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The Hills Special Zone Submission, Preliminary and Detailed Site Investigation

For

Trojan Helmet Limited

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The Hills Special Zone District Plan Submission

Preliminary and Detailed Site Investigation

Document Status

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A	Draft for Internal Review	FR	GD	19 Oct 2015
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E EC TI E S AR

Trojan Helmet Limited (THL) has prepared a submission to the district plan that seeks to establish 'The Hills Special Zone', which along with the existing golf course and ancillary facilities, would provide for residential housing and visitor accommodation activities. The proposal would result in subdivision, landuse change and earthworks activities, which trigger the National Environment Standard for Assessing and Managing Contaminants in Soil (NES).

In order to support the submission, THL commissioned Davis Consulting Group to consider the potential effect of historical activities on the soil quality of the site and undertake a review of risks to human health to meet the provisions of the NES.

The scope of work completed during the Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI) included:

- Review of the site history, including a review of the property file, certificate of title and historic photographs;
- Discussions with the staff from The Hills golf course;
- Completion of a site inspection to examine the condition of the property;
- Collection of soil samples across the site and analysis for heavy metals and organochlorine and multiresidue pesticides; and
- Consideration of the risk to human health based on a comparison of the adopted risk based soil guidelines values and detected soil contaminant concentrations.

Based on the findings of the PSI and DSI, the following conclusions are made:

- The Hills Golf Course has a number of historical and existing activities that have the potential to impact the soil quality of the site, including historic pastoral use of the site and more recently the operation of the golf course and ancillary facilities;
- The THL submission seeks to provide for a total of 10 house sites and 10 activity areas that may contain residential or visitor accommodation activities;
- The house sites and activity areas are separated from the golf course and are unlikely to be impacted by the use of chemicals on the fairways and greens;
- DCG concluded the risk to soil quality in the house sites and activity areas is associated with the possible historical application of the pesticides and fertilisers;
- Soil sampling was undertaken across all house sites and activity areas to support the assessment with a total of 129 soil samples collected;
- The soil samples were largely analysed for organochlorine pesticides and heavy metals that are associated with the broadacre application of pesticides and fertilisers; one soil sample

collected in close proximity to the golf course was also analysed for multiresidue pesticides to assess the possible impact from chemicals applied to the golf course;

- The analytical results show that the DDT was historically utilised on the site, but was detected at concentrations well below the risk based NES soil contaminant standard;
- Multiresidue pesticide concentrations (excluding DDT) in the sample collected nearest to the golf course in Activity Area 7 were reported below laboratory detection limits; and,
- Heavy metal results all returned concentrations below the adopted soil contaminant standards.

DCG conclude that the house sites and activity areas sought through the submission are suitable for rural residential and residential/visitor accommodation landuse and it is highly unlikely this development would present a risk to human health.

1.0 INTROD CTION

1.1 Purpose

Trojan Helmet Limited (THL) has prepared a submission to the district plan that seeks to establish 'The Hills Special Zone', which along with the existing golf course and ancillary facilities, would provide for residential housing and visitor accommodation activities. The proposal would result in subdivision, landuse change and earthworks activities, which trigger the National Environment Standard for Assessing and Managing Contaminants in Soil (NES).

In order to support the submission, THL commissioned Davis Consulting Group to consider the potential effect of historical activities on the soil quality of the site and undertake a review of risks to human health to meet the provisions of the NES.

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

1.2 Scope of ork

The scope of work completed during the Preliminary Site Investigation (PSI) and Detailed Site Investigation (DSI) included:

- Review of the site history, including a review of the property file, certificate of title and historic photographs;
- Discussions with the staff from The Hills golf course;
- Completion of a site inspection to examine the condition of the property;
- Collection of soil samples across the site and analysis for heavy metals and organochlorine and multiresidue pesticides;
- Consideration of the risk to human health based on a comparison of the adopted risk based soil guidelines values and detected soil contaminant concentrations; and
- Preparation of a PSI/DSI 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.

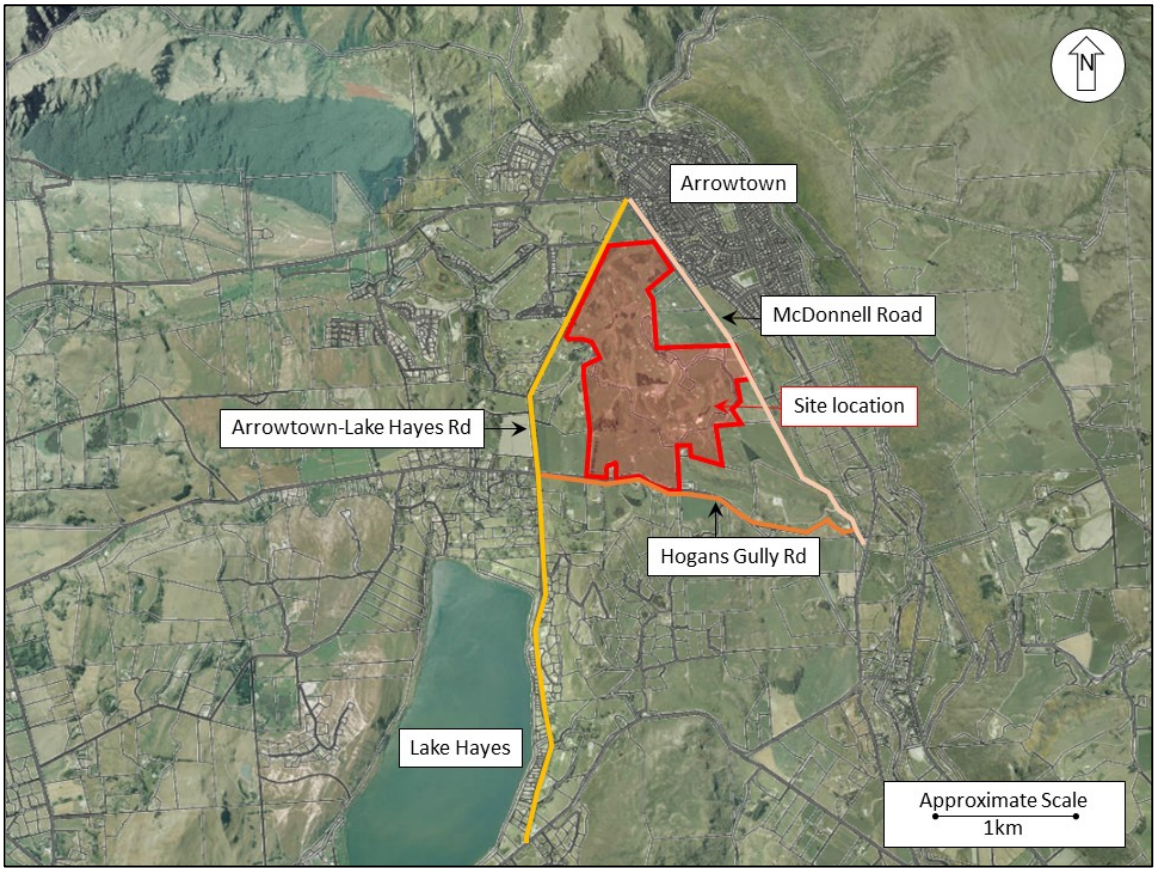
The results of this assessment are based upon site inspections conducted by DCG personnel, information from interviews with people who have knowledge of site conditions. All conclusions and recommendations regarding the properties are the professional opinions of DCG personnel involved with the project, 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 and Description of the Activity

The site is located between McDonnell Road and Arrowtown-Lake Hayes Road and has the following legal description Lots 3, 4 and 7 DP 392663 (see Figure 1). The total area of the site is approximately 155.57 hectares and is situated southwest of Arrowtown. According to the Queenstown Lakes District Council (QLDC) District Plan, the property lies within the Rural General Zone.

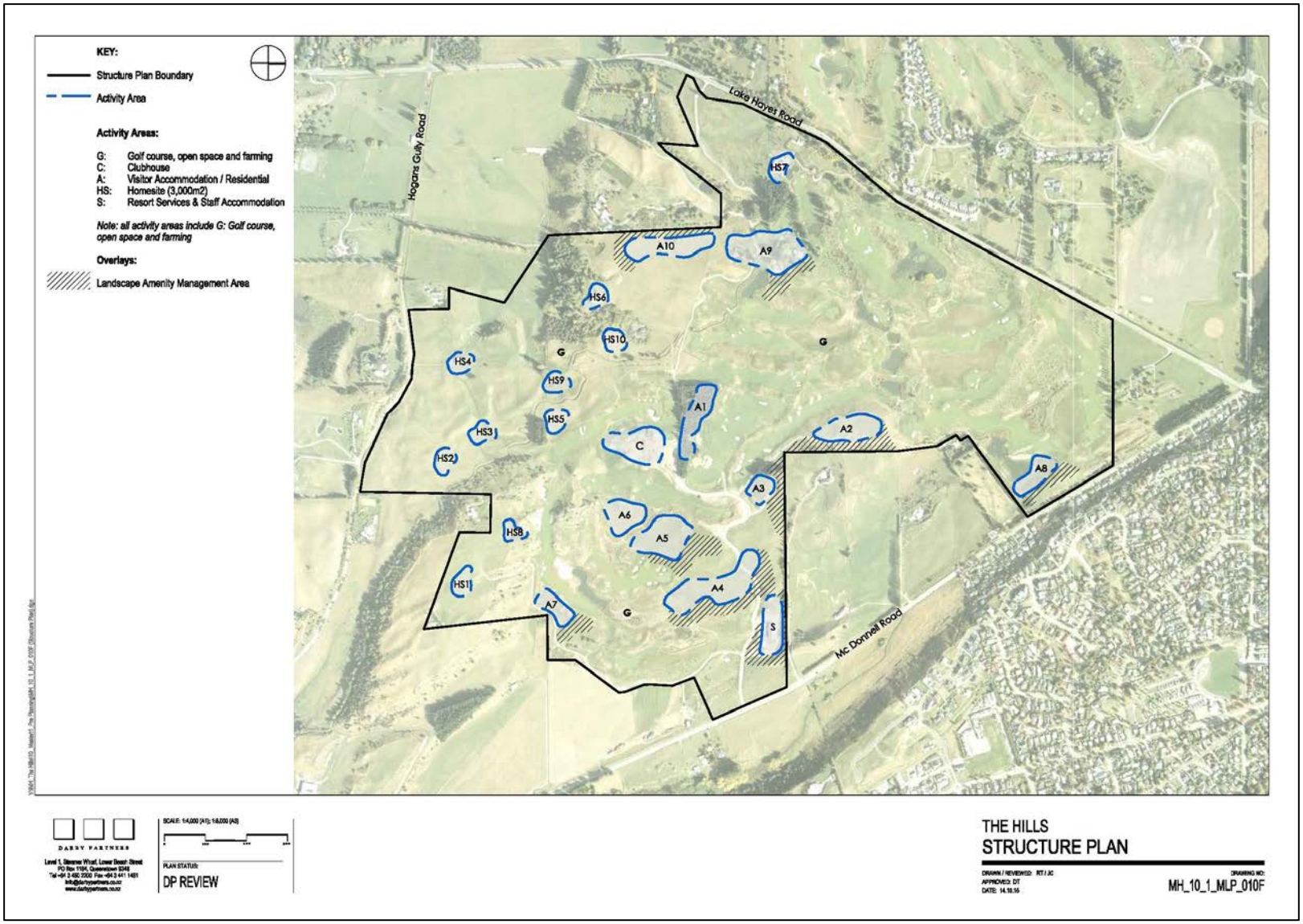
Coordinates for the property are E 1271068, N 5013500.



igure 1: Site Location Plan.

Figure 2 presents the layout of the proposed activities contained within the THL submission. In addition to the ongoing operation of the golf course and ancillary facilities, THL proposes the development of a number of new activity areas including:

- Ten areas (A1 – A10) for the purpose of visitor accommodation/residential activities; and
- Ten house sites (HS1 – HS10).



igure 2: Proposed Structure Plan – Prepared by Darby Partners.

2.2 Site History

Prior to the development of a golf course on the subject site in 2003, the property had a long history of pastoral activity. Historic photographs obtained from the Lakes District Museum (accessed 15/10/2015) indicate the property was used for pastoral activity from circa 1910 (see Plate 1). A second historical photograph taken in 1954 (see Plate 2) indicates the area continued to be under pastoral management at this time.

DCG understands the site was part of the Bob Jenkins Farm in the 1930s. The property was subsequently purchased in the 1940s by brothers Jack and Lawson Summer who then sold it on to Jim Monk (McDonald, 2010). The current owners, THL, purchased the property in circa 1992 and commenced the development of The Hills golf course in 2003. The golf course was developed over a 4-year period, with the golf course opening for play in 2007. Golf has been the primary activity on the site since this time, however, the property also contains a number of residential properties, a golf clubhouse and golf maintenance shed. The historic certificate of title is provided in Appendix B.

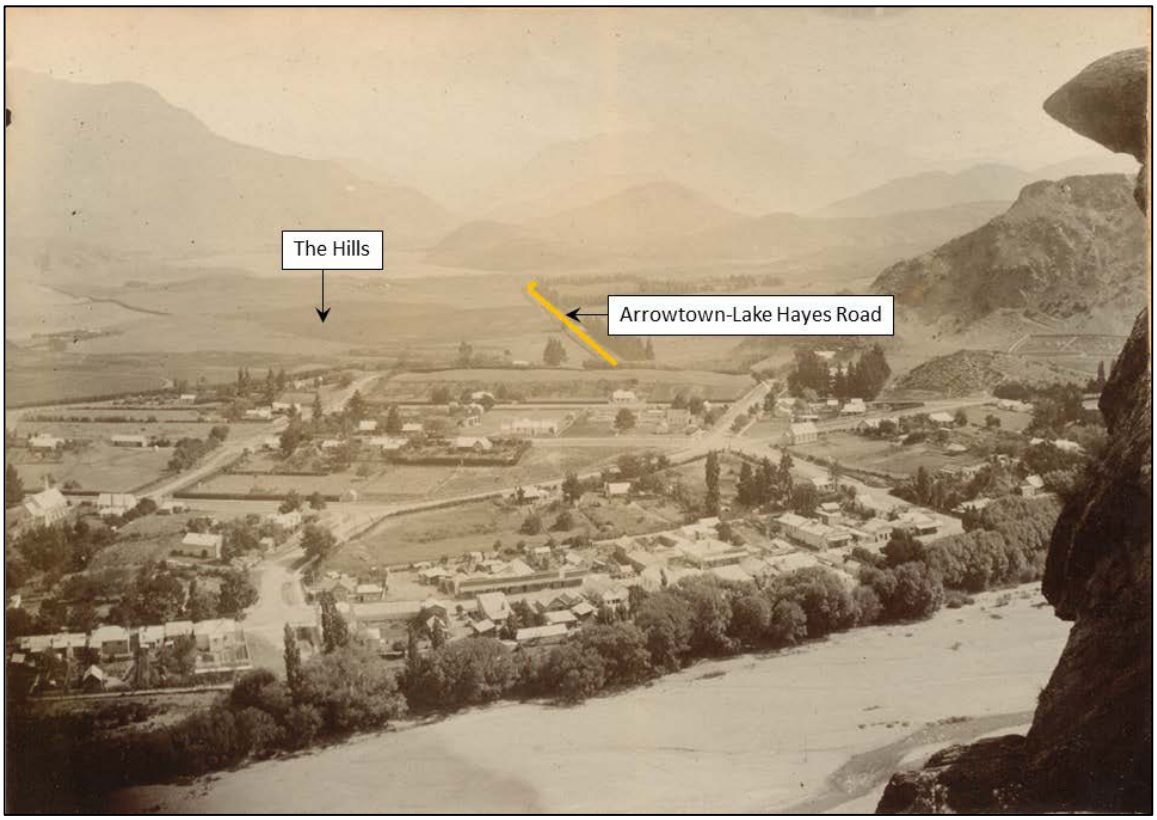


Plate 1: Looking southwest over Arrowtown towards Lake Hayes 1910.

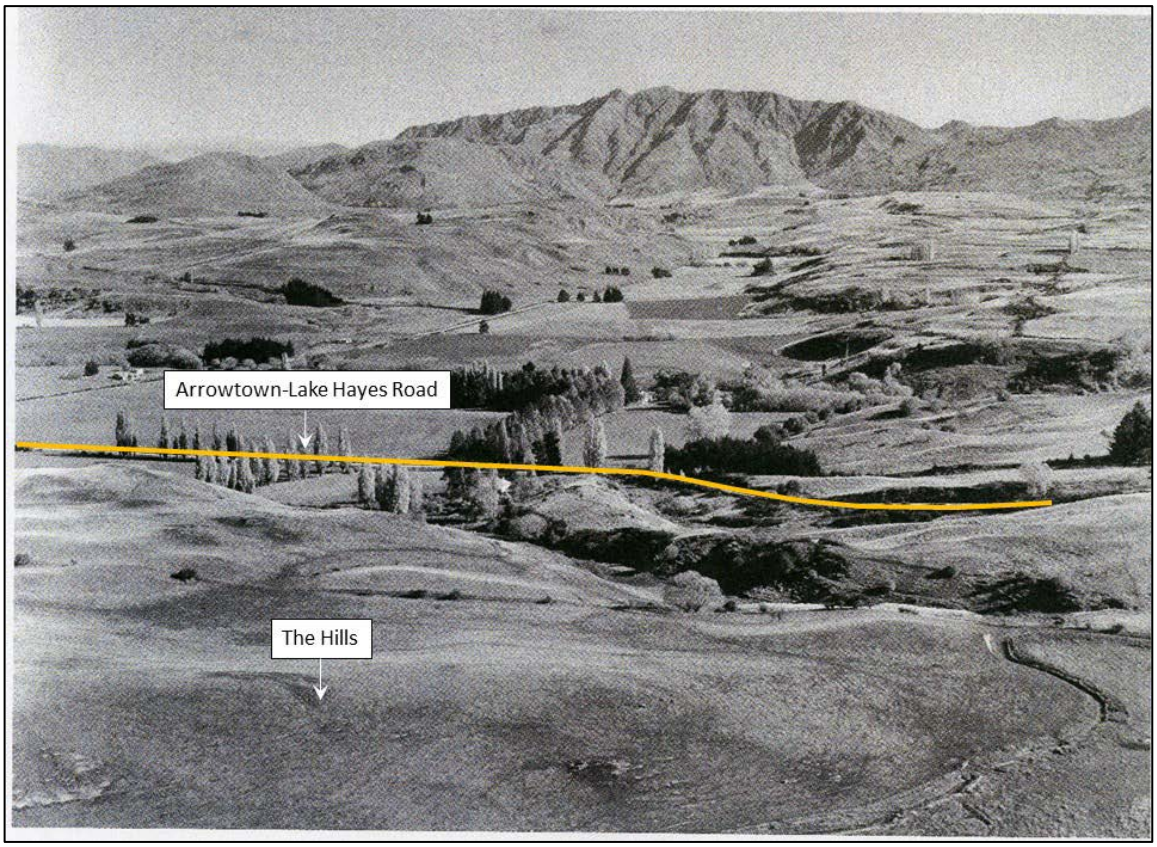


Plate 2: Looking west from above The Hills golf course, 1954.

2.3 Site Condition and Surrounding Environment

Figure 3 presents a site plan showing the current layout of the site. The site currently consists of an 18 hole golf course, driving range, golf clubhouse, golf course maintenance compound and 5 residential houses. Plates 3 to 5 present the general characteristics of the proposed residential activity areas.

According to the QLDC Webmaps (http://maps.qldc.govt.nz/qldcviewer/) the property is currently zoned Rural General along with properties to the south and southeast. Neighbouring to the west is Millbrook which is zoned Resort. Arrowtown is situated to the northeast and is zoned Low Density Residential. The site is located within a 'probably low risk' liquefaction area (QLDC Webmaps).

igure 3: Site Layout Plan.

Plate 3: Looking south across Activity Area A6.

Plate 4: Looking south across Activity Area A2.

Plate 5: Looking southeast across house site HS9.

2.4 Geology and Hydrogeology

The southern half of the subject site is situated on a glacial till and the northern half is situated on politic schist, variably segregated, veined and foliated (Turnbull, 2000). According to the QLDC Webmap, the site has a 'probably low risk' of liquefaction. The surface soils were described during the collection of soil samples; see Appendix C for the soil profile logs.

2.4.1 Hydrogeology

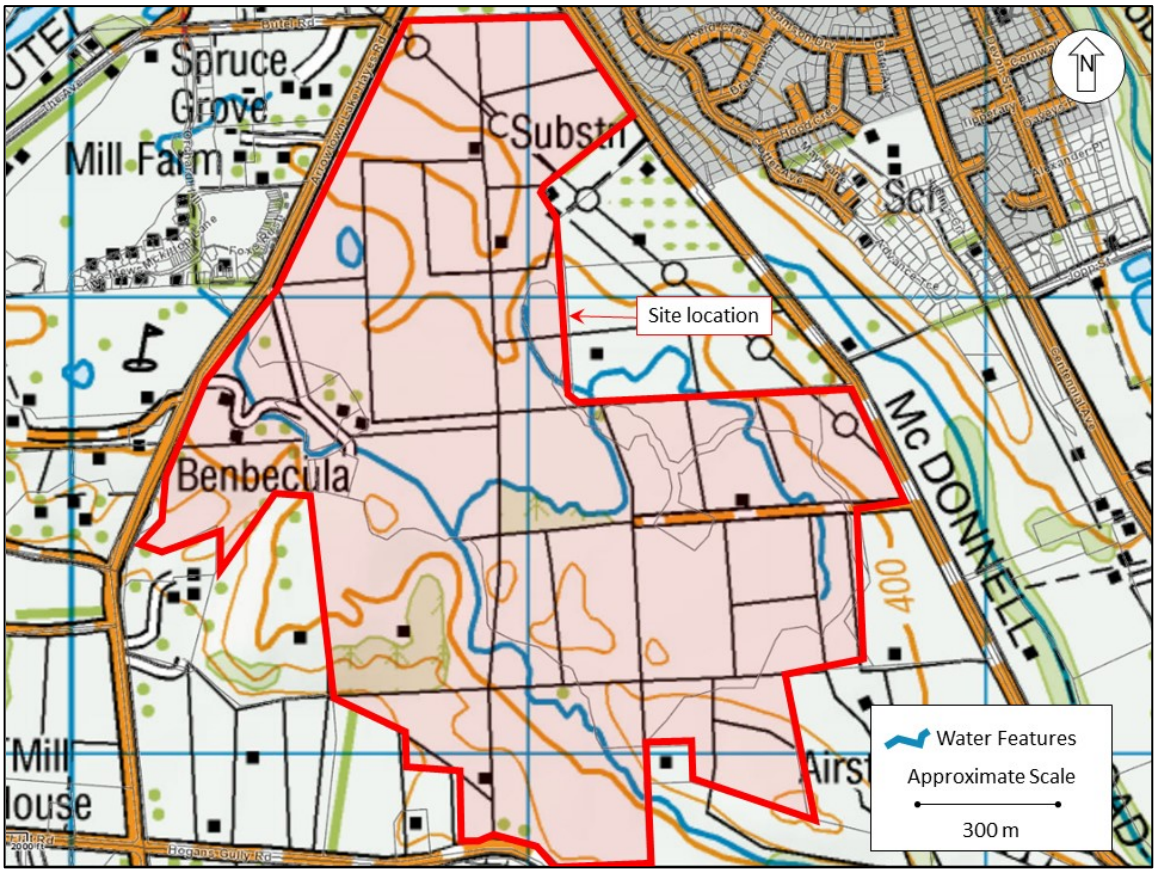
The site investigation did not include a groundwater assessment. The site is located within the Wakatipu Basin aquifer system, however, it is not situated above any identified aquifers. The Mid Mill Creek Aquifer is situated west of the subject site and north of Lake Hayes (ORC, 2014). The depth to groundwater on the site is unknown.

The location of groundwater bores within a 1 kilometre radius of the site (held by the ORC) is provided in Appendix D. A total of 9 consented bores have been installed within 1 kilometre of the site. The wells have been installed for a variety of purposes and are summarised as follows:

- 3 wells are used for domestic purposes;
- 3 wells are used for geological investigation;
- 2 wells are for scheme use;
- 1 well is disused; and
- 1 well has use unknown.

2.4.2 Hydrology

There are surface water bodies found on site which include ponds and drains. The closest surface water bodies are an unnamed tributary of the Arrow River, located 130 m to the east of the property boundary, and Mill Creek located 360 m to the west of the property boundary. Figure 4 presents the water features on the subject site as seen on a topographical map.



igure 4: Water features at The Hills golf course.

2.5 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, and examined the Queenstown Lakes District Council (QLDC) records, for Landuse and Site Contamination Status, Resource Consents, and Resource Management Act (RMA) incidents for the site. The ORC stated the following.

There are no records held on the Otago Regional Council's "Database of Selected Landuses" for the above site. The database identifies sites where activities have occurred that are known to have the potential to contaminate land. The record of a property in the database does not necessarily imply contamination. Similarly, the absence of available information does not necessarily mean that the property is uncontaminated; rather no information exists on the database.

Reference should be made to the Ministry for the Environment's Hazardous Activities and Industries List. If any of these activities have occurred on the above site, then it may be considered potentially contaminated. As a golf course, the site could have been subject to persistent pesticide use.

The ORC holds one discharge consent for the discharge of treated wastewater to land. The ORC do not hold any other records on their "Database of Selected Landuses" for the site, no records on the RMA incidents database regarding any spills or discharges, no resource consents associated with the site, and had no records of any on or off-site disposal locations.

Property files were obtained from the QLDC eDocs webpage (https://edocs.qldc.govt.nz/) for Lots 3, 4 and 7, DP 392663. The property file held information regarding consents ranging from 1992 to 2015 for building a house, erecting statues, earthworks for golf course development, permits for marquees, building a green keepers workshop, construction of the club house, residential platforms and installation of a water pump.

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

- Presence of Drums – No drums were recorded during the site visit.
- Wastes – No wastes were observed during the site visit.
- Fill Materials – Other than planting areas and golf course bunkers, no fill material was encountered.
- Odours – No odours were noted in the housing activity areas.
- Flood Risk – According to QLDC Hazard map the site is not at risk of flooding;
- Surface Water Quality – There are multiple ponds and drains located across the golf course site.
- Visible Signs of Contamination – No obvious stains or signs of contamination were noted during the fieldwork completed for the investigation.
- Local Sensitive Environments – There are multiple ponds across the golf course as well as a network of drains. The closest sensitive environments are an unnamed tributary of the Arrow River, located 130 m to the east of the property boundary, and Mill Creek located 360 m to the west of the property boundary.

2.6 Contaminants Commonly Associated with the Landuse

Based on the Contaminated Land Management Guidelines Schedule B and our understanding of use to support pastoral activities and golf course maintenance, the hazardous substances that may have been utilised on the property include a range of organochlorine and multiresidue pesticides and heavy metals associated with the application of fertilisers. We note that the golf course maintenance compound includes the storage of fuel, chemicals and operation of the workshop. The maintenance compound is physically separated from the proposed residential areas by at least 100 metres and is also downgradient from the nearest area. While the maintenance compound would be considered a site with the potential to impact soil quality it is

highly unlikely this would extend to any housing areas. This area has therefore been excluded from any further analysis in this investigation.

A list of the pesticides and herbicides utilised by The Hills golf course is provided in Table 1. The Hills stated that pesticide and fertiliser use is largely confined to the golf course fairways and greens, with very few herbicide applications outside the main golf course corridor. There is some risk of spray drift, however, this is mitigated by the following:

- Use of a Toro Multipro designated spray rig with drift reducing air induction nozzles at < 3 bar pressure;
- Use of drift reducing spray additives such as Li1000; and,
- Application height is a maximum of 50 cm and only undertaken in calm conditions.

Table 1: Products and Active Ingredients

Products	Active Ingredients
Escort	Metsulfuron
Quantum	Diflufenican
Axall	Mecoprop, Bromoxynil, Ioxynil
Versatil	Clopyralid
Tordon Brushkiller	Triclopyr Butoxyethyl ester
MCPA	Benzenesulfonic acid, dodecyl, 2-Ethylhexanol

Based on the above discussion, it is our view that the contaminants of concern across the site are predominantly those associated with historic farming and agriculture landuse. Specifically, the broadacre application of persistent pesticides and fertilisers has the potential for organochlorine pesticides and heavy metals to accumulate in soils that may present a risk to human health.

3.0 SA PLING AND ANAL SIS PLAN

3.1 Data Quality Objectives

The data quality objectives (DQOs) of the sampling and analysis plan were to:

- Characterise the nature of any contamination associated with the historical landuse of the site; and
- Determine the risk of any soil contamination encountered onsite to human health, based on the proposed residential and rural residential landuse scenarios proposed for the site.

3.2 Sampling and Analysis Plan

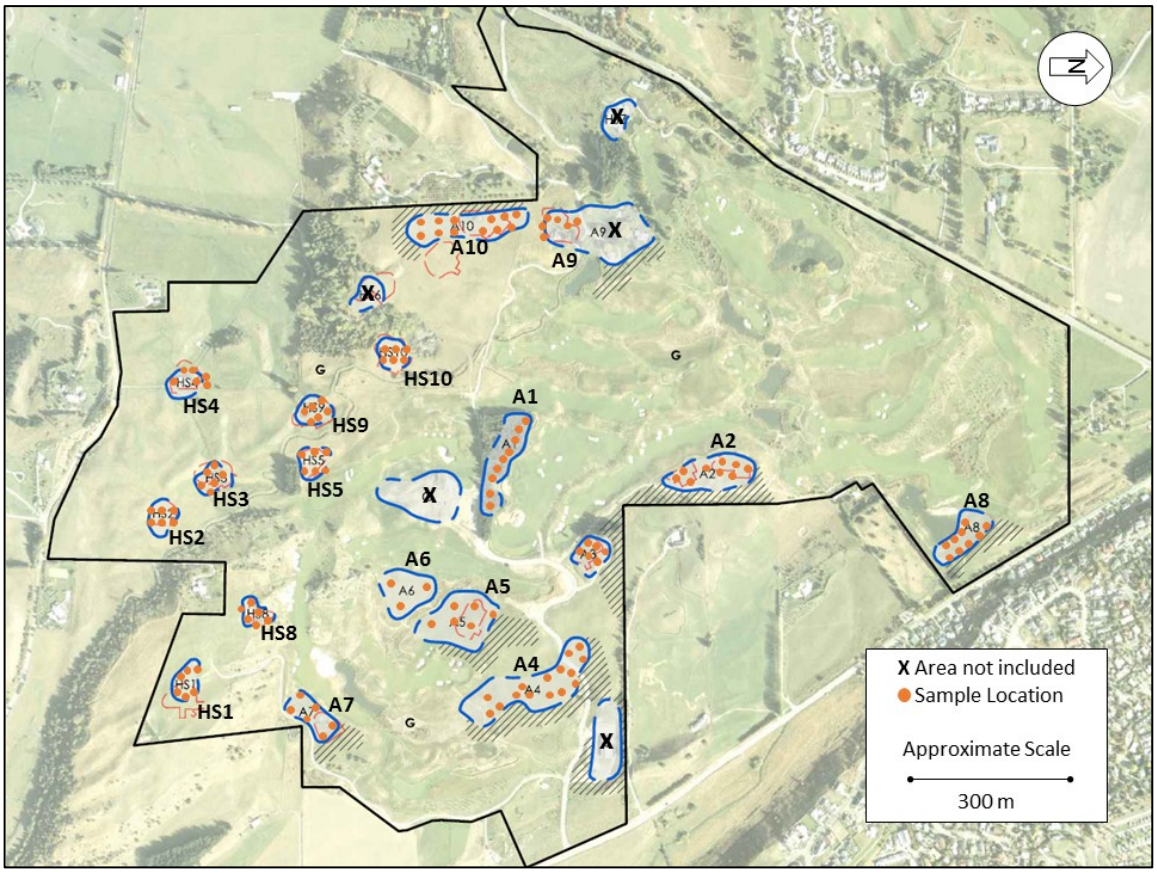
The sampling and analysis plan was designed to address the specific objectives, namely gain an understanding of contaminants associated with historic farming practices. In addition, soil samples were collected and analysed for multi-residue pesticides where residential activity areas are situated in close proximity to the golf course. This analysis was specifically confined to activity area A7.

Most of the sampling undertaken was systematic, with the number of samples for each Activity Area evenly spread across the activity area and house sites. We note that judgemental sampling was completed in house site HS4 in order to characterise soil contaminants that may have been associated with the cattle yards.

The average sampling density within the activity areas was approximately 1 sample per 120 square metres. Figure 5 presents the location of samples from each activity area and housing site. The sample IDs and coordinates are on the soil description log (see Appendix C).

Soil samples were composited into groups of three for the analysis of heavy metals. From each set of three samples, one sample was analysed for organochlorine pesticides. In addition, one sample was also analysed from Activity Area A7 for multiresidue pesticides. A total of 129 surface soil samples were collected from the site at a depth of 0 – 10 cm. We do however note some samples within A11, were recorded at a depth of between 0.05 and 0.15 m. This still represents a surface sample as there was a 0.05 layer of leaf litter at these locations. The sampling depth was considered appropriate due to the nature of the potential contaminants present, such as pesticides and heavy metals, which generally bind strongly to soils. Furthermore, the risk of exposure to people working and living on the site is associated with surface soils.

A soil sample and analysis summary table is provided in Appendix E.



igure 5: Sample Location Plan.

3.3 Soil Sampling ethodology

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.

3.4 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 agricultural activity and more recently a golf course. Based on these activities the following substances were included in the analytical suite:

- Organochlorine pesticides (including 4,4-DDE, 2,4-DDT and Dieldrin);
- Multiresidue Pesticides; and,
- Heavy metals.

The laboratory methods utilised for the analysis are provided in the laboratory report (see Appendix F).

3.5 Soil Sample ield 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; and,
- The threads on the sampling jars were cleaned to avoid Volatile Organic Compound (VOC) loss.

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.

3.6 Soil Guideline alues

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, organochlorine pesticide and multiresidue pesticide SGVs adopted for the site assessment were based on either the NES Soil Contaminant Standards (MfE, 2012) or the National Environmental Protection Measure (NEPM, 2013). Guidelines for the rural residential and residential landuse scenarios as set out in the NES were adopted for the house sites and residential activity areas respectively.

Table 2: Soil Guidelines

Analyses	Guideline
Heavy Metals and Organochlorine and Multiresidue Pesticides.	1. Soil Contaminant Standards *in* New Zealand 'Users' Guide: NES for Assessing & Managing Contaminants in Soil to Protect Human Health 2012 (MfE, 2012). 2. Guideline on the Investigation Levels for Soil and Groundwater *in* National Environment Protection (Assessment of Site Contamination) Measure 1999 - Volume # 2 (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 was checked for analytical and typographical errors.

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

4.0 IN ESTIGATION RES LTS

4.1 Analytical Results

The soil sample locations are provided in Figure 5 with GPS coordinates provided in in Appendix C.

4.1.1 Organochlorine and Multiresidue Pesticide Results

The organochlorine pesticide analytical results detected above the laboratory detection limit are provided in Tables 3 and 4. The remaining results are presented in the laboratory reports provided in Appendix F. Results can be summarised as follows:

- DDT concentrations ranging between 0.03 mg/kg and 0.142 mg/kg were detected in soil samples collected from Activity Areas A3, A4, A5, A6, A7 and A10;
- DDT concentrations ranging between 0.045 mg/kg to 0.174 mg/kg were detected in soil samples collected from house site HS4;
- All DDT concentrations detected are well below the NES soil contaminant standards of 45 mg/kg and 70 mg/kg for the rural residential and residential landuse scenarios respectively;
- Low concentrations of endosulfan sulphate were detected in soil samples collected from Activity Area A10; and,
- Multiresidue pesticide concentrations excluding DDT in Activity Area 7 were reported below laboratory detection limits.

The results indicate that DDT has been utilised across the property, most likely to control pests such as grass grub. Notwithstanding this finding, the concentrations are well below levels that present a risk to people working or living on the site.

4.1.2 Heavy Metal Results

The heavy metal results are presented in Tables 5 and 6 and summarised as follows:

- Arsenic concentrations detected in the Activity Areas and House Sites range from 8 mg/kg to 19 mg/kg and are all below the adopted guideline of 20 mg/kg;
- Cadmium concentrations in all samples analysed are at or below the laboratory reporting limits; and,
- Chromium, Copper, Lead, Nickel and Zinc concentrations are all well below the adopted soil guidelines values in all Activity Areas.

The consistency of the results confirms that most of the heavy metal concentrations are representative of background concentrations. The only results contrary to this are associated with soil samples collected from Activity Area 8 which contain noticeably higher concentrations of arsenic, copper, chromium, lead, nickel and zinc. While the concentrations remain below the adopted guidelines the results may suggest that fertilisers or pesticides may have been historically stored in the vicinity of Activity Area 8.

Given the consistency of the results, the practice of adjusting the guideline value for composite samples is not considered necessary as it is unlikely that contaminant hotspots are present on the site that exceed the adopted guideline values.

Table 3: Activity Area Organochlorine Pesticide Results (mg/kg)

Sample Area	A3	A7	A7	A6	A5	A5	A4	A10	A9	
Sample ID	A3.5	A7.2	A7.5	A6.2	A5.1	A5.5	A4.2	A10-11	A9-5	Guideline
4,4'-DDE	0.017	0.096	0.091	0.087	0.065	0.107	0.045	< 0.010	0.044	-
2,4'-DDT	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDT	0.014	0.036	0.023	0.013	0.019	0.025	0.022	< 0.010	0.015	-
Total DDT Isomers	0.041	0.142	0.124	0.11	0.094	0.142	0.077	0.03	0.069	70[1]
Endosulfan sulphate	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.018	< 0.010	270[2]

< denotes concentration below laboratory detection limits
- Denotes no guideline value
[1] Soil Contaminant Standards in New Zealand 'Users' Guide: NES for Assessing & Managing Contaminants in Soil to Protect Human Health 2012 (MfE, 2012).
[2] National Environment Protection (Assessment of Site Contamination) Measure 2013 Volume 2 (NEPC, 2013).

Table 4: Housing Site Organochlorine Pesticide Results (mg/kg)

Sample Area	HS4	HS4	HS4	HS4	
Sample ID	HS4-2	HS4-3	HS4-5	HS4-6	Guideline
4,4'-DDE	0.128	0.035	0.044	0.06	-
2,4'-DDT	< 0.010	< 0.010	< 0.010	< 0.010	-
4,4'-DDT	0.036	< 0.010	0.017	0.018	-
Total DDT Isomers	0.174	0.045	0.071	0.088	45[1]

< denotes concentration below laboratory detection limits
- Denotes no guideline value
[1] Soil Contaminant Standards in New Zealand 'Users' Guide: NES for Assessing & Managing Contaminants in Soil to Protect Human Health 2012 (MfE, 2012).

Table 5: Activity Area Heavy Metal Results (mg/kg)

Sample Area	A3	A3	A2	A2	A2	A8	A8	A8	A7	A7	A6	A5	
Composite #	1	2	3	4	5	6	7	8	9	10	11	12	Guideline
Arsenic	9	9	9	9	9	18	18	19	9	9	14	8	20[1]
Cadmium	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	3[1]
Chromium	7	7	7	7	7	12	13	13	8	7	7	7	>10,000[1]
Copper	8	9	8	9	9	18	18	20	10	12	11	9	>10,000[1]
Lead	12.9	12.2	12.8	11.9	11.6	26	23	24	12.8	12.7	17.2	10.9	210[1]
Nickel	7	7	7	7	7	12	13	13	8	8	8	7	400[2]
Zinc	36	33	34	33	36	60	62	62	39	38	35	33	7400[2]
Sample Area	A5	A4	A4	A4	A4	A4	A1	A1	A1	A10	A10	A10	
Composite #	13	14	15	16	17	18	19	20	21	22	23	24	Guideline
Arsenic	8	9	8	10	9	9	10	11	11	8	9	11	20[1]
Cadmium	< 0.10	< 0.10	0.11	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.11	3[1]
Chromium	7	7	7	7	6	7	7	7	6	6	7	8	>10,000[1]
Copper	9	12	10	10	10	10	10	12	12	7	8	12	>10,000[1]
Lead	10.9	14.1	11.3	11.5	11.4	12.4	11.7	13.2	12.2	9.8	10	11.5	210[1]
Nickel	7	8	8	7	7	7	7	8	8	7	7	8	400[2]
Zinc	35	45	33	47	31	31	37	31	30	35	35	40	7400[2]
Sample Area	A10	A9	A9										
Composite #	25	26	27	Guideline									
Arsenic	9	10	11	20[1]									
Cadmium	< 0.10	< 0.10	< 0.10	3[1]									
Chromium	8	7	8	>10,000[1]									
Copper	8	9	10	>10,000[1]									
Lead	10.2	10	14.4	210[1]									
Nickel	7	7	7	400[2]									
Zinc	33	35	39	7400[2]									

< denotes concentration below laboratory detection limits
[1] Soil Contaminant Standards in New Zealand 'Users' Guide: NES for Assessing & Managing Contaminants in Soil to Protect Human Health 2012 (MfE, 2012).
[2] Guideline on the Investigation Levels for Soil and Groundwater in National Environment Protection (Assessment of Site Contamination) Measure 2013 Volume 2 (NEPC, 2013).

Table 6: Housing Site Heavy Metal Results (mg/kg)

Sample Area	HS10	HS10	HS5	HS5	HS9	HS9	HS1	
Composite #	28	29	30	31	32	33	34	Guideline
Arsenic	8	10	13	10	11	10	9	17[1]
Cadmium	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.8[1]
Chromium	8	7	8	7	9	7	9	>10,000[1]
Copper	11	11	12	10	10	11	13	>10,000[1]
Lead	10.1	10.6	13.1	10.4	12.8	10.2	14.1	160[1]
Nickel	8	8	9	7	8	8	10	400[2]
Zinc	43	38	41	37	42	39	50	7,400[2]

Sample Area	HS1	HS8	HS8	HS2	HS2	HS3	HS3	
Composite #	35	36	37	38	39	40	41	Guideline
Arsenic	9	11	11	9	9	10	10	17[1]
Cadmium	< 0.10	0.12	< 0.10	0.11	0.1	0.14	< 0.10	0.8[1]
Chromium	9	10	9	8	7	9	8	>10,000[1]
Copper	11	14	14	10	10	12	14	>10,000[1]
Lead	14	14.4	13.1	10.5	10.4	13.9	11.3	160[1]
Nickel	8	10	10	8	8	9	8	400[2]
Zinc	45	59	53	47	39	51	39	7,400[2]

Sample Area	HS4	HS4	HS4	HS4	HS4	HS4	
Individual Analysis	HS4-1	HS4-2	HS4-3	HS4-4	HS4-5	HS4-6	Guideline
Arsenic	14	12	13	14	10	10	17[1]
Cadmium	< 0.10	< 0.10	0.1	< 0.10	0.12	< 0.10	0.8[1]
Chromium	12	10	17	13	13	9	>10,000[1]
Copper	16	11	16	22	11	11	>10,000[1]
Lead	16.9	12.3	13.5	15.3	12.6	11.3	160[1]
Nickel	11	10	14	10	11	8	400[2]
Zinc	130	92	71	260	59	63	7,400[2]

< denotes concentration below laboratory detection limits

[1] Soil Contaminant Standards in New Zealand 'Users' Guide: NES for Assessing & Managing Contaminants in Soil to Protect Human Health 2012 (MfE, 2012).

[2] Guideline on the Investigation Levels for Soil and Groundwater in National Environment Protection (Assessment of Site Contamination) Measure 2013 Volume 2 (NEPC, 2013).

4.2 QA QC Results

4.2.1 Field Duplicates

Six field duplicate soil samples were collected during the site investigation and analysed to review the reproducibility of the laboratory analysis. The duplicates and the corresponding sample results are presented in Table 7 below.

Table 7: Duplicate Percentage Differences

Analyte	A3-5	Dup 1	%	A5-1	Dup 2	%
4,4'-DDE	0.017	< 0.010	51	0.065	0.061	6
2,4'-DDT	< 0.010	< 0.010	0	< 0.010	< 0.010	0
4,4'-DDT	0.014	< 0.010	33	0.019	0.019	0
Analyte	A1-3	Dup 3	%	HS9-3	Dup 4	%
4,4'-DDE	< 0.010	< 0.010	0	< 0.010	< 0.010	0
2,4'-DDT	< 0.010	< 0.010	0	< 0.010	< 0.010	0
4,4'-DDT	< 0.010	< 0.010	0	< 0.010	< 0.010	0
Analyte	HS9-1	Dup 5	%	HS2-6	Dup 6	%
4,4'-DDE	< 0.010	< 0.010	0	< 0.010	< 0.010	0
2,4'-DDT	< 0.010	< 0.010	0	< 0.010	< 0.010	0
4,4'-DDT	< 0.010	< 0.010	0	< 0.010	< 0.010	0

An acceptable percentage difference between duplication samples is less than 30 to 50 % (MfE, 2011). The highest relative percentage difference between the six samples was 51 % (for 4,4 DDE), which is just over what is considered acceptable for soil analysis. The QA/QC analysis indicates the sampling and analysis undertaken was reproducible.

4.2.2 Laboratory Procedures

Hill Laboratories did not complete specific in-house QA/QC analysis, such as spike recoveries or laboratory duplicates during the processing of the soil samples. The Chain of Custody form and the Hill Laboratory results are provided in Appendix F.

5.0 CONCL SION

Based on the findings of the PSI and DSI, the following conclusions are made:

- The Hills Golf Course has a number of historical and existing activities that have the potential to impact the soil quality of the site, including historic pastoral use of the site and more recently the operation of the golf course and ancillary facilities;
- The THL submission seeks to provide for a total of 10 house sites and 10 activity areas that may contain residential or visitor accommodation activities;
- The house sites and activity areas are separated from the golf course and are unlikely to be impacted by the use of chemicals on the fairways and greens;
- DCG concluded the risk to soil quality in the house sites and activity areas is associated with the possible historical application of the pesticides and fertilisers;
- Soil sampling was undertaken across all house sites and activity areas to support the assessment with a total of 129 soil samples collected;
- The soil samples were largely analysed for organochlorine pesticides and heavy metals that are associated with the broadacre application of pesticides and fertilisers; one soil sample collected in close proximity to the golf course was also analysed for multiresidue pesticides to assess the possible impact from chemicals applied to the golf course;
- The analytical results show that the DDT was historically utilised on the site, but was detected at concentrations well below the risk based NES soil contaminant standard;
- Multiresidue pesticide concentrations (excluding DDT) in the sample collected nearest to the golf course in Activity Area 7 were reported below laboratory detection limits; and,
- Heavy metal results all returned concentrations below the adopted soil contaminant standards.

DCG conclude that the house sites and activity areas sought through the submission are suitable for rural residential and residential/visitor accommodation landuse and it is highly unlikely this development would present a risk to human health.

6.0 RE ERENCES

McDonald, B. (2010) Queenstown's Farms and Sheep Stations. Families that farmed the land.

Ministry for the Environment (2003a) *Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand.*

Ministry for the Environment (2003b) *Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values.*

Ministry for the Environment (2011) *Contaminated Land Management Guidelines No. 5: Site investigation and analysis of soils. Revised 2011.*

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

National Environment Protection Council (NEPC) (2013) *National Environment Protection (Assessment of Site Contamination) Measure - Schedule B (1) Guideline on Investigation Levels for Soil and Groundwater.* National Environment Protection Council.

Otago Regional Council (ORC), 2014. *Investigation into the Wakatipu Basin Aquifers, July 2014.* Report writer: Jens Rekker, Resource Scientist. Reviewed by: John Threlfall, Director of Environmental Science & Information.

Turnbull, I.M. (compiler) 2000. *Geology of the Wakatipu area.* Institute of Geological & Nuclear Sciences 1:250 000 geological map 18. 1 sheet + 72 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Limited

Queenstown Lakes District Council, 2009. *Queenstown Lakes District Plan*.

Lakes District Museum, 2015. Accessed 15/10/15

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.

RS 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.

