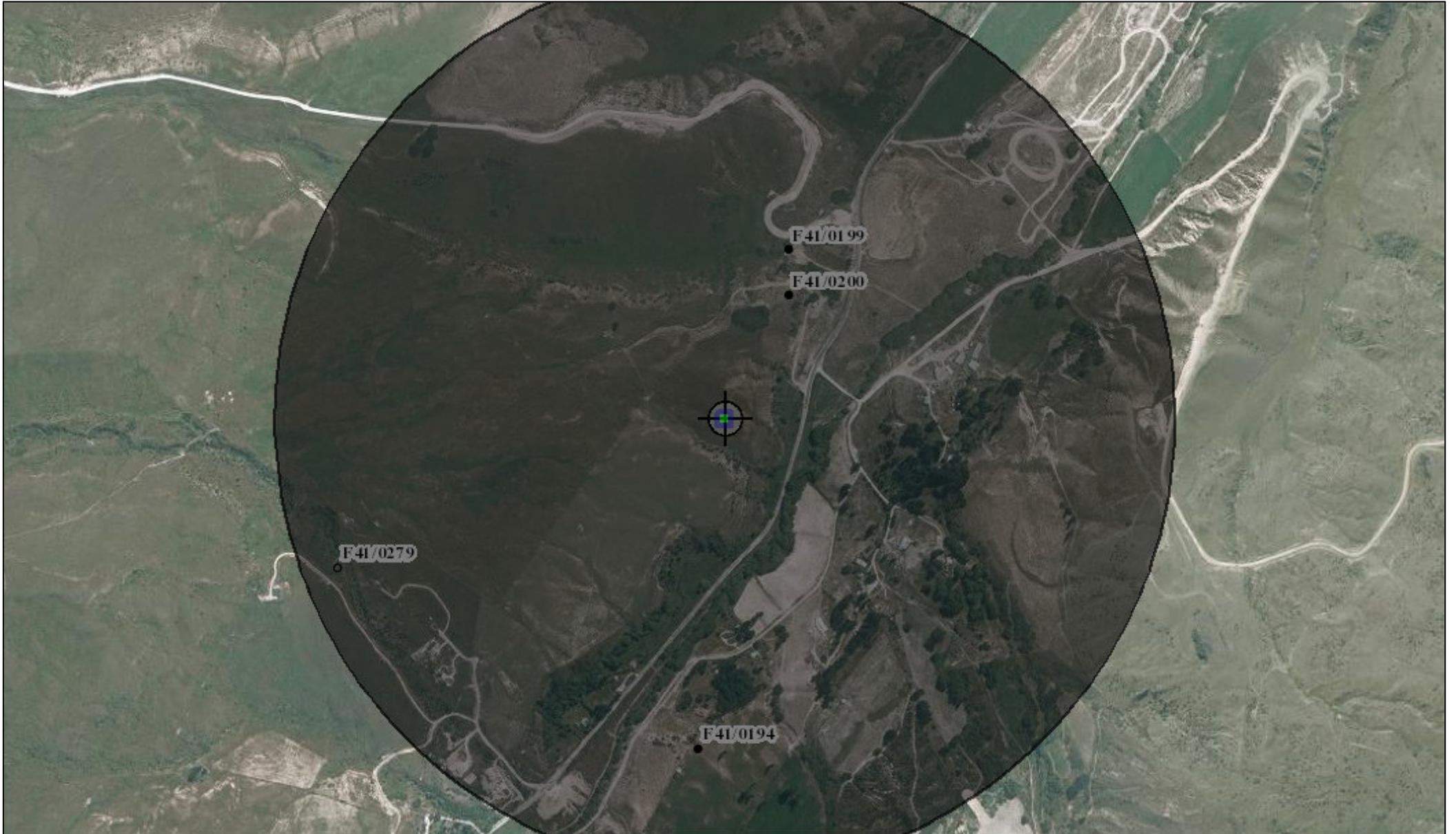
Sourced from the LINZ Data Service and licensed for re-use under the Creative Commons Attribution 3.0...

105%

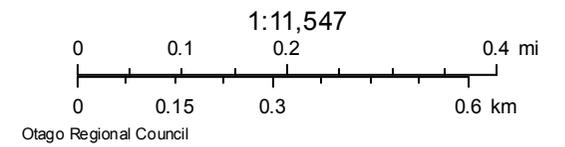
Windows taskbar showing various application icons (Internet Explorer, Office, etc.) and system tray information (Desktop, 2:34 p.m., 11/10/2016).

