APPENDIX H

Davis Consulting Group Preliminary Site Investigation

Peninsula Bay North End Proposed Plan Change, Wanaka Preliminary Site Investigation

For

Peninsula Bay Joint Venture

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Peninsula Bay North End

Proposed Plan Change

Wanaka

Preliminary Site Investigation

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EXECUTIVE SUMMARY

Infinity Investment Group is managing a plan change in behalf of Peninsula Village Limited and Wanaka Bay Limited herein referred to as the Peninsula Bay Joint Venture (PBJV). The plan change application will be submitted to the Queenstown Lakes District Council to rezone Open Space Zoned land to Low Density Residential Zoned land in Peninsula Bay, north of Wanaka. The plan change process and the NES requires the applicant to undertake a number of investigations to determine the suitability of the subject land for its proposed land use under the plan change. One of these investigations includes a review of the soil quality across the site to determine if historical activities have impacted the soil condition such that it may present a risk to human health or the environment.

In order to understand the condition of the site soils, PBJV commissioned Davis Consulting Group (DCG) to undertake a Preliminary Site Investigation (PSI) of the site. This PSI is designed to review the historical activities across the area proposed for re-zoning, identify any hazardous activities that may have occurred and whether there are any risks to human health and the environment as a result of any change in land use resulting from the rezoning of the subject land.

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

- Review of land use history including records held by the Queenstown Lakes District Council and search the Lakes District Museum Archives, Titles and historical photographs;
- Identification of hazardous activities and substances that may have been associated with the land use and consideration of likely impacts to soil quality;
- Completion of a site visit;
- Preparation of a soil sampling and analysis plan based on the findings of the historical activities that occurred on the site;
- Collection of soil samples to characterise the nature of soil quality in the vicinity of the areas of the site where persistent pesticides and hydrocarbons had been used;
- Consideration of the risk to human health based on the historic activities that have occurred on the site, the soil contaminant concentrations detected and the proposed land use of the site; and
- Preparation of a Preliminary Site Investigation report in accordance with the requirements of the Contaminated Land Management Guidelines (CLMG) No.1.

Based on the findings of the PSI, the following conclusions can be made:

- The first use of the land was farming in the early to mid 1900's.
- No agricultural infrastructure such as sheds or yards were observed within or in the immediate vicinity of the zone change boundary in aerial photography from 1956 to present day.
- Surrounding land uses include rural / lifestyle block and residential development.
- The site is subject to the provisions of the NES due to the history of agricultural activities that are associated with the application of persistent pesticides and fertilizers and the storage of hydrocarbons.
- Based on the Contaminated Land Management Guidelines Schedule B, the hazardous substances that may be associated with the former farming operation on the site include a range of organochlorine pesticides and trace metals associated with application of fertilisers.
- Searches of the Otago Regional Council's "Database of Selected Landuses" did not find any records of contaminated sites on the study site.
- No organochlorine pesticides were detected in analysis of soils taken from the site.
- Due to the low intensity of historical farming on the site and absence of organochlorine pesticides found in soil analysis, DCG considers it is unlikely that concentrations of pesticides within the soil would be present at concentrations that will exceed the contaminant standards for a rural residential land use scenario.
- Within the groundworks laydown area, petroleum hydrocarbon fractions concentrations in soil were below limits of detection. BTEX analysed in the soil screening yielded concentrations below limits of detection, except for xylene which was present at concentrations below adopted soil guideline values.
- DCG considers it is unlikely that concentrations of hydrocarbons and BTEX within the soil would be present at concentrations that exceed the soil contaminant standards for a rural residential land use scenario.
- Average arsenic concentrations detected across the site are below the NES soil contaminant standard and are representative of the natural background levels,
- DCG considers the risk to human health from arsenic concentrations in soil are not over and above the risk that is inherent in the NES soil contaminant standards.

In summary, the PSI has identified historical land use activities that may have impacted the soil quality of the site. Based on the results of this Preliminary Site Investigation, DCG concludes it is highly unlikely that there is a risk to human health from the proposed plan change and future subdivision and residential use of the site.

1.0 INTRODUCTION

1.1 Purpose

Infinity Investment Group is managing a plan change in behalf of Peninsula Village Limited and Wanaka Bay Limited herein referred to as the Peninsula Bay Joint Venture (PBJV). The plan change application will be submitted to the Queenstown Lakes District Council to rezone Open Space Zoned land to Low Density Residential Zoned land in Peninsula Bay, north of Wanaka. The plan change process and the NES requires the applicant to undertake a number of investigations to determine the suitability of the subject land for its proposed land use under the plan change. One of these investigations includes a review of the soil quality across the site to determine if historical activities have impacted the soil condition such that it may present a risk to human health or the environment.

In order to understand the condition of the site soils, PBJV commissioned Davis Consulting Group (DCG) to undertake a Preliminary Site Investigation (PSI) of the site. This PSI is designed to review the historical activities across the area proposed for re-zoning, identify any hazardous activities that may have occurred and whether there are any risks to human health and the environment as a result of any change in land use resulting from the rezoning of the subject land. DCGs 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 PSI included the following:

- Review of land use history including records held by the Queenstown Lakes District Council and search the Lakes District Museum Archives, Titles and historical photographs;
- Identification of hazardous activities and substances that may have been associated with the land use and consideration of likely impacts to soil quality;
- Completion of a site visit;
- Preparation of a soil sampling and analysis plan based on the findings of the historical activities that occurred on the site;
- Collection of soil samples to characterise the nature of soil quality in the vicinity of the areas of the site where persistent pesticides and hydrocarbons had been used;
- Consideration of the risk to human health based on the historic activities that have occurred on the site, the soil contaminant concentrations detected and the proposed land use of the site; and

- Preparation of a Preliminary 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 under investigation is located to the north of Wanaka, north of Infinity Drive and the Peninsula Bay housing development (Figure 1) within land zoned Open Space.

The area of the site is approximately 6.8 ha.

Central coordinates for the site are 5608886.2 N 2203511.6 E NZMG.

Figure 1: Site Location Plan

2.2 Site History

Farming activities are observed in aerial imagery dating back to 1956 (see Figures 2 to 4).

No farming infrastructure such as sheds or yards were observed within or in the immediate vicinity of the site in aerial photography from 1956 to present (see Figure 2 to 4).

A powerline is observed in 1976 aerial photograph (see Figure 3). No transformers were observed in aerial images. Powerlines were present in 2005 aerial imagery (see Figure 5) and removed prior to the 2015 site inspection. There was only 1 remaining power pole at the time of assessment. This was located in the eastern perimeter of the site.

