TechnologyOne ECM Document Summary
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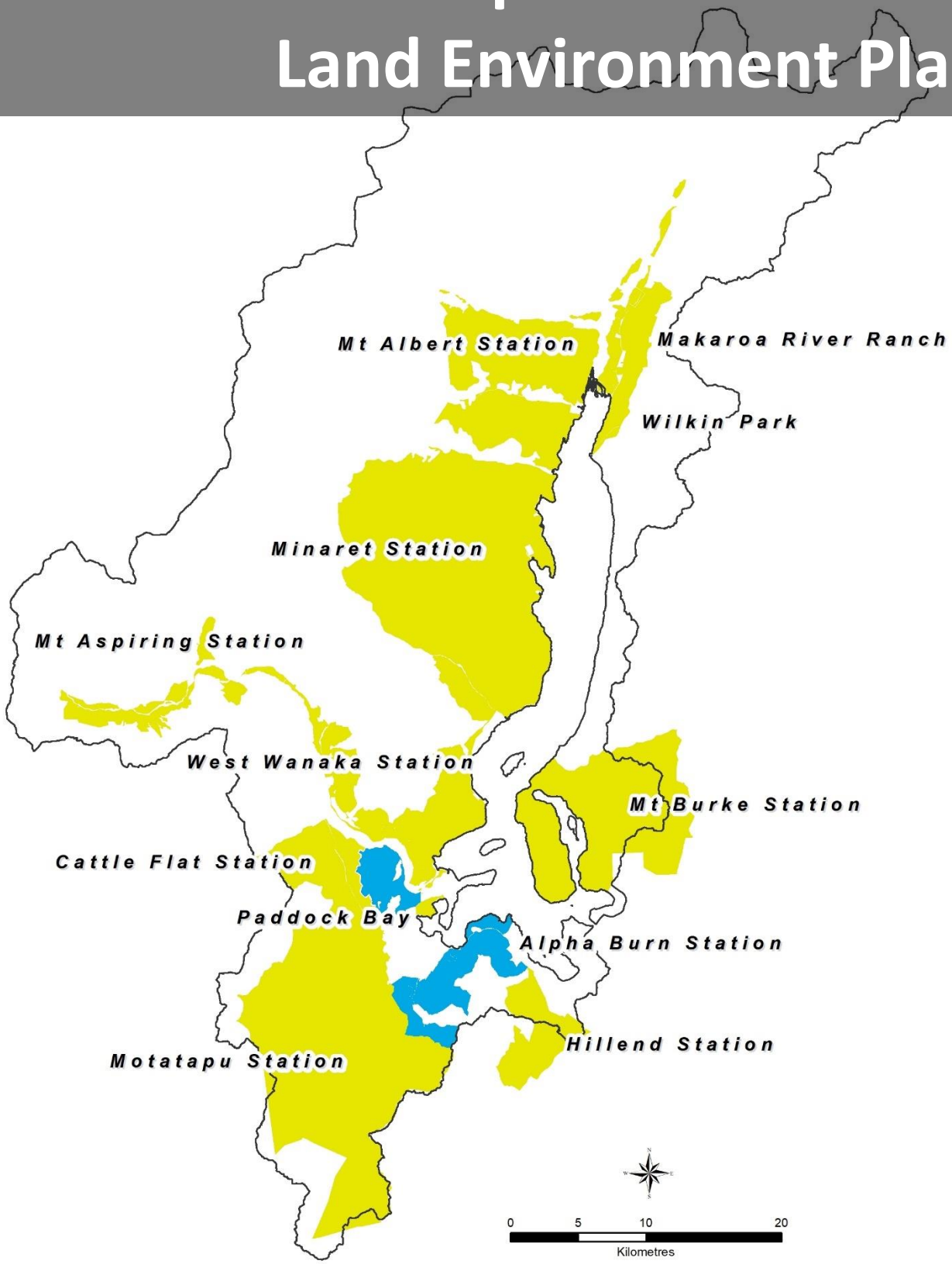
Class	Description	Doc Set Id / Note Id	Version	Date
PUB_ACC	Appendix 6 - Alpha Burn Land Environment Plan	6987712	1	31-Aug-2021
PUB_ACC	Appendix 7 - Water Proposal	6987711	1	31-Aug-2021
PUB_ACC	Appendix 7A - Water Proposal Schematic	6987710	1	31-Aug-2021
PUB_ACC	Appendix 7B - Water Proposal Site Plan	6987709	1	31-Aug-2021
PUB_ACC	Appendix 7C - Water Proposal Wet Well Intake Concept	6987708	1	31-Aug-2021
PUB_ACC	Appendix 8 - Regional Council Correspondence	6987707	1	31-Aug-2021
PUB_ACC	Appendix 9 - Access and Intersection Design	6987706	1	31-Aug-2021
PUB_ACC	Appendix 10 - Transport Assessment	6987705	1	31-Aug-2021
PUB_ACC	Appendix 11 - Geotechnical and Hazard Assessment	6987704	1	31-Aug-2021
PUB_ACC	Appendix 12 - Earthworks Plan	6987703	1	31-Aug-2021
PUB_ACC	Appendix 13 - Contaminated Land PSI Assessment	6987702	1	31-Aug-2021
PUB_ACC	Appendix 14 - Tourism Report	6987701	1	31-Aug-2021
PUB_ACC	Appendix 15 - Consent Order for RM030249	6987700	1	31-Aug-2021
PUB_ACC	Appendix 16 - Power Supply Confirmation - Aurora	6987699	1	31-Aug-2021

Wanaka Catchment Group
Alpha Burn Station
Land Environment Plan.



ASPIRING ENVIRONMENTAL

Wanaka Catchment Group, Alpha Burn Station
Land Environment Plan

September 2019

by Chris Arbuckle

Alpha Burn Station - 2019.

ASPIRING
ENVIRONMENTAL

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Introduction

Wanaka Catchment Group (WCG)

During the mediation process for Plan Change 6A it became apparent to local farmers and the Otago Regional Council (ORC) that while the quality of the water flowing into Lake Wanaka is already very good there are still plenty of research unknowns and opportunities for improvement on farm.

This led to the ORC and AgResearch carrying out an OVERSEER validation trial on Mt Aspiring Station and to Beef & Lamb NZ establishing their "High County Lakes Catchment Environment Project". This Beef & Lamb project implemented a Land Environment Plan (LEP) Level 3 on two properties in the Lake Wanaka catchment and allowed for the development of a common template / framework led by Aspiring Environmental to be used to advance environmental management across all properties in the catchment.

Following this work the Wanaka Catchment Group was established by Grant Ruddenklau (Mt Burke Station); supported by Chris Arbuckle (Aspiring Environmental) and Randall Aspinall (Mt Aspiring Station). The group was set up in response to an expanding community focus on Lake Wanaka's water quality and to respond to an increase in Regional Council / Government scrutiny on farming practices in the alpine region.

The WCG contains a group of farms that must adhere to a 15kg/ha/yr. nitrogen load limit. This limit needs to be considered for all properties future nutrient use reporting, but also could influence decisions about future development and overall farm management.

Therefore, by using Land and Environment Plans (LEP's) as a vehicle to provide practical advice, strategies and information, priority management approaches can be implemented in practical ways to address environmental issues, such as water quality decline at a farm scale.

WCG Plans are comprised of a farm map, information and recommendations based on a beef & lamb NZ LEP 3 template. The WCG Plans are developed through farm mapping process, include OVERSEER Nutrient reports and additional information specific to the Otago Regional Councils Plan change 6A.

This document houses Alpha Burn Station's WCG Land Environment Plan.

Otago Regional Council – Regional Water Plan - 6A.

The current Otago Regional Water Plan is about ensuring good quality water in waterways and aquifers. This means water that is clear of muck and odour, is safe to swim in and gather food from, and supports healthy ecosystems.

Four key things lakes farmers can do to reduce the pressure on these sensitive environments.

Check all waterways on your property for damage where stock have access.

- Stop stock causing pugging, erosion or sedimentation on the bed or banks of a river, stream or lake.
- Don't feed out to stock on a riverbed or wetland.
- Build culverts and bridges where possible for stock crossings.
- Find the sediment hotspots on your farm and fix the sources quickly.
- Have a look for any sediment runoff, stream clouding or sediment turning a creek brown.
- Before ploughing a paddock, harvesting forest or disturbing the land, make sure you protect waterways from sediment runoff with mitigation measures like a wide grass strip.

Value your wetlands, the kidneys of your farm.

- Wet, soggy areas on the farm can perform valuable functions such as trapping sediment and filtering nutrient run-off before it enters sensitive lakes and rivers.
- Your wetlands work like kidneys for your farm. They intercept and decrease losses of sediments, nutrients, and faecal contaminants to waterways.
- Protect and enhance these special areas.

There are two important Schedules in the Plan.

Schedule 15

Schedule 15 of the Otago Regional Water Plan describes and sets out the characteristics, contaminant concentration limits, and targets for good quality surface water in Otago rivers and lakes, as required by the National Policy Statement for Freshwater Management.

Schedule 16

Schedule 16 thresholds set the maximum concentration of contaminants that can come off any property, or from drains and irrigation races, and pass into waterways, without a consent.

The thresholds come into effect from April 2020 and only apply when your representative flow site is at or below median flow.

The sediment rules apply now.

See: https://www.orc.govt.nz/media/5795/regional-plan_-water-for-otago-updated-to-1-july-2018-schedules.pdf

Otago Regional Council (ORC) and AgResearch Project.

Nitrogen and phosphorus concentrations and fluxes in drainage from pasture, winter forage crop and native bush sites in the West Matukituki Valley

Following discussions regarding Otago Regional Plan 6A, farmers in the lakes catchment's (Lakes Landcare) and the Otago Regional Council (ORC) agreed to the development of a research project specific to the Schedule 15 standards and nitrogen limits set for the Lakes catchments. The purpose of the project was to examine Nitrogen and Phosphorus fluxes in drainage from pasture and fodder crops in high rainfall area. The aim also to examine in more detail the uncertainty of nitrogen (N) leaching loss predictions from OVERSEER® version 6 in the lakes area.

The premise for the project is that N leaching from soils in this area are not well validated and the discharge model within OVERSEER ® has not been calibrated at high rainfalls (Ministry for Primary Industries, 2013). Because Nitrogen is not the only contaminant of interest to ORC, further work needs to assess risk for other forms of contaminant loss, e.g. bacteria, sediment and phosphorus within the lake's catchments.

As a result, and in support of this project detailed soils classification work has been carried out at specific sites in the West Branch of the Matukituki Valley, this has applicability to all Stations in the Wanaka Catchment as soils are similar across that catchment.

See – Smith Et al 2016 Nitrogen and phosphorus concentrations and fluxes in drainage from pasture, winter forage crop and native bush sites in the West Matukituki Valley, AgResearch.

Alpha Burn Station- Location.

Alpha Burn Station (ABS) is located about 13 kilometres by road from the township of Wanaka. Positioned on the main tourist route from Wanaka to Mt Aspiring National Park, the property is just 10 minutes' drive from the township of Wanaka. (Figure 1).

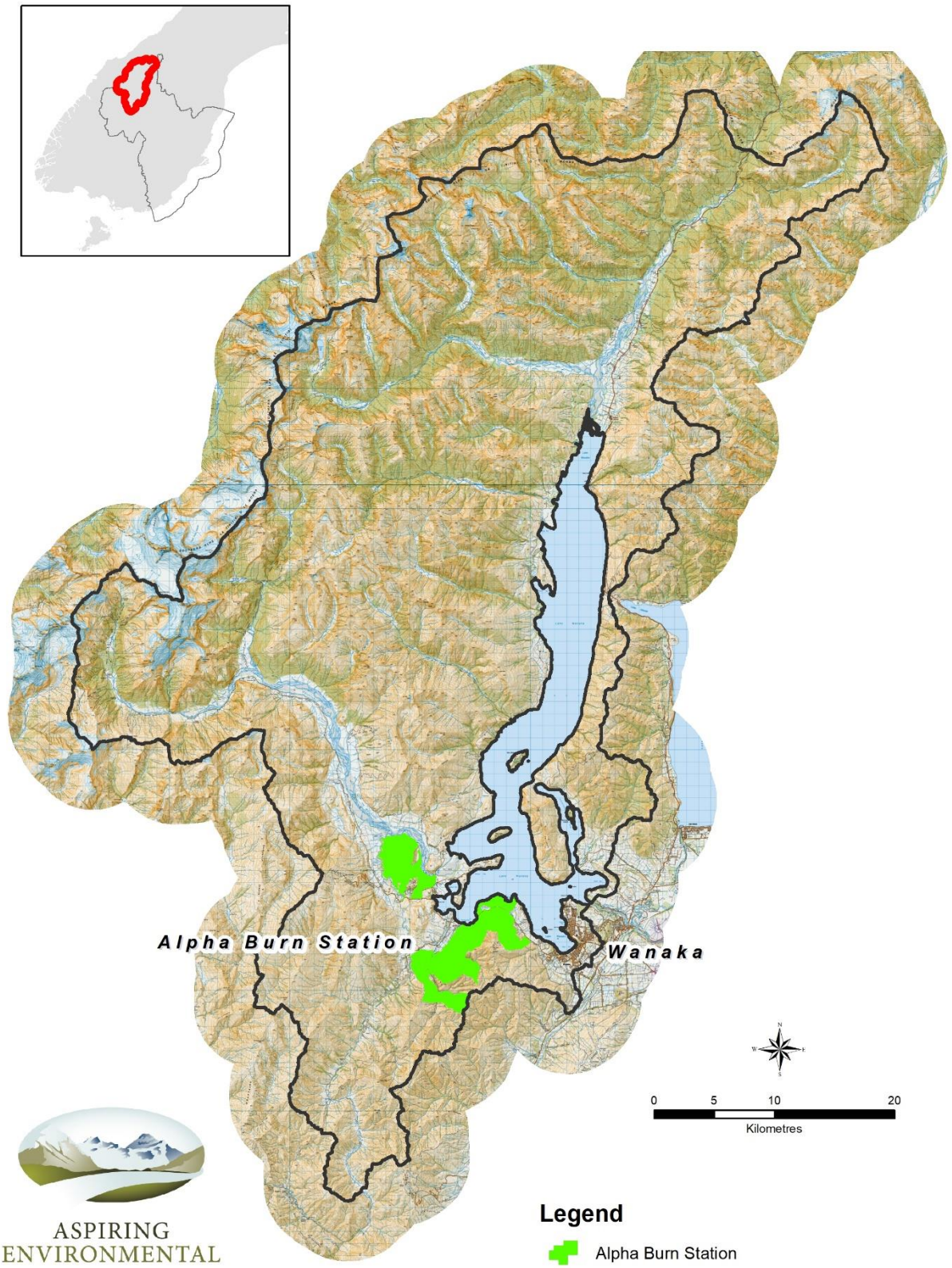


Figure 1: Alpha burn Station Location

Alpha Burn Station

Alpha Burn Station is owned by Duncan and Allannah McRae. The station is 4814 hectares with about 143 paddocks (runs), the largest ones being over 750 hectares.

The farm has been divided up into paddocks and runs. It can be summarised as having steep faces and lake terraces. It borders the Stack Conservation Area, the Fern Burn and Lake Wanaka and Hillend Station. ABS has operated as a high-country farm since the 1800's and in recent times it went through Pastoral lease tenure review, where some of the land has been absorbed into Conservation Park.

A medium-scale farm operates on the property running approximately 13500 stock units (2018).

Tenure

Freehold -	Alpha Burn -	3419 Ha,
Grazing Lease –	Rocky Mountain	1395 Ha
Total		4814 Ha

Alpha Burn Station – View from the Triangle.

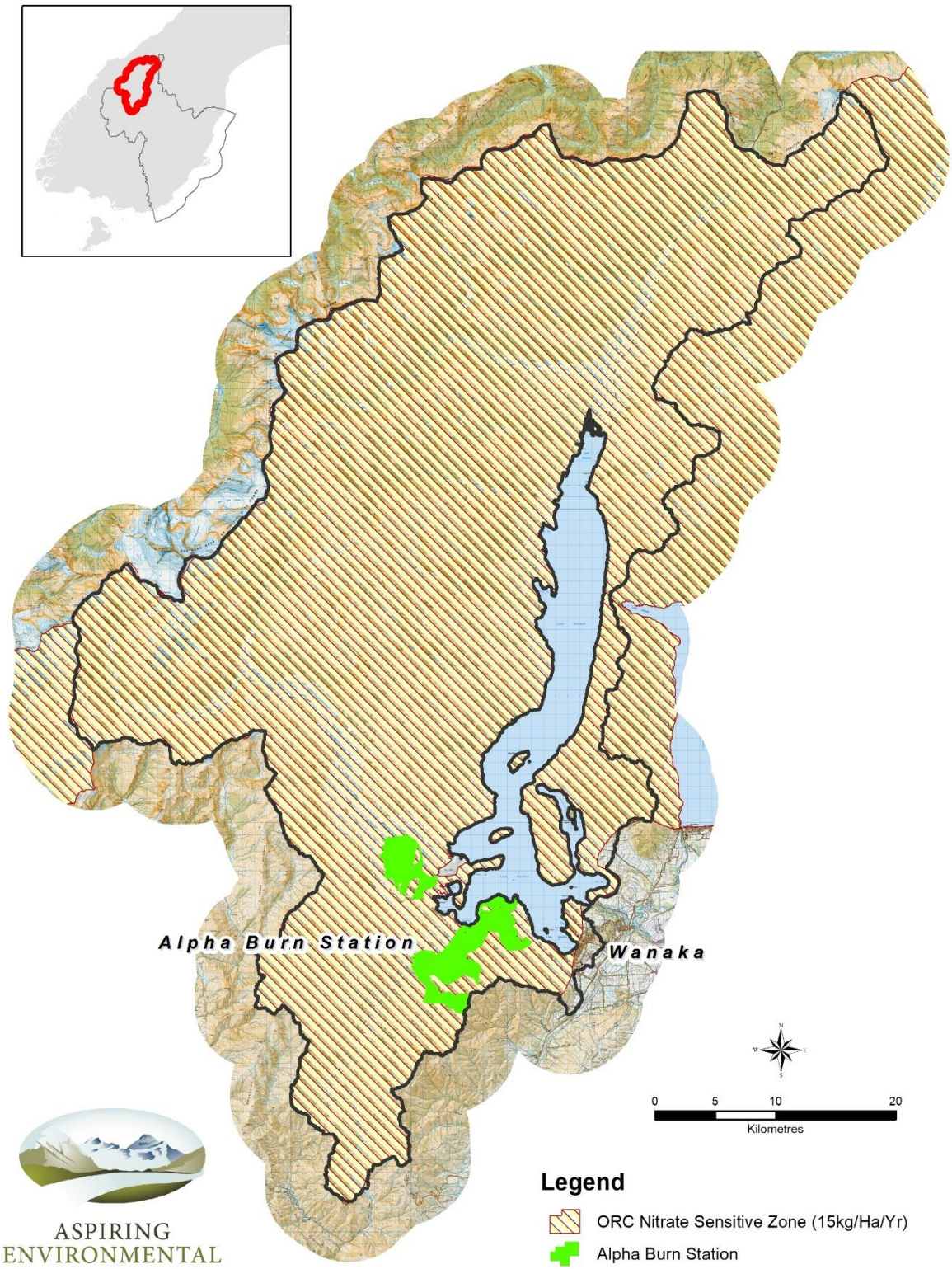


Figure 2: Map showing Alpha Burn Station and ORC Nitrate Sensitive Zone

Figure 3: Farm Map and paddock outlines.

Climate

Rainfall varies from around 1200mm per annum up the West end of the property to around 950mm at the homestead, ORC West Wanaka rain gauge. Warm summers give way to cold winters.

Year/Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2018	4	164.5	50	105.5	102	28.5	118	43.5	126.5	90.3	101.6	40.4	2280.0
2019	53	47.8	120.2	131.4	147.8	34.6	72.2	46	#	#	#	#	
Average	29	106	85	118	125	32	95	45	127	90	102	40	

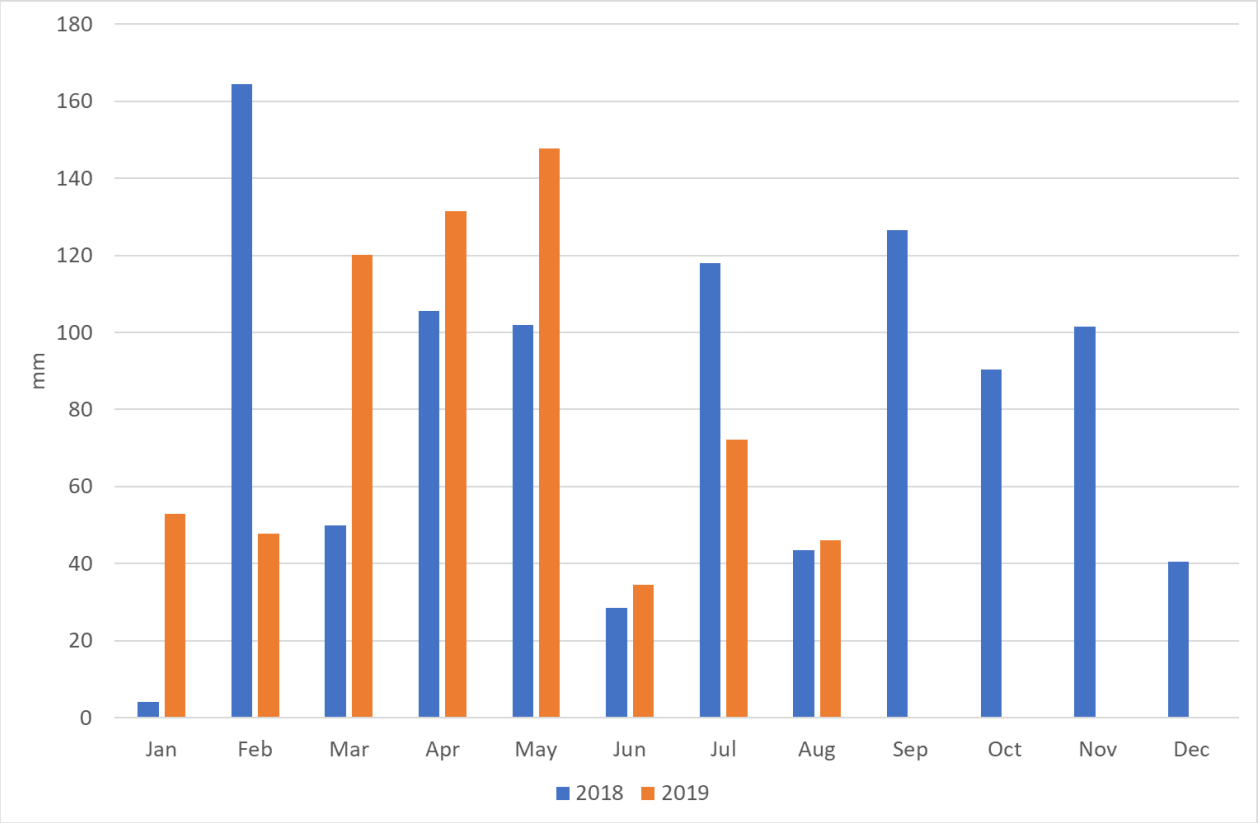


Figure 4: Monthly Rainfall –2019 - West Wanaka rain gauge

Soils

The New Zealand Soil Classification (NZSC)

The New Zealand Soil Classification is a national soil classification intended to replace the New Zealand Genetic Soil Classification (Taylor 1948; Taylor and Cox 1956; Taylor and Pohlen 1962). The present work has grown out of the New Zealand Genetic Soil Classification and, where possible, preserves successful parts of that classification. It has also been influenced by experience in testing the US Soil Taxonomy (Leamy et al. 1983).

Alpha Burn is dominated by recently deposited fluvial soils (light soils) on the valley floor and older brown soils on steep hill country.

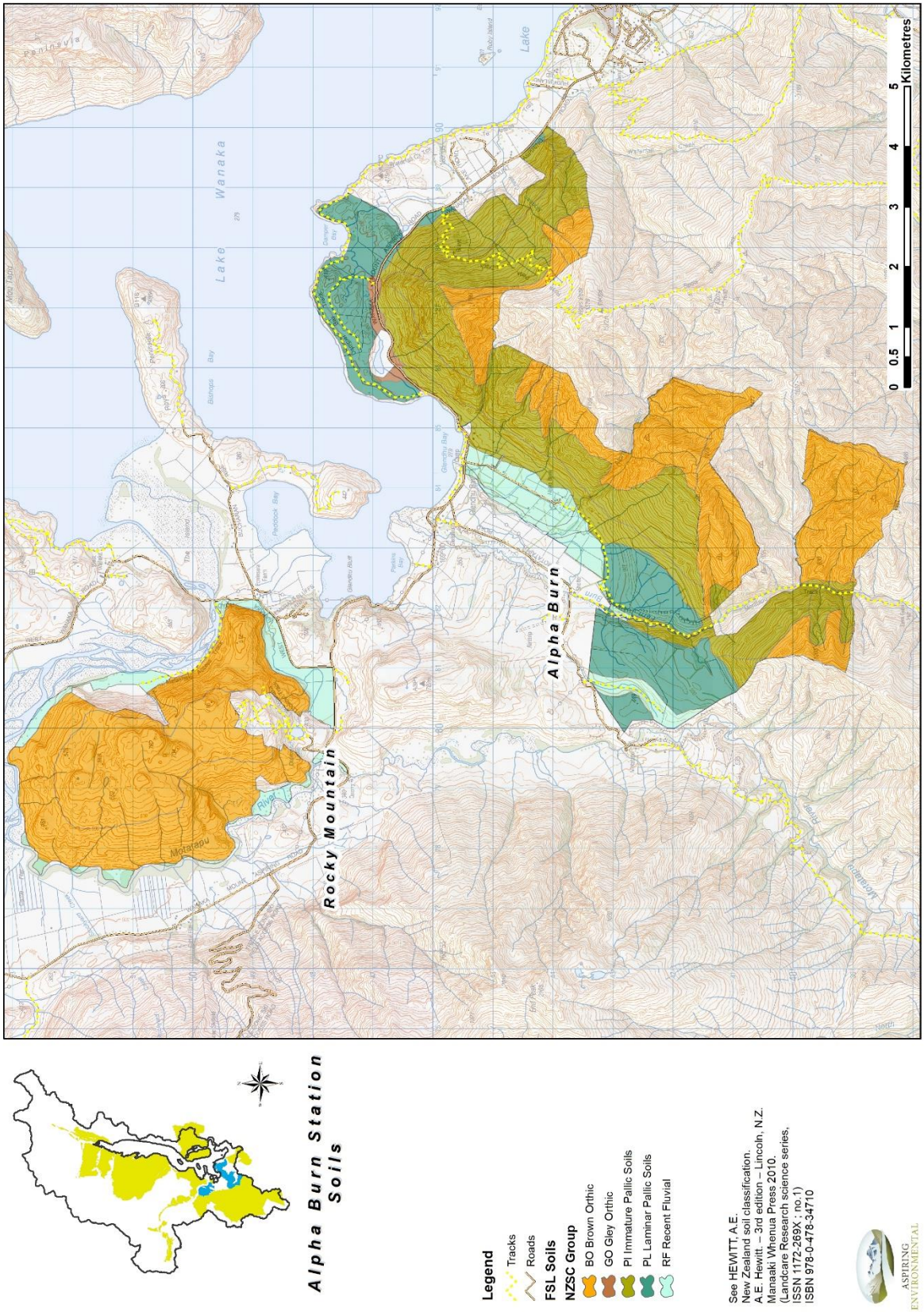


Figure 5: Soil Map of Alpha Burn Station

See HEWITT, A.E. New Zealand soil classification / A.E. Hewitt. – 3rd edition – Lincoln, N.Z.: Manaaki Whenua Press 2010. (Landcare Research science series, ISSN 1172-269X; no.1) ISBN 978-0-478-34710

Stock 2019

Stock	2019 Stock - Numbers	2019 Stock - Units
Sheep	**Breed - Romdales**	
MA Ewes	3400	3400
Ewes 2th	900	630
Ewe Hoggets	1100	770
Lambs		
Wethers Hgts		0
Works Hgts		0
Other		
Rams	100	70
TOTAL	**5,500**	**4,870**
Cattle	**Breed - Black Baldy (White face) (Angus / Hereford Cross)**	
MA Cows	420	2520
R3 Hfrs	100	500
R2 Hfrs	140	700
R1 Hfrs	0	0
Dry Cows / Hfrs		
Hfr Calves	170	850
Bulls	20	100
MA Steers		
R3 Bull/Steers		
R2 Bull/Steers		0
R1 Bull/Steers	10	40
Str Calves		0
TOTAL	**860**	**4,710**
Deer	**Breed - Red Deer**	
MA Hind	1150	2185
Rising 2 Yr Hinds	260	494
Rising 1 Yr Hinds		
Fawns		
Weaner Hinds	300	540
Trophy Stags		
Weaner Stags	510	918
Sire Stags	40	84
MA Stags		
Rising 2 YR Stags	20	36
Rising 1 Yr Stags		
Total	**2280**	**4,257**
Horses		
Total Stock	**8640**	**13837**

Table 1: Stock number and SU's

LUC assessment (number of classes, area, %)

Description: Mapping that delineates land areas classified according to their capability to sustain continuous production. Land Use Capability (LUC) is a hierarchical classification identifying: the land's general versatility for productive use; the factor most limiting to production; and a general association of characteristics relevant to productive use (e.g., landform, soil, erosion potential, etc.). LUC classifications have been constructed for each NZLRI survey region. These individual classifications have been correlated too North and South Island classifications to permit wide-area analyses.

Origin: Interpreted, for each predefined land unit delineated in the 1:63 360/1:50 000 scale New Zealand Land Resource Inventory survey, from reference to the inventory of physical factors mapped and from a knowledge of climate and the effects of past land use.

LUC Class code	Description	Alpha Burn (Inc. Rocky Mountain)
Area Hectares		**5004**
1	Land with virtually no limitations for arable use and suitable for cultivated crops, pasture or forestry	0.0%
2	Land with slight limitations for arable use and suitable for cultivated crops, pasture or forestry	0.0%
3	Land with moderate limitations for arable use, but suitable for cultivated crops, pasture or forestry	8.1%
4	Land with moderate limitations for arable use, but suitable for occasional cropping, pasture or forestry	9.6%
5	High producing land unsuitable for arable use, but only slight limitations for pastoral or forestry use	0.5%
6	Non-arable land with moderate limitations for use under perennial vegetation such as pasture or forest	58.0%
7	Non-arable land with severe limitations to use under perennial vegetation such as pasture or forest	21.3%
8	Land with very severe to extreme limitations or hazards that make it unsuitable for cropping, pasture or forestry	2.5%
% Area of Alpha Burn Station (Farm effective 4758ha)		

Table 2: Land Use Capability Descriptions

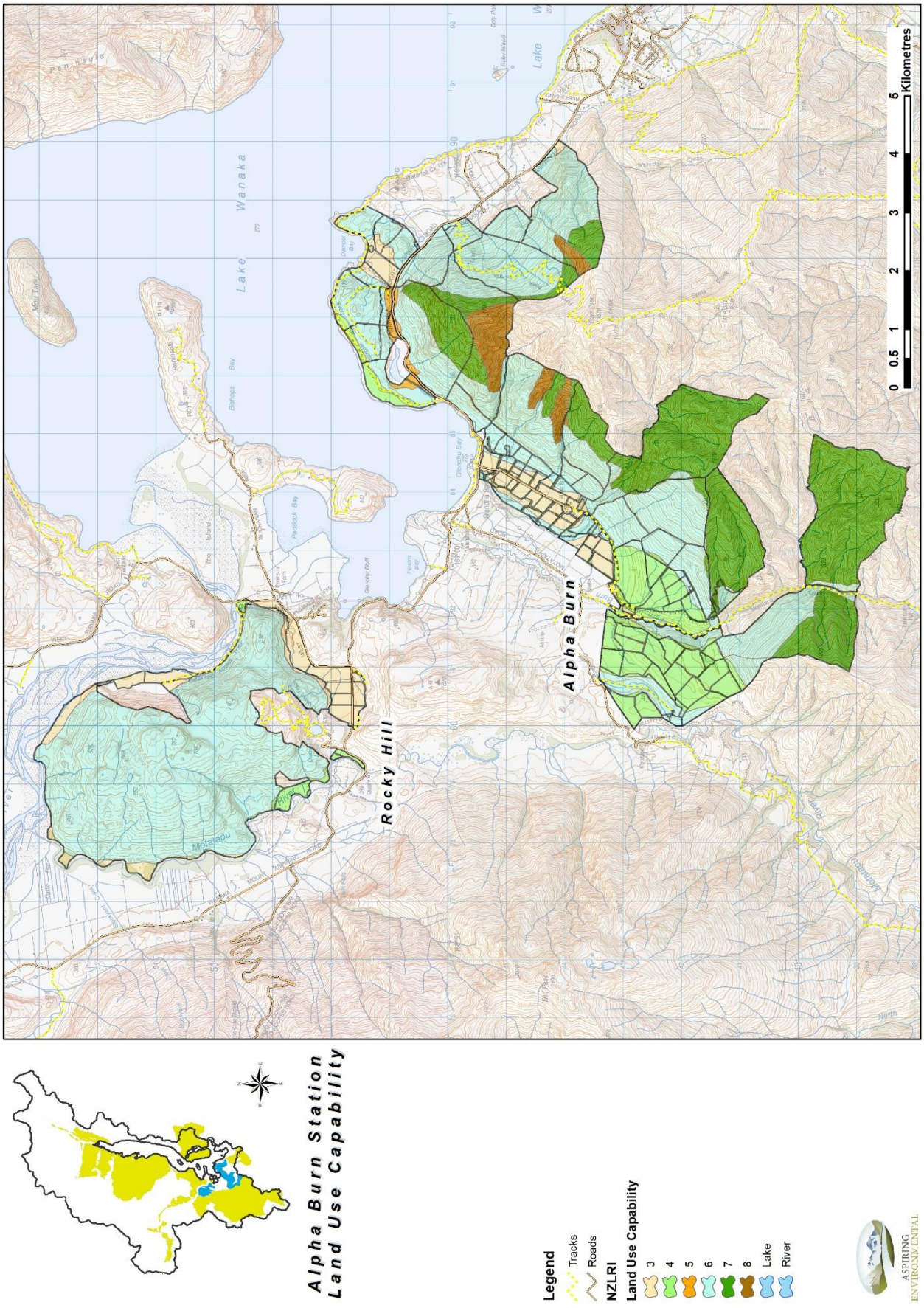


Figure 6: LUC Map

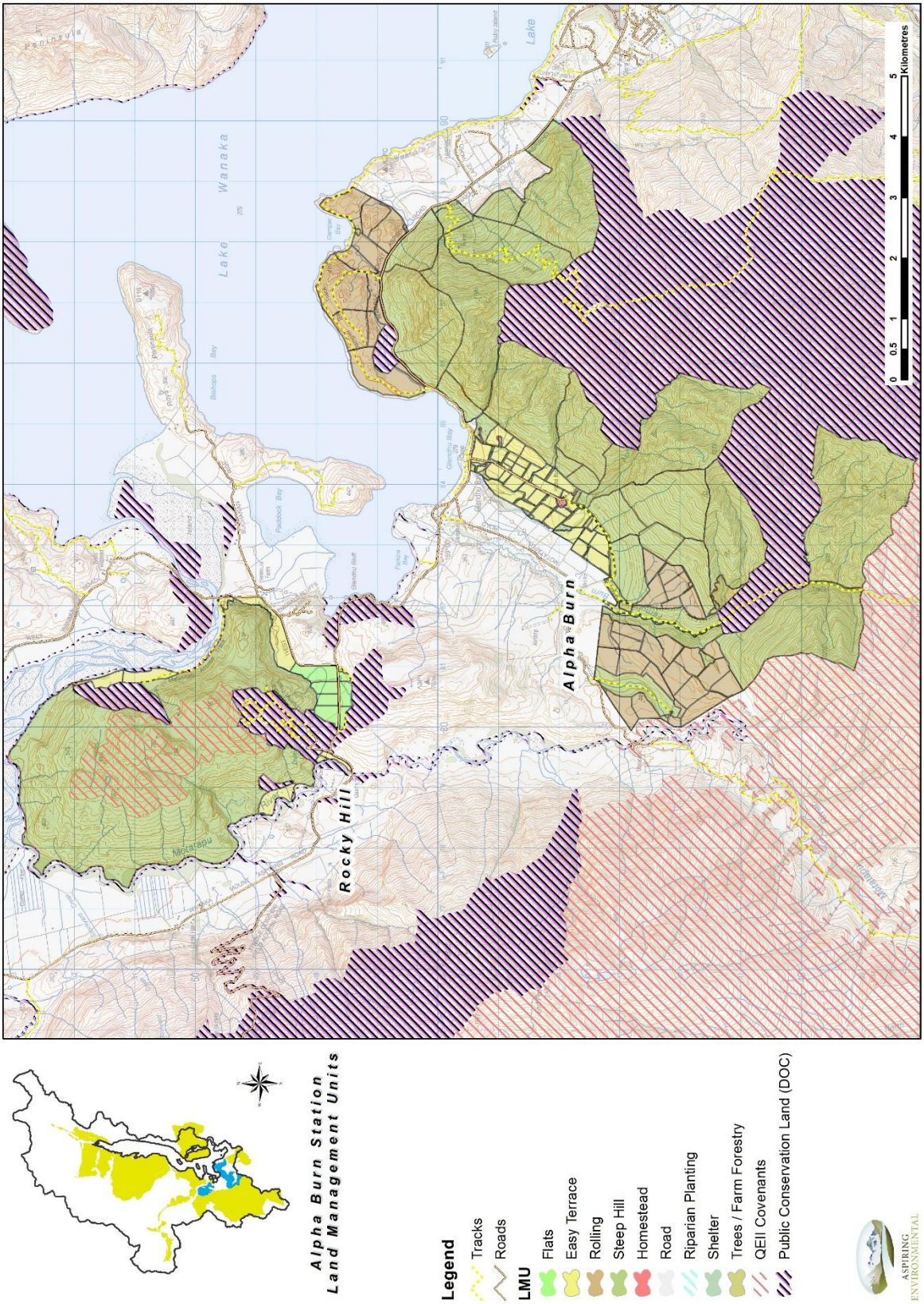


Figure 7: Land Management Units

Land Cover Database Summary

The New Zealand Land Cover Database (LCDB) is a multi-temporal, thematic classification of New Zealand's land cover. It contains 33 mainland classes (35 including the offshore Chatham Islands). The data set is designed to complement in theme, scale and accuracy, Land Information New Zealand's 1:50,000 topographic database. LCDB is suitable for use in national and regional state-of-environment monitoring, forest and shrubland inventory, biodiversity assessment, trend analysis and infrastructure planning.