ER 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

Historic Certificate of Title

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**413072**
Land Registration District	**Otago**
Date Issued	05 August 2008

Prior References

OT13A/734	OT15A/1076	OT17B/806
OT18B/1030	OT18B/991	OT18C/442

Estate	Fee Simple
Area	101.5914 hectares more or less
Legal Description	Lot 7 Deposited Plan 392663

Proprietors

Trojan Helmet Limited

Interests

Subject to a right to convey water in gross over part marked g-h DP 392663 to Arrow Irrigation Company Limited created by Transfer 828083 -21.4.1993 at 9.23 am

X14968 Irrigation Agreement (affects part formerly Section 105 Block VII Shotover SD)

Part formerly Section 105 Block VII Shotover Survey District is Subject to Section 8 Mining Act 1971

Part formerly Section 105 Block VII Shotover Survey District is Subject to Section 5 Coal Mines Act 1979

Subject to Part IV A Conservation Act 1987 (affects Part formerly part Section 102 Block VII Shotover Survey District - herein)

Subject to Section 11 Crown Minerals Act 1991 (affects Part formerly part Section 102 Block VII Shotover Survey District - herein)

X14880 Irrigation Agreement (affects part formerly Section 105 Block VII Shotover SD)

Subject to a right of way over part marked AD DP 392663 created by Transfer 746961.17 - 1.2.1990 at 9:51 am

Subject to a right to convey water over part marked aa-ab,ab-ac,ac-ad,ad-ae,ae-au DP 392663 and right to take & convey water over part marked A DP 392663 created by Transfer 749789 - 12.3.1990 at 9:29 am

Subject to a right to convey water over part marked aa-ab,ab-ac,ac-ad,ad-ae,af-ag,ag-ai,aj-i,i-ak,al-am,ae-af DP 392663,right to take & convey water over part marked A DP 392663 and right to store & convey water over part marked B DP 392663 created by Transfer 773822.1 - 27.2.1991 at 9:12 am

Appurtenant to part formerly part lot 1 DP 21438 are rights to convey water created by Transfer 773822.1 - 27.2.1991 at 9:12 am

Subject to a right to convey water over part marked aj-i,i-ak,al-am DP 392663 and right to store & convey water over part marked B DP 392663 created by Transfer 773822.2 - 27.2.1991 at 9:12 am

Subject to a right to convey water in gross over part marked k-l,m-n,v-w DP 392663 to The Arrow Irrigation Company Limited created by Transfer 825040 - 4.3.1993 at 9:30 am

Subject to a right to convey water in gross over part marked h-i,i-j,j-k DP 392663 to The Arrow Irrigation Company Limited created by Transfer 834732 - 23.7.1993 at 9:32 am

Subject to a right to convey water in gross over part marked o-p,q-y DP 392663 to Arrow Irrigation Company Limited created by Transfer 840451 - 13.10.1993 at 9:51 am

Appurtenant to part formerly CT OT17B/806 is a right to pump water,a right to convey electricity and rights to convey water created by Transfer 915672.3 - 6.9.1996 at 2:49 pm

The easements created by Transfer 915672.3 are subject to Section 243 (a) Resource Management Act 1991

Identifier **413072**

Appurtenant to part formerly CT OT17B/806 is a right to take water created by Transfer 953679.6 - 31.8.1998 at 10:56 am

The easements created by Transfer 953679.6 are subject to Section 243 (a) Resource Management Act 1991

Land Covenant in Deed 964442.3 - 23.3.1999 at 12.55 pm (affects part formerly CT OT17B/806)

7898685.3 Surrender of the right of way marked A,B SO 23066 created by Transfer 746961.17 as to land in CTs OT15A/1076,OT15D/881,OT17B/806,OT18B/991,OT18C/442 - 5.8.2008 at 9:00 am

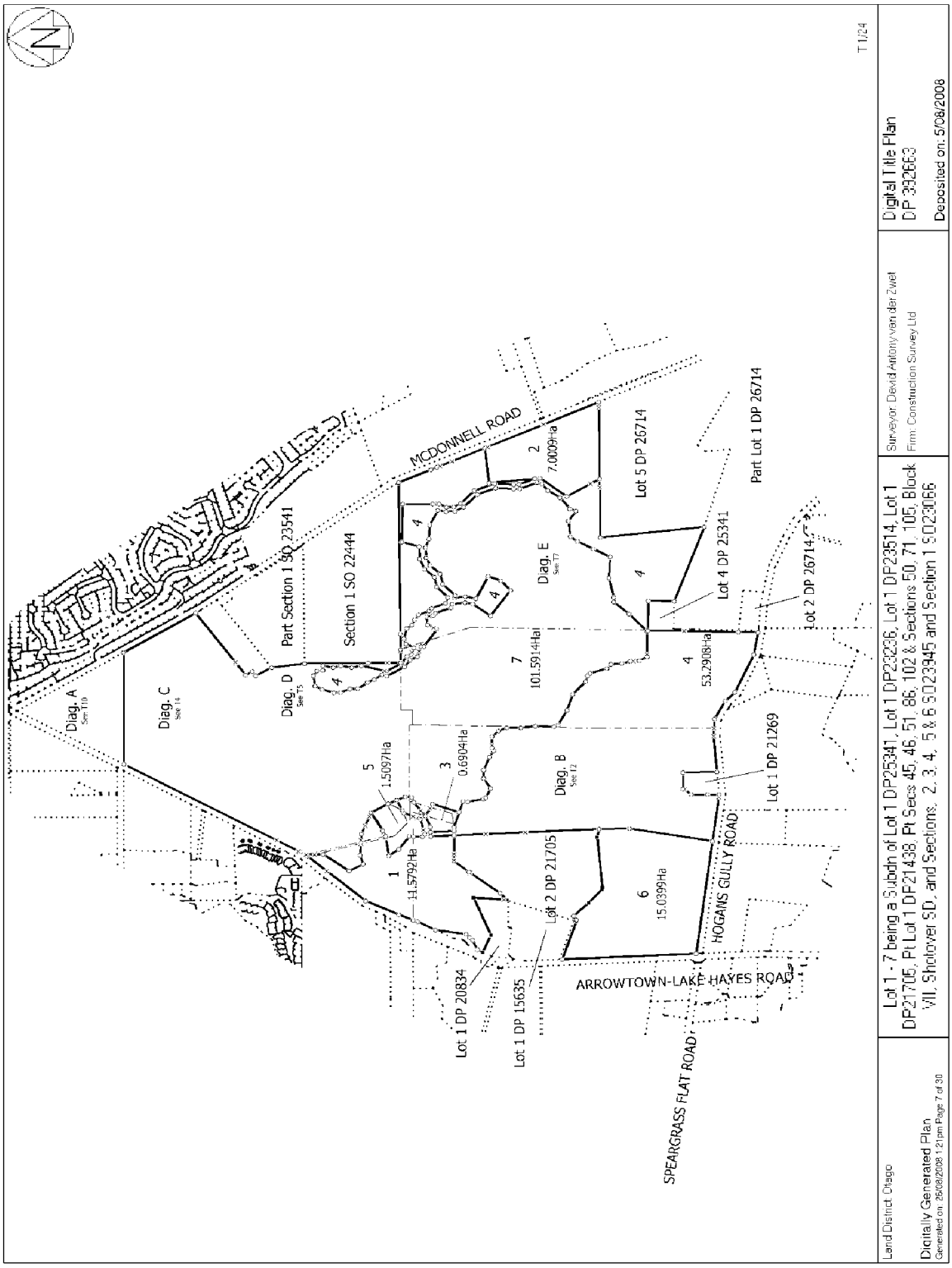
Subject to a right of way over part marked I,L DP 392663,right to convey telecommunications over part marked AB,AD,Q,AN DP 392663,right to convey electricity marked P,Q,R,AN DP 392663 and right to convey water marked AP,AQ,AR,AO,AN DP 392663 created by Easement Instrument 7898685.11 - 5.8.2008 at 9:00 am

The easements created by Easement Instrument 7898685.11 are subject to Section 243 (a) Resource Management Act 1991

8267348.1 Mortgage to Westpac New Zealand Limited - 28.8.2009 at 9:01 am

Subject to a right to convey electricity (in gross) over parts marked R, I, F, D, P, N, J, O & Q on DP 392663 and over parts marked A & B on DP 420440 and a right to transform electricity (in gross) over parts marked D, O & Q on DP 392663 and over part marked B on DP 420440 in favour of Aurora Energy Limited created by Easement Instrument 8735727.6 - 20.4.2011 at 2:52 pm

Subject to a right to convey water over part marked AQ on DP 392663 created by Easement Instrument 9136139.1 - 14.12.2012 at 1:49 pm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Firm: Construction Survey Ltd
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Part Section 1 SO 23541
Section 1 SO 22444
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Diag. C
Diag. D
Diag. E
Diag. B
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Lot 4 DP 25341
Part Lot 1 DP 26714
Lot 2 DP 26714
Lot 1 DP 21269
Lot 2 DP 21705
Lot 1 DP 20834
Lot 1 DP 15635
HOGANS GULLY ROAD
ARROWTOWN-LAKE HAYES ROAD
SPEARGRASS FLAT ROAD
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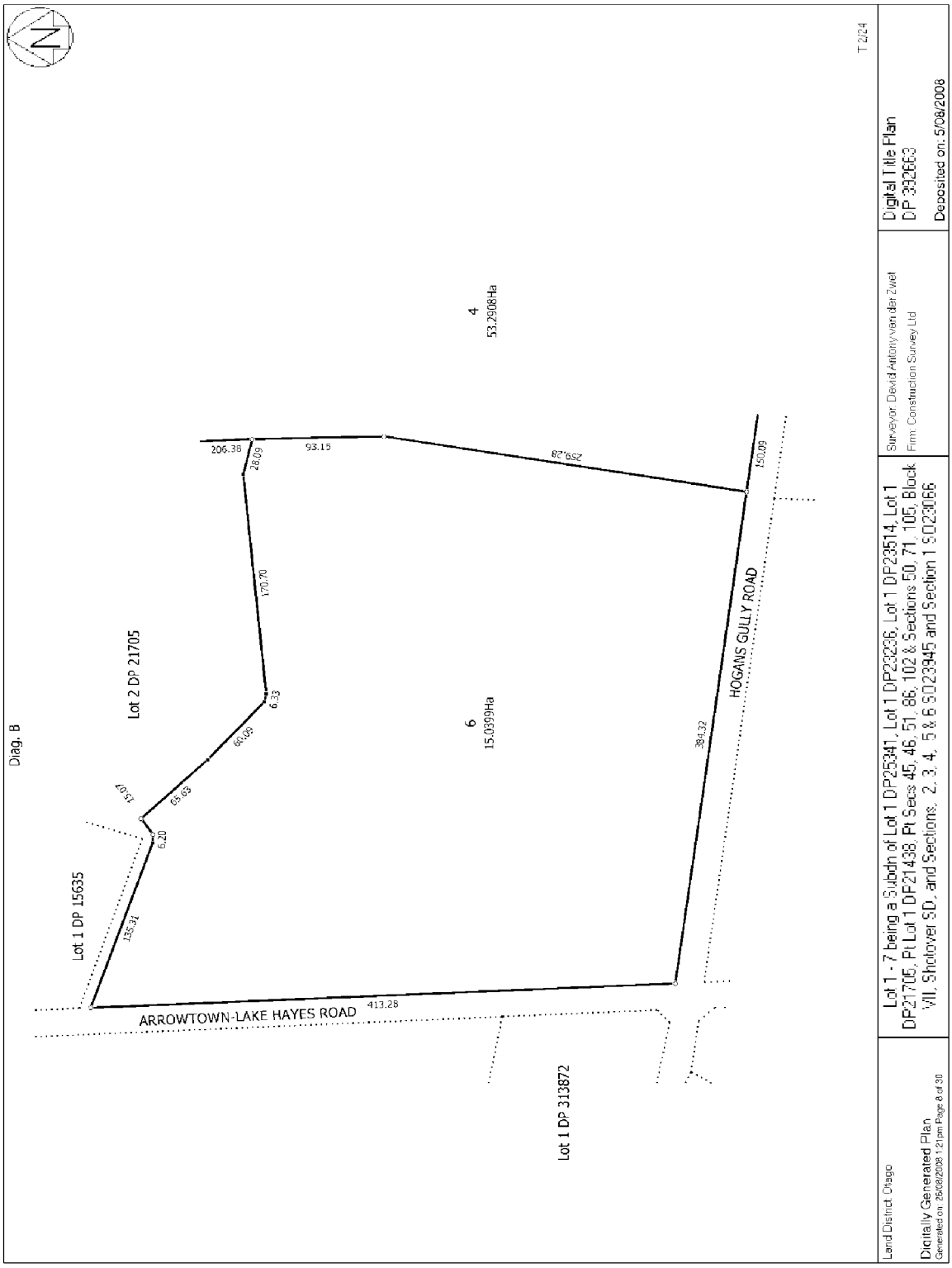

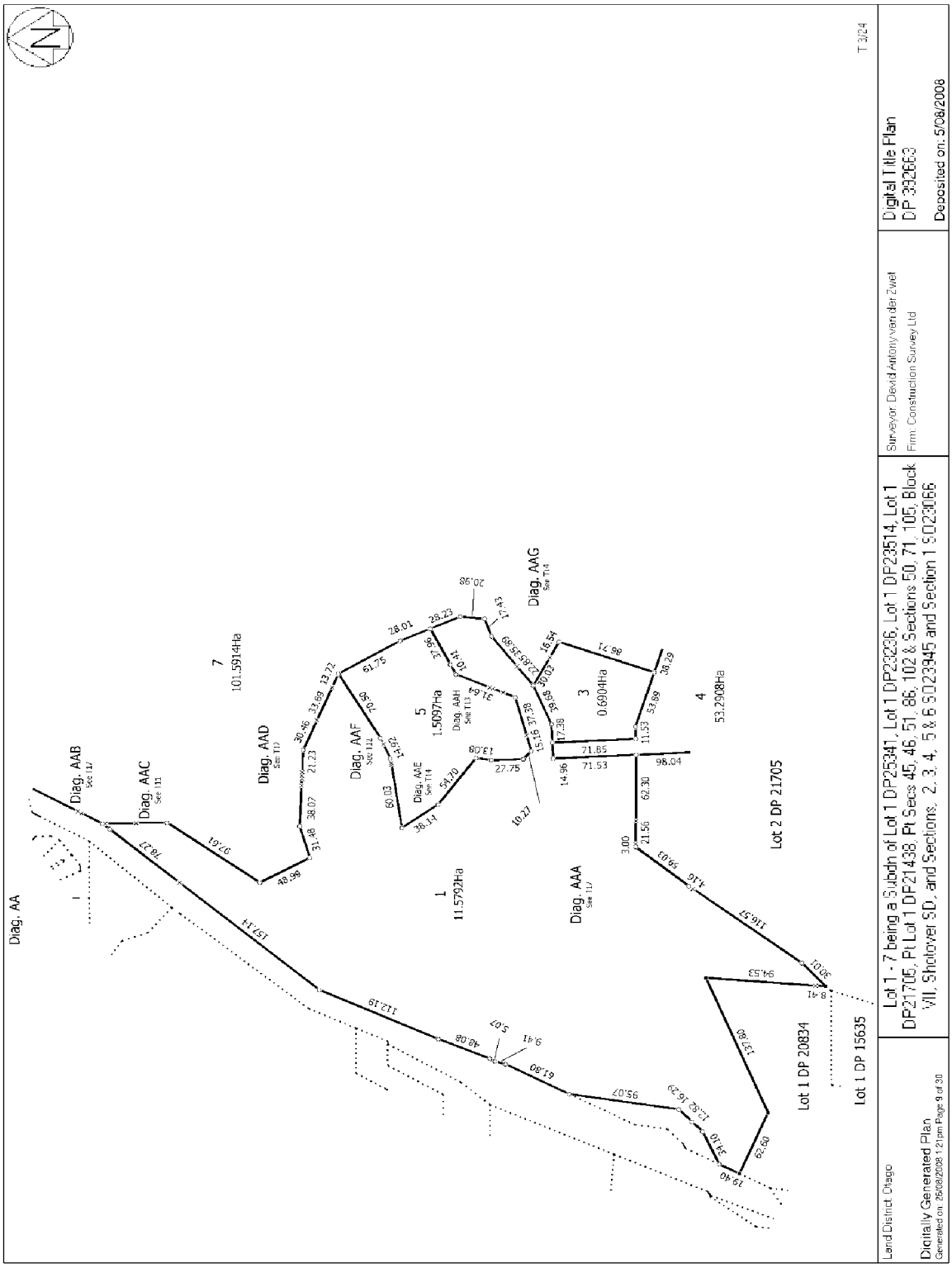
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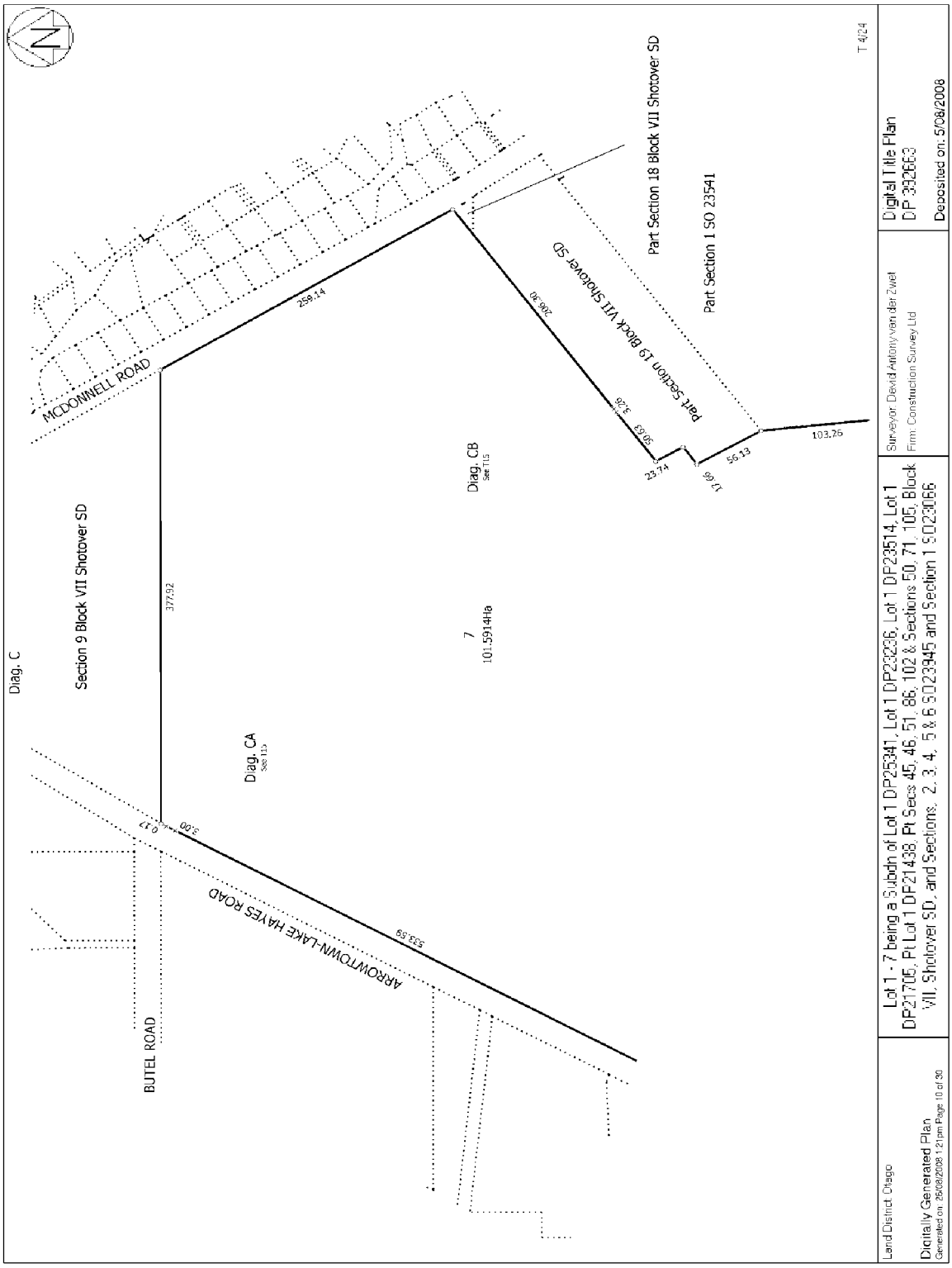

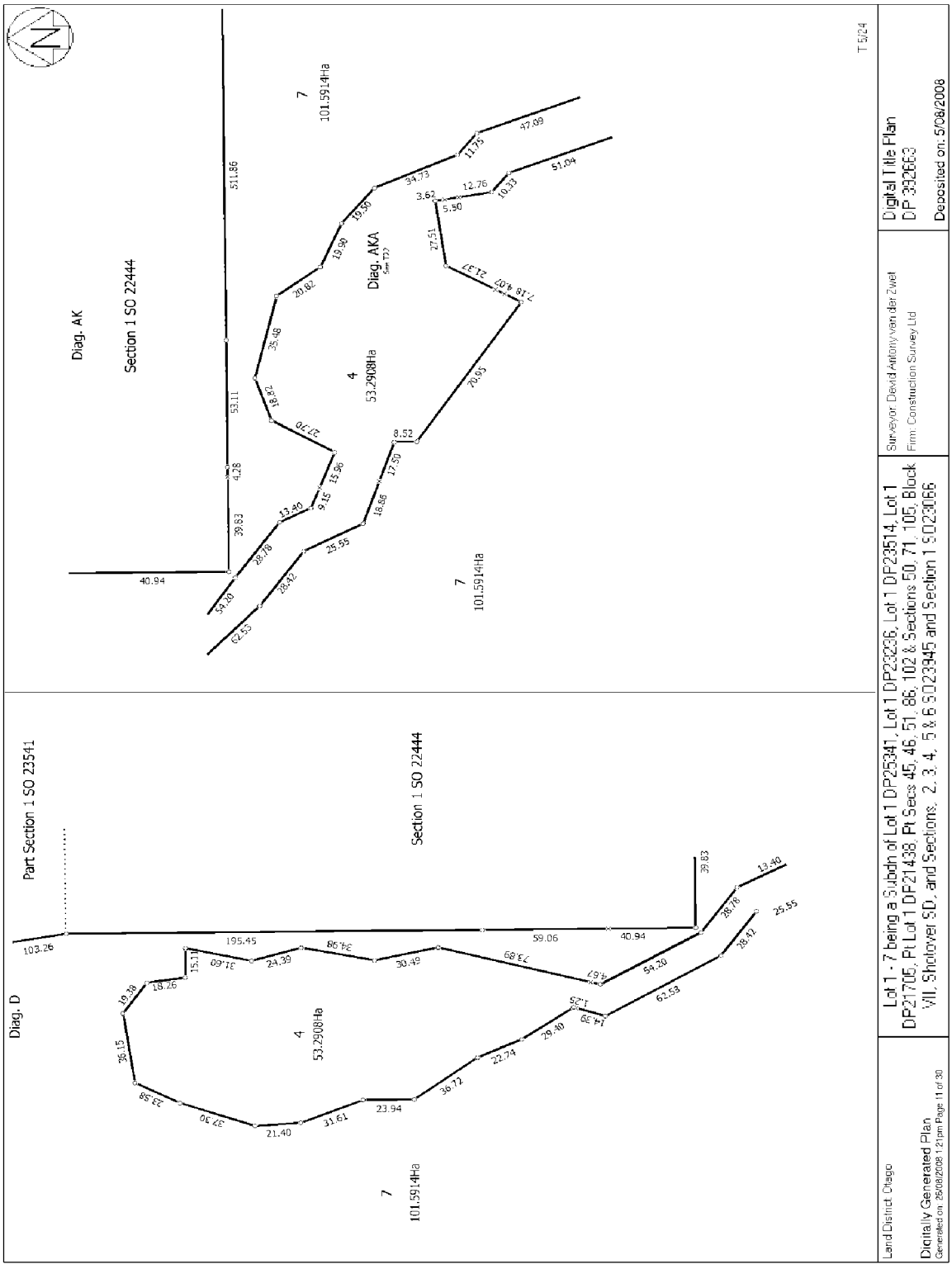
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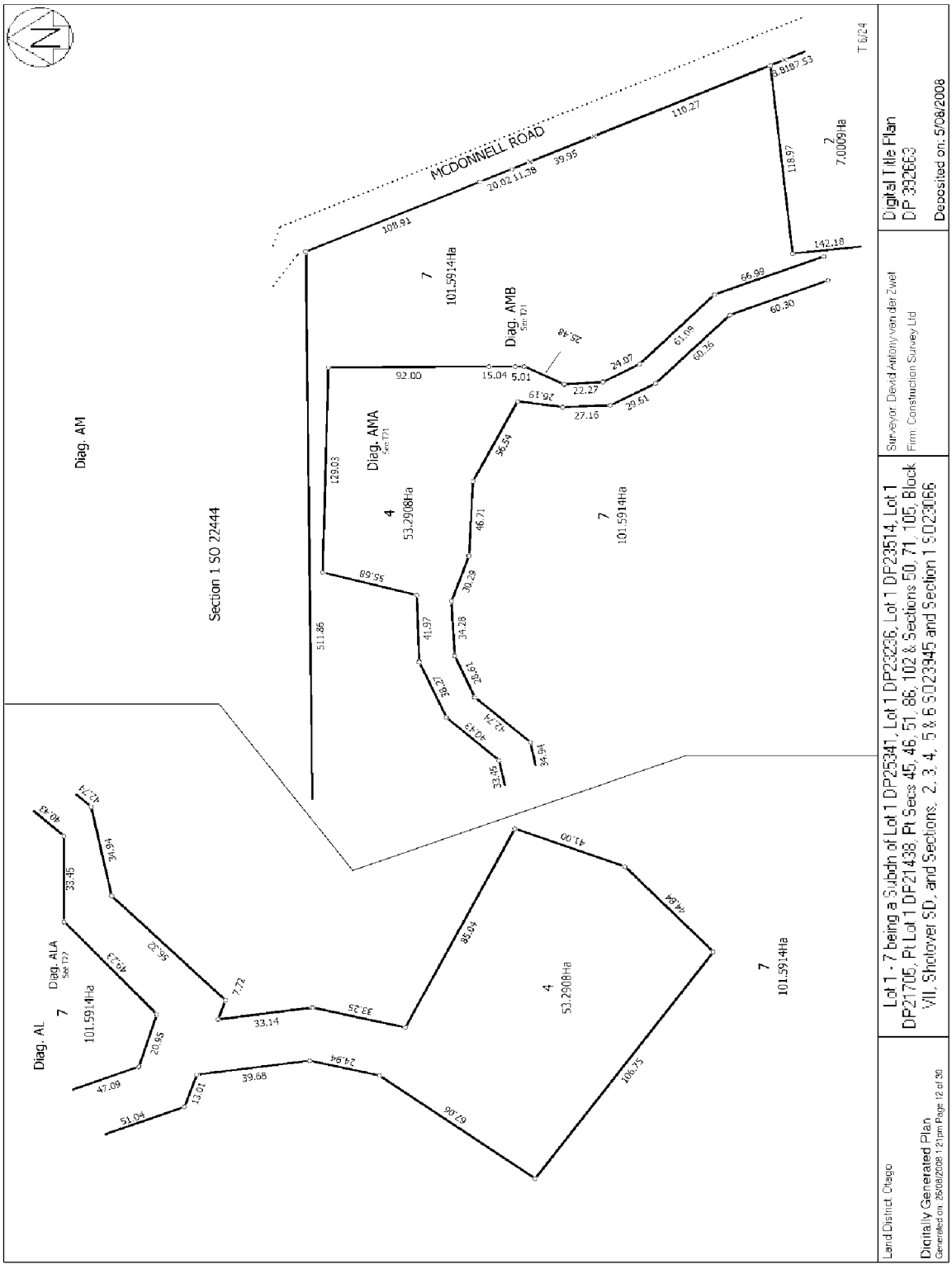
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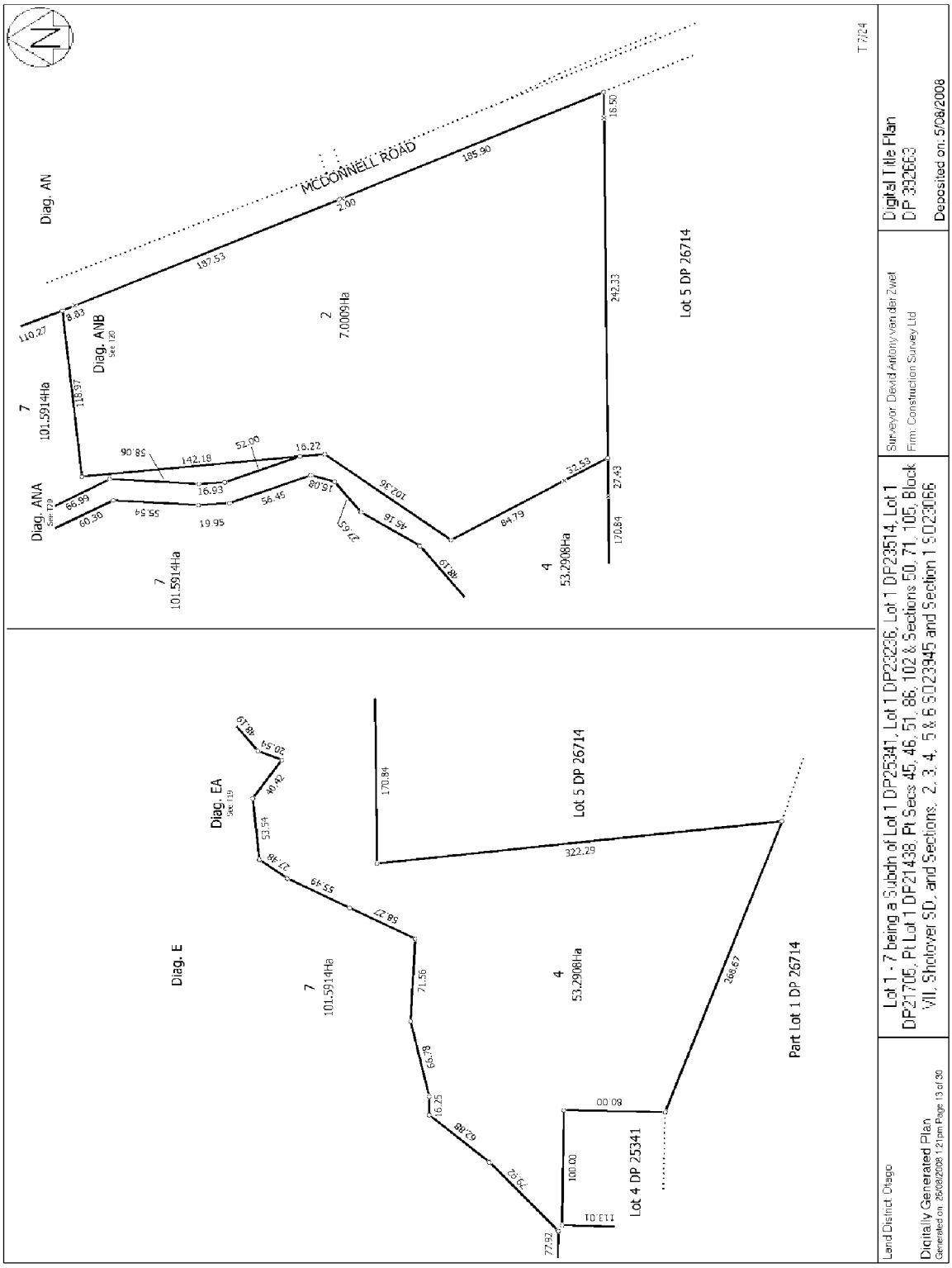

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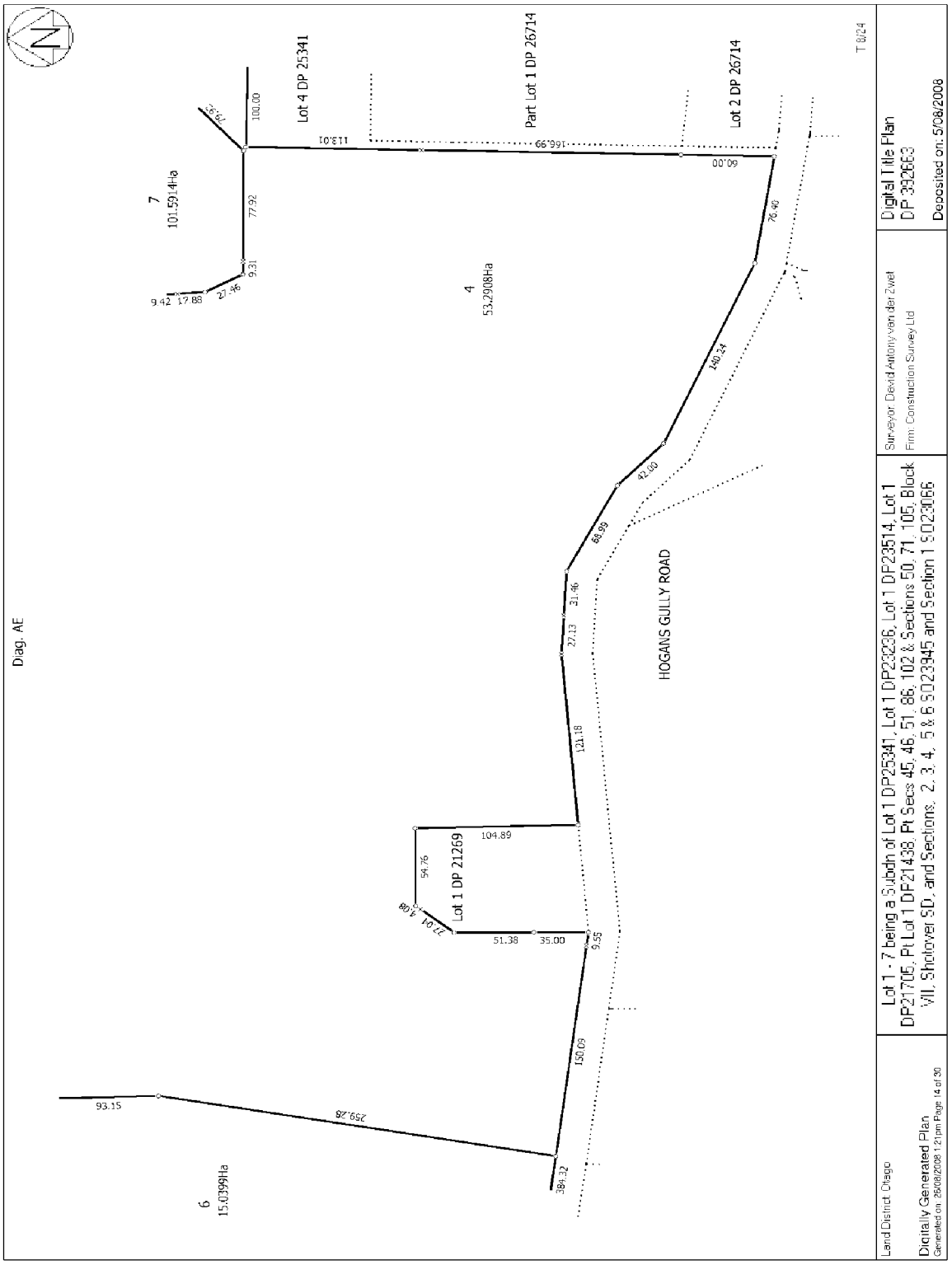

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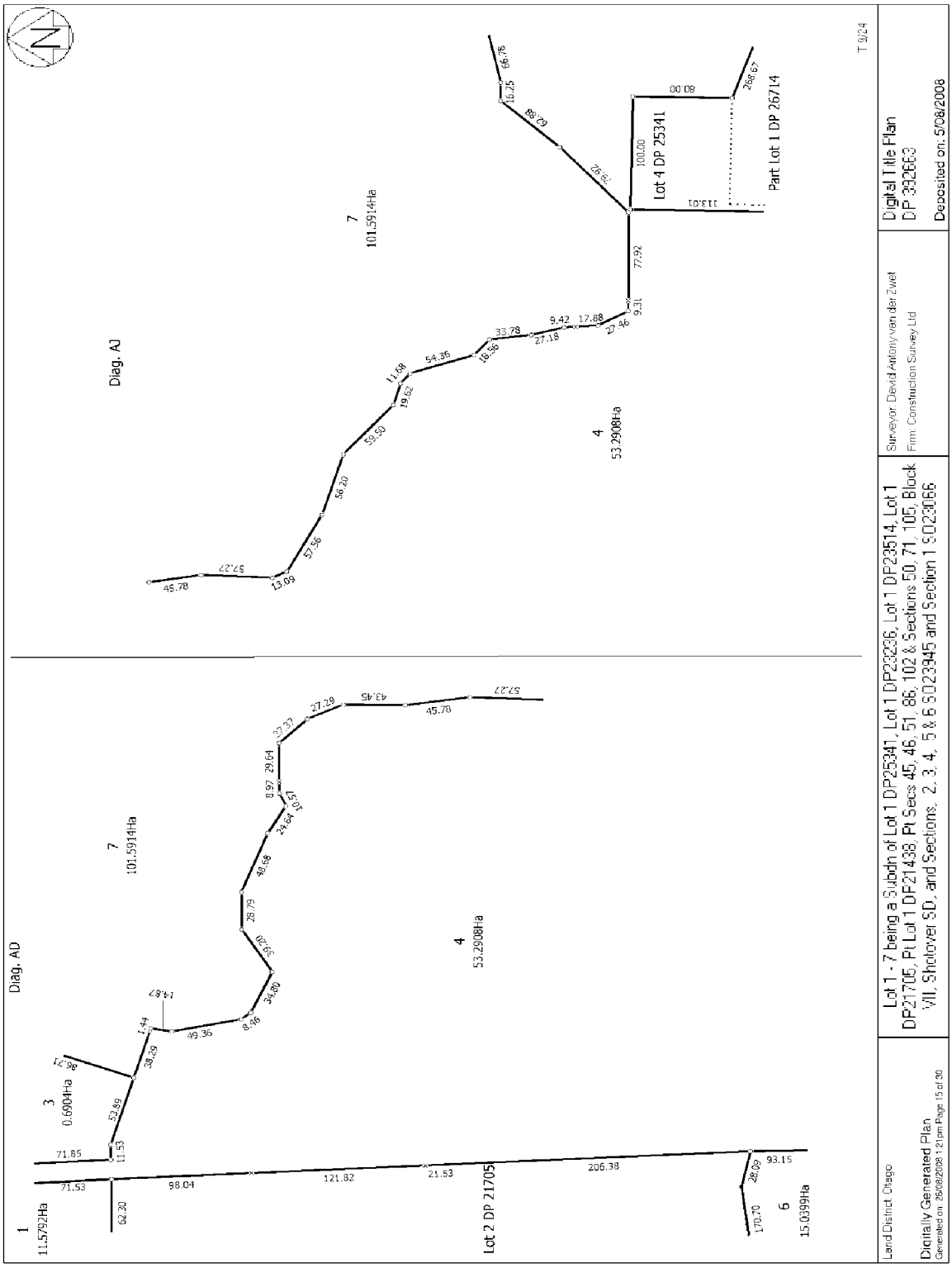

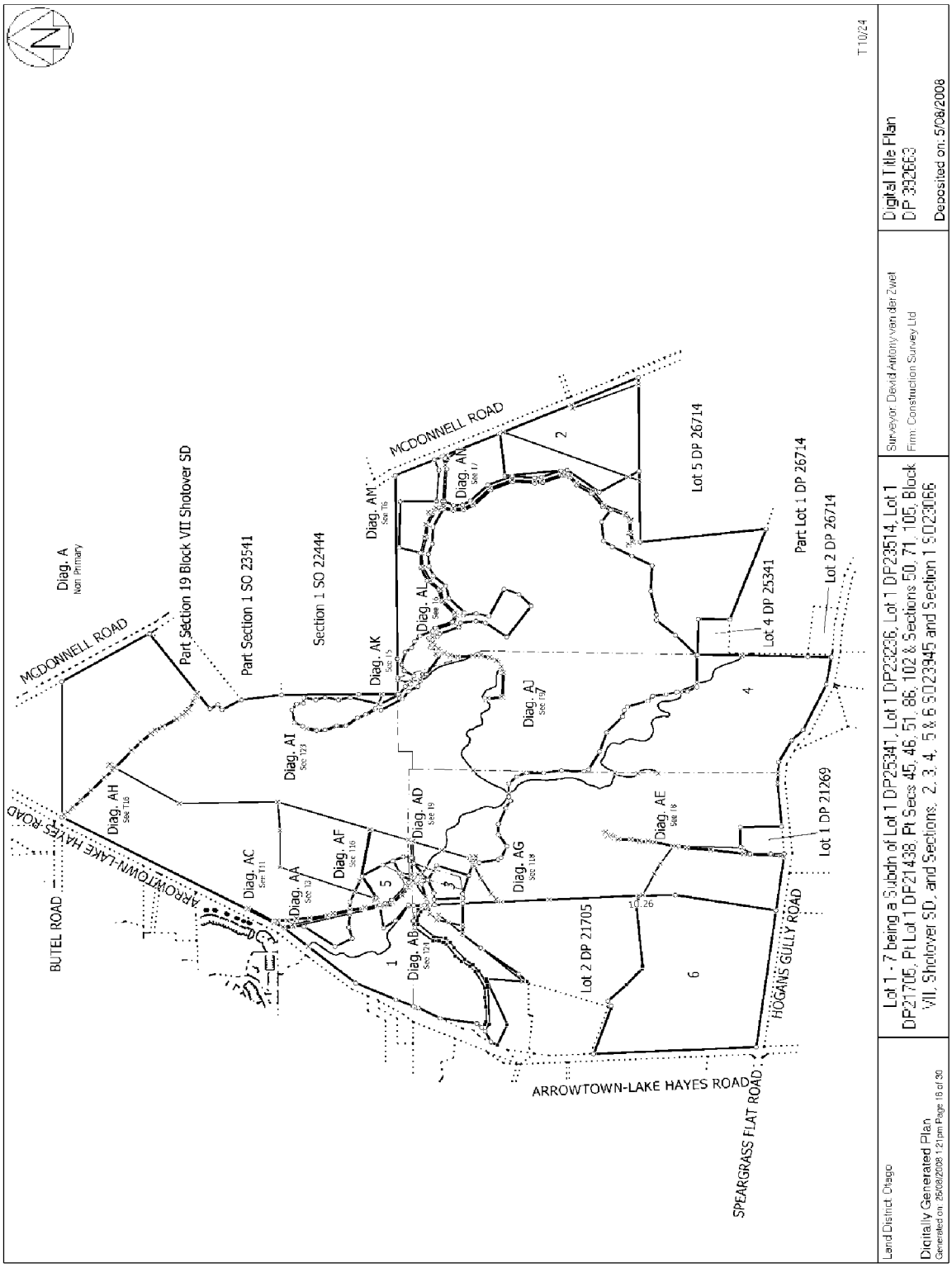
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Sec 118
Diag. AB
Sec 123
Diag. AE
Sec 18
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ARROWTOWN-LAKE HAYES ROAD
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Lot 4 DP 25341
Part Lot 1 DP 26714
Lot 2 DP 26714
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SPEARGRASS FLAT ROAD
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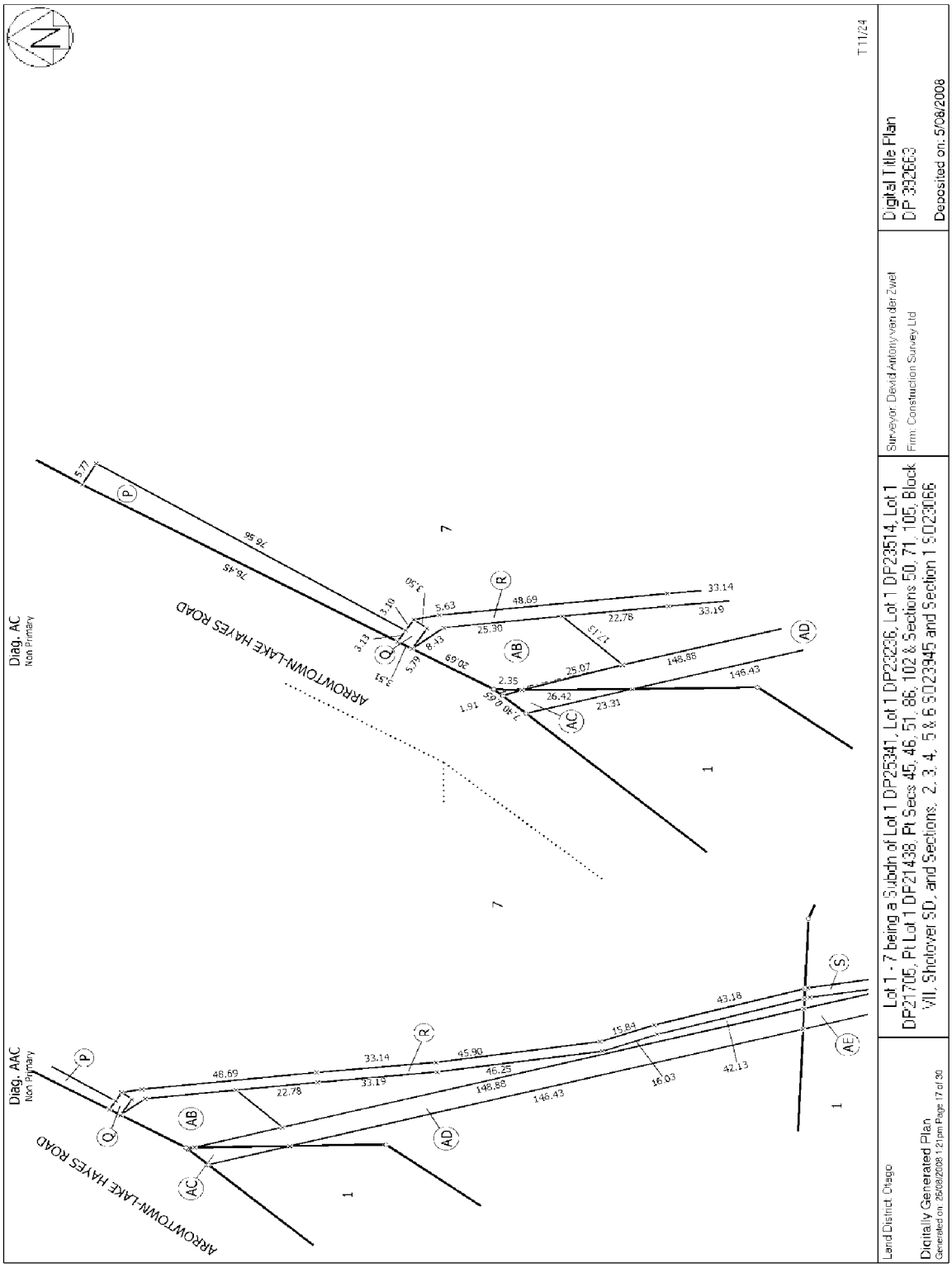