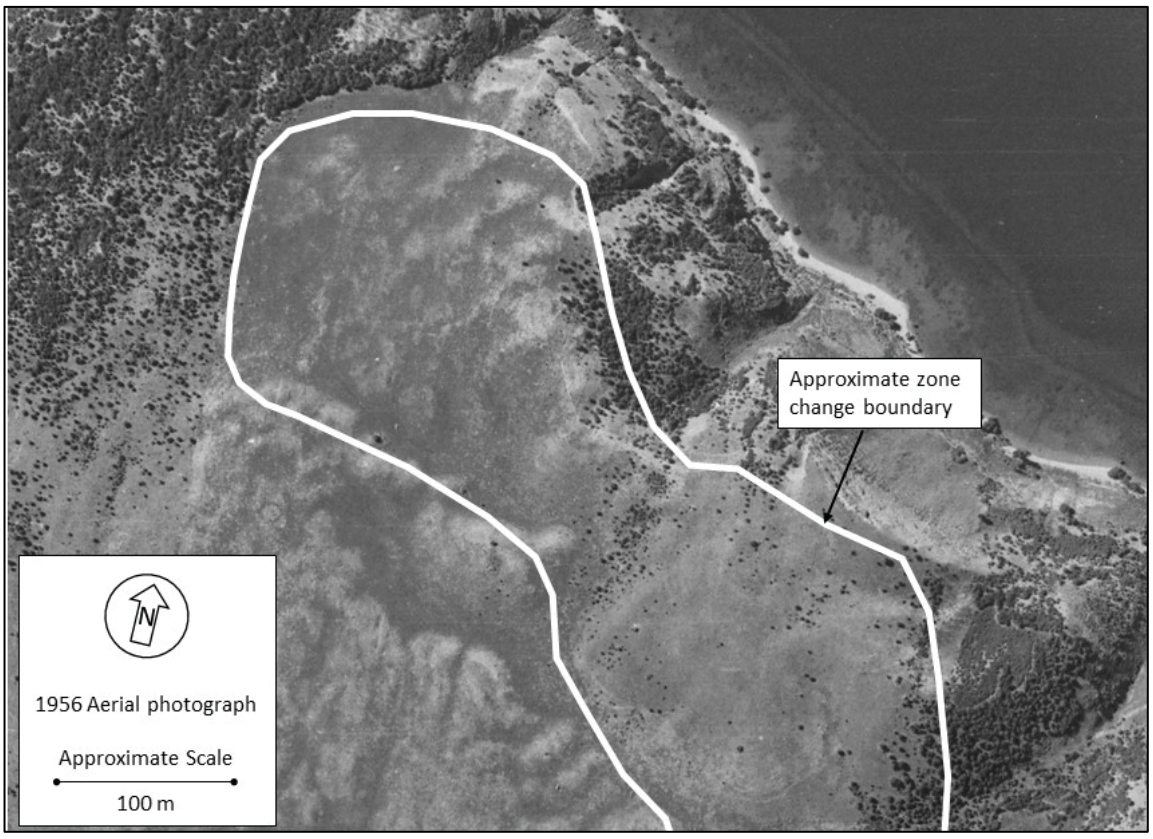

Figure 2: 1956 aerial photograph

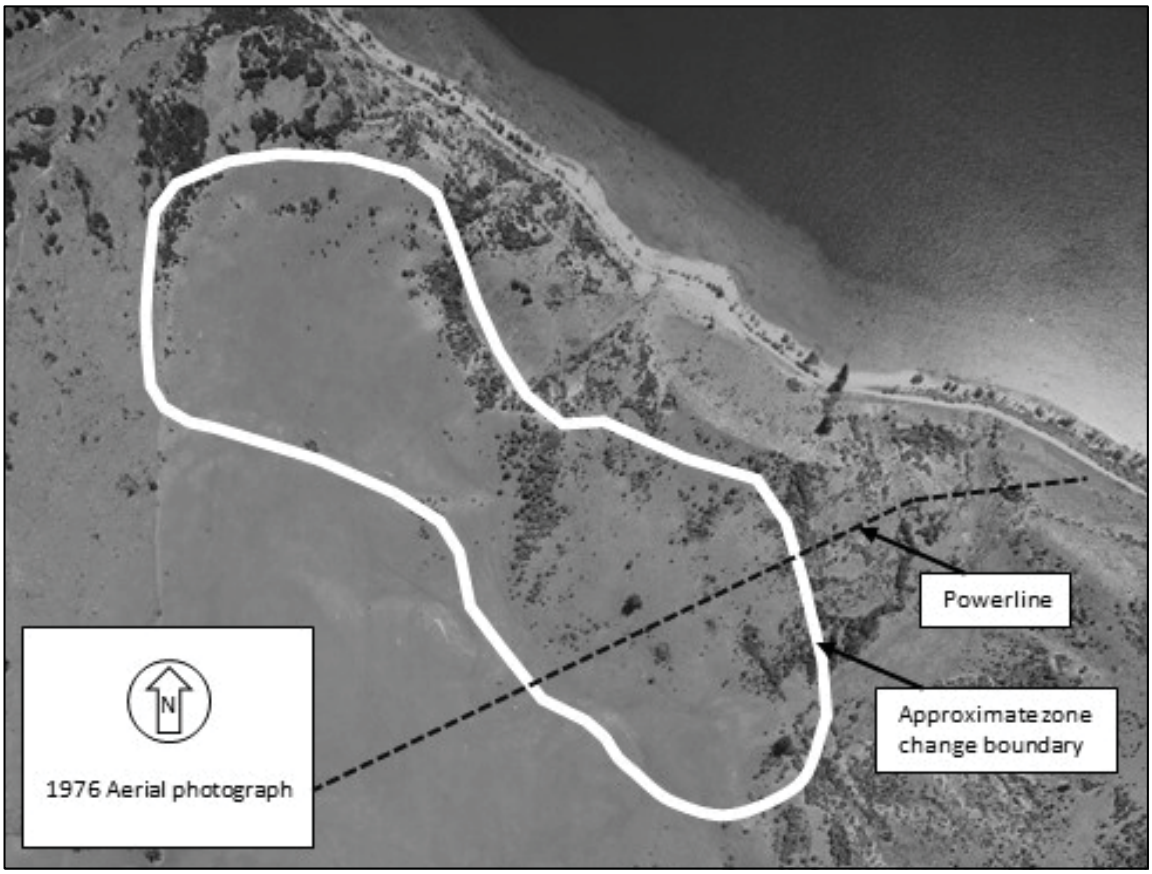

Figure 3: 1976 aerial photograph

Figure 4: 2005 aerial photograph showing approximate zone change boundary

2.3 Site Condition and Surrounding Environment

The site is surrounded by recent residential subdivisions to the west and south, plantation forest to the east and the southern shores of Lake Wanaka to the north (see Figure 1).

At the time of the site visit an earth and groundworks crew were working from a laydown area located in the north western corner of the area under investigation. The laydown area was approximately 300 m^2 and was sheeted with grey gravel/sand regolith. Within this area there was a transportable building, shipping container, portable self-contained toilet, mobile trailer mounted fuel storage, and a transportable rubbish bin (see Figure 5 and Plate 1-2). Several stockpiles of gravel and earth were located on the eastern perimeter of the yard. Water was pooling within a low lying area in-between stockpiles of earth and gravel (see Plate 3). There was no evidence of surface staining from hydrocarbon leaks and no odours observed during the site walk over. Surface soil from sample 11 had a slight hydrocarbon odour.

To the west of the groundworks area there is a wooden fence bordering the Penrith Park residential area (see Figure 5 and Plate 5).

At the time of the site visit, residential subdivisions were under construction south of the study site, with road construction underway and several building foundations in preparation (see Figure 1 and 5 and Plate 2).

To the south east of the study site there is a grassed area, manuka/kanuka shrubland and a pine timber plantation further east beyond Infinity Drive (see Figure 1 and Plate 6).

Other than the groundworks yard, the investigation area was largely undisturbed, with grass covered rolling hills and scattered native shrubs, increasing with density to the south (see Plate 7). Within the north western section of the study area, there were several stockpiles of rock and earth (see Figure 5 and Plates 8-10). There was no sign of contamination within these stockpiles and their most likely source was the groundworks being undertaken south of the site.

Access to the site was limited to the groundworks area in the northwest, and a gravel access track extending northeast of Infinity Drive in the south-eastern portion of the site and a trafficked track up the hill through the south eastern portion of the study area (see Plate 11 and 12).