Because of the size and extent of High-Country Stations, the LCDB has been used to calculate / inform certain inputs and Land Management Units for inputs into OVERSEER (such as Gravel / Rock and areas of sub-alpine vegetation / forest that are not farmed or grazed).

Land Cover	Area Ha	% of Area
Broadleaved Indigenous Hardwoods	39.8	0.8%
Built-up Area (settlement)	0.1	0.0%
Deciduous Hardwoods	37.8	0.8%
Exotic Forest	14.1	0.3%
Fernland	560.0	11.8%
Gravel or Rock	9.8	0.2%
Herbaceous Freshwater Vegetation	10.3	0.2%
High Producing Exotic Grassland	682.5	14.3%
Indigenous Forest	19.8	0.4%
Lake or Pond	1.3	0.0%
Low Producing Grassland	2515.2	52.9%
Manuka and/or Kanuka	24.4	0.5%
Matagouri or Grey Scrub	38.7	0.8%
Mixed Exotic Shrubland	60.5	1.3%
Tall Tussock Grassland	744.1	15.6%
Grand Total	**4758.5**	**100%**

Table 3: % LCDB Classes in farmed area.

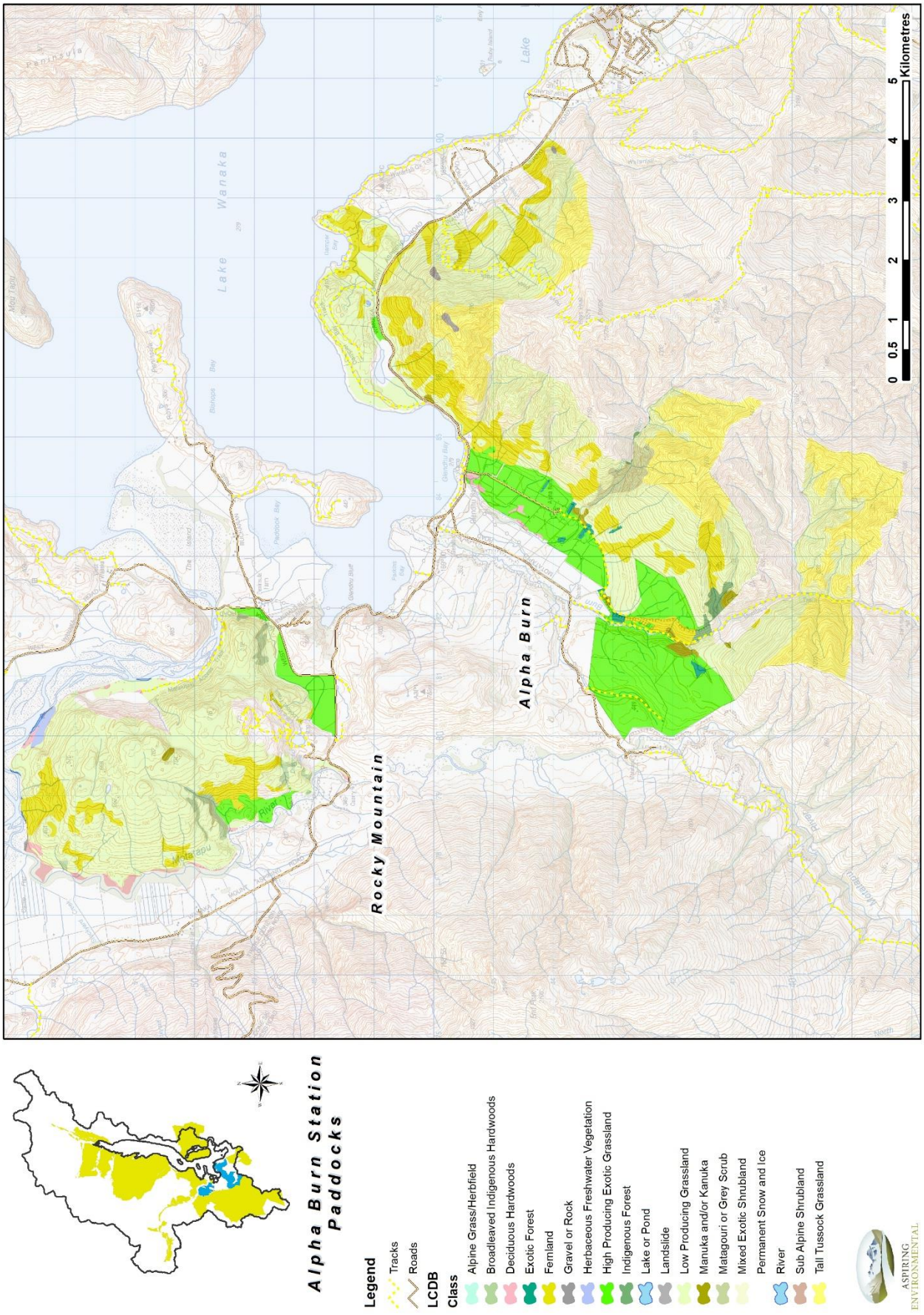


Figure 8: Land Cover Database v4

Winter Grazing

Winter grazing has high stock numbers in a confined area and is a relatively intensive land use compared to other times of the year (Ref WINTER FORAGE CROPS: MANAGEMENT DURING GRAZING, beef & Lamb NZ Fact Sheet)

Particularly for High Country Farms, this leads to increases in surface runoff during heavy rainfall events, from alluvial soils which can carry increased loads of sediment, nutrients and micro-organisms towards otherwise very clean stream and rivers.

It is essential to consider how to reduce nutrient and contaminant losses to streams and waterways as well as minimising damage to soils and paddocks.

Key points for grazing

- Ensure stock have adequate feed and are transitioned to crop appropriately
- Use narrow breaks with long faces that are moved more frequently to improve feed utilisation.
- Graze from the top of a paddock to the bottom (down slope, especially towards water ways).
- Back fence regularly.
- Keep stock out of damp areas in paddocks such as gullies and swales or leave these critical source areas un- grazed until the end of the crop.

Figure 9: A grazed winter crop paddock with the critical source area left un-grazed.

Water Quality Monitoring

It is recommended that Alpha Burn Station, perhaps at annual intervals take water quality samples from selected sites (tributaries, e.g. Alpha Burn, Fern Burn). Samples should be taken when the representative flow site (Matukituki at West Wanaka) is at or under its median flow (see ORC Waterinfo website).

Only tests for E. coli, NNN, DRP, and Ammoniacal Nitrogen need to be conducted. When compared, these test results with the threshold numbers in Schedule 16. Always keep your sample results for reference.

In 2019 ORC instigated a new State of the Environment Monitoring sites on the Fern Burn and Alpha Burn as part of a Catchment project and retained their site at the Matukituki West Wanaka. ABS can request this data.

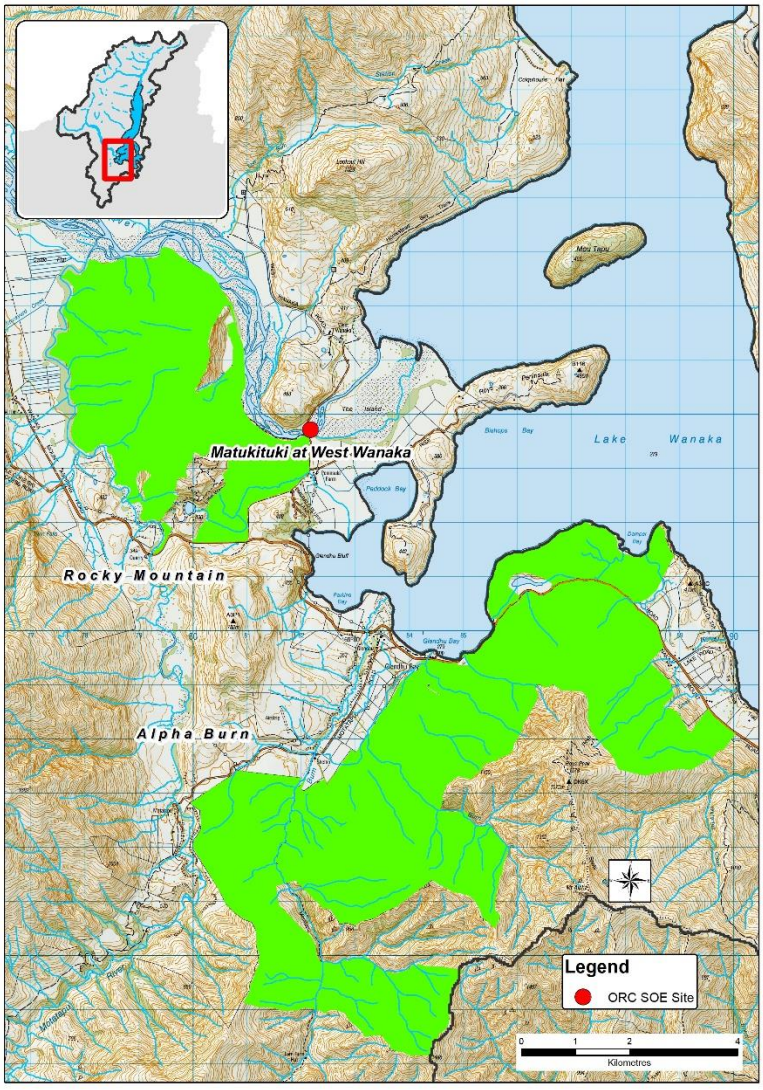
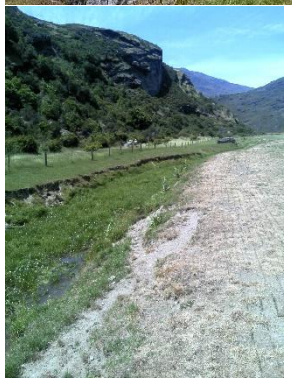


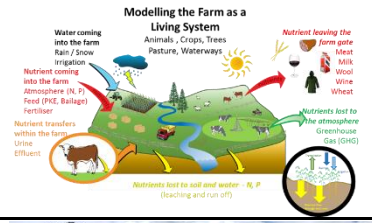
Figure 10: ORC SOE Water Quality Monitoring sites

Samples should be taken when the representative flow site (Matukituki at West Wanaka) is at or under its median flow (see ORC Waterinfo website).

Land Environment Works Programme - Challenges

Challenge	Primary issue	Description / Activity	Photo Example	Priority	RMA Rules	How to manage
Wetland Enhancement	Water Quality – Excellent Wetland development already in place, collects irrigation race and farm runoff. Primary stream fenced to the confluence with Alpha Burn.	A very small section of waterway has bank erosion / access for faecal contamination below wetland.	 	1	ORC 6A Schedule 15 + 16 WQ Standards	Still some strategic fencing required. Permanent fencing / provide strategic stock access and manage/ minimise stock crossings and bed disturbance as per ORC Rules. Benefit - Include in OVERSEER as a managed watershed. Reduces phosphorus loss and Nitrate loss at a block level.

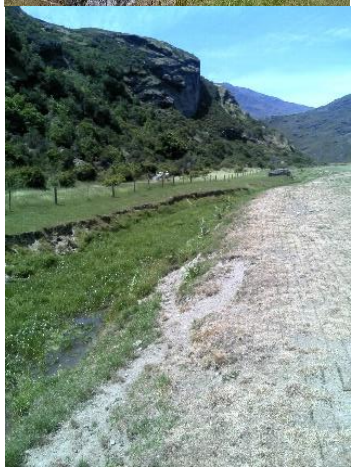
Stock Access Management	Several streams / wetland areas flowing through paddocks have direct stock access, especially cattle access. Alpha Burn, Fern Burn, Diamond Creek and Motatapu could be riparian planted and fenced aesthetics and WQ. .	Bank erosion / access for faecal contamination, dead stock. Alpha Burn proximity to the Glendhu Campground.	 	2	ORC 6A Schedule 15 + 16 WQ Standards	Consider temporary /permanent/ fencing of water race / provide strategic stock access and manage/ minimise stock crossings and bed disturbance as per ORC Rules. Fence where practical and/or provide stock water troughs. Retire riparian sections. Alpha Burn and Diamond Creek is a priority as they have visual bank erosion and pugging. Programme: 1. Alpha Burn 2. Diamond Creek 3. Motatapu River – TBC 4. Fern Burn
Winter Grazing	Risk to water quality /Runoff	Bank erosion / sediment / access for faecal contamination,		3	ORC 6A Schedule 15 + 16 WQ Standards	Consider temporary /permanent/ fencing of water race / provide strategic stock access and manage/ minimise stock crossings and bed disturbance as per ORC Rules. Follow best management practice. https://beeflambnz.com/wintergrazing/pre-grazing

Dead Hole/ Rubbish Management	Risk to water quality / ground water. Within 20m of a waterway. Aesthetics.	Faecal contamination, dead stock.		3	ORC 6A Schedule 15 + 16 WQ Standards, Human Health.	Remove from proximity to Alpha Burn Creek
Public Access	Public interacting with farm area and effecting management. Higher fire risk, rubbish, human faecal matter and elevated risks for stock health - Mt Roy Walking Track / Dampier Bay Track / Diamond Lake Track	Human Faecal Contamination, Biosecurity Risks		1 - 4	ORC 6A Schedule 15 + 16 WQ Standards, Human Health / Stock health	Work with DOC / Walking Access NZ on people management. Provide a water supply (DOC). High risk of people taking water from seepages / creeks and getting ill – stock and human. Mt Roy Track 2017/2018 year - 83000 People. Review lambing closure from October 1 to 10 November.
Nutrient Management	N/P Loss from Crop and sensitive areas of the farm.	Overseer / Nutrient budget		5	ORC 6A 15kg/ha/yr.	Refine use of the model, understand the drivers of n loss. Work with ORC / Research to understand how the model is representing high country farm system. Use OVERSEER to inform nutrient management on farm.
Stock Access Management	Seepages and dams could be fenced and planted. Stock water access improved, WQ would be better for stock.	Bank erosion / access for faecal contamination, dead stock.		6	ORC 6A Schedule 15 + 16 WQ Standards	Fence off and plant if practical. Aesthetics and improves WQ.

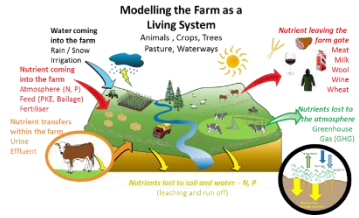
Biodiversity	Native scrub and bush areas	Fence off areas of native vegetation – Fern Burn		7	QEII	Fence off further if practical.

Land Environment Works Programme – Works Programme 2019/2020

Challenge	Primary issue	Response	Photo Example	Action	RMA Rules	Activity Report
Wetland Enhancement	Water Quality – Excellent Wetland development already in place, collects irrigation race and farm runoff. Primary stream fenced.	A very small section of waterway has bank erosion / access for faecal contamination below wetland.	 	Immediate - 5 wire to reduce sheep access Short term Year 1 – Fence Year 2 – 3 Plant out	ORC 6A Schedule 15 + 16 WQ Standards	5 wire fences to stop stock access and re-establishment of riparian plants were put in place in 2017. The whole creek section is fenced and culverted. 2017/2018 – Wetland area is an excellent example of a constructed wetland. 

Stock Access Management	Several streams / wetland areas flowing through paddocks have direct stock access, especially cattle access. Alpha Burn, Fern Burn, Diamond Creek and Motatapu River could be riparian planted and fenced, aesthetics and WQ. .	Bank erosion / access for faecal contamination, dead stock. Close to the Glendhu Campground.	 	Short term Year 1 – Fence Year 2 – 3 Plant out	ORC 6A Schedule 15 + 16 WQ Standards	Fence where practical and/or provide stock water troughs. Retire riparian sections. 2-5 wire / rabbit proof fence to reduce stock access and re-establishment of riparian plants. 1. Alpha Burn-Fenced and planted 2018/2019  Diamond Creek is a priority as it has significant bank erosion and pugging Other Creeks Programme: 2. Doc Wetland Creek 3. Motatapu River 4. Fern Burn

Winter Grazing	Risk to water quality /Runoff	Bank erosion / sediment / access for faecal contamination,		Short term Year 1 – Fence / Implement Good Practice.	ORC 6A Schedule 15 + 16 WQ Standards	Follow best management practice. https://beeflambnz.com/wintergrazing/pre-grazing
Dead Hole/ Rubbish Management	Risk to water quality / ground water. Aesthetics.	Faecal contamination, dead stock.		Short term Year 1 – Fence / Move	ORC 6A Schedule 15 + 16 WQ Standards	Fence off further if practical. Remove from proximity to Alpha Burn Creek
Public Access	Public contaminating farmed area with, rubbish, faecal matter and elevated risks for stock health and fire - Mt Roy Walking Track / Dampier Bay Track / Diamond Lake Track	Human Faecal Contamination / Pests and Biosecurity and stock management issues		Short term - Year 1 _ List Key issues to DOC from LEP, formalise issues with a risk report.	ORC 6A Schedule 15 + 16 WQ Standards, Human Health / Stock health	Work with DOC / Walking Access NZ on people management. Provide a water supply (DOC). High risk of people taking water from seepages / creeks and getting ill – stock and human. Suggest Local DOC office sells Poo Pots. Mt Roy Track 2017/2018 year - 83000 People 

Nutrient Management	N/P Loss from Crop and sensitive areas of the farm.	Overseer / Nutrient budget		Medium Term Have data and full understanding of N + P Loss by 2020.	ORC 6A 15kg/ha/yr.	Refine use of the model, understand the drivers of n + p loss. Work to understand how the model is representing Hillend Station and what changes could be made to the system to lessen losses. Current modelled losses 2017/2018 Year
Stock Access Management	Seepages and dams could be fenced and planted. Stock water access improved, WQ would be better for stock.	Bank erosion / access for faecal contamination, dead stock.		Long Term – 5 Years	ORC 6A Schedule 15 + 16 WQ Standards	Fence off and plant if practical. Aesthetics and improves WQ
Native scrub and bush.	Native scrub and bush areas	Fence off areas of native vegetation – Fern Burn		Long Term - 5 Years	ORC 6A Schedule 15 + 16 WQ Standards.	2 wire fences to reduce cattle access and re-establishment of native plants. Areas where Deer access requires longer term planning.

References

Beef and Lamb NZ Land Environment Planning LEP 1, 2 and 3 tool kit - http://beeflambnz.com/lep/

Overseer Answers to commonly asked questions, prepared for the Ministry for Primary Industries (February 2013).

Nitrogen and phosphorus leaching losses from pasture, winter forage crop and native bush sites in the West Matukituki Valley. AgResearch. Prepared for the Otago Regional Council (March 2016)

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Friday, August 27, 2021

Jo Fyfe,
John Edmonds and Associates,
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Wanaka

By Email

Dear Jo,

Damper Bay Water Supply

A water supply is required for development of Lot 1 DP337193. Water is needed for drinking, firefighting reserve, stock, water features and irrigation.

Proposed development includes construction of a lodge, owner's accommodation and regenerative planting of approx. 89 hectares. The property is partially grazed, and reliable stock water is required.

Water Requirements

Estimated peak daily water requirement excluding any irrigation and water features is :-

Lodge	
30 people @ 200 l/head/day	6,000
15 staff @ 30 l/day	450
Owners accommodation	
Allow as for rural dwelling	3,000
Stock water	
600 ewes @ 3 l/head/day	1,800
Miscellaneous	
Maintain fire reserve etc – allow	750

Total – allow 12,000 l/day

Water Available

Test drilling has been carried out looking for groundwater on this property in the past without success. Lake water is the only feasible source for this property.

The Regional Plan Water For Otago rule 12.1.2.2 allows the taking of up to 1,000,000 litres per day at a rate less than 100 litres per second as a permitted activity.

Proposal is to work within the permitted activity rule and put in place water supply infrastructure with capacity to take 1,000,000 litres per day in 12 hours pumping (23 l/s).

This is a reasonable operating time for a pump. Should more water be required in future, the pump can be run 24 hours per day to meet peak demands. A permit would be required for any take greater than 1,000,000 litres per day.

Irrigation and Water Features

Peak irrigation demand in this area is approx. 5mm/day or 50,000 litres per ha per day. Evaporation and seepage losses from water features would be similar.

The permitted activity rule allowing 1,000,000 litres/day would reasonably enable up to 20 ha to be fully irrigated.

Targeted irrigation for establishment of regenerative plantings would enable a far greater area to be serviced.

Concept Plan

Please find attached concept schematic sketch, draft water plan for water supply for the property and intake concept sketch.

Water would be drawn from the lake via a 300mm diameter screened pipe gravity feeding a wet well that sits outside the lakebed within the recreation reserve. The intake screen would be self-cleaning with the flow and pressure required for this provided by a small submersible pump in the well and a 63mm pipe back to the screen. Screen would exclude juvenile fish and elvers. Plan area of screen itself would be approx. 0.2m^2.

Wetwell diameter would be 1.5m with a 2.8m x 2.8m valve chamber on top. The top of the valve chamber would finish at ground level. The pump starters, switchboard and controls would be installed in a plinth mounted cabinet above flood level on freehold land with cables to the pumps in the wetwell. The cabinet would be approx. 1.8m high x 1.6m wide x 0.6m deep.

Water would be pumped from the well by the main pump to header tanks through a rising/falling main. The header tanks would be located at approx. 343.7m to provide gravity head to the demand points. A switch and telemetry at the header tanks would control pump operation.

Connections would be made to the rising falling main for the various uses at suitable locations.

Fire storage for FW3 fire water classification of 180,000 litres (6 x 30,000 litre plastic tanks) would be located at the back of the "Utility' area at a height of 312.5m to provide 50 l/s from 2 hydrants at the lodge with 100 kPa residual pressure.

Hydrants would be located within 90m and no closer than 6m of the buildings. They would be within 5m of the required 11m x 4.5m hardstand areas with access and working area for fire appliance operation.

Drinking water would be treated to drinking water standards by cartridge filtration and UV sterilization with provision for chlorination should this be required in future. 60,000 litres of treated storage (2 x 30,000 litre tanks) would be provided as a reserve and for contact time should chlorination be required. Drinking water would be pressurized with a pump to provide suitable pressure at the lodge, owners accommodation and the meditation facility. The treatment plant shed and storage tanks would be also located in the 'Utility' area

Stock water would be delivered to a single 30,000 litre tank to provide ample reserve. The tank would be located at approx. 330.5m to enable gravity flow to troughs up to at least 320m

Water for water features would be supplied from the rising/falling main to balance tanks (sumps) with float valves for replacement of evaporation and seepage losses. A sump is installed next to the water feature with an interconnecting pipe so the water level in the sump is the same as the water level in the feature. When the water level in the sump drops, the float valve will open and allow water in from the rising/falling main.

For irrigation of lower regenerative planting areas that the system header tanks can provide sufficient operating pressure for, a connection would be made directly to the rising falling main with a filter and irrigation controller for solenoids to control water delivery.

For irrigation of the higher areas, booster pumps would be required as well at the rising/falling main connection to provide the required pressure. Enclosures would be needed to protect the pumps from weather.

The rising falling main feeds into the bottom of the header tanks so that water can be pumped into the header tanks and gravity fed back out to meet demand when the pump in the lake is not operating. The float switch in the header tanks starts and stops the pump which will run to try and maintain full header tanks and so automates the system and the pump will only run when needed.

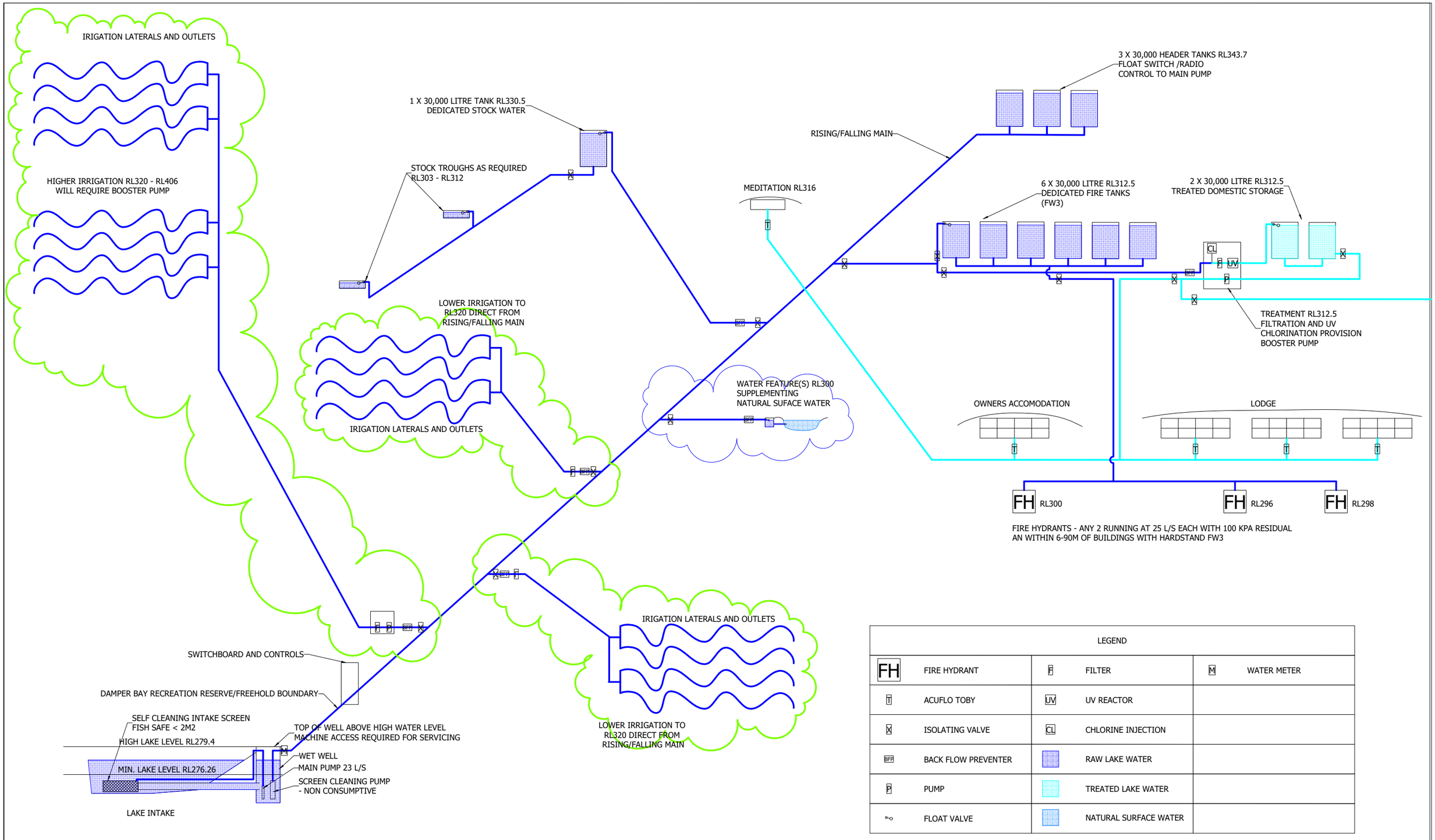
A backflow prevention device would be fitted at all rising/falling main connections.

Yours sincerely,

Ken Higgie BE (Ag.)

Attached :-

Draft Water Supply Concept Schematic for Damper Bay DB1.2
Draft Water Supply Concept for Damper Bay DB2.2
Draft Wetwell Intake Concept for Damper Bay DB3.0



LEGEND					
FH	FIRE HYDRANT	F	FILTER	M	WATER METER
T	ACUFLO TOBY	UV	UV REACTOR		
X	ISOLATING VALVE	CL	CHLORINE INJECTION		
BFP	BACK FLOW PREVENTER		RAW LAKE WATER		
P	PUMP		TREATED LAKE WATER		
	FLOAT VALVE		NATURAL SURFACE WATER		

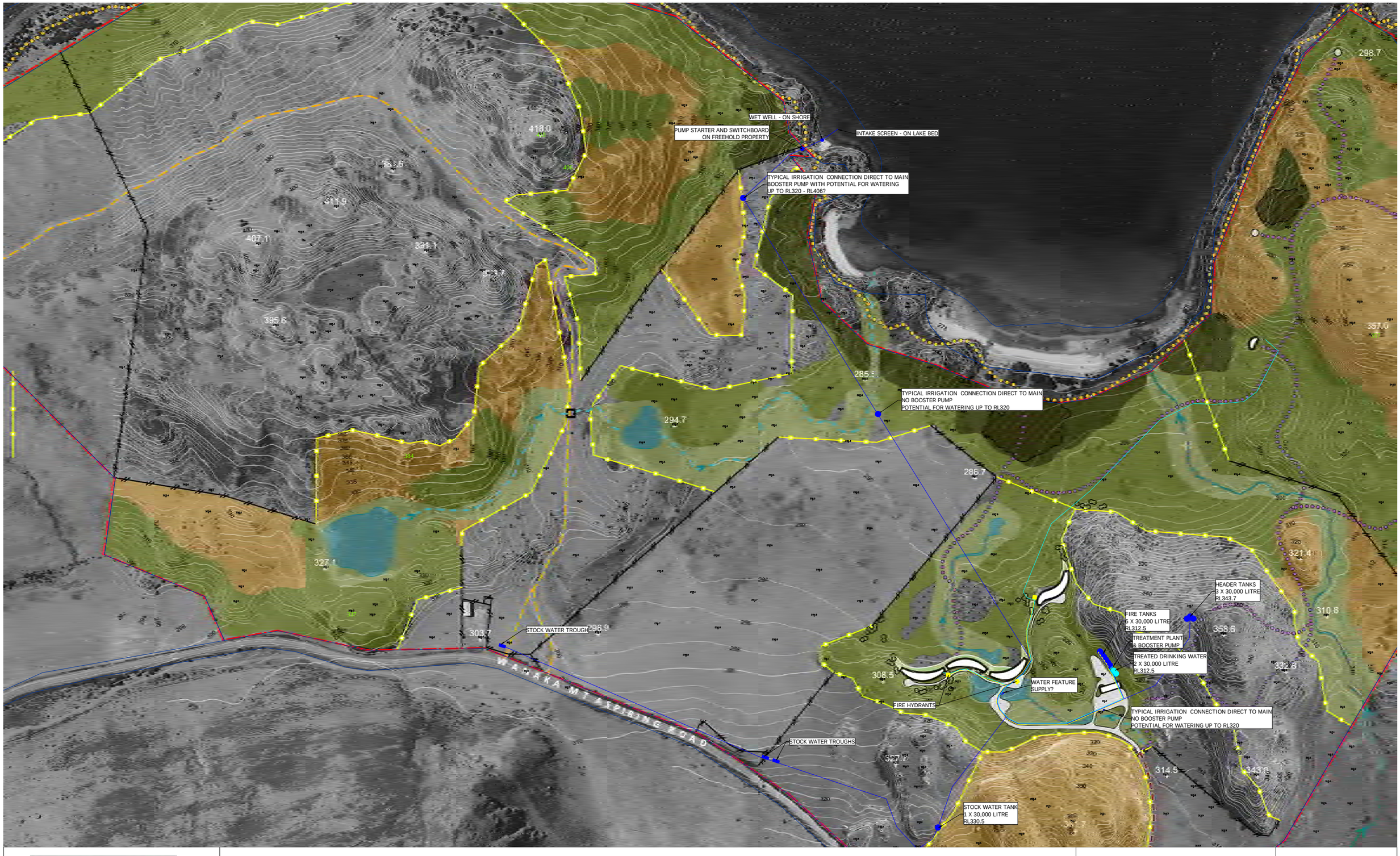
KEN HIGGIE LTD
CENTRALWATER
P.O. Box 52,
Alexandra
Phone/fax 03 4487673
Cell 0274 716411
Email ken@centralwater.co.nz

DRAFT WATER SUPPLY CONCEPT SCHEMATIC FOR DAMPER BAY

DRAWN :- K. HIGGIE
DATE :- 27-8-21
SCALE :- N.T.S
FILE :- P&H\

REF :-

DB1.2



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P.O. Box 52,
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Phone/fax 03 4487673
Cell 0274 716411
Email ken@centralwater.co.nz

DRAFT WATER SUPPLY CONCEPT FOR DAMPER BAY

DRAWN :- K. HIGGIE

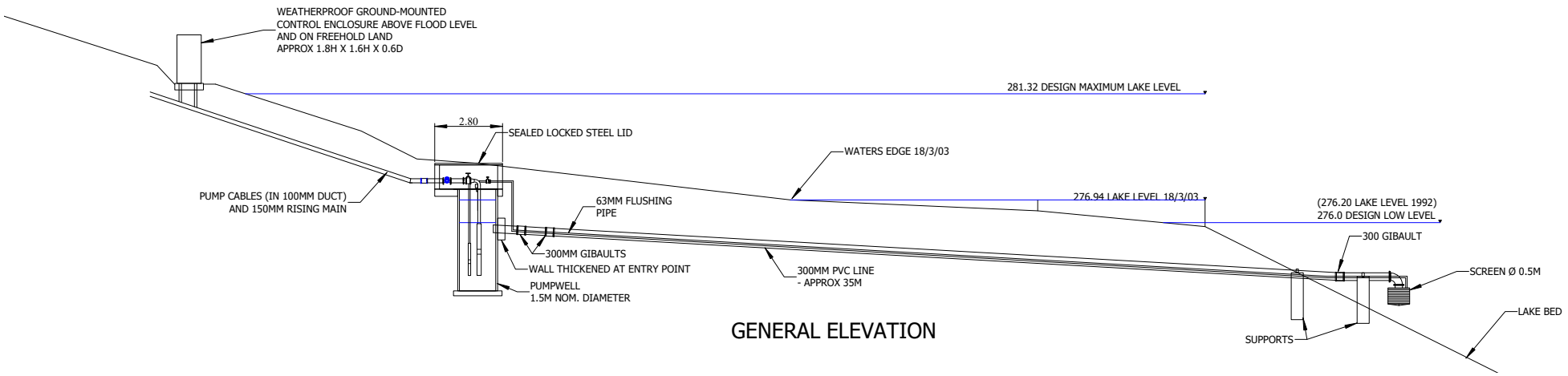
DATE :- 27/8/21

SCALE :- 1:5,000 A3 APPROX

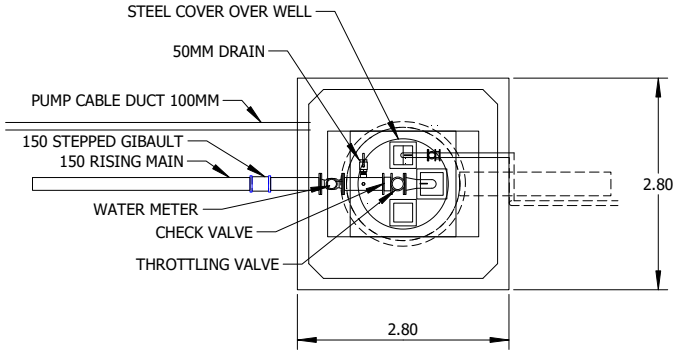
FILE :- P&H\

REF :-

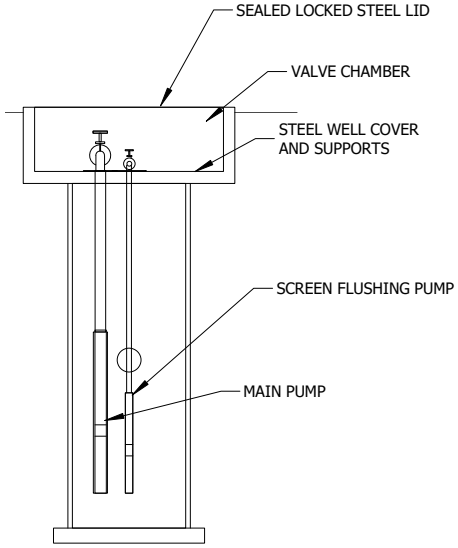
DB2.2



GENERAL ELEVATION



WETWELL PLAN VIEW



WETWELL ELEVATION

KEN HIGGIE LTD
CENTRALWATER
P.O. Box 52,
Alexandra
Phone/fax 03 4487673
Cell 0274 716411
Email ken@centralwater.co.nz

DRAFT WETWELL INTAKE CONCEPT FOR DAMPER BAY

DRAWN :- K. HIGGIE	REF :-
DATE :- 12/08/2021	DB3.0
SCALE :- NTS	
FILE :- P&H\	

From: Brad Trebilcock
To: Jo.Fyfe
Subject: FW: Consent Enquiry - 3 Jun Jo Fyfe
Date: Friday, 4 June 2021 2:14:33 PM
Attachments: image001.png

Hi Jo,

In regard to our phone we had earlier, from my understanding of what you are proposing, if you in line with the permitted activity rules you have listed below no consent is required.