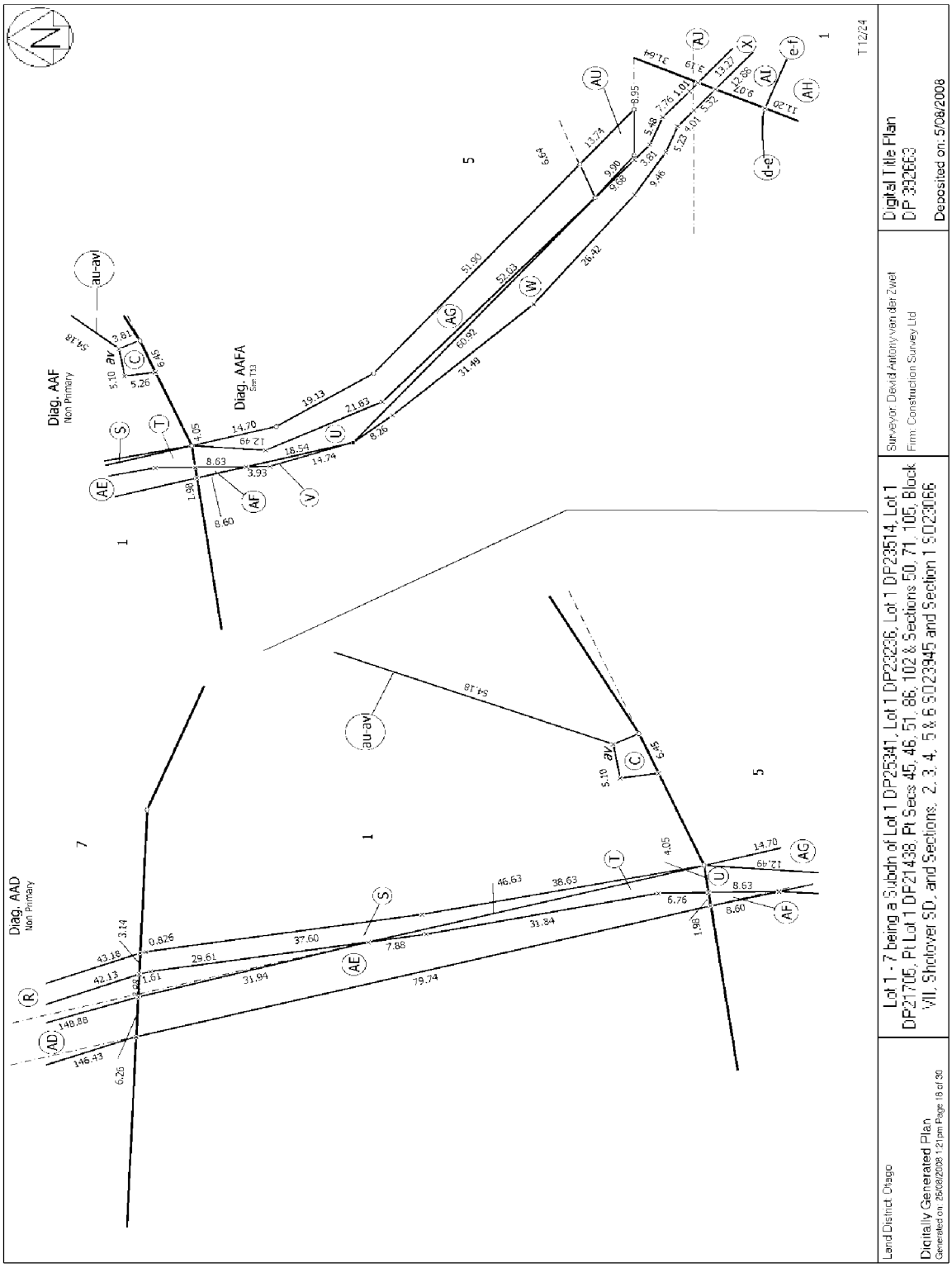
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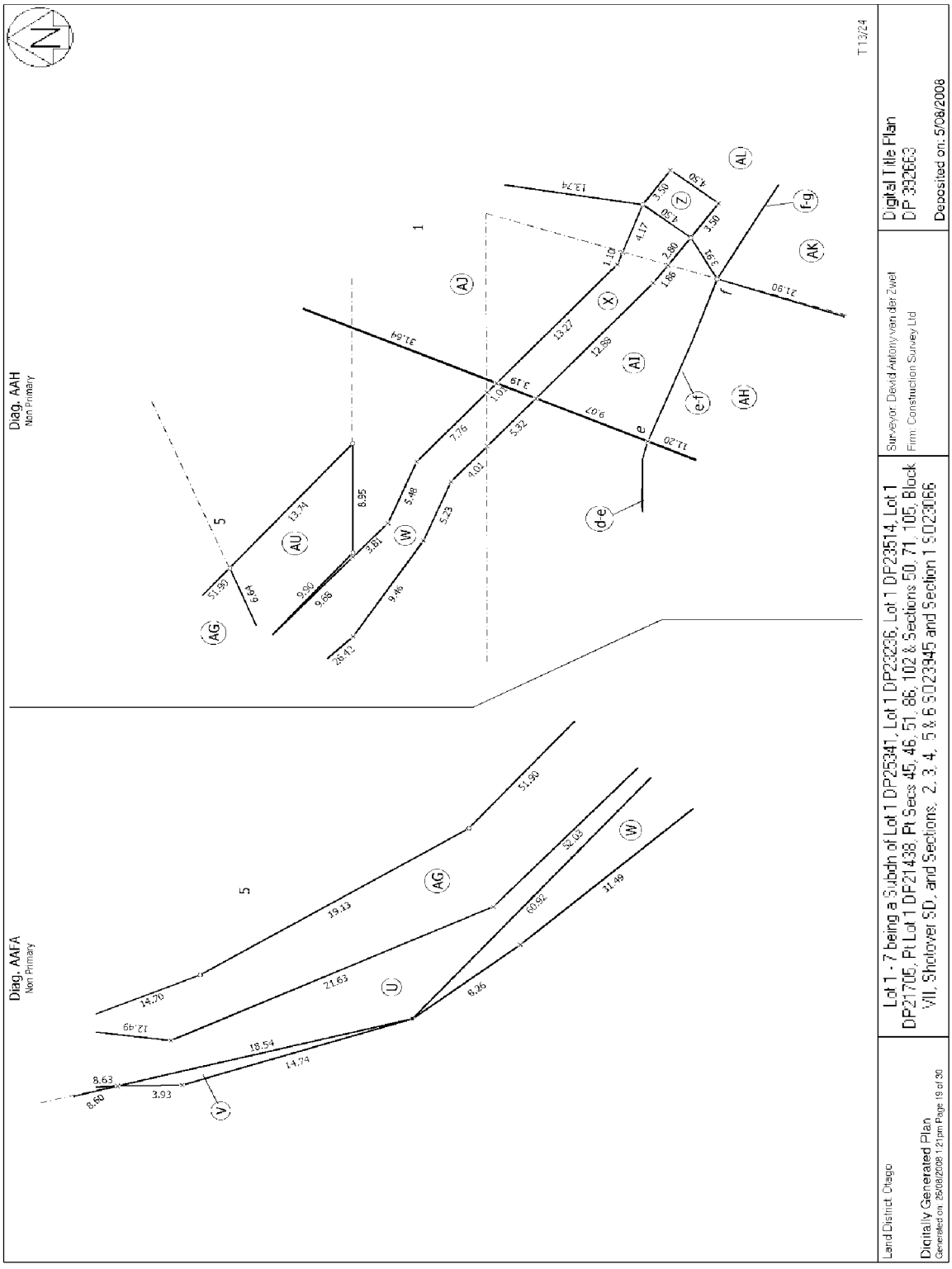
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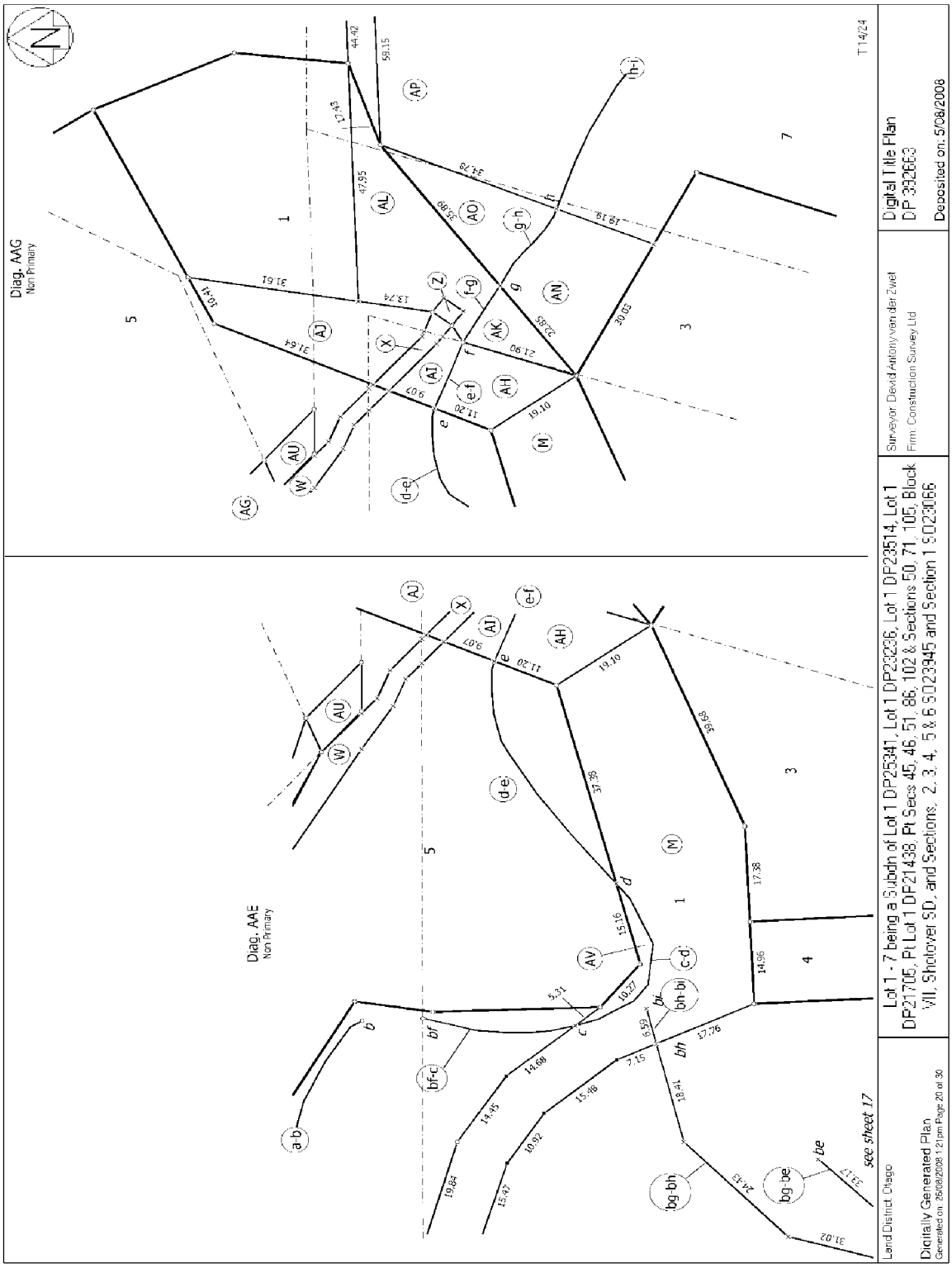

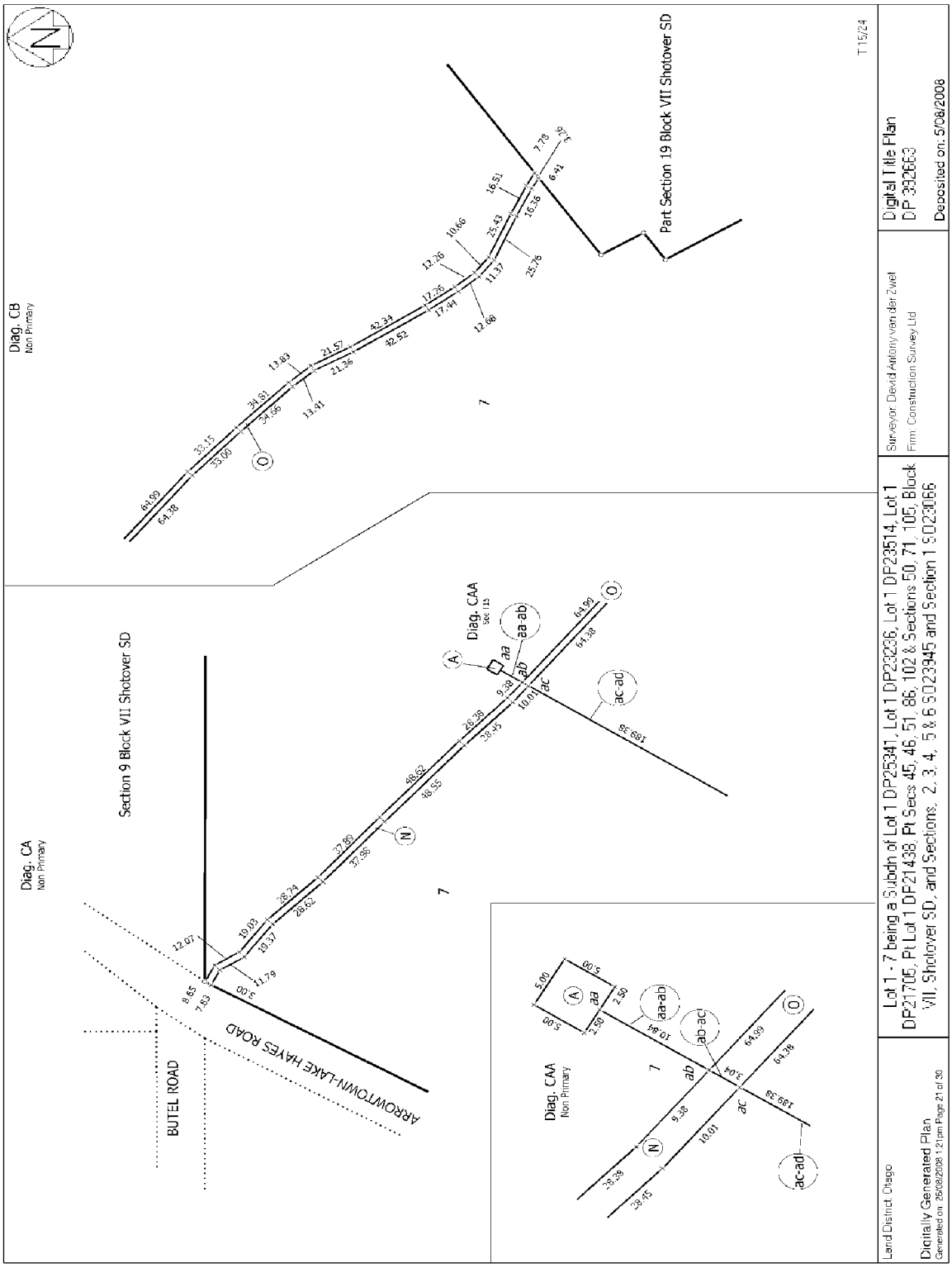
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BUTEL ROAD
ARROWTOWN-LAKE HAYES ROAD
Diag. CAA
Non Primary
Digital Title Plan
DP 392663
Deposited on: 5/08/2008
Surveyor: David Antony van der Zwet
Firm: Construction Survey Ltd
Lot 1 - 7 being a Subdn of Lot 1 DP25341, Lot 1 DP233236, Lot 1 DP233514, Lot 1 DP21705, Pt Lot 1 DP21438, Pt Secs 45, 46, 51, 86, 102 & Sections 50, 71, 105, Block VII, Shotover SD, and Sections 2, 3, 4, 5 & 6 SO23945 and Section 1 SO23066
Land District: Otago
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Generated on: 28/08/2008 1:21pm Page 21 of 30

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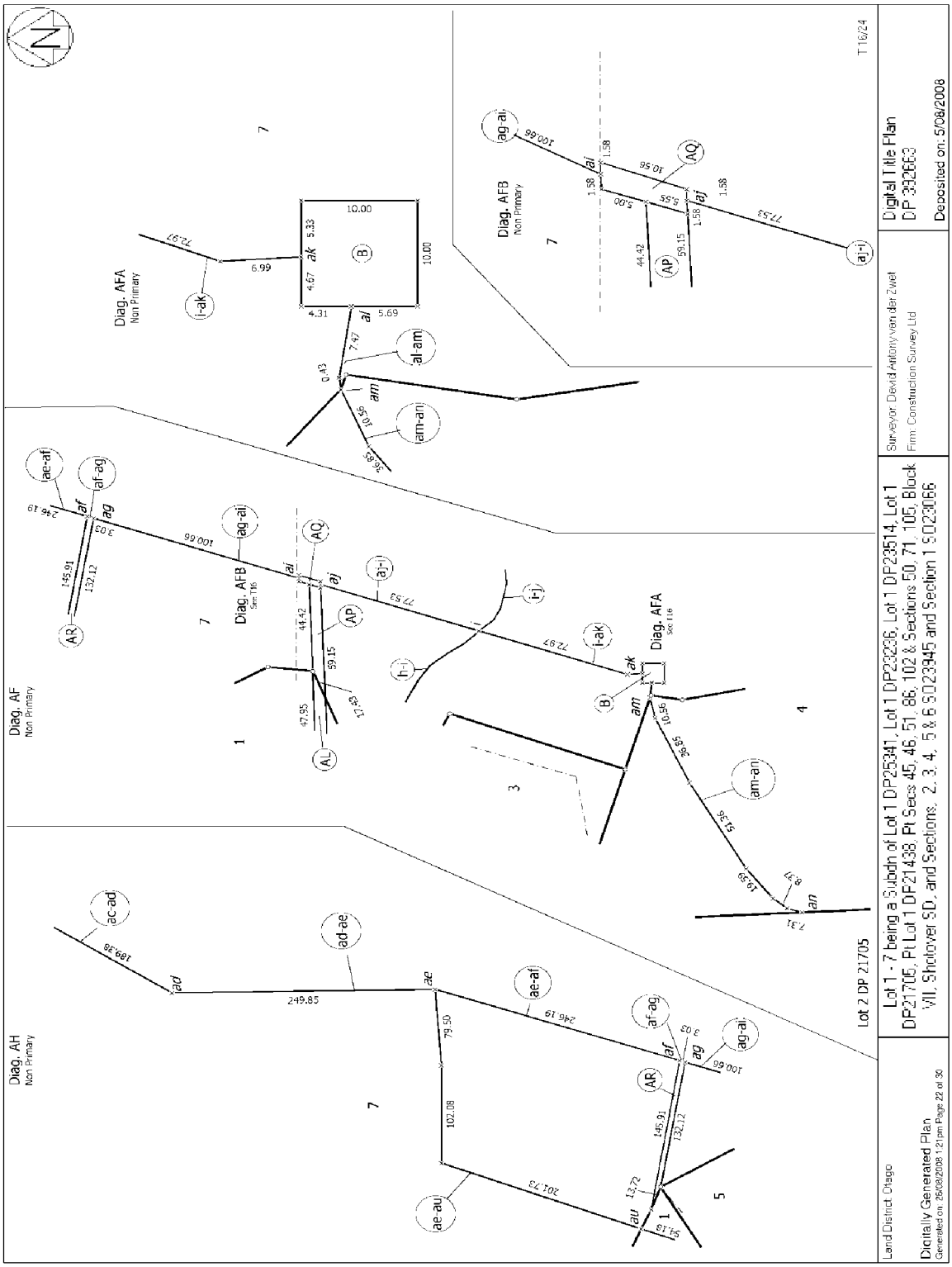

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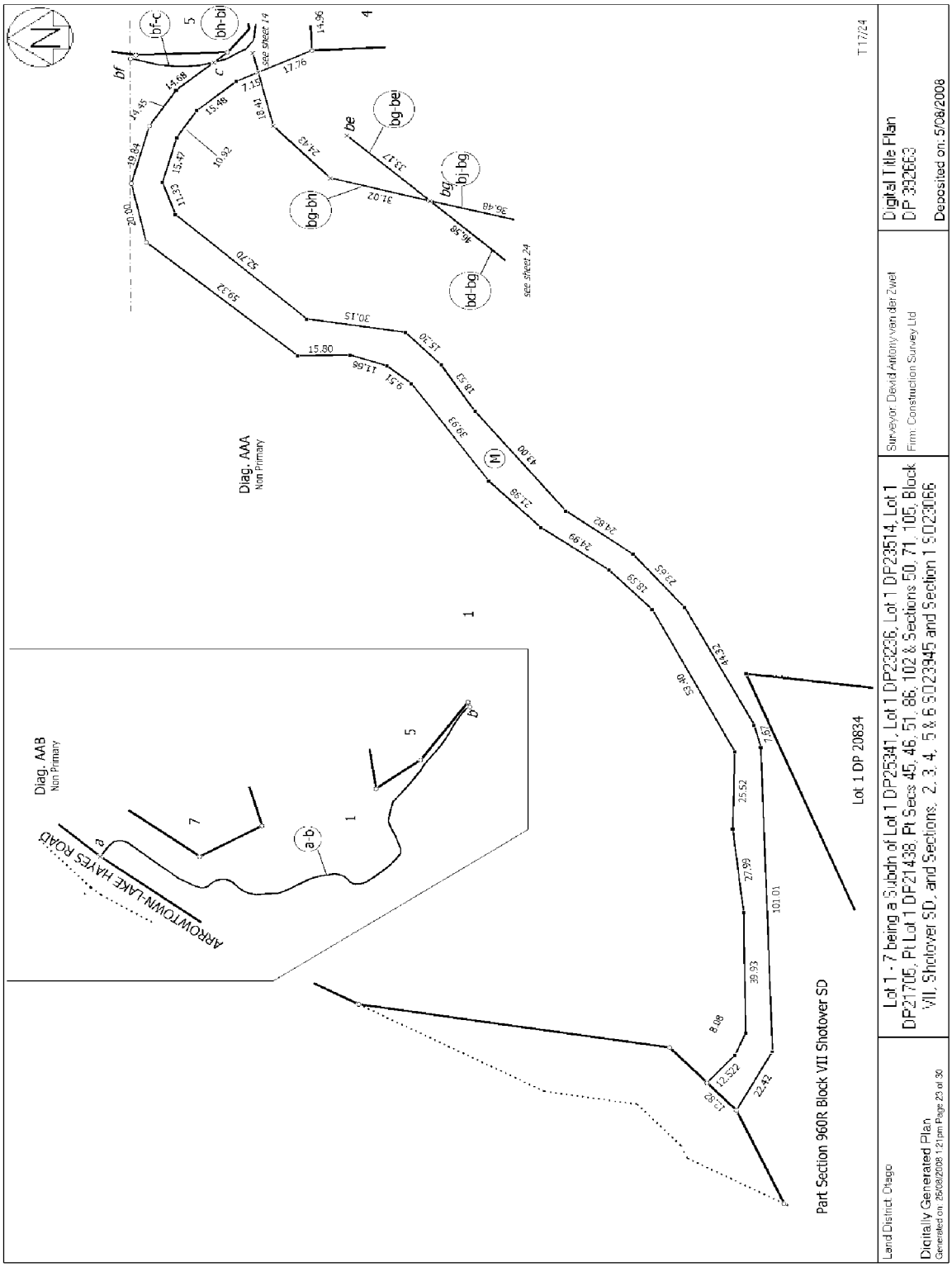

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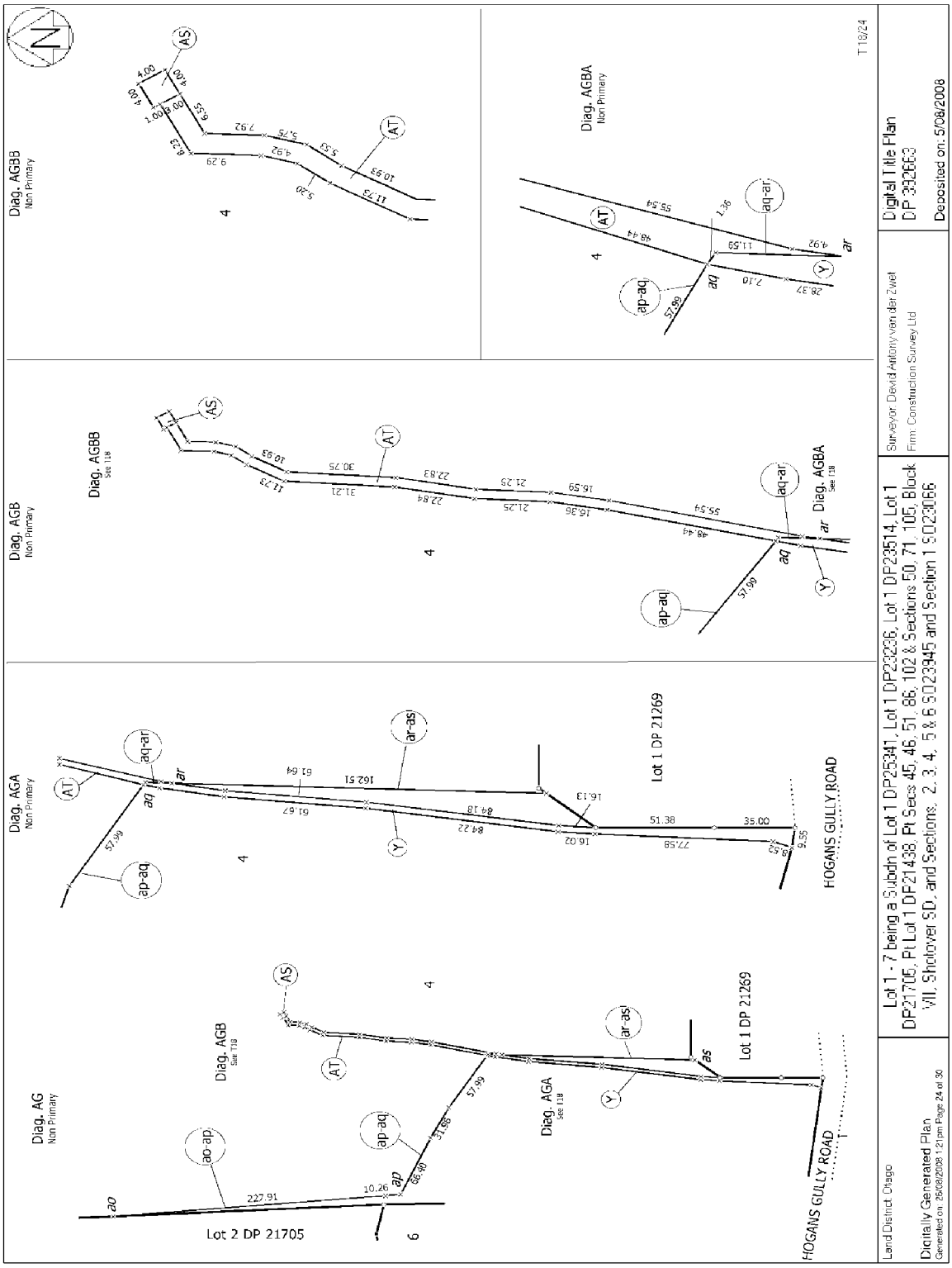

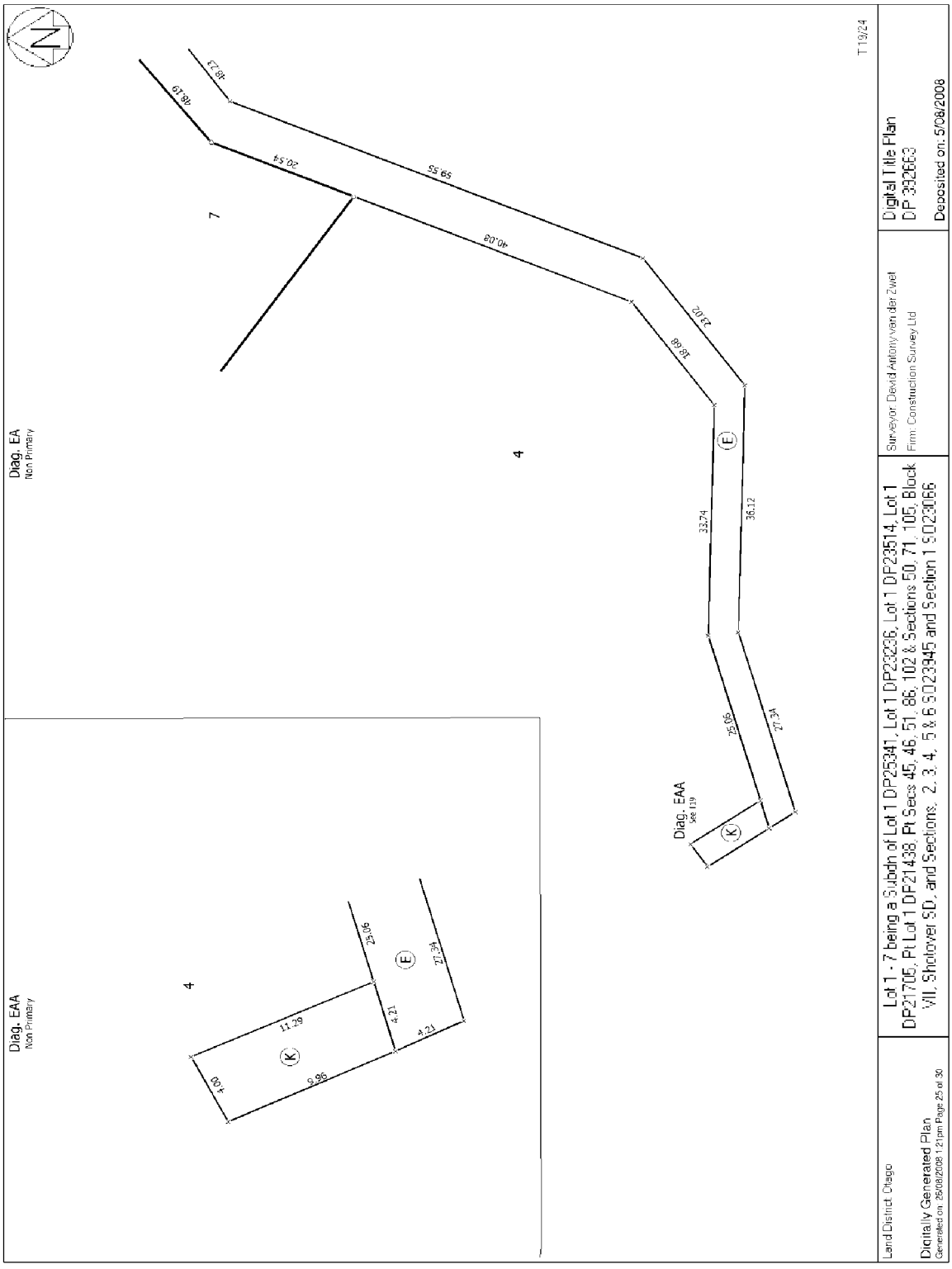
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Land District Otago
Digitally Generated Plan
Generated on 28/08/2008 1:21pm Page 25 of 30
Lot 1 - 7 being a Subdn of Lot 1 DP25341, Lot 1 DP23236, Lot 1 DP23514, Lot 1 DP21705, Pt Lot 1 DP21438, Pt Secs 45, 46, 51, 86, 102 & Sections 50, 71, 105, Block VII, Shotover SD, and Sections 2, 3, 4, 5 & 6 SO23945 and Section 1 SO23066
Surveyor David Antony van der Zwet
Firm Construction Survey Ltd
Digital Title Plan
DP 392663
Deposited on: 5/08/2008

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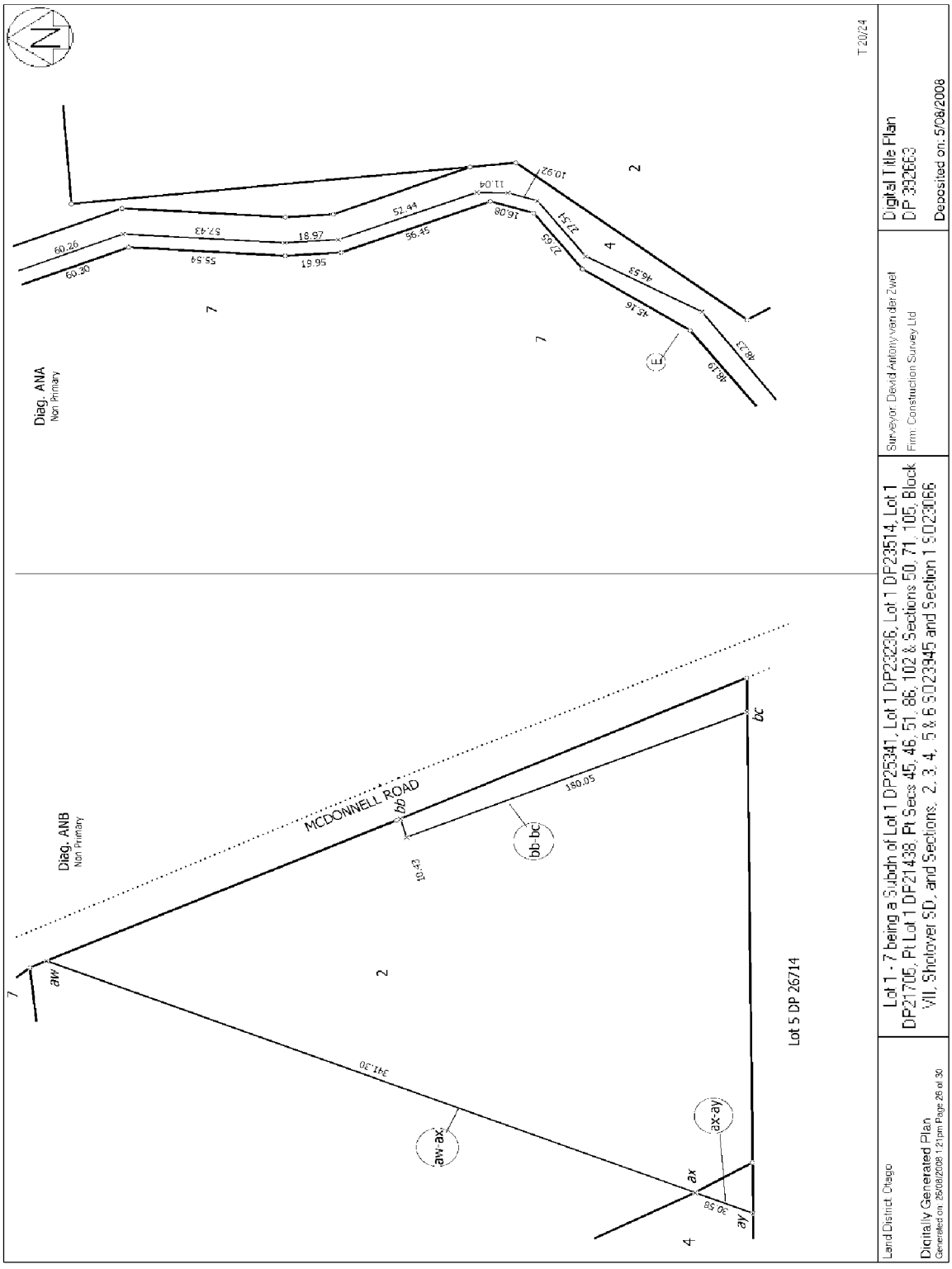

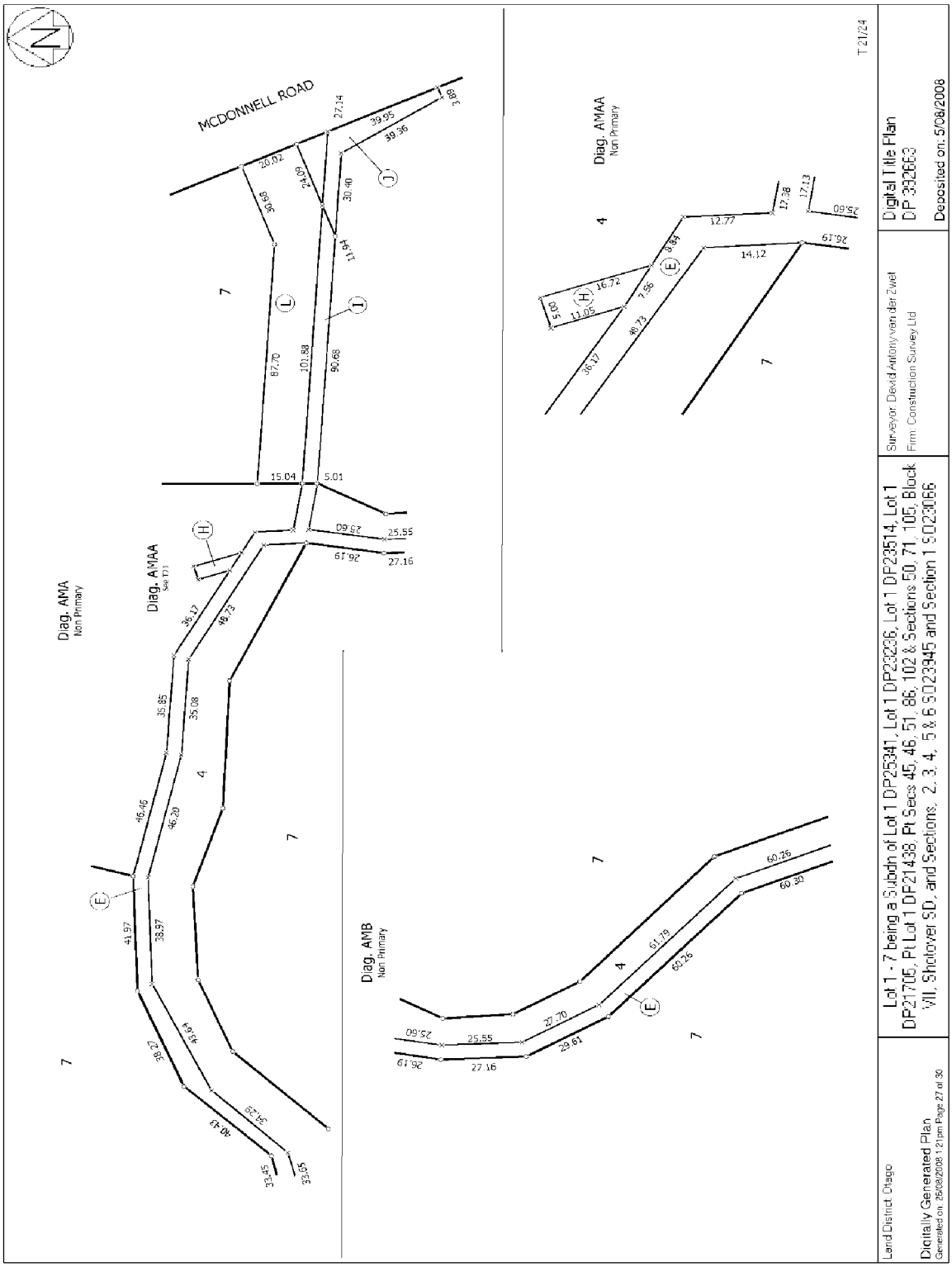
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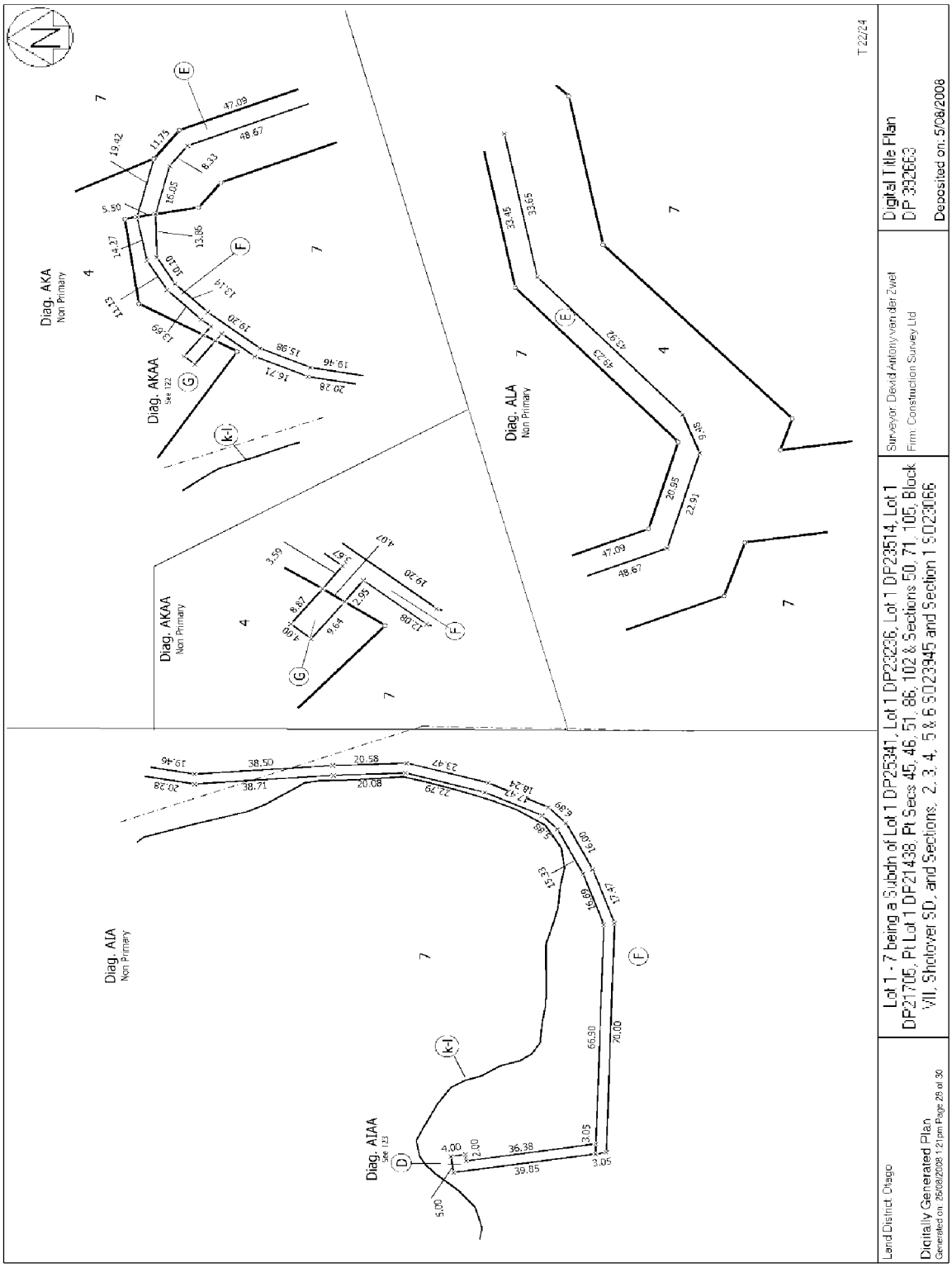
Digitally Generated Plan
Generated on 25/08/2008 1:21pm Page 27 of 30
Lot 1 - 7 being a Subdn of Lot 1 DP25341, Lot 1 DP23236, Lot 1 DP23514, Lot 1 DP21705, Pt Lot 1 DP21438, Pt Secs 45, 46, 51, 86, 102 & Sections 50, 71, 105, Block VII, Shotover SD, and Sections 2, 3, 4, 5 & 6 SO23945 and Section 1 SO23066
Surveyor David Antony van der Zwet
Firm Construction Survey Ltd
Digital Title Plan
DP 392663
Deposited on: 5/08/2008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Diag. AIAA
See 123
T 22/24
Land District Otago
Digitally Generated Plan
Generated on 25/08/2008 1:21pm Page 28 of 30
Lot 1 - 7 being a Subdn of Lot 1 DP25341, Lot 1 DP23236, Lot 1 DP23514, Lot 1 DP21705, Pt Lot 1 DP21438, Pt Secs 45, 46, 51, 86, 102 & Sections 50, 71, 105, Block VII, Shotover SD, and Sections 2, 3, 4, 5 & 6 SO23945 and Section 1 SO23066
Surveyor David Antony van der Zwet
Firm Construction Survey Ltd
Digital Title Plan
DP 392663
Deposited on: 5/08/2008

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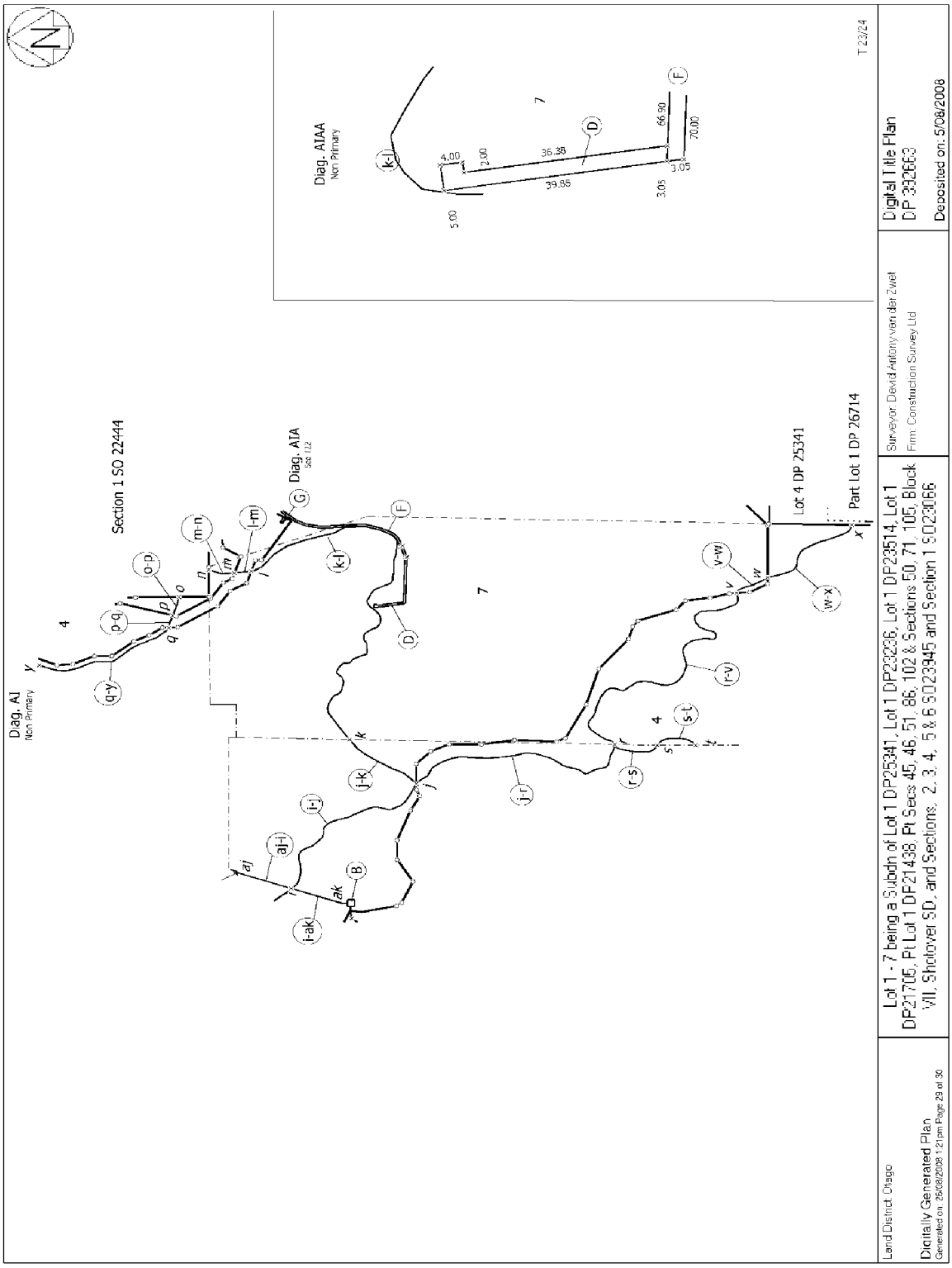

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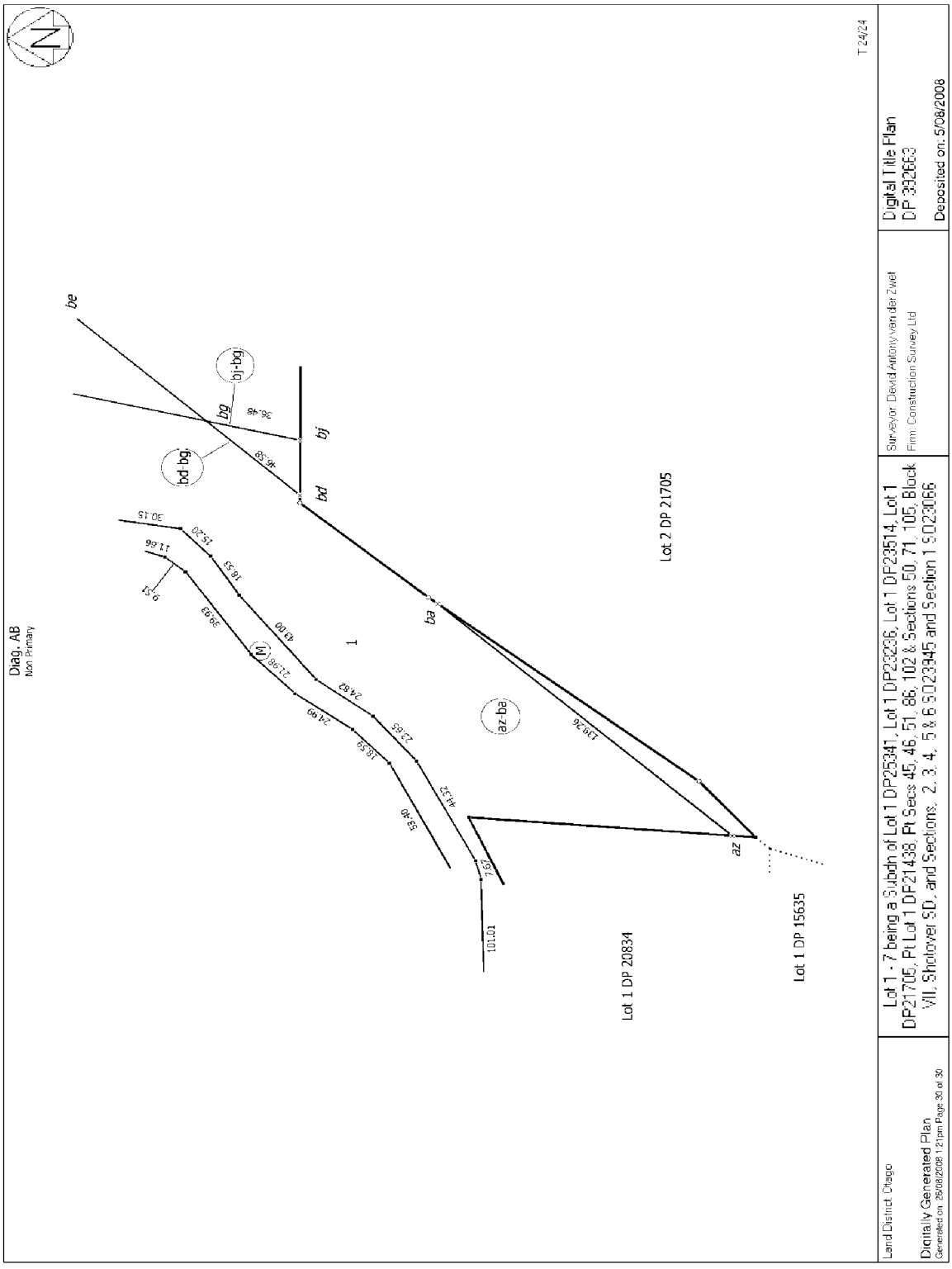