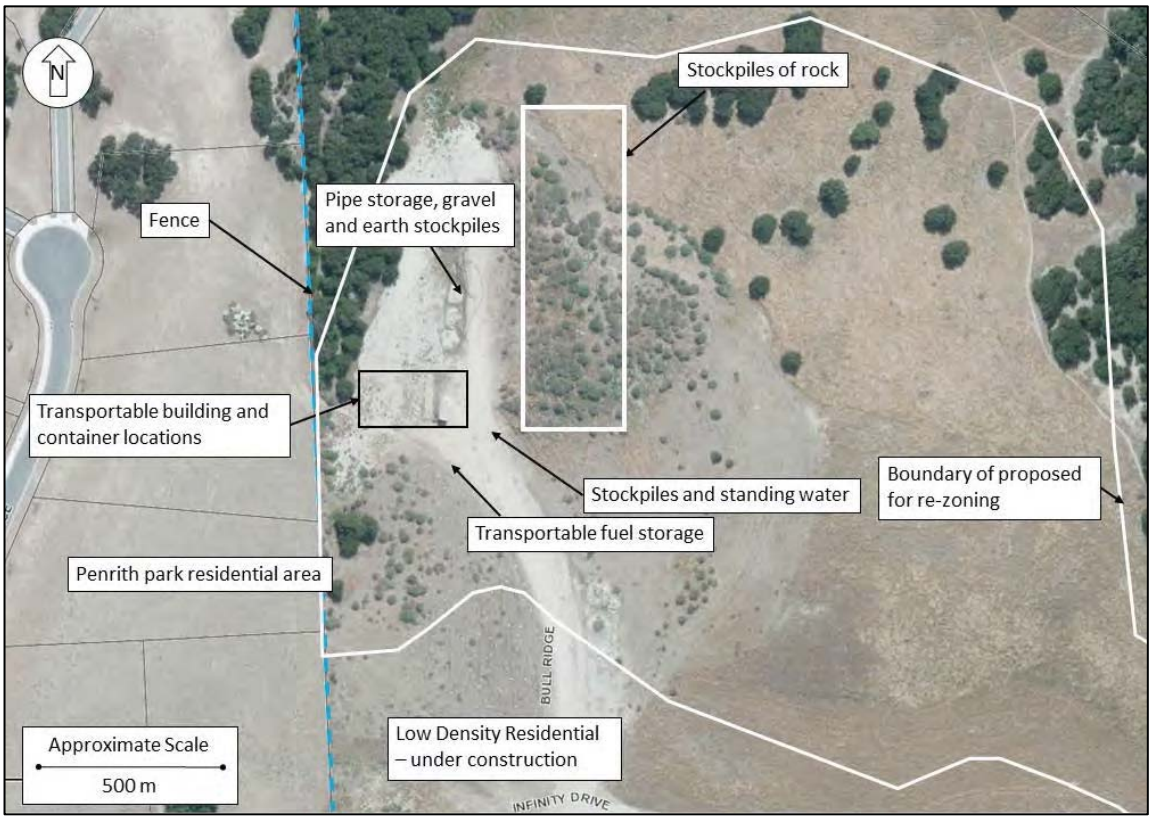

Figure 5: Layout of groundworks laydown area and rock stockpiles

Plate 1: Groundworks yard

Plate 2: Groundworks yard showing fuel storage, general waste bin and subdivision under construction in background

Plate 3: Southern portion of groundworks yard. Stockpiles of gravel and earth. Pooled water from recent rain

Plate 4: Gravel and earth stockpiles east of groundworks yard

Plate 5: Neighbouring property to the north of groundworks yard

Plate 6: Southern portion of proposed zone change area. Access track and timber plantation on right. Shrubland in centre

Plate 7: Typical grassed areas and shrubland within site

Plate 8: Stockpile of rock and soil near WPSS08

Plate 9: Stockpile of soil near WPSS09

Plate 10: Stockpile of soil near WPSS06

Plate 11 Access track in south-eastern portion of proposed re-zoning study area

Plate 12: Gravel track extension of Infinity Drive in south-eastern portion of the proposed re-zoning study area

2.4 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 stated that there are no records held on the Otago Regional Council's "Database of Selected Landuses" for the site regarding on or off-site disposal locations, recorded discharges, or spill loss history. The Mt Iron Timber Mill is located 1 km south east of the site. This is currently listed as 'unknown' contamination on the Otago Regional Council's "Database of Selected Landuses".

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

- Presence of Drums – No drums were recorded during the site visit.
- Wastes – Other than the rubbish bin, no other waste were observed.
- Fill Materials – Several stockpiles of gravel and earth were located on the eastern perimeter of the groundworks yard. Within the north western section of the proposed re-zoning there were several stockpiles of rock and earth. There was no sign of contamination within these stockpiles and their most likely source was the groundworks being undertaken south of the site.
- Odours – No odours were noted other than hydrocarbon odour at soil sample site 11 within the groundworks yard.
- Flood Risk – The flood risk to the site is minimal given its elevation above Lake Wanaka.
- Surface Water Quality – The only surface water observed on site was a small puddle within the groundworks area. This water was turbid due to the frequent trafficking.
- Site boundary condition – The site boundary is fenced in the areas adjoining residential developments.
- Visible Signs of Contamination – No visible signs of contamination were observed.
- Local Sensitive Environments – The nearest sensitive environment is Lake Wanaka approximately 100 m to the north of the proposed re-zoning.

2.5 Contaminants Commonly Associated with the Land use

Based on the Contaminated Land Management Guidelines Schedule B, the 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 use. The hazardous substances that may be associated with fuel storage include hydrocarbons, polycyclic aromatic hydrocarbons (PAH's), solvents and metals contained in waste oil.

2.6 Geology and Hydrogeology

The subject site is upslope from the shores of Lake Wanaka between Beacon Point to the west and the Clutha River to the east. The site is elevated between 40 and 60 m above the lake water level and is undulating with well to moderately drained, melanic soils (GrowOTAGO, 2015). Soil descriptions for the site can be found in Appendix D.

The geology of the property is within Pleistocene outwash undifferentiated till and associated outwash gravel (Turnbull 2000).

The only geological hazard within the area is a low risk of liquefaction (QLDS GIS, 2015).

The site is located in the northern portion of the Wanaka Basin Cardrona Gravel Aquifer (ORC, 2014). Groundwater bores within a one kilometre radius of the site (held by the Otago Regional Council) are shown on a plan provided in Appendix C. Two observation bores are located 200 m east of the site on the shore of Lake Wanaka. An irrigation bore is located 200 m south west of the investigation site. Three domestic bores are located approximately 800 m to the south west. This site investigation did not include a groundwater assessment.

3.0 SAMPLING AND ANALYSIS PLAN

3.1 Data Quality Objectives

The data quality objectives (DQOs) of the PSI were to:

- Characterise the presence and concentration of contamination associated with the historical farming activities and potential storage of hydrocarbons; and
- Determine the risk of any soil contamination encountered onsite to human health, based on the proposed residential subdivision.

The sampling undertaken was designed to support the PSI rather than provide the level of detail that may be required for a detailed site investigation. Laboratory analysis of the soils was considered appropriate given the proposed sensitive land use of the site, the possible accumulation of pesticides and heavy metals that can be associated with agricultural activity and DCGs experience regarding naturally elevated arsenic levels in the Wanaka area.

3.2 Sampling and Analysis Plan

The sampling and analysis plan was designed to address the specific objectives, namely characterise the presence and concentration of any contamination associated with historical agricultural activities and storage of hydrocarbons. A combined approach of judgemental and systematic sampling was adopted.

The soil sample locations and analysis are provided in Figure 6 and summarised in Table 1 below. The laboratory certificates are provided in Appendix E. Samples were analysed for heavy metals, organochlorine pesticides and hydrocarbons.