Cheers,

Otago Regional Council

Brad Trebilcock
CONSENTS OFFICER

P 0800 474 082 | M 027 226 8195
brad.trebilcock@orc.govt.nz
www.orc.govt.nz

From: Jo.Fyfe <Jo.Fyfe@jea.co.nz>
Date: Thursday, 3 June 2021, 15:17:18
To: customerservices@orc.govt.nz <customerservices@orc.govt.nz>
Subject: Water Take- Lake Wanaka

Hi there,

We are seeking confirmation of a permitted activity for a water take from Lake Wanaka for a residential/non-residential activity, for farm stock drinking water and a large area of landscape planting.

Provided the application complies with Rule 12.1.2.2(a)-(d) (rather than 12.1.2.1 as the take is not limited to domestic needs or drinking water for animals),

12.1.2.2 Except as provided for by Rules 12.1.1A.1 and 12.1.1.2, the taking and use of surface water from the main stem of the Clutha/Mata-Au or Kawarau Rivers, or Lakes Wanaka, Hawea, Wakatipu, Dunstan or Roxburgh, is a permitted activity, providing:
(a) The take does not exceed 100 litres per second, nor 1,000,000 litres per day; and
(b) No more than one such take occurs per landholding; and
(c) No back-flow of any contaminated water occurs to the water body; and
(d) Fish are prevented from entering the intake structure.

For the intake structure on the lake bed, provided we comply with Rule 13.2.1.4, this will be a permitted activity:

13.2.1.4 The erection or placement of any flow or level recording device, outfall or intake structure or navigational aid structure, that is fixed in, on or under the bed of any lake or river, or any Regionally Significant Wetland, is a permitted activity, providing:
(a) The structure does not exceed 2 square metres in area provided that in respect of any flow or level recording device any catwalk to the nearest bank shall be excluded from the area calculation; and
(b) The structure, or its erection or placement, does not cause any flooding or erosion; and
(c) The Otago Regional Council is notified of the location and nature of the structure, at least seven working days prior to commencing the erection or placement; and
(d) Except in the case of a navigational aid, or the sight board of any gauge, any visible part of the structure is of a neutral colour to blend in with the surroundings; and
(e) The structure is maintained in good repair; and
(f) The site is left tidy following the erection or placement.

For the pipe connecting the intake structure to the water tank within the land, the proposal would comply with Rule 13.2.1.2. Noting Lake Wanaka is within the 'outstanding natural feature or landscape' in Schedule 1A, therefore 13.2.1.1 would not apply.

13.2.1.2 The placement of any pipe, line, or cable on or under the bed of a lake or river, or any Regionally Significant Wetland, is a permitted activity, providing:
(a) The pipe, line, or cable does not impede the flow of water or debris, or is installed and maintained so it results in no flooding, erosion or sedimentation; and
(b) The location of the pipe, line, or cable is identified by markers on the banks of the river or lake; and
(c) The pipe, line, or cable is maintained in good repair.

Are there any other rules of relevance to this proposal?

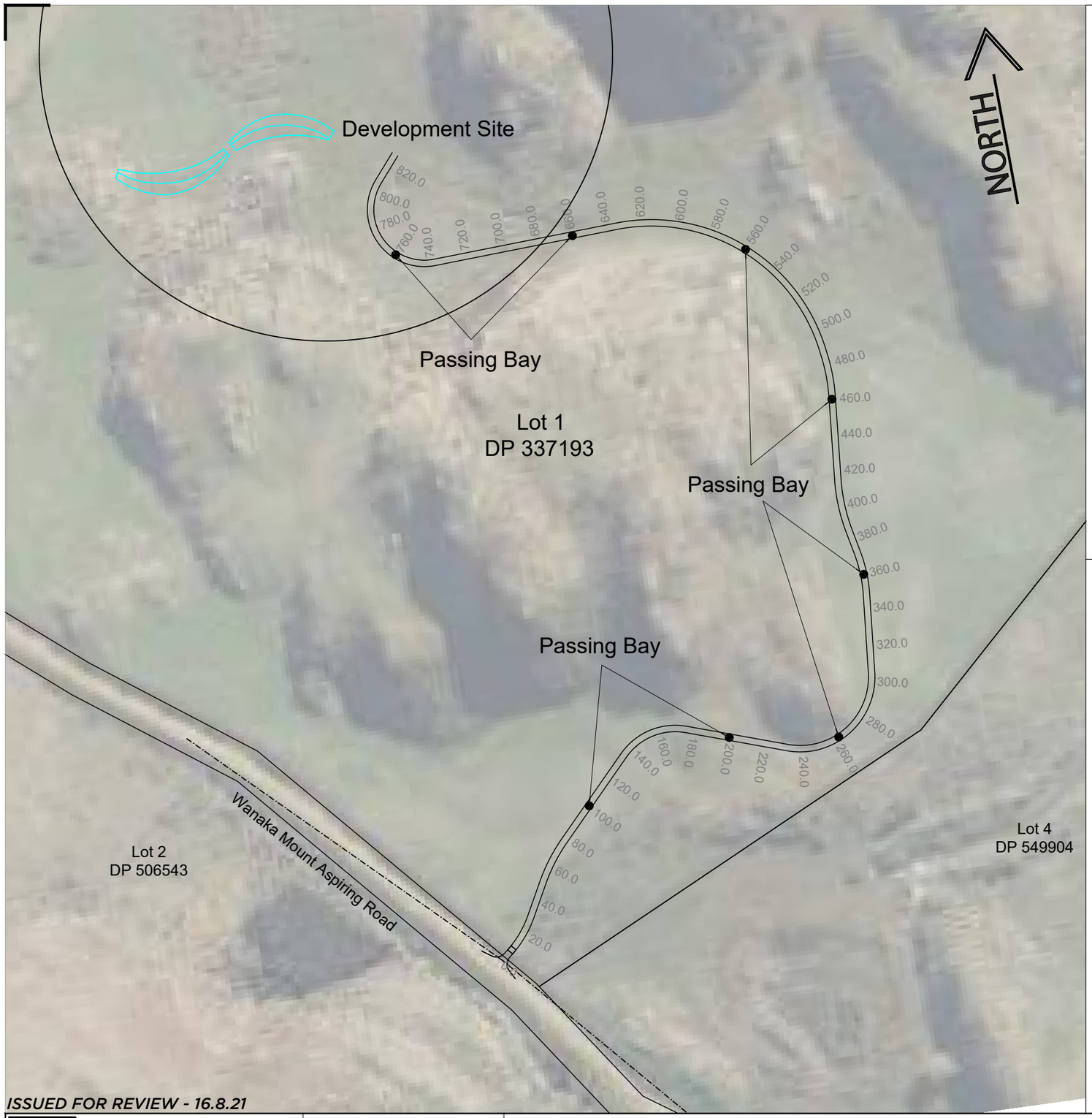
Thank you in advance.

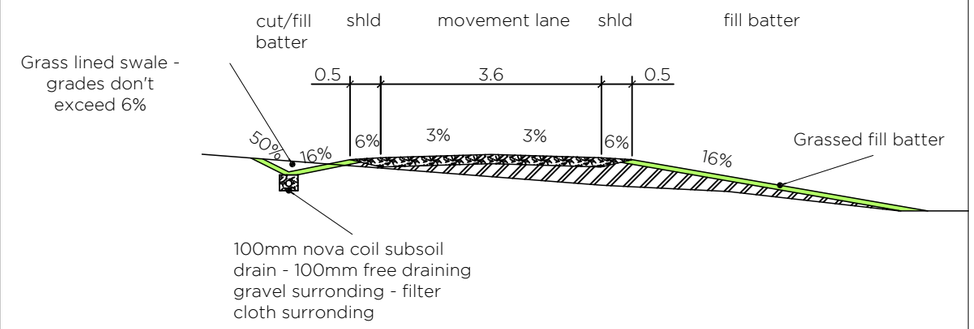
Warm regards,

Jo

JOHN EDMONDS & ASSOCIATES

JO FYFE
BSc, Assoc.NZPI
planner - director - Wanaka
022 158 8509 | 03 450 0009
jo.fyfe@jea.co.nz | **www.jea.co.nz**
Level 1, 24 Dungarvon Street, Wanaka 9343
PO Box 95, Queenstown 9300

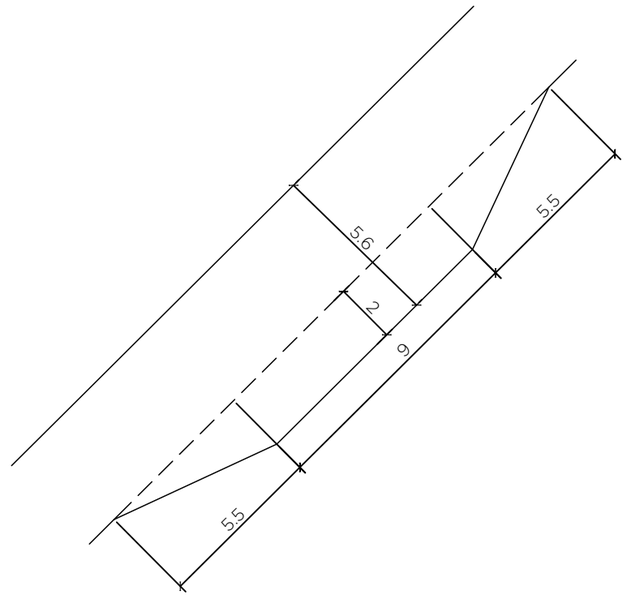




PROPOSED ACCESS FORMATION

150mm compacted AP40 on compacted cut to fill

SCALE 1:100



TYPICAL PASSING BAY

CHAINAGES - 100, 200, 260, 360
460, 560, 660, 760

SCALE 1:200

ISSUED FOR REVIEW - 16.8.21

JEA TOWN PLANNERS & SURVEYORS
Level 2, 36 Shotover Street
PO Box 95, Queenstown, 9300

CLIENT
DAMPER

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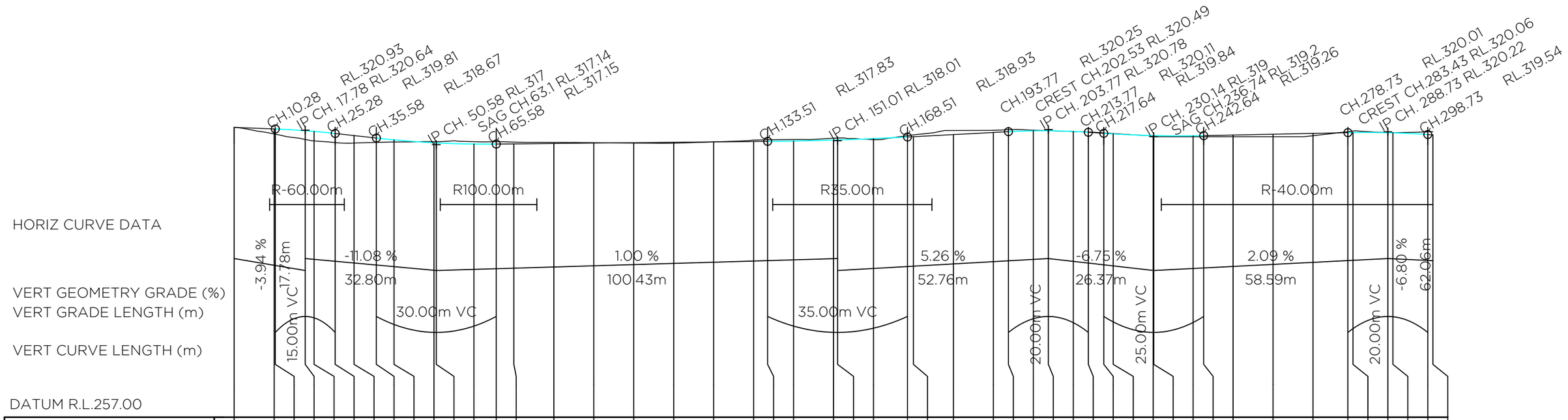
PROPOSED ACCESS ALIGNMENT DAMPER BAY, Sheet 1 - 6

REV.	DATE	REVISION DETAILS	BY
A	16.8.21	Add alignment	CW
B	24.8.21	Add passing bays	CW

SURVEYED	SIGNED	DATE	JOB NO.	DRAWING NO.
CW	CW	17.2.21	15047	05.02
DRAWN	CHECKED	DATE	SCALE	
CW	CW	8.7.21	1:2500m @ A3	
DATUM & LEVEL				REV.
LINDAS PEAK 2000				B

S:\Clients\2015\15047 - Damper\Survey\cad\15047.05.02B Access intersection.dwg Plotted: 31.08.2021



DATUM R.L.257.00

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C.L. FINISHED LEVEL	321.34	320.94	320.93	320.50	320.33	319.81	319.28	318.67	318.22	317.49	317.46	317.16	317.15	317.20	317.30	317.40	317.50	317.60	317.70	317.80	317.83	317.92	318.16	318.19	318.52	318.93	319.00	319.53	320.06	320.25	320.47	320.48	320.32	320.11	319.84	319.69	319.28	319.28	319.22	319.26	319.41	319.62	319.83	320.01	320.04	320.00	319.97	319.54	319.46
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CHAINAGE	0.00	10.00	10.28	17.78	20.00	25.28	30.00	35.58	40.00	50.00	50.58	60.00	65.58	70.00	80.00	90.00	100.00	110.00	120.00	130.00	133.51	140.00	150.00	151.01	160.00	168.51	170.00	180.00	190.00	193.77	200.00	203.77	210.00	213.77	217.64	220.00	230.00	230.14	240.00	242.64	250.00	260.00	270.00	278.73	280.00	288.73	290.00	298.73	300.00

ISSUED FOR REVIEW - 16.8.21

JEA TOWN PLANNERS & SURVEYORS
Level 2, 36 Shotover Street
PO Box 95, Queenstown, 9300

CLIENT: Damper

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ACCESS LONGSECTION
DAMPER BAY
Sheet 2 - 6

REV.	DATE	REVISION DETAILS	BY

SURVEYED	SIGNED	DATE	JOB NO.	DRAWING NO.
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DATUM & LEVEL				REV.
MT NIC 2000 - NZVD16				-

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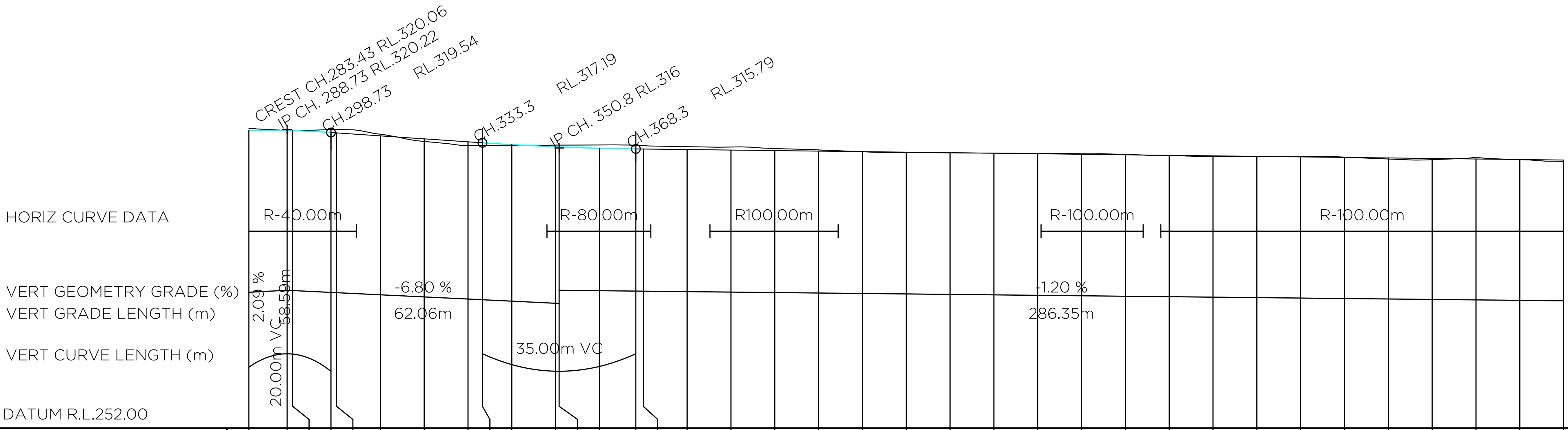

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C.L. FINISHED LEVEL	320.04	320.00	319.97	319.54	319.46	318.78	318.10	317.41	317.19	316.77	316.28	316.25
EXISTING G.L.	320.42	320.02	320.01	320.20	320.24	319.14	317.51	316.63	316.63	316.58	316.66	316.66
CHAINAGE	280.00	288.73	290.00	298.73	300.00	310.00	320.00	330.00	333.30	340.00	350.00	350.80

DEPTH	-0.75	-0.83	-0.76	-0.65	-0.70	-0.47	-0.28	0.03	0.09	0.04	-0.02	-0.08
C.L. FINISHED LEVEL	315.94	315.79	315.77	315.65	315.53	315.41	315.29	315.17	315.05	314.93	314.81	314.69
EXISTING G.L.	316.69	316.62	316.53	316.30	316.23	315.88	315.57	315.14	314.96	314.89	314.83	314.77
CHAINAGE	360.00	368.30	370.00	380.00	390.00	400.00	410.00	420.00	430.00	440.00	450.00	460.00

DEPTH	-0.13	-0.07	-0.01	0.21	0.01	-0.03	-0.07	0.25	0.28	-0.39	0.03	0.30
C.L. FINISHED LEVEL	314.57	314.45	314.33	314.21	314.09	313.97	313.85	313.73	313.61	313.49	313.37	313.25
EXISTING G.L.	314.70	314.52	314.34	314.00	314.08	314.00	313.92	313.48	313.33	313.88	313.34	312.95
CHAINAGE	470.00	480.00	490.00	500.00	510.00	520.00	530.00	540.00	550.00	560.00	570.00	580.00

ISSUED FOR REVIEW - 16.8.21

JESA TOWN PLANNERS & SURVEYORS
Level 2, 36 Shotover Street
PO Box 95, Queenstown, 9300

CLIENT: DAMPER

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ACCESS LONGSECTION
DAMPER BAY
Sheet 3 - 6

REV.	DATE	REVISION DETAILS	BY

SURVEYED	SIGNED	DATE	JOB NO.	DRAWING NO.
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DRAWN	CHECKED	DATE	SCALE	
CW	CW	16.8.21	1:1 @ A3	
DATUM & LEVEL				REV.
MT NIC 2000 - NZVD16				-

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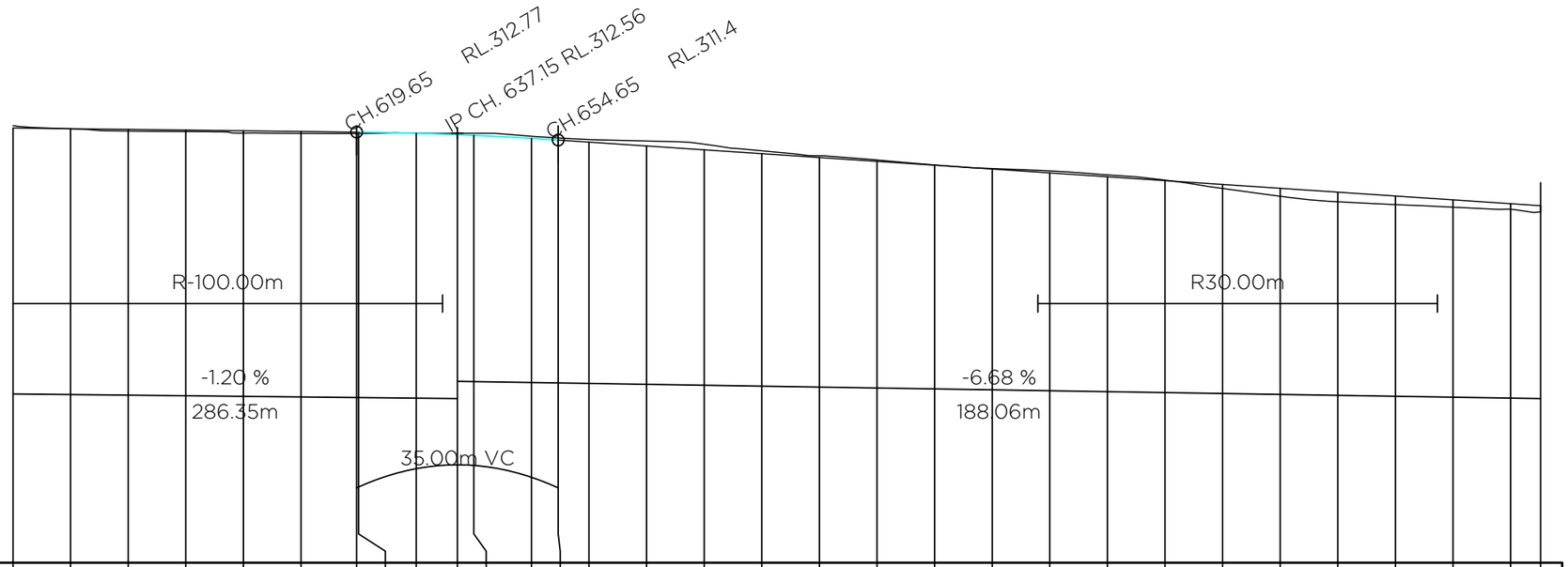

DEPTH	-0.39	0.03	0.30	0.26	0.41	0.35	0.23	0.23	-0.02	-0.25	-0.36	-0.37	-0.37	-0.45	-0.87	-0.98	-0.50	-0.30	-0.25	-0.04	-0.09	-0.35	-0.33	-0.09	0.70	1.38	1.67	1.50	1.27	0.97	1.06	
C.L. FINISHED LEVEL	313.49	313.37	313.25	313.13	313.01	312.89	312.77	312.77	312.57	312.32	312.21	311.69	311.40	311.04	310.37	309.70	309.03	308.36	307.70	307.03	306.36	305.69	305.02	304.36	303.69	303.02	302.35	301.68	301.01	300.35	300.00	
EXISTING G.L.	313.88	313.34	312.95	312.87	312.60	312.55	312.54	312.54	312.59	312.57	312.57	312.06	311.76	311.49	311.24	310.68	309.53	308.67	307.94	307.07	306.45	306.04	305.35	304.44	302.99	301.64	300.68	300.19	299.74	299.37	298.94	
CHAINAGE	560.00	570.00	580.00	590.00	600.00	610.00	619.65	620.00	630.00	637.15	640.00	650.00	654.65	660.00	670.00	680.00	690.00	700.00	710.00	720.00	730.00	740.00	750.00	760.00	770.00	780.00	790.00	800.00	810.00	820.00	825.21	

ISSUED FOR REVIEW - 16.8.21

JEA TOWN PLANNERS & SURVEYORS
Level 2, 36 Shotover Street
PO Box 95, Queenstown, 9300

CLIENT: DAMPER

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ACCESS LONGSECTION
DAMPER BAY
Sheet 4 - 6

REV.	DATE	REVISION DETAILS	BY

SURVEYED	SIGNED	DATE	JOB NO.	DRAWING NO.
-	-	-	15047	05.02
DRAWN	**CHECKED**	**DATE**	**SCALE**	
CW	CW	16.8.21	1:1 @ A3	
DATUM & LEVEL				**REV.**
MT NIC 2000 - NZVD16				-

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PROPOSED INTERSECTION SIGHT DISTANCE DAMPER BAY, Sheet 5 - 6

REV.	DATE	REVISION DETAILS	BY

SURVEYED	SIGNED	DATE	JOB NO.	DRAWING NO.
CW	CW	17.2.21	15047	05.02
DRAWN	CHECKED	DATE	SCALE	
CW	CW	8.7.21	1:2000m @ A3	
DATUM & LEVEL				REV.
LINDAS PEAK 2000				-

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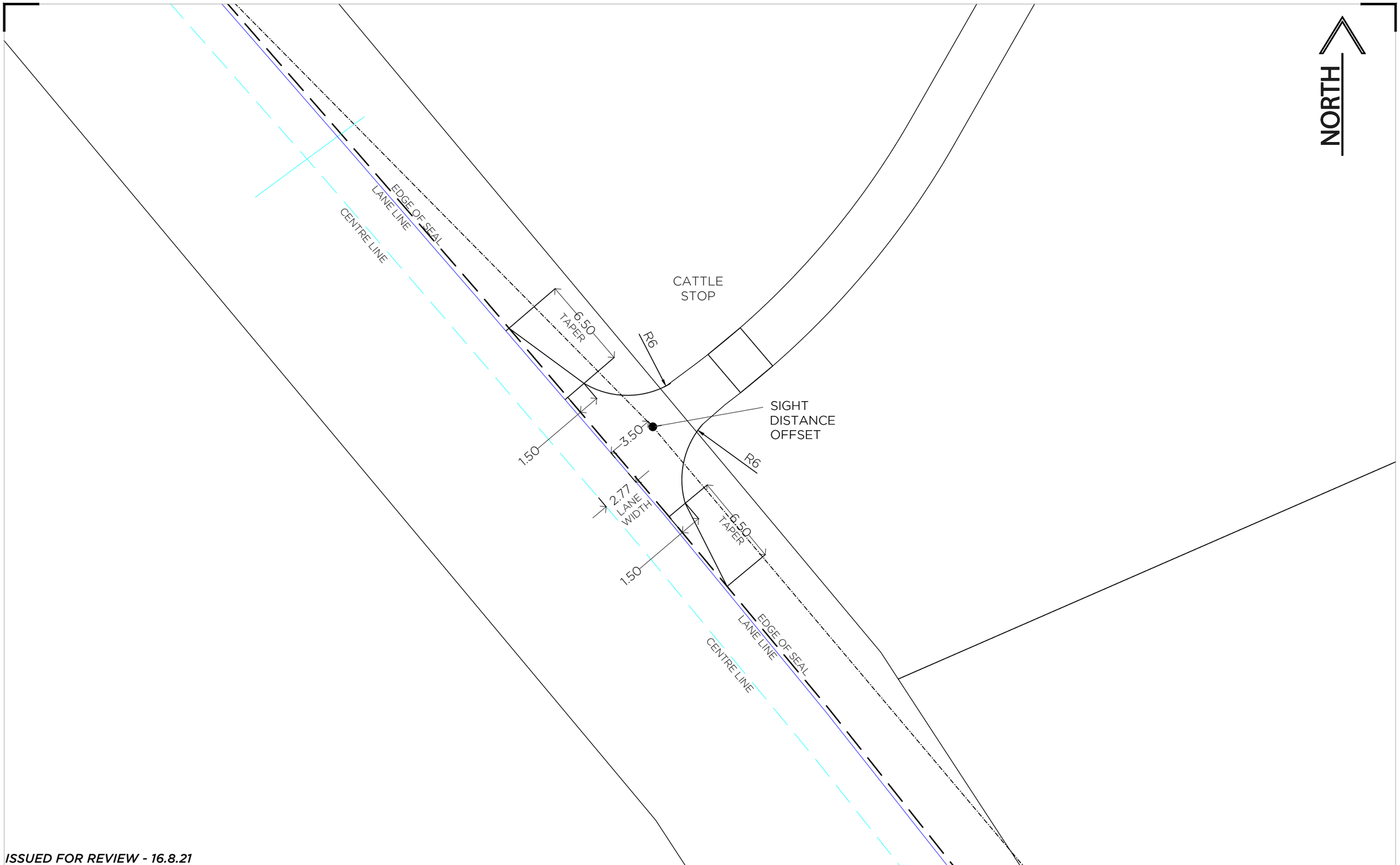

ISSUED FOR REVIEW - 16.8.21

JEA TOWN PLANNERS & SURVEYORS
Level 2, 36 Shotover Street
PO Box 95, Queenstown, 9300

CLIENT
DAMPER

NOTES:
- *ALL DIMENSIONS SHOWN ARE IN METERS UNLESS SHOWN OTHERWISE.*
- *CHECK ELECTRONIC DATA AGAINST LATEST HARD COPY VERSION.*
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- *THIS PLAN MAY BE SUBJECT TO FINAL SURVEY.*

PROPOSED INTERSECTION/PAVEMENT DESIGN
DAMPER BAY, Sheet 6 - 6

REV.	DATE	REVISION DETAILS	BY

SURVEYED	SIGNED	DATE	JOB NO.	DRAWING NO.
-	-	-	15047	05.02
DRAWN	**CHECKED**	**DATE**	**SCALE**	
CW	CW	8.7.21	1:250m @ A3	
DATUM & LEVEL				**REV.**
LINDAS PEAK 2000				-

S:\Clients\2015\15047 - Damper\Survey\cad\15047.05.02B Access intersection.dwg Plotted: 31.08.2021

11 August 2021

Novo Group Limited
Level 1, 279 Montreal Street
PO Box 365, Christchurch 8140
O - 03 365 5570
info@novogroup.co.nz

John Edmonds and Associates
Attention: Jo Fyfe

By email: Jo.Fyfe@jea.co.nz

Dear Jo,

TRANSPORT ADVICE AND ASSESSMENT PROPOSED DWELLING AND ACCOMODATION LODGE DAMPER BAY

1. You have requested that we provide a transport assessment, considering the proposed traffic generation, sight distance and access formation for the proposed owners cabin and lodge on the site at Damper Bay.

2. The proposal will provide for an owners cabin and a 10 unit accommodation lodge. The proposed activity will operate as a retreat style accommodation with ancillary features including on-site dining, swimming areas and meditation. All required car parking will be provided on the site.

3. Survey data for the two lodges in the *NZ Trips and Parking Database* indicated a daily traffic generation rate of 4.57-7.2 trips per room which would equate 46-72 trips per day. Noting the retreat style nature of the proposal traffic generation rates are likely to be lower than a typical hotel within an urban area with many guests choosing to making few or no trips off the site during their stay. The PM peak hour traffic generation rate was 0.5-0.75 trips per room, equating to around 5-8 trips in the peak hour. For comparison the ITE Trip Generation rate for resort hotels suggests a rate of 0.27-0.72 trips per occupied room in the PM peak hour.

4. In addition, one trip in the peak hour could be anticipated for the owners cabin and around 7 trips per day, i.e., similar to a dwelling.

5. Access is proposed to Wanaka Mount Aspiring Road in the location shown in **Figure 1** below and the proposed site plan is provided in **Attachment 1**. Wanaka Mount Aspiring Road is a Collector Road with a 100km/h speed limit and one traffic lane in each direction. The mobile road website[1] indicates daily traffic volumes of around 1,706 vehicles per day. Assuming a peak hour volume of around 15% of the daily volume this would suggest around 256 vehicles in the peak hour.

[1] https://mobileroad.org/desktop.html

Figure 1: Site access location [Aerial Source: LINZ Data Service[2]]

6. A review of Waka Kotahi NZTA's Crash Database (CAS) indicates only one reported crash in the vicinity of the site over the last 10 year period, this occurred as a result of a driver losing control on a corner due to inappropriate speed. This appears to be driver error and no existing safety concerns have been identified. The Crash Report is provided in **Attachment 2.**

7. A compliance check against the transport rules in Chapter 29 of the Proposed District Plan is included in **Attachment 3** and identified the following areas of non-compliance:

    - Rule 29.5.16 -The vehicle crossing design does not comply with Diagram 9.
    - Rule 29.5.18 - 250m sight distance is not achieved at the access.

8. Each of these matters are assessed below.

9. The Proposed District Plan requires a vehicle crossing design as per Chapter 29, Diagram 9 (refer to **Figure 2**). This applies to sites generating 31-100 equivalent car movements per day with roads carrying less than 10,000 vehicles per day.

[2] https://data.linz.govt.nz/data/category/aerial-photos/?page=2

29.14.9 Diagram 9 - Access Design

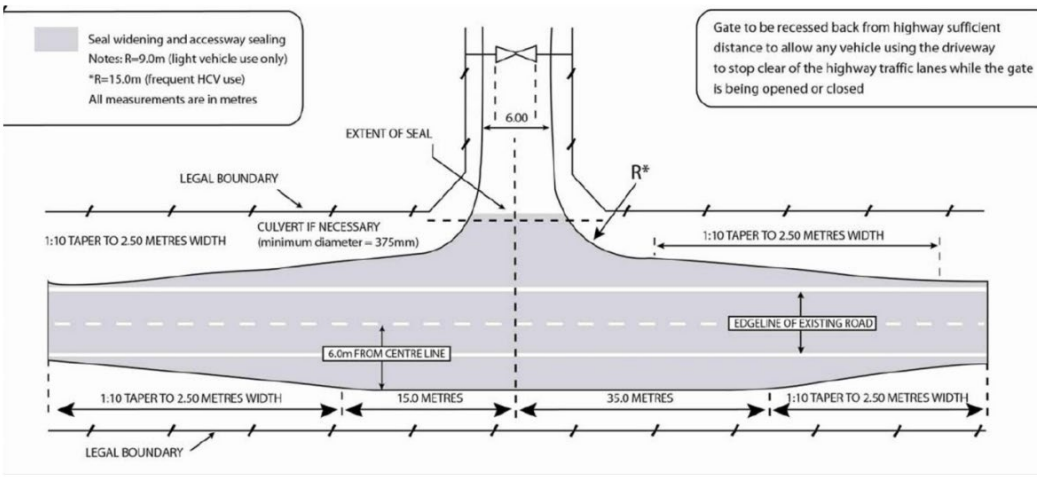


Figure 2: Extract From QTLDC Proposed District Plan, Chapter 29, Diagram 9

10. There is an existing culvert (refer to **Figure 3**) approximately 7m east of the access which is approximately 2.0m from the edge line[3]. On the southern side there is also a reasonably deep swale adjacent to a steep embankment.

Figure 3: Culvert approx. 7m east of access

11. The location of the swale will not affect the ability to achieve the tapers either side of the access on the same side of the road as the application site, in accordance with Diagram 9. However, it will constrain the ability to provide the seal widening on the opposite

[3] At a 1:10 taper, 7m from the access the seal widening would be 1.8m wide from the edge line and could be accommodated clear of the culvert.

(southern) side of the road and as such the vehicle crossing design will not comply with Diagram 9 in this respect.