Appendix C

Soil Profile Logs

SOIL PROFILE LOGS

PROJECT NUMBER: 15063 | FIELD STAFF: Fiona R and Rebecca T | DATE: 24,25,28/9/2015
SITE NAME: The Hills Golf Course | METHOD: Spade | WEATHER: Fine and windy

Sample Location	Coordinates		Sample Depth (m)	Sample ID	Soil Lithology
A3-1	-44.953668	168.831457	0-0.1	A3-1 (0.1) 15063	Medium greyish brown LOAM with gravels and organic matter
A3-2	-44.953835	168.831510	0-0.1	A3-2 (0.1) 15063	Medium greyish brown LOAM with gravels and organic matter
A3-3	-44.953970	168.831552	0-0.1	A3-3 (0.1) 15063	Medium greyish brown LOAM with gravels and organic matter
A3-4	-44.953995	168.831353	0-0.1	A3-4 (0.1) 15063	Medium greyish brown LOAM with gravels and organic matter
A3-5	-44.953839	168.831282	0-0.1	A3-5 (0.1) 15063	Medium greyish brown LOAM with gravels and organic matter
A3-6	-44.953704	168.831248	0-0.1	A3-6 (0.1) 15063	Medium greyish brown LOAM with gravels and organic matter
A2-1	-44.952248	168.829444	0-0.1	A2-1 (0.1) 15063	Medium brown LOAM with fine gravels and organic matter
A2-2	-44.952175	168.829619	0-0.1	A2-2 (0.1) 15063	Medium brown LOAM with organic matter
A2-3	-44.952318	168.829634	0-0.1	A2-3 (0.1) 15063	Medium brown LOAM with organic matter
A2-4	-44.951990	168.829387	0-0.1	A2-4 (0.1) 15063	Medium brown LOAM with gravels and organic matter
A2-5	-44.951771	168.829472	0-0.1	A2-5 (0.1) 15063	Medium brown LOAM with gravels and organic matter
A2-6	-44.951561	168.829553	0-0.1	A2-6 (0.1) 15063	Medium brown LOAM with gravels and organic matter
A2-7	-44.951644	168.829276	0-0.1	A2-7 (0.1) 15063	Medium brown LOAM with gravels and organic matter
A2-8	-44.951444	168.829274	0-0.1	A2-8 (0.1) 15063	Medium brown LOAM with gravels and organic matter
A2-9	-44.951235	168.829287	0-0.1	A2-9 (0.1) 15063	Medium brown LOAM with gravels and organic matter
A8-1	-44.947848	168.831629	0-0.1	A8-1 (0.1) 15063	Medium brown clayey SILT with fine gravels
A8-2	-44.947711	168.831499	0-0.1	A8-2 (0.1) 15063	Medium brown clayey SILT with coarse gravels
A8-3	-44.947577	168.831411	0-0.1	A8-3 (0.1) 15063	Medium brown clayey SILT with fine to coarse gravels
A8-4	-44.947435	168.831273	0-0.1	A8-4 (0.1) 15063	Medium brown clayey SILT with fine to coarse gravels
A8-5	-44.947329	168.831179	0-0.1	A8-5 (0.1) 15063	Medium brown clayey SILT with fine to coarse gravels
A8-6	-44.947474	168.830918	0-0.1	A8-6 (0.1) 15063	Medium brown clayey SILT with fine gravels
A8-7	-44.947569	168.831119	0-0.1	A8-7 (0.1) 15063	Medium brown clayey SILT with fine gravels
A8-8	-44.947707	168.831225	0-0.1	A8-8 (0.1) 15063	Medium brown clayey SILT with fine gravels
A8-9	-44.947828	168.831324	0-0.1	A8-9 (0.1) 15063	Medium brown clayey SILT with fine gravels
A7-1	-44.958514	168.835761	0-0.1	A7-1 (0.1) 15063	Medium brown clayey SILT with organic matter
A7-2	-44.958823	168.835456	0-0.1	A7-2 (0.1) 15063	Medium brown clayey SILT with cobbles and organic matter
A7-3	-44.959060	168.835291	0-0.1	A7-3 (0.1) 15063	Medium brown clayey SILT with organic matter
A7-4	-44.958855	168.834986	0-0.1	A7-4 (0.1) 15063	Greyish brown LOAM with gravels, cobbles and organic matter
A7-5	-44.958668	168.835221	0-0.1	A7-5 (0.1) 15063	Medium brown clayey SILT with organic matter
A7-6	-44.958383	168.835514	0-0.1	A7-6 (0.1) 15063	Medium brown clayey SILT with gravels and organic matter
A6-1	-44.957233	168.832233	0-0.1	A6-1 (0.1) 15063	Medium brown clayey SILT with organic matter
A6-2	-44.956790	168.832294	0-0.1	A6-2 (0.1) 15063	Medium brown clayey SILT with organic matter

Sample Location	Coordinates		Sample Depth (m)	Sample ID	Soil Lithology
A6-3	-44.957045	168.832857	0-0.1	A6-3 (0.1) 15063	Medium brown clayey SILT with organic matter
A5-1	-44.955807	168.833495	0-0.1	A5-1 (0.1) 15063	Medium brown clayey SILT with organic matter
A5-2	-44.956240	168.833301	0-0.1	A5-2 (0.1) 15063	Medium brown clayey SILT with organic matter
A5-3	-44.956673	168.833189	0-0.1	A5-3 (0.1) 15063	Medium brown clayey SILT with organic matter
A5-4	-44.956309	168.832755	0-0.1	A5-4 (0.1) 15063	Medium brown clayey SILT with organic matter
A5-5	-44.955871	168.832863	0-0.1	A5-5 (0.1) 15063	Medium brown clayey SILT with organic matter
A5-6	-44.955586	168.832862	0-0.1	A5-6 (0.1) 15063	Medium brown clayey SILT with organic matter
A4-1	-44.955690	168.835327	0-0.1	A4-1 (0.1) 15063	Medium brown clayey SILT with gravels, cobbles and organic matter
A4-2	-44.956006	168.835100	0-0.1	A4-2 (0.1) 15063	Medium brown clayey SILT with organic matter
A4-3	-44.955667	168.834969	0-0.1	A4-3 (0.1) 15063	Medium brown clayey SILT with gravels and organic matter
A4-4	-44.955321	168.835028	0-0.1	A4-4 (0.1) 15063	Medium brown clayey SILT with organic matter
A4-5	-44.955217	168.834884	0-0.1	A4-5 (0.1) 15063	Medium brown LOAM with fine gravels and organic matter
A4-6	-44.955335	168.834701	0-0.1	A4-6 (0.1) 15063	Medium brown clayey SILT with gravels and organic matter
A4-7	-44.954172	168.834888	0-0.1	A4-7 (0.1) 15063	Medium brown LOAM with fine gravels and organic matter
A4-8	-44.954224	168.834564	0-0.1	A4-8 (0.1) 15063	Medium brown clayey SILT with organic matter
A4-9	-44.954365	168.834468	0-0.1	A4-9 (0.1) 15063	Medium brown clayey SILT with organic matter
A4-10	-44.954744	168.834722	0-0.1	A4-10 (0.1) 15063	Medium brown clayey SILT with gravels and organic matter
A4-11	-44.954820	168.835265	0-0.1	A4-11 (0.1) 15063	Medium brown clayey SILT with organic matter
A4-12	-44.954591	168.835174	0-0.1	A4-12 (0.1) 15063	Medium brown clayey SILT with organic matter
A4-13	-44.954107	168.833959	0-0.1	A4-13 (0.1) 15063	Medium brown clayey SILT with gravels, cobbles and organic matter
A4-14	-44.953946	168.833738	0-0.1	A4-14 (0.1) 15063	Medium brown clayey SILT with gravels and organic matter
A4-15	-44.953924	168.833929	0-0.1	A4-15 (0.1) 15063	Medium brown clayey SILT with organic matter
A1-1	-44.954958	168.828345	0-0.15	A1-1 (0.15) 15063	Medium greish brown clayey SILT with pine litter
A1-2	-44.955106	168.828588	0-0.15	A1-2 (0.15) 15063	Medium greish brown clayey SILT with gravels and pine litter
A1-3	-44.955221	168.828875	0-0.15	A1-3 (0.15) 15063	Medium greish brown clayey SILT with gravels and pine litter
A1-4	-44.955259	168.829018	0-0.15	A1-4 (0.15) 15063	Medium greish brown clayey SILT with gravels and pine litter
A1-5	-44.955465	168.829288	0-0.15	A1-5 (0.15) 15063	Medium greish brown clayey SILT with gravels and pine litter
A1-6	-44.955578	168.829575	0-0.15	A1-6 (0.15) 15063	Medium greish brown clayey SILT with gravels and pine litter
A1-7	-44.955586	168.829760	0-0.15	A1-7 (0.15) 15063	Friabel medium greish brown clayey SILT with gravels and pine litter
A1-8	-44.955614	168.830152	0-0.15	A1-8 (0.15) 15063	Medium greish brown clayey SILT with gravels and pine litter
A1-9	-44.955653	168.830382	0-0.15	A1-9 (0.15) 15063	Medium greish brown clayey SILT with pine litter
A10-1	-44.955033	168.823013	0-0.1	A10-1 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-2	-44.955333	168.823038	0-0.1	A10-2 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-3	-44.955647	168.823123	0-0.1	A10-3 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-4	-44.955664	168.823496	0-0.1	A10-4 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-5	-44.955412	168.823418	0-0.1	A10-5 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-6	-44.955122	168.823285	0-0.1	A10-6 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-7	-44.956763	168.823309	0-0.1	A10-7 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-8	-44.956427	168.823278	0-0.1	A10-8 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-9	-44.956144	168.823275	0-0.1	A10-9 (0.1) 15063	Medium brown clayey SILT with organic matter

Sample Location	Coordinates		Sample Depth (m)	Sample ID	Soil Lithology
A10-10	-44.956121	168.823591	0-0.1	A10-10 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-11	-44.956425	168.823663	0-0.1	A10-11 (0.1) 15063	Medium brown clayey SILT with organic matter
A10-12	-44.956729	168.823741	0-0.1	A10-12 (0.1) 15063	Medium brown clayey SILT with organic matter
A9-1	-44.954633	168.823664	0-0.1	A9-1 (0.1) 15063	Medium brown clayey SILT with organic matter
A9-2	-44.954564	168.823423	0-0.1	A9-2 (0.1) 15063	Medium brown clayey SILT with organic matter
A9-3	-44.954489	168.823343	0-0.1	A9-3 (0.1) 15063	Medium brown clayey SILT with organic matter
A9-4	-44.954154	168.823652	0-0.1	A9-4 (0.1) 15063	Medium brown clayey SILT with organic matter
A9-5	-44.954349	168.823505	0-0.1	A9-5 (0.1) 15063	Medium brown clayey SILT with organic matter
A9-6	-44.954126	168.823430	0-0.1	A9-6 (0.1) 15063	Medium brown clayey SILT with organic matter
HS10-1	-44.957237	168.826610	0-0.1	HS10-1 (0.1) 15063	Medium brown clayey SILT with organic matter
HS10-2	-44.957368	168.826526	0-0.1	HS10-2 (0.1) 15063	Medium brown clayey SILT with organic matter
HS10-3	-44.957455	168.826470	0-0.1	HS10-3 (0.1) 15063	Medium brown clayey SILT with organic matter
HS10-4	-44.957476	168.826727	0-0.1	HS10-4 (0.1) 15063	Medium brown clayey SILT with organic matter
HS10-5	-44.957371	168.826759	0-0.1	HS10-5 (0.1) 15063	Medium brown clayey SILT with organic matter
HS10-6	-44.957254	168.826893	0-0.1	HS10-6 (0.1) 15063	Medium brown clayey SILT with organic matter
HS5-1	-44.958729	168.829504	0-0.1	HS5-1 (0.1) 15063	Medium brown clayey SILT with organic matter
HS5-2	-44.958619	168.829401	0-0.1	HS5-2 (0.1) 15063	Medium brown clayey SILT with gravels and organic matter
HS5-3	-44.958713	168.829218	0-0.1	HS5-3 (0.1) 15063	Medium brown clayey SILT with organic matter
HS5-4	-44.958604	168.829136	0-0.1	HS5-4 (0.1) 15063	Medium brown clayey SILT with organic matter
HS5-5	-44.958445	168.829111	0-0.1	HS5-5 (0.1) 15063	Medium brown clayey SILT with organic matter
HS5-6	-44.958488	168.829321	0-0.1	HS5-6 (0.1) 15063	Medium brown clayey SILT with organic matter
HS9-1	-44.958347	168.828034	0-0.1	HS9-1 (0.1) 15063	Medium brown clayey SILT with organic matter
HS9-2	-44.958503	168.828061	0-0.1	HS9-2 (0.1) 15063	Medium brown clayey SILT with fine sand and organic matter
HS9-3	-44.958771	168.828020	0-0.1	HS9-3 (0.1) 15063	Medium brown clayey SILT with organic matter
HS9-4	-44.958834	168.828350	0-0.1	HS9-4 (0.1) 15063	Medium brown clayey SILT with organic matter
HS9-5	-44.958559	168.828370	0-0.1	HS9-5 (0.1) 15063	Medium brown clayey SILT with organic matter
HS9-6	-44.958317	168.828272	0-0.1	HS9-6 (0.1) 15063	Medium brown clayey SILT with organic matter
HS1-1	-44.960687	168.834866	0-0.1	HS1-1 (0.1) 15063	Medium brown clayey SILT with organic matter
HS1-2	-44.960735	168.834694	0-0.1	HS1-2 (0.1) 15063	Medium brown clayey SILT with organic matter
HS1-3	-44.960715	168.834485	0-0.1	HS1-3 (0.1) 15063	Medium brown clayey SILT with fine gravels and organic matter
HS1-4	-44.960548	168.834513	0-0.1	HS1-4 (0.1) 15063	Medium brown clayey SILT with organic matter
HS1-5	-44.960491	168.834695	0-0.1	HS1-5 (0.1) 15063	Medium brown clayey SILT with organic matter
HS1-6	-44.960471	168.834898	0-0.1	HS1-6 (0.1) 15063	Medium brown clayey SILT with organic matter
HS8-1	-44.959593	168.832855	0-0.1	HS8-1 (0.1) 15063	Medium brown clayey SILT with organic matter
HS8-2	-44.959633	168.833053	0-0.1	HS8-2 (0.1) 15063	Medium brown clayey SILT with organic matter
HS8-3	-44.959637	168.833244	0-0.1	HS8-3 (0.1) 15063	Medium brown clayey SILT with weathered schist rock and organic matter
HS8-4	-44.959459	168.833198	0-0.1	HS8-4 (0.1) 15063	Medium brown clayey SILT with weathered schist rock and organic matter
HS8-5	-44.959484	168.833022	0-0.1	HS8-5 (0.1) 15063	Medium brown clayey SILT with organic matter
HS8-6	-44.959533	168.832848	0-0.1	HS8-6 (0.1) 15063	Medium brown clayey SILT with weathered schist rock and organic matter
HS4-1	-44.960751	168.827166	0-0.1	HS4-1 (0.1) 15063	Medium greyish brown clayey sandy SILT with gravels, cobbles and organic matter

Sample Location	Coordinates		Sample Depth (m)	Sample ID	Soil Lithology
HS4-2	-44.960861	168.827169	0-0.1	HS4-2 (0.1) 15063	Medium greish brown clayey SILT with organic matter
HS4-3	-44.961099	168.827376	0-0.1	HS4-3 (0.1) 15063	Medium brownish grey claeye SILT with cobbles and organic matter
HS4-4	-44.960780	168.827446	0-0.1	HS4-4 (0.1) 15063	Medium brown silty clayey GRAVEL with organic matter
HS4-5	-44.960666	168.827293	0-0.1	HS4-5 (0.1) 15063	Medium brown clayey SILT with organic matter
HS4-6	-44.960639	168.827487	0-0.1	HS4-6 (0.1) 15063	Medium brown clayey SILT with organic matter
HS2-1	-44.961038	168.830664	0-0.1	HS2-1 (0.1) 15063	Medium brown clayey SILT with organic matter
HS2-2	-44.961203	168.830643	0-0.1	HS2-2 (0.1) 15063	Medium brown clayey SILT with organic matter
HS2-3	-44.961324	168.830596	0-0.1	HS2-3 (0.1) 15063	Medium brown clayey SILT with organic matter
HS2-4	-44.961304	168.830383	0-0.1	HS2-4 (0.1) 15063	Medium brown clayey SILT with organic matter
HS2-5	-44.961162	168.830403	0-0.1	HS2-5 (0.1) 15063	Medium brown clayey SILT with organic matter
HS2-6	-44.961003	168.830444	0-0.1	HS2-6 (0.1) 15063	Medium brown clayey SILT with organic matter
HS3-1	-44.960463	168.829568	0-0.1	HS3-1 (0.1) 15063	Medium brown clayey SILT with organic matter
HS3-2	-44.960371	168.829697	0-0.1	HS3-2 (0.1) 15063	Medium brown clayey SILT with gravels and organic matter
HS3-3	-44.960490	168.829759	0-0.1	HS3-3 (0.1) 15063	Medium brown clayey SILT with organic matter
HS3-4	-44.960253	168.829399	0-0.1	HS3-4 (0.1) 15063	Medium brown clayey SILT with gravels and organic matter
HS3-5	-44.960231	168.829573	0-0.1	HS3-5 (0.1) 15063	Medium brown clayey SILT with organic matter
HS3-6	-44.960094	168.829504	0-0.1	HS3-6 (0.1) 15063	Medium brown clayey SILT with organic matter

Appendix D

Bore Search Information

Land-use and Site Contamination Request - Arrowtown-Lake Hayes Road

Appendix E

Soil Sample and Analysis Summary Table

Composite Analysis			
Area/House site	Sample ID	Sample Depth	Heavy Metals Composite
A3	A3-1	0-0.1	1
	A3-2	0-0.1	
	A3-3	0-0.1	
	A3-4	0-0.1	2
	A3-5	0-0.1	
	A3-6	0-0.1	
A2	A2-1	0-0.1	3
	A2-2	0-0.1	
	A2-3	0-0.1	
	A2-4	0-0.1	4
	A2-5	0-0.1	
	A2-6	0-0.1	
	A2-7	0-0.1	5
	A2-8	0-0.1	
	A2-9	0-0.1	
A8	A8-1	0-0.1	6
	A8-2	0-0.1	
	A8-3	0-0.1	
	A8-4	0-0.1	7
	A8-5	0-0.1	
	A8-6	0-0.1	
	A8-7	0-0.1	8
	A8-8	0-0.1	
	A8-9	0-0.1	
A7	A7-1	0-0.1	9
	A7-2	0-0.1	
	A7-3	0-0.1	
	A7-4	0-0.1	10
	A7-5	0-0.1	
	A7-6	0-0.1	
A6	A6-1	0-0.1	11
	A6-2	0-0.1	
	A6-3	0-0.1	
A5	A5-1	0-0.1	12
	A5-2	0-0.1	
	A5-3	0-0.1	
	A5-4	0-0.1	13
	A5-5	0-0.1	
	A5-6	0-0.1	
A4	A4-1	0-0.1	14
	A4-2	0-0.1	
	A4-3	0-0.1	
	A4-4	0-0.1	15
	A4-5	0-0.1	
	A4-6	0-0.1	
	A4-7	0-0.1	16
	A4-8	0-0.1	
	A4-9	0-0.1	

Area/House site	Sample ID	Sample Depth	Heavy Metals Composite
A4	A4-10	0-0.1	17
	A4-11	0-0.1	
	A4-12	0-0.1	
	A4-13	0-0.1	18
	A4-14	0-0.1	
	A4-15	0-0.1	
A1	A1-1	0.05-0.15	19
	A1-2	0.05-0.15	
	A1-3	0.05-0.15	
	A1-4	0.05-0.15	20
	A1-5	0.05-0.15	
	A1-6	0.05-0.15	
	A1-7	0.05-0.15	21
	A1-8	0.05-0.15	
	A1-9	0.05-0.15	
A10	A10-1	0-0.1	22
	A10-2	0-0.1	
	A10-3	0-0.1	
	A10-4	0-0.1	23
	A10-5	0-0.1	
	A10-6	0-0.1	
	A10-7	0-0.1	24
	A10-8	0-0.1	
	A10-9	0-0.1	
	A10-10	0-0.1	25
	A10-11	0-0.1	
	A10-12	0-0.1	
A9	A9-1	0-0.1	26
	A9-2	0-0.1	
	A9-3	0-0.1	
	A9-4	0-0.1	27
	A9-5	0-0.1	
	A9-6	0-0.1	
HS10	HS10-1	0-0.1	28
	HS10-2	0-0.1	
	HS10-3	0-0.1	
	HS10-4	0-0.1	29
	HS10-5	0-0.1	
	HS10-6	0-0.1	
HS5	HS5-1	0-0.1	30
	HS5-2	0-0.1	
	HS5-3	0-0.1	
	HS5-4	0-0.1	31
	HS5-5	0-0.1	
	HS5-6	0-0.1	
HS9	HS9-1	0-0.1	32
	HS9-2	0-0.1	
	HS9-3	0-0.1	
	HS9-4	0-0.1	33

Area/House site	Sample ID	Sample Depth	Heavy Metals Composite
HS9	HS9-5	0-0.1	33
	HS9-6	0-0.1	
HS1	HS1-1	0-0.1	34
	HS1-2	0-0.1	
	HS1-3	0-0.1	
	HS1-4	0-0.1	35
	HS1-5	0-0.1	
	HS1-6	0-0.1	
HS8	HS8-1	0-0.1	36
	HS8-2	0-0.1	
	HS8-3	0-0.1	
	HS8-4	0-0.1	37
	HS8-5	0-0.1	
	HS8-6	0-0.1	
HS2	HS2-1	0-0.1	38
	HS2-2	0-0.1	
	HS2-3	0-0.1	
	HS2-4	0-0.1	39
	HS2-5	0-0.1	
	HS2-6	0-0.1	
HS3	HS3-1	0-0.1	40
	HS3-2	0-0.1	
	HS3-3	0-0.1	
	HS3-4	0-0.1	41
	HS3-5	0-0.1	
	HS3-6	0-0.1	

Sample ID	Sample Depth	Individual Analysis
DUP1	0-0.1	Organochlorine Pesticides
DUP2	0-0.1	Organochlorine Pesticides
A3-2	0-0.1	Organochlorine Pesticides
A3-5	0-0.1	Organochlorine Pesticides
A2-2	0-0.1	Organochlorine Pesticides
A2-5	0-0.1	Organochlorine Pesticides
A2-8	0-0.1	Organochlorine Pesticides
A8-2	0-0.1	Organochlorine Pesticides
A8-5	0-0.1	Organochlorine Pesticides
A8-8	0-0.1	Organochlorine Pesticides
A7-2	0-0.1	Organochlorine Pesticides
A7-5	0-0.1	Multi-Residue pesticides
A6-2	0-0.1	Organochlorine Pesticides
A5-1	0-0.1	Organochlorine Pesticides
A5-5	0-0.1	Organochlorine Pesticides
A4-2	0-0.1	Organochlorine Pesticides
A4-5	0-0.1	Organochlorine Pesticides
A4-8	0-0.1	Organochlorine Pesticides
A4-11	0-0.1	Organochlorine Pesticides
A4-14	0-0.1	Organochlorine Pesticides
DUP3	0-0.1	Organochlorine Pesticides

Sample ID	Sample Depth	Individual Analysis
DUP4	0-0.1	Organochlorine Pesticides
DUP5	0-0.1	Organochlorine Pesticides
A1-3	0.05-0.15	Organochlorine Pesticides
A1-5	0.05-0.15	Organochlorine Pesticides
A1-8	0.05-0.15	Organochlorine Pesticides
A10-2	0-0.1	Organochlorine Pesticides
A10-5	0-0.1	Organochlorine Pesticides
A10-8	0-0.1	Organochlorine Pesticides
A10-11	0-0.1	Organochlorine Pesticides
A9-2	0-0.1	Organochlorine Pesticides
A9-5	0-0.1	Organochlorine Pesticides
HS10-2	0-0.1	Organochlorine Pesticides
HS10-5	0-0.1	Organochlorine Pesticides
HS5-2	0-0.1	Organochlorine Pesticides
HS5-5	0-0.1	Organochlorine Pesticides
HS9-3	0-0.1	Organochlorine Pesticides
HS9-5	0-0.1	Organochlorine Pesticides
HS1-2	0-0.1	Organochlorine Pesticides
HS1-5	0-0.1	Organochlorine Pesticides
HS8-1	0-0.1	Organochlorine Pesticides
HS8-5	0-0.1	Organochlorine Pesticides
DUP6	0-0.1	Organochlorine Pesticides
HS2-2	0-0.1	Organochlorine Pesticides
HS2-6	0-0.1	Organochlorine Pesticides
HS3-2	0-0.1	Organochlorine Pesticides
HS3-5	0-0.1	Organochlorine Pesticides
HS4-1	0-0.1	Heavy Metals and Organochlorine Pesticides
HS4-2	0-0.1	Heavy Metals and Organochlorine Pesticides
HS4-3	0-0.1	Heavy Metals and Organochlorine Pesticides
HS4-4	0-0.1	Heavy Metals and Organochlorine Pesticides
HS4-5	0-0.1	Heavy Metals and Organochlorine Pesticides
HS4-6	0-0.1	Heavy Metals and Organochlorine Pesticides

Appendix F

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

Heavy Metals Composite9	A7-3	24/09/2015
	A7-4	
	A7-5	
Heavy Metals Composite10	A7-6	
	A6-1	
	A6-2	
Heavy Metals Composite11	A6-3	
	A5-1	
	A5-2	
Heavy Metals Composite12	A5-3	
	A5-4	
	A5-5	
Heavy Metals Composite13	A5-6	
	A4-1	
	A4-2	
Heavy Metals Composite14	A4-3	
	A4-4	
	A4-5	
Heavy Metals Composite15	A4-6	
	A4-7	
	A4-8	
Heavy Metals Composite16	A4-9	
	A4-10	
	A4-11	
Heavy Metals Composite17	A4-12	
	A4-13	
	A4-14	
Heavy Metals Composite18	A4-15	

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Chain of Custody

Sheet 1 of

Laboratory use

Job No: 148 0301

Date Recv: 25-Sep-15 05:30

Received by: Jennifer Singlewood

3114803018

Date Collected: 24/9/15		Sampling Conditions *(brief description of weather conditions/flow rates etc)* windy, fine	
Your Address: Davis Consulting Group Ltd. Arrow Lane Arrowtown 9302		Samples Filtered and/or Preserved?	Priority: HIGH CoC to be emailed back: Yes
Phone Number: 03 409 8664		Email Address: fiona@davisconsultinggroup.co.nz	
Project No/Property Name: The Hills 15063		Who Sampled: Fiona + Rebecca	
Samples Released By (Signature): FOR Date and Time Released: 24/9/15 1630		Samples Received By (Signature): Date and Time Received: 25/9/15	

Sample ID	Date	Time	Matrix	Analytes						
						1				
A3-1 (0-1)	24/9/15	930	Soil							
A3-2 (0-1)		935	Soil							
A3-3 (0-1)		940	Soil							
A3-4 (0-1)		945	Soil							
A3-5 (0-1)		950	Soil		HOLD					
A3-6 (0-1)		955	Soil		COLD					
A2-1 (0-1)		1000	Soil							
A2-2 (0-1)		1005	Soil							
A2-3 (0-1)		1010	Soil							
A2-4 (0-1)		1015	Soil							
A2-5 (0-1)		1020	Soil							
A2-6 (0-1)		1025	Soil							

Note:

Temperature On Arrival

13.2 °C

Temperature was measured on arbitrarily chosen samples in this batch.
The Microbiology sample temperature will be recorded at Melville Lab before testing.

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Chain of Custody

Laboratory use

Date Collected:	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:
Phone Number: 03 409 8664	Email Address: @davisconsultinggroup.co.nz	
Project No/Property Name:	Who Sampled:	
Samples Released By (Signature): Date and Time Released:	Samples Received By (Signature): Date and Time Received:	

Sample ID	Date	Time	Matrix	Analytes						
						1				
A2-7 (0.1)	24/9/15	1030	Soil							
A2-8 (0.1)		1035	Soil							
A2-9 (0.1)		1040	Soil							
DUP#1		951	Soil							
A8-1 (0.1)		1045	Soil		HOLD					
A8-2 (0.1)		1050	Soil		(OLD)					
A8-3 (0.1)		1055	Soil							
A8-4 (0.1)		1100	Soil							
A8-5 (0.1)		1105	Soil							
A8-6 (0.1)		1110	Soil							
A8-7 (0.1)		1115	Soil							
A8-8 (0.1)		1120	Soil							

Note:

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Chain of Custody

Laboratory use

Date Collected:	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:
Phone Number: 03 409 8664	Email Address:	@davisconsultinggroup.co.nz
Project No/Property Name:	Who Sampled:	
Samples Released By (Signature): Date and Time Released:	Samples Received By (Signature): Date and Time Received:	

Sample ID	Date	Time	Matrix	Analytes						
A8-9 (0.1)	24/9/15	1125	Soil							
A7-1 (0.1)		1130	Soil							
A7-2 (0.1)		1135	Soil							
A7-3 (0.1)		1140	Soil							
A7-4 (0.1)		1145	Soil		HOLD					
A7-5 (0.1)		1150	Soil		COLD					
A7-6 (0.1)		1155	Soil							
A6-1 (0.1)		1200	Soil							
A6-2 (0.1)		1205	Soil							
A6-3 (0.1)		1210	Soil							
A5-1 (0.1)		1215	Soil							
A5-2 (0.1)	↓	1220	Soil							

Note:

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Laboratory use

Date Collected:	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:
Phone Number: 03 409 8664	Email Address: @davisconsultinggroup.co.nz
Project No/Property Name:	Who Sampled:
Samples Released By (Signature): Date and Time Released:	Samples Received By (Signature): Date and Time Received:

Sample ID	Date	Time	Matrix	Analytes						
AS-3 (0.1)	24/9/25	1225	Soil							
AS-4 (0.1)		1230	Soil							
AS-5 (0.1)		1235	Soil							
AS-6 (0.1)		1240	Soil							
AH-1 (0.1)		1245	Soil							
AH-2 (0.1)		1250	Soil		HOLD					
AH-3 (0.1)		1255	Soil		COLD					
AH-4 (0.1)		1300	Soil							
AH-5 (0.1)		1305	Soil							
AH-6 (0.1)		1310	Soil							
AH-7 (0.1)		1315	Soil							
AH-8 (0.1)		1320	Soil							

Note:

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Laboratory use

Date Collected:	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:
Phone Number: 03 409 8664	Email Address: @davisconsultinggroup.co.nz	
Project No/Property Name:	Who Sampled:	
Samples Released By (Signature): Date and Time Released:	Samples Received By (Signature): Date and Time Received:	

Sample ID	Date	Time	Matrix	Analytes						
AH-9 (0.1)	24/9/15	1325	Soil							
AH-10 (0.1)		1330	Soil							
AH-11 (0.1)		1335	Soil							
AH-12 (0.1)		1340	Soil		HOLD					
AH-13 (0.1)		1345	Soil		(OLD)					
AH-14 (0.1)		1350	Soil							
AH-15 (0.1)		1355	Soil							
			Soil							
			Soil							
			Soil							
			Soil							
			Soil							

Note:

COMPOSITE SAMPLES		
Analysis	ID	Date
Heavy Metals Composite1	A3-1	24/09/2015
	A3-2	
	A3-3	
Heavy Metals Composite2	A3-4	
	A3-5	
	A3-6	
Heavy Metals Composite3	A2-1	
	A2-2	
	A2-3	
Heavy Metals Composite4	A2-4	
	A2-5	
	A2-6	
Heavy Metals Composite5	A2-7	
	A2-8	
	A2-9	
Heavy Metals Composite6	A8-1	
	A8-2	
	A8-3	
Heavy Metals Composite7	A8-4	
	A8-5	
	A8-6	
Heavy Metals Composite8	A8-7	
	A8-8	
	A8-9	
Heavy Metals Composite9	A7-1	
	A7-2	
	A7-3	
Heavy Metals Composite10	A7-4	
	A7-5	
	A7-6	
Heavy Metals Composite11	A6-1	
	A6-2	
	A6-3	
Heavy Metals Composite12	A5-1	
	A5-2	
	A5-3	
Heavy Metals Composite13	A5-4	
	A5-5	
	A5-6	
Heavy Metals Composite14	A4-1	
	A4-2	
	A4-3	
Heavy Metals Composite15	A4-4	
	A4-5	
	A4-6	
	A4-7	

Heavy Metals Composite16	A4-8	
	A4-9	
Heavy Metals Composite17	A4-10	
	A4-11	
	A4-12	
Heavy Metals Composite18	A4-13	
	A4-14	
	A4-15	
Heavy Metals Composite19	A1-1	
	A1-2	
	A1-3	
Heavy Metals Composite20	A1-4	
	A1-5	
	A1-6	
Heavy Metals Composite21	A1-7	
	A1-8	
	A1-9	
Heavy Metals Composite22	A10-1	
	A10-2	
	A10-3	
Heavy Metals Composite23	A10-4	
	A10-5	
	A10-6	
Heavy Metals Composite24	A10-7	
	A10-8	
	A10-9	
Heavy Metals Composite25	A10-10	
	A10-11	
	A10-12	
Heavy Metals Composite26	A9-1	
	A9-2	
	A9-3	
Heavy Metals Composite27	A9-4	
	A9-5	
	A9-6	
Heavy Metals Composite28	HS10-1	
	HS10-2	25/09/2015
	HS10-3	
Heavy Metals Composite29	HS10-4	
	HS10-5	
	HS10-6	
Heavy Metals Composite30	HS5-1	
	HS5-2	
	HS5-3	
Heavy Metals Composite31	HS5-4	
	HS5-5	
	HS5-6	
Heavy Metals	HS9-1	
	HS9-2	

Composite32	HS9-3	
Heavy Metals Composite33	HS9-4	
	HS9-5	
	HS9-6	
Heavy Metals Composite34	HS1-1	
	HS1-2	
	HS1-3	
Heavy Metals Composite35	HS1-4	
	HS1-5	
	HS1-6	
Heavy Metals Composite36	HS8-1	
	HS8-2	
	HS8-3	
Heavy Metals Composite37	HS8-4	
	HS8-5	
	HS8-6	
Heavy Metals Composite38	HS2-1	28/09/2015
	HS2-2	
	HS2-3	
Heavy Metals Composite39	HS2-4	
	HS2-5	
	HS2-6	
Heavy Metals Composite40	HS3-1	
	HS3-2	
	HS3-3	
Heavy Metals Composite41	HS3-4	
	HS3-5	
	HS3-6	

INDIVIDUAL SAMPLES		
Analysis	ID	Date
OCP	DUP1	24/09/2015
OCP	DUP2	
OCP	A3-2	
OCP	A3-5	
OCP	A2-2	
OCP	A2-5	
OCP	A2-8	
OCP	A8-2	
OCP	A8-5	
OCP	A8-8	
OCP	A7-2	
multi residue pesticides	A7-5	
OCP	A6-2	
OCP	A5-1	
OCP	A5-5	
OCP	A4-2	

OCP	A4-5	
OCP	A4-8	
OCP	A4-11	
OCP	A4-14	
OCP	DUP3	25/09/2015
OCP	DUP4	
OCP	DUP5	
OCP	A1-3	
OCP	A1-5	
OCP	A1-8	
OCP	A10-2	
OCP	A10-5	
OCP	A10-8	
OCP	A10-11	
OCP	A9-2	
OCP	A9-5	
OCP	HS10-2	
OCP	HS10-5	
OCP	HS5-2	
OCP	HS5-5	
OCP	HS9-3	
OCP	HS9-5	
OCP	HS1-2	
OCP	HS1-5	
OCP	HS8-1	
OCP	HS8-5	
OCP	DUP6	28/09/2015
OCP	HS2-2	
OCP	HS2-6	
OCP	HS3-2	
OCP	HS3-5	
Heavy Metals and OCP	HS4-1	
Heavy Metals and OCP	HS4-2	
Heavy Metals and OCP	HS4-3	
Heavy Metals and OCP	HS4-4	
Heavy Metals and OCP	HS4-5	
Heavy Metals and OCP	HS4-6	

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Chain of Custody

Sheet | of

Laboratory use

Date Collected: 25/9/15 + 26/9/15

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

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

Samples Filtered and/or Preserved?

Priority: HIGH

CoC to be emailed back: Yes

Phone Number: 03 409 8664

Email Address: Fiona @davisconsultinggroup.co.nz

Project No/Property Name: 15063 The Hills

Who Sampled: Fiona

Samples Released By (Signature): FOR

Date and Time Released: 28/9/15 1630

Samples Received By (Signature):

Date and Time Received:

Sample ID	Date	Time	Matrix	Analytes						
A1-1 (0-5)	25/9/15	950	Soil							
A1-2 (0-5)		955	Soil							
A1-3 (0-5)		1000	Soil							
A1-4 (0-5)		1005	Soil		HOLD					
A1-5 (0-5)		1010	Soil		COLD					
A1-6 (0-5)		1015	Soil							
A1-7 (0-5)		1020	Soil							
A1-8 (0-5)		1025	Soil							
A1-9 (0-5)		1030	Soil							
A10-1 (0-1)		1035	Soil							
A10-2 (0-1)		1040	Soil							
A10-3 (0-1)	↓	1045	Soil							

Temperature On Arrival

15.0 °C

Temperature was measured on arbitrarily chosen samples in this batch.
The Microbiology sample temperature will be recorded at Melville Lab before testing.

Note:

3114803018

Job No: **148 0301**

Date Recv: 25-Sep-15 05:30

Received by: Jennifer Singlewood

Davis Consulting Group Limited
Arrow Lane
Arrowtown
Phone: 03 409 8664
email: glenn.davis@davisconsultinggroup.co.nz

DAVIS consulting group

Chain of Custody

Sheet 1 of

Laboratory use

Date Collected:	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:
Phone Number: 03 409 8664	Email Address:	@davisconsultinggroup.co.nz
Project No/Property Name:	Who Sampled:	
Samples Released By (Signature): Date and Time Released:	Samples Received By (Signature): Date and Time Received:	

Sample ID	Date	Time	Matrix	Analytes						
DUP3	25/9/19	1001	Soil							
A10-4 (0-1)		1050	Soil							
A10-5 (0-1)		1055	Soil							
A10-6 (0-1)		1100	Soil							
A10-7 (0-1)		1105	Soil		HOLD					
A10-8 (0-1)		1110	Soil		HOLD					
A10-9 (0-1)		1115	Soil							
A10-10 (0-1)		1120	Soil							
A10-11 (0-1)		1125	Soil							
A10-12 (0-1)		1130	Soil							
A9-1 (0-1)		1135	Soil							
A9-2 (0-1)		1140	Soil							

Note:

Davis Consulting Group Limited
Arrow Lane
Arrowtown
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Chain of Custody

Sheet 2 of

Laboratory use

Date Collected:				Weather Conditions				
Your Address: Davis Consulting Group Ltd. Arrow Lane Arrowtown 9302				Samples Filtered and/or Preserved?		Priority: CoC to be emailed back:		
Phone Number: 03 409 8664				Email Address: @davisconsultinggroup.co.nz				
Project No/Property Name:				Who Sampled:				
Samples Released By (Signature): Date and Time Released:				Samples Received By (Signature): Date and Time Received:				
Sample ID	Date	Time	Matrix	Analytes				
				Hold Cold				
A9-3 (0.1)	18/9/18	1145	Soil	✓				
A9-4 (0.1)		1150	Soil	✓				
A9-5 (0.1)		1155	Soil	✓				
A9-6 (0.1)		1200	Soil	✓				
HSID-1 (0.1)		1205	Soil	✓				
HSID-2 (0.1)		1210	Soil	✓				
HSID-3 (0.1)		1215	Soil	✓				
HSID-4 (0.1)		1220	Soil	✓				
HSID-5 (0.1)		1225	Soil	✓				
HSID-6 (0.1)		1230	Soil	✓				
HSS-1 (0.1)		1235	Soil	✓				
HSS-2 (0.1)		1240	Soil	✓				
HSS-3 (0.1)		1245	Soil	✓				
HSS-4 (0.1)		1250	Soil	✓				
HSS-5 (0.1)	↓	1255	Soil	✓				

Note:

Davis Consulting Group Limited
Arrow Lane
Arrowtown
Phone: 03 409 8664
email: glenn.davis@davisconsultinggroup.co.nz

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Chain of Custody

Sheet 1 of 1

Laboratory use

Date Collected:				Weather Conditions				
Your Address: Davis Consulting Group Ltd. Arrow Lane Arrowtown 9302				Samples Filtered and/or Preserved?		Priority: CoC to be emailed back:		
Phone Number: 03 409 8664				Email Address: @davisconsultinggroup.co.nz				
Project No/Property Name:				Who Sampled:				
Samples Released By (Signature): Date and Time Released:				Samples Received By (Signature): Date and Time Received:				
Sample ID	Date	Time	Matrix	Analytes				
				Hold Cold				
HS5-6 (0.1)	25/9/16	1300	Soil	✓				
HS9-1 (0.1)		1305	Soil	✓				
HS9-2 (0.1)		1310	Soil	✓				
HS9-3 (0.1)		1315	Soil	✓				
HS9-4 (0.1)		1320	Soil	✓				
HS9-5 (0.1)		1325	Soil	✓				
HS9-6 (0.1)		1330	Soil	✓				
Dup4		1316	Soil	✓				
HS1-1 (0.1)		1335	Soil	✓				
HS1-2 (0.1)		1340	Soil	✓				
HS1-3 (0.1)		1345	Soil	✓				
HS1-4 (0.1)		1350	Soil	✓				
HS1-5 (0.1)		1355	Soil	✓				
HS1-6 (0.1)		1400	Soil	✓				
HS8-1 (0.1)		1405	Soil	✓				
Note:								

Davis Consulting Group Limited
Arrow Lane
Arrowtown
Phone: 03 409 8664
email: glenn.davis@davisconsultinggroup.co.nz

Chain of Custody

Sheet 5 of

Laboratory use

Date Collected:		Weather Conditions	
Your Address: Davis Consulting Group Ltd. Arrow Lane Arrowtown 9302		Samples Filtered and/or Preserved?	Priority: CoC to be emailed back:
Phone Number: 03 409 8664		Email Address:	@davisconsultinggroup.co.nz
Project No/Property Name:		Who Sampled:	
Samples Released By (Signature): Date and Time Released:		Samples Received By (Signature): Date and Time Received:	

Sample ID	Date	Time	Matrix	Analytes			
				Hold Cold			
HS8-2 (0-1)	25/9/15	1410	Soil	✓			
DUP5		1406	Soil	✓			
HS8-3 (0-1)		1415	Soil	✓			
HS8-4 (0-1)		1420	Soil	✓			
HS8-5 (0-1)		1425	Soil	✓			
HS8-6 (0-1)	↓	1430	Soil	✓			
HS4-1	28/9/14	1255	Soil	✓			
HS4-2		1300	Soil	✓			
HS4-3		1305	Soil	✓			
HS4-3		1310	Soil	✓			
HS4-4		1315	Soil	✓			
HS4-5		1320	Soil	✓			
HS4-6		1325	Soil	✓			
HS2-1		1330	Soil	✓			
HS2-2	↓	1335	Soil	✓			

Note:

Davis Consulting Group Limited
Arrow Lane
Arrowtown
Phone: 03 409 8664
email: glenn.davis@davisconsultinggroup.co.nz

DAVIS consulting group

Chain of Custody

Laboratory use

Date Collected:				Weather Conditions				
Your Address: Davis Consulting Group Ltd. Arrow Lane Arrowtown 9302				Samples Filtered and/or Preserved?		Priority: CoC to be emailed back:		
Phone Number: 03 409 8664				Email Address: @davisconsultinggroup.co.nz				
Project No/Property Name:				Who Sampled:				
Samples Released By (Signature): Date and Time Released:				Samples Received By (Signature): Date and Time Received:				
Sample ID	Date	Time	Matrix	Analytes				
				Hold Cold				
HS2-3 (0-1)	28/9/15	1335	Soil	✓				
HS2-4 (0-1)		1340	Soil	✓				
HS2-5 (0-1)		1345	Soil	✓				
HS2-6 (0-1)		1350	Soil	✓				
HS3-1 (0-1)		1355	Soil	✓				
HS3-2 (0-1)		1400	Soil	✓				
HS3-3 (0-1)		1405	Soil	✓				
HS3-4 (0-1)		1410	Soil	✓				
HS3-5 (0-1)		1415	Soil	✓				
HS3-6 (0-1)		1420	Soil	✓				
DUP6		1351	Soil	✓				
			Soil					
			Soil					
			Soil					
			Soil					
Note:								

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	**Lab No:**	1480301
Contact:	Fiona Rowley	**Date Registered:**	25-Sep-2015 9:50 am
	C/- Davis Consulting Group Limited	**Priority:**	High
	PO Box 2450	**Quote No:**	
	Wakatipu	**Order No:**	
	QUEENSTOWN 9349	**Client Reference:**	The Hills 15063
		Add. Client Ref:	
		Submitted By:	Fiona Rowley
		Charge To:	Davis Consulting Group Limited
		Target Date:	06-Oct-2015 4:30 pm

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
1	A3.1 (0.1) 24-Sep-2015 9:30 am	Soil	GSoil300	Composite Environmental Solid Samples
2	A3.2 (0.1) 24-Sep-2015 9:35 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
3	A3.3 (0.1) 24-Sep-2015 9:40 am	Soil	GSoil300	Composite Environmental Solid Samples
4	A3.4 (0.1) 24-Sep-2015 9:45 am	Soil	GSoil300	Composite Environmental Solid Samples
5	A3.5 (0.1) 24-Sep-2015 9:50 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
6	A3.6 (0.1) 24-Sep-2015 9:55 am	Soil	GSoil300	Composite Environmental Solid Samples
7	A2.1 (0.1) 24-Sep-2015 10:00 am	Soil	GSoil300	Composite Environmental Solid Samples
8	A2.2 (0.1) 24-Sep-2015 10:05 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
9	A2.3 (0.1) 24-Sep-2015 10:10 am	Soil	GSoil300	Composite Environmental Solid Samples
10	A2.4 (0.1) 24-Sep-2015 10:15 am	Soil	GSoil300	Composite Environmental Solid Samples
11	A2.5 (0.1) 24-Sep-2015 10:20 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
12	A2.6 (0.1) 24-Sep-2015 10:25 am	Soil	GSoil300	Composite Environmental Solid Samples
13	A2.7 (0.1) 24-Sep-2015 10:30 am	Soil	GSoil300	Composite Environmental Solid Samples
14	A2.8 (0.1) 24-Sep-2015 10:35 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
15	A2.9 (0.1) 24-Sep-2015 10:40 am	Soil	GSoil300	Composite Environmental Solid Samples
16	Dup#1 24-Sep-2015 9:51 am	Soil	GSoil300	Organochlorine Pesticides Screening in Soil
17	A8.1 (0.1) 24-Sep-2015 10:45 am	Soil	GSoil300	Composite Environmental Solid Samples
18	A8.2 (0.1) 24-Sep-2015 10:50 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
19	A8.3 (0.1) 24-Sep-2015 10:55 am	Soil	GSoil300	Composite Environmental Solid Samples
20	A8.4 (0.1) 24-Sep-2015 11:00 am	Soil	GSoil300	Composite Environmental Solid Samples
21	A8.5 (0.1) 24-Sep-2015 11:05 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
22	A8.6 (0.1) 24-Sep-2015 11:10 am	Soil	GSoil300	Composite Environmental Solid Samples
23	A8.7 (0.1) 24-Sep-2015 11:15 am	Soil	GSoil300	Composite Environmental Solid Samples
24	A8.8 (0.1) 24-Sep-2015 11:20 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
25	A8.9 (0.1) 24-Sep-2015 11:25 am	Soil	GSoil300	Composite Environmental Solid Samples
26	A7.1 (0.1) 24-Sep-2015 11:30 am	Soil	GSoil300	Composite Environmental Solid Samples
27	A7.2 (0.1) 24-Sep-2015 11:35 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
28	A7.3 (0.1) 24-Sep-2015 11:40 am	Soil	GSoil300	Composite Environmental Solid Samples
29	A7.4 (0.1) 24-Sep-2015 11:45 am	Soil	GSoil300	Composite Environmental Solid Samples
30	A7.5 (0.1) 24-Sep-2015 11:50 am	Soil	GSoil300	Composite Environmental Solid Samples; Multiresidue Pesticides in Soil samples by GCMS