Desktop 2:34 p.m. 11/10/2016

Cardrona Bore Search



October 12, 2016



Appendix C:

**Laboratory Analysis Report, Summary of Methods and Chain of Custody
Documentation**



ANALYSIS REPORT

Client:	Davis Consulting Group Limited	Lab No:	1662218	SPV1
Contact:	C Pritchard C/- Davis Consulting Group Limited PO Box 2450 Wakatipu Queenstown 9349	Date Received:	11-Oct-2016	
		Date Reported:	14-Oct-2016	
		Quote No:	72204	
		Order No:		
		Client Reference:	16109 MT Cardrona Station Village	
		Submitted By:	Duncan Keenan	

Sample Type: Soil

Sample Name:	Composite of CV01 (0-0.1), CV02 (0-0.1) & CV003 (0-0.1)	Composite of CV04 (0-0.1), CV05 (0-0.1) & CV006 (0-0.1)	Composite of CV07 (0-0.1), CV08 (0-0.1) & CV009 (0-0.1)	Composite of CV10 (0-0.1), CV11 (0-0.1) & CV012 (0-0.1)	Composite of Dup1, Dup2 & Dup3
Lab Number:	1662218.16	1662218.17	1662218.18	1662218.19	1662218.20
Heavy Metals, Screen Level					
Total Recoverable Arsenic mg/kg dry wt	6	7	6	7	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	15	17	16	18	17
Total Recoverable Copper mg/kg dry wt	12	14	12	14	13
Total Recoverable Lead mg/kg dry wt	11.6	13.4	12.4	12.1	12.4
Total Recoverable Nickel mg/kg dry wt	12	15	12	13	14
Total Recoverable Zinc mg/kg dry wt	44	49	49	49	51

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	16-20
Composite Environmental Solid Samples	Individual sample fractions mixed together to form a composite fraction.	-	1-15

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

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

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

Ara Heron BSc (Tech)
Client Services Manager - Environmental





Job Information Summary

Page 1 of 1

Client:	Davis Consulting Group Limited	Lab No:	1662218
Contact:	C Pritchard C/- Davis Consulting Group Limited PO Box 2450 Wakatipu Queenstown 9349	Date Registered:	11-Oct-2016 12:20 pm
		Priority:	High
		Quote No:	72204
		Order No:	
		Client Reference:	16109 MT Cardrona Station Village
		Add. Client Ref:	
		Submitted By:	Duncan Keenan
		Charge To:	Davis Consulting Group Limited
		Target Date:	18-Oct-2016 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	CV01 (0-0.1) 10-Oct-2016 11:00 am	Soil	GSoil300	Composite Environmental Solid Samples
2	CV02 (0-0.1) 10-Oct-2016 11:13 am	Soil	GSoil300	Composite Environmental Solid Samples
3	CV03 (0-0.1) 10-Oct-2016 11:22 am	Soil	GSoil300	Composite Environmental Solid Samples
4	CV04 (0-0.1) 10-Oct-2016 11:36 am	Soil	GSoil300	Composite Environmental Solid Samples
5	CV05 (0-0.1) 10-Oct-2016 11:49 am	Soil	cGSoil	Composite Environmental Solid Samples
6	CV06 (0-0.1) 10-Oct-2016 11:58 am	Soil	GSoil300	Composite Environmental Solid Samples
7	CV07 (0-0.1) 10-Oct-2016 12:10 pm	Soil	GSoil300	Composite Environmental Solid Samples
8	CV08 (0-0.1) 10-Oct-2016 12:18 pm	Soil	GSoil300	Composite Environmental Solid Samples
9	CV09 (0-0.1) 10-Oct-2016 12:27 pm	Soil	GSoil300	Composite Environmental Solid Samples
10	CV10 (0-0.1) 10-Oct-2016 12:33 pm	Soil	GSoil300	Composite Environmental Solid Samples
11	CV11 (0-0.1) 10-Oct-2016 12:41 pm	Soil	GSoil300	Composite Environmental Solid Samples
12	CV12 (0-0.1) 10-Oct-2016 12:48 pm	Soil	GSoil300	Composite Environmental Solid Samples
13	Dup1 10-Oct-2016 12:00 pm	Soil	GSoil300	Composite Environmental Solid Samples
14	Dup2 10-Oct-2016 12:01 pm	Soil	GSoil300	Composite Environmental Solid Samples
15	Dup3 10-Oct-2016 12:03 pm	Soil	GSoil300	Composite Environmental Solid Samples
16	Composite of CV01 (0-0.1), CV02 (0-0.1) & CV003 (0-0.1)	Soil	GSoil300	Heavy Metals, Screen Level
17	Composite of CV04 (0-0.1), CV05 (0-0.1) & CV006 (0-0.1)	Soil	GSoil300	Heavy Metals, Screen Level
18	Composite of CV07 (0-0.1), CV08 (0-0.1) & CV009 (0-0.1)	Soil	GSoil300	Heavy Metals, Screen Level
19	Composite of CV10 (0-0.1), CV11 (0-0.1) & CV012 (0-0.1)	Soil	GSoil300	Heavy Metals, Screen Level
20	Composite of Dup1, Dup2 & Dup3	Soil	GSoil300	Heavy Metals, Screen Level