12. In this instance the traffic generation of the proposal is relatively low and the impact on through traffic has been considered using SIDRA Intersection v9. This showed that even if all 9 peak hour vehicles turned right into the site, that there would be very minimal impact on through traffic, with vehicles in the through lanes maintaining average speeds of at least 98km/h and vehicles turning right slowing but not needing to queue to turn into the site.

13. As a scenario test the through volumes on Wanaka Mount Aspiring Road were doubled and this showed no change to the SIDRA model results. The movement summaries for the anticipated operation and the scenario test are provided in **Attachment 4.** On this basis there would be no noticeable impact on the through traffic function of Wanaka Mount Aspiring Road despite not providing the seal widening on the southern side of the vehicle crossing.

14. In respect of safety, in the unlikely event that a vehicle did have to wait to turn right into the site, there is some 203m forward visibility to the access for north-west bound traffic. The Austroads Guide to Road Design Part 4A, Table 3.1 recommends an approach sight distance of 165m -179m based on a 2.0 - 2.5 second reaction time and a design speeds of 100km/h. This is readily met and ensures approaching drivers would have sufficient time to see and avoid a collision with any vehicle waiting to turn at the access albeit as outlined above no such delay is anticipated.

15. The Proposed District Plan requires 250m sight distance in each direction from the access along Wanaka Mount Aspiring Road. In this instance there is approximately 203m sight distance to the east and 212m site distance to the west as shown in **Figure 4** below. The sight distance is primarily constrained by the vertical and horizontal alignment of the road.

Figure 4:Sight distance from the proposed access to the east (left) and west (right)

16. Whilst 250m sight distance would be desirable, it is noted that Waka Kotahi NZTA's *Road and Traffic Standards 6 Guidelines for Visibility at Driveways* would require a low volume access (less than 200 vehicle movements per day) to a collector road, to provide 160-190m sight distance for a 100km/h and 110km/hr operating speed respectively. Noting this is readily met, and that the access location maximises sight distance in each direction, the proposed access location is considered to be appropriate for the safe and efficient use of the access.

17. Overall, for the reasons outlined above, the traffic generation of the proposal is considered to be low, the proposed access can be formed with tapers on the northern side and the location is appropriate to accommodate access to and from the site in a safe and efficient manner.

18. We trust the above assessment has addressed your request. Please do not hesitate to contact me directly should you have any questions.

Yours sincerely,

Novo Group Limited

Lisa Williams

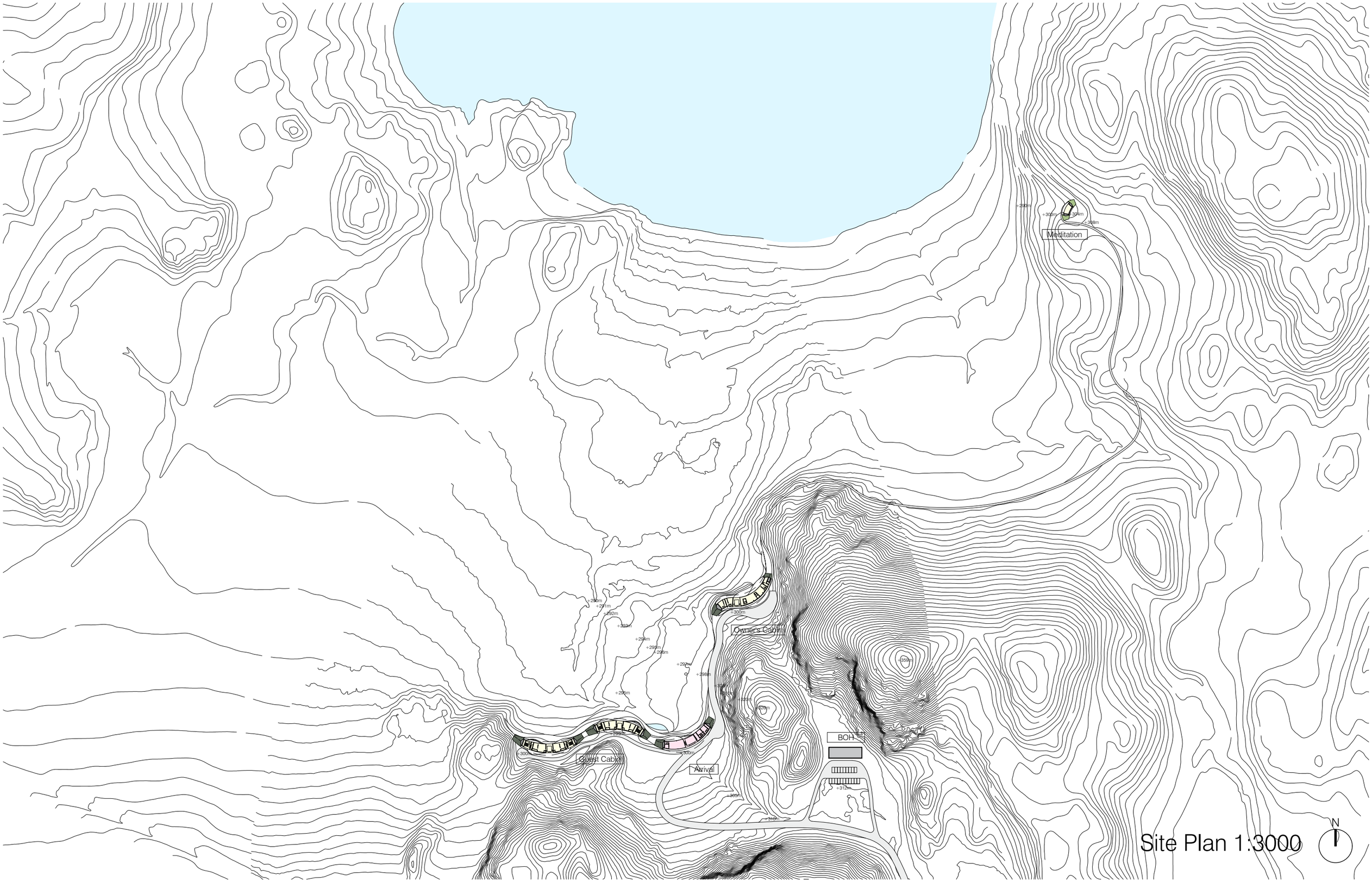
Transport Engineer and Planner

D: 03 365 5596 | **M**: 027 2929 825 | **O**: 03 365 5570

E: lisa@novogroup.co.nz | W: www.novogroup.co.nz

750006

Attachment 1: Proposed Site Plan



Not for construction. Assurance for safety and compliance for applicable law/code will be ensured by the appointed architect-contractor

KENGO KUMA & ASSOCIATES 隈研吾建築都市設計事務所	DRAWN 24/06/2021	SUBMISSION & REVISION		PROJECT TITLE Wanaka Project	PROJECT No. ----	DRAWING TITLE Detailed Site Plan 1F	DRAWING No. A-01-01
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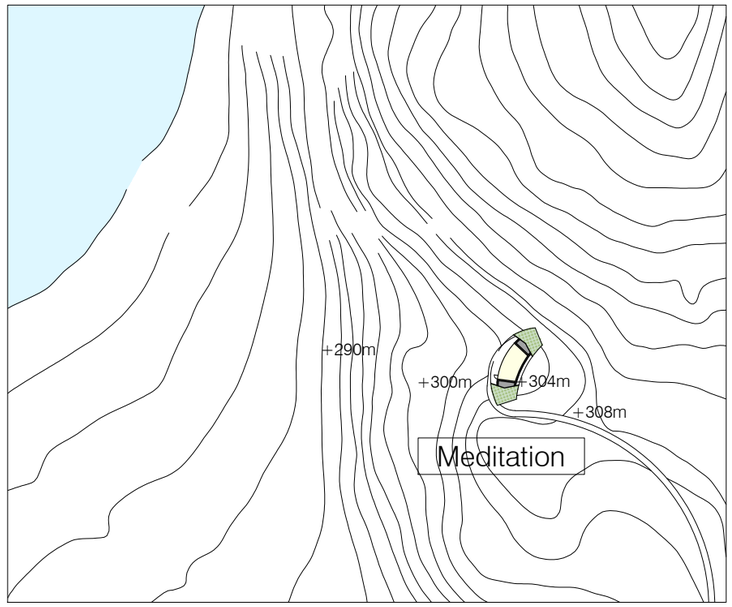
	APPROVED ----	DD 100%					
		Revision A					
		Revision B					



+290m
+291m
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+293m
+294m
+295m
+296m
+297m
+298m
+305m
+310m
+320m
+326m
+295m
+299m
+300m
+300m
+300m
+359m
+312m
+305m
+310m

Owner's Cabin

Guest Cabin

Arrival

BOH

N

Detailed Site Plan 1F 1:1500

Not for construction. Assurance for safety and compliance for applicable law/code will be ensured by the appointed architect-contractor

KENGO KUMA & ASSOCIATES 隈研吾建築都市設計事務所	DRAWN 24/06/2021	SUBMISSION & REVISION		PROJECT TITLE Wanaka Project	PROJECT No. ----	DRAWING TITLE Detailed Site Plan 1F	DRAWING No. A-01-02
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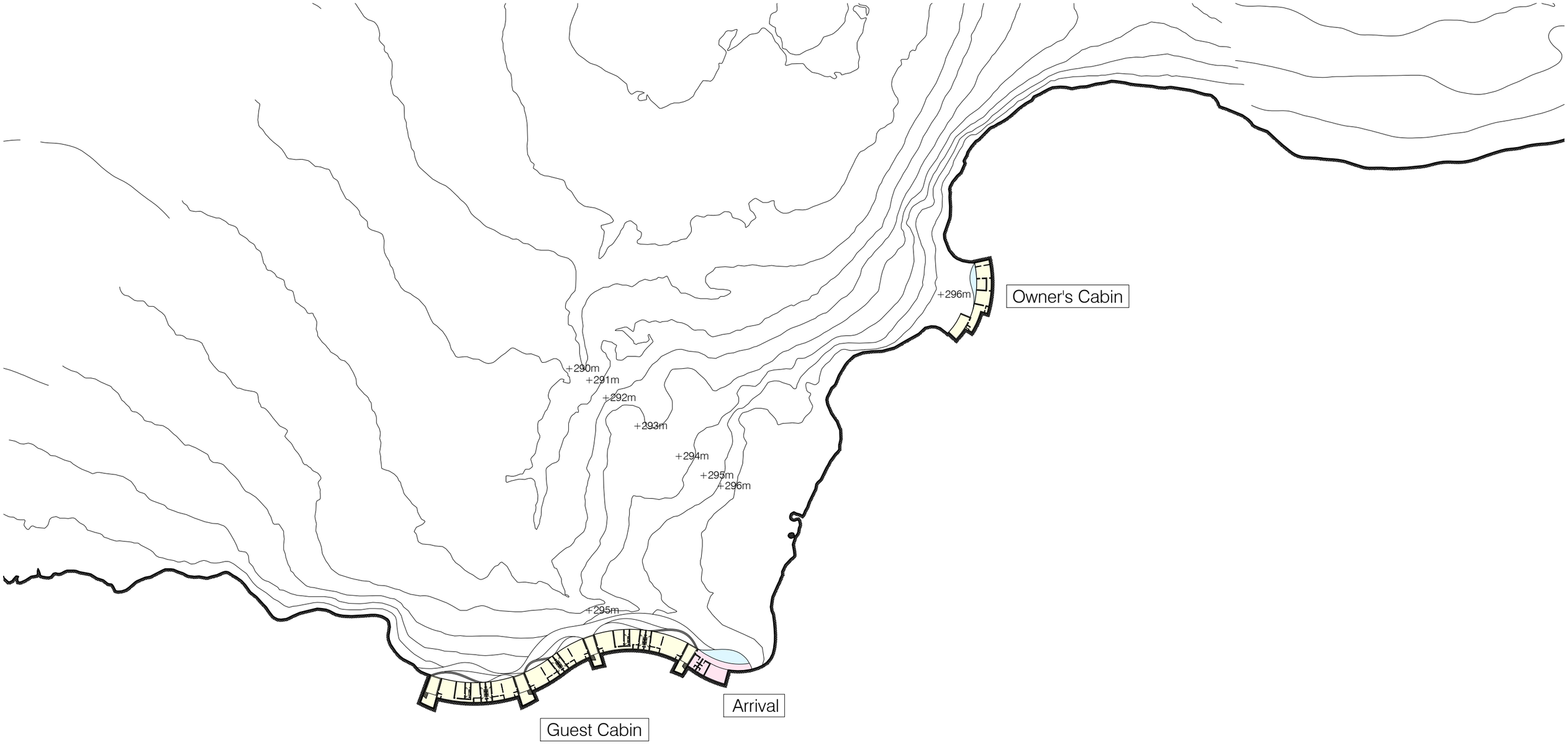
	APPROVED ----	DD 100%					
		Revision A					
		Revision B					



Detailed Site Plan BF 1:1500

N

Not for construction. Assurance for safety and compliance for applicable law/code will be ensured by the appointed architect-contractor

KENGO KUMA & ASSOCIATES 隈研吾建築都市設計事務所	DRAWN 24/06/2021	SUBMISSION & REVISION		PROJECT TITLE Wanaka Project	PROJECT No. ----	DRAWING TITLE Detailed Site Plan BF	DRAWING No. A-01-03
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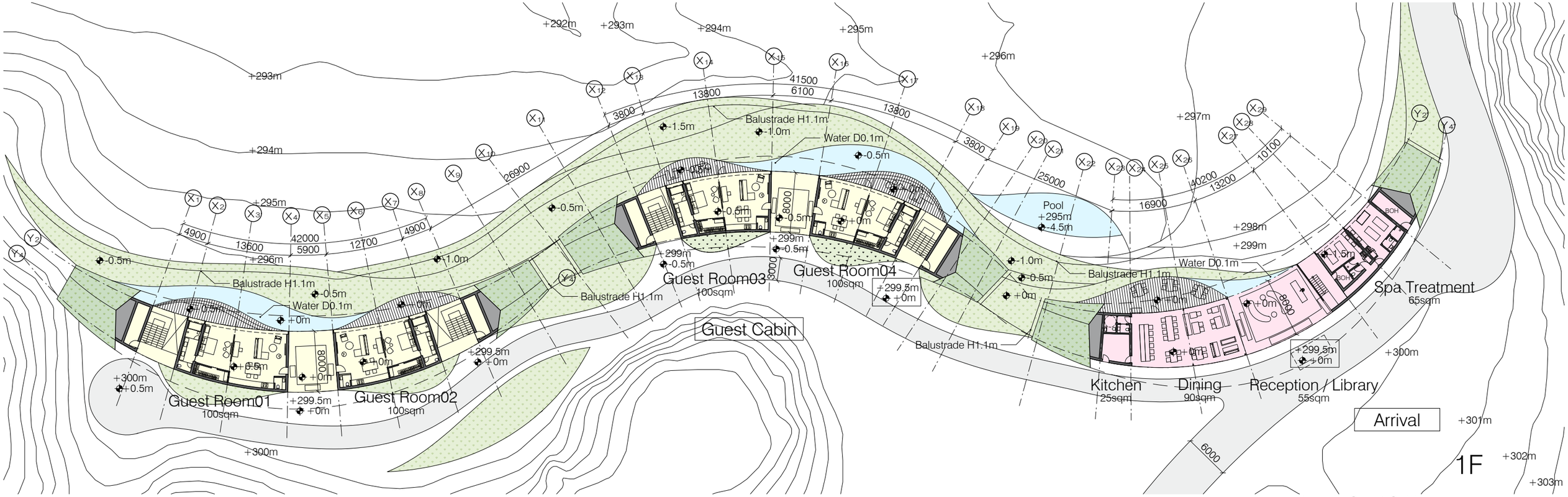
		Revision A					
		Revision B					



1F	Unit	Number	GFA
Reception / Library			90
Dining			90
Spa treatment			65
Arrival BOH			40
1 Bed Unit	100	4	400
Storage			60
Other / Circulation			200
1F GFA			945

BF	Unit	Number	GFA
Changing Room			40
Pool Lounge			100
1 Bed Unit	100	2	200
1 Bed Unit	140	2	280
2 Bed Unit	160	2	320
Other / Circulation			225
BF GFA			1165

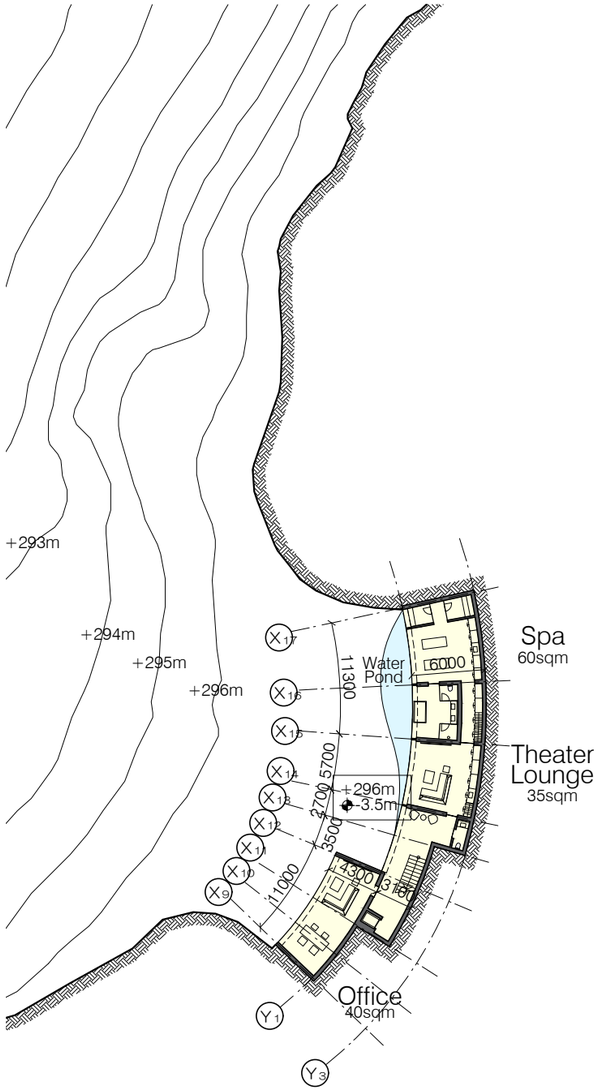
Arrival / Guest Cabin GFA	2110
Footprint	985 sqm

BF
Arrival / Guest Cabin Plan 1:500

N

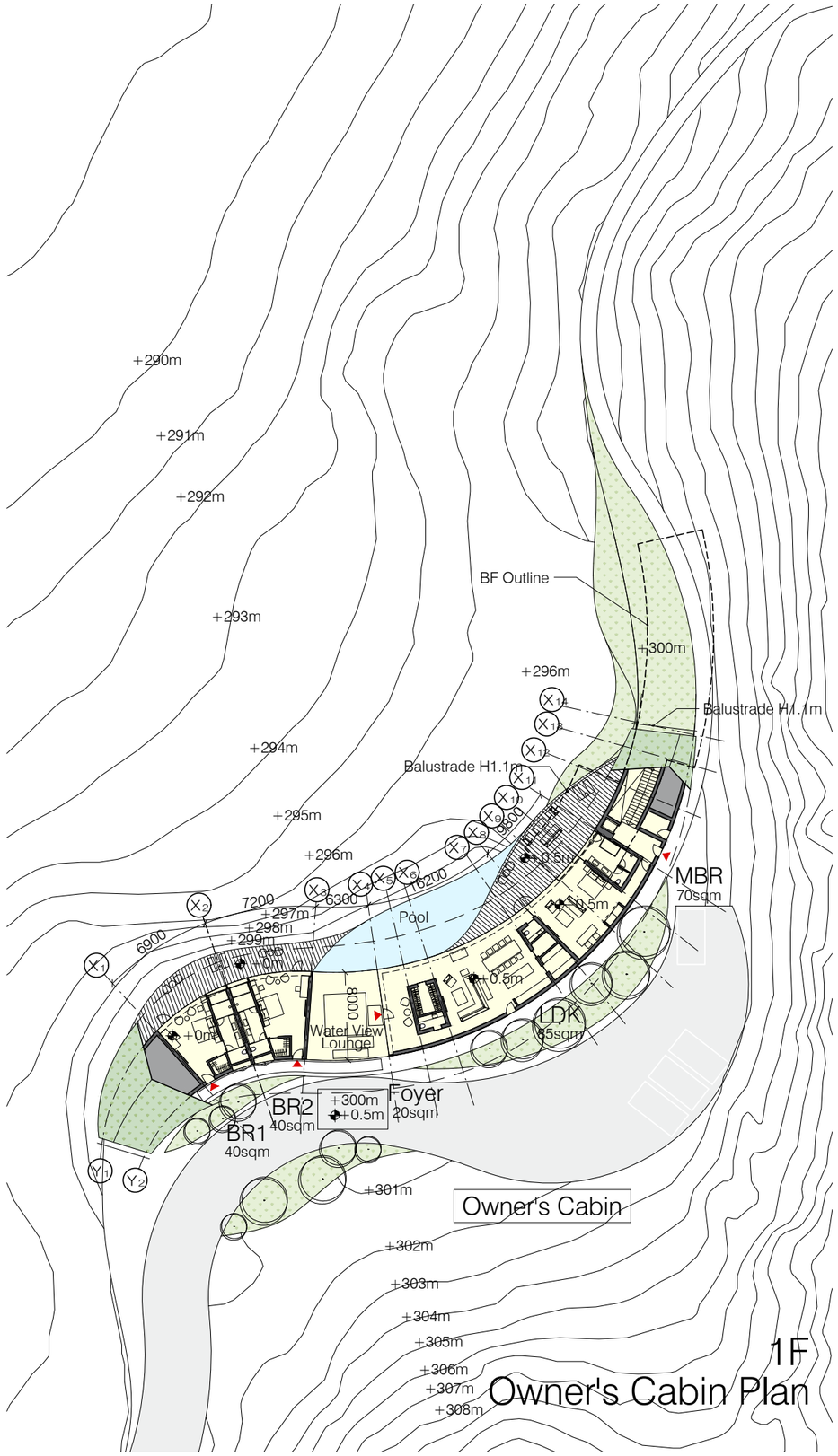
Not for construction. Assurance for safety and compliance for applicable law/code will be ensured by the appointed architect-contractor

KENGO KUMA & ASSOCIATES 隈研吾建築都市設計事務所	DRAWN 24/06/2021 CHECKED ---- APPROVED ----	SUBMISSION & REVISION DD 50% DD 100% Revision A Revision B	PROJECT TITLE Wanaka Project	PROJECT No. ----	DRAWING TITLE Arrival / Guest Cabin Plan SCALE 1:500@A3	DRAWING No. A-01-04 DATE 24/06/2021



BF

Owner's Cabin Plan



1F

Owner's Cabin Plan

Owner's Cabin

1F	GFA
Foyer	20
Living	35
Dininig	20
Kitchen	20
Master Bedroom	70
Bedroom1	40
Bedroom2	40
BOH	10
Other / Circulation	130
1F GFA	385

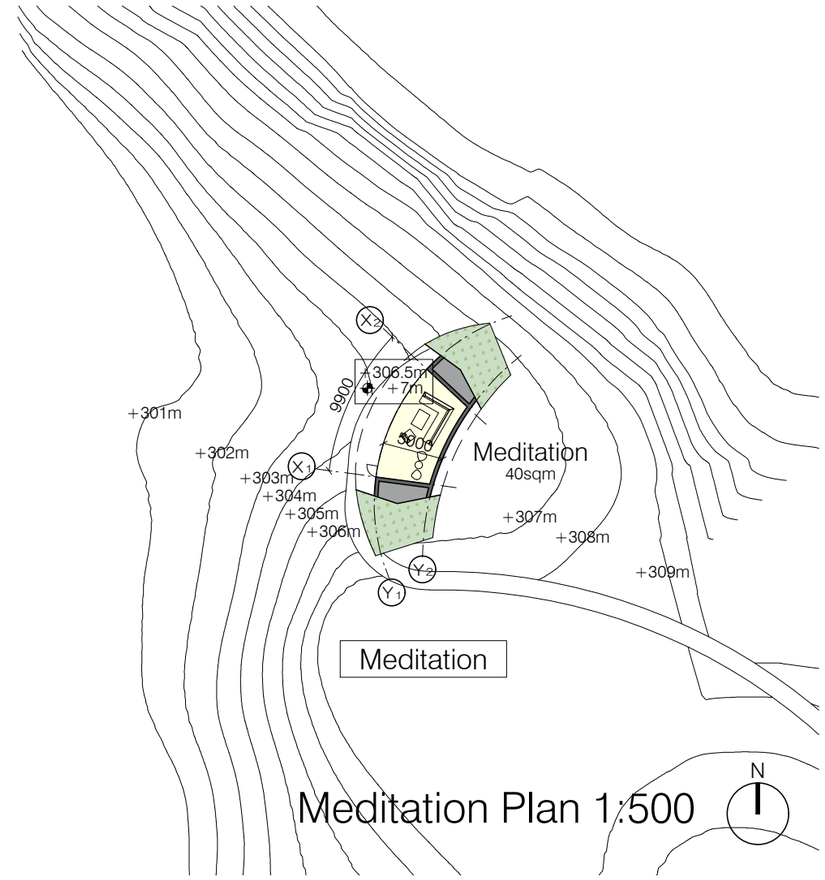
BF	GFA
Spa	60
Theater Lounge	35
Office	40
Other / Circulation	45
BF GFA	180

Owner's Cabin GFA	565
Footprint	385 sqm

Meditation

1F	GFA
Meditation	40

Meditation GFA	40
Footprint	40 sqm



Meditation Plan 1:500

N

Not for construction. Assurance for safety and compliance for applicable law/code will be ensured by the appointed architect-contractor

KENGO KUMA & ASSOCIATES 隈研吾建築都市設計事務所	DRAWN 15/07/2021	SUBMISSION & REVISION		PROJECT TITLE Wanaka Project	PROJECT No. ----	DRAWING TITLE Owner's Cabin Plan	DRAWING No. A-01-05
	CHECKED ----	DD 50%				SCALE 1:500@A3	DATE 15/07/2021
	APPROVED ----	DD 100%					
		Revision A					
		Revision B					

Attachment 2: NZTA CAS Report

Untitled query

Saved sites

Damper

Crash year

2011 — 2021

Plain English report

1 results from your query.

1-1 of 1

Crash road	Side road	Feature	Distance from side road/feature	Direction	Reference station	Route position	Easting	Northing	Longitude	Latitude	ID	Date	Day of week	Time	Description of events	Crash factors	Surface condition	Natural light	Weather	Junction	Control	Casualty count fatal	Casualty count serious	Casualty count minor	Social cost $(m)
WANAKA-MOUNT ASPIRING ROA	LAKE ROAD		1500m	N			1288095	5046552	169.065369	-44.666584	201613247	16/05/2016	Mon	15:30	Car/Wagon1 EDB on WANAKA-MOUNT ASPIRING ROA lost control turning right, Car/Wagon1 hit non specific ditch	CAR/WAGON1, inappropriate speed for weather conditions, lost control under braking	Wet	Overcast	Light rain	Nil (Default)	Unknown	0	0	1	0.11

1-1 of 1

Attachment 3: Transport Compliance Assessment

Rule	Assessment	Complies?
29.4.11 High Traffic Generating Activities Any new land-use or subdivision activity, including changes in use that exceeds the traffic generation standards or thresholds set out in Table 29.5, excluding in the Airport Zone.	The site has fewer than 50 residential units. The visitor accommodation is fewer than 100 units.	Yes
29.5.1 Minimum Parking Requirements The number of parking spaces (other than cycle parking) shall be provided in accordance with the minimum parking requirements specified in Table 29.4, except that where consent is required for a High Traffic Generating Activity pursuant to Rule 29.4.11 no minimum parking is required ***Requires:*** *Residential – 1 per unit (1 space)* *Guest accommodation – 1 per unit and 1 staff space per 10 units (11 spaces).*	Requires 12 car parks (minimum) and 12 will be provided.	Yes
29.5.2 Location and Availability of Parking Spaces a. Any parking space required by Table 29.4 or loading space shall be available for staff and visitors during the hours of operation and any staff parking required by this rule shall be marked as such.. b. No parking space required by Table 29.4 shall be located on any access or outdoor living space required by the District Plan, such that each parking space required by Table 29.5 shall have unobstructed vehicular access to a road or service lane, except where tandem parking is specifically provided for by Rule 29.5.8. c. Parking spaces and loading spaces may be served by a common manoeuvring area (which may include the installation of vehicle turntables), which shall remain unobstructed. d. The following activities may provide some or all of the parking spaces required by Table 29.4 off-site (on a different site to that which the land-use activity is located on) (i) Residential units and visitor accommodation units or activities in any High Density Residential Zone, Medium Density Residential Zone, or Business Mixed Use Zone is located within 800m of an established public transport facility or a public transport facility identified on any Council Active Transport Network Plan may provide, all of the car parking required off-site.. (ii) some or all coach parking required by Table 29.4 in relation to visitor accommodation activity may be provided off-site.. (iii) all other residential activity and visitor accommodation activity not captured by 29.5.2(d)(i) may provide up to one-third of the parking spaces required by Table 29.4 off-site.. (iv) all activities other than residential and visitor accommodation activity in the Business Mixed Use Zone may provide all of the car parking required off-site. (v) off-site parking spaces provided in accordance with the above rules 29.5.2(d)(i)-(iv) must be: i. dedicated to the units or rooms or floor space within the development; and ii. located so that all the “off-site” car parking spaces allocated to the development are within an 800m walking distance of the boundary of the development. This does not apply to coach parking; iii. not located on a private road or public road; and	All parking will be designed to comply	Yes

Rule	Assessment	Complies?
iv. secured by a legally binding agreement attached to the relevant land titles that guarantees the continued availability of the parking for the units the off -site parking is intended to serve.		
29.5.3 Size of Parking Spaces and layout a. All required parking spaces and associated manoeuvring areas are to be designed and laid out in accordance with the Car Parking Layout requirements of Table 29.7, Table 29.8 and Diagram 3 (car space layouts) of Schedule 29.2 This standard does not apply to parking, loading and associated access areas for Ski Area Activities in the Ski Area Subzone b. The installation of a vehicle turntable for residential units and residential flats is an acceptable alternative to achieve the required turning manoeuvres of the swept path Diagram 4.	All parking will be designed to comply	Yes
29.5.4 Gradient of Parking Spaces and Parking Areas Parking spaces and parking areas shall have a gradient of no more than 1 in 20 in any one direction.	Will be designed to comply	Yes
29.5.5 Mobility Parking spaces a. Other than in relation to residential units and visitor accommodation with less than 6 guests, wherever an activity requires parking to be provided, mobility parking spaces shall be provided in accordance with the following minimum standards: … … b. Mobility parking spaces shall be: (i) on a level surface; (ii) clearly signposted; (iii) located on the same site as the activity; (iv) be as close as practicable to the building entrance; and (v) be accessible to the building via routes that give direct access from the car park to the building.	Compliant mobility parking will be provided.	Yes
29.5.6 Drop off/ pick up (set down) areas in all zones except in the Queenstown Town Centre Zone, the Wanaka Town Centre Zone, and the Arrowtown Town Centre Zone a. All day care facilities, educational facilities, and healthcare facilities must provide drop off / pick up (set down) areas to allow vehicles to drop off and pick up children, students, elderly persons, or patients in accordance with the following standards: … … b. In calculating the total number of drop-off / pick up car spaces required, where the required amount results in a fraction of a space less than 0.5 it shall be disregarded and where the fraction is 0.5 or higher, then the requirement shall be rounded up to the next highest whole number and where there are two activities on one site (such as healthcare and day care) the total required shall be combined prior to rounding.	Not applicable	N/A
29.5.7 Reverse manoeuvring for any day care facility, educational facility, or healthcare facility	Not applicable	N/A
29.5.8 Residential Parking Space Design	Complies	Yes

Rule	Assessment	Complies?
a. The minimum width of the entrance to a single garage shall be no less than 2.4 m. b. The minimum length of a garage shall be 5.5m. c. Where a car space is proposed between a garage door and the road boundary, the minimum length of this car space shall be 5.5m. d. Where onsite manoeuvring is required, the minimum manoeuvring area between the road boundary and the garage entrance shall be designed to accommodate a B85 design vehicle. e. Where two parking spaces are provided for on a site containing only a single visitor accommodation unit or a single residential unit, which may also include a single residential flat, the parking spaces may be provided in tandem.		
29.5.9 Queuing a. On-site queuing space shall be provided for all vehicles entering a parking or loading area in accordance with the following: … … b. Where the parking area has more than one access the required queuing space may be divided between the accesses based on the expected traffic volume served at each access point. c. Queuing space length shall be measured from the road boundary at the vehicle crossing to the nearest vehicle control point or point where conflict with vehicles already on the site may arise.	The accesses require 6m queue space, this will be provided at the site entrance	Yes
29.5.10 Loading Spaces a. Off -street loading shall be provided in accordance with this standard on every site in the Business Mixed Use Zone, the Town Centre zones, and the Local Shopping Centre Zone, except on sites where access is only available from the following roads: … … b. Every loading space shall meet the following dimensions: … … c. Notwithstanding the above: (i) Where articulated trucks are used in connection with any site sufficient space not less than 20m in depth shall be provided. (ii) Each loading space required shall have unobstructed vehicular access to a road or service lane. (iii) Parking areas and loading areas may be served in whole or in part by a common manoeuvre area, which shall remain unobstructed.	No loading is required.	Yes
29.5.11 Surface of Parking Spaces, Parking Areas, and Loading Spaces a. The surface of all parking, loading and associated access areas and spaces shall be formed, sealed, or otherwise maintained so as to avoid creating a dust or noise nuisance, to avoid water ponding on the surface, and to avoid run-off onto adjoining roads. b. The first 10m of such areas, as measured from the edge of the traffic lane, shall be formed and surfaced to ensure that material such as mud, stone chips or gravel is not carried onto any footpath, road or service lane.	The access will be formed and maintained to comply.	Yes
29.5.12 Lighting of parking areas a. Excluding parking areas accessory to residential activity, where a parking area provides for 10 or more parking spaces, which are likely to be used during the hours of darkness, the parking and manoeuvring areas and associated pedestrian routes shall be adequately lit. b. Such lighting shall be designed in accordance with the Queenstown Lakes District Council Southern Light Part One - A Lighting	Assumed to comply	Yes

Rule	Assessment	Complies?
Strategy (March 2017) and Queenstown Lakes District Council Southern Light Part Two – Technical Specifications (March 2017). c. Such lighting shall not result in a greater than 10 lux spill (horizontal or vertical) of light onto any adjoining site within the Business Mixed Use Zone, the Town Centre Zones, and the Local Shopping Centre Zone, measured at any point inside the boundary of any adjoining site d. Such lighting shall not result in a greater than 3 lux spill (horizontal or vertical) of light onto any adjoining site that is zoned High Density Residential, Medium Density Residential, Low Density Residential, or Airport Zone (Wanaka) measured at any point more than 2m inside the boundary of the adjoining site.		
29.5.13 Bicycle parking and the provision of lockers and showers Bicycle parking, lockers, and showers shall be provided in accordance with the minimum requirements specified in Table 29.6 and the layout of short term bicycle parking, including aisle depth, shall have minimum dimensions presented in Diagram 5 (bicycle layouts) of Schedule 29.2.	None required.	N/A
29.5.14 Access Design a. All vehicular access to fee simple title lots, cross lease, unit title or leased premises shall be in accordance with Table 3.2 (Road Design Standards) of the QLDC Land Development and Subdivision Code of Practice 2018, including the notes within Table 3.2 and Appendices E and F; except as provided for in 29.5.14b below. b. All shared private vehicular accesses serving residential units and / or visitor accommodation units in the High Density Residential Zone, Medium Density Residential Zone, and Low Density Residential Zone shall comply with the following standards: … … c. No private way or private vehicle access or shared access in any zone shall serve sites with a potential to accommodate more than 12 units on the site and adjoining sites. d. Private shared vehicle accesses shall have legally enforceable arrangements for maintenance put in place at the time they are created. e. All vehicle access design shall comply with Schedule 29.2. f. The above access width rules do not apply to existing private shared vehicle accessways for the purpose of controlling the number of units that may be built using the accessways, unless the total land served by the accessway could provide for more than 12 units.	Not applicable, as the site is not being subdivided.	N/A
29.5.15 Width and design of vehicle crossings - urban zones a. The following vehicle crossing widths shall apply as measured at the property boundary: … … b. Vehicle crossings in all zones other than in those Rural zones which are regulated by Rule 29.5.16 shall comply with Diagram 2 and with either Diagram 6 or 7 in Schedule 29.2, depending on the activity served by the access, such that: (i) the access crosses the property boundary at an angle of between 45 degrees and 90 degrees; (ii) the vehicle crossing intersects with the carriageway at an angle of 90 degrees plus or minus 15 degrees; (iii) roading drainage shall be continuous across the length of the crossing; (iv) all vehicular accessways adjacent to State Highways shall be sealed from the edge of the carriageway to the property boundary.	N/A.	N/A