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
31	A7.6 (0.1) 24-Sep-2015 11:55 am	Soil	GSoil300	Composite Environmental Solid Samples
32	A6.1 (0.1) 24-Sep-2015 12:00 pm	Soil	GSoil300	Composite Environmental Solid Samples
33	A6.2 (0.1) 24-Sep-2015 12:05 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
34	A6.3 (0.1) 24-Sep-2015 12:10 pm	Soil	GSoil300	Composite Environmental Solid Samples
35	A5.1 (0.1) 24-Sep-2015 12:15 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
36	A5.2 (0.1) 24-Sep-2015 12:20 pm	Soil	GSoil300	Composite Environmental Solid Samples
37	A5.3 (0.1) 24-Sep-2015 12:25 pm	Soil	GSoil300	Composite Environmental Solid Samples
38	A5.4 (0.1) 24-Sep-2015 12:30 pm	Soil	GSoil300	Composite Environmental Solid Samples
39	A5.5 (0.1) 24-Sep-2015 12:35 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
40	A5.6 (0.1) 24-Sep-2015 12:40 pm	Soil	GSoil300	Composite Environmental Solid Samples
41	A4.1 (0.1) 24-Sep-2015 12:45 pm	Soil	GSoil300	Composite Environmental Solid Samples
42	A4.2 (0.1) 24-Sep-2015 12:50 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
43	A4.3 (0.1) 24-Sep-2015 12:55 pm	Soil	GSoil300	Composite Environmental Solid Samples
44	A4.4 (0.1) 24-Sep-2015 1:00 pm	Soil	GSoil300	Composite Environmental Solid Samples
45	A4.5 (0.1) 24-Sep-2015 1:05 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
46	A4.6 (0.1) 24-Sep-2015 1:10 pm	Soil	GSoil300	Composite Environmental Solid Samples
47	A4.7 (0.1) 24-Sep-2015 1:15 pm	Soil	GSoil300	Composite Environmental Solid Samples
48	A4.8 (0.1) 24-Sep-2015 1:20 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
49	A4.9 (0.1) 24-Sep-2015 1:25 pm	Soil	GSoil300	Composite Environmental Solid Samples
50	A4.10 (0.1) 24-Sep-2015 1:30 pm	Soil	GSoil300	Composite Environmental Solid Samples
51	A4.11 (0.1) 24-Sep-2015 1:35 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
52	A4.12 (0.1) 24-Sep-2015 1:40 pm	Soil	GSoil300	Composite Environmental Solid Samples
53	A4.13 (0.1) 24-Sep-2015 1:45 pm	Soil	GSoil300	Composite Environmental Solid Samples
54	A4.14 (0.1) 24-Sep-2015 1:50 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
55	A4.15 (0.1) 24-Sep-2015 1:55 pm	Soil	GSoil300	Composite Environmental Solid Samples
56	Dup#2 24-Sep-2015 12:16 pm	Soil	GSoil300	Organochlorine Pesticides Screening in Soil
57	Composite of A3.1 (0.1), A3.2 (0.1) & A3.3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
58	Composite of A3.4 (0.1), A3.5 (0.1) & A3.6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
59	Composite of A2.1 (0.1), A2.2 (0.1) & A2.3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
60	Composite of A2.4 (0.1), A2.5 (0.1) & A2.6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
61	Composite of A2.7 (0.1), A2.8 (0.1) & A2.9 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
62	Composite of A8.1 (0.1), A8.2 (0.1) & A8.3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
63	Composite of A8.4 (0.1), A8.5 (0.1) & A8.6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
64	Composite of A8.7 (0.1), A8.8 (0.1) & A8.9 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
65	Composite of A7.1 (0.1), A7.2 (0.1) & A7.3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
66	Composite of A7.4 (0.1), A7.5 (0.1) & A7.6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
67	Composite of A6.1 (0.1), A6.2 (0.1) & A6.3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
68	Composite of A5.1 (0.1), A5.2 (0.1) & A5.3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
69	Composite of A5.4 (0.1), A5.5 (0.1) & A5.6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
70	Composite of A4.1 (0.1), A4.2 (0.1) & A4.3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
71	Composite of A4.4 (0.1), A4.5 (0.1) & A4.6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
72	Composite of A4.7 (0.1), A4.8 (0.1) & A4.9 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
73	Composite of A4.10 (0.1), A4.11 (0.1) & A4.12 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
74	Composite of A4.13 (0.1), A4.14 (0.1) & A4.15 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
75	A1-1 (0.15) 25-Sep-2015 9:50 am	Soil	GSoil300	Composite Environmental Solid Samples
76	A1-2 (0.15) 25-Sep-2015 9:55 am	Soil	GSoil300	Composite Environmental Solid Samples
77	A1-3 (0.15) 25-Sep-2015 10:00 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
78	A1-4 (0.15) 25-Sep-2015 10:05 am	Soil	GSoil300	Composite Environmental Solid Samples
79	A1-5 (0.15) 25-Sep-2015 10:10 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
80	A1-6 (0.15) 25-Sep-2015 10:15 am	Soil	GSoil300	Composite Environmental Solid Samples
81	A1-7 (0.1) 25-Sep-2015 10:20 am	Soil	GSoil300	Composite Environmental Solid Samples
82	A1-8 (0.15) 25-Sep-2015 10:25 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
83	A1-9 (0.15) 25-Sep-2015 10:30 am	Soil	GSoil300	Composite Environmental Solid Samples
84	A10-1 (0.1) 25-Sep-2015 10:35 am	Soil	GSoil300	Composite Environmental Solid Samples
85	A10-2 (0.1) 25-Sep-2015 10:40 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
86	A10-3 (0.1) 25-Sep-2015 10:45 am	Soil	GSoil300	Composite Environmental Solid Samples
87	DUP3 25-Sep-2015 10:01 am	Soil	GSoil300	Organochlorine Pesticides Screening in Soil
88	A10-4 (0.1) 25-Sep-2015 10:50 am	Soil	GSoil300	Composite Environmental Solid Samples
89	A10-5 (0.1) 25-Sep-2015 10:55 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
90	A10-6 (0.1) 25-Sep-2015 11:00 am	Soil	GSoil300	Composite Environmental Solid Samples
91	A10-7 (0.1) 25-Sep-2015 11:05 am	Soil	GSoil300	Composite Environmental Solid Samples
92	A10-8 (0.1) 25-Sep-2015 11:10 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
93	A10-9 (0.1) 25-Sep-2015 11:15 am	Soil	GSoil300	Composite Environmental Solid Samples
94	A10-10 (0.1) 25-Sep-2015 11:20 am	Soil	GSoil300	Composite Environmental Solid Samples
95	A10-11 (0.1) 25-Sep-2015 11:25 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
96	A10-12 (0.1) 25-Sep-2015 11:30 am	Soil	GSoil300	Composite Environmental Solid Samples
97	A9-1 (0.1) 25-Sep-2015 11:35 am	Soil	GSoil300	Composite Environmental Solid Samples
98	A9-2 (0.1) 25-Sep-2015 11:40 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
99	A9-3 (0.1) 25-Sep-2015 11:45 am	Soil	GSoil300	Composite Environmental Solid Samples
100	A9-4 (0.1) 25-Sep-2015 11:50 am	Soil	GSoil300	Composite Environmental Solid Samples
101	A9-5 (0.1) 25-Sep-2015 11:55 am	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
102	A9-6 (0.1) 25-Sep-2015 12:00 pm	Soil	GSoil300	Composite Environmental Solid Samples
103	HS10-1 (0.1) 25-Sep-2015 12:05 pm	Soil	GSoil300	Composite Environmental Solid Samples
104	HS10-2 (0.1) 25-Sep-2015 12:10 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
105	HS10-3 (0.1) 25-Sep-2015 12:15 pm	Soil	GSoil300	Composite Environmental Solid Samples
106	HS10-4 (0.1) 25-Sep-2015 12:20 pm	Soil	GSoil300	Composite Environmental Solid Samples
107	HS10-5 (0.1) 25-Sep-2015 12:25 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
108	HS10-6 (0.1) 25-Sep-2015 12:30 pm	Soil	GSoil300	Composite Environmental Solid Samples
109	HS5-1 (0.1) 25-Sep-2015 12:35 pm	Soil	GSoil300	Composite Environmental Solid Samples

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
110	HS5-2 (0.1) 25-Sep-2015 12:40 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
111	HS5-3 (0.1) 25-Sep-2015 12:45 pm	Soil	GSoil300	Composite Environmental Solid Samples
112	HS5-4 (0.1) 25-Sep-2015 12:50 pm	Soil	GSoil300	Composite Environmental Solid Samples
113	HS5-5 (0.1) 25-Sep-2015 12:55 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
114	HS5-6 (0.1) 25-Sep-2015 1:00 pm	Soil	GSoil300	Composite Environmental Solid Samples
115	HS9-1 (0.1) 25-Sep-2015 1:05 pm	Soil	GSoil300	Composite Environmental Solid Samples
116	HS9-2 (0.1) 25-Sep-2015 1:10 pm	Soil	GSoil300	Composite Environmental Solid Samples
117	HS9-3 (0.1) 25-Sep-2015 1:15 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
118	HS9-4 (0.1) 25-Sep-2015 1:20 pm	Soil	GSoil300	Composite Environmental Solid Samples
119	HS9-5 (0.1) 25-Sep-2015 1:25 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
120	HS9-6 (0.1) 25-Sep-2015 1:30 pm	Soil	GSoil300	Composite Environmental Solid Samples
121	DUP4 25-Sep-2015 1:16 pm	Soil	GSoil300	Organochlorine Pesticides Screening in Soil
122	HS1-1 (0.1) 25-Sep-2015 1:35 pm	Soil	GSoil300	Composite Environmental Solid Samples
123	HS1-2 (0.1) 25-Sep-2015 1:40 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
124	HS1-3 (0.1) 25-Sep-2015 1:45 pm	Soil	GSoil300	Composite Environmental Solid Samples
125	HS1-4 (0.1) 25-Sep-2015 1:50 pm	Soil	GSoil300	Composite Environmental Solid Samples
126	HS1-5 (0.1) 25-Sep-2015 1:55 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
127	HS1-6 (0.1) 25-Sep-2015 2:00 pm	Soil	GSoil300	Composite Environmental Solid Samples
128	HS8-1 (0.1) 25-Sep-2015 2:05 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
129	HS8-2 (0.1) 25-Sep-2015 2:10 pm	Soil	GSoil300	Composite Environmental Solid Samples
130	DUP5 25-Sep-2015 2:06 pm	Soil	GSoil300	Organochlorine Pesticides Screening in Soil
131	HS8-3 (0.1) 25-Sep-2015 2:15 pm	Soil	GSoil300	Composite Environmental Solid Samples
132	HS8-4 (0.1) 25-Sep-2015 2:20 pm	Soil	GSoil300	Composite Environmental Solid Samples
133	HS8-5 (0.1) 25-Sep-2015 2:25 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
134	HS8-6 (0.1) 25-Sep-2015 2:30 pm	Soil	GSoil300	Composite Environmental Solid Samples
135	HS4-1 (0.1) 28-Sep-2015 12:55 pm	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil
136	HS4-2 (0.1) 28-Sep-2015 1:00 pm	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil
137	HS4-3 (0.1) 28-Sep-2015 1:05 pm	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil
138	HS4-4 (0.1) 28-Sep-2015 1:10 pm	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil
139	HS4-5 (0.1) 28-Sep-2015 1:15 pm	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil
140	HS4-6 (0.1) 28-Sep-2015 1:20 pm	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn; Organochlorine Pesticides Screening in Soil
141	HS-1 (0.1) 28-Sep-2015 1:25 pm	Soil	GSoil300	Composite Environmental Solid Samples
142	HS2-2 (0.1) 28-Sep-2015 1:30 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
143	HS2-3 (0.1) 28-Sep-2015 1:35 pm	Soil	GSoil300	Composite Environmental Solid Samples
144	HS2-4 (0.1) 28-Sep-2015 1:40 pm	Soil	GSoil300	Composite Environmental Solid Samples
145	HS2-5 (0.1) 28-Sep-2015 1:45 pm	Soil	GSoil300	Composite Environmental Solid Samples
146	HS2-6 (0.1) 28-Sep-2015 1:50 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
147	HS3-1 (0.1) 28-Sep-2015 1:55 pm	Soil	GSoil300	Composite Environmental Solid Samples
148	HS3-2 (0.1) 28-Sep-2015 2:00 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
149	HS3-3 (0.1) 28-Sep-2015 2:05 pm	Soil	GSoil300	Composite Environmental Solid Samples
150	HS3-4 (0.1) 28-Sep-2015 2:10 pm	Soil	GSoil300	Composite Environmental Solid Samples

Samples

No	Sample Name	Sample Type	Containers	Tests Requested
151	HS3-5 (0.1) 28-Sep-2015 2:15 pm	Soil	GSoil300	Composite Environmental Solid Samples; Organochlorine Pesticides Screening in Soil
152	HS3-6 (0.1) 28-Sep-2015 2:20 pm	Soil	GSoil300	Composite Environmental Solid Samples
153	DUP6 28-Sep-2015 1:51 pm	Soil	GSoil300	Organochlorine Pesticides Screening in Soil
154	Composite of A1-1 (0.15), A1-2 (0.15) & A1-3 (0.15)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
155	Composite of A1-4 (0.15), A1-5 (0.15) & A1-6 (0.15)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
156	Composite of A1-7 (0.1), A1-8 (0.15) & A1-9 (0.15)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
157	Composite of A10-1 (0.1), A10-2 (0.1) & A10-3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
158	Composite of A10-4 (0.1), A10-5 (0.1) & A10-6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
159	Composite of A10-7 (0.1), A10-8 (0.1) & A10-9 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
160	Composite of A10-10 (0.1), A10-11 (0.1) & A10-12 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
161	Composite of A9-1 (0.1), A9-2 (0.1) & A9-3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
162	Composite of A9-4 (0.1), A9-5 (0.1) & A9-6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
163	Composite of HS10-1 (0.1), HS10-2 (0.1) & HS10-3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
164	Composite of HS10-4 (0.1), HS10-5 (0.1) & HS10-6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
165	Composite of HS5-1 (0.1), HS5-2 (0.1) & HS5-3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
166	Composite of HS5-4 (0.1), HS5-5 (0.1) & HS5-6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
167	Composite of HS9-1 (0.1), HS9-2 (0.1) & HS9-3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
168	Composite of HS9-4 (0.1), HS9-5 (0.1) & HS9-6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
169	Composite of HS1-1 (0.1), HS1-2 (0.1) & HS1-3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
170	Composite of HS1-4 (0.1), HS1-5 (0.1) & HS1-6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
171	Composite of HS8-1 (0.1), HS8-2 (0.1) & HS8-3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
172	Composite of HS8-4 (0.1), HS8-5 (0.1) & HS8-6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
173	Composite of HS-1 (0.1), HS2-2 (0.1) & HS2-3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
174	Composite of HS2-4 (0.1), HS2-5 (0.1) & HS2-6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
175	Composite of HS3-1 (0.1), HS3-2 (0.1) & HS3-3 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn
176	Composite of HS3-4 (0.1), HS3-5 (0.1) & HS3-6 (0.1)	Soil	GSoil300	Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn

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%.	-	57-74, 135-140, 154-176
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	57-74, 135-140, 154-176
Multiresidue Pesticides in Soil samples by GCMS	Sonication extraction, GC-MS analysis. Tested on as received sample, then results corrected to a dry weight basis using the separate Dry Matter result.	0.003 - 0.06 mg/kg dry wt	30

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
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	2, 5, 8, 11, 14, 16, 18, 21, 24, 27, 33, 35, 39, 42, 45, 48, 51, 54, 56, 77, 79, 82, 85, 87, 89, 92, 95, 98, 101, 104, 107, 110, 113, 117, 119, 121, 123, 126, 128, 130, 133, 135-140, 142, 146, 148, 151, 153
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	30
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	57-74, 135-140, 154-176
Composite Environmental Solid Samples	Individual sample fractions mixed together to form a composite fraction.	-	1-15, 17-55, 75-86, 88-120, 122-129, 131-134, 141-152

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ANALYSIS REPORT

Client:	Davis Consulting Group Limited	**Lab No:**	1480301 SPv2
Contact:	Fiona Rowley	**Date Registered:**	25-Sep-2015
	C/- Davis Consulting Group Limited	**Date Reported:**	07-Oct-2015
	PO Box 2450	**Quote No:**	
	Wakatipu	**Order No:**	
	QUEENSTOWN 9349	**Client Reference:**	The Hills 15063
		Submitted y:	Fiona Rowley

Sample Type: Soil

Sample Name:		A3.2 (0.1) 24-Sep-2015 9:35 am	A3.5 (0.1) 24-Sep-2015 9:50 am	A2.2 (0.1) 24-Sep-2015 10:05 am	A2.5 (0.1) 24-Sep-2015 10:20 am	A2.8 (0.1) 24-Sep-2015 10:35 am
Lab Number:		1480301.2	1480301.5	1480301.8	1480301.11	1480301.14
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	0.017	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	0.014	< 0.010	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Name:		Dup#1 24-Sep-2015 9:51 am	A8.2 (0.1) 24-Sep-2015 10:50 am	A8.5 (0.1) 24-Sep-2015 11:05 am	A8.8 (0.1) 24-Sep-2015 11:20 am	A7.2 (0.1) 24-Sep-2015 11:35 am
Lab Number:		1480301.16	1480301.18	1480301.21	1480301.24	1480301.27
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		Dup#1 24-Sep-2015 9:51 am	A8.2 (0.1) 24-Sep-2015 10:50 am	A8.5 (0.1) 24-Sep-2015 11:05 am	A8.8 (0.1) 24-Sep-2015 11:20 am	A7.2 (0.1) 24-Sep-2015 11:35 am
Lab Number:		1480301.16	1480301.18	1480301.21	1480301.24	1480301.27
Organochlorine Pesticides Screening in Soil						
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	0.096
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	0.036
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Name:		A7.5 (0.1) 24-Sep-2015 11:50 am	A6.2 (0.1) 24-Sep-2015 12:05 pm	A5.1 (0.1) 24-Sep-2015 12:15 pm	A5.5 (0.1) 24-Sep-2015 12:35 pm	A4.2 (0.1) 24-Sep-2015 12:50 pm
Lab Number:		1480301.30	1480301.33	1480301.35	1480301.39	1480301.42
Individual Tests						
Dry Matter	g/100g as rcvd	85	-	-	-	-
Multiresidue Pesticides in Soil samples by GCMS						
Acetochlor	mg/kg dry wt	< 0.007	-	-	-	-
Alachlor	mg/kg dry wt	< 0.006	-	-	-	-
Aldrin	mg/kg dry wt	< 0.010	-	-	-	-
Atrazine	mg/kg dry wt	< 0.007	-	-	-	-
Atrazine-desethyl	mg/kg dry wt	< 0.007	-	-	-	-
Atrazine-desisopropyl	mg/kg dry wt	< 0.014	-	-	-	-
Azaconazole	mg/kg dry wt	< 0.004	-	-	-	-
Azinphos-methyl	mg/kg dry wt	< 0.014	-	-	-	-
Benalaxyl	mg/kg dry wt	< 0.004	-	-	-	-
Bendiocarb	mg/kg dry wt	< 0.007	-	-	-	-
Benodanil	mg/kg dry wt	< 0.014	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.010	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.010	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.010	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	-	-	-	-
Bifenthrin	mg/kg dry wt	< 0.004	-	-	-	-
Bitertanol	mg/kg dry wt	< 0.014	-	-	-	-
Bromacil	mg/kg dry wt	< 0.007	-	-	-	-
Bromophos-ethyl	mg/kg dry wt	< 0.007	-	-	-	-
Bromopropylate	mg/kg dry wt	< 0.007	-	-	-	-
Bupirimate	mg/kg dry wt	< 0.007	-	-	-	-
Buprofezin	mg/kg dry wt	< 0.007	-	-	-	-
Butachlor	mg/kg dry wt	< 0.007	-	-	-	-
Captafol	mg/kg dry wt	< 0.04	-	-	-	-
Captan	mg/kg dry wt	< 0.014	-	-	-	-
Carbaryl	mg/kg dry wt	< 0.007	-	-	-	-
Carbofenothion	mg/kg dry wt	< 0.007	-	-	-	-
Carbofuran	mg/kg dry wt	< 0.007	-	-	-	-

Sample Type: Soil						
Sample Name:		A7.5 (0.1) 24-Sep-2015 11:50 am	A6.2 (0.1) 24-Sep-2015 12:05 pm	A5.1 (0.1) 24-Sep-2015 12:15 pm	A5.5 (0.1) 24-Sep-2015 12:35 pm	A4.2 (0.1) 24-Sep-2015 12:50 pm
Lab Number:		1480301.30	1480301.33	1480301.35	1480301.39	1480301.42
Multiresidue Pesticides in Soil samples by GCMS						
Carboxin	mg/kg dry wt	< 0.007	-	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.010	-	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.010	-	-	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	-	-	-	-
Chlorfenvinphos	mg/kg dry wt	< 0.010	-	-	-	-
Chlorfluazuron	mg/kg dry wt	< 0.007	-	-	-	-
Chlorothalonil	mg/kg dry wt	< 0.007	-	-	-	-
Chlorpropham	mg/kg dry wt	< 0.014	-	-	-	-
Chlorpyrifos	mg/kg dry wt	< 0.007	-	-	-	-
Chlorpyrifos-methyl	mg/kg dry wt	< 0.007	-	-	-	-
Chlortoluron	mg/kg dry wt	< 0.014	-	-	-	-
Chlozolinate	mg/kg dry wt	< 0.007	-	-	-	-
Coumaphos	mg/kg dry wt	< 0.014	-	-	-	-
Cyanazine	mg/kg dry wt	< 0.007	-	-	-	-
Cyfluthrin	mg/kg dry wt	< 0.009	-	-	-	-
Cyhalothrin	mg/kg dry wt	< 0.007	-	-	-	-
Cypermethrin	mg/kg dry wt	< 0.018	-	-	-	-
Cyproconazole	mg/kg dry wt	< 0.014	-	-	-	-
Cyprodinil	mg/kg dry wt	< 0.007	-	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.010	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDE	mg/kg dry wt	0.091	-	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDT	mg/kg dry wt	0.023	-	-	-	-
Total DDT Isomers	mg/kg dry wt	0.11	-	-	-	-
Deltamethrin (including Tralomethrin)	mg/kg dry wt	< 0.007	-	-	-	-
Demeton-S-methyl	mg/kg dry wt	< 0.014	-	-	-	-
Diazinon	mg/kg dry wt	< 0.004	-	-	-	-
Dichlobenil	mg/kg dry wt	< 0.007	-	-	-	-
Dichlofenthion	mg/kg dry wt	< 0.007	-	-	-	-
Dichlofluanid	mg/kg dry wt	< 0.007	-	-	-	-
Dichloran	mg/kg dry wt	< 0.03	-	-	-	-
Dichlorvos	mg/kg dry wt	< 0.010	-	-	-	-
Dicofol	mg/kg dry wt	< 0.04	-	-	-	-
Dicrotophos	mg/kg dry wt	< 0.007	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.010	-	-	-	-
Difenoconazole	mg/kg dry wt	< 0.010	-	-	-	-
Dimethoate	mg/kg dry wt	< 0.014	-	-	-	-
Dinocap	mg/kg dry wt	< 0.08	-	-	-	-
Diphenylamine	mg/kg dry wt	< 0.014	-	-	-	-
Disulfoton	mg/kg dry wt	< 0.007	-	-	-	-
Diuron	mg/kg dry wt	< 0.007	-	-	-	-
Endosulfan I	mg/kg dry wt	< 0.010	-	-	-	-
Endosulfan II	mg/kg dry wt	< 0.010	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	-	-	-	-
Endrin	mg/kg dry wt	< 0.010	-	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.010	-	-	-	-
Endrin ketone	mg/kg dry wt	< 0.010	-	-	-	-
EPN	mg/kg dry wt	< 0.007	-	-	-	-
Esfenvalerate	mg/kg dry wt	< 0.010	-	-	-	-
Ethion	mg/kg dry wt	< 0.007	-	-	-	-
Etrimfos	mg/kg dry wt	< 0.007	-	-	-	-

Sample Type: Soil						
Sample Name:		A7.5 (0.1) 24-Sep-2015 11:50 am	A6.2 (0.1) 24-Sep-2015 12:05 pm	A5.1 (0.1) 24-Sep-2015 12:15 pm	A5.5 (0.1) 24-Sep-2015 12:35 pm	A4.2 (0.1) 24-Sep-2015 12:50 pm
Lab Number:		1480301.30	1480301.33	1480301.35	1480301.39	1480301.42
Multiresidue Pesticides in Soil samples by GCMS						
Famphur	mg/kg dry wt	< 0.007	-	-	-	-
Fenamiphos	mg/kg dry wt	< 0.007	-	-	-	-
Fenarimol	mg/kg dry wt	< 0.007	-	-	-	-
Fenitrothion	mg/kg dry wt	< 0.007	-	-	-	-
Fenpropathrin	mg/kg dry wt	< 0.007	-	-	-	-
Fenpropimorph	mg/kg dry wt	< 0.007	-	-	-	-
Fensulfothion	mg/kg dry wt	< 0.007	-	-	-	-
Fenthion	mg/kg dry wt	< 0.007	-	-	-	-
Fenvalerate	mg/kg dry wt	< 0.010	-	-	-	-
Fluazifop-butyl	mg/kg dry wt	< 0.007	-	-	-	-
Fluometuron	mg/kg dry wt	< 0.007	-	-	-	-
Flusilazole	mg/kg dry wt	< 0.007	-	-	-	-
Fluvalinate	mg/kg dry wt	< 0.006	-	-	-	-
Folpet	mg/kg dry wt	< 0.014	-	-	-	-
Furalaxyl	mg/kg dry wt	< 0.004	-	-	-	-
Haloxyfop-methyl	mg/kg dry wt	< 0.007	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.010	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	-	-	-	-
Hexaconazole	mg/kg dry wt	< 0.007	-	-	-	-
Hexazinone	mg/kg dry wt	< 0.004	-	-	-	-
Hexythiazox	mg/kg dry wt	< 0.04	-	-	-	-
Imazalil	mg/kg dry wt	< 0.04	-	-	-	-
Indoxacarb	mg/kg dry wt	< 0.007	-	-	-	-
Iodofenphos	mg/kg dry wt	< 0.007	-	-	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/kg dry wt	< 0.04	-	-	-	-
Isazophos	mg/kg dry wt	< 0.007	-	-	-	-
Isofenphos	mg/kg dry wt	< 0.004	-	-	-	-
Kresoxim-methyl	mg/kg dry wt	< 0.004	-	-	-	-
Leptophos	mg/kg dry wt	< 0.007	-	-	-	-
Linuron	mg/kg dry wt	< 0.007	-	-	-	-
Malathion	mg/kg dry wt	< 0.007	-	-	-	-
Metalaxyl	mg/kg dry wt	< 0.007	-	-	-	-
Methacrifos	mg/kg dry wt	< 0.007	-	-	-	-
Methamidophos	mg/kg dry wt	< 0.04	-	-	-	-
Methidathion	mg/kg dry wt	< 0.007	-	-	-	-
Methiocarb	mg/kg dry wt	< 0.007	-	-	-	-
Methoxychlor	mg/kg dry wt	< 0.010	-	-	-	-
Metolachlor	mg/kg dry wt	< 0.006	-	-	-	-
Metribuzin	mg/kg dry wt	< 0.007	-	-	-	-
Mevinphos	mg/kg dry wt	< 0.014	-	-	-	-
Molinate	mg/kg dry wt	< 0.014	-	-	-	-
Myclobutanil	mg/kg dry wt	< 0.007	-	-	-	-
Naled	mg/kg dry wt	< 0.04	-	-	-	-
Nitrofen	mg/kg dry wt	< 0.014	-	-	-	-
Nitrothal-isopropyl	mg/kg dry wt	< 0.007	-	-	-	-
Norflurazon	mg/kg dry wt	< 0.014	-	-	-	-
Omethoate	mg/kg dry wt	< 0.04	-	-	-	-
Oxadiazon	mg/kg dry wt	< 0.007	-	-	-	-
Oxychlordane	mg/kg dry wt	< 0.004	-	-	-	-
Oxyfluorfen	mg/kg dry wt	< 0.004	-	-	-	-
Paclobutrazol	mg/kg dry wt	< 0.007	-	-	-	-
Parathion-ethyl	mg/kg dry wt	< 0.007	-	-	-	-
Parathion-methyl	mg/kg dry wt	< 0.007	-	-	-	-

Sample Type: Soil						
Sample Name:		A7.5 (0.1) 24-Sep-2015 11:50 am	A6.2 (0.1) 24-Sep-2015 12:05 pm	A5.1 (0.1) 24-Sep-2015 12:15 pm	A5.5 (0.1) 24-Sep-2015 12:35 pm	A4.2 (0.1) 24-Sep-2015 12:50 pm
Lab Number:		1480301.30	1480301.33	1480301.35	1480301.39	1480301.42
Multiresidue Pesticides in Soil samples by GCMS						
Penconazole	mg/kg dry wt	< 0.007	-	-	-	-
Pendimethalin	mg/kg dry wt	< 0.007	-	-	-	-
Permethrin	mg/kg dry wt	< 0.003	-	-	-	-
Phorate	mg/kg dry wt	< 0.014	-	-	-	-
Phosmet	mg/kg dry wt	< 0.007	-	-	-	-
Phosphamidon	mg/kg dry wt	< 0.007	-	-	-	-
Pirimicarb	mg/kg dry wt	< 0.007	-	-	-	-
Pirimiphos-methyl	mg/kg dry wt	< 0.007	-	-	-	-
Prochloraz	mg/kg dry wt	< 0.04	-	-	-	-
Procymidone	mg/kg dry wt	< 0.007	-	-	-	-
Prometryn	mg/kg dry wt	< 0.004	-	-	-	-
Propachlor	mg/kg dry wt	< 0.007	-	-	-	-
Propanil	mg/kg dry wt	< 0.03	-	-	-	-
Propazine	mg/kg dry wt	< 0.004	-	-	-	-
Propetamphos	mg/kg dry wt	< 0.007	-	-	-	-
Propham	mg/kg dry wt	< 0.007	-	-	-	-
Propiconazole	mg/kg dry wt	< 0.006	-	-	-	-
Prothiofos	mg/kg dry wt	< 0.007	-	-	-	-
Pyrazophos	mg/kg dry wt	< 0.007	-	-	-	-
Pyrifenox	mg/kg dry wt	< 0.010	-	-	-	-
Pyrimethanil	mg/kg dry wt	< 0.007	-	-	-	-
Pyriproxyfen	mg/kg dry wt	< 0.007	-	-	-	-
Quintozene	mg/kg dry wt	< 0.014	-	-	-	-
Quizalofop-ethyl	mg/kg dry wt	< 0.007	-	-	-	-
Simazine	mg/kg dry wt	< 0.007	-	-	-	-
Simetryn	mg/kg dry wt	< 0.007	-	-	-	-
Sulfentrazone	mg/kg dry wt	< 0.04	-	-	-	-
Sulfotep	mg/kg dry wt	< 0.007	-	-	-	-
TCMTB [2-(thiocyanomethylthio) benzothiazole,Busan]	mg/kg dry wt	< 0.014	-	-	-	-
Tebuconazole	mg/kg dry wt	< 0.007	-	-	-	-
Tebufenpyrad	mg/kg dry wt	< 0.004	-	-	-	-
Terbacil	mg/kg dry wt	< 0.007	-	-	-	-
Terbufos	mg/kg dry wt	< 0.007	-	-	-	-
Terbumeton	mg/kg dry wt	< 0.007	-	-	-	-
Terbuthylazine	mg/kg dry wt	< 0.004	-	-	-	-
Terbuthylazine-desethyl	mg/kg dry wt	< 0.007	-	-	-	-
Terbutryn	mg/kg dry wt	< 0.007	-	-	-	-
Tetrachlorvinphos	mg/kg dry wt	< 0.007	-	-	-	-
Thiabendazole	mg/kg dry wt	< 0.04	-	-	-	-
Thiobencarb	mg/kg dry wt	< 0.007	-	-	-	-
Thiometon	mg/kg dry wt	< 0.014	-	-	-	-
Tolylfluanid	mg/kg dry wt	< 0.004	-	-	-	-
Triadimefon	mg/kg dry wt	< 0.007	-	-	-	-
Triazophos	mg/kg dry wt	< 0.007	-	-	-	-
Trifluralin	mg/kg dry wt	< 0.007	-	-	-	-
Vinclozolin	mg/kg dry wt	< 0.007	-	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		A7.5 (0.1) 24-Sep-2015 11:50 am	A6.2 (0.1) 24-Sep-2015 12:05 pm	A5.1 (0.1) 24-Sep-2015 12:15 pm	A5.5 (0.1) 24-Sep-2015 12:35 pm	A4.2 (0.1) 24-Sep-2015 12:50 pm
Lab Number:		1480301.30	1480301.33	1480301.35	1480301.39	1480301.42
Organochlorine Pesticides Screening in Soil						
trans-Chlordane	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	-	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	-	0.087	0.065	0.107	0.045
2,4'-DDT	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	-	0.013	0.019	0.025	0.022
Dieldrin	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	-	< 0.010	< 0.010	< 0.010	< 0.010

Sample Name:		A4.5 (0.1) 24-Sep-2015 1:05 pm	A4.8 (0.1) 24-Sep-2015 1:20 pm	A4.11 (0.1) 24-Sep-2015 1:35 pm	A4.14 (0.1) 24-Sep-2015 1:50 pm	Dup#2 24-Sep-2015 12:16 pm
Lab Number:		1480301.45	1480301.48	1480301.51	1480301.54	1480301.56
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	0.061
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	0.019
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Name:		Composite of A3.1 (0.1), A3.2 (0.1) & A3.3 (0.1)	Composite of A3.4 (0.1), A3.5 (0.1) & A3.6 (0.1)	Composite of A2.1 (0.1), A2.2 (0.1) & A2.3 (0.1)	Composite of A2.4 (0.1), A2.5 (0.1) & A2.6 (0.1)	Composite of A2.7 (0.1), A2.8 (0.1) & A2.9 (0.1)
Lab Number:		1480301.57	1480301.58	1480301.59	1480301.60	1480301.61

Sample Type: Soil						
Sample Name:		Composite of A3.1 (0.1), A3.2 (0.1) & A3.3 (0.1)	Composite of A3.4 (0.1), A3.5 (0.1) & A3.6 (0.1)	Composite of A2.1 (0.1), A2.2 (0.1) & A2.3 (0.1)	Composite of A2.4 (0.1), A2.5 (0.1) & A2.6 (0.1)	Composite of A2.7 (0.1), A2.8 (0.1) & A2.9 (0.1)
Lab Number:		1480301.57	1480301.58	1480301.59	1480301.60	1480301.61
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	9	9	9	9	9
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	7	7	7	7	7
Total Recoverable Copper	mg/kg dry wt	8	9	8	9	9
Total Recoverable Lead	mg/kg dry wt	12.9	12.2	12.8	11.9	11.6
Total Recoverable Nickel	mg/kg dry wt	7	7	7	7	7
Total Recoverable Zinc	mg/kg dry wt	36	33	34	33	36

Sample Name:		Composite of A8.1 (0.1), A8.2 (0.1) & A8.3 (0.1)	Composite of A8.4 (0.1), A8.5 (0.1) & A8.6 (0.1)	Composite of A8.7 (0.1), A8.8 (0.1) & A8.9 (0.1)	Composite of A7.1 (0.1), A7.2 (0.1) & A7.3 (0.1)	Composite of A7.4 (0.1), A7.5 (0.1) & A7.6 (0.1)
Lab Number:		1480301.62	1480301.63	1480301.64	1480301.65	1480301.66
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	18	18	19	9	9
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	12	13	13	8	7
Total Recoverable Copper	mg/kg dry wt	18	18	20	10	12
Total Recoverable Lead	mg/kg dry wt	26	23	24	12.8	12.7
Total Recoverable Nickel	mg/kg dry wt	12	13	13	8	8
Total Recoverable Zinc	mg/kg dry wt	60	62	62	39	38

Sample Name:		Composite of A6.1 (0.1), A6.2 (0.1) & A6.3 (0.1)	Composite of A5.1 (0.1), A5.2 (0.1) & A5.3 (0.1)	Composite of A5.4 (0.1), A5.5 (0.1) & A5.6 (0.1)	Composite of A4.1 (0.1), A4.2 (0.1) & A4.3 (0.1)	Composite of A4.4 (0.1), A4.5 (0.1) & A4.6 (0.1)
Lab Number:		1480301.67	1480301.68	1480301.69	1480301.70	1480301.71
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	14	8	8	9	8
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	0.11
Total Recoverable Chromium	mg/kg dry wt	7	7	7	7	7
Total Recoverable Copper	mg/kg dry wt	11	9	9	12	10
Total Recoverable Lead	mg/kg dry wt	17.2	10.9	10.9	14.1	11.3
Total Recoverable Nickel	mg/kg dry wt	8	7	7	8	8
Total Recoverable Zinc	mg/kg dry wt	35	33	35	45	33

Sample Name:		Composite of A4.7 (0.1), A4.8 (0.1) & A4.9 (0.1)	Composite of A4.10 (0.1), A4.11 (0.1) & A4.12 (0.1)	Composite of A4.13 (0.1), A4.14 (0.1) & A4.15 (0.1)	A1-3 (0.15) 25-Sep-2015 10:00 am	A1-5 (0.15) 25-Sep-2015 10:10 am
Lab Number:		1480301.72	1480301.73	1480301.74	1480301.77	1480301.79
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	10	9	9	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	-	-
Total Recoverable Chromium	mg/kg dry wt	7	6	7	-	-
Total Recoverable Copper	mg/kg dry wt	10	10	10	-	-
Total Recoverable Lead	mg/kg dry wt	11.5	11.4	12.4	-	-
Total Recoverable Nickel	mg/kg dry wt	7	7	7	-	-
Total Recoverable Zinc	mg/kg dry wt	47	31	31	-	-
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

Sample Type: Soil						
Sample Name:		Composite of A4.7 (0.1), A4.8 (0.1) & A4.9 (0.1)	Composite of A4.10 (0.1), A4.11 (0.1) & A4.12 (0.1)	Composite of A4.13 (0.1), A4.14 (0.1) & A4.15 (0.1)	A1-3 (0.15) 25-Sep-2015 10:00 am	A1-5 (0.15) 25-Sep-2015 10:10 am
Lab Number:		1480301.72	1480301.73	1480301.74	1480301.77	1480301.79
Organochlorine Pesticides Screening in Soil						
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 Name:		A1-8 (0.15) 25-Sep-2015 10:25 am	A10-2 (0.1) 25-Sep-2015 10:40 am	DUP3 25-Sep-2015 10:01 am	A10-5 (0.1) 25-Sep-2015 10:55 am	A10-8 (0.1) 25-Sep-2015 11:10 am
Lab Number:		1480301.82	1480301.85	1480301.87	1480301.89	1480301.92
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Name:		A10-11 (0.1) 25-Sep-2015 11:25 am	A9-2 (0.1) 25-Sep-2015 11:40 am	A9-5 (0.1) 25-Sep-2015 11:55 am	HS10-2 (0.1) 25-Sep-2015 12:10 pm	HS10-5 (0.1) 25-Sep-2015 12:25 pm
Lab Number:		1480301.95	1480301.98	1480301.101	1480301.104	1480301.107
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		A10-11 (0.1) 25-Sep-2015 11:25 am	A9-2 (0.1) 25-Sep-2015 11:40 am	A9-5 (0.1) 25-Sep-2015 11:55 am	HS10-2 (0.1) 25-Sep-2015 12:10 pm	HS10-5 (0.1) 25-Sep-2015 12:25 pm
Lab Number:		1480301.95	1480301.98	1480301.101	1480301.104	1480301.107
Organochlorine Pesticides Screening in Soil						
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	0.044	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	0.015	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	0.018	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Name:		HS5-2 (0.1) 25-Sep-2015 12:40 pm	HS5-5 (0.1) 25-Sep-2015 12:55 pm	HS9-3 (0.1) 25-Sep-2015 1:15 pm	HS9-5 (0.1) 25-Sep-2015 1:25 pm	DUP4 25-Sep-2015 1:16 pm
Lab Number:		1480301.110	1480301.113	1480301.117	1480301.119	1480301.121
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		HS1-2 (0.1) 25-Sep-2015 1:40 pm	HS1-5 (0.1) 25-Sep-2015 1:55 pm	HS8-1 (0.1) 25-Sep-2015 2:05 pm	DUP5 25-Sep-2015 2:06 pm	HS8-5 (0.1) 25-Sep-2015 2:25 pm
Lab Number:		1480301.123	1480301.126	1480301.128	1480301.130	1480301.133
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Name:		HS4-1 (0.1) 28-Sep-2015 12:55 pm	HS4-2 (0.1) 28-Sep-2015 1:00 pm	HS4-3 (0.1) 28-Sep-2015 1:05 pm	HS4-4 (0.1) 28-Sep-2015 1:10 pm	HS4-5 (0.1) 28-Sep-2015 1:15 pm
Lab Number:		1480301.135	1480301.136	1480301.137	1480301.138	1480301.139
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	14	12	13	14	10
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	0.10	< 0.10	0.12
Total Recoverable Chromium	mg/kg dry wt	12	10	17	13	13
Total Recoverable Copper	mg/kg dry wt	16	11	16	22	11
Total Recoverable Lead	mg/kg dry wt	16.9	12.3	13.5	15.3	12.6
Total Recoverable Nickel	mg/kg dry wt	11	10	14	10	11
Total Recoverable Zinc	mg/kg dry wt	130	92	71	260	59
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	< 0.010	0.128	0.035	< 0.010	0.044
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	< 0.010	0.036	< 0.010	< 0.010	0.017
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Type: Soil						
Sample Name:		HS4-1 (0.1) 28-Sep-2015 12:55 pm	HS4-2 (0.1) 28-Sep-2015 1:00 pm	HS4-3 (0.1) 28-Sep-2015 1:05 pm	HS4-4 (0.1) 28-Sep-2015 1:10 pm	HS4-5 (0.1) 28-Sep-2015 1:15 pm
Lab Number:		1480301.135	1480301.136	1480301.137	1480301.138	1480301.139
Organochlorine Pesticides Screening in Soil						
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Name:		HS4-6 (0.1) 28-Sep-2015 1:20 pm	HS2-2 (0.1) 28-Sep-2015 1:30 pm	HS2-6 (0.1) 28-Sep-2015 1:50 pm	HS3-2 (0.1) 28-Sep-2015 2:00 pm	HS3-5 (0.1) 28-Sep-2015 2:15 pm
Lab Number:		1480301.140	1480301.142	1480301.146	1480301.148	1480301.151
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	10	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	9	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	11	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	11.3	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	8	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	63	-	-	-	-
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
alpha-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
beta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
delta-BHC	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
cis-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
trans-Chlordane	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
2,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDD	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDE	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDE	mg/kg dry wt	0.060	< 0.010	< 0.010	< 0.010	< 0.010
2,4'-DDT	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
4,4'-DDT	mg/kg dry wt	0.018	< 0.010	< 0.010	< 0.010	< 0.010
Dieldrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Sample Name:		DUP6 28-Sep-2015 1:51 pm	Composite of A1-1 (0.15), A1-2 (0.15) & A1-3 (0.15)	Composite of A1-4 (0.15), A1-5 (0.15) & A1-6 (0.15)	Composite of A1-7 (0.1), A1-8 (0.15) & A1-9 (0.15)	Composite of A10-1 (0.1), A10-2 (0.1) & A10-3 (0.1)
Lab Number:		1480301.153	1480301.154	1480301.155	1480301.156	1480301.157
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						

Sample Type: Soil						
Sample Name:		DUP6 28-Sep-2015 1:51 pm	Composite of A1-1 (0.15), A1-2 (0.15) & A1-3 (0.15)	Composite of A1-4 (0.15), A1-5 (0.15) & A1-6 (0.15)	Composite of A1-7 (0.1), A1-8 (0.15) & A1-9 (0.15)	Composite of A10-1 (0.1), A10-2 (0.1) & A10-3 (0.1)
Lab Number:		1480301.153	1480301.154	1480301.155	1480301.156	1480301.157
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	-	10	11	11	8
Total Recoverable Cadmium	mg/kg dry wt	-	< 0.10	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	-	7	7	6	6
Total Recoverable Copper	mg/kg dry wt	-	10	12	12	7
Total Recoverable Lead	mg/kg dry wt	-	11.7	13.2	12.2	9.8
Total Recoverable Nickel	mg/kg dry wt	-	7	8	8	7
Total Recoverable Zinc	mg/kg dry wt	-	37	31	30	35
Organochlorine Pesticides Screening in Soil						
Aldrin	mg/kg dry wt	< 0.010	-	-	-	-
alpha-BHC	mg/kg dry wt	< 0.010	-	-	-	-
beta-BHC	mg/kg dry wt	< 0.010	-	-	-	-
delta-BHC	mg/kg dry wt	< 0.010	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt	< 0.010	-	-	-	-
cis-Chlordane	mg/kg dry wt	< 0.010	-	-	-	-
trans-Chlordane	mg/kg dry wt	< 0.010	-	-	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt	< 0.04	-	-	-	-
2,4'-DDD	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDD	mg/kg dry wt	< 0.010	-	-	-	-
2,4'-DDE	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDE	mg/kg dry wt	< 0.010	-	-	-	-
2,4'-DDT	mg/kg dry wt	< 0.010	-	-	-	-
4,4'-DDT	mg/kg dry wt	< 0.010	-	-	-	-
Dieldrin	mg/kg dry wt	< 0.010	-	-	-	-
Endosulfan I	mg/kg dry wt	< 0.010	-	-	-	-
Endosulfan II	mg/kg dry wt	< 0.010	-	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	-	-	-	-
Endrin	mg/kg dry wt	< 0.010	-	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.010	-	-	-	-
Endrin ketone	mg/kg dry wt	< 0.010	-	-	-	-
Heptachlor	mg/kg dry wt	< 0.010	-	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	-	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	-	-	-	-
Methoxychlor	mg/kg dry wt	< 0.010	-	-	-	-

Sample Name:		Composite of A10-4 (0.1), A10-5 (0.1) & A10-6 (0.1)	Composite of A10-7 (0.1), A10-8 (0.1) & A10-9 (0.1)	Composite of A10-10 (0.1), A10-11 (0.1) & A10-12 (0.1)	Composite of A9-1 (0.1), A9-2 (0.1) & A9-3 (0.1)	Composite of A9-4 (0.1), A9-5 (0.1) & A9-6 (0.1)
Lab Number:		1480301.158	1480301.159	1480301.160	1480301.161	1480301.162
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	9	11	9	10	11
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.11	< 0.10	< 0.10	< 0.10
Total Recoverable Chromium	mg/kg dry wt	7	8	8	7	8
Total Recoverable Copper	mg/kg dry wt	8	12	8	9	10
Total Recoverable Lead	mg/kg dry wt	10.0	11.5	10.2	10.0	14.4
Total Recoverable Nickel	mg/kg dry wt	7	8	7	7	7
Total Recoverable Zinc	mg/kg dry wt	35	40	33	35	39

Sample Name:		Composite of HS10-1 (0.1), HS10-2 (0.1) & HS10-3 (0.1)	Composite of HS10-4 (0.1), HS10-5 (0.1) & HS10-6 (0.1)	Composite of HS5-1 (0.1), HS5-2 (0.1) & HS5-3 (0.1)	Composite of HS5-4 (0.1), HS5-5 (0.1) & HS5-6 (0.1)	Composite of HS9-1 (0.1), HS9-2 (0.1) & HS9-3 (0.1)
Lab Number:		1480301.163	1480301.164	1480301.165	1480301.166	1480301.167
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	8	10	13	10	11
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Sample Type: Soil						
Sample Name:		Composite of HS10-1 (0.1), HS10-2 (0.1) & HS10-3 (0.1)	Composite of HS10-4 (0.1), HS10-5 (0.1) & HS10-6 (0.1)	Composite of HS5-1 (0.1), HS5-2 (0.1) & HS5-3 (0.1)	Composite of HS5-4 (0.1), HS5-5 (0.1) & HS5-6 (0.1)	Composite of HS9-1 (0.1), HS9-2 (0.1) & HS9-3 (0.1)
Lab Number:		1480301.163	1480301.164	1480301.165	1480301.166	1480301.167
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Chromium	mg/kg dry wt	8	7	8	7	9
Total Recoverable Copper	mg/kg dry wt	11	11	12	10	10
Total Recoverable Lead	mg/kg dry wt	10.1	10.6	13.1	10.4	12.8
Total Recoverable Nickel	mg/kg dry wt	8	8	9	7	8
Total Recoverable Zinc	mg/kg dry wt	43	38	41	37	42

Sample Name:		Composite of HS9-4 (0.1), HS9-5 (0.1) & HS9-6 (0.1)	Composite of HS1-1 (0.1), HS1-2 (0.1) & HS1-3 (0.1)	Composite of HS1-4 (0.1), HS1-5 (0.1) & HS1-6 (0.1)	Composite of HS8-1 (0.1), HS8-2 (0.1) & HS8-3 (0.1)	Composite of HS8-4 (0.1), HS8-5 (0.1) & HS8-6 (0.1)
Lab Number:		1480301.168	1480301.169	1480301.170	1480301.171	1480301.172
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	10	9	9	11	11
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	< 0.10	< 0.10	0.12	< 0.10
Total Recoverable Chromium	mg/kg dry wt	7	9	9	10	9
Total Recoverable Copper	mg/kg dry wt	11	13	11	14	14
Total Recoverable Lead	mg/kg dry wt	10.2	14.1	14.0	14.4	13.1
Total Recoverable Nickel	mg/kg dry wt	8	10	8	10	10
Total Recoverable Zinc	mg/kg dry wt	39	50	45	59	53

Sample Name:		Composite of HS-1 (0.1), HS2-2 (0.1) & HS2-3 (0.1)	Composite of HS2-4 (0.1), HS2-5 (0.1) & HS2-6 (0.1)	Composite of HS3-1 (0.1), HS3-2 (0.1) & HS3-3 (0.1)	Composite of HS3-4 (0.1), HS3-5 (0.1) & HS3-6 (0.1)	
Lab Number:		1480301.173	1480301.174	1480301.175	1480301.176	
Heavy metal screen level As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Recoverable Arsenic	mg/kg dry wt	9	9	10	10	-
Total Recoverable Cadmium	mg/kg dry wt	0.11	0.10	0.14	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	8	7	9	8	-
Total Recoverable Copper	mg/kg dry wt	10	10	12	14	-
Total Recoverable Lead	mg/kg dry wt	10.5	10.4	13.9	11.3	-
Total Recoverable Nickel	mg/kg dry wt	8	8	9	8	-
Total Recoverable Zinc	mg/kg dry wt	47	39	51	39	-

S AR O ETHODS

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	**ethod 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%.	-	57-74, 135-140, 154-176
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	57-74, 135-140, 154-176
Multiresidue Pesticides in Soil samples by GCMS	Sonication extraction, GC-MS analysis. Tested on as received sample, then results corrected to a dry weight basis using the separate Dry Matter result.	0.003 - 0.06 mg/kg dry wt	30

Sample Type: Soil			
Test	**ethod Description**	**Default Detection Limit**	**Sample No**
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	2, 5, 8, 11, 14, 16, 18, 21, 24, 27, 33, 35, 39, 42, 45, 48, 51, 54, 56, 77, 79, 82, 85, 87, 89, 92, 95, 98, 101, 104, 107, 110, 113, 117, 119, 121, 123, 126, 128, 130, 133, 135-140, 142, 146, 148, 151, 153
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	30
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	57-74, 135-140, 154-176
Composite Environmental Solid Samples*	Individual sample fractions mixed together to form a composite fraction.	-	1-15, 17-55, 75-86, 88-120, 122-129, 131-134, 141-152

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

MARSHALL DAY Acoustics

THE HILLS REZONING
HELICOPTER NOISE ASSESSMENT

Rp001 R01 2015564C | 12 October 2015

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Report No.: **Rp001 R02 2015564C**

Document Control

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Client Draft			8 October 2015	Steve Peakall	
	R01	Internal Review	12 October 2015	Steve Peakall	Laurel Smith
	R02	Legal Review	15 October 2015	Steve Peakall	

TABLE OF CONTENTS

1.0 INTRODUCTION

Marshall Day Acoustics has been engaged by the Boxer Hill Trust (the Trust) to undertake an assessment of helicopter noise effects from helicopter movements using a private helicopter landing area on the Hills golf course, located at 164 McDonnell Road, Arrowtown.