The investigation took place on the 22nd May 2015. A total of 18 surface soil samples were collected on site from 0 – 10 cm depth for assessment of pesticides and arsenic and 3 soil samples from 0 to 0.05 cm and 1 from 0.1 to 0.15 cm depth for assessment of hydrocarbons and arsenic.

3.3 Sampling rationale

Arsenic and pesticides were assessed throughout the study area to investigate the impact of historical agricultural activities. The relevant sample sites 1 to 9 and 13 to 18 are marked in Figure 6. Surface sampling was considered appropriate for the assessment of pesticides for two

reasons. First, pesticides and heavy metals generally bind strongly to soils, generally remaining in the surface profile. Second, people living on the site will predominantly be exposed to surface soils.

Hydrocarbon contamination was investigated within the groundworks laydown after hydrocarbon storage activities were observed in the area during the site inspection. The relevant sample sites 10 to 12 are marked in Figure 6. Surface sampling was considered appropriate for the assessment of hydrocarbons for two reasons. First, contamination is most likely limited to small drips and spills on surface. Second, people living on the site will predominantly be exposed to surface soils.

Figure 6: Soil sample location plan

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 Hill 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 chilly bin to reduce the potential for volatilisation should volatile contaminants be present.

Soil logs are included in Appendix D.

3.5 Analytical Parameters

The laboratory analytical suite determined for the site investigation is in recognition of our understanding of the current and historical use of the subject site. DCG understands the site has had a history of pesticide use associated with agricultural activities. Based on these activities the following substances were included in the analytical suite:

- Organochlorine pesticides (including 4,4-DDE, 2,4-DDT and Dieldrin);
- Arsenic;
- Total Petroleum Hydrocarbons in Soil;
- BTEX in Soil.

Laboratory methods utilised for the analysis are provided in the laboratory report (see Appendix E).

3.6 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;

- The threads on the sampling jars were cleaned to avoid Volatile Organic Compound (VOC) loss;
- All samples were stored in a chilly bin while in the field.

All soil samples were couriered on ice to Hill Laboratories. Hill Laboratories is IANZ accredited for the analysis of heavy metals and pesticides. Hill Laboratories conduct internal QA/QC in accordance with IANZ requirements.

3.7 Soil Guideline Values

DCG have applied soil guideline values (SGVs) which are consistent with the principles of the Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2003b). According to the hierarchy, SGVs for residential landuse have been taken from either the NES Soil Contaminant Standards (MfE, 2012) or Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater (National Environmental Protection Measure (Assessment of Site Contamination) NEPC, 2013).

In addition to the soil contaminant standards provided in the NES, soil guideline values for BTEX and TPH were taken from Tier 1 soil acceptance criteria for residential use defined within the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999).

3.8 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 was checked for analytical and typographical errors.

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

4.0 INVESTIGATION RESULTS

4.1 Analytical Results

The soil sample locations and analysis are provided in Figure 6 and summarised in Table 1 below. The laboratory certificates are provided in Appendix E.

Table 1: Soil Sample Summary

Samples	Sample Depth (m)	Composite	Analysis
WPSS01 (0-0.1)	0 - 0.1	Composite 1	Organochlorine pesticides and arsenic
WPSS02 (0-0.1)	0 - 0.1		
WPSS03 (0-0.1)	0 - 0.1		
WPSS01B (0-0.1)	0 - 0.1	Composite 1 duplicate	Organochlorine pesticides and heavy metals
WPSS02B (0-0.1)	0 - 0.1		
WPSS03B (0-0.1)	0 - 0.1		
WPSS04 (0-0.1)	0 - 0.1	Composite 2	Organochlorine pesticides and arsenic
WPSS05 (0-0.1)	0 - 0.1		
WPSS06 (0-0.1)	0 - 0.1		
WPSS07 (0-0.1)	0 - 0.1	Composite 3	Organochlorine pesticides and arsenic
WPSS08 (0-0.1)	0 - 0.1		
WPSS09 (0-0.1)	0 - 0.1		
WPSS010 (0-0.1)	0 - 0.05		TPH + BTEX profile and heavy metals
WPSS011 (0-0.05)	0 - 0.05		TPH + BTEX profile and heavy metals
WPSS011 (0.1-0.15)	0.1-0.15		Sample held
WPSS012 (0-0.1)	0 - 0.1		TPH + BTEX profile and heavy metals
WPSS013 (0-0.1)	0 - 0.1	Composite 4	Arsenic
WPSS014 (0-0.1)	0 - 0.1		
WPSS015 (0-0.1)	0 - 0.1		
WPSS016 (0-0.1)	0 - 0.1	Composite 5	Arsenic
WPSS017 (0-0.1)	0 - 0.1		
WPSS018 (0-0.1)	0 - 0.1		

BTEX in soil: *Benzene, Toluene, Ethylbenzene, m&p-Xylene, o-Xylene*
TPH in soil: *C7 – C9, C10 – C14, C15 – C36, Total Hydrocarbons (C7 – C36)*
Organochlorine Pesticides Screening in Soil: *Aldrin, alpha-BHC, beta-BHC, delta-BHC, gamma-BHC (Lindane), cis-Chlordane, trans-Chlordane, Total Chlordane [(cis+trans)*100/42], 2,4' DDD, 4,4'-DDD, 2,4'-DDE, 4,4"DDE, 2,4'-DDT, 4,4'-DDT, Dieldrin, Endosulfan I, Endosulfan II, Endosulfan sulphate, Endrin, Endrin aldehyde, Endrin ketone, Heltachlor, Heptachlor epoxide, Hexachlorbenzene, Methoxychlor*

4.1.1 Organochlorine Pesticides

All pesticides analysed in the organochlorine pesticides soil screening yielded concentrations below limits of detection.

4.1.2 Arsenic

Arsenic concentrations from the composited samples ranged from 11 to 18 mg/kg. Composite arsenic results are listed below:

- WP01 – 03 composite 16 mg/kg
- WP04 – 06 composite 18 mg/kg
- WP07 – 09 composite 16 mg/kg
- WP13 – 15 composite 11 mg/kg
- WP16 – 18 composite 15 mg/kg

Arsenic concentration was greater than the rural residential SGV of 17 mg/kg in only one composite sample, WP04 – 06, located in the centre west of the proposed subdivision (Figure 6). The average arsenic concentration is 15 mg/kg. In DCGs experience, all the results represent background arsenic concentrations. In summary the arsenic results show arsenic levels are generally slightly below the NES soil contaminant standard.

4.1.3 Hydrocarbons

Petroleum hydrocarbon fractions concentrations in soil were below limits of detection in all soils analysed.

BTEX analysed in the soil screening were below limits of detection, except for xylene in the surface sample from WPSS11. Xylene was 0.2mg/kg (m&p-Xylene) and 0.1mg/kg (o-Xylene). These concentrations are well below the adopted soil guideline value (59 mg/kg).

4.1.4 Laboratory Procedures

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

5.0 CONCEPTUAL SITE MODEL

5.1 Sources of Potential Contamination

Based on our review of the current and historical activities that have occurred within the site the potential hazardous substances that may be present include;

- a range of heavy metals and pesticides associated with the potential broad acre application of persistent pesticides and fertilisers, and
- hydrocarbons associated with fuel storage within the groundworks yard.

5.2 Risks to Human Health

The risk to human health from exposure to contaminants depends on the contaminant toxicity, concentration and the length of time and type of the exposure. To account for the range of exposure scenarios, the NES soil contaminant standards have been derived for five standard landuse scenarios. Based on the proposed zone change, DCG understands the landuse of the site will be consistent with a rural/lifestyle landuse scenario.