Rule	Assessment	Complies?
c. For vehicle crossings in all zones other than in those rural zones which are regulated by Rule 29.5.16, the width of the vehicle crossings at the kerb shall be 1.0m wider than the width at the boundary. d. All vehicle crossings in all zones other than in those rural zones which are regulated by Rule 29.5.16 shall be located at least 500mm from any internal property boundary and from any other vehicle crossing on the same site.		
29.5.16 Design of vehicle crossings – Rural Zone, Rural Residential Zone, Rural Lifestyle Zone, Wakatipu Basin Rural Amenity Zone, and the Wakatipu Basin Lifestyle Precinct Vehicle crossings providing access to a road other than a state highway in the Rural Zone, Rural Residential Zone, Rural Lifestyle Zone, and Wakatipu Basin Rural Amenity Zone, and the Wakatipu Basin Lifestyle Precinct shall comply with Diagram 2 and with either Diagram 8, 9, or 10 of Schedule 29.2, as determined by the following standards: … … Diagram 9 (for 31-100 ecm to a road with less than 10,000 vpd.	Does not comply as seal widening is not proposed opposite the access due to the existing road environment.	No
29.5.17 Maximum Gradient for Vehicle Access a. The maximum gradient for any private way used for vehicle access shall be 1 in 6. b. In residential zones where a private way serves no more than 2 residential units the maximum gradient may be increased to 1 in 5 provided: (i) The average gradient over the full length of the private way does not exceed 1 in 6; and (ii) The maximum gradient is no more than 1 in 6 within 6m of the road boundary; and (iii) The private way is sealed with a non-slip surfacing. For the purpose of this rule gradient (maximum and average) shall be measured on the centreline of the access. c. The vehicle break-over angles shown in Diagram 2 of Schedule 29.2 shall not be exceeded over any part of the width of the vehicle access/crossing.	Complies	Yes
29.5.18 Minimum Sight Distances from Vehicle Access on all roads other than State Highways a. The following minimum sight distances from any access, shall be complied with, as measured from the points shown on Diagram 11 of Schedule 29.2: … … **Requires 250m** b. Proposed and existing landscaping (at maturity) and/ or structures shall be considered when assessing compliance with site distances.	250m visibility is not achieved because of horizontal and vertical alignment of the road	**No**
29.5.19 Minimum Sight Distances from Vehicle Access onto State Highways The following minimum sight distances from any access, shall be complied with, as measured from the points shown on Diagram 11 of Schedule 29.2: … …	Not Applicable	N/A

Rule	Assessment	Complies?
29.5.20 Maximum Number of Vehicle Crossings The following maximum number of crossings shall be complied with:	1 crossing is proposed	Yes
29.5.21 Minimum distance between vehicle crossings onto State Highways a. The minimum distance between any two vehicle crossings onto any State Highway, regardless of the side of the road on which they are located and whether they are single or combined, shall be: (i) 40 metres where the posted speed is equal to or lower than 70 km/h (ii) 100 metres where the posted speed is 80 km/h (iii) 200 metres where the posted speed is 100 km/h.	Not Applicable	N/A
29.5.22 Minimum distances of Vehicle Crossings from Intersections a. No part of any vehicle crossing shall be located closer to the intersection of any roads than the following minimum distances permitted below and as shown in Diagram 12 of Schedule 29.2: b. Roads with a speed limit of less than 70 km/hr: … … c. Roads with a speed limit equal to or greater than 70 km/ hr: … … Collector – 60m d. Except that where the boundaries of the site do not enable a conforming vehicle crossing to be provided, a single vehicle crossing may be constructed provided it is located 0.5m from the internal boundary of the site in the position that most closely complies with the above provisions.	Complies.	Yes
29.5.23 Minimum distances of Vehicle Crossings from Intersections onto State Highways a. No part of any vehicle crossing shall be located closer to the intersection of any state highway than the following minimum distances permitted below and as shown in Diagram 12 of Schedule 29.2: (i) 30 metres where the posted speed is less than 70 km/ h (ii) 100 metres where the posted speed is equal to or greater than 70 km/ h (iii) 200 metres where the posted speed is equal to or greater than 90 km/ h.	Not Applicable	N/A
29.5.24 Service Stations a. All service stations shall comply with the following rules: b. The canopy shall be setback 2m from the road boundary. c. Accessways into Service Stations shall comply with the following minimum separation distances from other driveways. (i) Between driveways for residential activities - 7.5m (ii) Between driveways for other activities - 15m d. The width of any driveway into a Service Station shall comply with the following: (i) One way - 4.5m min and 6.0m max. (ii) Two way: - 6.0m min and 9.0m max.	Not Applicable	N/A

Rule	Assessment	Complies?
e. Any one way entrance or exit shall be signposted as such. f. The road boundary of the site shall be bordered by a nib wall or other device to control traffic flows and to clearly define entrance and exit points. g. Pumps shall be located a minimum of 4.5m from the road boundary and 12m from the midpoint of any vehicle crossing at the road boundary. All vehicles shall be clear of the footpath and accessways when stopped for refuelling. h. A minimum path width of 4.5m and a minimum inside turning radius of at least 7.5m shall be provided for vehicles through the service station forecourt, except that for pumps which are not proposed to be used by heavy vehicles, the minimum path width required is 3.5m. i. Tanker access to bulk tank filling positions shall ensure tankers drive in and out in a forward direction, without the need for manoeuvring either on the site or adjacent roadways. Where this cannot be achieved tankers shall be able to be manoeuvred so they can drive out in a forward direction. j. Tankers discharging shall not obstruct the footpath or any part of the site intended for use by vehicles being served at refuelling positions or waiting for service.		

Attachment 4: SIDRA Reports

MOVEMENT SUMMARY

Site: 101 [Site1 (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Wanaka Mount Aspiring Road														
2	T1	128	0.0	135	0.0	0.076	0.0	LOS A	0.1	0.5	0.04	0.04	0.04	98.1
3	R2	9	0.0	9	0.0	0.076	7.8	LOS A	0.1	0.5	0.04	0.04	0.04	33.9
Approach		137	0.0	144	0.0	0.076	0.6	NA	0.1	0.5	0.04	0.04	0.04	87.3
East: Proposed Access														
4	L2	1	0.0	1	0.0	0.002	0.4	LOS A	0.0	0.0	0.25	0.16	0.25	31.5
6	R2	1	0.0	1	0.0	0.002	1.7	LOS A	0.0	0.0	0.25	0.16	0.25	31.4
Approach		2	0.0	2	0.0	0.002	1.0	LOS A	0.0	0.0	0.25	0.16	0.25	31.4
North: Wanaka Mount Aspiring Road														
7	L2	1	0.0	1	0.0	0.075	7.9	LOS A	0.0	0.0	0.00	0.00	0.00	89.6
8	T1	138	0.0	145	0.0	0.075	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.8
Approach		139	0.0	146	0.0	0.075	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.7
All Vehicles		278	0.0	293	0.0	0.076	0.3	NA	0.1	0.5	0.02	0.03	0.02	91.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Scenario Test (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Wanaka Mount Aspiring Road														
2	T1	156	0.0	164	0.0	0.093	0.1	LOS A	0.1	0.5	0.05	0.04	0.05	98.2
3	R2	9	0.0	9	0.0	0.093	8.4	LOS A	0.1	0.5	0.05	0.04	0.05	33.9
Approach		165	0.0	174	0.0	0.093	0.5	NA	0.1	0.5	0.05	0.04	0.05	89.0
East: Proposed Access														
4	L2	1	0.0	1	0.0	0.002	0.9	LOS A	0.0	0.0	0.37	0.24	0.37	31.4
6	R2	1	0.0	1	0.0	0.002	2.5	LOS A	0.0	0.0	0.37	0.24	0.37	31.3
Approach		2	0.0	2	0.0	0.002	1.7	LOS A	0.0	0.0	0.37	0.24	0.37	31.3
North: Wanaka Mount Aspiring Road														
7	L2	1	0.0	1	0.0	0.150	7.9	LOS A	0.0	0.0	0.00	0.00	0.00	89.6
8	T1	276	0.0	291	0.0	0.150	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		277	0.0	292	0.0	0.150	0.0	NA	0.0	0.0	0.00	0.00	0.00	99.8
All Vehicles		444	0.0	467	0.0	0.150	0.2	NA	0.1	0.5	0.02	0.02	0.02	94.6

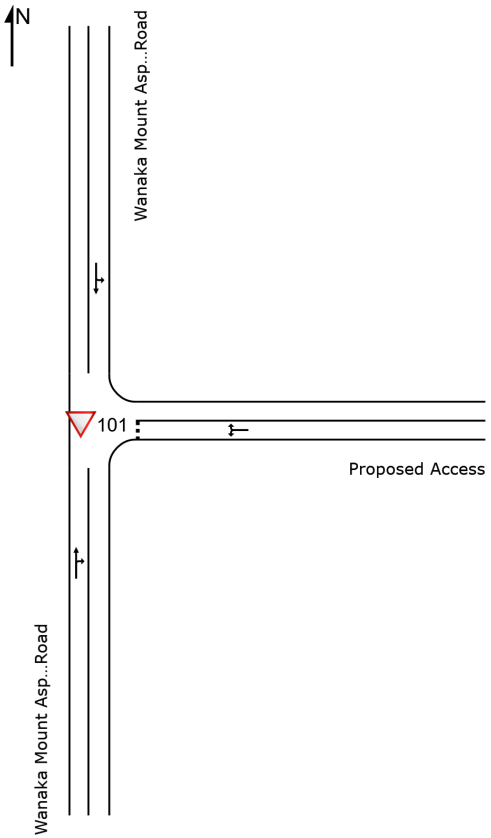
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Site1 (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Geotechnical Report for Resource Consent

Damper Bay Development,

Mount Aspiring Rd, Wanaka

Report prepared for:

John Edmonds & Associates Ltd

Report prepared by:

GeoSolve Limited

Distribution:

John Edmonds & Associates Ltd

GeoSolve Limited (File)

August 2021

GeoSolve Ref: 200393 Rev1

Revision	Issue Date	Purpose	Author	Reviewed
0	22/07/2021	Client issue	MBS/SR	PGF
1	12/08/21	Updated based on client feedback	MBS/SR	PGF

GEOTECHNICAL WATER RESOURCES PAVEMENTS

Table of Contents

1 Introduction

1.1 General

This report presents the results of geotechnical assessment undertaken by GeoSolve Ltd to determine the geological conditions and confirm the suitability of the site for a development at Damper Bay, Wanaka.

Photo 1 - Site photo looking southeast across the site.

This assessment has been completed for John Edmonds & Associates Ltd in accordance with GeoSolve Ltd proposal reference 200393 dated 4 February 2021, which outlines the scope of work and conditions of engagement.

1.2 Development

A layout plan of the proposed development is provided in Appendix A.

Geosolve understand future development will comprise a large main arrival building and numerous smaller accommodation units (guest and owner) with associated structures. An accessway is proposed from Mt Aspiring Rd to the southeast.

The earthworks plan provided by John Edmonds & Associates Ltd indicate that cut earthworks with a total volume of 18,400 m^3 and fill earthworks with a total volume of

18,400 m^3 are proposed. We understand that cut and fill depths are generally up to around 3.5 to 4 m, but that a cut depth of up to approximately 7-8 m are proposed northeast of the Owners Building. The earthworks plan is attached in Appendix F.

1.3 Purpose

The purpose of this report is to confirm the suitability of the area for visitor accommodation development and to support a resource consent application. This report aims to summarise the geotechnical conditions present at the site, including susceptibility to natural hazards (liquefaction, alluvial fan, landslide and rockfall), and provide preliminary engineering recommendations, foundation and/or ground improvement options for detailed design.

A qualitative risk assessment has been undertaken for liquefaction, alluvial fan and landslide hazards, calculating low, moderate or high risk. The risk of rockfall poses the primary natural hazard risk to the site and a quantitative risk assessment has been undertaken for the rockfall hazard which calculates the risk in terms of insignificant, tolerable or intolerable.

2 Site Description

2.1 General

The site is accessed from Mount Aspiring Road to the south and lies approximately 6 km northwest of central Wanaka, as shown below in Figure 1.

Figure 1 – Site location plan (Source: https://qldc.maps.arcgis.com/apps/webappviewer/index.html?id=06e3573625ac4b9f90c45c13651f29c6)

The site currently comprises undeveloped farmland. The ground cover in the location of the proposed building locations comprises grass and farm crops.

Lake Wanaka is located approximately 300 m north of the site and topographically approximately 14-15 m lower. The site is surrounded by undeveloped farmland in all directions. The Wanaka – Mt Aspiring Road is present along the south boundary of the site.

2.2 Topography and Surface Drainage

A site plan with topographic contours is provided in Figure 1, Appendix A. Cross-sections showing site topography is attached in Figures 2a-2i, Appendix A.

Overall, the site topography is generally gently sloping (<5 to 10°) to the north and east towards Lake Wanaka. Hills are present south and east of the proposed building platform locations, with localised rock bluffs sloping up to approximately 70-75° present on the hillsides.

Overland flow paths are present on the site as shown on Figure 1a, Appendix A. Overland flow at the site generally flows from south-southeast to north-northwest, towards Lake Wanaka.

The overland flow paths were dry at the time of the site investigations and inspection indicating they do not flow continuously and are ephemeral in behaviour.

3 Geotechnical Investigations

An engineering geological site assessment has been undertaken with confirmatory subsurface investigations. GeoSolve visited the subject site on the 3rd, 5th and 19th to 21st of May 2021, undertaking geotechnical investigations comprising:

- 14 test pits (TP 1-14) which were advanced to a maximum depth of 3.9 m;
- Scala penetrometer testing at each of the test pit locations;
- 2 Dynamic Probe (Heavy) tests (DPH 1-2) to a maximum depth of 8.3 m to assess liquefaction potential and relative density of the subsoils;
- 3 soakage tests (SP 1-3) to assess stormwater soakage permeability.

Test pit and soak pit locations and logs are contained in Appendix A and B respectively.

DPH locations and logs are contained in Appendix A and C respectively.

Results from the soakage testing are presented in Appendix D.

4 Subsurface Conditions

4.1 Geological Setting

The site is located in the Wanaka Basin, a valley feature formed predominately by glacial advances. Published references indicate last glacial advance occurred in the region about 18,000 years ago.

The glaciations have left glacial deposits comprising glacial till, and outwash gravel over ice-scoured schist bedrock. Post-glacial times have been dominated by erosion of the bedrock by local watercourses and deposition of alluvial fan deposits. Rockslides and rock-falls have also occurred on steep slopes. Lacustrine sediments were deposited in Lake Wanaka and beach gravel around the shoreline as post-glacial lake levels fell.

The Motutapu Fault, the NW Cardrona Fault and the Cardrona-Hawea Fault are considered active. The trace of the Motutapu Fault lies approximately 2.5-3 km west of the site. The trace of the NW Cardrona Fault and the Cardrona-Hawea Fault lies approximately 2-7 km east of the site. However, due to the estimated recurrence intervals of >5,000 to ≤10,000 for the Motutapu Fault and the NW Cardrona Fault, and >20,000 years for the Cardrona-Hawea Fault, the risk posed by these seismic features is considered relatively low.

The Alpine Fault which is located along the west coast of the South Island is likely to present a more significant seismic risk in the short term. There is a high probability that an earthquake of Magnitude 8 or greater will occur along the Alpine Fault within the next 50 years. This will result in very strong ground shaking in the Wanaka region.

4.2 Stratigraphy

A geological model has been produced based on observations during site investigations. The model is presented in Figures 2a-2i, Appendix A.

The geological stratigraphy at the site generally comprises:

- 0.2 to 0.4 m of **topsoil**, overlying;
- 0.2 to 0.4 m of localised **colluvium**, overlying;
- 0.2 to 3.3+ m of interbedded **alluvial silt, sand and gravel deposit**, overlying;
- 1.3 to 3.4 m of **lake sediment,** overlying;
- 1.3 m + of **outwash gravel** (TP 7 and 11 only), overlying;
- **Schist bedrock** (TP 12 only).

Topsoil was observed at the surface of all test pits and soakage pits to depths of between 0.2 and 0.3 m.

Colluvium was observed beneath the topsoil in TP 2-5, 7 and 11-12 to depths of between 0.4 and 0.7 m. The colluvium comprises firm to stiff, sandy SILT to sandy gravelly SILT with occasional cobbles and boulders, and loose to medium dense, sandy silty GRAVEL with minor boulders to sandy GRAVEL with cobbles.

Alluvial deposit was observed beneath the topsoil and colluvium in all test pits and soakage pits except from TP 7 to depths of between 0.5 and 3.8+ m. The alluvial deposit comprises interbedded alluvial silt, sand and gravel.

- The **alluvial silt** comprises firm, SILT with minor sand to sandy SILT with occasional gravel.
- The **alluvial sand** comprises loose to medium dense, SAND with a trace of silt to gravelly SAND.
- The **alluvial gravel** comprises loose to medium dense to dense, sandy GRAVEL with occasional boulders to silty sandy GRAVEL with minor cobbles, medium dense, GRAVEL with some silt and sand and dense, GRAVEL with boulders.

The base of the alluvial gravel deposit was not intercepted in TP 2 and 4, which extended to depths of 3.8 and 3.4 m respectively.

Lake sediment was observed at the base of TP 1, 3, 5-11 and 13-14 from depths of between 0.5 and 2.1 m. The lake sediment comprises loose to medium dense, SAND with occasional gravel and firm to stiff, SILT with minor sand to sandy SILT with occasional gravel, cobbles and boulders. The base of the lake sediment was not observed in TP 1, 3, 5-6, 8-10 and 13-14, however it is inferred from DPH data that lake sediment extend to approximately 6.5 to 6.8 m depth beneath the site in the vicinity of the DPH tests.

Outwash gravel was observed at the base of TP 7 and 11, from depths of 3.0 and 2.1 m respectively. The outwash gravel comprises medium dense to dense, sandy GRAVEL and silty sandy GRAVEL. The base of the outwash gravel was not intercepted in TP 7 and 11, which extended to 3.1 and 3.4 m depth. The base of the outwash gravels was inferred not to have been intercepted by the DPH tests.

Schist bedrock was observed at the base of TP 12 and outcrops at the surface in various locations across the site, as seen in Figure 1, Appendix A. The schist bedrock comprises moderately strong, psammitic SCHIST. The foliation was observed to dip 20-30° towards the southeast (130-160°).

Detailed geological descriptions of the soils are provided in the test pit logs contained in Appendix B.

4.3 Groundwater

Seepage was observed within TP 2 at 3.3 m depth and groundwater was within DPH 1 and 2 at 2.7 and 3.2 m depth respectively. No groundwater or seepage was observed within the other test pits.

The water levels above are inferred to be perched groundwater in vicinity of the overland flow paths shown in Figure 1, Appendix A. The overland flow paths are in the vicinity of the Arrival Building and Guest Building 2. The regional groundwater table is expected to lie at depth beneath the site, close to the level of Lake Wanaka.

Groundwater seepages will be subject to seasonal variations in response to rainfall and snow melt. Perched groundwater may develop on the contact between the schist bedrock and overlying soil materials during times of high rainfall. Groundwater issues are discussed in Section 9.8 below.

5 Liquefaction Analysis

5.1 Introduction

A liquefaction assessment has been undertaken using test pit and heavy dynamic probe (DPH) data.

We note that the liquefaction analysis has been undertaken based on DPH 1 and DPH 2, which was undertaken adjacent to the Arrival Building and Guest Building 1 and in the vicinity of Guest Building 2. As seen on Cross Section D (Figure 2d, Appendix A) schist bedrock is exposed in the western half and eastern edge of the Owners Building. Schist bedrock is also inferred at shallow depths beneath the Meditation Room. Nil to very little liquefaction is therefore predicted for the Owners Building and Meditation Room.

We also note that Schist Bedrock is exposed along the western edge of Guest Building 2, as seen on Cross-Section F. No liquefaction potential is expected for the western edge of this building.

The liquefaction analysis presented below is applicable for the Arrival Building, Guest Building 1 and the areas of Guest Building 2 not founded on schist bedrock.

5.2 Earthquake Scenarios

In accordance with NZS1170 – Structural Design Actions[1], the following two earthquake scenarios were considered based on a building with Importance Level 2 with a 50-year design life.

These scenarios represent the following design performance requirements:

- Serviceability Limit State (SLS) – to avoid damage that would prevent the structure from being used as originally intended, without repair, and;
- Ultimate Limit State (ULS) – to avoid collapse of the structural system.

In terms of NZS 1170, Class C subsoil conditions (shallow soil site) were assumed to underlie the site.

The methods presented within the NZTA Bridge Manual (2014)[2] have been adopted for deriving the site peak ground accelerations (PGA) as they use unweighted seismic hazard factors and corresponding (effective) earthquake magnitudes that are better suited to be used in the assessment of liquefaction.

[1]NZS1170-5 (2004) Structural Design Actions, Part 5: Earthquake Actions – New Zealand.
[2] NZTA Bridge Manual, Third Addition, Amendment 2, Effective from May 2016 (Manual Number SP/M/022).

Table 5.1 below provides a summary of the annual exceedance probability, effective magnitude and PGA adopted for each seismic case analysed in the liquefaction assessment

Scenario	Performance Requirements	Annual Probability of Exceedance	Peak Horizontal Ground Acceleration (PGA)	Effective Magnitude
Serviceability Limit State (SLS)	*Avoid damage that would prevent the structure being used as originally intended without repair*	1/25	0.10 g	6.1
Ultimate Limit State (ULS)	*Avoid collapse of the structural system*	1/500	0.41 g	6.2

5.3 Liquefaction Assessment

5.3.1 General

Liquefaction occurs when susceptible, saturated soils attempt to move to a denser state under cyclic shearing. In this report, liquefaction is defined as pore pressures rising to reach the overburden stress. When this occurs, the following effects can happen at flat sites:

- Loss of strength;
- Ejection of material under pressure to the ground surface (i.e. surface disruptions), and;
- Post-liquefaction volumetric densification as the materials reconsolidate.

In addition, sloping sites or sites with a 'free face' may experience lateral spreading or movement.

The occurrence of liquefaction is dependent on several factors, including the intensity and duration of ground shaking, soil density, particle size distribution, and elevation of the groundwater table.

5.3.2 DPH Analysis

Analyses has been completed to evaluate the liquefaction potential of the loose sands and low plasticity silts interpreted from the DPH data, utilising the methods recommended by Idriss & Boulanger[3]. This method uses information obtained from soil logging and in situ testing, such as soil type, fines content, layer thicknesses, and blow count.

In order to use DPH results in the above analysis, they first need to be corrected to give equivalent standard penetration test (SPT) "N" values. This procedure uses the energy per blow from a DPH blow and compares it to the energy per blow from a standard SPT

[3] Idriss, I.M. & Boulanger, R.W. (2014). *Soil liquefaction during earthquakes*, MNO–12, Earthquake Engineering Research Institute, 242p

hammer. A correction is also made to take account of rod friction in the DPH results using the torque measurements taken during the test.

As no samples are recovered with the DPH, it has been assumed that all soils below the termination depth of the test pits are of a composition that is potentially liquefiable. This is considered to be a realistic assumption based on the site geology (see Sections 4.1 and 4.2 and test pit and DPH logs in Appendix B and C respectively).

Water levels adopted for each DPH analysis were based on the actual water level measured in each DPH hole, as presented in Appendix C.

Seepage was observed within TP 2 at 3.3 m depth and groundwater was within DPH 1 and 2 at 2.7 and 3.2 m depth respectively. As discussed in Section 4.3, this seepage is inferred to be a perched level in the vicinity of the overland flow paths shown in Figure 1a, Appendix A. No groundwater or seepage was observed within the other test pits.

The liquefaction analysis indicates the following:

- No liquefaction is predicted for the SLS design earthquake;
- Moderate liquefaction is predicted for the ULS design earthquake.
- Liquefaction at the site is "triggered" at a PGA of around 0.15g which has an annual probability of exceedance of around 1/50.

A summary of the factors considered to assess the consequences of the predicted liquefaction is presented in Table 5.2 below.

Table 5.2 – Summary of factors considered to assess the consequences of the predicted liquefaction

Factor	Assessment		Implications
Crust thickness	The crust thickness is approximately 2.7 m for DPH 1 and 3.2 m for DPH2. Data from the Canterbury earthquake sequence plus other historic earthquakes[4] has been collated and observed surface damage compared with crust thickness. This data indicates that surface damage is likely for crusts of less than about 3.5 m thickness.		Crust not sufficiently thick to limit surface damage in a ULS seismic event.
LSN	1/500 AEP (ULS) 1/25 AEP (SLS)	LSN range = 11-25 LSN range = 0	Minor to moderate surface expression of liquefaction, with sand boils and some structural damage.
Free field settlement	1/500 AEP (ULS) 1/25 AEP (SLS)	50-115 mm Limited settlement	Some differential settlement is likely for the Arrival Building and Guest Building 1, 30-60mm estimated in the area tested. Greater differential settlements likely for Guest Building 2, as Schist Bedrock is exposed along the western edge and potentially liquefiable soils

[4] Bowen, H.J. and Jacka, M.E. (2013). Liquefaction induced ground damage in the Canterbury Earthquake: Predictions versus reality. Proceedings of the 19th NZGS Geotechnical Symposium. Editor CY Chin. Queenstown, New Zealand.

			beneath all other parts of the building. Up to 115 mm estimated. Differential settlements also likely between areas of deeper engineered fill and alluvial depots/lake sediment. This will need to be considered during the detailed design of the foundation system.
Lateral spread	The site is located approximately 300 m from Lake Wakatipu and the topography between the site and Lake Wakatipu is gently sloping. The overland flow path that runs through the site was dry at the time of our site investigations. The risk of lateral spread is expected to be low due to the unsaturated crust of about 2.7-3.2 m and the shallow gradient and distance towards Lake Wakatipu.		Lateral spreading will not govern design.

A detailed discussion of the process of liquefaction and the various considerations summarised in Table 5.2 above can be found in Appendix C, which also contains the full liquefaction analysis results from the DPHs.

Based on the subsurface investigations undertaken for the purposes of this report for the subject site and the estimated liquefaction settlements, the foundations for the Arrival Building, Guest Building 1 and Guest Building 2 would likely be classified as foundation Technical Category 2 (TC2), as defined by the MBIE Guidance (2012).

We note that the liquefaction analysis above is based on the site conditions prior to earthworks being undertaken. Liquefaction potential may change following earthworks and should therefore be reviewed at the detailed design stage.

A preliminary review of the earthworks plans provided to GeoSolve indicates relatively minor cut and fill earthworks are proposed beneath the front (north) part of the buildings, and more significant cut and fill depths beneath the back (south) part of the buildings. No significant variation from the liquefaction potential outlined above is therefore expected for the front of the buildings, however the liquefaction potential for areas along the back of the buildings where up to 3.5 m of engineered fill is proposed will likely result in reducing the risk of liquefaction affecting the building.

6 Rock Fall Assessment

6.1 General

An assessment has been undertaken by GeoSolve to quantify the rockfall hazard. Three methods have been undertaken and are described below, geomorphological mapping, shadow angle and RAMMS (Rapid Mass Movement Simulation) software modelling.

Field mapping has been conducted to determine the extent of existing rock fall debris and locate potential rock fall source areas from both inside and outside the site. A rock fall analysis has been undertaken to determine the potential for rock fall to affect the site. The locations of the rock bluff source areas are shown in Figure 1a, Appendix A.

6.2 Rock Fall Risk to the Site from External Sources.

Beyond the subject site, Point 1196 lies approximately 1600 m to the west of the proposed development, upslope of the Wanaka-Mount Aspiring Road and at the end of the ridgeline that connects to Roys Peak. Point 1196 comprises steeply to moderately north facing slopes that fall down towards Wanaka - Mt Aspiring road and the site. Schist bedrock bluffs are present at the crest of these slopes and are considered to be source area for rockfall, with the approximate location of mapped rockfall boulders from these source areas shown in Figure 1b, Appendix A. The schist bluffs are likely to be part of the headscarp feature of a historic schist debris landslide.

The risk to the development from the point 1196 rockfall source areas is considered to be very low to nil for the following reasons.

- The formation of the Wanaka-Mount Aspiring Road has created an informal catch bench for any future rockfall from the above-mentioned source areas.
- The proposed development is also topographically protected by existing elevated schist outcrops between the development and Wanaka – Mt Aspiring Road.
- The alluvial fan surface downslope of the Wanaka-Mount Aspiring Road is sloping northwest towards Lake Wanaka and away from the proposed development.
- Mapped rock fall boulders do not extend as far as the development area.

Based on this assessment no mitigation of this hazard is considered necessary. The main geomorphological features are shown in Figure 1b, Appendix A.

The rockfall risk within the proposed development is explained below.

6.3 Rock Fall Risk from within the Development

A summary of the key geological mapping observations with respect to rock fall within the site are presented below.

- Schist bedrock outcrops of varying heights (2-10m+ high) are present above the development and are considered to be source areas for rockfall, see Figure 1a, Appendix A;
- Block instability resulting from the interaction between joint sets has been observed within the rockfall source areas and is considered possible in the future.

- General fretting/spalling of small individual rock debris (0.3 m diameter) occurs on a regular basis from the bluffs during typical daily conditions;
- Mapped fallen boulders from the source area bluffs typically ranged in size from 0.5-1.5m³ in volume and are elongated to tabular in shape.
- Four main rockfall source areas are present for the subject site, for the purposes of this report they have been labelled Source Area One to Four.
- The indicative locations of the mapped rockfall boulders are shown in Figure 1a, Appendix A.

Photograph 1: Photo of rock fall source area one, two and three (looking south). A tabular rock fall boulder is shown in the foreground.

Photograph 2: Photo of rock fall source area four (looking south east), located behind the owners building.

6.4 Shadow Angle

Determining the shadow angle footprint provides an empirical method to assess the expected downslope limit of rock fall runout[5]. The shadow angle, the angle of a straight line between the highest point of the talus slope and stopping point of the longest runout boulder for a given rockfall, has been assessed for this site. A minimum shadow angle of 21° is recommended in the literature.

The 21° shadow angle for Source Area 1-3 is located approximately 40 m upslope of the proposed buildings.

The 21° shadow angle for Source Area 4 is located approximate at the location of the proposed building (owners building).

This method indicates the site is very unlikely to be affected by rock roll from Source Area 1-3. This method also shows that there may be a low risk of the proposed building being affected by rock roll for Source Area 4. These findings are in agreement with field observations.

[5] Massey et al. 2014. Determining rockfall risk in Christchurch using rockfalls triggered by the 2010 – 2011 Canterbury earthquake sequence. Earthquake Spectra. 30(1):155-181.doi:10.1193/021413eqs026m.

6.5 3D Rockfall Analysis:

A 3-Dimensional rock fall analysis has been undertaken using RAMMS. RAMMS uses numerical models to simulate natural rock falls and considers the influence of the actual environment, underlying geology, topographic features and vegetation.

The analysis has been run for each rockfall source area location, Source Area 1-4 inclusive.

The 95th percentile boulder can be difficult to estimate given the limited boulder data set on the site. The guidance document "MBIE Design considerations for Passive Protection Structures, October 2016" suggests, where there is evidence of rock fall on the slope, either new or historic, then selecting the largest of the most common boulders would be appropriate. For the purposes of this assessment a boulder with a volume of 4.4 m^3, elongated to tabular in shape has been chosen to represent the size of the 95th percentile boulder.

The rock fall hazard assessment assumes no vegetation is present. It is often difficult to predict the influence of vegetation on rock fall runout, bounce heights and energies. Therefore, a more conservative, vegetation free approach has been taken. This approach also allows for future unplanned removal of the vegetation, e.g. by fire.

6.5.1 Results- Source Area 1-3:

The results of the 3D modelling show that 0 (0%) rock fall trajectories modelled passed through the eastern edge of the proposed building platform for Source Areas 1, 2 & 3, shown in Figures 6.1, 6.2 & 6.3 respectively.

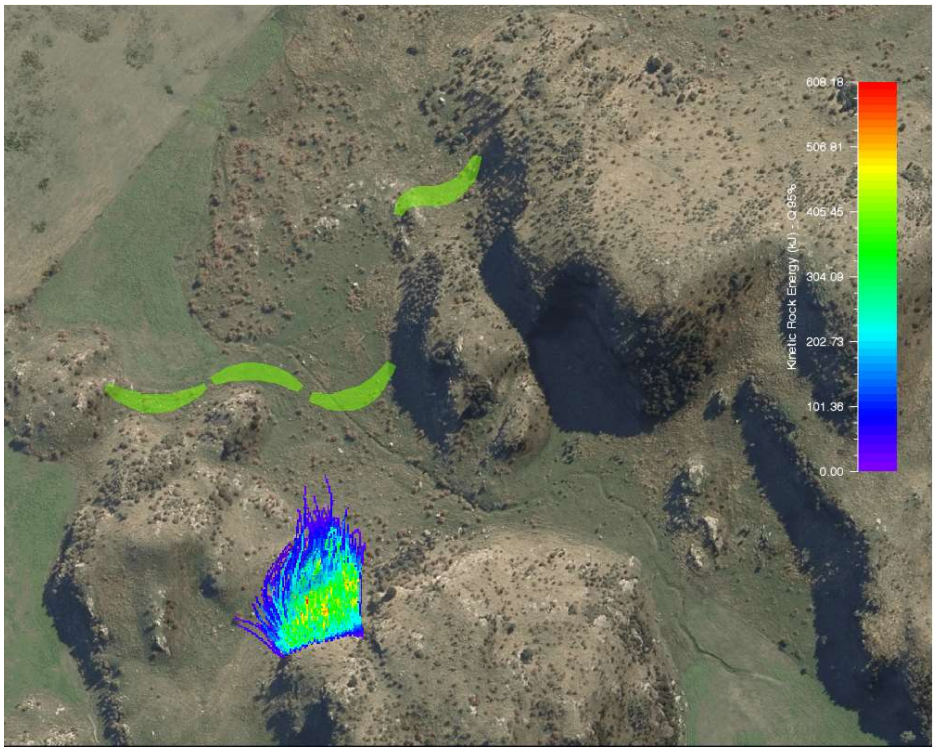


Figure 6.1 - Modelled rock fall kinetic energy of simulation results from Source Area One (proposed building platforms shown in green).

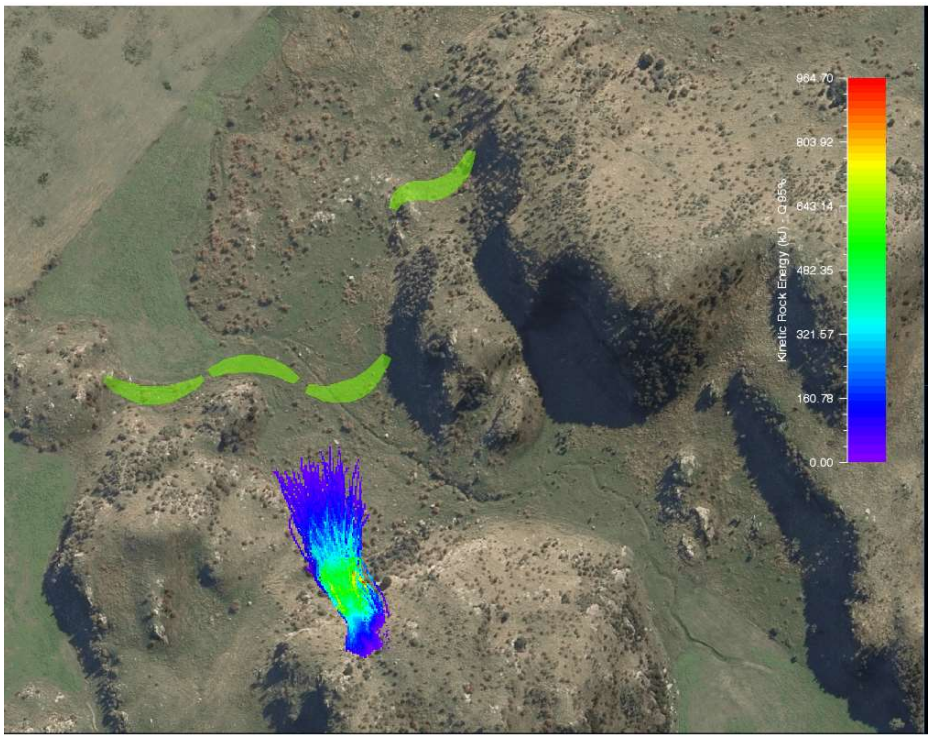


Figure 6.2 - Modelled rock fall kinetic energy of simulation results from Source Area Two (proposed building platforms shown in green).