Noise emissions from the proposed helicopter operations have been predicted using the Integrated Noise Model (INM) software. Predicted noise levels are considered in relation to the noise rules of the Operative Queenstown Lakes District Plan and the relevant text of the notified Proposed District Plan.

Noise performance standards have been recommended based on the Operative and Proposed District Plan noise provisions and New Zealand Standard NZS 6807: 1994 "*Noise Management and Land Use Planning for Helicopter Landing Areas*".

This report presents the findings of the noise assessment. A glossary of terminology is presented in Appendix A.

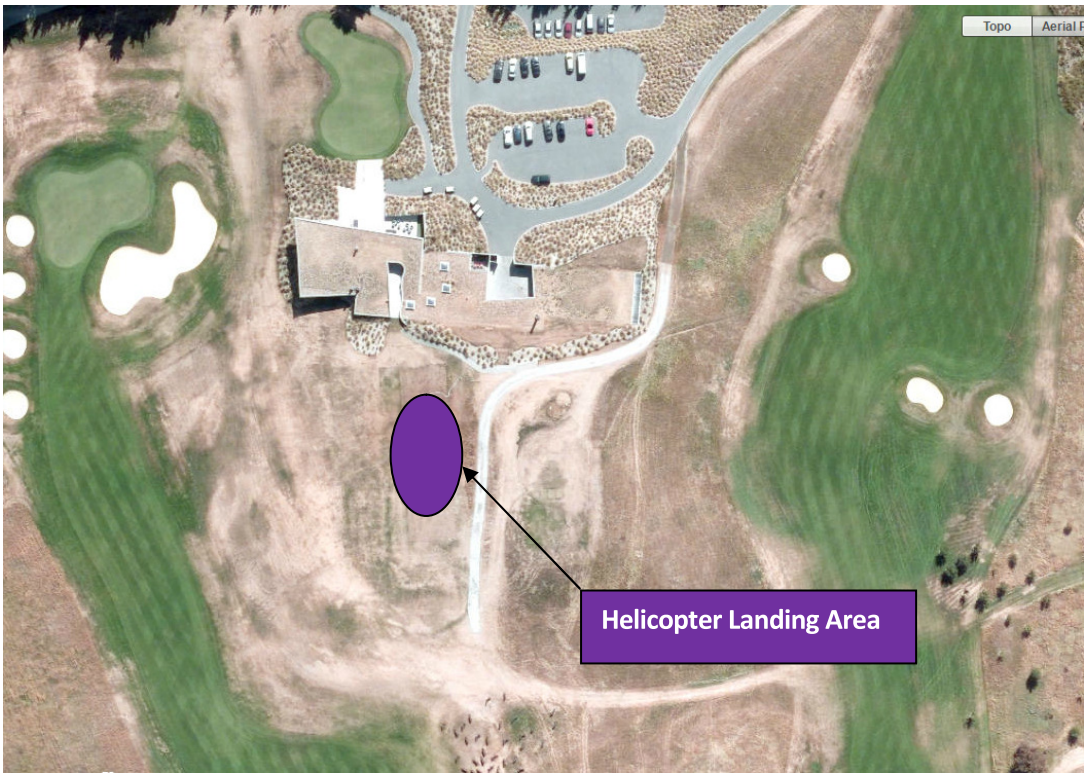
2.0 PROPOSAL

It is proposed by the Boxer Hill Trust to formalise a helicopter landing area at the Hills Golf Course in Arrowtown for private transportation to and from the site.

The golf course is located at 164 McDonnell Road, Arrowtown. The total land area of the site is approximately 162 Hectares. The proposed helicopter landing area is located just to the south of the existing clubhouse associated with the golf course and is currently used on an informal basis for helicopter movements.

Figure 1 shows the location of the proposed helicopter landing area.

Figure 1: Proposed Helicopter Landing Area



2.1 Proposed Activity

Typically the landing site has been used infrequently with approximately five movements per week on average. The landing zone has also been used historically for a higher number of movements on special event days at the golf course, an example of which is the New Zealand Golf Open.

The Trust is seeking to rezone its land to provide for resort style development, including visitor accommodation, residential activity, worker accommodation and ancillary commercial activity. In association with these activities the Trust is also seeking to formally allow for a number of helicopter movements to and from the site, for both special event days and for typical everyday usage.

For typical activity, the helicopter landing area would be used for not more than 12 movements (6 landings and 6 take-offs) in any consecutive seven day period. Helicopter movements would take place between the hours of 7.00 am and 10.00 pm Monday to Sunday

The type of helicopter would vary but is likely to be a Eurocopter EC130 or other type that is equivalent or lower in noise emissions. The helicopters would approach and depart the site generally to the south-east; and would not directly overfly any building or when below 500 ft in altitude.

For special event days it is envisaged that up to 20 helicopter movements could occur on any given day. MDA understand that special event days would only occur for up to ten days per year. The noise effects of consecutive special event days are discussed in more detail in section 4.3.

2.2 Existing Environment

Surrounding the site are several dwellings at various distances. Most are located over one kilometre from the proposed helipad, the closest being 500m away to the south. The receivers used in the assessment are shown on Figure 1, Appendix B.

It is noted that Receiver E is a wood shed and therefore not a noise sensitive receiver and that Receiver I, L, M and N are associated with the site and therefore not considered to be affected by helicopter noise for the purposes of this assessment. These have been excluded from our assessment.

Marshall Day Acoustics has visited the general area of the site on a number of occasions and observed the vicinity of the site and surrounding environs to be typical of a rural environment. The golf course is expected to be reasonably similar to a typical rural environment, and for extended periods of time may be noticeably quieter. Whilst, at the time of writing this report, no specific noise measurements on-site have occurred, the noise environment is expected to be relatively quiet, with natural sounds such as wind, birds in trees and trees rustling the main noise sources on-site.

Occasional heavy vehicles using the nearby road would be audible, as would aircraft activity associated with Queenstown Airport. The area is also subject to a moderate degree of existing helicopter activity, serving the various tourist operations that are common in the Queenstown Lakes District.

3.0 NOISE PERFORMANCE STANDARDS

General noise performance standards are not suitable for controlling noise from helicopter operations which involve high noise levels for short intermittent periods of time.

Helicopter noise emissions involve periods of relatively high noise levels for short periods, followed by periods where no noise is occurring, as the helicopter has either departed and left, or has been shut down. The general noise performance standards do not allow for or recognise that helicopters are inherently noisy, but also that noise occurs over a relatively short timeframe, with significant periods of respite between events where no noise is occurring.

New Zealand Standards published NZS 6807:1994 "*Noise Management and Land Use Planning for Helicopter Landing Areas*" (NZS 6807) to provide a standard approach to managing the effects of helicopter noise on sensitive receivers (e.g. dwellings). Some district plans throughout the country reference NZS 6807 directly, whereas others apply the principles of the Standard but with modified noise limits. The approach taken in the Operative Proposed Queenstown Lakes District Plan is described below.

3.1 Operative Queenstown Lakes District Plan

The site is currently zoned Rural General in the Queenstown Lakes District Plan. Helicopter landing areas are not provided for explicitly in the Operative District Plan, and helicopter noise emissions would be controlled by the general noise rules of the zone.

We understand that a helicopter landing area in the General Rural zone is a Discretionary Activity. For reference the general noise limits for the General Rural Zone are contained in Rule 8.2.4.2 (iii) (a) and are as follows:

Table 1: Noise from non-residential activities received within the Notional Boundary in Rural General Zone

Noise Limits dBA $L_{eq\,(15mins)}$	
Daytime 8.00am – 8.00pm	**Night-time 8.00pm – 8.00am**
50	40 and 70 dBA L_{AFmax}

As mentioned, general noise limits are not considered suitable for controlling noise from helicopter operations. In addition, the District Plan specifically refers, in rule 5.3.5.2 (v) (a), to New Zealand Standard NZS 6802:2008 *"Acoustics - Environmental Noise"* for the assessment of environmental noise emissions. This standard specifically defines helicopter noise emissions as requiring special assessment techniques outside the general scope of that standard.

Therefore the Operative Plan (to the extent it is relevant) acknowledges that helicopter noise requires special consideration, but does not provide any express guidance as to how it should be assessed.

3.2 Proposed (Notified District Plan Review)

The notified text of the Queenstown Lakes Proposed District Plan recognises helicopter noise emissions as requiring special consideration by proposing a specific rule (Proposed District Plan, Chapter 36, Rule 36.5 Table 3 – Specific Standards, 36.5.13) , as outlined below:

"*Table 3 Specific Standards*

> *36.5.13 – Helicopters: Sound from any helicopter landing area must be measured and assessed in accordance with NZ 6807:1994 Noise Management and Land Use Planning for Helicopter Landing Areas. Sound from helicopter landing areas must comply with the limits of acceptability set out in Table 1 of NZS 6807. For the avoidance of doubt this rule does not apply to designated airports*."

The rule also specifies a noise limit of 50 dB L_{dn} for residential sites, which is consistent with NZS 6807.

3.3 New Zealand Standard 6807:1994

NZS 6807:1994 "*Noise Management and Land Use Planning for Helicopter Landing Areas*" has been written to provide territorial authorities guidance on the control of noise from helicopter landing areas by way of resource consents or rules in the District Plan. The Standard recognises that general

community noise controls are not appropriate for managing the noise effects of helicopter operations.

NZS 6807 is intended for helicopter landing areas used for ten or more movements in any month or where flight movements are likely to result in a maximum sound level exceeding 70 dB L_{AFmax} at night or 90 dB L_{AFmax} during the day in any residential zone or notional boundary of any rural dwelling. It is not intended to apply to infrequently used helicopter landing areas or emergency operations. Given that under the proposed re-zoning of the Trust's land there may be more than 10 flight movements per month, it is appropriate to apply the NZS 6807 in this case.

The Standard sets out the following limits of acceptability for helicopter noise for a range of receivers:

Table 2: NZS 6807 Limits of Acceptability

Affected Land Use	L_{dn} day-night average sound level (dB)	L_{Amax} night-time maximum sound level (dB)
i. Industrial	75	n/a
ii. Commercial	65	n/a
iii. Residential	50	70
iv. Rural (at notional boundary)	50	70
v. Residential (internal)	40	55

The hours for night-time L_{max} shall be defined by the local authority. In the absence of any specific definition by the local authority for helicopter landing areas, the hours of 10.00pm to 7.00am the following day shall be defined as night-time for the purposes of the Standard.

The Standard defines an acceptable limit of 50 dB L_{dn} and an additional night-time limit of 70 dB L_{Amax} for residential and rural receivers. L_{dn} is the day night average noise level where helicopter noise between 10pm and 7am is penalised by ten decibels to account for the extra sensitivity at night. The Standard states the L_{dn} may be averaged over seven days provided that the level on any one day does not exceed 53 dB L_{dn}. L_{AFmax} is the maximum noise level received during a helicopter movement. It applies at night to protect against sleep disturbance.

3.4 Recommended Performance Standards

The proposed activity is for helicopter operations during the day time only. Based on the provisions of NZS 6807 and the Proposed District Plan we recommend the following noise limits apply to helicopter operations from the site in the (newly formed) zone:

> Noise from helicopter operations shall not exceed 50 dB L_{dn} at the notional boundary of any dwelling. The day night average noise level (L_{dn}) shall be averaged over any consecutive seven day period and shall not exceed 53 dB L_{dn} on any one day.

4.0 PREDICTED NOISE LEVELS

4.1 Noise Modelling Methodology

Aircraft noise modelling software called the Integrated Noise Model (INM) has been used to predict L_{dn} noise emissions from the proposed helicopter operations. The INM is produced by the Federal Aviation Administration (FAA) of the United States and is widely used internationally for modelling noise emissions from airports and heliports.

We understand the proposed helicopter landing area would be approached and departed from the south east, although other routes may be flown depending on prevailing meteorological conditions on any given day.

We understand that either a Eurocopter EC130 or AS350 Squirrel helicopter or an alternative that is equivalent or quieter will be operated to and from the proposed helipad. Noise levels have been predicted using the EC130 (which has a similar noise footprint to a AS350 Squirrel) in the INM and using the model's standard approach and departure profiles which include time on the ground with the engine and rotor operating before a departure and after an arrival.

4.2 Measured Sound levels

MDA has measured noise emissions from a Eurocopter EC130 in general accordance with the New Zealand noise measurement standard NZS6801:2008. Detailed sound exposure level (L_{AE} or SEL) measurements of these helicopters arriving, departing and flying at 500 feet were performed. These measurements have been used to verify the INM modelling. In general the INM modelling is accurate for the helicopter types under investigation on centreline of the flight paths, but the model tends to over-predict noise levels off axis from the helicopter flight path, in some cases by up to 5 decibels. Therefore the noise modelling presented in this report is considered to be conservative.

4.3 Predicted Noise Levels

Four scenarios have been modelled:

(A) Existing Activity	**5 movements per week**
(B) Future Typical Activity	**12 movements per week**
(C) Special Event Days	**20 movements per day**
(D) Cumulative Noise level	**The cumulative noise level averaged over 7 days from the future typical activity and three consecutive days of Special Event activity**

The predicted noise levels for each receiver shown in Appendix B are shown in Table 3 below. Note that for Scenario (A), (B) and (D) the noise levels have been averaged over 7 days in accordance with NZS 6807. For Scenario (C) the noise level is for a single day of activity has been calculated to assess whether the single daytime L_{dn} exceeds a noise level of 53 dB L_{dn} on any one day.

Table 3: Predicted Noise Levels

Assessment Location	Predicted Noise Levels			
	(A) Existing Activity (dB $L_{dn\ 7day}$)	(B) Future Typical Activity (dB $L_{dn\ 7day}$)	(C) Special Event Days (dB L_{dn})	(D) Cumulative Noise level (dB $L_{dn\ 7day}$)
Receiver A	<30	<30	31	<30
Receiver B	<30	<30	37	34
Receiver C	<30	<30	38	35
Receiver D	<30	32	43	40
Receiver F	<30	33	43	40
Receiver G	34	37	48	45
Receiver H	31	35	46	43
Receiver J	<30	33	44	41
Receiver K	<30	<30	39	36

The results show that for all scenarios the proposed noise control of 50 dB $L_{dn\ 7\ day}$ at the notional boundary of all surrounding dwellings can be readily complied with. This applies for typical activity and also for weeks where up to 3 special event days occur in any 7 day period.

For the worst case "Special Event Day" where up to twenty movements occur on any day, the noise levels are predicted to be no greater than 48 dB L_{dn} at the notional boundary of all dwellings. This ensures that on any one day the maximum noise level does not exceed 53 dB L_{dn} and is therefore compliant with NZS 6807. If there were to be more than three special event days in any 7 day period noise levels may exceed the criterion to a small extent.

Noise contours for the three scenarios are shown in Figure 2, Appendix B. It can be seen that terrain effects have some influence on the shape of the contours in some locations, but that generally the noise level is higher along the flight path, with noise emissions from the ground idle and flight idle components of each movement contributing to noise levels in close proximity to the helipad.

4.4 Assessment of Noise Effects

Based on the predicted noise levels presented above, noise from helicopter operations would typically be at a low level at nearby residences. For special event days, noise would approach the upper limit of acceptability for helicopter noise emissions, but still fall within the proposed maximum noise control by some margin. Because there are only envisaged to be a small handful of such days per year, we consider that helicopter movements as presented in this report would result in noise effects that are reasonable.

5.0 CONCLUSION

Marshall Day Acoustics has assessed noise emissions from proposed typical helicopter activity and special event ays at the Hills golf course, Arrowtown.

The assessment has been carried out generally in accordance with the provisions of New Zealand Standard NZS 6807:1994 *"Noise Management and Land Use Planning for Helicopter Landing Areas"* , as required in the Proposed Queenstown Lakes District Plan.

Our predictions show that in both cases noise emissions can readily comply with a noise control of 50 dB L_{dn} at all nearby sensitive receivers. In addition, on any one day the predicted noise levels would not exceed the criterion by more than 3 decibels, which would be compliant with the provisions of NZS 6807. On this basis we recommend the new zone rules should limit helicopter use so that:

- Helicopter noise emissions do not exceed 50 dB L_{dn} at the notional boundary of any dwelling (averaged over seven days) and shall not exceed 53 dB L_{dn} on any one day, when assessed in accordance with New Zealand Standard NZS 6807:1994 "*Noise Management and Land Use Planning for Helicopter Landing Areas*"

It is considered that the noise effects from the proposed helicopter operations on noise sensitive receivers would be reasonable where emissions are below the recommended performance standards in Section 3.3.

APPENDIX A GLOSSARY OF TERMINOLOGY

Noise	A sound that is unwanted by, or distracting to, the receiver.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 µPa i.e. dB = 20 x log(P/Pr)
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
Notional Boundary	In the Queenstown Lakes District, means a line 20m from the façade of any residential unit or the legal boundary whichever is closer to the residential unit.
$L_{Aeq\,(t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
$L_{A90\,(t)}$	The A-weighted noise level equalled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{dn}	The day night noise level which is calculated from the 24 hour L_{Aeq} with a 10 dB penalty applied to the night-time (2200-0700 hours) L_{Aeq}.
SEL or L_{AE}	Sound Exposure Level The sound level of one second duration which has the same amount of energy as the actual noise event measured. Usually used to measure the sound energy of a particular event, such as a train pass-by or an aircraft flyover
NZS 6801:2008	New Zealand Standard NZS 6801:2008 *"Acoustics – Measurement of environmental sound"*
NZS 6802:2008	New Zealand Standard NZS 6802:2008 *"Acoustics – Environmental Noise"*
NZS 6805:1992	New Zealand Standard NZS 6805:1992 *"Airport Noise Management and Land Use Planning"*
NZS 6807:1994	New Zealand Standard NZS 6807:1994 *"Noise Management and Land Use Planning for Helicopter Landing Areas"*

APPENDIX B FIGURES

Figure 1 – Receiver Locations

Figure 2 – Predicted Noise Levels

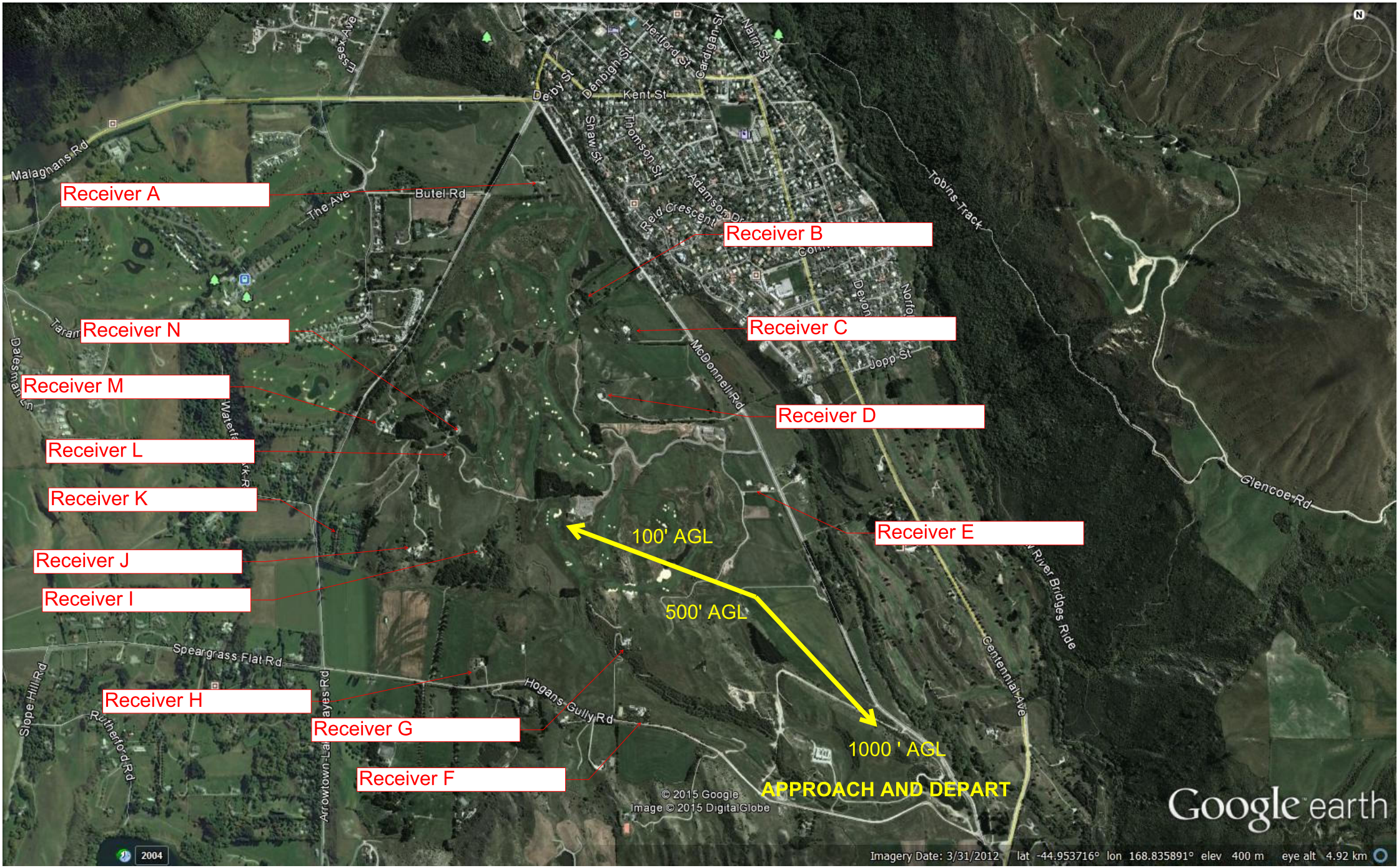
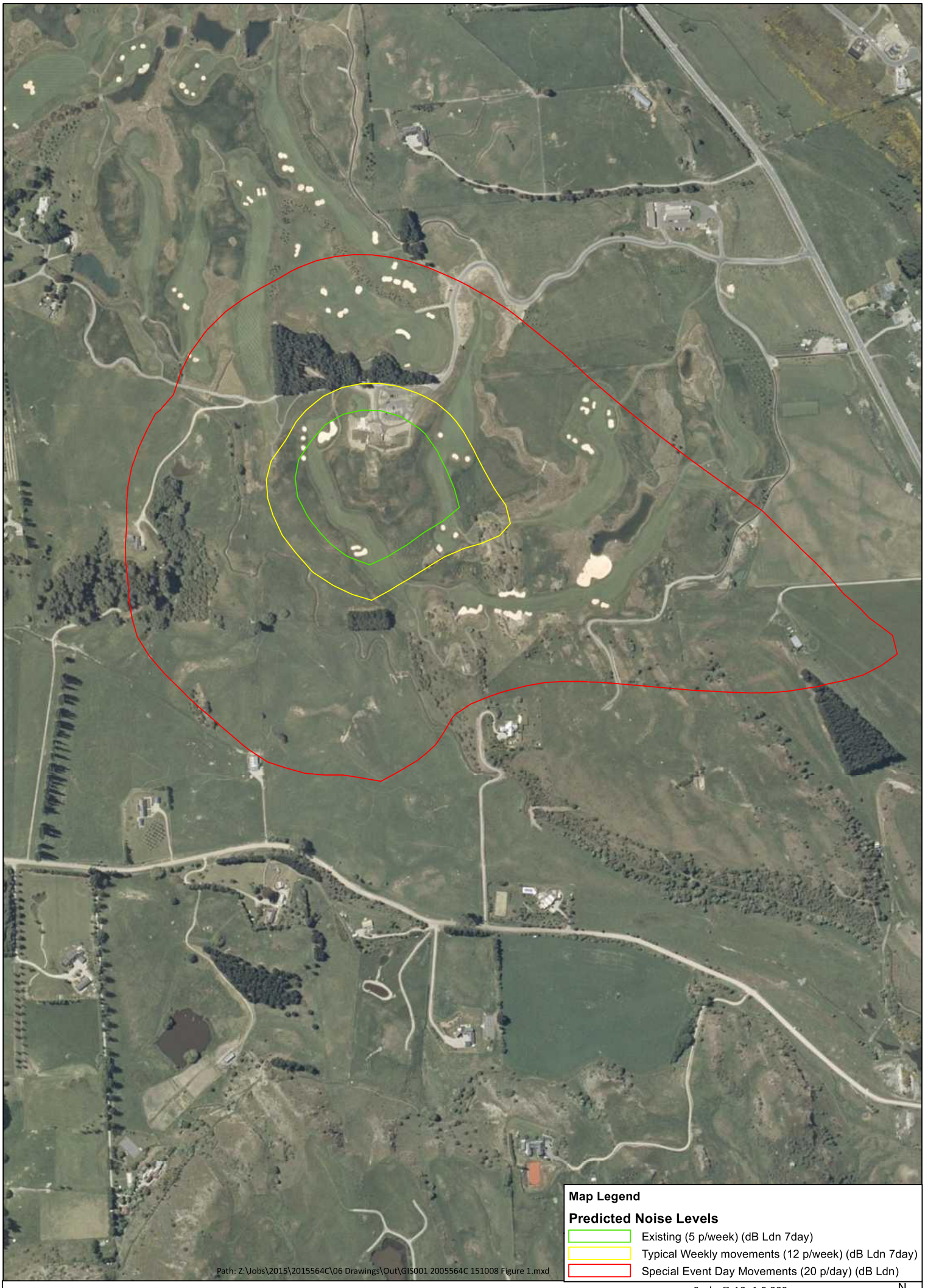


Figure 1 - Receiver Locations



MARSHALL DAY Acoustics

Figure 2 - Predicted Helicopter Noise Contours

Prepared By: SJP
Date: 12/10/2015
Time: 2:16:04 p.m.

Scale @ A3: 1:5,000
0 50 100 200 m

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The Hills Resort Zone

Queenstown Lakes District Plan Review

Transportation Assessment Report

October 2015

TDG Ref: 13470 151021 the hills resort zone rep.docx

The Hills Resort Zone

Queenstown Lakes District Plan Review

Transportation Assessment Report

Quality Assurance Statement

Prepared by:

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Transportation Planner

Reviewed by:

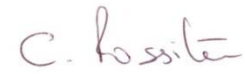
Tony Penny

Principal Consultant

Approved for Issue by:

Chris Rossiter

Principal Transportation Engineer



Status: Final report

Date: 21 October 2015

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Table of Contents

1. Introduction

It is proposed to create a Resort Zone around The Hills golf course as part of the Queenstown Lakes District Plan review. The proposed zone will provide for limited residential and visitor accommodation in areas of the golf course that are able to absorb development. The zone also provides for the on-going development and maintenance of the championship golf course, hosting events, ancillary commercial activity and a sculpture park.

The report provides a description of the existing transport infrastructure in the vicinity of the golf course and existing travel patterns. This is followed by a description of the transport components of the proposed development and the expected traffic generation of the development enabled by the rezoning. This forms the basis of the assessment of traffic effects and the assessment against the transport rules of the District Plan.

2. Existing Transport Infrastructure

2.1 Site Location

The location of the proposed zone is indicated in Figure 1 to the south of the Arrowtown urban area and is bounded by McDonnell Road to the north-east, Arrowtown-Lakes Hayes Road to the west and Hogans Gully Road to the south.

The Operative Queenstown Lakes District Plan ("District Plan") includes this land within the Rural General Zone. The site currently contains two dwellings, the Hills Golf Course and associated buildings.

Figure 1 also shows the location of the site in relation to the road hierarchy as defined in the District Plan.

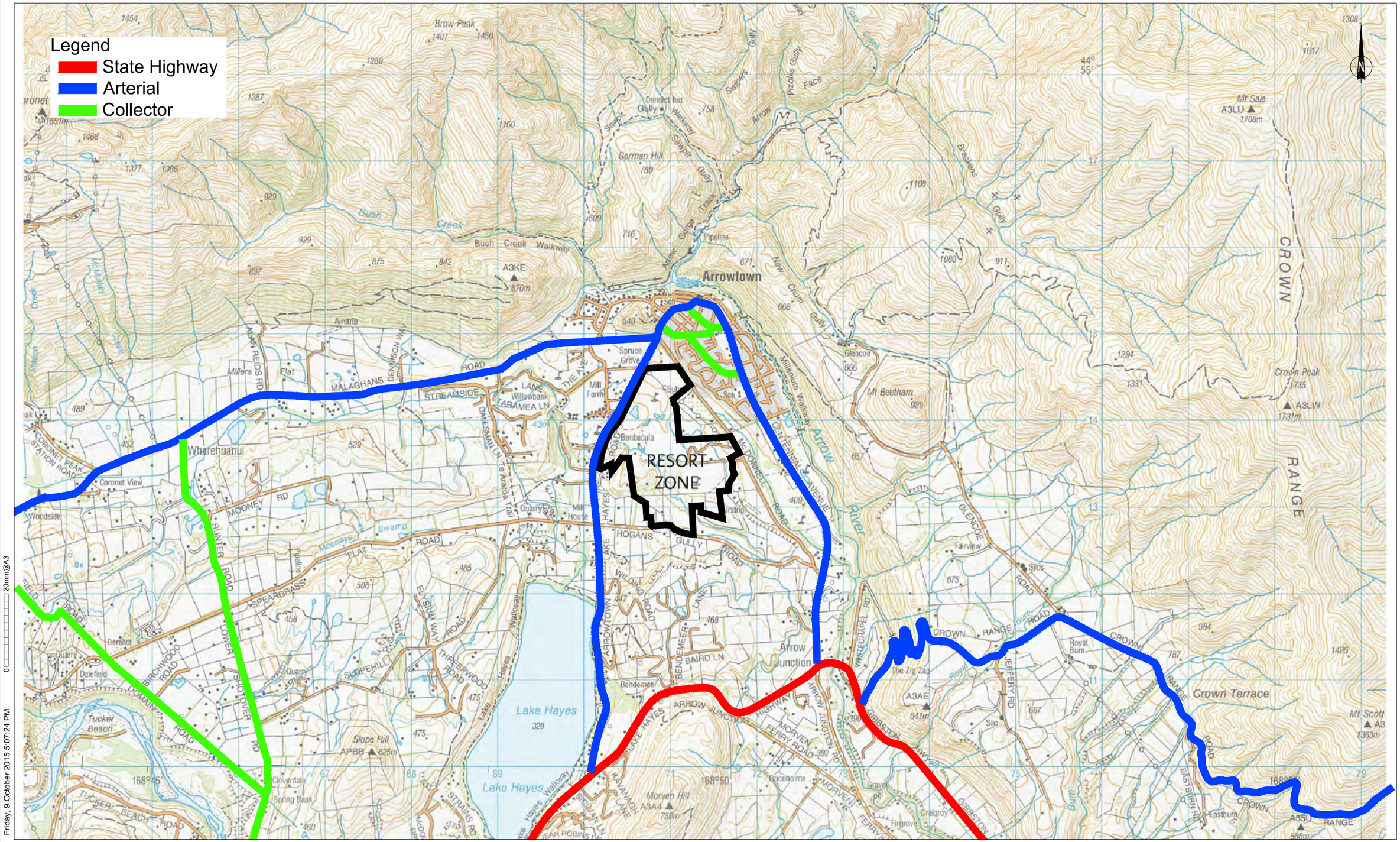
2.2 Roading Network

On the west side of the site, Arrowtown-Lake Hayes Road is classified as an Arterial Road with a role of being a dominant element in the road network, connecting the major settlements with the District. The District Plan states that arterial roads will be managed to minimise their local access function. McDonnell Road runs in a generally northwest-southeast direction and is defined as a local road in the vicinity of the site. Local roads are described by the District Plan as functioning almost entirely as accessways to properties and are not intended to act as through-routes for vehicle travel. Hogans Gully Road along the southern side of the site is also a local road.

2.3 Roading Form

In the vicinity of the site, Arrowtown-Lake Hayes Road has a seal width of 8.0m to 8.5m. No footpaths are provided in this location.

The speed limit along the section of Arrowtown-Lake Hayes Road near the site is 70 km/h, except near its intersections with McDonnell Road (to the north) where the speed limit changes to 50km/h.



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The Hills Golf Course QLDC Planning Review

Site Location

Boffa Miskell
www.boffamiskell.co.nz

DRAWN: CTM	---	---
DATE: 09.10.15	STATUS: ---	
SCALE: NTS		
DWG NO:13470A2A		

TDG

1

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Photograph 1: Arrowtown-Lake Hayes Road, Looking North Past Hogans Gully Road

At its northern end, Arrowtown-Lake Hayes Road intersects with McDonnell Road and Malaghans Road. This intersection is in the form of a 'GIVE WAY' priority-controlled, cross-road intersection, with priority given to Arrowtown-Lake Hayes Road.

Photograph 2: Arrowtown-Lake Hayes Road Looking South Past McDonnell Road

McDonnell Road in the vicinity of the site access has a seal width of approximately 7.0m, with unsealed shoulders of between 2.2m and 2.5m on both sides of the carriageway. It has a speed limit of 80 km/h except for 1 km of the northern section within the urban area where the speed limit is 50 km/h. In this section of McDonnell Road speed humps have been installed with an advisory negotiation speed of 25 km/h.

Photograph 3: McDonnell Road, Looking North at Existing Golf Course Entrance

Photograph 4: McDonnell Road, Looking South at Existing Golf Course Entrance

No sealed footpaths are provided on McDonnell Road in the vicinity of site. An unsealed track is provided on the western side of McDonnell Road separated from the sealed carriageway, from the northern end of the site through to the intersection with Hogans Gully Road. In the vicinity of the Hogans Gully Road intersection this walking track switches to the eastern side of McDonnell Road, before extending further south through to the intersection with Centennial Avenue.

Photograph 5: McDonnell Road, Looking North at Existing Golf Course Access with the Unsealed Walking Track on the Western Side

Photograph 6: Hogans Gully Road, Looking East

At the southern boundary of the site, Hogans Gully Road runs in a generally east-west direction. At its western end it intersects with Arrowtown-Lake Hayes Road and Speargrass Flat Road. To the east Hogans Gully road terminates at a T-intersection with McDonnell Road. Both the intersections with Arrowtown-Lake Hayes Road and McDonnell Road are priority controlled, with Hogans Gully Road being restricted in both cases by a "GIVE WAY' control.

Photograph 7: Hogans Gully Road, Looking Towards Intersection with McDonnell Road

Hogans Gully Road has an 80 km/h speed limit. It is unsealed and has a formed width of about 5.2m. In the vicinity of Arrowtown-Lake Hayes Road there are grass verges of 6.2m and 1.7m on the southern and northern side of the road respectively. Further east the road winds over a hilly section and the verges vary in width. Footpaths are not provided on either side of Hogans Gully Road.

Photograph 8: Hogans Gully Road, Looking Towards Intersection with Arrowtown-Lake Hayes Road

It is understood that Queenstown Lakes District Council has no plans for the sealing of Hogans Gully Road.

3. Current and Future Travel Patterns

3.1 Traffic Volumes

Table 1 shows the most recent daily traffic count data for roads in the vicinity of the site collected from records held by the Queenstown Lakes District Council.

Road Section	ADT (vpd)	Count Date
Arrowtown-Lake Hayes Rd, north of Hogans Gully Rd	3,157	November 2010
Arrowtown-Lake Hayes Rd, south of McDonnell Rd	2,978	June 2005
Malaghans Rd, west of Arrowtown-Lake Hayes Rd	1,522	November 2011
McDonnell Rd, east of Arrowtown-Lake Hayes Rd	847	February 2013
McDonnell Rd, east of Arrowtown-Lake Hayes Rd	403	April 2005
McDonnell Rd, north of Hogans Gully Rd	257	February 2004
Hogans Gully Rd, west of McDonnell Rd	133	March 2012
Hogans Gully Rd, east of Arrowtown-Lake Hayes Rd	137	May 2005

Table 1: Daily Traffic Counts

The traffic volumes to the south-west of Arrowtown show the strength of the town's relationship with Queenstown. The other roads surrounding the site have relatively low traffic counts. However a significant amount of growth can be seen on McDonnell Road traffic in the past 10 years.

3.2 Provision of Public Transport

Connectabus runs the Number 10 route from Arrowtown to Queenstown which operates 13 times a day between 7:35am and 9:35pm. Six of these services run via Arthurs Point, the other seven travel down Arrowtown-Lake Hayes Road and through Frankton down State Highway 6 to Queenstown. Passengers may interchange onto Kelvin Heights, Sunshine Bay, Fernhill, Quail Rise, Wanaka or a number of other places including Remarkables Park and the airport. Connectabus also runs a service to Wanaka twice daily.

There are several smaller operators targeted towards tourists who offer services from Queenstown to Arrowtown and vice versa, often allowing stops along the way. There is also a school bus which operates down Hogans Gully Road.

3.3 Travel to Work

It has been identified from the 2013 census, that there were 2,445 people living in Arrowtown and 699 jobs there. Of these jobs 261 were taken by employees who commute to Arrowtown from a different area, primarily Queenstown and Frankton, while the remaining 438 jobs were taken by residents of Arrowtown. There were 741 people who commute out of Arrowtown for work, again mainly to Queenstown and Frankton. The largest percentage commuting increase from 2006 to 2013 was people commuting to

Arrowtown, which increased by 55% or 93 people. However the number commuting out of Arrowtown also increased by 17%, or 103 people. Further increases in these commuting patterns will lead to increases, primarily in the peak hour, of traffic volumes using Arrowtown-Lake Hayes Road, and particularly the intersection with Malaghans and McDonnell Roads.

Of those who travelled to work on the census day in 2013, the overwhelming majority, (84% or 867 people) drove a vehicle to get there. This number remained relatively consistent with 2006, where 852 people drove. Cycling's share of travel choice has had an increase of 3% between 2006 and 2013 (33 people), but walking remained the second most popular mode of travel to get to work with 84 commuters (8%) choosing this method. There was also an increase of 40% in people who work from home, jumping from 105 in 2006 to 147 in 2013.

3.4 Road Safety

The New Zealand Transport Association Crash Analysis System (CAS) has been used to identify all reported accidents on Arrowtown-Lake Hayes Road, McDonnell Road, and Hogans Gully Road, between and inclusive of their respective intersections. The search covered all reported crashes for the period between 2008 and the present.

A total of 18 crashes were reported within this area, with six crashes resulting in minor injuries. There have been no crashes which resulted in fatal or serious injuries in this area since 2008.

Eleven of these crashes occurred on Arrowtown-Lake Hayes Road, three of these causing minor injuries. Two of these injury crashes were the result of drivers failing to give way at the intersection of McDonnell Road and the other at the intersection of McDonnell Road was caused by following too closely.

Four crashes on Arrowtown-Lake Hayes Road had rain, snow, frost or ice as a factor in the cause, with two of these located 100m and 500m north of Waterfall Park Road. Neither of these crashes involved injuries.

There were four recorded crashes on Hogans Gully Road, all due to loss of control from the unsealed road, frost or ice or speed. The speed related crash resulted in a head on collision, but no injuries. Three crashes were recorded on McDonnell Road, with two of these caused by intoxicated drivers hitting parked vehicles.

Overall seven of the 18 crashes recorded were affected by environmental factors, made up of narrow, unsealed, frosty or icy roads. Three crashes were attributed down to alcohol and six to driver error at intersections. Three of these occurred at the intersection of Arrowtown-Lake Hayes Road / McDonnell Road and three at the intersection of Arrowtown-Lake Hayes Road / Hogans Gully Road.

No crashes occurred at existing driveways to The Hills property or adjacent properties.

4. Future Changes

4.1 Queenstown Lakes District Council

On 30 June 2015 Queenstown Lakes District Council (QLDC) adopted their 10 year land transport plan (2015-2025). There are no specific changes to the transportation network around Arrowtown planned. However, the report did have a key objective to reduce growth in vehicle use by promoting greater use of other transport modes. This will be achieved by:

- Increasing affordability and convenience of public transport; and
- Making cycling and walking easier and safer.

4.2 The Arrowtown Plan

A Strategic Planning document outlining the future growth and community planning proposals for Arrowtown has been prepared. This Plan resulted from a community planning workshop carried out in February 2003 with the aim of reviewing and updating Arrowtown planning. It should be noted that this document does not have formal statutory status, but is a statement of community desire. Amongst the issues outlined in this Plan was traffic management, and the comments relating to relevant sections of the road network are referenced below:

- McDonnell Road was installed as a heavy traffic route being described as providing a logical bypass to the town and good access to the industrial area;
- In time, the Malaghans / Arrowtown-Lake Hayes / McDonnell intersection may need improvement. However, a threshold treatment involving planting is envisaged to assist in speed management. There was not full support for a roundabout solution;
- From Arrowtown-Lake Hayes Road adequate signage and encouragement is needed to ensure heavy traffic is routed along Malaghans Road to the industrial area.

It is noted that McDonnell Road has since been sealed and speed humps installed. However no other actions have evolved that have a confirmed timeframe.

4.3 Wakatipu Trails

The Wakatipu Trails Strategy, released in May 2004 was prepared to guide development of an integrated network of walking and cycling trails and cycle-ways in the Wakatipu Basin. Preparation of the strategy was initiated by the Wakatipu Trails Trust is association with Transfund and Queenstown Lakes District Council. The Strategy identified a series of desired outcomes with those relevant to The Hills site listed below:

- Construction of a premier walking and cycling trail linking Queenstown to Arrowtown via Lake Hayes;
- Improvements to rural roads to accommodate horse riding and road cycling;
- New trail signs, publications and information on trails.

An extensive range of walking and cycling tracks have now been developed within the Queenstown and Arrowtown area. One of the routes constructed links Arrowtown with the Historic Shotover Bridge. This follows Manse Road from Arrowtown and passes through the Millbrook resort to Lake Hayes and does not cross any part of The Hills golf course land.

5. Levels of Service

5.1 Vehicles

The AUSTROADS Guide to Traffic Engineering Practice Part 2 ('Roadway Capacity') provides a generalised measure for the capacity and performance of a route. This concept of level of service indicates that with the existing traffic flows, Arrowtown-Lake Hayes Road, McDonnell Road and Hogans Gully Road retain a condition of free flow in which individual drivers are virtually unaffected by the presence of other vehicles in the traffic stream, have freedom to select their own desired speeds and generally experience high levels of comfort and convenience.

5.2 Road Safety

Based upon the information from the Land Transport New Zealand Crash Analysis System (CAS), it does not appear that there are any underlying road safety issues on Arrowtown-Lake Hayes Road. Since McDonnell Road has been sealed, the number of loss of control crashes on this road has reduced. If Hogans Gully Road were to be sealed, this would also yield a reduction in this type of crash. The traffic effects of the proposal are not considered to be sufficient reason for sealing because the expected volume changes on Hogans Gully Road will be minimal.

6. The Proposal

6.1 Development

The proposal to create a Resort Zone centred on The Hills Golf Course could allow for a total of up to 100 residential / visitor accommodation units including 10 home sites. These would be developed in conjunction with the existing golf course in a manner similar to that indicated on the concept structure plan presented as Figure 2. The proposal would also enable development of some ancillary commercial activity as part of the Clubhouse facilities.

The concept structure plan shows the potential locations for permanent dwellings. HS7 and HS6 are existing dwellings. Resource consent is currently being sought to replace HS6. The HS6 replacement will obtain access via an existing access point to Hogans Gully Road and HS7 has existing access to Arrowtown-Lake Hayes Road as indicated in Figure 3.

The new dwelling HS4 would gain access from an existing driveway off Hogans Gully Road while HS2, HS3, HS5, HS9 and HS10 would require a new shared driveway from Hogans Gully Road. HS1 and HS8 will have access off the existing main entrance to the golf course on McDonnell Road.

Activity Areas (A1-A7) will provide for the visitor accommodation and may contain about 50 lots, all of which will have access via the existing main entrance to the golf course. Activity Area A8 will have a new access formed to McDonnell Road.

Activity areas A9 and A10 could accommodate about 20 lots and will have access from an existing driveway to Arrowtown-Lake Hayes Road.

The McDonnell Road driveway will continue to provide the main access to the clubhouse area and other areas of the golf course.

6.2 Events

The proposal also seeks provision for 'temporary events" including golf tournaments and concerts as a controlled activity subject to the following conditions:

- The duration of the temporary events does not exceed 14 consecutive calendars days (excluding set up and pack down);
- The event does not operate outside the houses of 0600 to 2200. Set up and pack down outside of these hours are permitted but cannot breech the noise limits for the Zone;
- There shall be no more than 10 temporary events per calendar year;
- All structures and equipment is removed from the zone within 10 working days of the completion of the event;
- For the purpose of this rule the relevant noise standards of the Zone shall not apply.

It is proposed that Council's control is limited to:

(i) A Traffic Management Plan

(ii) The ability to minimise and manage waste from the event

(iii) The provision of adequate sanitation for event attendees

(iv) The acceptance of an Operations Plan for the event

(v) Signs located off-site on public or private land

This proposal would facilitate the hosting of events such as the NZ Open and smaller charity golf tournaments.