5.2.1 Persistent Pesticides and Heavy Metals

Due to the low intensity of historical farming on the site and absence of persistent pesticides found in soil analysis, DCG considers it is unlikely that concentrations of contaminants within the soil would be present at concentrations that will exceed the contaminant standards for a rural residential land use scenario.

The arsenic concentrations detected in the soils collected from the site are representative of background concentrations. The average concentration of the five samples analysed was 15 mg/kg and is below the NES soil contaminant standard for the rural residential landuse scenario. One sample slightly exceeded the guideline. This result is highly unlikely to represent a hotspot, and is instead more likely to be due to natural variation of arsenic concentration in soils.

DCG considers the risk to human health from arsenic concentrations in soil across the site are not over and above the risk that is inherent in the NES soil contaminant standard.

5.2.2 Hydrocarbons

Hydrocarbon contamination associated with minor spills over the groundworks yard are highly unlikely to be more than localised contamination associated with small drips and spills. If a significant loss had occurred the district council or regional councils should have been informed or staining of the surface soils would have been encountered during the site visit. Neither council holds any records associated with any fuel spills on the sites.

Total Petroleum Hydrocarbon concentrations in soil were below limits of detection. BTEX analysed in the soil screening yielded concentrations below limits of detection, except for xylene which was present at concentrations well below adopted soil guideline values.

In conclusion, DCG considers it is unlikely that concentrations of hydrocarbon associated contaminants within the soil would be present at concentrations that will exceed the Tier 1 soil acceptance criteria for residential use provided in the Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (MfE, 1999).

5.3 Other NES Matters

The risks to human health from contaminated soils are considered low. However there are other risks associated with the development of the site that need to be considered, specifically any offsite disposal that may be required. Section 5.2.1 highlights the slightly elevated background concentrations of arsenic in soil. As discussed, the concentrations are highly unlikely to be a risk to human health based on the proposed landuse however the Class B landfill acceptance criteria are often much lower than the NES soil contaminant standards. For example, the Class B landfill acceptance criteria for arsenic is 10 mg/kg compared to the NES soil contaminant standard for rural residential activity of 17 mg/kg. Testing of the soil would be required if offsite disposal of the soil is required and disposal off site may be limited to Class A landfills, dependant on leachate analysis.

6.0 SUMMARY AND RECOMMENDATIONS

Based on the findings of the PSI, the following conclusions can be made:

- The first use of the land was farming in the early to mid 1900's.
- No agricultural infrastructure such as sheds or yards were observed within or in the immediate vicinity of the zone change boundary in aerial photography from 1956 to present day.
- Surrounding land uses include rural / lifestyle block and residential development.
- The site is subject to the provisions of the NES due to the history of agricultural activities that are associated with the application of persistent pesticides and fertilizers and the storage of hydrocarbons.
- Based on the Contaminated Land Management Guidelines Schedule B, the hazardous substances that may be associated with the former farming operation on the site include a range of organochlorine pesticides and trace metals associated with application of fertilisers.
- Searches of the Otago Regional Council's "Database of Selected Landuses" did not find any records of contaminated sites on the study site.
- No organochlorine pesticides were detected in analysis of soils taken from the site.
- Due to the low intensity of historical farming on the site and absence of organochlorine pesticides found in soil analysis, DCG considers it is unlikely that concentrations of pesticides within the soil would be present at concentrations that will exceed the contaminant standards for a rural residential land use scenario.
- Within the groundworks laydown area, petroleum hydrocarbon fractions concentrations in soil were below limits of detection. BTEX analysed in the soil screening yielded concentrations below limits of detection, except for xylene which was present at concentrations below adopted soil guideline values.
- DCG considers it is unlikely that concentrations of hydrocarbons and BTEX within the soil would be present at concentrations that exceed the soil contaminant standards for a rural residential land use scenario.
- Average arsenic concentrations detected across the site are below the NES soil contaminant standard and are representative of the natural background levels,
- DCG considers the risk to human health from arsenic concentrations in soil are not over and above the risk that is inherent in the NES soil contaminant standards.

In summary, the PSI has identified historical land use activities that may have impacted the soil quality of the site. Based on the results of this Preliminary Site Investigation, DCG concludes it is

highly unlikely that there is a risk to human health from the proposed plan change and future subdivision and residential use of the site.

7.0 REFERENCES

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Appendices

Appendix A

Davis Consulting Group Contaminated Land Experience

Appendix A

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. DCG also provides contaminated land advice to district and regional councils.

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 or 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

Historical Certificates of Title

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Historical Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**685724**
Land Registration District	**Otago**
Date Issued	27 January 2015

Prior References
683554

Estate	Fee Simple
Area	17.9589 hectares more or less
Legal Description	Lot 919 Deposited Plan 479637

Original Proprietors
Peninsula Village Limited as to a 1/2 share
Wanaka Bay Limited as to a 1/2 share

Interests

Subject to Section 59 Land Act 1948

7124098.2 Mortgage to Bank of New Zealand - 23.11.2006 at 11:39 am

Subject to a right (in gross) to convey electricity over part marked C and E on DP 479637 in favour of Aurora Energy Limited created by Easement Instrument 9585989.6 - 23.1.2014 at 4:27 pm

The easements created by Easement Instrument 9585989.6 are subject to Section 243 (a) Resource Management Act 1991

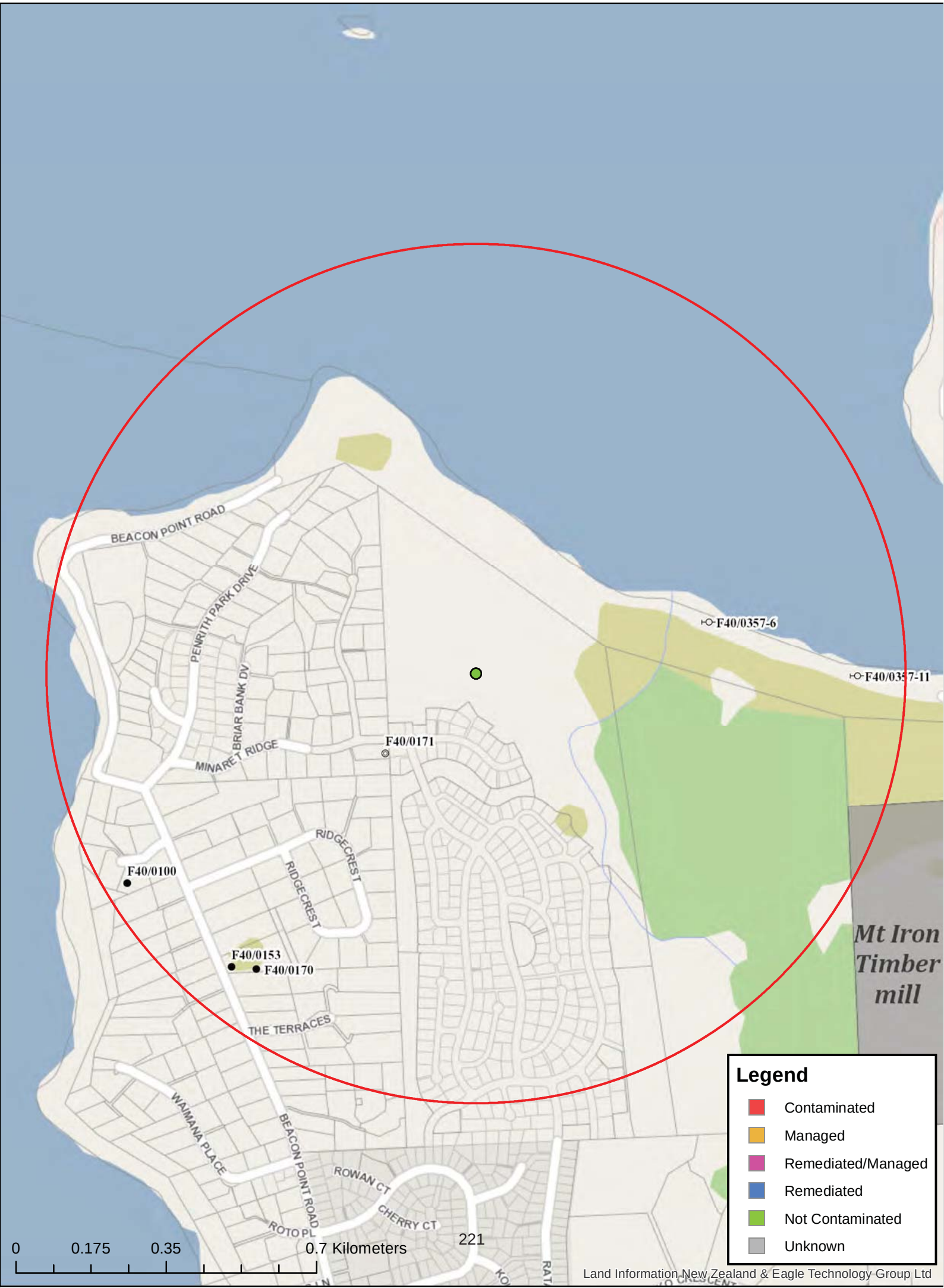
Subject to a right (in gross) to drain sewage and water over part marked C and D on DP 479637 in favour of Queenstown Lakes District Council created by Easement Instrument 9859288.5 - 26.11.2014 at 12:19 pm