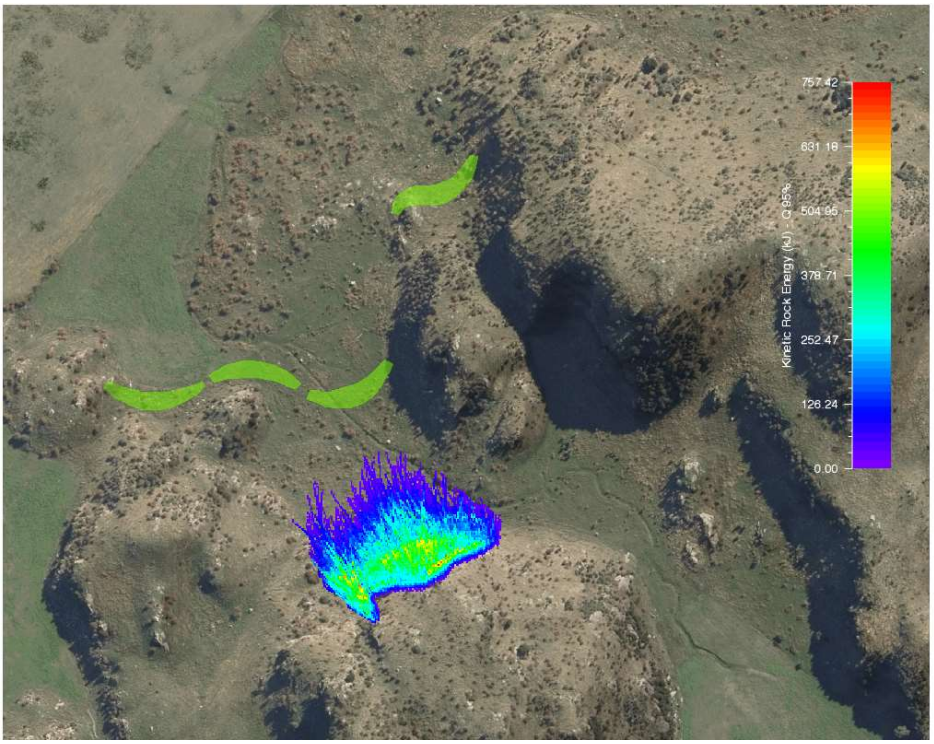


Figure 6.3 - Modelled rock fall kinetic energy of simulation results from Source Area Three (proposed building platforms shown in green).

6.5.2 Results- Source Area 4:

The results of the 3D modelling show that out of a total number of 1,776 rock fall trajectories modelled, 163 (9.18%) passed through the eastern edge of the proposed building platform, Figure 6.4. Preferred boulder paths are shown in Figure 6.4. A quantitative risk assessment has been conducted and is discussed below.

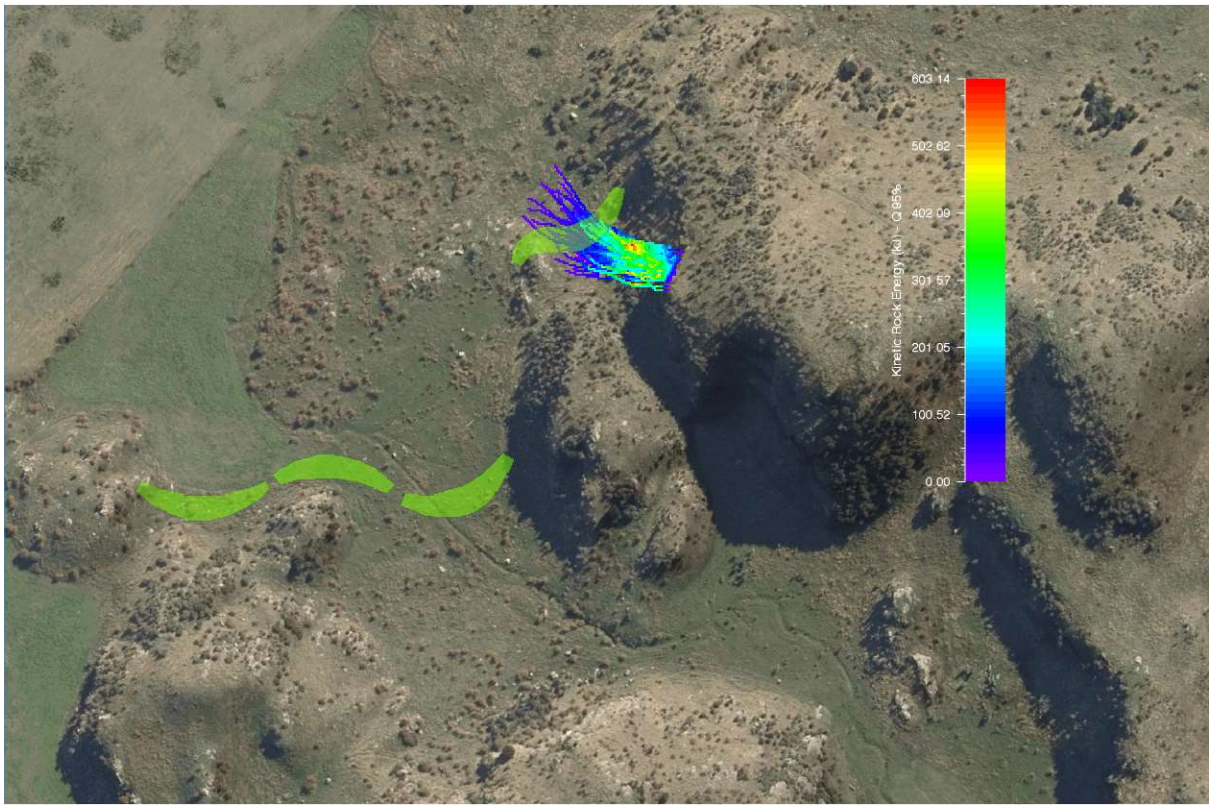


Figure 6.4 - Modelled rock fall kinetic energy of simulation results from Source Area Four (building platform shown in green).

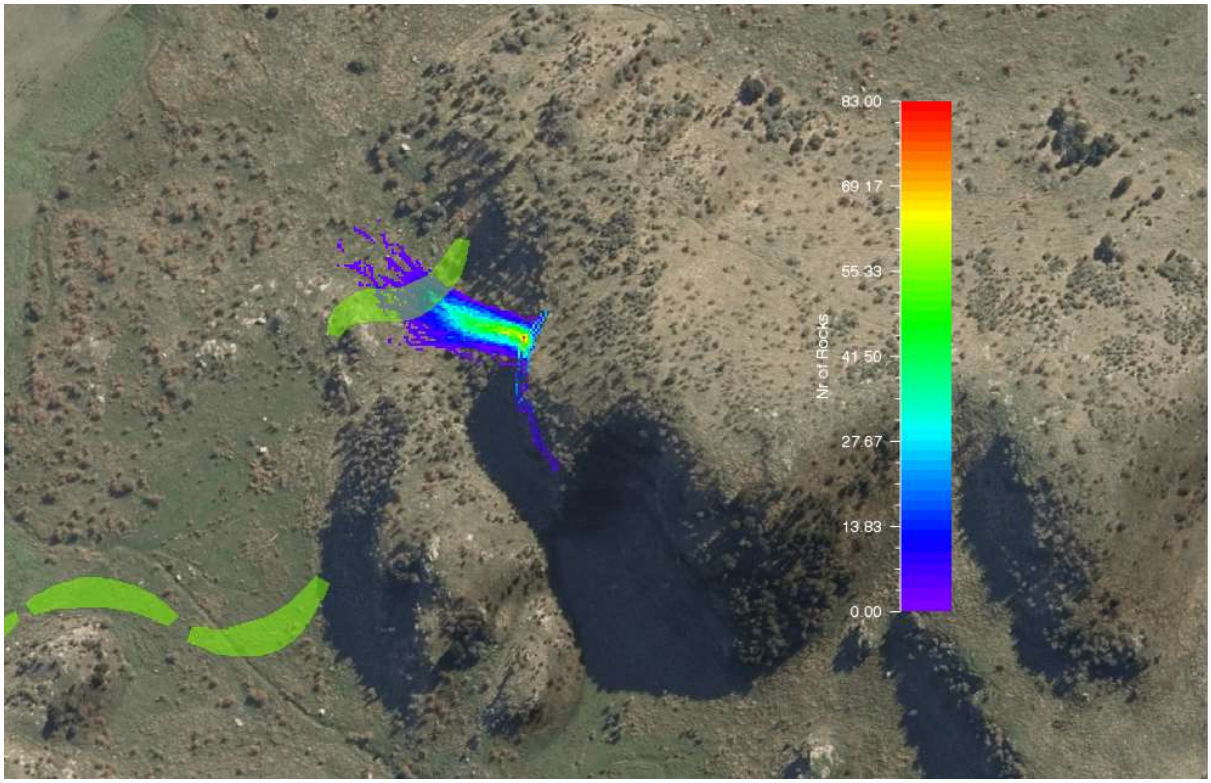


Figure 6.5: Modelled rock fall trajectories. Preferred boulder paths are indicated by higher number of rocks passing through a particular point on the slope for Source Area Four.

6.6 Quantitative Rock Fall Risk Assessment

6.6.1 General

Field mapping has concluded that rockfall has the potential to enter the site and 3D modelling indicates a small number of rockfall trajectories have the potential to pass through the eastern edge of the proposed Owners Building, as shown on Figure 6.4 & 6.5 for Source Area Four. For source areas 1, 2 and 3, mapping and modelling indicates it is very unlikely rock fall will reach the buildings beneath.

This section presents the results of a quantitative assessment to clarify the risk of rock fall to people in a buildings beneath the source areas:

- Calculation of the probability of an individual rock fall affecting the building, and the associated risk to the person who will spend most time there, i.e. the “person most at risk”.
- Calculation of the probability of a large rock fall from a seismic event affecting the building, and the associated risk to the “person most at risk”.
- To place the risk in context comparisons to guidelines, and other causes of fatality, are provided.

Estimates of the Annual Individual Fatality Risk (AIFR) are provided below. The method for the risk assessment of rockslide instability used for this report generally follows the approach used for assessing the annual probability loss of life (death) of an individual from

rockfalls[6] and cliff collapse[7] of the Port Hills, this approach was adapted from AGS 2007[8]. This method is understood to be applicable for risk assessment of rockslide instability for a visitor accommodation development.

6.6.2 Assumptions and inputs:

- Conservatively, 1 rock fall per 25-year period has been adopted, an annual probability of occurrence of 0.04.
- The probability of a seismic event (alpine fault rupture) is inferred to be certain in the next 50 years (0.02 or 2%).
- The probability of a boulder being dislodged during a seismic event is inferred to be 100%.
- RAMMS rockfall data has been used to calculate the probability of spatial impact (i.e. the likelihood that rockfall will reach the site).
- For Source Area One, Two & Three; 0 simulated rock falls passed through the eastern site boundary of the proposed buildings. The number of simulated rockfall trajectories ranged between 2540-5160. To enable the risk assessment; 1 boulder out of the minimum 2540 simulated rockfall has been conservatively adopted for the spatial impact probability (0.00394 or 0.03%).
- For Source Area Four; Out of 1776 simulated rock falls, 163 passed through the eastern site boundary of the Owners Building. A spatial impact input probability of (0.0918 or 9.2%). has been adopted
- For Source Area One, Two & Three- The length of each proposed building is approximately 70 m. The estimated design boulder is approximately 2m in diameter. Therefore, the spatial impact probability is 0.0000112 or 0.001% for the proposed buildings.
- For Source Area Four- The length of the eastern edge of the proposed site boundary facing the rockfall source areas, where modelled rockfall has passed through, is approximately 40 m. The estimated design boulder is approximately 2m in diameter. Therefore, the spatial impact probability is 0.00459 or 0.459% for the owners building.
- The proposed platforms are located at a distal extent of rock fall, the velocity of the moving rock fall as it intercepts the dwelling will be low.
- Any future dwelling will offer some protection and a vulnerability of 0.05 has been adopted for an individual present in the rock fall path for Source Area One, Two & Three (AGS 2007c, Practice Note for Landslide Risk Management, Appendix F).

[6] Massey, C. I., et al. "Canterbury earthquakes 2010/11 Port Hills slope stability: life-safety risk from rockfalls (boulder rolls) in the Port Hills." *GNS Science Consultancy Report* 123 (2012): 34

[7] Massey, C. I., et al. "Canterbury Earthquakes 2010/11 Port Hills Slope Stability: Pilot study for assessing life-safety risk from cliff collapse." *GNS Science Consultancy Report* 57 (2012)

[8] Australian Geomechanics Society, Volume 42, No. 1 March 2007.

- A vulnerability of 0.2 has been adopted for an individual present in the rock fall path for Source Area Four. This is considered conservative given the low energies the location at the distal end of the fan, and the person most at risk being inside the building.
- Conservatively, an occupancy rate of 80% or 0.8 has been assumed within the proposed building.

6.6.3 Results

Based on the assumptions outlined above, the following AIFR result has been calculated;

- An AIFR for Source Area One, Two & Three of **2.69 x 10-8 is calculated.**
- A combined total AIFR for the Arrival Building & Guest Building of **8.06 x 10-8 is calculated**.
- An AIFR for Source Area Four on the Owners Building of **4.40 x 10-5 is calculated.**

The results are also presented in Appendix E.

6.6.4 Guidelines and Risk Comparisons:

Tolerable and acceptable risk from a natural hazard is a complex subject with much research and debate published. Geosolve cannot prescribe a level of tolerable risk for the site. This decision must be made by the relevant stakeholders and the regulating body. Acceptable and tolerable risks are described as follows:

- Tolerable Risks are risks within a range that society can live with so as to secure certain benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if practicable.
- Acceptable Risks are risks which everyone affected is prepared to accept. Action to further reduce such risk is usually not required unless reasonably practicable measures are available at low cost in terms of money, time and effort.

Guidance on acceptability criteria are presented in the Australian Geomechanics Society (AGS) 2007 document on Landside Risk Management. This document provides guidelines only and do not necessarily need to be adopted. AGS recommendations in relation to tolerable risk for loss of life are summarised in Table 6.1 below.

Table 6.1 AGS suggested tolerable loss of life for individual risk.

Situation	Suggested Tolerable Loss of Life Risk for the person most at risk
Existing Slope (1) / Existing Development (2)	10^{-4} / annum
New Constructed Slope (3) / New Development (4) / Existing Landslide (5)	10^{-5} / annum

Examples of acceptable and tolerable risk from a number of organisations and development scenarios are provided in Table 6.2 below. The AIFR risk calculated for the site is lower than all residential cases shown. To put the AIFR into perspective it is helpful

to compare it with other familiar causes of Fatality. Figure 6.6 below shows the risk of fatality from a number of causes.

Table 6.2: Example individual loss of life tolerable and acceptable risk from various organisations

Organisation	Industry	Description	Risk/annum	Reference
Health and Safety Executive, United Kingdom	Land use planning around industries	Broadly acceptable risk. Tolerable limit	10^{-6}/annum, public and workers 10^{-4}/annum public[1] 10^{-3}/annum workers	HSE (2001)
Netherlands Ministry of Housing	Land use planning for industries	Tolerable limit [2]	10^{-5}/annum, existing installation 10^{-6}/annum, proposed installation	Netherlands Ministry of housing (1989), Ale (2001), Vrijling *et al.* (1998)
Department of Urban Affairs and Planning, NSW, Australia	Land use planning for hazardous industries	"acceptable" (tolerable) limits [2]	$5x10^{-7}$/annum hospitals, schools, childcare facilities, old age housing 10^{-6}/annum residential, hotels, motels $5x10^{-6}$/annum commercial developments 10^{-5}/annum sporting complexes	
Australian National Committee on Large Dams	Dams	Tolerable limit	10^{-4}/annum existing dam, public most at risk subject to ALARP 10^{-5}/annum new dam or major augmentation, public most at risk, subject to ALARP.	ANCOLD (2003)
Australian Geomechanics Society guidelines for landslide risk management	Landslides (from engineered and natural slopes)	Suggested tolerable limit	10^{-4}/annum public most at risk, existing slope 10^{-5}/annum, public most at risk, new slope	AGS (2000)
Hong Kong Special Administrative Region Government	Landslides from natural slopes	Tolerable limit	10^{-4}/annum public most at risk, existing slope. 10^{-5}/annum public most at risk, new slope	Ho et al. (2000), ERM (1998), Reeves *et al.* (1999)
Iceland ministry for the environment hazard zoning	Avalanches and landslides	"acceptable" (tolerable) limit	$3x10^{-5}$/annum residential, schools, day care centres, hospitals, community centres. 10^{-4}/annum commercial buildings $5x10^{-5}$ recreational homes[3]	Iceland Ministry for the environment (2000), Arnalds *et al.* (2002)
Roads and Traffic Authority, NSW Australia	Highway landslide risk	Implied tolerable risk	10^{-3}/annum[4]	Stewart *et al.* (2002), RTA (2001)

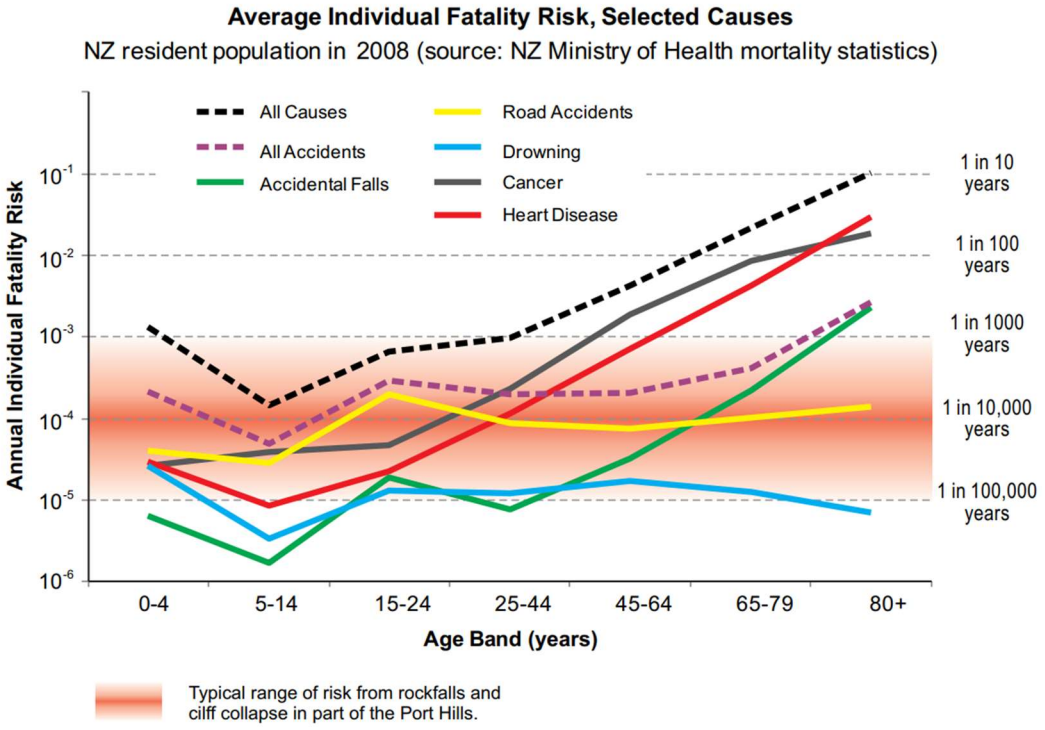


Figure 6.6 – Showing the average individual fatality risk from multiple causes (source: GNS)

6.6.5 Summary

3D RAMMS modelling shows that very low to no modelled rock falls trajectories will enter the eastern edge of the proposed building location from Source Area One, Two & Three, this modelling is in agreement with the field mapping and shadow angle assessment. All 3 methods indicate the likelihood of rock fall reaching the proposed building is very low from these bluffs.

3D RAMMS modelling shows that a low number of modelled rock falls trajectories enter the eastern edge of the proposed building platform from Source Area Four, this modelling is in agreement with the field mapping and shadow angle assessment.

A quantitative risk assessment has been undertaken to clarify the level of risk from rock fall. The calculated risk values for Source Area 1, 2 & 3 are below the guidelines provided in AGS 2007 and are inferred to be tolerable.

For Source Area 4, above the owners accommodation building, we consider there is an intolerable risk from rock fall during the lifetime of the structure. We therefore recommend that scaling and isolated block removal be undertaken prior to construction. Removal of failure prone rock will also reduce the AIFR value for Source Area 4 to a tolerable level as outlined in the guidelines provided in AGS 2007. Assessment indicates values will fall approximately 1 order magnitude to the mid 10^{-6} area.

GeoSolve cannot prescribe a level of tolerable risk for the site. This decision must be made by the relevant stakeholders and the regulating body. If the level of risk is determined to be unacceptable by the relevant stakeholders a passive protection rockfall mitigation measure (bund or fence) would be readily achievable and sufficient to mitigate the rock fall hazard. Alternatively, scaling of the rockfall hazard could be undertaken readily.

7 Alluvial Fan

The northern part of the proposed development is located within an alluvial fan area hazard mapped by QLDC as ‘‘active, floodwater-dominated’ on regional scale mapping, as shown in Figure 1b. Therefore, site-specific assessment is appropriate.

The geomorphology of the mapped alluvial fan hazard catchment was closely examined on aerial photographs and in the field as far as practicable. Geomorphological site observations are presented in Figure 1b, Appendix A. The principal observations are summarised as follows:

- The catchment of the alluvial fan hazard is inferred to be the steeply to moderately north facing slopes of Point 1196.
- A central channel on these slopes appears to drain the majority of the catchment.
- The catchment slopes are located on an existing historic schist debris landslide. Incision of this landslide feature is minimal suggesting relatively low volume flows/limited ability to mobilise debris during high rainfall events.
- The topographic apex of this fan feature, from the main overland flow channel, is located approximately 500 metres upslope of the proposed development. Overland flow from this area is likely to radiate out from this point.
- The formation of the Wanaka-Mount Aspiring Road has created a catch bench for any future upslope debris or overland flow. A topographic high point on this road will serve as a dividing point for any future flow, moving in either a north-west or south-east direction.
- The proposed development is also topographically protected by existing elevated schist outcrops from the alluvial fan hazard. The alluvial fan surface downslope of the Wanaka-Mount Aspiring Road is sloping northwest towards Lake Wanaka and away from the proposed development.
- No other debris source areas were identified downslope of the Wanaka-Mount Aspiring Road within the catchment for the mapped alluvial fan hazard and given the relatively shallow slope angles beyond the road, overland flows would be water dominated not debris.
- The site was generally lacking any features that would suggest recent alluvial fan activity.
- A well-established topsoil cover is present.

Based on the above observation the alluvial fan hazard to the site is considered to be very low to nil and no mitigation or further assessment is considered necessary for alluvial fan activity.

8 Landslide

A QLDC mapped non-verified landslide feature is located within the north facing catchment slopes of Point 1196, as shown on Figure 1a, Appendix A. This is sourced from IGNS QMAP 1:50,000 Compilation Sheets.

We understand that the mapping of the landslide feature at the site is based on a broad-brush aerial photography assessment. Detailed geomorphological field mapping and an aerial photography analysis has been conducted as part of the hazard assessment for the subject site.

These features are located in excess of 250 m to the south-west of the proposed development. No deep seated, recent or active slope instability was observed by GeoSolve during the site walkover in the vicinity of the south-western site boundary. Given the absence of subsurface landslide debris material and the lack of geomorphological evidence for movement, it is expected that the area of the proposed development has not been affected by slope instability.

Given the proximity of this feature from the subject site and relatively low angle topography along this distance, there is a nil to extremely low risk from the mapped landslide feature adversely affecting the stability of the proposed development. No further assessment is considered necessary with respect to this hazard.

9 Engineering Considerations

9.1 General

The recommendations and opinions contained in this report are based upon ground investigation data obtained at discrete locations and historical information held on the GeoSolve database. The nature and continuity of subsoil conditions away from the investigation locations is inferred and cannot be guaranteed.

9.2 Geotechnical Parameters

Table 9.1 provides a summary of the recommended geotechnical design parameters for the soil materials expected to be encountered during subdivision earthworks.

Table 9.1 – Recommended geotechnical design parameters

Unit	Thickness (m)	Bulk Density γ (kN/m^3)	Effective Cohesion c´ (kPa)	Effective Friction ϕ´ (deg)	Elastic Modulus E (kPa)	Poissons Ratio ν
Topsoil	0.2-0.4	16	N/A	N/A	N/A	N/A
Colluvium	0.2-0.4	18	0	30	5,000	0.3
Alluvial Deposit	0 - 12	18	0	SILT 30 SAND 30-32 Sandy GRAVEL and GRAVEL 34-36	SILT 3,000-5,000 SAND and gravelly SAND 5,000-10,000 Sandy GRAVEL and GRAVEL 10,000-30,000	0.3
Lake Sediment	Up to 3.4 m observed. Up to 6 m inferred from DPH testing.	18	0	30	3,000-5,000	0.3
Outwash Gravel	Not proven	19	0	34	10,000-20,000	0.3
Moderately Strong Schist Bedrock	Unconfirmed (> 100 m)	27	100+	30	100,000	0.25
Schist Bedrock Defects	N/A	N/A	0 (along defect)	25 (along defect)	N/A	0.2

9.3 Site Preparation

During the earthworks operations all topsoil, organic matter, colluvium, uncontrolled fill and other unsuitable materials should be removed from the construction areas in accordance with the recommendations of NZS 4431:1989.

Robust, shallow graded sediment control measures should be instigated during construction where rainwater and drainage run-off across exposed soils is anticipated.

Exposure to the elements should be limited for all soils and covering the soils with polythene sheeting will reduce degradation due to wind, rain and surface run-off.

Water should not be allowed to pond or collect near or under a foundation slab. Positive grading of the subgrade should be undertaken to prevent water ingress or ponding.

All fill that is utilised as bearing for foundations should be placed and compacted in accordance with the recommendations of NZS 4431:1989 and certification provided to that effect.

We recommend topsoil stripping and subsequent earthworks be undertaken only when a suitable interval of fair weather is expected, or during the earthworks construction season.

9.4 Site Management, Preparation and Earthworks

Robust, shallow graded sediment control measures should be instigated during construction where rainwater and drainage run-off over exposed soils is anticipated. If slope gradients in excess of 4% are proposed in soils then the construction and lining of drainage channels is recommended, e.g. with geotextile and suitably graded rock, or similarly effective armouring.

We recommend topsoil stripping and subsequent earthworks be undertaken only when a suitable interval of fair weather is expected, and only during the earthworks construction season.

Owing to the highly erodible nature of some of the alluvial silt and lake sediment present across the site, sediment control measures should be instigated during earthworks construction.

Queenstown Lakes District guidelines for environmental management plans should consulted to ensure environmental aspects are appropriately controlled during construction.

Water should not be allowed to pond or collect near or under pavement subgrades. Positive grading of the subgrade should be undertaken to prevent water ingress or ponding. There is a high risk that the alluvial silt and lake sediment and will soften if water is allowed to infiltrate through the soil. This can result in costly undercutting of pavement subgrades and greater pavement thickness. The alluvial silt and lake sediment are also susceptible to frost heave. Heavy plant traffic can also damage subgrade materials and temporary haulage roads are likely to be required.

All engineered fill that is utilised as bearing for foundations should be placed and compacted in accordance with the recommendations of NZS 4431:1989 and certification

provided to that effect. Topsoil, colluvium, alluvial silt & sand and lake sediment will not be suitable for reuse as engineered fill and will need to be kept separate from all engineered fill sources. These soils should be stockpiled separately for reuse as landscaping fill and bunding.

The alluvial gravel and outwash gravel could be used as engineered fill on site (during good weather and in accordance with an earthfill specification). Boulders and cobbles over 75 mm in size will need to be screened from engineered fill sources prior to re-use and the soils will need to be thoroughly blended for consistency.

If site won fill is used, any engineered fill earthworks is recommended in drier, warmer months (during earthworks season). Due to the changeable grain size of onsite source materials, a range of compaction reference tests will be required. Maximum density and optimum moisture content will also vary. Compaction of the fill sources at lab tested optimum moisture content is critical for these soil types.

Alternatively, granular fill can be imported from a local source or quarry for consistency. An earthfill specification can be provided by GeoSolve on request.

9.5 Excavations

Based on the earthworks plan and information provided by John Edmonds & Associates Ltd we understand that cuts are generally up to 3.5 to 4 m high, with a maximum cut depth of up to approximately 7-8 m proposed northeast of the Owners Building.

Excavations are expected to be undertaken within topsoil, colluvium, alluvial deposit, lake sediment, outwash gravel and schist bedrock.

Seepages are common in excavations completed in hillside areas, predominantly observed as perched layers at the soil to rock contact. Drainage measures, such as horizontal drains, may be required if excessive groundwater seepages are encountered during excavation. The final design and location of all sub-soil drainage works should be confirmed during construction by a suitably qualified and experienced Geotechnical Engineer or Engineering Geologist.

All slopes should be periodically monitored during construction for signs of instability and excessive erosion, and, where necessary, corrective measures should be implemented to the satisfaction of a suitably qualified Geotechnical Engineer or Engineering Geologist.

Minor seepages and overland flows were observed across the site during investigations. Batters excavated within wet soils should be cut as per the recommendations of Table 8.2, it is also recommended that a geotechnical engineer or engineering geologist should inspect any seepage, spring flow or under-runners where encountered during construction.

9.5.1 Cut Slopes in Soil Materials

Recommendations for temporary and permanent batter slope angles are described below in Table 9.2. Slopes that are required to be steeper than those described below should be structurally retained or subject to specific geotechnical design.

Table 9.2 - Recommended maximum batter angles for cut slopes up to 4 m high in site soils.

Material Type	Recommended Maximum Batter Angles for Temporary Cut Slopes Formed in Soil (horizontal to vertical)		Recommended Maximum Batter Angles for Permanent Cut Slopes Formed in Soil – dry ground only (horizontal to vertical)
	Dry Ground	Wet Ground	
Topsoil, Colluvium, Alluvial Deposit, Lake Sediment	1.5H: 1V	3H: 1V	3H: 1V
Outwash Gravel	1.5H: 1V	2.5H: 1V	2H:1V

The temporary batter slopes in wet soils are provisional only and should be inspected on a case by case basis. **Note, recommendations in Table 9.2 for permanent cut slopes are for dry soils only. If permanent cuts in wet soils are required, then specific geotechnical assessment is recommended.**

9.5.2 Cuts in Schist Bedrock

The proposed cuts for the Owners Building and Guest Building 2 are expected to be partially formed in schist bedrock. Cuts in schist bedrock are generally expected to be < 4 high m for the Guest Building and < 7 m high for the Owners Building. The stability of cut slopes in schist rock is governed by the strength and orientation of the defects present within the rock mass (joints, fractures, crush zones, foliation shear zones etc).

The primary defect present within the schist rock is the foliation which is a persistent plane of weakness with the potential to cause slope instability. The foliation was observed to dip 20-30° towards the southeast (130-160°). The apparent dip for the main cut of each building where schist bedrock is expected to be encountered in excavations, is presented in Table 9.3 below.

Table 9.3 – Apparent dip of foliation

Building	Main Cut Direction	Apparent Dip
Owners Building	North-west	Approx. 20-28° into the proposed excavations
Guest Building 2	North	Approx. 20° into the proposed excavations

The foliation is considered to be favourable for the proposed development and no deep-seated instability on this defect is expected.

Secondary defect sets are also expected present in the rock mass which can interact with the foliation to form unstable blocks and effect the stability of the proposed cut slopes. The presence, location, condition and impact of the secondary defects is difficult to assess prior to construction.

Geosolve recommend that the cuts can be formed at 0.25H:1.0V in the first instance. The cuts should then be mapped by Geosolve to confirm any local instability that may arise from the interaction of the foliation and secondary defects.

Due to the variability of schist terrain, and the random occurrence of secondary defects, it is recommended that a staged approach be adopted for the proposed excavation construction to enable any additional support requirements to be confirmed on a case-by-case basis.

The excavation should be completed in stages with each stage being no more than 2 m high. Each stage should be inspected by an engineering geologist or geotechnical engineer to confirm the ground conditions and verify any requirement for additional support measures or modification to the excavation sequence. Spot bolts will be required, the requirements for rock anchors are to be addressed during excavation.

9.6 Engineered Fill and Engineered Fill Slopes

The earthworks plan provided show that fill depths of up to approximately 3.5 to 4 m are required to achieve final design levels.

All engineered fill should be placed and compacted in accordance with the recommendations of NZS4431: 1989 and Queenstown Lakes District Council Standards. All cut and fill earthworks should be inspected and tested as appropriate during construction and certified by a Chartered Professional Engineer. See Section 9.4 above for further details on engineered fill.

All un-retained fill slopes which are less than 4 m high and do not directly support a structure should be constructed with a batter slope angle of 2.0H: 1.0V (horizontal to vertical) or flatter and be benched into sloping ground. If buildings are to be located close to the crest of the fill slope batters of 3H:1V and a building set-back of 0.6 m are recommended in the first instance.

Specific engineering assessment, retaining and/or reinforced earth slopes can be considered if batters need to be steeper than 2H:1V or if building foundations are close to slope crests.

9.7 Ground Retention

The detailed design of the buildings is yet to be finalised and therefore the use of retaining as part of the development is yet to be confirmed. All retaining walls should be designed by a Chartered Professional Engineer using the geotechnical parameters recommended in Table 8.1 of this report. Due allowance should be made during the detailed design of all retaining walls for forces such as surcharge due to the sloping ground surface behind the retaining walls, groundwater, seismic and traffic loads.

All temporary slopes for retaining wall construction should be battered in accordance with the recommendations outlined in Table 2 of this report. Where these batter slopes cannot be achieved temporary retaining will be required.

Groundwater seepage was regularly observed during investigations, infiltration of surface water behind retention structures, in particular as a result of heavy or prolonged rainfall, can occur. To ensure potential water seepage or flows are properly controlled behind retaining walls, the following recommendations are provided:

- A minimum 0.3 m width of durable free draining granular material should be placed behind all retaining structures;
- A heavy duty non-woven geotextile cloth, such as Bidim A14, should be installed between the natural ground surface and the free draining granular material to prevent siltation and blockage of the drainage media;
- A heavy-duty (TNZ F/2 Class 500) perforated pipe should be installed within the drainage material at the base of all retaining structures to minimise the risk of excessive groundwater pressures developing. This drainage pipe should be connected to the permanent piped storm water system, and;
- Comprehensive waterproofing measures should be provided to the back face of all retaining walls forming changes in floor level within the dwelling to remove groundwater seepage into the finished buildings.

It is recommended that the retaining wall excavation batters are inspected by a suitably qualified and experienced Geotechnical Engineer or Engineering Geologist.

9.8 Groundwater & Surface Water Issues

Seepage was observed within TP 2 at 3.3 m depth and perched groundwater was measured within DPH 1 and 2 at 2.7 and 3.2 m depth respectively, which is inferred to be perched groundwater in the vicinity of the overland flow paths shown in Figure 1, Appendix A. Therefore, it is recommended that allowances be made in the construction budget to provide groundwater control, such as subsoil drains or contour drains.

All overland flow paths were dry at the time of our site investigations; however, it is expected that perched water flows will develop following heavy rainfall. It is therefore recommended that some upslope contour/subsoil drains are installed along the upslope side of the proposed building locations to divert water flows around the buildings.

The regional groundwater table is expected to lie below the proposed excavation levels. Dewatering is therefore unlikely to be required.

Permanent drainage will be required behind all buildings and retaining structures to control groundwater seepages from excavations.

9.9 Foundations

9.9.1 General

Preliminary guidance on foundations is provided in this section. It is recommended that specific assessment and design for each building is undertaken once building layouts and floor levels are finalised.

The most appropriate foundation type should be selected at the detailed design stage, however it is considered that both shallow foundations and foundations that bear at depth, e.g. piles, be suitable provided that the recommendations within this report are followed.