KEY:

Structure Plan Boundary

Activity Area

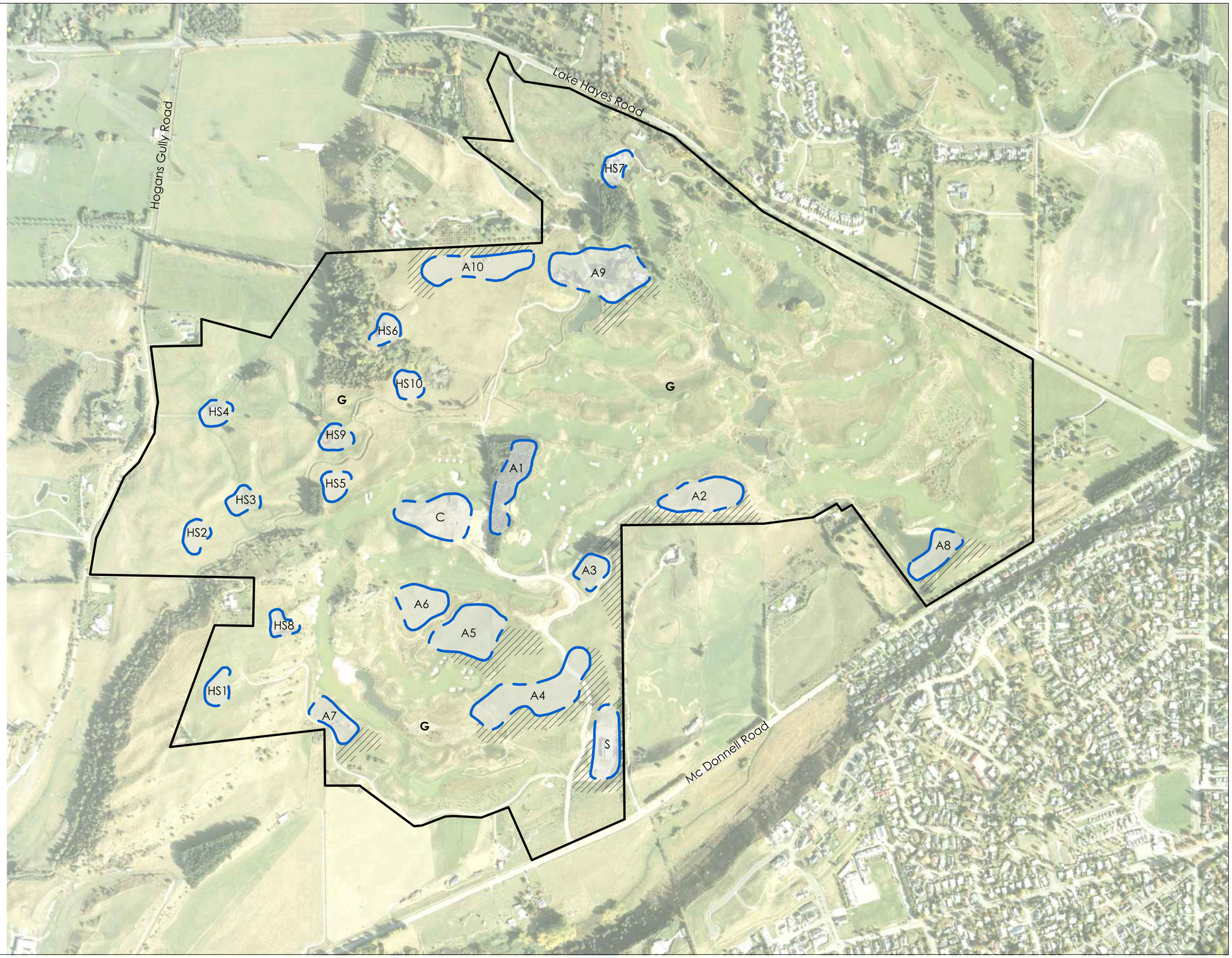
Activity Areas:

G: Golf course, open space and farming
C: Clubhouse
A: Visitor Accommodation / Residential
HS: Homesite (3,000m2)
S: Resort Services & Staff Accommodation

Note: all activity areas include G: Golf course, open space and farming

Overlays:

Landscape Amenity Management Area



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SCALE: 1:4,000 (A1); 1:8,000 (A3)

0 100 200 300

PLAN STATUS:

DP REVIEW

THE HILLS
STRUCTURE PLAN

DRAWN / REVIEWED: RT / JC
APPROVED: DT
DATE: 14.10.15

DRAWING NO:
MH_10_1_MLP_010F

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Note: all activity areas include G: Golf course, open space and farming

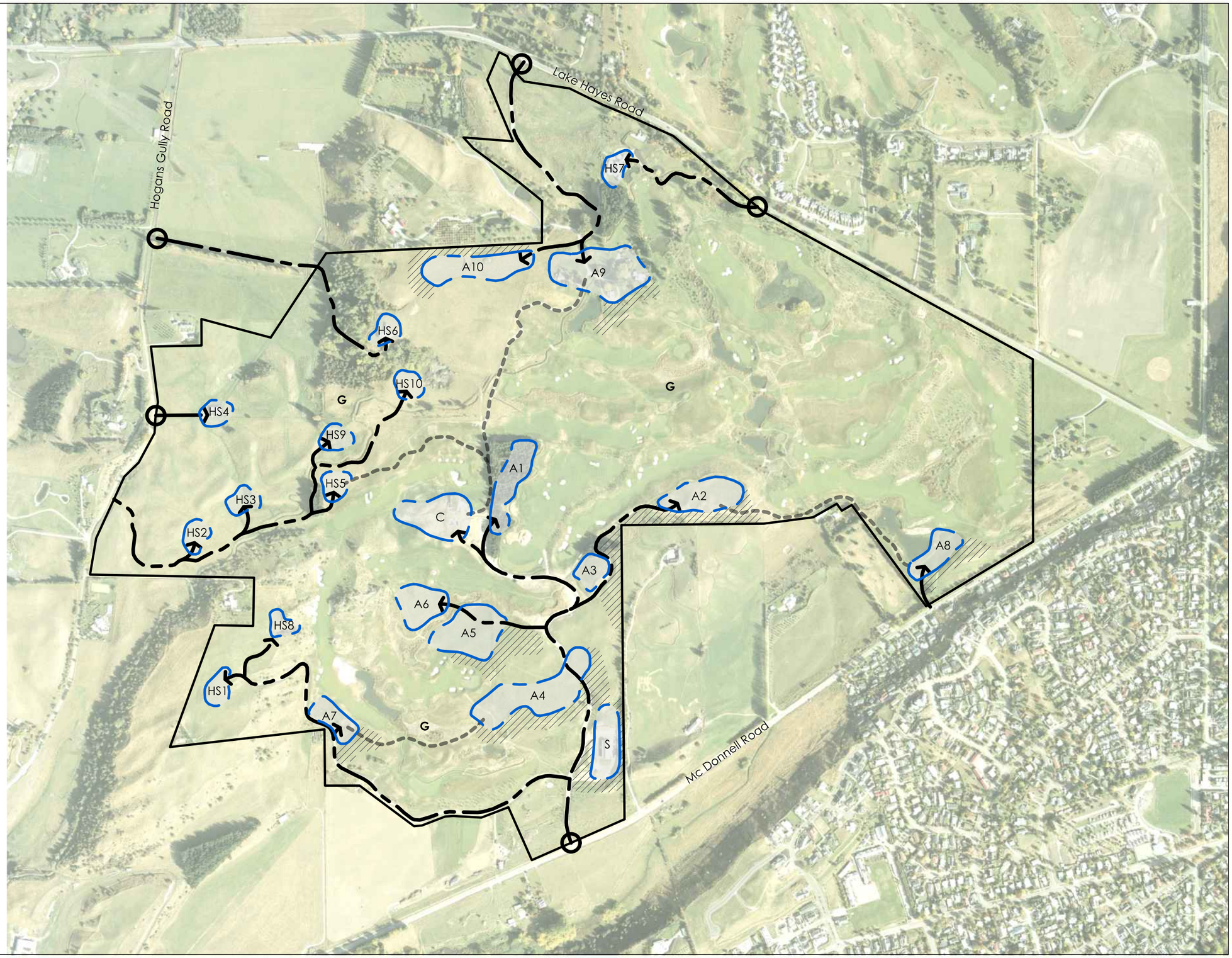
Overlays:

Landscape Amenity Management Area

Existing access point

Road access

Buggy / cart access



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0 100 200 300

PLAN STATUS:

DP REVIEW

THE HILLS
STRUCTURE PLAN - ACCESS

DRAWN / REVIEWED: RT / DT
APPROVED: DT
DATE: 14.10.15

DRAWING NO:
MH_10_1_MLP_011B

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7. Traffic Generation and Distribution

7.1 Existing Site Traffic Generation

The proposed zone area currently contains a golf course, clubhouse, dwellings, a large implement shed, farmland and a farm building.

The Transfund NZ Research Report 209: "Trips and Parking Related to Land Use" includes daily rates of between 6 and 9 vehicles per day (vpd) (IN+OUT) for rural residential subdivisions. It notes that these rates are lower than for urban residences and "reflect the increased trip linking which occurs when the primary employment trip is longer, eg greater than 20 minutes, as with rural lifestyle properties located on the outskirts of an urban area". For the purposes of this assessment, a rate of 8vpd per unit has been adopted. On this basis, the two existing dwellings would currently generate 16vpd on average.

Residential activity typically generates a high proportion of outbound movements during the morning peak period (80%) with a more balanced pattern in the evening, 35% outbound and 65% inbound. While visitor accommodation will not usually have a high traffic generation during the morning peak period, the pattern of movements in the evening peak is expected to be comparable to residential activity.

The golf course operation is limited through resource consent conditions to a maximum of 16 commercial players per hour. Adopting the rates of traffic generation previously used, this equates to a traffic generation of between 200 and 350 vpd for the golf course.

Two special charity tournament events per year are currently permitted at which approximately 100 persons per day may attend. It could be expected that these charity tournament occasions would generate around 200 vpd. During the tournaments, the tee times will be closer together resulting in a higher number of players on the course at any one time.

The golf course has also secured the rights to host the New Zealand Golf Open. This is a major event which can attract significant numbers of spectators. However it is an infrequent occurrence (annual) and there is no guarantee that the rights will be extended indefinitely. Consequently it has been disregarded for the purposes of this assessment and because a specific traffic management plan is prepared for this event.

7.2 Additional Site Traffic Generation

It is anticipated that up to 100 residential / visitor accommodation units will be developed within the resort zone. Residential dwellings or visitor accommodation units in this location are expected to generate between 6 and 9 vpd. The traffic generation of the resort accommodation will be at the lower end of this range with residential accommodation being at the upper end of the range. Again, to ensure a robust analysis, an average traffic generation rate of 8 vpd per unit has been adopted. Based on this rate, the expected additional traffic generation for this development is as follows:

DEVELOPMENT	NUMBER OF UNITS	TRIP VOLUMES (Vehicle Movements)								
		Morning Peak Hour			Evening Peak Hour			Daily		
		In	Out	Total	In	Out	Total	In	Out	Total
Residential / Visitor Accommodation Units	100	20	80	100	65	35	100	400	400	800

Table 2: Additional Trip Generation of the Proposed Residential / Visitor Accommodation Units

7.3 Total Traffic Generation of the Site

The total future traffic generating activities for the proposed resort zone will consist of 100 dwellings which will generate about 800 vpd and the golf course operation (200-350vpd).

The typical daily traffic generation is expected to be in the range 1,000 to 1,1500vpd.

7.4 Construction Traffic Generation

Previous survey work by TDG has indicated that the construction phase of a single residential dwelling could generate up to some 20vpd. The simultaneous construction of all dwellings would not result in this daily traffic generation for all dwellings due to the number of common trips to several dwellings and to dwellings being at different stages of construction. Moreover, it is considered extremely unlikely that all new dwellings would be constructed simultaneously. In fact it is expected that individual dwellings or groups of dwellings will be constructed over a long period and by their nature, construction traffic movements for each site would occur only over a short timeframe.

7.5 Trip Distribution

The design of the proposed development allows all of the proposed visitor accommodation dwellings in A1 – A10, except those in A9 and A10 (and possibly A8) to access the external road network via the existing McDonnell Road access. Homesites HS1 and HS8 will also use this access. The clubhouse and other golf course facilities will continue using the McDonnell Road access. HS2-HS6 and HS9-HS10 will use the Hogans Gully Road accesses. A9-A10 and HS7 will use two existing driveways on the Arrowtown-Lake Hayes Road. Based on 100 dwellings being constructed, this broadly represents about ten dwellings using the Hogans Gully Road access, about 25 using Arrowtown-Lake Hayes Road for access, and about 65 dwellings using the McDonnell Road access. Currently there is one dwelling with access off Hogans Gully Road and one with access off Arrowtown-Lake Hayes Road.

The distribution of additional trips generated by the site is summarised in the following table:

ACCESS LOCATION	TRIP DISTRIBUTION								
	Morning Peak Hour			Evening Peak Hour			Daily		
	In	Out	Total	In	Out	Total	In	Out	Total
McDonnell Road	13	52	65	42	23	65	260	260	520
Hogans Gully Road	2	8	10	7	3	10	40	40	80
Arrowtown-Lake Hayes Road	5	20	25	16	9	25	100	100	200
Total	20	80	100	65	35	100	400	400	800

Table 3: Trips Generated by the Proposal – Distribution

With this level of development, it is expected that about 520 new vehicle movements per day will occur at the McDonnell Road access. Approximately 80 vehicle movements per day will occur at the Hogans Gully Road accesses and a further 200 vehicle movements per day will be made to / from Arrowtown-Lake Hayes Road.

8. Assessment of Rezoning Effects

8.1 Effects on Roading Network

The AUSTROADS Guide to Traffic Management Part 3 ("Traffic Studies and Analysis") currently recommends that unsignalised intersections are evaluated using SIDRA intersection analysis software or an equivalent tool. This advice supersedes previous recommendations that detailed analysis of low volume driveways was not normally required because capacity was unlikely to be a critical factor.

The following table shows the traffic volume thresholds previously adopted by Austroads below which detailed analysis was not considered necessary and the expected traffic volumes at the resort zone access points. The peak hour traffic volumes on the frontage roads have been estimated as 105 of the average daily traffic volumes.

Intersection	Major Road Flow (vph)	Minor Road Flow (vph)
AUSTROADS Guide to Traffic Management	400	250
Two-lane Road	500	200
Peak Hour Capacity Combinations	650	100
McDonnell Road / Site Access	80	65
Arrowtown-Lake Hayes Road / Site Access	300	25
Hogans Gully Road / Site Access	15	10

Table 4: Intersection Capacity – Uninterrupted Flow Conditions (PM Peak)

Since the expected traffic volumes on each of the access points are well below the thresholds previously adopted by Austroads, no further analysis has been undertaken to evaluate levels of service because there are no capacity issues. On this basis, the proposed development is not expected to have any adverse effect on the road network at these locations.

Although the peak hour traffic volumes at the temporary events will be higher than on a typical day, they will remain below 100vph and again it is considered unlikely that there would be any noticeable effects on the local road network. In the event that higher flows were anticipated, then this would be addressed by the proposed condition requiring a traffic management plan.

8.2 Buses, Cyclists and Pedestrians

The increase of traffic flow due to the proposal is not expected to affect the level of service provided to cyclists and pedestrians. The increase in traffic volume represents about one extra vehicle every minute which not be noticeable.

While it is also anticipated that the demand for public transport services would only increase marginally as a result of this proposal, equally the proposed zone would not adversely affect existing or possible future services.

8.3 Access Arrangements

The activities proposed with the new zone will obtain access via five existing access points and two new accesses, one located off McDonnell Road and one off Hogans Gully Road. It is intended that the Hogans Gully Road access point will not have a physical connection with the existing formed internal road network within the golf course.

The existing access from Hogans Gully Road provides a sight distance of 200m to the east, while sight distance to the west allows visibility right through to the intersection with Arrowtown-Lake Hayes Road. The District Plan requires access points on an 80km/h road to provide 115m sight distance if they serve a residential activity. The available sight distance at the existing Hogans Gully Road access exceeds the requirements in both instances and is therefore considered entirely appropriate.

The other existing access on Hogans Gully Road provides sight distance to the west in excess of the required 115m. However the sight distance available to the east is only about 90m. There are mitigating circumstances as this section of Hogans Gully Road has a winding alignment to the east which dictates a speed environment of less than 80 km/h. Furthermore it is an existing driveway and it is proposed that the driveway will continue to only serve one residence.

The proposed new access on Hogan's Gully Road will serve three new home sites. It will have a sight distance of more than 115m to the west but the sight distance to the east could be constrained by the local topography to less than 115m. Although the speed limit of Hogans Gully Road is 80km/h, it is considered that the topography, road surface and winding alignment create a speed environment of less than 80km/h and a lower sight distance requirement is acceptable. On this basis, it is considered that an access can be constructed that provides adequate sight distance for the speed environment.

The access on Arrowtown-Lake Hayes Road for HS7 will not have any extra traffic and therefore retains existing use rights.

The other existing access on Arrowtown-Lake Hayes Road is expected to carry an additional 20 vph at peak times associated with visitor accommodation or residential use. Visibility to the north (right) is well in excess of 180m, but to the south it is restricted to about 160m by the bend in the road. While the speed limit on this stretch of road is 70 km/h, the prevailing speed of vehicles, even those travelling uphill from the south, is in excess of 70 km/h. The Austroads Guide to Road Design Part 4A "Unsignalised and Signalised Intersections" recommends that a Safe Intersection Sight Distance of 181m is provided for a road with a design speed of 80km/h and 151m at 70km/h. On this basis, the available sight distance is considered to be adequate. However, it has been noted that installation of signage to alert drivers to the access would provide improved safety.

It is proposed that the Hogans Gully Road accesses will be constructed in accordance with Appendix 7, Diagram 2 of the District Plan, as required for a private access. This standard does not require any localised road widening. Hogans Gully Road has a formed width of approximately 5.2m in the vicinity of the accesses, which would generally be considered somewhat narrow for an access that is providing ingress and egress for both left and right turns. However, in this instance it is considered that few vehicles will turn right into the site accesses or left out onto Hogans Gully Road and therefore the current width is considered suitable for the projected turning volumes.

Similarly it is not considered necessary to modify the two existing accesses on Arrowtown-Lake Hayes Road.

The existing main golf course access from McDonnell Road provides a sight distance in excess of 200m in each direction. As non-residential traffic currently uses this access and will continue to do so under the proposal, the District Plan requires that a minimum sight distance of 170m be provided in an 80km/h area such as this. Accordingly this access also fully complies with the District Plan sight distance requirements.

The existing McDonnell Road access has been constructed as a private property access with no widening of the McDonnell Road shoulders. With the increased volume of movements at the driveway, it is recommended that the driveway is upgraded to comply with the design requirements of Austroads Guide to Road Design Part 4A. This involves widening of the carriageway shoulder to provide sufficient space for through traffic to pass a vehicle that has stopped to turn right.

8.4 Internal Roading

The District Plan requires that all vehicular access shall be in accordance with the standards contained in NZS4404. For the purposes of this analysis, the 2004 version of NZS4404 plus Council amendments has been used to assess the proposed roadway widths.

The policy standards relating to "rural general" areas are shown as follows:

Type	Number of Lots	Number of Traffic Lanes	Carriageway Width (m)	Shoulder Width (m)	Maximum Longitudinal Grade	Minimum Road Reserve Width (m)	Type of Surface
Private Right of Way	Less than 5 Lots	1	3.5	None	16.7%	6	Metal
Private Right of Way	5-10 Lots	1 or 2	3.5+ (1 lane), 5.5 (2 lanes)	0.5 Grass	12.5%	10	Seal
Public Cul-de-sac	Less than 15 Lots	2	5.5	0.5 Grass	10%	20	Seal
Public Local	Less than 250 vpd	2	6.25	0.5 Grass	10%	20	Seal

Table 5: Council Subdivision Guidelines (Rural General, Rolling Topography)

As such, several different geometric standards will be relevant to the assessment and design of the various internal roads within the development. It is proposed that those roads serving less than five lots will be constructed to the Private Right of Way (less than 5 Lots) standard given above (3.5m carriageway).

The 2005 Subdivision Policy guideline does not provide guidance as to when to provide 1 or 2 lanes for a Private Right of Way (5-10 lots) for rolling terrain. Only one lane (3.5m+) with passing bays would be required if the topography was deemed to be mountainous, while flat terrain would require two lanes (5.5m).

The internal road that provides a link through the development from the McDonnell Road access through to the clubhouse operates over a combination of terrain classified initially as flat from the main access and mountainous as it rises towards the accommodation and clubhouse areas.

Access to the section of this road between the McDonnell Road access and the clubhouse will be restricted to use by visitors to the clubhouse and traffic associated with residential / worker and visitor accommodation units through the use of electronic pin control gates. This section of road could provide access for up to 65 dwellings and will therefore meet the standard set down for a public local road.

The existing section of road to the clubhouse will provide for the golf course traffic as well as the new dwellings. The existing level of construction exceeds that required for a Public Local road and is therefore considered appropriate for the projected traffic volumes. It is also considered suitable for the higher peak hour volumes associated with temporary events at the Golf Course.

In order to maintain the 'rural' look of the existing rural environment, it is considered that the provision of a 3.5m one lane road, with 5.5m passing bays at regular intervals is appropriate for the access roads to individual accommodation blocks.

Compliance with the 2005 Subdivision Policy guideline would be achieved by construction of the accesses from the Hogans Gully Road at 5.5m for any flat sections and the 3.5m mountainous section as it rises towards the dwellings. This would allow continuous passing opportunities where driver inter-visibility is good and restrict passing opportunities where driver inter-visibility is not so good. It is considered more appropriate to construct the whole section with a consistent treatment with periodic passing opportunities over both the flat and mountainous sections so that drivers have a consistent experience of viewing approaching vehicles at places where passing opportunities are available.

The treatment proposed for the access road off Arrowtown-Lake Hayes Road at D6 to serve the visitor accommodation units is recommended to match the public cul-de-sac standard (5.5m width) even though the limit is indicated to be 15 units. The reduced width will encourage slower speeds with consequential road safety benefits.

The remaining sections of new internal roading serve fewer than five lots or are in mountainous terrain and the lower standards of a 3.5m width in the 2005 Subdivision Policy are appropriate.

9. Compliance with Planning Requirements

9.1 District Plan Requirements

The site currently lies within the Rural General Zone in the District Plan. The District Plan sets out a number of rules relating to the transport related elements of any development proposal which are relevant to the proposed rezoning because of the details included in the proposed structure plan. The relevant rules are set out below for the additional visitor accommodation and residential dwelling units associated with the proposed rezoning.

Criterion
Rule 14.2.4.1 (i) (Table 1, Page 14/14)   *Residential units require 2 spaces per unit, while visitor accommodation units require 1 space per unit (2 spaces per unit Plan Change 8), plus one staff space per 10 units, plus one coach space per 30 units.*
Rule 14.2.4.1 (iv)   *All vehicular access shall be in accordance with the standards contained in NZS4404:1981 including updates.*
Rule 14.2.4.2 (ii)   *Vehicle crossings providing access to a road in a Rural Zone shall comply with the Appendix 7, Diagram 2 (Private Access) or Diagram 4 (Commercial Access).*
Rule 14.2.4.2 (iv)   *The minimum sight distance for an access in an 80km/h zone serving a residential activity is 115m, or 170m for a non-residential activity. The minimum sight distance in a 100km/h zone is 170m for a residential activity or 250m for a non-residential activity.*
Rule 14.2.4.2 (v)   *Maximum number of vehicle crossings for a site frontage greater than 100m and onto a local road is three (or two onto an Arterial).*
Rule 14.2.4.2 (vi)   *The minimum distance between any vehicle access onto an arterial road and an intersection with a local road shall be 100m (100 km/h speed limit). For a vehicle crossing on a local road the minimum distance from an intersection with an arterial or local road is 25m (80 km/h speed limit).*

Table 6: Existing Relevant Rules of the District Plan

With the exception of the proposed new access on Hogans Gully Road, it is considered that all other access points will meet the sight distance requirements of the District Plan. The available sight distance at the proposed new access on Hogans Gully Road will depend upon its location which remains the subject of detailed design. In the event that the required sight distance cannot be achieved, this will trigger a requirement for an assessment of safety and the effects of the road geometry. This is considered appropriate to ensure that the new access operates safely. On this basis, no additional transport rules are considered necessary because all new roads and vehicle crossing locations are subject to existing rules to ensure that they can operate safely.

10. Summary and Conclusions

This Transport Assessment has identified, evaluated and assessed the various transport and access elements of the residential / visitor accommodation activities that are associated with the proposal for The Hills Resort Zone. It is considered that the traffic that would be generated by the proposed land use activities would be accommodated without adversely affecting the level of service or road safety on Arrowtown-Lake Hayes Road, McDonnell Road and Hogans Gully Road, and at their intersections.

Having due regard to the provision made for road users, it is considered that the proposed rezoning will have no discernible adverse effects upon the adjacent transport networks or adjacent properties.

hadley consultants LTD

CONSULTING ENGINEERS STRUCTURAL / CIVIL / PROJECT MANAGEMENT / GEOTECHNICAL

Trojan Helmet Ltd

Hills Golf Course Land

Proposed District Plan Submission

Infrastructure Feasibility Report

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B (For Submission)	J. McCartney		J. Hadley		22 October 2015

Limitations

This report has been written for the particular brief to HCL and no responsibility is accepted for the use of the report for any other purpose, or in any other context or by any third party without prior review and agreement.

In addition, this report contains information and recommendations based on information obtained by inspection, sampling or testing at specific times and locations with limited site coverage as outlined in this report. This report does not purport to completely describe all site characteristics and properties and it must be appreciated that the actual conditions encountered throughout the site may vary, particularly where ground conditions and continuity have been inferred between test locations. If conditions at the site are subsequently found to differ significantly from those described and/or anticipated in this report, HCL must be notified to advise and provide further interpretation.

Contents

1. Introduction

This report has been prepared to support a Submission to Queenstown Lakes District Council's (QLDC) Proposed District Plan Review to re-zone approximately 163 hectares of land near Arrowtown from Rural General to a new zone ("the site"). The site is referred to as "The Hills". The Submission is to be made by Trojan Helmet Limited (THL) as the land owner.

The site is located within the triangle formed by McDonnell Road, Hogans Gully Road and Arrowtown – Lake Hayes Road. The site is contained in various parcels held by various entities and is currently zoned Rural General under the Queenstown Lakes District Plan.

QLDC's Proposed District Plan Review seeks the re-zoning of the site to give effect to a resort style zoning enabling residential development of up to 100 new dwellings.

THL has engaged Hadley Consultants Limited (HCL) to investigate and report on the feasibility of providing utility services and the necessary development infrastructure for the development of the site.

This report considers the nature of the proposed development, the site conditions affecting the implementation of the necessary utility services and development infrastructure and describes the proposed implementation of the following elements:

- Water supply reticulation,
- Wastewater reticulation,
- Stormwater control, and
- Natural Hazards.

2. Nature of Proposed Development

THL proposes to develop the existing site near Arrowtown. The site, located to the south of Arrowtown and covering 162.7 hectares will cover land legally described as:

- Lot 7 Deposited Plan 392663, comprising 101.5914 ha, owned by Trojan Helmet Limited.
- Part of Lot 4 Deposited Plan 392663, comprising 53.2908 ha, owned by Trojan Helmet Limited.
- Lot 1 Deposited Plan 392663, comprising 11.5792 ha, owned by Richard Michael Hill and Ann Christine Hill.
- Lot 5 Deposited Plan 392663, comprising 1.5097 ha, owned by Richard Michael Hill, Ann Christine Hill and Veritas Limited.
- Lot 3 Deposited Plan 392663, comprising 0.6904 ha, owned by Trojan Helmet Limited.

The structure plan for the development indicates areas of open space and specific areas for dwelling development. The maximum number of dwellings in the proposed zone is limited to 100. This is made up of ten individual house sites and a further ten activity areas. These house sites and activity areas are laid out around the existing golf course and there is also golf course club house and associated services areas to be included in the proposed zone. A copy of the Structure Plan used to carry out the feasibility reporting is included in Appendix 1.

We note that the assessment of the necessary development infrastructure provided below is limited to consideration of the scale of the development as it is currently proposed and excludes consideration of specific stages and the specific locations of future dwellings and infrastructure within the site.

3. Site Description

The area of the proposed rezoning is located on 163 ha of land to the west of the Arrowtown – Lake Hayes Road between McDonnell Road and Hogans Gully Road. There are current accesses to the site from the Arrowtown – Lake Hayes Road, McDonnell Road and Hogans Gully Road. There is existing QLDC infrastructure for water supply and wastewater located along Arrowtown – Lake Hayes Road, McDonnell Road and Hogans Gully Road.

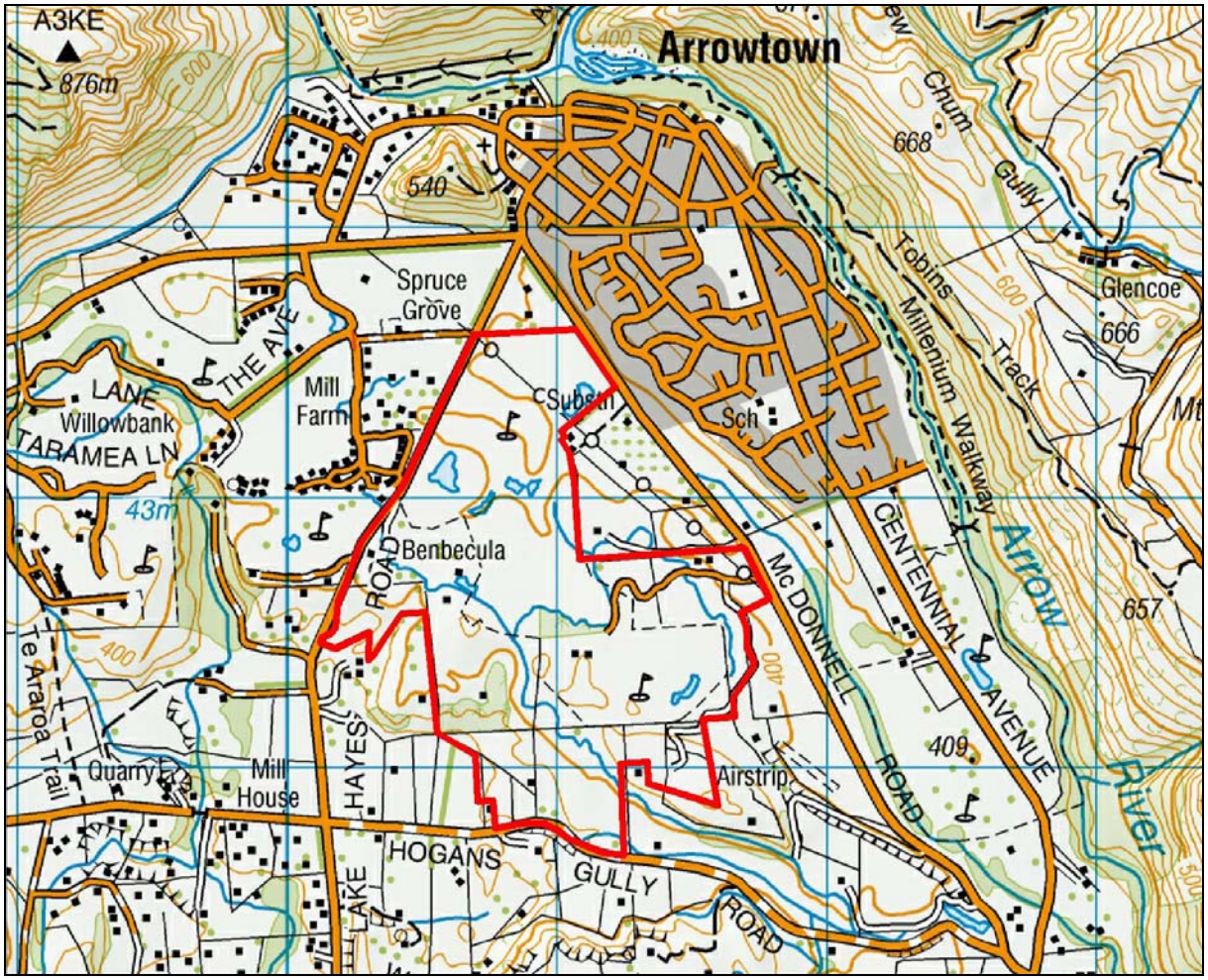


Figure 1 - Topographical Map Excerpt Showing Subject Site

The site comprises gently to moderately undulating land with some locally steeper slopes particularly in the southern areas. The overall topography of the site is gently falling to the north east.

Based upon the published geological information (Institute of Geological and Nuclear Sciences (IGNS), 1:250,000 Geological Map 18, Geology of the Wakatipu) and geological examination carried out by others the underlying geological materials within the site are comprised of

outwash gravels and till and morainic deposits. These soils overlie schist bedrock that can be seen as outcropping in various locations across the site.

The existing land use at the site comprises mainly a landscaped golf course with some grazing occurring in the southern areas. Vegetation covering the area is mainly that associated with golf courses and pasture. There are areas of landscape plantings across the site along with significant mature tree plantations.

There are areas of standing water such as streams, ponds and landscape features. It is expected that ephemeral watercourses may be formed in some of the topographic depressions on site during periods of high precipitation.

The proposed development site and surrounding Arrowtown area experience generally cold winters with severe frosts at times and hot dry summers. Strong north-westerly winds are also a climatic characteristic of the area. The land receives approximately 850mm of rainfall per annum and may be subject to drought conditions during the summer months.

4. Water Supply

4.1 General

The site is located between the QLDC water supply schemes of Arrowtown and Lake Hayes with infrastructure from both schemes being in road frontages of the site. In addition, the existing buildings and dwellings on the site are currently serviced by existing on site water bore supplies. The Arrow Irrigation Company irrigation water race runs through the site and provides existing landscaping irrigation and meets water feature water demand.

4.2 Water Demand Assessment

Peak water demand would be expected during the summer months when seasonal populations are at their peak and irrigation usage will be at its highest. The following design figures have been adopted.

Demand Item	Potable Demand (litres/day)	No.	Total (litres/day)
Dwelling (average day)	2,100	100	210,000

The additional average daily water supply demand of 210 m^3 per day equates to 2.43 litres per second average flow over twenty four hours.

From the QLDC Land Development and Subdivision Code of Practice the peaking factors for either the Arrowtown or Lake Hayes water supply schemes are as follows:

Item	Peaking Factor
Average daily flow to peak daily flow	3.3
Average daily flow to peak hourly flow	6.6

Using the QLDC peaking factor, the peak hour flow is estimated at 16.04 litres per second.

4.3 Fire Fighting Demand

In accordance with *SNZ PAS 4509:2008 New Zealand Fire Service Firefighting Water Supplies Code of Practice,* the usage for the developed site is expected to fall into the *"Housing: includes single family dwellings, multi-unit dwellings but excludes multi storey apartment blocks"* category. This will result in a fire fighting water supply classification of FW2. An FW2 classification requires 12.5

l/s of water flow available within a distance of 135 metres and an additional 12.5 l/s of water flow available within a distance of 270 metres.

4.4 Water Supply - Option 1

The first option to provide a water supply to the proposed zone, is to connect to an existing QLDC water supply scheme. Given the relative elevations and proximity to site, it would be most appropriate to connect to the Arrowtown water supply scheme.

No network modelling has been undertaken due to time constraints. However, it would appear that the relatively modest levels of flow required would be able to be accommodated. This would be by way of either a direct connection to the existing infrastructure or via some on site buffering to reduce the peak demands on the existing water supply scheme. If buffering was required, it is expected that booster pumping will be required to then reticulate water to the development areas around the site.

In order to connect to the QLDC Water Supply Scheme, approval of Council would be required to extend the water supply scheme boundary to include the proposed zone. In addition, Development Contributions would need to be paid for each dwelling connected. Council may include other conditions for extending the water supply scheme to include the proposed zone which may result in additional upgrade costs being borne by the developer. Early liaison with Council will be required in order to determine exact Council requirements and potential cost liabilities.

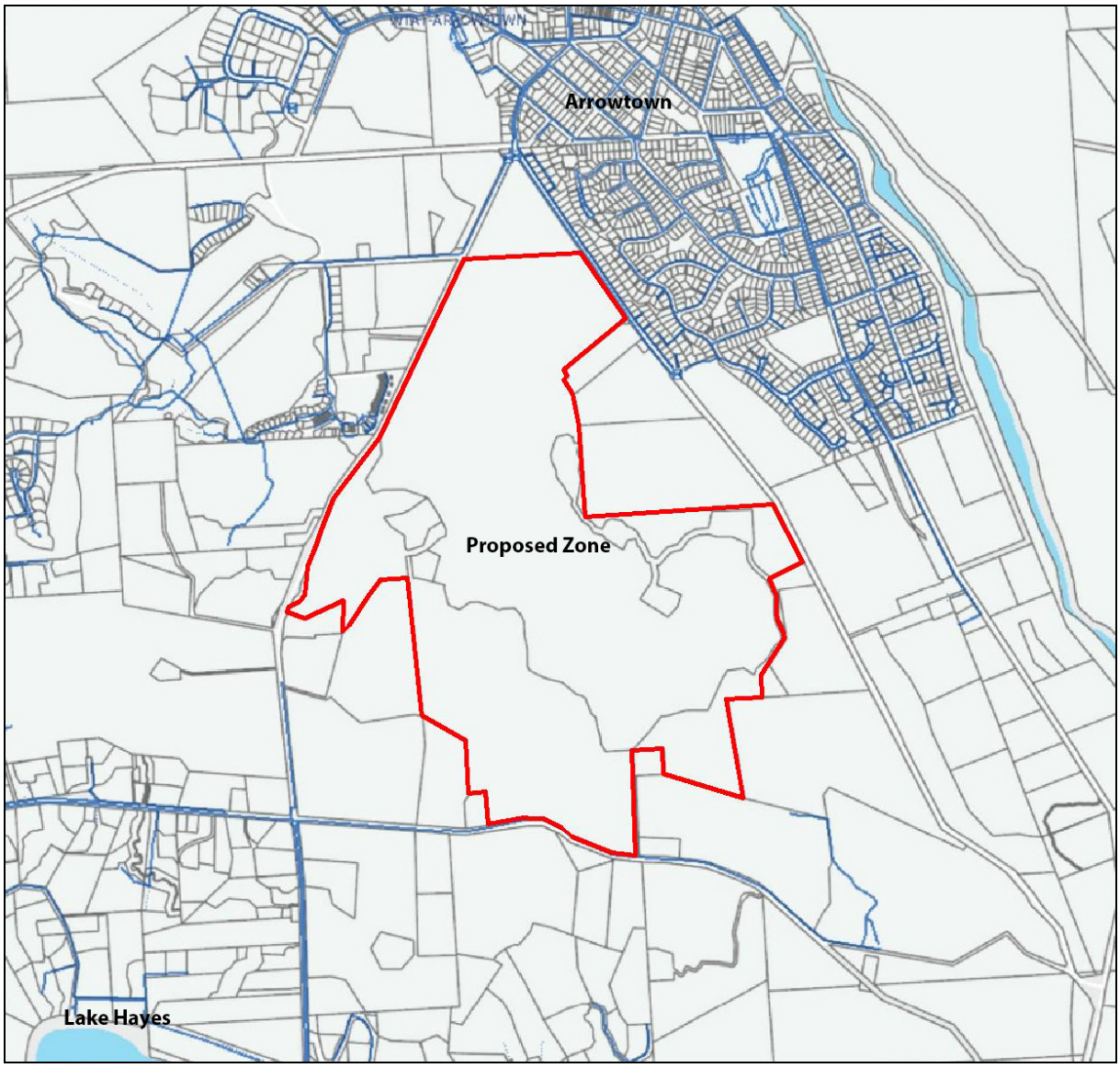


Figure 2 - Map Showing Existing QLDC Water Supply Infrastructure.

This option would also require the construction and installation of fire hydrants in proximity to the future dwellings in order to meet the fire fighting water supply requirements.

4.5 Water Supply - Option 2

The second option for providing a water supply for the development would be to use either a new water bore or an existing bore (or a combination of the two) to supply the proposed zone with potable water. This would mean that the zone would have a standalone water supply that was separate from any Council reticulation.

The basic components of such a system would include the water bore intakes and pumps, rising main and storage reservoir as well as a water treatment system sufficient to bring the supply in line with Drinking Standards for New Zealand 2005 (Revised 2008) (DWSNZ).

The water supply storage reservoir for the proposed zone, based upon Council reservoir requirements would be approximately 200 m^3. As there is no significant high point with suitable elevation above the highest proposed area of development, it is likely that a water pressure boosting pump station would be required to provide domestic and firefighting pressures.

As well as the physical construction issues involved with this option a number of consenting and maintenance matters would also need to be addressed. A resource consent will be required to construct any new bore and it is likely that a further consent will be required for the water take itself as both the calculated total daily demand and the peak hourly flow exceed the permitted water take rates set out in the Otago Regional Council's Regional Plan for Water. Land use and building consents may also be required for the reservoir and water treatment facilities.

There are existing productive bores on the site and on neighbouring sites. Two bores are currently used for servicing the site with both potable and irrigation water. It is likely that these two bores would provide sufficient water for the potable demand for the proposed zone. However, this may reduce the amount of water available for irrigation of the associated golf course and landscaping and this would need to be assessed at the time development proceeded to ensure there was sufficient water for all purposes across the site.

The main issue to be considered with regards to this option would be the on-going maintenance and management of the water supply and treatment system. One option would see the system vested with Council. Alternatively, the water supply could be owned by a lot owners association (or similar) responsible for the on-going management and maintenance of the infrastructure. A similar system to this has been used at Jacks Point near Queenstown.

4.6 Conclusions and Recommendations

Both of the two options outlined above to supply water to the subject site are feasible. Further investigation, consultation with Council and cost analysis will be necessary to establish the final methodology used.

5. Wastewater Disposal

5.1 General

A Council reticulated sewerage scheme exists adjacent to the site including an existing rising main that runs through the site. In addition, there is the possibility of constructing a standalone communal treatment and disposal system to cater for the wastewater drainage from the development of the proposed zone.

Both of these options are considered further below.

5.2 Demand Assessment

Peak wastewater generation is expected to coincide with peak water demand. The following design figures have been adopted:

Wastewater Generation Item	Wastewater Generation (litres/day)	No.	Total (litres/day)
Dwelling (average day)	1,050	100	105,000

The additional average daily wastewater generation of 105 m^3 per day equates to 1.22 litres per second average flow over twenty four hours.

From the QLDC amendments to NZS4404:2004 Land Development and Subdivision Engineering, the peaking factors for the wastewater network are as follows:

Item	Peaking Factor
Dry weather diurnal peak flow	2.5
Wet weather dilution/infiltration factor	2

Using the QLDC peaking factors, during the wet weather peak flow is estimated at 6.08 litres per second.

5.3 Wastewater Drainage – Option 1 – Council Reticulated Scheme

This option involves connecting to the existing Council reticulation that runs through and adjacent to the site. An existing Council rising main runs through the site, this becomes

gravity reticulation near the Arrowtown – Lake Hayes Road. There is also Council reticulation in McDonnell Road adjacent to the proposed zone.

HCL have previously been engaged in order to connect the existing golf clubhouse to the nearby QLDC wastewater reticulation. This has been done by way of a small pump station with a rising main connection to the first gravity manhole after the Council rising main that runs through the site. QLDC formally approved this connection to their scheme.

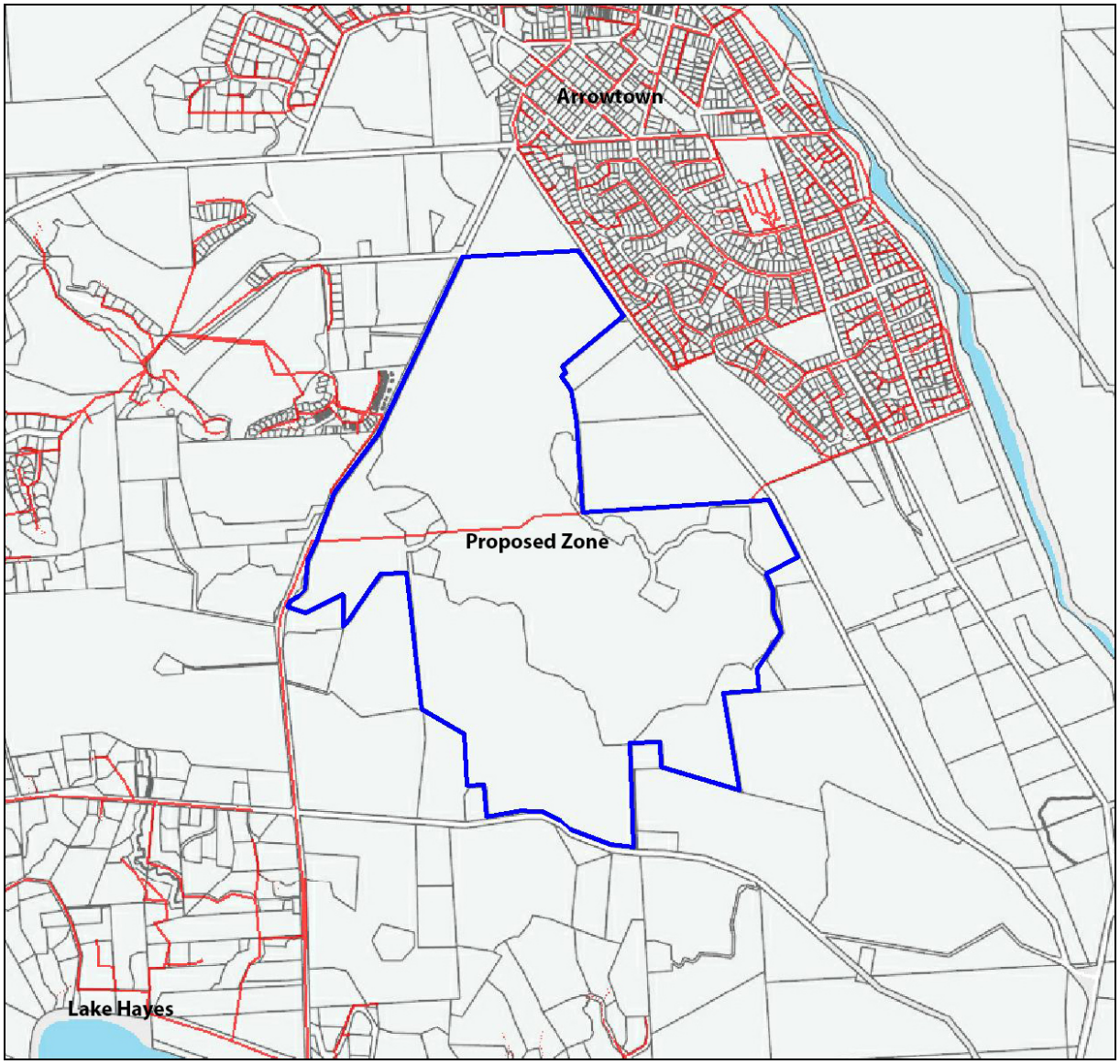


Figure 3 - Map Showing Existing QLDC Wastewater Drainage Infrastructure.

As previously stated, the site is undulating. It is anticipated that much of the site will be able to be drained using standard trunk and lateral gravity pipelines. These will drain to a central primary pump station that will then pump to a suitable discharge point in the Council network.

To address topographical variation, it is possible that some home sites may require a small package grinder pump and small bore rising main to connect to the new internal reticulation.

The primary pump station would be able to be designed and constructed in such a fashion to enable buffering to reduce flows into the existing Council infrastructure at peak times.

In order to connect to the QLDC Wastewater Drainage Scheme, approval of Council would be required to extend the wastewater scheme boundary to include the proposed zone. In addition, Development Contributions would need to be paid for each dwelling connected. Council may include other conditions for extending the wastewater scheme to include the proposed zone which may result in additional upgrade costs being borne by the developer. Early liaison with Council will be required in order to determine exact Council requirements and potential cost liabilities.

5.4 Wastewater Drainage – Option 2 – Communal System

This option involves constructing a new communal wastewater treatment and disposal system at a suitable location on site and treating all wastewater flows from the proposed development prior to discharge to land.

It is envisaged that a package plant system similar to that used at Jacks Point could be accommodated to service the Golf Course Land and, if desired, this system could be designed to provide for future expansion to allow inclusion of adjacent development areas. The system would involve the primary treatment of wastewater at each individual dwelling or block of dwellings by way of a septic tank to remove solids. Primary treated effluent from each septic tank is then pumped or drained to the communal package treatment facility where it undergoes secondary and possibly tertiary treatment prior to disposal to land.