The easements created by Easement Instrument 9859288.5 are subject to Section 243 (a) Resource Management Act 1991

Appendix C

Supporting Maps

Land-use and Site Contamination Request - Lot 916 DP 454163



Appendix D

Soil Logs

SOIL PROFILE LOGS

PROJECT NUMBER: 15031 FIELD STAFF: CP DATE: 22/05/2015
SITE NAME: Wanaka Peninsula PSI METHOD: Spade WEATHER: Fine

Sample Location	Coordinates		Sample Depth	Sample ID	Soil Lithology
1	1293577	5047266	0 - 0.1	WPSS01 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15
2			0 - 0.1	WPSS01B (0-0.1)	Duplicate
3	1293535	5047294	0 - 0.1	WPSS02 (0-0.1)	Moist. Brown sandy SILT. Some gravel (under 10%) Grass roots to 0.15
4			0 - 0.1	WPSS02B (0-0.1)	Duplicate
5	1293494	5047339	0 - 0.1	WPSS03 (0-0.1)	Moist. Brown sandy SILT. Some cobbles (under 10%) Grass roots to 0.15
6			0 - 0.1	WPSS03B (0-0.1)	Duplicate
7	1293434	5047435	0 - 0.1	WPSS04 (0-0.1)	Moist. Brown sandy SILT. Some cobbles (under 10%) Grass roots to 0.15
8	1293448	5047395	0 - 0.1	WPSS05 (0-0.1)	Moist. Brown sandy SILT. Thick grass roots to 0.15
9	1293447	5047347	0 - 0.1	WPSS06 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15. Some gravels noted on surface.
10	1293414	5047357	0 - 0.1	WPSS07 (0-0.1)	Moist. Brown sandy SILT. Some cobbles (under 10%) Grass roots to 0.15
11	1293396	5047399	0 - 0.1	WPSS08 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15. 4WD traffic has moved over the area
12	1293387	5047429	0 - 0.1	WPSS09 (0-0.1)	Moist. Brown sandy SILT. Thick grass roots to 0.15
13	1293336	5047349	0 - 0.1	WPSS10 (0-0.1)	Moist. Brown sandy SILT. Some gravel (under 20%) . Compact
14	1293352	5047343	0 - 0.05	WPSS11 (0-0.05)	Moist. Brown sandy SILT. Some gravel (under 30%) . Compact. Odor of hydrocarbons
15			0.1 - 0.15	WPSS11 (0.1-0.15)	Moist. Brown sandy SILT. Some gravel (under 30%) . No change with depth. No odor.
16	1293338	5047364	0 - 0.1	WPSS12 (0-0.1)	Moist. Brown sandy SILT. Some gravel (under 20%). Earth had been translocated. Very loose.
17	1293775	5047037	0 - 0.1	WPSS13 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15. On a track.
18	1293774	5047093	0 - 0.1	WPSS14 (0-0.1)	Moist. Brown sandy SILT. Some grass roots to 0.15. On a track.
19	1293778	5047135	0 - 0.1	WPSS15 (0-0.1)	Moist. Brown sandy SILT. Grass roots to 0.15. On a track.
20	1293685	5047177	0 - 0.1	WPSS16 (0-0.1)	Moist. Brown sandy SILT. Some cobbles (under 10%) Grass roots to 0.15
21	1293718	5047199	0 - 0.1	WPSS17 (0-0.1)	Moist. Brown sandy SILT. Groundcover roots to 0.15.
22	1293755	5047245	0 - 0.1	WPSS18 (0-0.1)	Moist. Brown sandy SILT. Thick grass roots to 0.15.

Appendix E

Laboratory analytical certificate and results, and chain of custody documentation.

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Davis Consulting Group Limited	**Lab No:**	1429944	SPv1
Contact:	C Pritchard	**Date Registered:**	23-May-2015	
	C/- Davis Consulting Group Limited	**Date Reported:**	08-Jun-2015	
	PO Box 2450	**Quote No:**	68892	
	Wakatipu	**Order No:**		
	QUEENSTOWN 9349	**Client Reference:**	15031	
		Submitted By:	C Pritchard	

Sample Type: Soil

Sample Name:		WPSS 10 (0-0.05 22-May-2015 1:50 pm	WPSS 11 (0-0.05) 22-May-2015 1:58 pm	WPSS 12 (0-0.1) 22-May-2015 2:20 pm	Composite of WPSS 01 (0-0.1), WPSS 02 (0-0.1) & WPSS 03 (0-0.1)	Composite of WPSS 04 (0-0.1), WPSS 05 (0-0.1) & WPSS 06 (0-0.1)
Lab Number:		1429944.13	1429944.14	1429944.16	1429944.23	1429944.25
Individual Tests						
Dry Matter	g/100g as rcvd	90	92	90	-	-
Total Recoverable Arsenic	mg/kg dry wt	-	-	-	16	18
BTEX in Soil by Headspace GC-MS						
Benzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Toluene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
Ethylbenzene	mg/kg dry wt	< 0.05	< 0.05	< 0.05	-	-
m&p-Xylene	mg/kg dry wt	< 0.10	0.20	< 0.10	-	-
o-Xylene	mg/kg dry wt	< 0.05	0.10	< 0.05	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	-	-	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	-	-	-	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	-	-	-	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	-	-	-	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	-	-	-	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	-	-	-	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	-	-	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	-	-	-	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	-	-	-	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	-	-	-	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	-	-	-	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	-	-	-	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endrin	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	-	-	-	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	-	-	-	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		WPSS 10 (0-0.05 22-May-2015 1:50 pm	WPSS 11 (0-0.05) 22-May-2015 1:58 pm	WPSS 12 (0-0.1) 22-May-2015 2:20 pm	Composite of WPSS 01 (0-0.1), WPSS 02 (0-0.1) & WPSS 03 (0-0.1)	Composite of WPSS 04 (0-0.1), WPSS 05 (0-0.1) & WPSS 06 (0-0.1)
Lab Number:		1429944.13	1429944.14	1429944.16	1429944.23	1429944.25
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	< 20	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	< 40	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	< 70	-	-