Topsoil and colluvium up to 0.7 m thick have been observed at the site. These materials will not provide adequate bearing for building foundations and will need to be removed from beneath any building, engineered fill footprints or piles during construction.

Owing to the size of the proposed buildings, the variable stratigraphy and the proposed earthworks the foundations for each building will likely bear on several geological materials. The inferred ground model beneath each building is shown in Figures 2a-2i, Appendix A.

Schist bedrock is exposed at the surface in the vicinity of the Owners Building, Guest Building 2 and the Meditation Room, and is expected to be encountered in part of the foundation excavations for these buildings.

All unsuitable materials identified in foundation excavations, particularly those softened by exposure to water, should be undercut and replaced with engineered fill or site concrete during construction. Any fill that is utilised as bearing for foundations should be placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect.

To minimise the effects of freeze-thaw cycles in footings founded on soil, all shallow foundations should be founded a minimum of 0.4 m below the adjacent finished ground level.

9.9.2 Arrival Building, Guest Building 1 and Guest Building 2

The foundations for The Arrival Building, Guest Building 1 and Guest Building 2 will likely span several geological units, including alluvial deposit, lake sediment, engineered fill and schist bedrock for a small section of the western part of Guest Building 2.

Following completion of earthworks, it is likely that engineered fill will be present at the back (south) of the buildings with alluvial deposit and lake sediment at the front of the building. A small section of Guest Building 2 is expected to be founded on Schist Bedrock, as shown in Cross Section F attached (Figure 2f, Appendix A.)

The alluvial deposit and lake sediment will provide a reduced bearing capacity with respect to good ground and specific engineering design (SED) will be required for foundations bearing directly upon these soil types. Additionally, the SED will need to cater for the liquefaction risk outlined in Section 5. Ground improvement can be undertaken to improve the foundation bearing capacity of the alluvial deposit and lake sediment, as outlined in Section 9.9.4 below.

Schist bedrock will provide an allowable working stress of 300 kPa for a 0.4 m wide by 0.4 m deep footing. This corresponds to a factored (ULS) geotechnical bearing capacity of approximately 450kPa and an ultimate geotechnical bearing capacity of 900 kPa.

Settlements are expected to occur between the different geological materials, following placement of engineered fill and following a seismic event, see Section 9.10 below and Table

5.2 for liquefaction induced settlements. Settlements are also expected where engineered fill overlies alluvial silt and lake sediment, as discussed in Section 9.10 below.

To summarise the above, the SED will need to consider:

- Founding on varying soil geologies with variable bearing capacity;
- Moderate liquefaction potential at the site for the ULS design earthquake with approximately 50-115 mm of predicted settlements for the ULS event;
- Long term settlements of the alluvial silt and lake sediment during and following placement of engineered fill over these soil types.

9.9.3 Owners Building and Meditation Room

The foundations for the Owners Building will likely bear on a combination of soil materials (engineered fill, alluvial deposit, lake sediment, outwash gravel) and schist bedrock.

As discussed in Section 5, no liquefaction mitigating foundation design will be required for these buildings due to the shallow depth to bedrock and the depth to groundwater table.

As for the Arrival Building, Guest Building 1 and Guest Building 2, discussed in Section 9.9.2 above, the alluvial deposit and lake sediment will provide a reduced bearing capacity with respect to good ground and specific engineering design (SED) will be required for foundations bearing directly upon these soil types.

Alternatively, ground improvement can be undertaken to improve foundation bearing capacities, asper Section 9.9.4 below.

Outwash gravel and engineered fill will meet the requirements of good ground in accordance with NZS 3604:2011 provided that all fill is placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect.

As discussed in Section 9.9.2 above, schist bedrock will provide an allowable working stress of 300 kPa is recommended for 0.4 m wide by 0.4 m deep footing.

9.9.4 Ground Improvement

Ground improvement could be conducted to improve the bearing capacity of the underlying soil materials. Founding the building on a suitable thickness of engineered fill can improve the ultimate bearing capacity of the alluvial deposit and lake sediment to 200 kPa or 300 kPa ultimate bearing capacity, depending on fill thickness and location. Further details can be provided during the detailed design phase of the project.

The engineered fill should extend at least 1.0 m beyond the edge of any proposed building footprint.

The imported fill should be placed and compacted in accordance with NZS4431 and certification provided to that affect. A filter fabric separation layer is recommended to separate the engineered fill from the natural ground.

9.10 Settlement and Compressibility

9.10.1 Engineered Fill overlying Alluvial Silt and Lake Sediment

Given the low undrained shear strength and low permeability of the alluvial silt and lake sediment, consolidation settlements are expected to occur during and following placement of engineered fill overlying these soil types.

A settlement analysis is recommended once the earthworks plans (depths and volumes) have been completed. Settlement monitoring is expected to be required.

Settlement should be monitored weekly for at least four weeks following fill placement (monitoring should continue if the construction programme allows this). If settlement is found to continue, an extension of the monitoring program may be required. Settlement should be monitored in relation to the finished level of the site, a number of survey plates should be set up across the site and measured in relation to the established reference datum. The monitoring set up should have the ability to measure +/- 1 mm accuracy and be agreed between the geotechnical engineer/engineering geologist and surveyor before the end of placement of the engineered fill.

Monitoring should be completed to ensure sufficient settlement has occurred prior to pavement and building construction. Allowing sufficient time in the construction programme for this to occur will need consideration, weeks to months may be required to ensure this process is complete.

9.10.2 Soil to Rock Contact

Where foundations transition from rock to soil low levels of differential settlement may occur between the 2 geological units and should be considered during the detailed design of the buildings.

9.11 Stormwater & Overland Flow Paths

A stormwater drainage design is recommended at detailed design stage.

All sources of slope saturation should be eliminated by cut-off drains, swale drains and bunds and redirected around building platforms and access roads.

9.12 Site Subsoil Category

For detailed design purposes it is recommended the magnitude of seismic acceleration be estimated in accordance with the recommendations provided in NZS 1170.5:2004.

Geotechnical investigations for the development were carried out to 8.3 m depth. A historic borehole located approximately 100 m west of the development encountered schist bedrock at 13 m depth. Schist bedrock is also exposed at the surface in the locations shown in Figure 1a, Appendix A.

The site is likely to be Class C (Shallow soil site) in most locations, however Class B (Rock) will be present in some locations, where depth to schist bedrock does not exceed 3 m.

Based on the above Class C will likely be present for the Arrival Building and Guest Building 1. The Owners Building and Guest Building 2 will likely be a combination of Class B and C.

Class B (Rock) is likely for the Meditation Room.

If any filling is undertaken beneath the Meditation Room and which raises the building footprint greater than 3 m above rock head then the site subsoil category should be re-assessed. Depending where the filling is may become equivalent to Class C (shallow soil) in accordance with NZS 1170.5:2004.

10 Stormwater and Wastewater Soakage Assessment

Three soakage tests were undertaken as part of the site investigations, two within the west of the site (SP1 and SP2) and one near the Owners Building in the east of the site (SP3), as shown in Figure 1a, Appendix A. Soakage testing was undertaken within alluvial sand overlying lake sediment and within the lake sediment.

Soakage testing was undertaken at depths of 0.9 and 1.0 m. Deeper soakage testing was not completed to maximise the depth to the underlying low-permeability lake sediment and groundwater table.

Soakage testing was performed by introducing water to the test pit until the water level of the pit reached the designated testing level. The inflow was then ceased and the time it took for the water level to drop was recorded. Multiple tests were completed within each soakage pit until a representative amount of testing had been achieved for each test location. All soakage tests were pre-soaked prior to soakage testing.

Following completion of the soakage testing the base of the soakage pits were excavated through to depths of between 3.3 and 3.5 m to confirm the underlying soil profile for validation of the permeability results. Full details of the subsurface stratigraphy observed in soakage pits can be found within the soak pit logs contained in Appendix B.

10.1.1 Permeability Analysis

The regional groundwater table was observed during site investigations at depths of between 2.7 and 3.3 m however due to the low permeability of the underlying lake sediment (in the location of testing) the groundwater depth is not predicted to limit soakage capability to ground (for design storms less than 24 hours). Where greater thicknesses of alluvial sand and gravel were observed the groundwater may limit long-term soakage capability to ground.

Calculated infiltration rates from onsite soakage testing are presented below in Table 10.1. Soakage graphs are presented in Appendix D.

Table 10.1: Assessed long term infiltration rate (note all values are factored).

Test	Infiltration Depth (bgl)	Soil type at base of pit	Factored infiltration rate*
SP 1	0.9 m	SILT with some sand (lake sediment)	**11 mm/hr***
SP 2	0.9 m	gravelly SAND overlying SAND with some gravel (alluvial sand) at 1.0 m depth and sandy SILT (lake sediment) at 1.1 m depth	**36 mm/hr***
SP 3	1.0	SILT with minor sand and a trace of gravel (lake sediment)	**8 mm/hr***
*Includes a reduction factor of 0.5 to account for loss of soakage performance over time.			

10.1.2 Preliminary Soakage Design Recommendations

- A long-term factored infiltration rate of 8 mm/hr within SP1 and 3 for soakage systems installed into SILT with minor sand (lake sediment) is considered suitable for design purposes.
- A long-term factored infiltration rate of 36 mm/hr within SP2 for soakage systems installed into gravelly SAND (alluvial sand) is considered suitable for design purposes. Note that testing was completed 0.2 m above the contact of alluvial sand and low permeability lake sediment. A reduced infiltration rate compared to the above value is expected if the thickness of alluvial sand underlying the base of any soakage pit is less than 0.2 m.
- It is recommended the base of the soakage system is constructed as shallow as possible, to maximise the depth to groundwater table and depth to lake sediment where the soakage system can be installed into alluvial sand or gravel.
- Appropriate setbacks of soakage areas from building platforms and slope crests, will be required and should be considered during the detailed design of any disposal system.
- It is currently unknown how stormwater and wastewater is proposed to be managed at the site. It is recommended that GeoSolve confirm the provided recommendations once it is known how stormwater and wastewater will be managed.
- Further test pitting and permeability testing should be carried out in the proposed disposal areas if stormwater and wastewater disposal to ground is proposed for the site, particularly if proposed away from where specific testing was undertaken.
- A geotechnical practitioner who is familiar with the findings of this report should inspect the base of any soakage area during earthworks construction.
- Provision should be included for long-term inspection and routine maintenance of the soakage systems.
- The wastewater design will need to take into consideration the proximity to the overland flow path shown in Figure 1a, Appendix A.

A QLDC Site and Soils assessment has been completed to inform wastewater disposal for the site. This is attached in Appendix D.

11 Neighbouring Structures/Hazards

Natural Hazards: A risk of seismic activity has been identified for the region as a whole and appropriate allowance should be made for seismic loading during detailed design of the proposed development, but there are no site-specific constraints.

Liquefaction, rock fall, alluvial fan and landslide hazards are discussed in Sections 5, 6, 7 and 8 respectively.

Distances to adjoining structures: No adverse geotechnical implications apply for neighbouring properties as a result of the development.

Aquifers: No aquifer resource will be adversely affected by the development.

Erosion and Sediment Control: The site presents a high potential to generate silt runoff from easily erodible soils and this would naturally drain downslope and towards the overland flow path that runs through the site. Silt runoff should not be permitted to enter any watercourse.

Effective systems for erosion control are runoff diversion drains and contour drains, while for sediment control, options are earth bunds, silt fences, hay bales, vegetation buffer strips and sediment ponds.

Only the least amount of subsoil should be exposed at any stage and surfacing established as soon as practical. Details for implementation are given in Appendix B within the following link: http://esccanterbury.co.nz/.

Noise: It is expected that conventional earthmoving equipment, such as excavators and rock breakers, will be required during construction. The construction contractor should take appropriate measures to control the construction noise, and ensure QLDC requirements are met in regard to this issue.

Dust: Regular dampening of soil materials with sprinklers should be effective if required.

Vibration: Vibration induced settlement may occur in these soil types and should be considered during detailed design.

12 Conclusions and Recommendations

The proposed development is considered acceptable from a geotechnical perspective, provided the recommendation of this report are followed and further work is undertaken at the detailed design stage. A summary of the geotechnical assessment is provided below.

- The stratigraphy at the site generally comprises topsoil and colluvium overlying alluvial deposit, lake sediment, glacial outwash deposit and schist bedrock.
- A risk of liquefaction has been identified for the Arrival Building, Guest Building 1 and Guest Building 2 and foundations should be designed to address this hazard. Further details are provided in Section 5. A liquefaction review will be required at the detailed design stage to ensure cut and fill depth have been considered.
- A rock fall assessment of the bluffs present above the site has been completed, see Section 6. 3D RAMMS modelling shows that very low to no modelled rock falls trajectories will enter the eastern edge of the proposed building location for the Arrival Building, Guest Building 1 and Guest Building 2. 3D RAMMS modelling shows that a low number of modelled rock falls trajectories will enter the eastern edge of the proposed building location for the Owners Building.
- A quantitative risk assessment has been undertaken to clarify the level of risk from rock fall, see Section 6.5.
- For Source Area 4, above the owners accommodation building, we consider there is an intolerable risk from rock fall during the lifetime of the structure. We therefore recommend that scaling and isolated block removal be undertaken prior to construction.
- Removal of failure prone rock will also reduce the AIFR value for Source Area 4 to a tolerable level as outlined in the guidelines provided in AGS 2007. Assessment indicates AIFR values will fall approximately 1 order magnitude to the mid 10^{-6} area.
- A risk to property may exist from the schist outcrops and rockfall source areas surrounding the proposed development, as shown on Figure 1a, Appendix A. Scaling works is recommended to reduce this risk, specifically above the owners building.
- The northern part of the proposed development area is located within an alluvial fan area hazard mapped by QLDC as "active, floodwater-dominated' on regional scale mapping. Based on our observation the alluvial fan hazard to the site is considered to be very low to nil and no mitigation to this hazard is considered necessary. Alluvial fan hazard is discussed further in Section 7.
- No landslide hazards affect the development.
- Foundations for each building will likely bear on several geological materials. The alluvial deposit and lake sediment will provide a reduced bearing capacity with respect to good ground and specific engineering design (SED) will be required for foundations bearing directly upon these soil types. Additionally, the SED for the

Arrival Building, Guest Building 1 and Guest Building 2 will need to cater for the liquefaction risk outlined in Section 5.

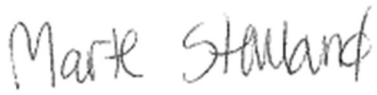
- At the detailed design stage it is recommended that specific assessment for each building platform is undertaken once building layouts and floor levels are finalised.
- The alluvial silt and lake sediments are highly erodible in nature and an appropriate site management plan will be required. Similarly, these soil types will be prone to softening if exposed to the elements, in particular if ponding occurs. The site management plan will need to ensure that these soils are protected to reduce the risk of having to undercut softened or damaged soils.
- Placement of fill onto lake sediments and alluvial silts may result in consolidation settlement which will need to be assessed prior to construction. Timing of earthwork and building construction will need to be considered and extending the construction programme to ensure this process is monitored and controlled is expected to be required.

13 Applicability

This report has been prepared for the benefit of John Edmonds & Associates Ltd with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

It is important that we be contacted if there is any variation in subsoil conditions from those described in this report.

Report prepared by:



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Marte Stemland
Engineering Geologist

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Simon Reeves
Senior Engineering Geologist

Reviewed for GeoSolve Ltd by:

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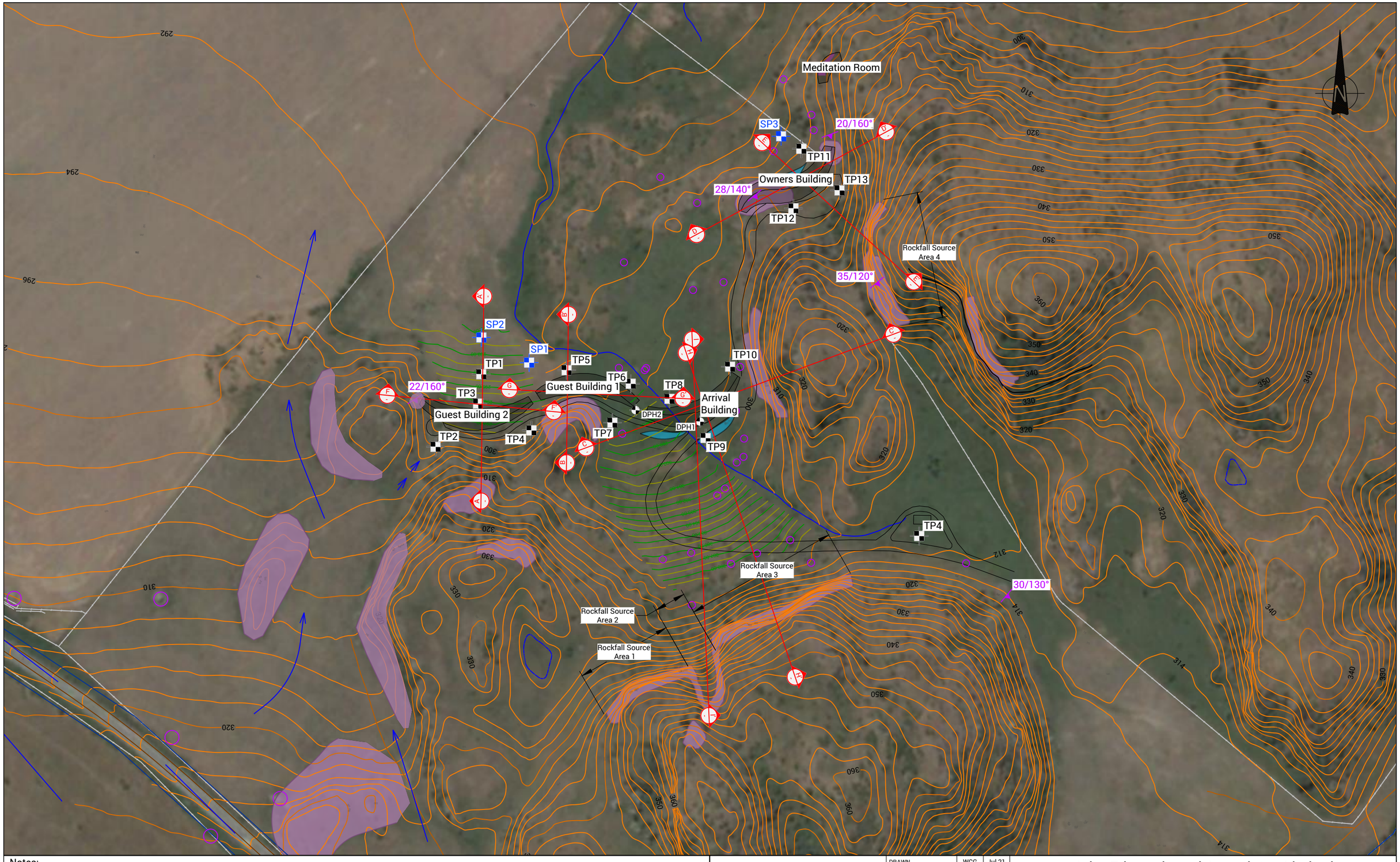
Paul Faulkner
Senior Engineering Geologist

Appendix A: Site Plan & Cross-Sections



Notes:
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Legend:

- Rockfall Boulder
- Proposed Pond
- Approximate location of Schist outcrops adjacent to the proposed development

SCALE 1:2000

0 20 40 60 80 100 (m)

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DRAWN	WCG	Jul.21
DRAFTING CHECKED		
APPROVED		
CADFILE: 200393.dwg		
SCALES (AT A3 SIZE): 1:2000		
PROJECT No: 200393	FIG No: Appendix A, Figure 1a	REV. 0

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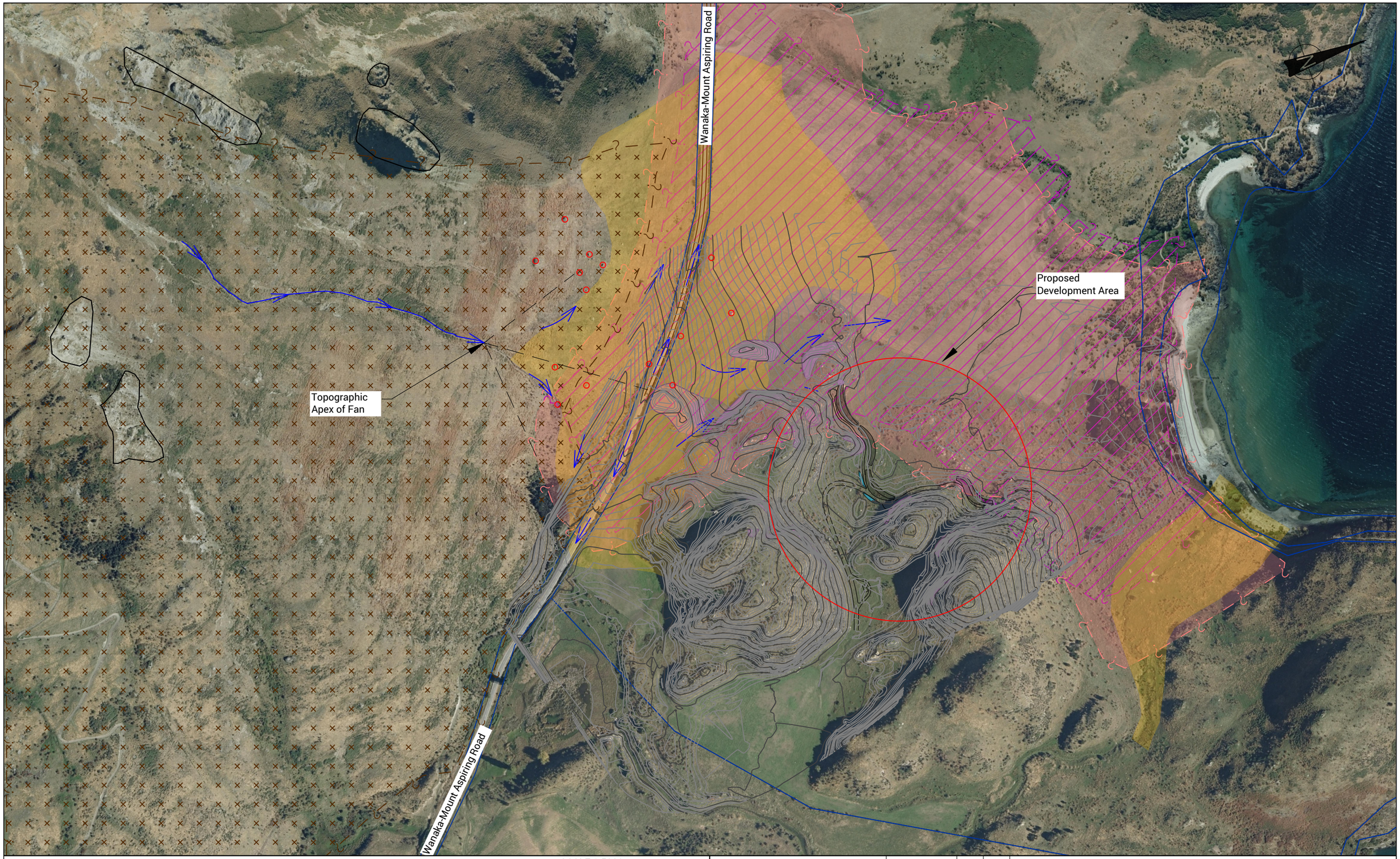
Damper Bay (Lot 1 DP 337193)

Geotechnical Inputs

Site Plan



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QLDC Mapped Hazards Legend:

- Landslide (Non Verified)
- Liquefaction (Susceptible)
- Alluvial Fan (Regional Scale-Floodwater Dominated)
- Alluvial Fan (ORC-Fan Recently Active)

SCALE 1:5000

0 50 100 150 200 250 (m)

- Observed Rockfall Boulder
- Approximate location of Schist outcrops adjacent to the proposed development
- Overland Flow Paths / Flow Direction

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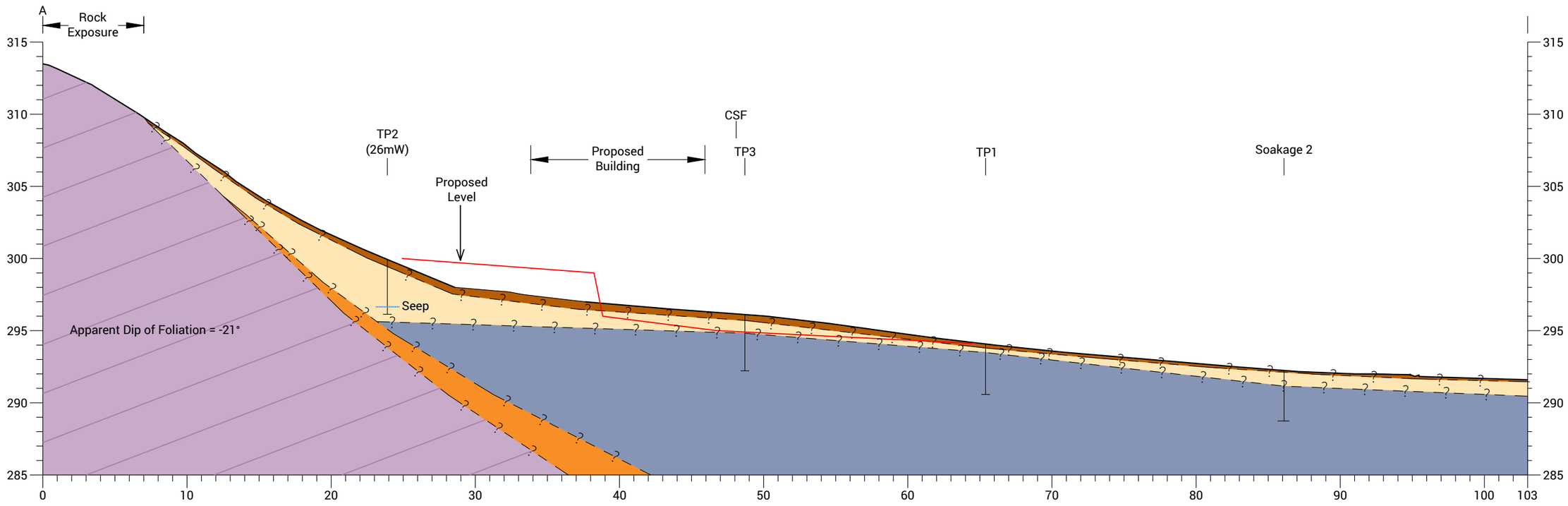
Geotechnical Inputs

Hazard Plan

FIG No: Appendix A, Figure 1b

REV. 0



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- Topsoil / Colluvium
- Alluvium
- Lake Sediment
- Outwash Gravel
- Schist Bedrock

SCALE 1:300
0 3 6 9 12 15 (m)

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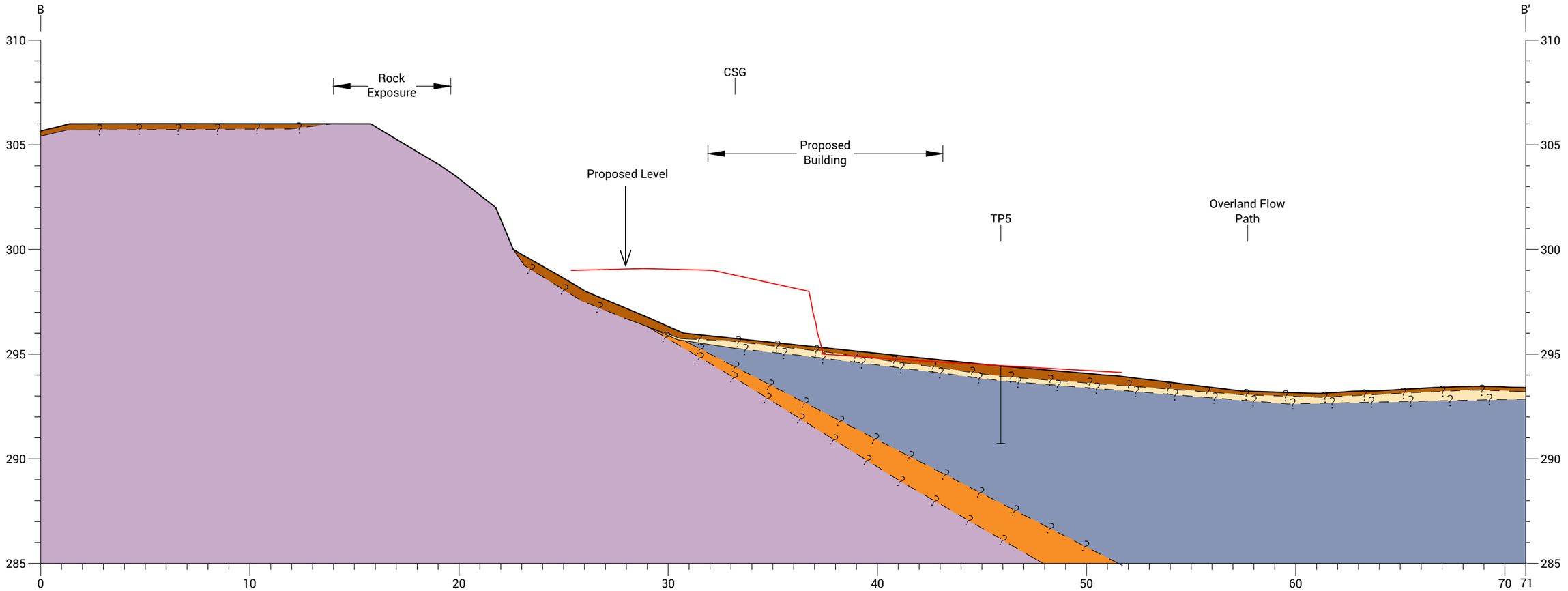
Geotechnical Inputs

Cross Section A

FIG No: Appendix A, Figure 2a

REV. 0



Notes:
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- Topsoil / Colluvium
- Alluvium
- Lake Sediment
- Outwash Gravel
- Schist Bedrock

SCALE 1:1500

0 15 30 45 60 75 (m)

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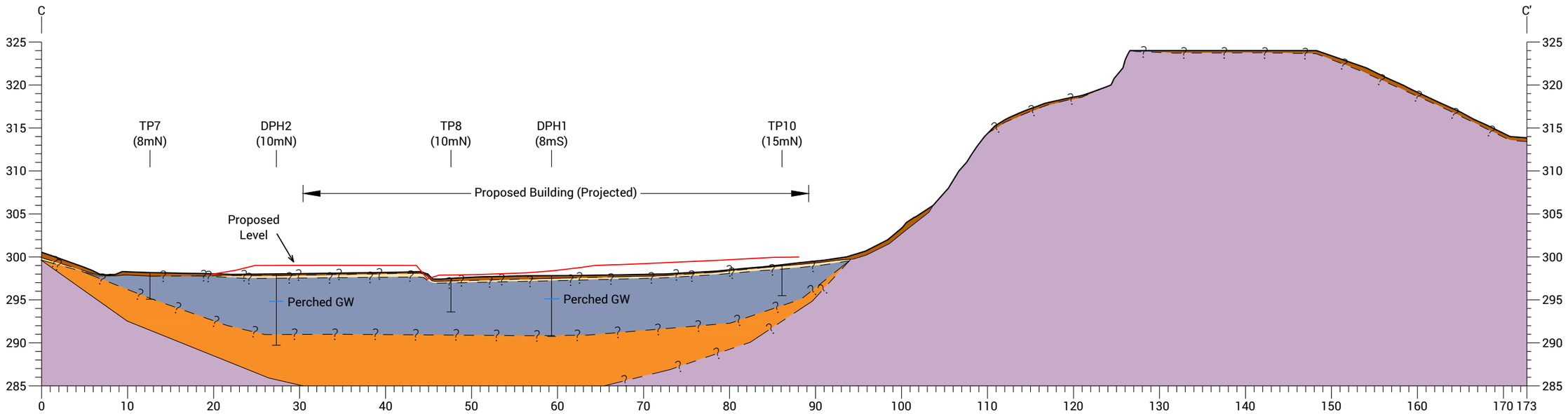
Damper Bay (Lot 1 DP 337193)

Geotechnical Inputs

Cross Section B

FIG No: Appendix A, Figure 2b

REV. 0



Notes:

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- Topsoil / Colluvium
- Alluvium
- Lake Sediment
- Outwash Gravel
- Schist Bedrock

SCALE 1:1500

0 15 30 45 60 75 (m)

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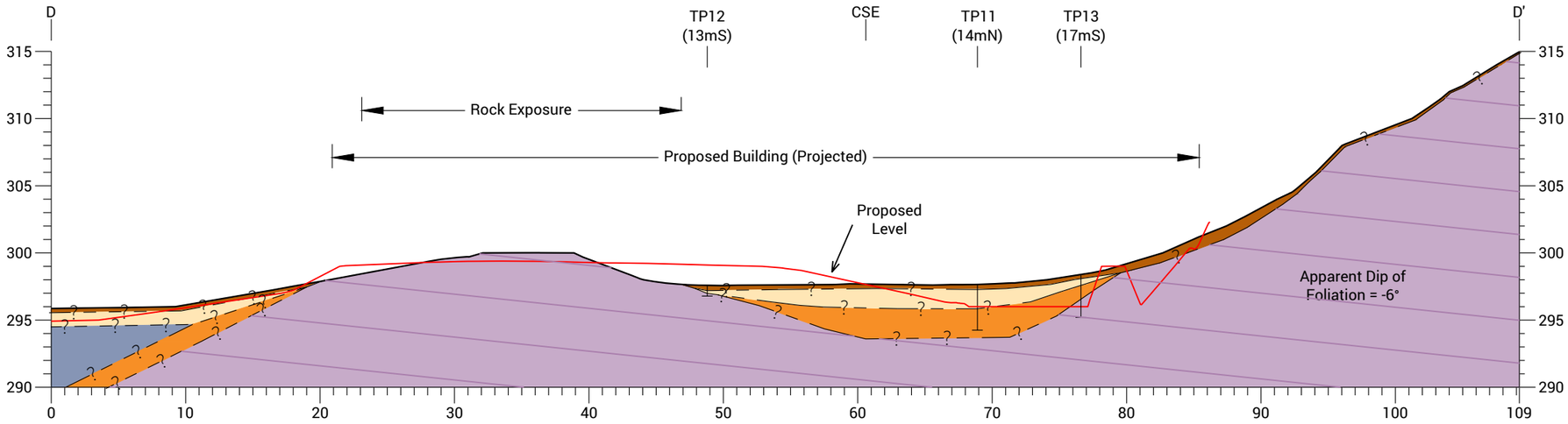
Geotechnical Inputs

Cross Section C

FIG No: Appendix A, Figure 2c

REV. 0



Notes:
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- Topsoil / Colluvium
- Alluvium
- Lake Sediment
- Outwash Gravel
- Schist Bedrock

SCALE 1:400

0 4 8 12 16 20 (m)