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	16-20
Composite Environmental Solid Samples	Individual sample fractions mixed together to form a composite fraction.	-	1-15



Chain of Custody

Sheet / of /

Date Collected: 10/10/2016
 Your Address: Davis Consulting Group Ltd.
 Arrow Lane
 Arrowtown 9302
 Phone Number: 03 409 8664
 Project No/Property Name: 16109 MT Cardrona Matrix Village
 Samples Released By (Signature): [Signature]
 Date and Time Released: 10/10/16 3pm

Weather Conditions: FINE
 Samples Filtered and/or Preserved?
 Priority: HIGH
 CoC to be emailed back:
 Email Address: Cavvie @davisconsultinggroup.co.nz
 Who Sampled: Duncan Kawan
 Samples Received By (Signature):
 Date and Time Received:

Laboratory use

Sample ID	Date	Time	Matrix	Analytes		
				Hold Cold		
CV01	10/10/2016	1100	Soil			
CV02		1113			} composite Heavy Metals	
CV03		1122				
CV04		1136				
CV05		1149			} composite Heavy Metals	
CV06		1158				
CV07		1210				
CV08		1218			} composite Heavy Metals	
CV09		1227				
CV10		1233				
CV11		1241			} composite Heavy Metals	
CV12		1248				
DUP1						
DUP2					} composite Heavy Metals	
DUP3						

Temperature On Arrival
15.0 °C
 Temperature was measured on one or more arbitrarily chosen samples in this batch.

Note: Composite in groups of 3.



Received by: Lisa Bailey

Job No: **166 2218**
 Date Recv: 11-Oct-16 06:22

Appendix D:

Soil descriptions



SOIL PROFILE LOGS

PROJECT NUMBER: 16109

FIELD STAFF: Dk & CP

DATE: 11/10/2016

SITE NAME: Mt Cardrona Village Station

METHOD: Spade

WEATHER: Fine

Sample Location	Coordinates		Sample Depth	Sample ID	Soil Lithology
CV01	-44.8703	169.0045	0.1	CV01(0-0.1)	Light brown clayey SILT with organinc grass/root matter, moist.
CV02	-44.8672	169.0077	0.1	CV02(0-0.1)	Dark brown clayey SILT with organinc grass/root matter, moist.
CV03	-44.8687	169.0061	0.1	CV03(0-0.1)	Dark brown clayey SILT with organinc grass/root matter, moist.
CV04	-44.8678	169.0141	0.1	CV04(0-0.1)	Light brown clayey SILT with organinc grass/root matter, moist.
CV05	-44.8723	169.0103	0.1	CV05(0-0.1)	Dark brown clayey SILT with organinc grass/root matter, moist.
CV06	-44.8706	169.0132	0.1	CV06(0-0.1)	Greyish brown clayey SILT with orgainc grass/root matter, moist
CV07	-44.8714	169.0084	0.1	CV07(0-0.1)	Dark brown clayey SILT with organinc grass/root matter, moist.
CV08	-44.8696	169.0114	0.1	CV08(0-0.1)	Light brown clayey SILT with organinc grass/root matter, moist.
CV09	-44.8675	169.0119	0.1	CV09(0-0.1)	Yellowish brown clayey SILT with organic grass/root matter, dry.
CV10	-44.8672	169.0099	0.1	CV10(0-0.1)	Dark brown clayey SILT with organinc grass/root matter, moist. Note: Tightly packed organic matter in top 0 - 0.05 of sample.
CV11	-44.8688	169.0095	0.1	CV11(0-0.1)	Dark brown clayey SILT with organinc grass/root matter, moist.
CV12	-44.8709	169.0063	0.1	CV12(0-0.1)	Dark brown clayey SILT with organinc grass/root matter, moist.
CVO1	-44.8703	169.0045	0.1	DUP1(0-0.1)	Light brown clayey SILT with organinc grass/root matter, moist.
CVO2	-44.8672	169.0077	0.1	DUP2(0-0.1)	Dark brown clayey SILT with organinc grass/root matter, moist.
CVO3	-44.8687	169.0061	0.1	DUP3(0-0.1)	Dark brown clayey SILT with organinc grass/root matter, moist.