This type of system has a number of positive attributes including:

- The ability to stage expansion of the treatment plant to cater for staged development of the zone.
- No pond based treatment.
- Possible reuse of water for irrigation purposes.

The system would be made up of the following components:

1. Each dwelling would drain wastewater flows to a septic tank located close by. This septic tank would be installed at the time the dwelling was constructed. Depending on

the location and topography, the tank would be fitted with a pump and rising main to reticulate flows to gravity reticulation or would simply connect via gravity to nearby reticulation. The septic tanks will require routine inspections and maintenance. This will mostly involve pumping out the solid wastes from time to time. The inspections and maintenance would be managed by a lot owners association or similar. If dwellings were to consist of units or terraced residences, a communal septic tank would be used for that group of dwellings. This would require specific design at the time, but the tank's function would be similar to that for a single dwelling.

2. It is likely that a mix of gravity and pumped mains will reticulate flows to a suitably located treatment facility. In the case of pumped mains, individual tanks would connect to this via a non-return valve kit.
3. At this stage, a package treatment plant is anticipated to be located near the existing service area. This will receive all wastewater flows into a buffer tank and then treat it using a proprietary treatment system. This system would be a package treatment plant from a proprietary manufacturer/supplier. The actual process adopted will be the subject of detailed design and procurement evaluation. For some guidance, the system used at Jacks Point involves the use of textile packed bed reactors. If deemed necessary at the time of detailed design, tertiary treatment such as UV disinfection could be included to further treat the effluent.
4. The final treated effluent would be reticulated to a suitable disposal location. If suitable tertiary treatment is included, it is likely that this treated effluent could be used for shallow subsurface irrigation around the site. This would need to be carefully considered at the time of detailed design to ensure freezing pipes and public access were appropriately managed.

Similar to the water supply system, one of the main issues to be considered with regards to this option would be the on-going maintenance and management of the wastewater treatment and disposal system. One option would see the system vested with Council. Alternatively, the wastewater drainage and treatment system could be owned by a lot owners association (or similar) responsible for the on-going management and maintenance of the infrastructure. A similar approach to this has been adopted at Jacks Point near Queenstown and accepted by QLDC.

5.5 Conclusions and Recommendations

It is recommended that the wastewater generated from the proposed development be disposed of by way of connection to either the QLDC reticulated scheme or a new purpose built communal treatment and disposal facility on site. The feasibility of the chosen

wastewater option will need further detailed analysis, consultation and consenting prior to implementation.

6. Stormwater Disposal

6.1 General

Generally, it is proposed to maintain the runoff characteristics of the existing catchment. However the proposed development on the site will alter the existing stormwater run off patterns and will serve to increase the peak flow runoff. We recommend to collect and control the stormwater runoff and dispose via connection to local water courses or to dispose of on site using stormwater infiltration and soakage features.

6.2 Planning Rules and Regulations

Rule 12.5.1.1 of the Regional Plan: Water for Otago states that the discharge of drainage water to water (or onto land where it might enter water) from any drain is a permitted activity so long as certain conditions are met. The conditions of particular relevance to the discharge of stormwater from the proposed new roads and domestic allotments are as follows:

> *12.5.1.1 (b) The discharge, after reasonable mixing, does not give rise to all or any of the following effects in the receiving water:*
>
> *(i) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials; or*
>
> *(ii) Any conspicuous change in the colour or visual clarity; or*
>
> *…*
>
> *(v) Any significant adverse effects on aquatic life.*

It is further stated that:

> *The discharge of drainage water under Rule 12.5.1.1 will have no more than minor adverse effects on the natural and human use values supported by water bodies, or on any other person. This rule is adopted to enable drainage water to be discharged while providing protection for those values and the interests of those people. Any other activity involving the discharge of drainage water is a restricted discretionary activity in order that any adverse effects can be assessed.*

Contaminants associated with vehicular traffic can include oils, rubber, heavy metals and sediments. In large amounts these contaminants can greatly decrease the natural and human use values of bodies of water. As the stormwater from the site will likely be discharging either directly into local water courses or to ground, appropriate protections will need to be installed in the on-site drainage system in order to remove such contaminants

from the stormwater. The aim of stormwater quality treatment used at the site would be to ensure that the runoff from the new development is in a similar condition to that being achieved before the development. Of particular concern are the “first flush” flows that carry the highest pollutant loadings.

Appropriate technologies to separate contaminants from the stormwater flows might include the use of mud-tanks located in the on-site drainage sumps and a vortex separator mechanism such as a Hynds Downstream Defender which provide high removal efficiencies of suspended solids and floatables over a wide range of flow rates.

Careful design of the stormwater reticulation for the site will ensure that the requirements set out in the Regional Plan: Water for Otago are met.

6.3 Stormwater Quantities

At this early stage in the development of the proposed zone, it is difficult to determine the increase in storm water runoff from the site. Initial calculations have been undertaken and these indicate that for a 10 minute rain event with an average reoccurrence interval (ARI) of 10 years the development is expected to increase the storm water flow rate by approximately 1 m^3 per second. This will vary depending upon the density of the development and the permeability of the site.

This level of increase in runoff would result in very large infrastructure if the traditional approach of reticulating all the flows from the site was adopted. If a single point of discharge was developed, the required outlet pipe would be approximately 675 mm in diameter. This level of infrastructure would be expensive and can be mitigated using a Low Impact Design (LID) approach.

From NZS4404:2010 Land Development and Infrastructure:

> *Low impact design aims to use natural processes such as vegetation and soil media to provide stormwater management solutions as well as adding value to urban environments. The main principles of low impact design are reducing stormwater generation by reducing impervious areas, minimising site disturbance, and avoiding discharge of contaminants. Stormwater should be managed as close to the point of origin as possible to minimise collection and conveyance. Benefits include limiting discharges of silt, suspended solids, and other pollutants into receiving waters, and protecting and enhancing natural waterways.*

And:

> *Low impact design is a type of storm water system that aims to minimise environmental impacts by:*

(a) Reducing peak flow discharges by attenuation;

(b) Eliminating or reducing discharges by infiltration or soakage;

(c) Improving water quality by filtration;

(d) Installing detention devices for beneficial reuse.

The types of low impact devices and practices that could be included in the zone include the following:

- Detention Ponds;
- Vegetated swales;
- Rain gardens;
- Rainwater tanks;
- Soakage pits and soak holes;
- Filter strips; and
- Infiltration trenches/basins.

Subdivision urban design principles may also assist in mitigating runoff from the site. These include clustering development to increase open area around developed areas and decreasing road setbacks in order to decrease the likely impervious areas.

In addition to reducing the peak discharge from the site, LID approaches may also improve the quality of the runoff from the site.

It is noted that due to the local topography, the area in the southwest corner of the site drains off site and through private land. The storm water runoff solutions in this area will need to ensure that the post development runoff is no greater than the pre-existing development runoff. It is expected that the use of specific soakage and attenuation devices will be used to meet this requirement.

6.4 Conclusions and Recommendations

We consider that the collection and subsequent disposal of stormwater from the proposed development is entirely feasible via collecting and controlling the stormwater runoff and disposing by draining to the local water courses passing the site.

Dependent upon the overall design approach for the subdivision, the storm water runoff leaving the site could be greatly reduced by the introduction of low impact design approaches including the use of attenuation and filtration devices.

7. Natural Hazards

Natural Hazards have been separately assessed by HCL as part of a global Natural Hazards Assessment for THL land holdings.

The HCL Natural Hazards Assessment report is included as Appendix 2 and confirms there are no natural hazard constraints applying to the Golf Course Land.

8. Conclusions and Recommendations

The subject site and the proposed development have been assessed to determine the suitability for development in relation to infrastructure services. No significant constraints have been identified and the Golf Course Land is suitable for the proposed development from an infrastructure servicing viewpoint.

The key findings are summarised as follows;

i. There are two options for supplying water to the site. The first option would be to utilise the QLDC reticulated water supply. This would likely require the construction of water storage and water pressure boosting to achieve buffering and firefighting flows. The second option would be to install a new, private water bore intake and treatment along with a new reservoir and a water supply boosting pump station. The final decision on which methodology to use will be decided at a later point following further investigation, consultation and cost analysis.

ii. Wastewater drainage reticulation from the site will be able to be catered for with either connection to the existing QLDC reticulation or construction of a proposed wastewater reticulation and treatment and disposal system. The majority of the site will be able to be reticulated by the construction of gravity sewer pipes. However, it is anticipated that parts of the development site will require pump stations in order to convey flows to either the existing QLDC infrastructure or the new treatment plant.

iii. Stormwater runoff from the site can be satisfactorily disposed of by the construction of necessary reticulation with disposal to local water courses. It is recommended that in order to reduce the peak runoff and to improve runoff quality, low impact design approaches are adopted.

iv. Based on the global Natural Hazard Assessment prepared by HCL, no natural hazard issues exist which constrain development on the Golf Course Land.

Overall, we confirm that there are no significant impediments to development of the site with respect to Infrastructure Services or Natural Hazard.

We recommend that the timing and scale of the proposed infrastructure upgrades be further assessed once the layout of the proposed zone has been further progressed and staging of development has been confirmed.

Appendix 1

Structure Plan

KEY:

Structure Plan Boundary

Activity Area

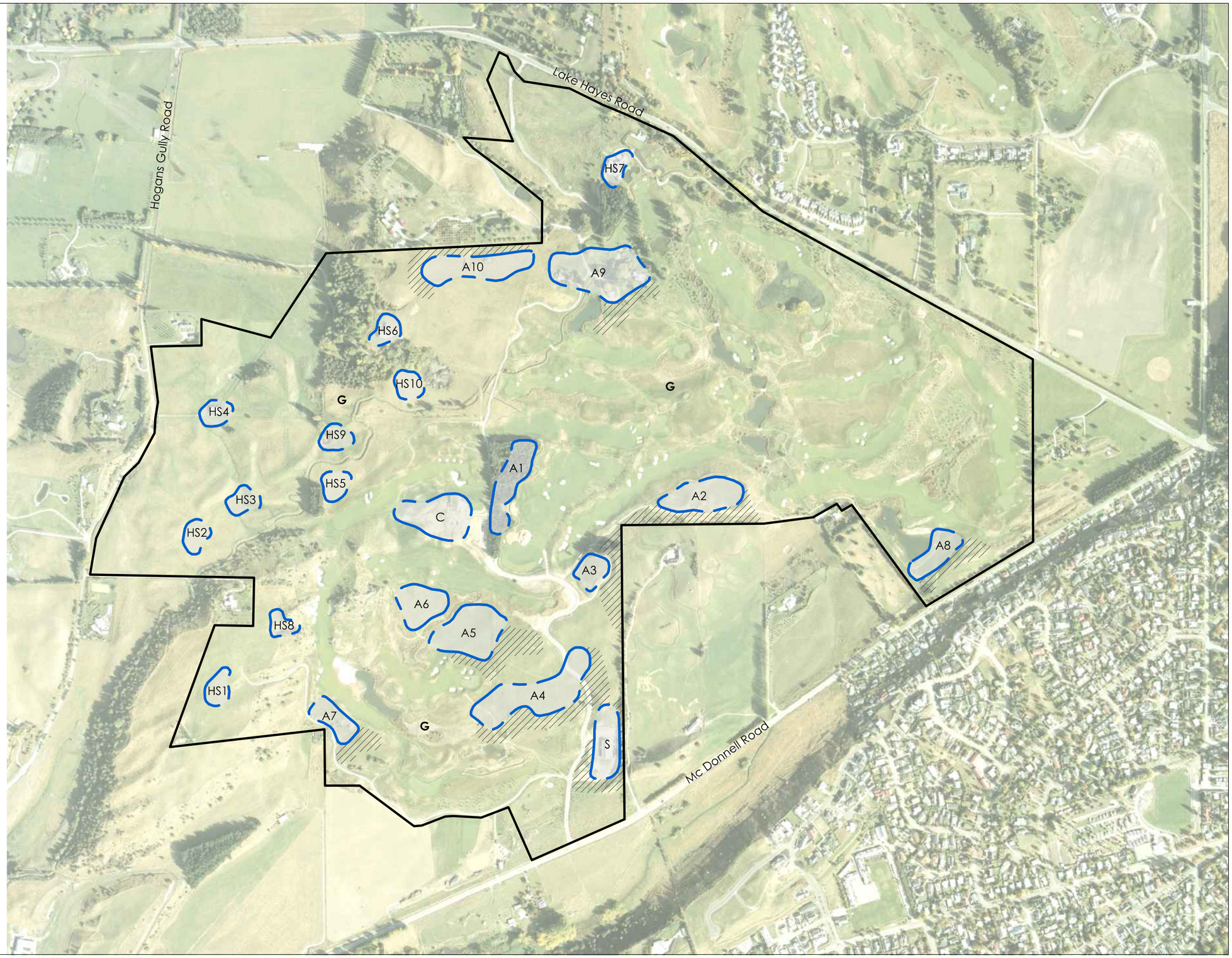
Activity Areas:

G: Golf course, open space and farming
C: Clubhouse
A: Visitor Accommodation / Residential
HS: Homesite (3,000m2)
S: Resort Services & Staff Accommodation

Note: all activity areas include G: Golf course, open space and farming

Overlays:

Landscape Amenity Management Area



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SCALE: 1:4,000 (A1); 1:8,000 (A3)

0 100 200 300

PLAN STATUS:

DP REVIEW

THE HILLS
STRUCTURE PLAN

DRAWN / REVIEWED: RT / JC
APPROVED: DT
DATE: 14.10.15

DRAWING NO:
MH_10_1_MLP_010F

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Road access

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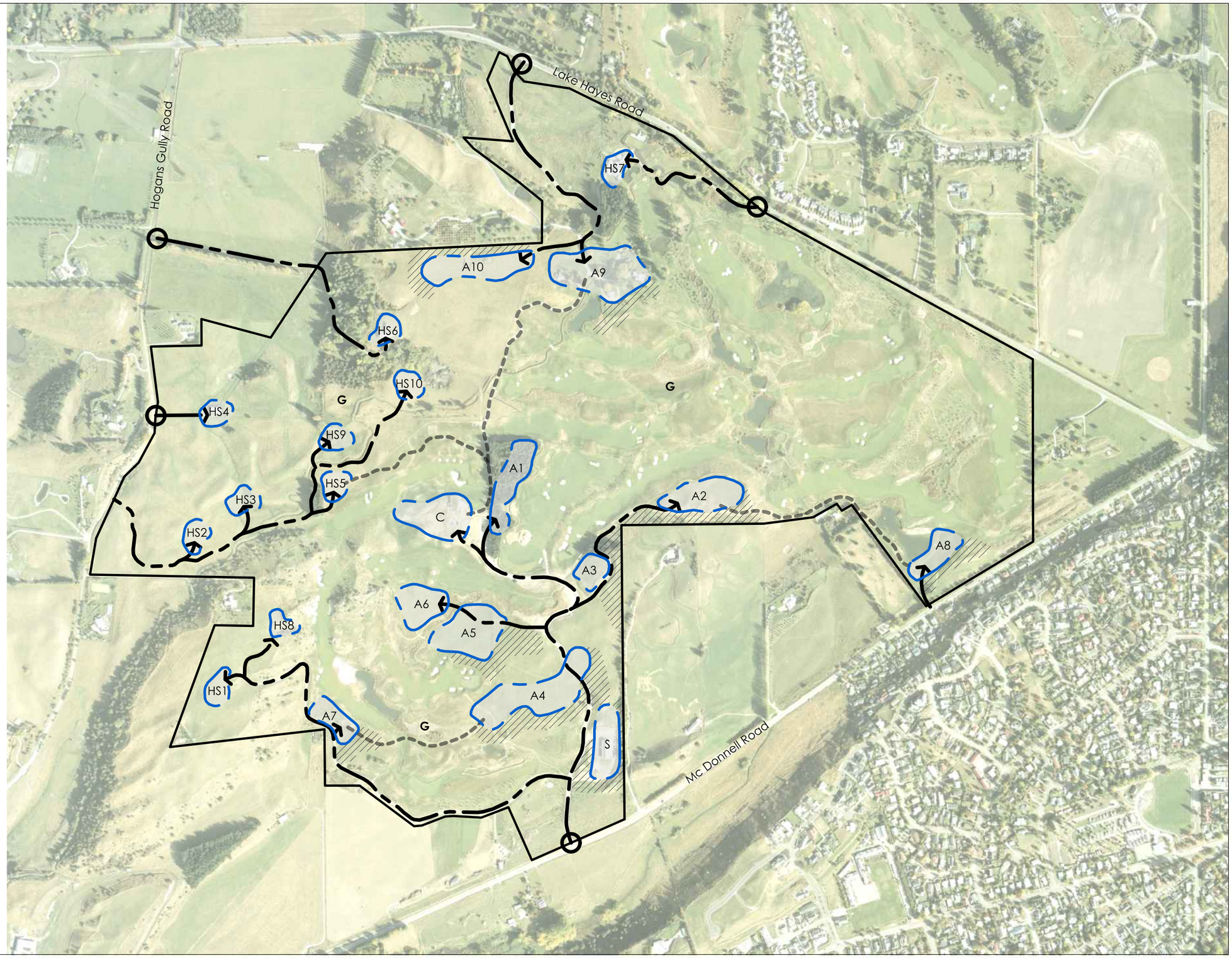

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Appendix 2

HCL Natural Hazards Assessment Report

hadley consultants LTD
CONSULTING ENGINEERS STRUCTURAL / CIVIL / PROJECT MANAGEMENT / GEOTECHNICAL

Trojan Helmet Ltd

Hills Golf Course (including McDonnell Road Land) and Hogans Gully Road Land

Proposed District Plan Submission

Natural Hazard Assessment

hadley consultants LTD
CONSULTING ENGINEERS STRUCTURAL / CIVIL / PROJECT MANAGEMENT / GEOTECHNICAL

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Document Status

Revision	Author:		Reviewer:		
	Name	Signature	Name	Signature	Date
A (Initial Issue)	J. Hadley		J. McCartney		20 October 2015
B (For Submission)	J. Hadley		J. McCartney		21 October 2015
C (Final)	J. Hadley		J. McCartney		22 October 2015

Limitations

This report has been written for the particular brief to HCL from their client and no responsibility is accepted for the use of the report for any other purpose, or in any other context or by any third party without prior review and agreement.

In addition, this report contains information and recommendations based on information obtained by inspection, sampling or testing at specific times and locations with limited site coverage as outlined in this report. This report does not purport to completely describe all site characteristics and properties and it must be appreciated that the actual conditions encountered throughout the site may vary, particularly where ground conditions and continuity have been inferred between test locations. If conditions at the site are subsequently found to differ significantly from those described and/or anticipated in this report, HCL must be notified to advise and provide further interpretation.

Contents

1. Introduction

Trojan Helmet Ltd (THL) has engaged Hadley Consultants Limited (HCL) to conduct a natural hazards assessment of their land which comprises both the Hills Golf Course and an adjacent land holding which fronts Hogans Gully Road.

This report considers the relevant site conditions and natural hazard issues affecting the potential building development within possible development areas identified by others. Specifically, the natural hazard elements investigated and assessed are:

- Liquefaction hazard,
- Alluvial fan hazard, and
- Inundation and flood risk.

The purpose of this report is to provide a reference document to assess whether any natural hazard constraints exist in a global context which will adversely impact proposed development areas on the THL land holdings.

This report is intended to inform submissions made by THL on the Queenstown Lakes District Council's (QLDC) Proposed District Plan.

2. Nature of Proposed Development

The development proposed across the THL land comprises new zoned Rural Lifestyle Areas combined with a new Resort Zoning (the Hills Resort Zone) in which specific pockets of building development are identified for activities which include discrete Homesites, Visitor Accommodation, Farm and Resort Services and Staff Accommodation.

There are two primary Proposed Rural Lifestyle zones as follows;

- Proposed Rural Lifestyle Area A comprising a 19.7Ha block bounded by Hogans Gully Road to the south and Arrowtown – Lake Hayes Road to the west; and
- Proposed Rural Lifestyle Area B comprising an 8.4Ha block with frontage to McDonnell Road.

The remainder of the proposed development areas are located wholly within the existing Golf Course area (which will form the new Hills Resort Zone) and represent discrete pockets of development across the site.

The overall development sites and areas are indicated on the Darby Partners and HCL topographic drawings contained in Appendix A.

Some of the proposed development areas within the Golf Course site include building platforms previously consented under RM081223. Where relevant, previous work on these platforms has been considered in this more global evaluation of natural hazards impacting the land holding.

3. Scope of Assessment

The purpose of this report is to provide a global overview of the natural hazard issues which might affect development capability across the THL land holdings. In making this assessment, HCL have undertaken the following activities;

- Stereo pair photo analysis of geological features to identify potential areas of instability.
- Review of previous site investigation and assessment work by others for previous developments at the THL site. These investigations have been used to verify the HCL developed geological and geotechnical models adopted when assessing hazard.
- Detailed site walkover and geological mapping of all proposed development areas.
- Logging and mapping of open excavations and test pits across the site to confirm site lithologies.
- Review and consideration of QLDC Hazard Maps and their impact and relevance to the THL site following specific evaluation and verification of the geomorphology which exists.

It is intended that this document form a master Natural Hazards document for the THL land holdings which may be referred to when considering discrete planning submissions for the separate Rural Lifestyle A and B areas, and the other Activity Areas within the proposed Hills Resort Zone.

4. Site Description

The proposed development takes in the Hills Golf Course Land, located at 164 McDonnell Road approximately 1km south of Arrowtown and an area of land comprising 19.7Ha to the south of the Golf Course. This land, referred to as the Hogans Gully Land, is bounded by Hogans Gully Road to the south and Arrowtown – Lake Hayes Road to the west. The drawings included in Appendix A illustrate the site location and development areas.

The Golf Course is accessed from McDonnell Road which runs along the eastern boundary of the site and the Hogans Gully Land is accessed from Hogans Gully Road which runs along the southern site boundary.

Prior to the development of the golf course the THL land comprised farmland. The existing vegetative cover comprises a combination of long pasture, golf course green, landscaped areas and wooded areas. Vegetative cover on the Hogans Gully Land currently comprises farmland, paddocks and pasture.

The site includes several existing structures and these existing building sites have not been assessed as it is assumed they have been considered in detail as part of previous assessment work which allowed their construction.

Topographic contours of the site are shown on HCL Drawings 152859-S01 and S02 in Appendix A.

The site is undulating and ground levels typically vary between RL350m to RL430m. Slopes on the site are predominately gentle (5 to 15º); however, localised steep slopes are also present in some areas across the site.

Rock exposures also exist across the site, most notably on the Golf Course Land but also on the south facing flanks above the Hogans Gully Land.

There are a number of springs, gullies and manmade drainage features present across the site which will give rise to emphemeral flows during wet periods. The most significant drainage features include a stream which runs along the southern boundary of the THL land roughly parallel with Hogans Gully Road and an internal water race system which traverses the higher elevation Golf Course Land roughly west to east.

The site is primarily accessed from McDonnell Road, although additional farm track access is possible from Hogans Gully Road and from Arrowtown – Lake Hayes Road for existing private residences.

The site also includes a relatively complex system of internal roads, footpaths, cart paths and farm tracks that will impact local catchment boundaries and run off characteristics.

The land receives approximately 850mm of rainfall per annum and may be subject to drought conditions during the summer months.

5. QLDC Hazard Register and Previous Work

QLDC Hazard Maps (refer Appendix B) note that the site may be affected by;

- Liquefaction Hazard, assessed as provisionally LIC1.
- Alluvial Fan Hazard.

The liquefaction risk classification is shown to affect the majority of the Golf Course Land, whilst the Alluvial Fan Hazard is limited in its extent, taking in parts of the south facing slopes above the Hogans Gully Land.

In August 2006, Tonkin and Taylor Ltd (T&T) conducted a detailed investigation of the Golf Course area as part of a previous development proposal. This work by T&T included;

- Site evaluation,
- The excavation and logging of 12 test pits ranging in depth from 1.8m to 4.8m,
- Scala Penetrometer testing.

As part of their reporting T&T also provided soil parameters for foundation design and slope stability analysis.

T&T recorded that there was no evidence of slope instability recorded in the vicinity of the proposed building platforms, although some instability was observed in the oversteepened slopes above the Hogans Gully Land.

With regard to liquefaction, T&T noted that;

i) Subgrade materials were expected to provide good bearing for shallow foundations.
ii) Settlement of the subgrade materials under seismic loading is expected to be minimal.
iii) For detailed design in accordance with NZS 1170.5:2004, subsoil Class C conditions could be assumed.
iv) The regional groundwater table was not encountered and is expected to lie at a depth several metres below existing ground surface across the site.

Overall the T&T work did not identify any natural hazard issues (such as liquefaction) affecting any of the proposed Golf Course sites and concluded that building foundations were expected to be founded on glacial outwash and glacial sediment which should provide good bearing.

6. Geological Setting

6.1 Physiography

The site is located within the Wakatipu Basin, a feature formed by a series of glacial advances.

The most recent glacial advance occurred in the area between 10,000 and 20,000 years ago. This glacial activity has deposited glacial till, outwash and lake sediments over scoured bedrock.

Post glacial times were then dominated by erosion and deposition of alluvial gravels by local watercourses and river systems and during periods of high lake levels. This is relevant in the context of the Hogans Gully Land, where Shotover River derived alluvium is identified.

6.2 Site Lithologies

The predominant site lithologies across the site may be summarised as follows;

i) **Schist.** Schist outcrops irregularly, and is particularly evident beneath the higher terrain towards the south above the Hogans Gully Land. No particular distress was observed (eg glacial shearing/plucking), nor was there any evidence of mass movement.

ii) **Glacial Till.** Glacial Till dominates across the Golf Course Land, and is particularly notable by the presence of the hummocky terrain. Where visible in outcrop and suboutcrop, it is a lodgement till, comprising compact silt/sand, with subordinate gravel clasts, and generally rare cobbles with rare boulders.

There appear to be three different ages of tills, the oldest being a capping on schist in the vicinity of Sites HS1 and HS8, intermediate age tills form the hummocky terrain within the Golf Course proper, while the youngest till has intruded into the Hogans Gully Land. The latter is finer than the older type, but there isn't a marked difference in grading. Additional observations include;

- No mass movement noted in the till,
- Possible historic fill mounds sometimes hard to differentiate from insitu till.

iii) **River Alluvium.** The presence of river alluvium is defined in different areas of the site as follows;

- **Within Proposed Rural Lifestyle Area A:** This area is assessed as Shotover derived alluvium sourced from the west. Of particular note are the finger-like beach deposits which accumulated at the surface of the river alluvium by long shore drift when the lake was high.
- **Within Proposed Rural Lifestyle Area B:** Observations in a test pit near the western margin of this zone disclosed a well-bedded, river alluvium comprising well-graded sandy gravel to cobbly sandy gravel. Clasts appear to be Shotover sourced, hence it is likely that the sediments were deposited by a former Hayes Creek draining the basin south of Coronet Peak. Degradation has produced a stepped morphology, grading gently down towards McDonnell Road.

iv) **Fans.** Small fans do grade out into the Proposed Rural Lifestyle Area A, but they do not appear to be active. A small, intra-course fan is present near Site A6 and there may be other fan elements around the site and away from proposed development areas. Due to their lack of activity these fan areas require consideration in any detailed design, but are not considered a high risk hazard.

7. Specific Development Area Assessment

7.1 General

Consideration of the Development Area as a whole has been separated as follows;

i) Proposed Rural Lifestyle Area A,
ii) Proposed Rural Lifestyle Area B,
iii) Development Sites designated “HS” and “A” across the Golf Course area.

We note that due to the presence of existing structures the following sites were excluded from evaluation by HCL;

- Site S – the Resort Services Area,
- Site C – the Clubhouse,
- HS6 – An existing house site,
- HS7 – Existing loge.

We confirm that all other development areas indicated on the Darby Partners drawings contained in Appendix A have been assessed. To avoid repetition in reporting, we have grouped sites with common features.

7.2 Liquefaction Risk and Flood Hazard

We collectively address the Liquefaction Risk noted by QLDC as affecting Proposed Rural Lifestyle Area B and all of the HS and A development areas within the Golf Course Land.

HCL’s assessment of the site lithologies is that the Golf Course Land is mantled by glacial till comprising compact sands and gravels with a regional groundwater level located at depth. Schist bedrock outcrops in several locations and neither the compact till or the bedrock are susceptible to liquefaction. Further, Proposed Rural Lifestyle Area B includes alluvial deposits, again with a significant depth of groundwater.

HCL’s assessment is also verified by the previous reporting and site investigation work of T&T.

The confirmed presence of compact glacial tills and the absence of shallow groundwater allow us to confirm that liquefaction hazard is not a relevant risk for any of the proposed development areas.

A flood hazard is not recorded by QLDC and we confirm that subject to normal cut off drainage and catchment management, no large scale flood or inundation risk exists.

7.3 Proposed Rural Lifestyle Area A

Observations relevant to this area include;

- Greater than 50% of the proposed site is located on flat to gently sloping terrain comprising Shotover-derived alluvium.
- Some inactive fan elements encroach into the development area from the north and northeast mantling both glacial till and alluvial deposits in these areas. This is depicted in Figure 2 contained in Appendix C.
- Streams associated with the fan elements are small and assessed as ephemeral with minor source catchments.
- Former high level Lake Wakatipu storm benches are identifiable features in the central reaches of the site and are well drained.
- Based on field inspection and the small size of the streams and source catchments, we do not believe the QLDC classification of the fan elements as active and debris dominated to be correct.

In summary, we believe that the alluvial fan hazard risks associated with this development area are very low subject to;

a) Provision of normal cut off drainage measures to control upslope runoff from ephemeral watercourses.
b) Further test pitting as part of any resource consent application to confirm the age and activity of the fan deposition.

7.4 Proposed Rural Lifestyle Area B

The following observations were made with respect to Proposed Rural Lifestyle Area B;

- The area contains alluvial deposits and consists of low relief with terraces degrading to the east.
- The exposed cut in the western edge of the development area shows Shotover-derived alluvium circa 23,000 years old comprising sandy gravels.
- The lithology is consistent across the site with the depth to groundwater likely to exceed 10m.

In summary, and noting our earlier comment under Section 7.2 with regard to liquefaction and flood risk, we again believe that the natural hazard risks associated with this development area are very low.

7.5 Sites Requiring Little or No Mitigation

The following sites have been assessed and grouped as relatively benign with minimal mitigation required for building development. These sites are;

- A1,
- A2,
- A3,
- A4,
- A5,
- A9,
- HS1,
- HS5, and
- HS8.

Other than the southern extent of A4 where a small depression exists, all of these sites are well drained with competent subgrade conditions. The sites are considered very low risk with regard to natural hazard where normal building controls around verification of bearing capacities for foundation design along with the provision of positive surface drainage control will allow development of these sites.

7.6 Site A8

Site A8 at the northern end of the Golf Course Land occupies a low relief mound on the north east side of the low relief pond.

Concern exists that the building or development area could include uncertified fill as part of pond construction. The relative heights of the pond water level (controlled by its outlet) and likely subgrade levels for foundations increases the risk of saturated subgrade conditions.

The site is not subject to natural hazard, but should be the subject of a specific geotechnical investigation to confirm the presence or otherwise of uncertified fill prior to the construction of any building.

7.7 Site A6

This site occupies a low relief localised fan which grades out from the hummocky till zone to the west. The site is located slightly above the creek level, suggesting a perched water table may be present in this area.

Some surface water control from the catchment to the west is required.

Again, the site is not subject to any natural hazard issues, but prior to construction of buildings the site should be subject to a specific geotechnical investigation to confirm the nature and extent of any fan materials and presence or otherwise of a perched water table which may require draining.

7.8 Site A10

This site takes in a substantial area of saturated ground in a through-drainage depression heading south. There are also overland flow issues to be resolved from the steep terrain catchment to the east.

The site could be developed subject to specifically designed drainage and ground improvement works involving cut to waste, installation of piped stormwater reticulation including resolution of secondary overflow issues and import to fill to achieve positive drainage to the area and to provide suitable foundation conditions.

7.9 Site A7

This site is currently constrained by existing services due to the presence of a pump shed, transformer and inspection panels.

There is also localised uncertainty regarding lithologies with the possible presence of fill due to the services modifications.

There are no natural hazard issues affecting the site, however we recommend a detailed geotechnical investigation to define fill areas prior to any building construction occurring.

7.10 Site HS10

This site is affected by water race leakage concentrating in the slope comprising the house site area.

Prior to building development at this site it will be necessary to;

- Complete subsurface investigations to confirm the impact of the race leakage on overall slope stability.
- Pipe the water race for long term security of the site and provide for some form of diversion away from buildings in the event of a catastrophic pipe rupture.

7.11 Site HS9

This site is located in a localised depression and it will be necessary to resolve drainage to the south to avoid a ponding risk.

Similar to HS10, it will be necessary to;

- Complete subsurface investigations to confirm the depth to competent bearing materials (till) in the base of the depression due to likely thick colluvium/soil layer accumulation in the natural basin.
- Pipe the water race for long term security of the site and provide for some form of diversion away from buildings in the event of a catastrophic pipe rupture in the race.

7.12 Sites HS2, HS3 and HS4

These three sites are all located in the valley lines of ephemeral drainage systems. Consequently they are presently wet and saturated. Figure 10 included in Appendix D illustrates the location of the sites and how the channel and ephemeral gully systems affect each area.

It will be possible to develop Sites HS2, HS3 and HS4 if drainage, diversion and ground improvement work is completed, but we recommend that at the time detailed house designs are proposed, consideration is given to locating construction to higher relief ground within the respective Housesite areas. This will minimize the diversion and drainage works required.

All of HS2, HS3 and HS4 are subject to risk from a failure in the water race. Again, piping of the race and consideration of diversions in the event of a breach are recommended to mitigate this risk.

8. Conclusions and Recommendations

Based on our site evaluation and assessment work we have made the following conclusions with regard to Natural Hazards and how they impact the THL Golf Course Land (encompassing the proposed Hills Resort Zone and proposed Rural Lifestyle Area B Zone) and Hogans Gully Land (encompassing the proposed Rural Lifestyle Are A Zone);

Natural Hazard Risks

i) The Golf Course Land, including Proposed Rural Lifestyle Area B where alluvial deposits are identified, comprises competent and compact glacial till underlain by near surface schist bedrock. These materials are not susceptible to liquefaction and the risk of liquefaction is further reduced by low regional groundwater levels.

ii) Based on our assessment and investigation of the Golf Course Land, the provisional classification of the site as an LIC1 liquefaction risk by QLDC is not valid. The risk of liquefaction impacting the site is assessed as very low and liquefaction does not constrain the site as a natural hazard.

iii) The Proposed Rural Lifestyle Area A (Hogans Gully) Land comprises predominately alluvial material where the northern section of the Proposed Rural Lifestyle Area A may potentially be impacted by an alluvial fan hazard. Based on our assessment we don't believe the fan area is active and in the event it was active, its extent would be significantly reduced from that indicated by QLDC Hazard Maps. We have assessed any risk from alluvial fan hazard as low, recognising that if further investigation confirms activity, the risk can be mitigated through bunding protection and regrading at the time of resource consent.

iv) None of the land areas or development areas are subject to regional flood or inundation hazard.

Specific Development Site Controls

v) Prior to any building construction occurring we recommend that sites A6, A7 and A8 require specific geotechnical investigation and design of foundations by a Chartered Professional Engineer. This investigation shall include rationalisation of cut off drainage to improve subgrade conditions and to address overland flow paths.

vi) Sites HS9 and HS10 are impacted by the existing water race and potential leakage from this race. Prior to any building construction occurring we recommend that a specific geotechnical investigation be completed by a Chartered Professional Engineer to confirm the extent of potential soil accumulation in the depression on HS9 and slope stability impacts of the water race on HS10. Both sites will require piping of the water race and diversion design in the event of a catastrophic pipe breach.

vii) Development sites A10, HS2, HS3 and HS4 are more complex sites as a result of being sited across some natural drainage paths. The sites are not subject to large scale natural hazard risk, but to develop them will require specific design of works to cut off and divert existing flow paths to prevent site inundation, and to address hazards associated with the water race to the north. To ensure that these site development issues are properly addressed, we recommend that prior to any building construction occurring, specific engineering design of drainage and ground improvement works be completed by a Chartered Professional Engineer. We recommend consideration be given to refining the location of these development sites so that they take in higher ground within their respective activity areas, removed from natural drainage paths.

Appendix A

Darby Partners and HCL

Topographic Drawings

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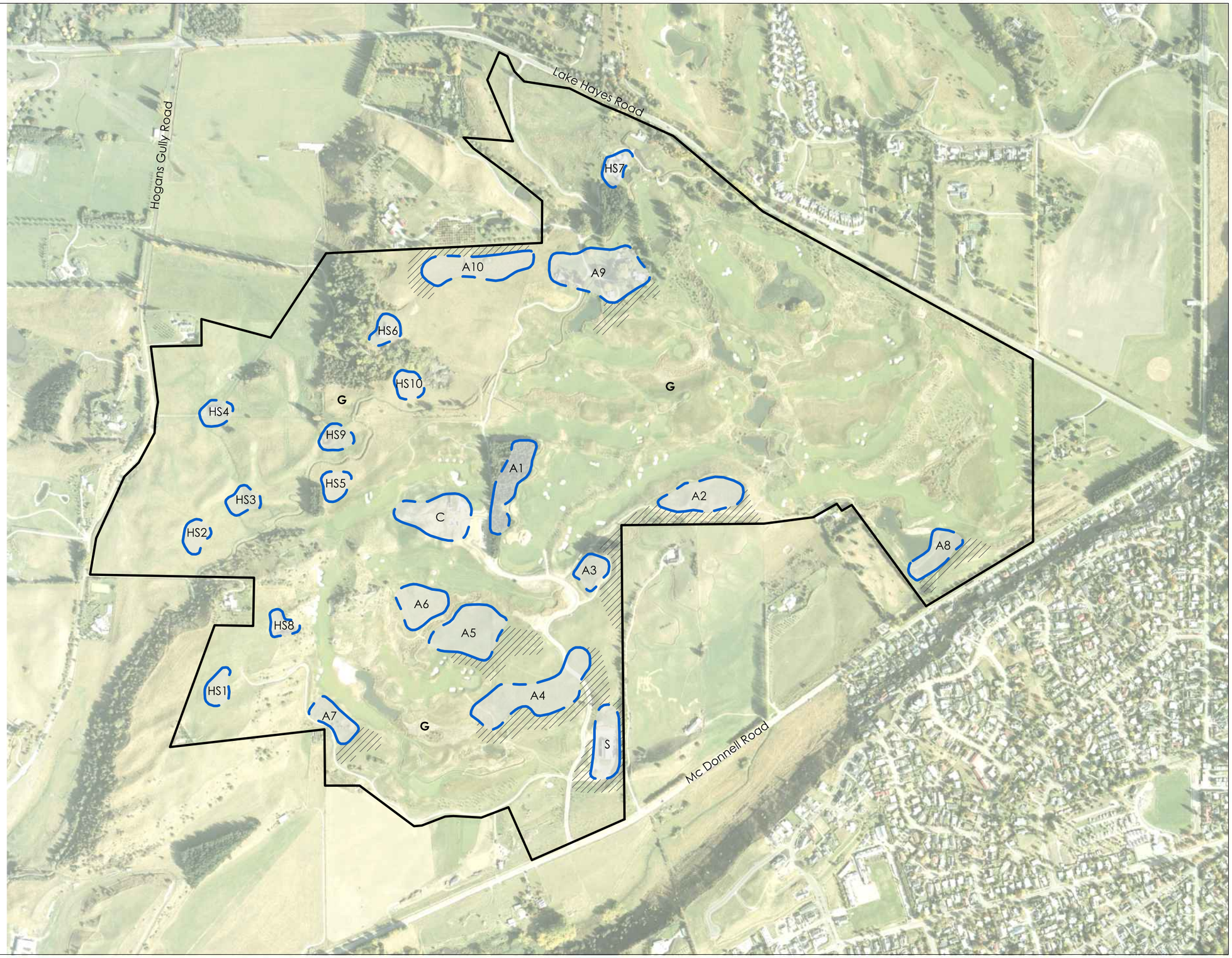

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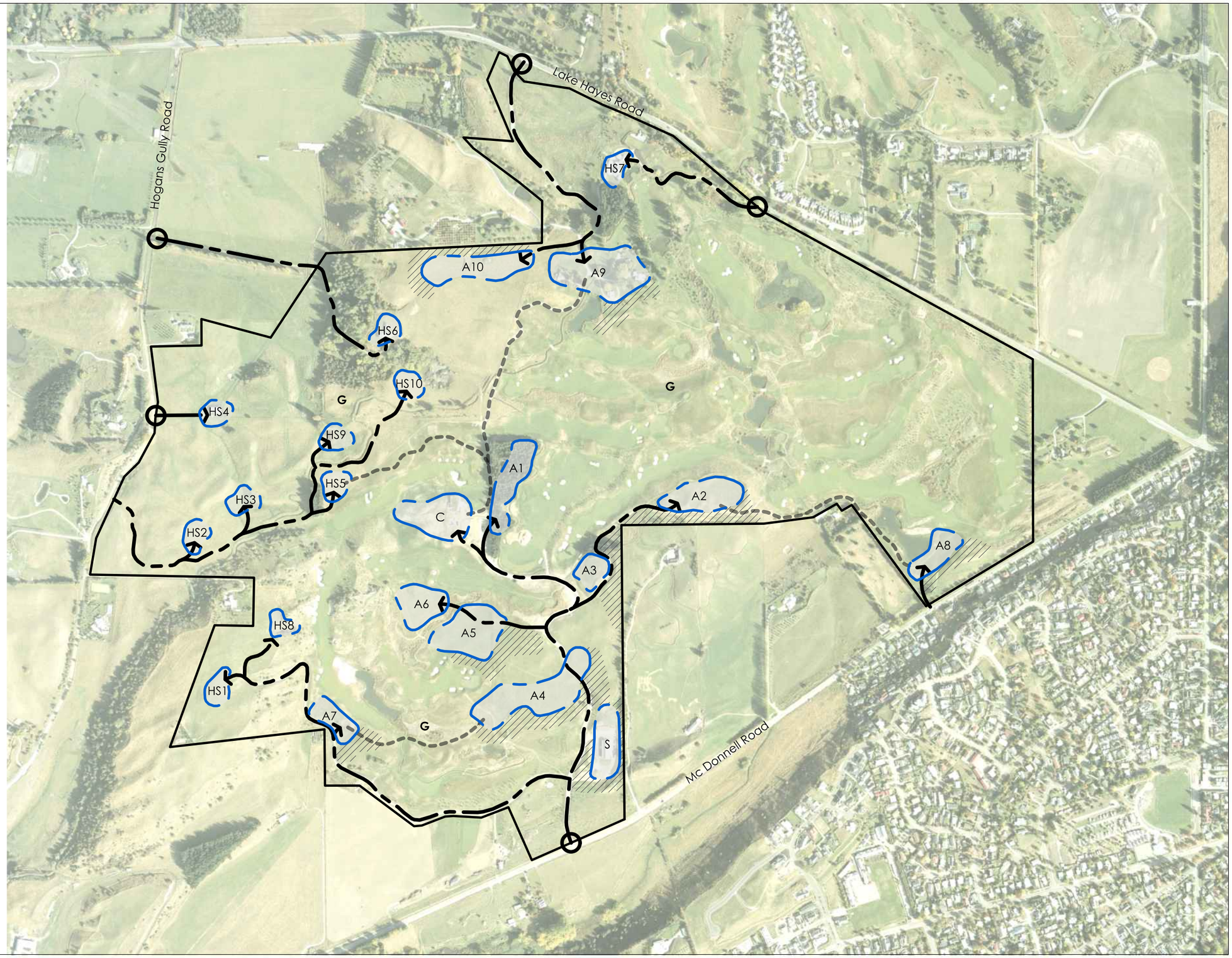

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SCALE: 1:4,000 (A1); 1:8,000 (A3)

0 100 200 300

PLAN STATUS:

DP REVIEW

THE HILLS
STRUCTURE PLAN - ACCESS

DRAWN / REVIEWED: RT / DT
APPROVED: DT
DATE: 14.10.15

DRAWING NO:
MH_10_1_MLP_011B

V:\MH_The Hills\10_Master\1_Pre Planning\MH_10_1_MLP_011B (Structure Plan - Access).dgn

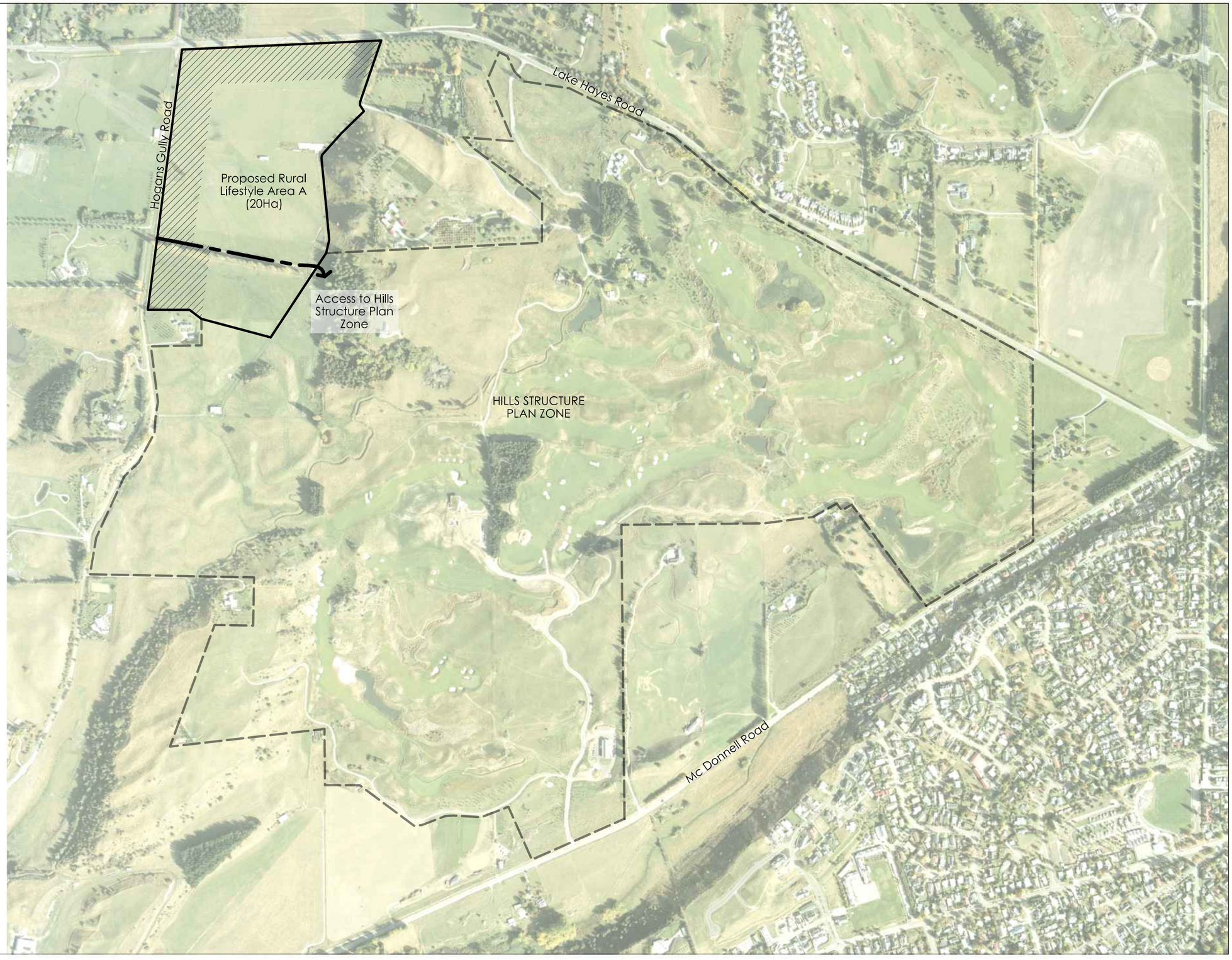
KEY:

Hills Structure Plan Boundary

Proposed zoning Areas

Overlays:

Landscape Amenity Management Area:
Includes tree planting, sited to preserve views of surrounding landscape and partially screen proposed dwellings



V:\MH_The Hills\10_Master\1_Pre Planning\MH_10_1_MLP_012B (Rural Lifestyle Area A).dgn

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0 100 200 300

PLAN STATUS:

DP REVIEW

THE HILLS
PROPOSED RURAL LIFESTYLE AREA A

DRAWN / REVIEWED: RT / JC
APPROVED: DT
DATE: 14.10.15

DRAWING NO:
MH_10_1_MLP_012B