Sample Name:		Composite of WPSS 07 (0-0.1), WPSS 08 (0-0.1) & WPSS 09 (0-0.1)	Composite of WPSS 13 (0-0.1), WPSS 14 (0-0.1) & WPSS 15 (0-0.1)	Composite of WPSS 16 (0-0.1), WPSS 17 (0-0.1) & WPSS 18 (0-0.1)		
Lab Number:		1429944.26	1429944.27	1429944.28		
Individual Tests						
Total Recoverable Arsenic	mg/kg dry wt	16	11	15	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	-	-	-
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	-	-	-
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	-	-	-
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	-	-	-

SUMMARY OF METHODS

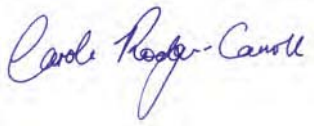
The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix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

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	23, 25-28
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	13-14, 16
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.04 mg/kg dry wt	23, 25-27

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	13-14, 16
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	13-14, 16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	23, 25-28
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-12, 17-22
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	23, 25-28

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.



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

QUOTE No. 68892. PAGE 1 of 2

Davis Consulting Group Limited
Arrow Lane
Arrowtown
Phone: 03 409 8664

DAVIS consulting group

Chain of Custody

Sheet of

Laboratory use

Date Collected: 22ND MAY 2015

Sampling Conditions *(brief description of weather conditions/flow rates etc)*: FINE WEATHER.

Your Address: Davis Consulting Group Ltd.
Arrow Lane
Arrowtown 9302

Samples Filtered and/or Preserved?

Priority:

CoC to be emailed back: carrie@daviesconsultinggroup.co.nz

Phone Number: 03 409 8664

Email Address:

Project No/Property Name: 15031

Who Sampled: Carrie Pritchard

Samples Released By (Signature):
Date and Time Released:

Samples Received By (Signature):
Date and Time Received:

Organochlorine pesticides in soil.

Sample ID	Date	Time	Matrix	Analytes						
				TPH/BTEX	PAH	Metals[1]	pH	OCP		
WPSS01 (0-0.1)		11.26	Soil			✓	✓	✓	composite (1)	
WPSS01B (0-0.1)		11.28	Soil			✓	✓	✓	composite (1B)	
WPSS02 (0-0.1)		11.40	Soil			✓	✓	✓	composite (1)	
WPSS02B (0-0.1)		11.42	Soil			✓	✓	✓	composite (1B)	
WPSS03 (0-0.1)	22.5.15.	11.55	Soil			✓	✓	✓	composite (1)	
WPSS03B (0-0.1)		11.57	Soil			✓	✓	✓	composite (1B)	
WPSS04 (0-0.1)		12.46	Soil			✓	✓	✓		
WPSS05 (0-0.1)		12.55	Soil			✓	✓	✓	composite (2)	
WPSS06 (0-0.1)		13.01	Soil			✓	✓	✓		
WPSS07 (0-0.1)		13.10	Soil			✓	✓	✓		
WPSS08 (0-0.1)		13.26	Soil			✓	✓	✓	composite (3)	
WPSS09 (0-0.1)		13.30	Soil			✓	✓	✓		

Note:

1 Metals Analysis to include Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Lead and Zinc

Temperature On Arrival

9.1 °C

Temperature was measured on one or more arbitrarily chosen samples in this batch.

3114299447

Job No: 142 9944

Date Recv: 23-May-15 07:19

Received by: David Nicholls

Page 2 of 2

QUOTE No.: 68892

Davis Consulting Group Limited
Arrow Lane
Arrowtown
Phone: 03 409 8664

DAVIS consulting group

Chain of Custody

Sheet of

Laboratory use

Date Collected: 22nd MAY 2015

Sampling Conditions *(brief description of weather conditions/flow rates etc)*

Your Address: Davis Consulting Group Ltd.
Arrow Lane
Arrowtown 9302

Samples Filtered and/or Preserved?

Priority:

CoC to be emailed back: As on Page 1

Phone Number: 03 409 8664

Email Address:

Project No/Property Name: 15031

Who Sampled: Carrie Pritchard

Samples Released By (Signature):
Date and Time Released:

Samples Received By (Signature):
Date and Time Received:

Sample ID	Date	Time	Matrix	Analytes						
				TPH/BTEX	PAH	Metals[1]	pH	OCP		
WPSS10 (0-0.05)		1350	Soil	✓						
WPSS11 (0-0.05)		1355	Soil	✓						
WPSS11 (0.1-0.15)		1405	Soil	✓						
WPSS12 (0-0.1)		1420	Soil	✓						
WPSS13 (0-0.1)		1440	Soil			✓	✓	✓		
WPSS14 (0-0.1)		1450	Soil			✓	✓	✓	composite	4
WPSS15 (0-0.1)		1457	Soil			✓	✓	✓		
WPSS16 (0-0.1)		1518	Soil					✓		
WPSS17 (0-0.1)		1525	Soil					✓	composite	5
WPSS18 (0-0.1)		1537	Soil					✓		
			Soil							
			Soil							

Note:

1 Metals Analysis to include Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Lead and Zinc

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

Job Information Summary

Client: Davis Consulting Group Limited
Contact: C Pritchard
C/- Davis Consulting Group Limited
PO Box 2450
Wakatipu
QUEENSTOWN 9349

Lab No: 1429944
Date Registered: 23-May-2015 12:38 pm
Priority: High
Quote No: 68892
Order No:
Client Reference: 15031
Add. Client Ref:
Submitted By: C Pritchard
Charge To: Davis Consulting Group Limited
Target Date: 03-Jun-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	WPSS 01 (0-0.1) 22-May-2015 11:26 am	Soil	GSoil300	Composite Environmental Solid Samples
2	WPSS 01B (0-0.1) 22-May-2015 11:28 am	Soil	GSoil300	Composite Environmental Solid Samples
3	WPSS 02 (0-0.1) 22-May-2015 11:40 am	Soil	GSoil300	Composite Environmental Solid Samples
4	WPSS 02B (0-0.1) 22-May-2015 11:42 am	Soil	GSoil300	Composite Environmental Solid Samples
5	WPSS 03 (0-0.1) 22-May-2015 11:55 am	Soil	GSoil300	Composite Environmental Solid Samples
6	WPSS 03B (0-0.1) 22-May-2015 11:57 am	Soil	GSoil300	Composite Environmental Solid Samples
7	WPSS 04 (0-0.1) 22-May-2015 12:46 pm	Soil	GSoil300	Composite Environmental Solid Samples
8	WPSS 05 (0-0.1) 22-May-2015 12:55 pm	Soil	GSoil300	Composite Environmental Solid Samples
9	WPSS 06 (0-0.1) 22-May-2015 1:01 pm	Soil	GSoil300	Composite Environmental Solid Samples
10	WPSS 07 (0-0.1) 22-May-2015 1:10 pm	Soil	GSoil300	Composite Environmental Solid Samples
11	WPSS 08 (0-0.1) 22-May-2015 1:26 pm	Soil	GSoil300	Composite Environmental Solid Samples
12	WPSS 09 (0-0.1) 22-May-2015 1:30 pm	Soil	GSoil300	Composite Environmental Solid Samples
13	WPSS 10 (0-0.05 22-May-2015 1:50 pm	Soil	GSoil300	TPH + BTEX profile, Soil
14	WPSS 11 (0-0.05) 22-May-2015 1:58 pm	Soil	GSoil300	TPH + BTEX profile, Soil
15	WPSS 11 (0.1-0.15) 22-May-2015 2:05 pm	Soil	GSoil300	TPH + BTEX profile, Soil
16	WPSS 12 (0-0.1) 22-May-2015 2:20 pm	Soil	GSoil300	TPH + BTEX profile, Soil
17	WPSS 13 (0-0.1) 22-May-2015 2:40 pm	Soil	GSoil300	Composite Environmental Solid Samples
18	WPSS 14 (0-0.1) 22-May-2015 2:50 pm	Soil	GSoil300	Composite Environmental Solid Samples
19	WPSS 15 (0-0.1) 22-May-2015 2:57 pm	Soil	GSoil300	Composite Environmental Solid Samples
20	WPSS 16 (0-0.1) 22-May-2015 3:18 pm	Soil	GSoil300	Composite Environmental Solid Samples
21	WPSS 17 (0-0.1) 22-May-2015 3:25 pm	Soil	GSoil300	Composite Environmental Solid Samples
22	WPSS 18 (0-0.1) 22-May-2015 3:37 pm	Soil	GSoil300	Composite Environmental Solid Samples
23	Composite of WPSS 01 (0-0.1), WPSS 02 (0-0.1) & WPSS 03 (0-0.1)	Soil	GSoil300	~~pH~~ Heavy metal screen level (As,Cd,Cr,Cu,Ni,Pb,Zn), Organochlorine Pesticides Screening in Soil

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
24	Composite of WPSS 01B (0-0.1), WPSS 02B (0-0.1) & WPSS 03B (0-0.1)	Soil	GSoil300	pH; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil
25	Composite of WPSS 04 (0-0.1), WPSS 05 (0-0.1) & WPSS 06 (0-0.1)	Soil	GSoil300	~~pH; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil~~
26	Composite of WPSS 07 (0-0.1), , WPSS 08 (0-0.1) & WPSS 09 (0-0.1)	Soil	GSoil300	~~pH; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil~~
27	Composite of WPSS 13 (0-0.1), WPSS 14 (0-0.1) & WPSS 15 (0-0.1)	Soil	GSoil300	~~pH; Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil~~
28	Composite of WPSS 16 (0-0.1), WPSS 17 (0-0.1) & WPSS 18 (0-0.1)	Soil	GSoil300	~~Organochlorine Pesticides Screening in Soil~~ Arsenic only

SUMMARY OF METHODS

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

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	23-27
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	23-27
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	23-27
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	13-16
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.04 mg/kg dry wt	23-28
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	13-16
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	13-16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2	-	23-27
Composite Environmental Solid Samples	Individual sample fractions mixed together to form a composite fraction.	-	1-12, 17-22
pH	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH.	0.1 pH Units	23-27

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Job Information Summary

Client:	Davis Consulting Group Limited	**Lab No:**	1429944
Contact:	C Pritchard	**Date Registered:**	23-May-2015 12:38 pm
	C/- Davis Consulting Group Limited	**Priority:**	High
	PO Box 2450	**Quote No:**	68892
	Wakatipu	**Order No:**	
	QUEENSTOWN 9349	**Client Reference:**	15031
		Add. Client Ref:	
		Submitted By:	C Pritchard
		Charge To:	Davis Consulting Group Limited
		Target Date:	08-Jun-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	WPSS 01 (0-0.1) 22-May-2015 11:26 am	Soil	GSoil300	Composite Environmental Solid Samples
2	WPSS 01B (0-0.1) 22-May-2015 11:28 am	Soil	GSoil300	Composite Environmental Solid Samples
3	WPSS 02 (0-0.1) 22-May-2015 11:40 am	Soil	GSoil300	Composite Environmental Solid Samples
4	WPSS 02B (0-0.1) 22-May-2015 11:42 am	Soil	GSoil300	Composite Environmental Solid Samples
5	WPSS 03 (0-0.1) 22-May-2015 11:55 am	Soil	GSoil300	Composite Environmental Solid Samples
6	WPSS 03B (0-0.1) 22-May-2015 11:57 am	Soil	GSoil300	Composite Environmental Solid Samples
7	WPSS 04 (0-0.1) 22-May-2015 12:46 pm	Soil	GSoil300	Composite Environmental Solid Samples
8	WPSS 05 (0-0.1) 22-May-2015 12:55 pm	Soil	GSoil300	Composite Environmental Solid Samples
9	WPSS 06 (0-0.1) 22-May-2015 1:01 pm	Soil	GSoil300	Composite Environmental Solid Samples
10	WPSS 07 (0-0.1) 22-May-2015 1:10 pm	Soil	GSoil300	Composite Environmental Solid Samples
11	WPSS 08 (0-0.1) 22-May-2015 1:26 pm	Soil	GSoil300	Composite Environmental Solid Samples
12	WPSS 09 (0-0.1) 22-May-2015 1:30 pm	Soil	GSoil300	Composite Environmental Solid Samples
13	WPSS 10 (0-0.05 22-May-2015 1:50 pm	Soil	GSoil300	TPH + BTEX profile, Soil
14	WPSS 11 (0-0.05) 22-May-2015 1:58 pm	Soil	GSoil300	TPH + BTEX profile, Soil
15	WPSS 11 (0.1-0.15) 22-May-2015 2:05 pm	Soil	GSoil300	Hold Cold
16	WPSS 12 (0-0.1) 22-May-2015 2:20 pm	Soil	GSoil300	TPH + BTEX profile, Soil
17	WPSS 13 (0-0.1) 22-May-2015 2:40 pm	Soil	GSoil300	Composite Environmental Solid Samples
18	WPSS 14 (0-0.1) 22-May-2015 2:50 pm	Soil	GSoil300	Composite Environmental Solid Samples
19	WPSS 15 (0-0.1) 22-May-2015 2:57 pm	Soil	GSoil300	Composite Environmental Solid Samples
20	WPSS 16 (0-0.1) 22-May-2015 3:18 pm	Soil	GSoil300	Composite Environmental Solid Samples
21	WPSS 17 (0-0.1) 22-May-2015 3:25 pm	Soil	GSoil300	Composite Environmental Solid Samples
22	WPSS 18 (0-0.1) 22-May-2015 3:37 pm	Soil	GSoil300	Composite Environmental Solid Samples
23	Composite of WPSS 01 (0-0.1), WPSS 02 (0-0.1) & WPSS 03 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Organochlorine Pesticides Screening in Soil; Total Recoverable Arsenic

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
24	Composite of WPSS 01B (0-0.1), WPSS 02B (0-0.1) & WPSS 03B (0-0.1)	Soil	GSoil300	Hold Cold
25	Composite of WPSS 04 (0-0.1), WPSS 05 (0-0.1) & WPSS 06 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
26	Composite of WPSS 07 (0-0.1), WPSS 08 (0-0.1) & WPSS 09 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
27	Composite of WPSS 13 (0-0.1), WPSS 14 (0-0.1) & WPSS 15 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Total Recoverable Arsenic; Organochlorine Pesticides Screening in Soil
28	Composite of WPSS 16 (0-0.1), WPSS 17 (0-0.1) & WPSS 18 (0-0.1)	Soil	GSoil300	Minimum charge for ICP-MS analysis; Total Recoverable Arsenic

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
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	23, 25-28
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	13-14, 16
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.04 mg/kg dry wt	23, 25-27
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	13-14, 16
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	13-14, 16
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	23, 25-28
Composite Environmental Solid Samples	Individual sample fractions mixed together to form a composite fraction.	-	1-12, 17-22
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	23, 25-28