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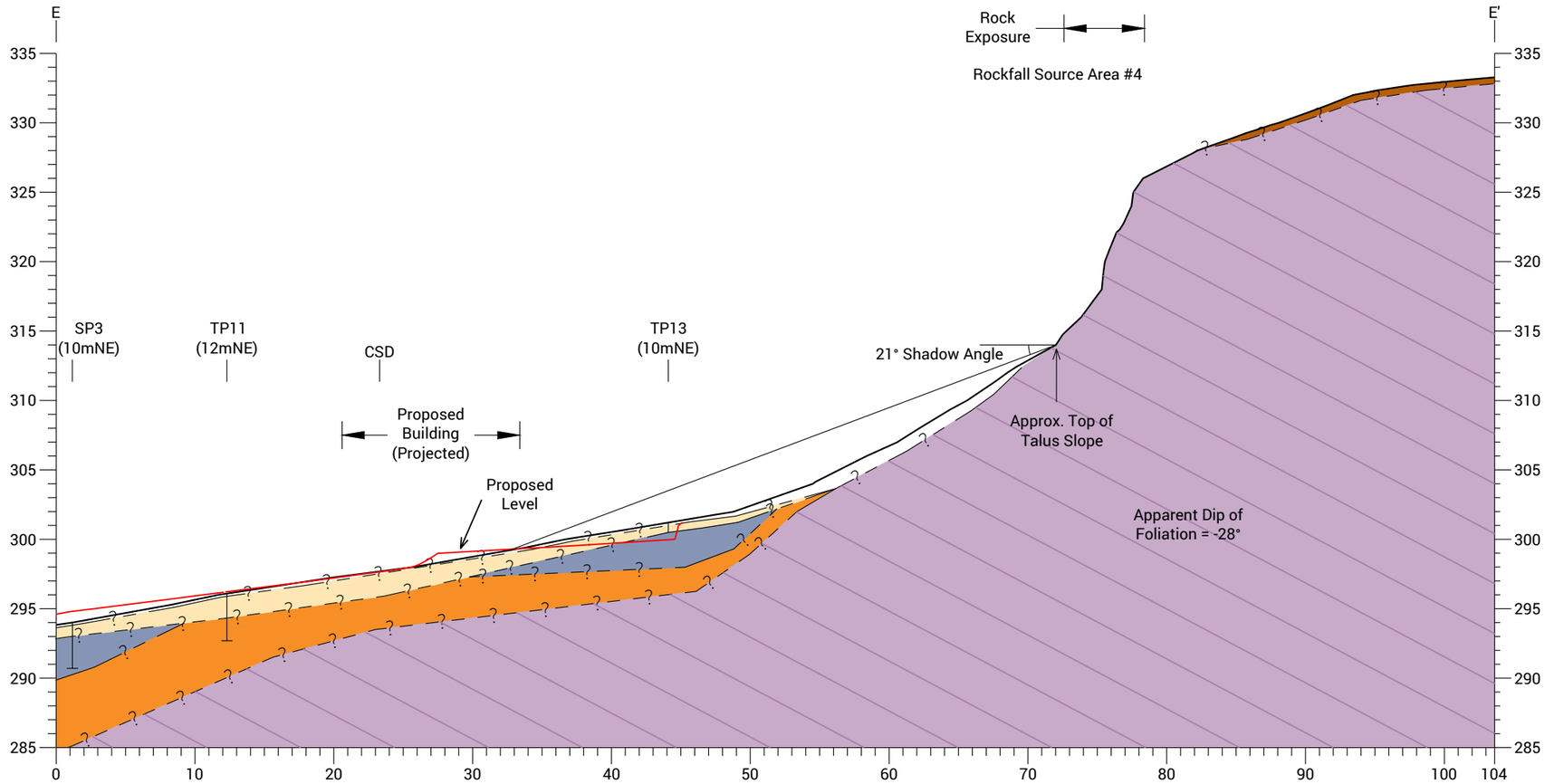
Damper Bay (Lot 1 DP 337193)

Geotechnical Inputs

Cross Section D

FIG No: Appendix A, Figure 2d

REV. 0



Notes:
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- Topsoil / Colluvium
- Alluvium
- Lake Sediment
- Outwash Gravel
- Schist Bedrock

SCALE 1:400

0 4 8 12 16 20 (m)

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PROJECT No: 200393		

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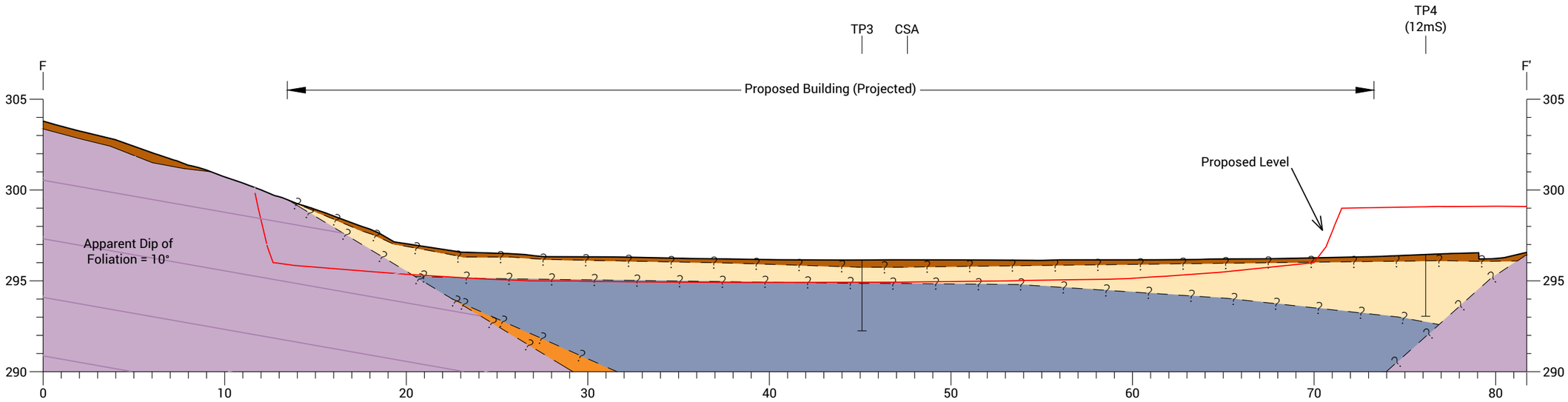
Damper Bay (Lot 1 DP 337193)

Geotechnical Inputs

Cross Section E

FIG No: Appendix A, Figure 2e

REV. 0



Notes:
1. These drawings have been prepared for the benefit of John Edmonds and Associates Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

- Topsoil / Colluvium
- Alluvium
- Lake Sediment
- Outwash Gravel
- Schist Bedrock

SCALE 1:250
0 2.5 5.0 7.5 10.0 12.5 (m)

GEOSOLVE
Level 1, 70 MacAndrew Road, South Dunedin
www.geosolve.co.nz

DRAWN	WCG	Jul.21
DRAFTING CHECKED	MBS	Jul.21
APPROVED	SR	Jul.21
CADFILE: 200393.dwg		
SCALES (AT A3 SIZE): 1:250		
PROJECT No: 200393		

John Edmonds and Associates Limited

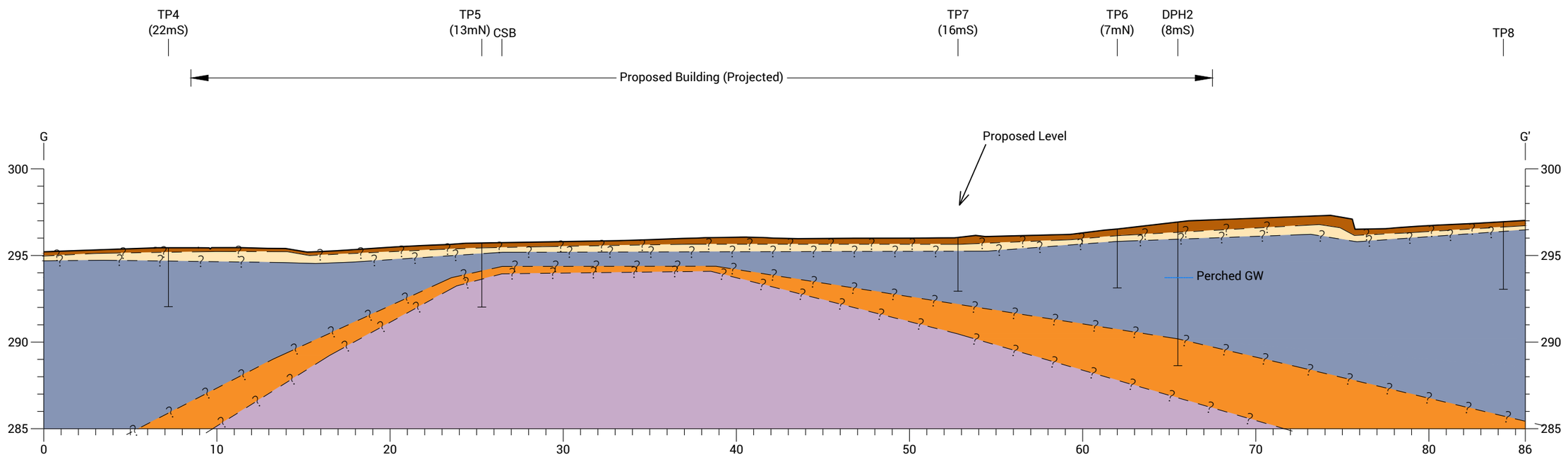
Damper Bay (Lot 1 DP 337193)

Geotechnical Inputs

Cross Section F

FIG No: Appendix A, Figure 2f

REV. 0



Notes:
1. These drawings have been prepared for the benefit of John Edmonds and Associates Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

- Topsoil / Colluvium
- Alluvium
- Lake Sediment
- Outwash Gravel
- Schist Bedrock

SCALE 1:250
0 2.5 5.0 7.5 10.0 12.5 (m)

GEOSOLVE
Level 1, 70 MacAndrew Road, South Dunedin
www.geosolve.co.nz

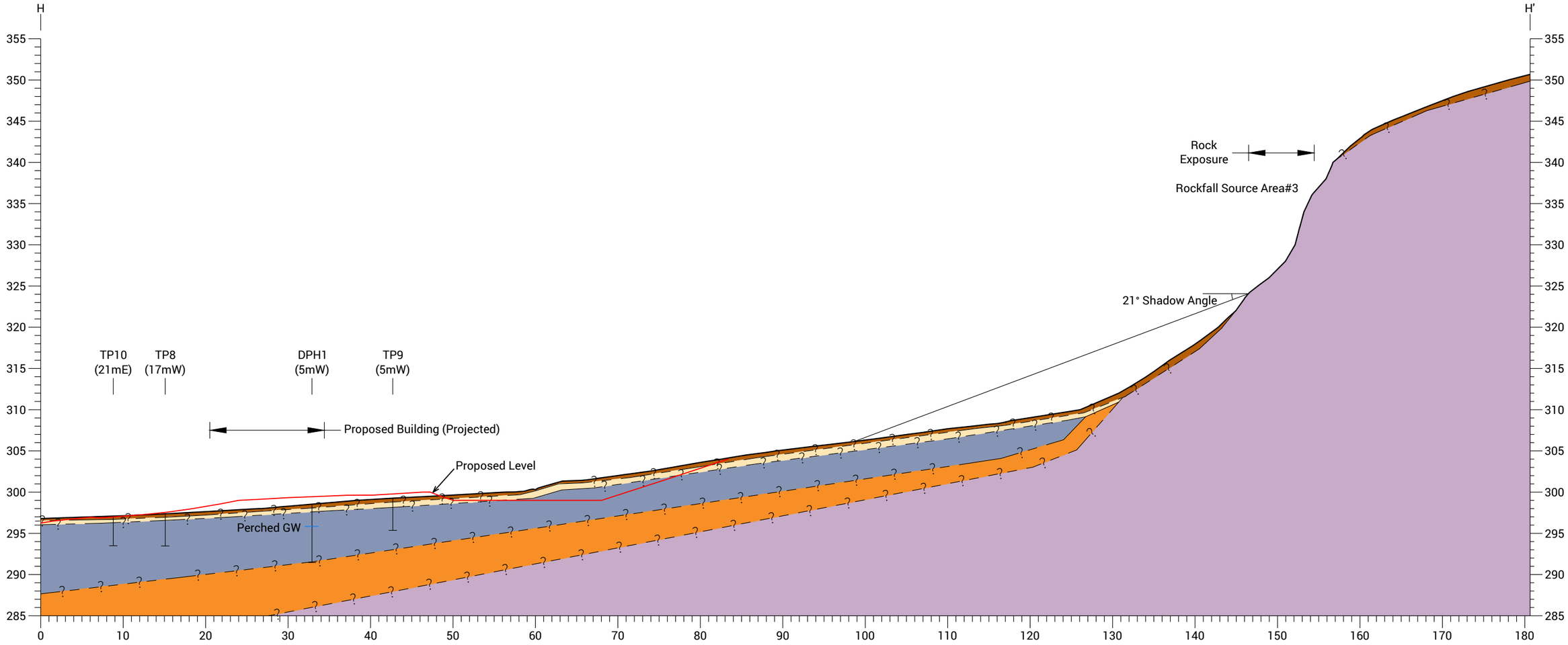
DRAWN	WCG	Jul.21
DRAFTING CHECKED	MBS	Jul.21
APPROVED	SR	Jul.21
CADFILE: 200393.dwg		
SCALES (AT A3 SIZE): 1:250		
PROJECT No: 200393		
FIG No: Appendix A, Figure 2g		
REV. 0		

John Edmonds and Associates Limited

Damper Bay (Lot 1 DP 337193)

Geotechnical Inputs

Cross Section G



Notes:
1. These drawings have been prepared for the benefit of John Edmonds and Associates Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

- Topsoil / Colluvium
- Alluvium
- Lake Sediment
- Outwash Gravel
- Schist Bedrock

SCALE 1:500

0 5 10 15 20 25 (m)

GEOSOLVE
Level 1, 70 MacAndrew Road, South Dunedin
www.geosolve.co.nz

DRAWN	WCG	Jul.21
DRAFTING CHECKED	MBS	Jul.21
APPROVED	SR	Jul.21
CADFILE: 200393.dwg		
SCALES (AT A3 SIZE): 1:500		
PROJECT No: 200393		

John Edmonds and Associates Limited

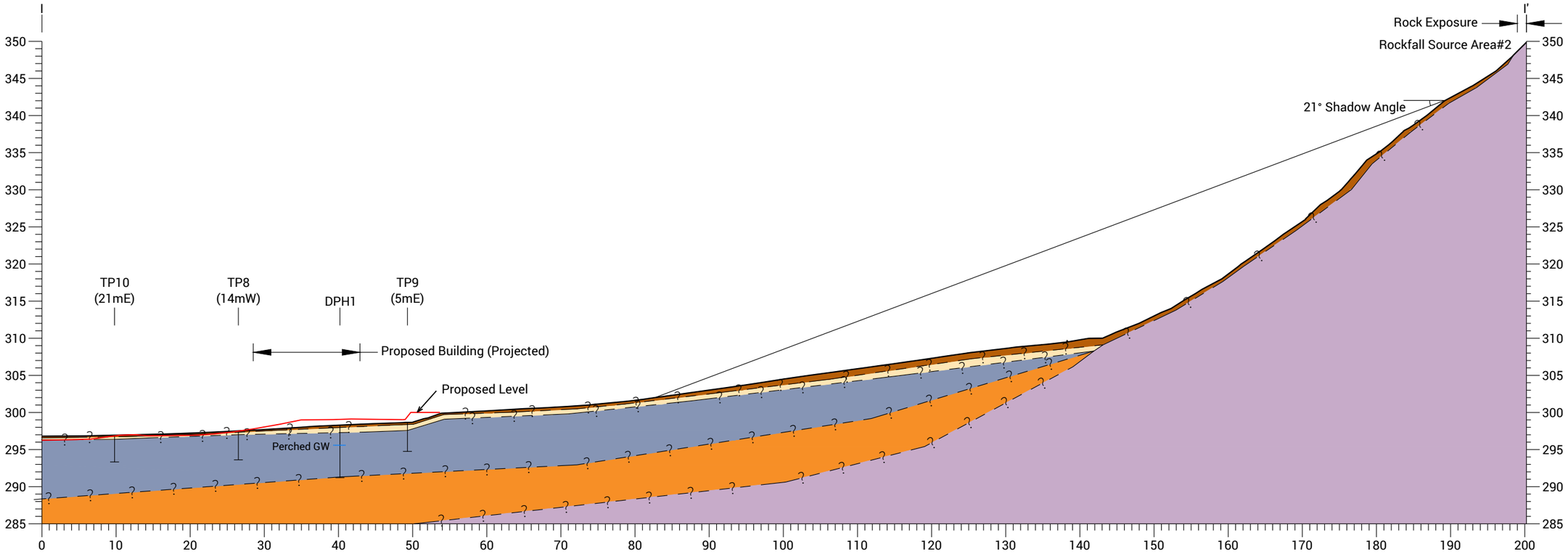
Damper Bay (Lot 1 DP 337193)

Geotechnical Inputs

Cross Section H

FIG No: Appendix A, Figure 2h

REV. 0



Notes:
1. These drawings have been prepared for the benefit of John Edmonds and Associates Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

- Topsoil / Colluvium
- Alluvium
- Lake Sediment
- Outwash Gravel
- Schist Bedrock

SCALE 1:500

0 5 10 15 20 25 (m)

GEOSOLVE
Level 1, 70 MacAndrew Road, South Dunedin
www.geosolve.co.nz

DRAWN	WCG	Jul.21
DRAFTING CHECKED		
APPROVED		
CADFILE: 200393.dwg		
SCALES (AT A3 SIZE): 1:500		
PROJECT No: 200393		

John Edmonds and Associates Limited

Damper Bay (Lot 1 DP 337193)

Geotechnical Inputs

Cross Section I

FIG No: Appendix A, Figure 2i

REV. 0

Appendix B: Investigation Data

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 1**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

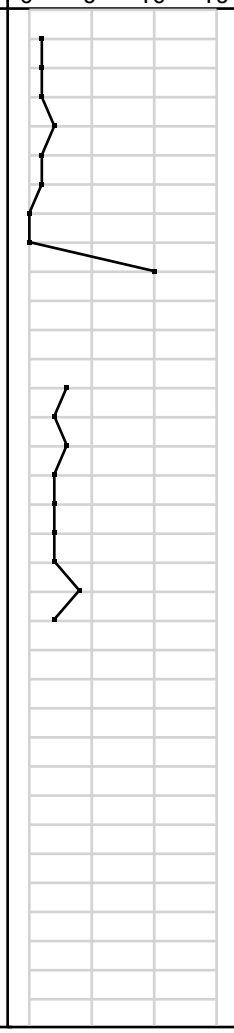
EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Depth (m)
TOPSOIL	Organic SILT with minor sand; dark brown. Firm; moist; non-plastic; sand, fine to medium. A trace of rootlets.	0m – 0.3m
ALLUVIAL SILT	Sandy SILT; brown. Firm; moist; sand, fine to medium. A trace of rootlets and amorphous organics.	0.3m – 0.5m
ALLUVIAL GRAVEL	Sandy fine to medium GRAVEL; brown. Loose to medium dense; moist; sand, fine to coarse; gravel, subrounded.	0.5m – 0.6m
LAKE SEDIMENT	Fine to coarse SAND with a trace of gravel; grey. Loose to medium dense; moist; gravel, fine to medium, subrounded.	0.6m – 1.2m
LAKE SEDIMENT	SILT with some sand, minor boulders and a trace of gravel; grey, laminated. Firm to stiff; moist; sand, fine to medium, gravel, fine to coarse, rounded. Occasional angular schist boulders to 200 mm+ diameter.	1.2m – 3.5m

Graphic Log

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm)



Total Excavation Depth = 3.5 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 2**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Depth
TOPSOIL	Organic SILT with minor sand; dark brown. Firm; moist; non-plastic; sand, fine to medium. A trace of rootlets.	0m – 0.3m
COLLUVIUM	Sandy SILT; brown. Firm; moist; non-plastic; sand, fine to medium.	0.3m – 0.5m
ALLUVIAL GRAVEL	Sandy fine to coarse GRAVEL; greyish brown. Loose to medium dense; moist; sand, fine to coarse; gravel, fine to coarse, subrounded.	0.5m – 0.7m
ALLUVIAL SILT	Sandy SILT with minor gravel; greyish brown. Firm to stiff; moist; sand, fine to coarse; gravel, fine to coarse, subrounded.	0.7m – 1.3m
ALLUVIAL GRAVEL	Silty sandy fine to coarse GRAVEL with minor cobbles; brown, massive. Medium dense to dense; moist; sand, fine to coarse; gravel, fine to coarse, subrounded.	1.3m – 3.2m
ALLUVIAL GRAVEL	Sandy fine to coarse GRAVEL; greyish brown. Medium dense to dense; wet. Saturated from 3.3 m; sand, fine to coarse.	3.2m – 3.8m

Graphic Log

Depth (m): 0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8

Groundwater / Seepage: Inflow of 1-2 ltrs/min

Scala Penetrometer (Blows per 100mm): 0, 5, 10, 15

Total Excavation Depth = 3.8 m

COMMENT:	Pit walls stood well above water level during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 3**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

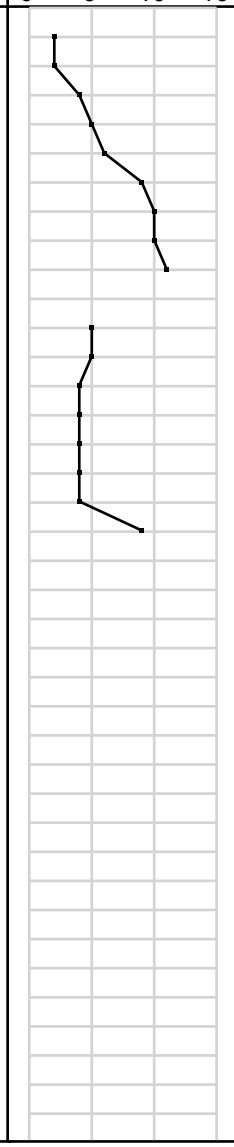
EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Depth (m)
TOPSOIL	Organic SILT with minor sand; dark brown. Firm; moist; non-plastic; sand, fine to medium. A trace of rootlets.	0m – 0.2m
COLLUVIUM	Sandy SILT with minor gravel, cobbles and boulders; brown, massive. Stiff; dry; sand, fine to coarse; gravel, fine to coarse, subrounded.	0.2m – 0.4m
ALLUVIAL SAND	Fine to medium SAND with a trace of silt; grey, massive. Medium dense; moist.	0.4m – 0.8m
ALLUVIAL GRAVEL	Sandy fine to coarse GRAVEL with a trace of silt and boulders; brownish grey, massive. Dense; moist; chaotic; sand, fine to coarse; gravel, angular to subangular.	0.8m – 1.3m
LAKE SEDIMENT	SILT with minor sand; grey, massive. Stiff to very stiff; moist; non-plastic; sand, fine to medium.	1.3m – 3m
LAKE SEDIMENT	Fine to medium SAND with a trace of gravel; brownish grey. Medium dense; moist; gravel, fine to medium, subrounded.	3m – 3.9m

Graphic Log

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm)



Total Excavation Depth = 3.9 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 4**

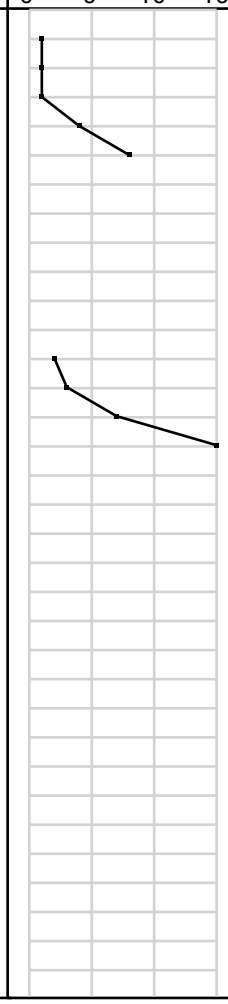
PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Graphic Log	Depth (m)
TOPSOIL/ COLLUVIUM	0m — Organic SILT with minor sand and boulders; dark brown. Firm; moist; non-plastic; sand, fine to medium. A trace of rootlets. — 0.3m		0.0 – 0.3
COLLUVIUM	Sandy silty fine to coarse GRAVEL with minor boulders; brown. Loose to medium dense; moist; sand, fine to coarse; gravel, subrounded. — 0.7m		0.3 – 0.7
ALLUVIAL SILT	SILT with minor sand; grey, laminated. Firm; moist; sand, fine to medium.		0.7 – 1.3
ALLUVIAL GRAVEL	1.3m — Sandy fine to coarse GRAVEL; greyish brown, bedded, 5° to the north. Medium dense; moist; sand, fine to coarse; gravel, subrounded. — 2.2m		1.3 – 2.2
ALLUVIAL GRAVEL	Fine to coarse GRAVEL with boulders; grey, massive. Dense; moist; gravel, subangular to subrounded. — 2.4m		2.2 – 2.4
ALLUVIAL GRAVEL	Silty sandy fine to coarse GRAVEL; brown, massive. Dense; moist; sand, fine to coarse; gravel, subrounded to subangular. — 3.4m		2.4 – 3.4

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm)



Total Excavation Depth = 3.4 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 5**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

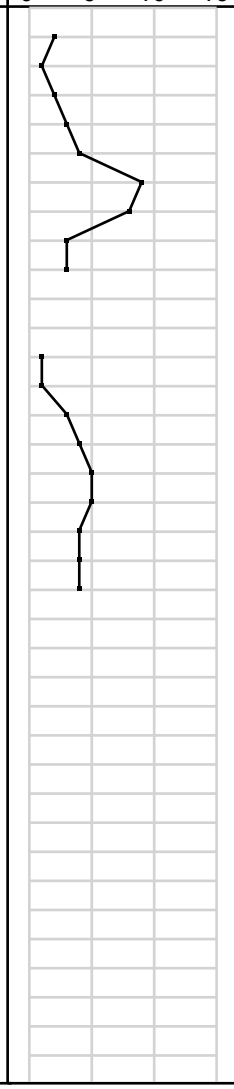
EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Depth (m)
TOPSOIL	Organic SILT; dark brown. Firm; moist; non-plastic; a trace of rootlets.	0m – 0.3m
COLLUVIUM	Sandy SILT; brown. Firm; moist; sand, fine to medium.	0.3m – 0.5m
ALLUVIAL GRAVEL	Sandy fine to coarse GRAVEL; grey mottled orange, bedded. Loose; moist; sand, fine to coarse; gravel, subrounded. Weathered horizons.	0.5m – 0.7m
LAKE SEDIMENT	Fine to medium SAND; grey. Loose; dry.	0.7m – 1.5m
LAKE SEDIMENT	Sandy SILT with a trace of gravel; grey mottled orange, massive. Stiff; moist; sand, fine to medium; gravel, fine to medium, subrounded.	1.5m – 3.7m

Graphic Log

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm)



Total Excavation Depth = 3.7 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 6**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

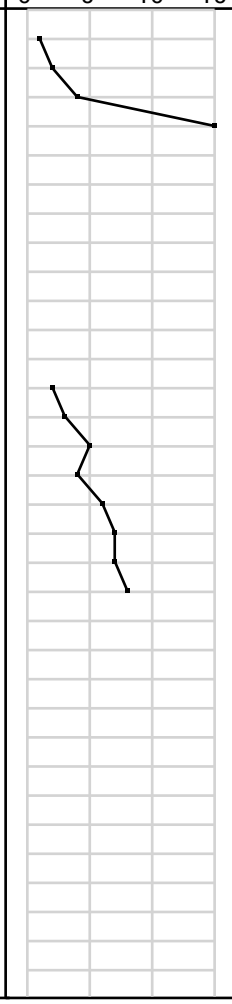
EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Depth (m)
TOPSOIL	Organic SILT; dark brown. Firm; moist; a trace of rootlets.	0m – 0.4m
ALLUVIAL GRAVEL	Sandy fine to coarse GRAVEL with some silt, cobbles and boulders; brown, massive. Medium dense; moist; sand, fine to coarse; gravel, subrounded to sub-angular.	0.4m – 0.7m
LAKE SEDIMENT	SILT with some sand and gravel; grey, massive. Very stiff to hard; moist to wet; sand, fine to coarse; gravel inclusions, fine to coarse, subrounded to subangular.	0.7m – 3.4m

Graphic Log

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm)



Total Excavation Depth = 3.4 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

Document Set ID: 6987704
Version: 1, Version Date: 31/08/2021

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 7**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Depth (m)	Groundwater / Seepage	Scala Penetrometer (Blows per 100mm)
TOPSOIL	Sandy organic SILT; dark brown. Firm; moist; sand, fine to medium. A trace of rootlets.	0m – 0.2m		
COLLUVIUM	Sandy gravelly SILT with cobbles; dark brown. Firm to stiff; moist; sand, fine to coarse; gravel, fine to coarse.	0.2m – 0.4m		
LAKE SEDIMENT	SILT with minor sand; grey mottled orange. Firm to stiff; moist to wet; occasional schist gravel inclusions.	0.4m – 3m	NO SEEPAGE	
OUTWASH GRAVEL	Silty sandy fine to coarse GRAVEL; grey. Dense; moist to wet; sand, fine to coarse; gravel, subrounded.	3m – 3.1m		

Total Excavation Depth = 3.1 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 8**

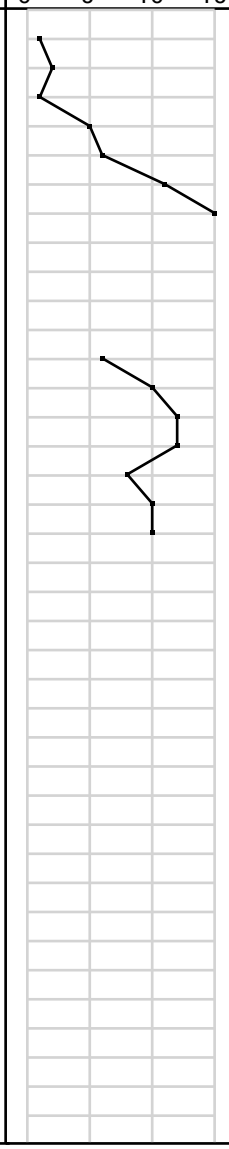
PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Graphic Log	Depth (m)
TOPSOIL	Organic SILT; dark brown. Soft to firm; moist; a trace of rootlets.	0m	0.0
		0.3m	0.3
ALLUVIAL GRAVEL	Fine to coarse GRAVEL with some silt and sand; brownish grey. Medium dense; moist; sand, fine to medium; gravel, subrounded.		0.5
LAKE SEDIMENT	SILT with minor sand and gravel; grey, laminated. Very stiff to hard; moist; non-plastic; sand, fine to coarse; occasional gravel lenses/inclusions, fine to medium, subrounded to subangular.	0.5m	
		3.9m	3.9

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm)



Total Excavation Depth = 3.9 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 9**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

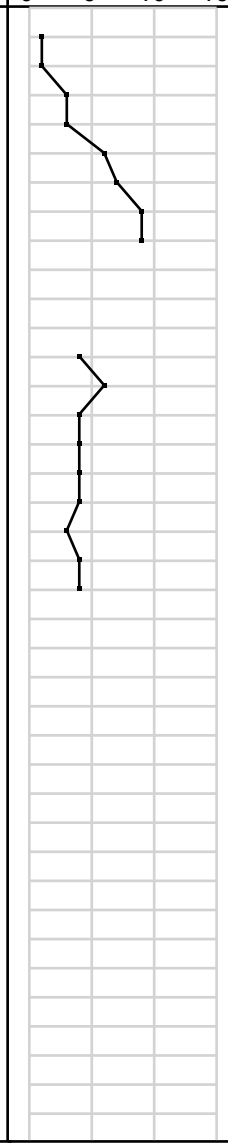
EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Depth (m)
TOPSOIL	Organic SILT; dark brown. Soft to firm; moist; a trace of rootlets.	0m – 0.4m
ALLUVIAL GRAVEL	Sandy fine to coarse GRAVEL with cobbles; greyish brown. Medium dense; moist; sand, fine to coarse; gravel, subrounded.	0.4m – 1.1m
LAKE SEDIMENT	SILT with some sand; grey. Stiff; moist; non-plastic; sand, fine to medium.	1.1m – 3.9m

Graphic Log

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm)



Total Excavation Depth = 3.9 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 10**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

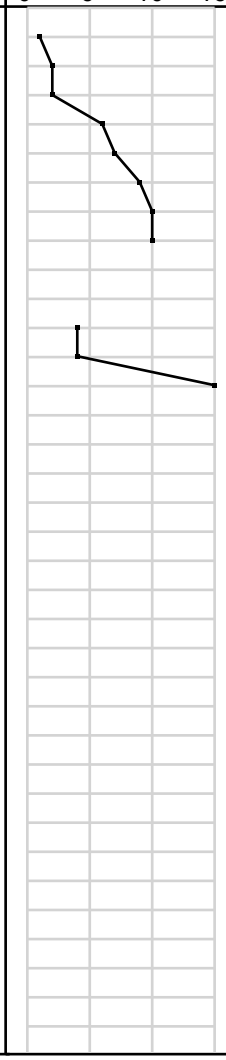
Soil / Rock Type	Description	Depth
TOPSOIL	Organic SILT with some sand, gravel and boulders; dark brown. Soft to firm; moist; sand, fine to coarse; gravel, fine to coarse, subrounded to subangular. Angular schist boulders. A trace of rootlets.	0m
ALLUVIAL GRAVEL	Sandy fine to coarse GRAVEL; grey. Medium dense; moist; sand, fine to coarse; gravel, subrounded to subangular.	0.4m
LAKE SEDIMENT	Sandy SILT with gravel, cobbles and boulders; grey. Stiff to very stiff; moist; sand, fine to medium; gravel, medium to coarse, subrounded to subangular. Schist boulders, cobble inclusions and gravel lenses.	0.6m
LAKE SEDIMENT	Sandy SILT; grey. Stiff; moist; fine to medium.	1.5m
		3.6m

Graphic Log

Depth (m): 0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm)



Total Excavation Depth = 3.6 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

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TEST PIT LOG

EXCAVATION NUMBER: **TP 11**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	19/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	19/05/2021

Soil / Rock Type	Description	Depth (m)
TOPSOIL	Organic SILT; dark brown. Soft to firm; moist; a trace of rootlets.	0m – 0.2m
COLLUVIUM	Sandy, fine to coarse GRAVEL with cobbles; brown. Loose to medium dense; moist; sand, fine to coarse; gravel, subangular to subrounded. Cobble inclusions.	0.2m – 0.4m
ALLUVIAL SILT	SILT with minor sand; greyish brown. Stiff; moist to wet; sand, fine to medium.	0.4m – 2.1m
OUTWASH GRAVEL	Sandy fine to coarse GRAVEL; greyish brown. Medium dense; moist; sand fine to coarse; gravel, subrounded.	2.1m – 3.4m

Graphic Log

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm): 0 5 10 15

Total Excavation Depth = 3.4 m

COMMENT:		LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

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TEST PIT LOG

EXCAVATION NUMBER: **TP 12**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	20/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	20/05/2021

Soil / Rock Type	Description		Graphic Log	Depth (m)	Groundwater / Seepage	Scala Penetrometer (Blows per 100mm)
TOPSOIL	Organic SILT; dark brown. Very soft; moist; a trace of rootlets.	0m 0.2m		0.0 0.1	NO SEEPAGE	0 5 10 15
COLLUVIUM	Sandy SILT with minor cobbles and boulders; brown, massive. Soft; dry to moist; sand, fine to medium.	0.4m		0.2 0.3 0.4		
ALLUVIAL GRAVEL	Sandy fine to medium GRAVEL; brown, bedded. Loose to medium dense; moist; sand, fine to coarse; gravel, subrounded.			0.5 0.6		
SCHIST BEDROCK	Grey, psammitic SCHIST; Moderately strong.	0.6m 0.8m		0.7 0.8		

Total Excavation Depth = 0.8 m

COMMENT:	Excavator refusal on bedrock. Test pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

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TEST PIT LOG

EXCAVATION NUMBER: **TP 13**

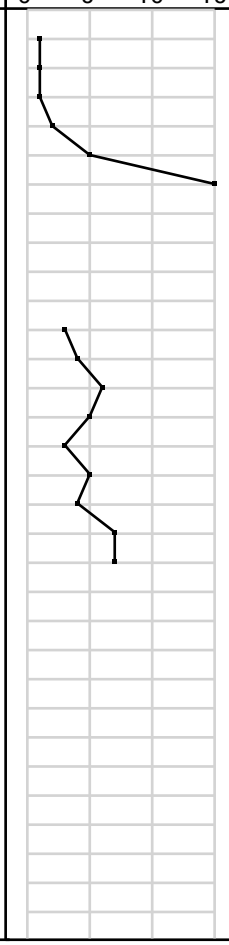
PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	20/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	20/05/2021

Soil / Rock Type	Description	Graphic Log	Depth (m)
TOPSOIL	0m Organic SILT; dark brown. Soft to firm; moist; a trace of rootlets.		0.0
ALLUVIAL GRAVEL	0.3m Sandy fine to coarse GRAVEL with minor silt and boulders; brown, bedded. Loose; moist; sand, fine to coarse. Schist angular colluvium boulders up to 300 mm diameter.		0.3
LAKE SEDIMENT	0.7m Sandy SILT; grey, laminated. Stiff to very stiff; moist; sand, fine to medium.		0.7
LAKE SEDIMENT	3m Silty fine to medium SAND; grey, massive. Medium dense; moist. 3.2m		3.0

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm)



Total Excavation Depth = 3.2 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

TEST PIT LOG

EXCAVATION NUMBER: **TP 14**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	20/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	20/05/2021

Soil / Rock Type	Description	Graphic Log	Depth (m)
TOPSOIL	0m Sandy organic SILT; dark brown. Very soft; moist; sand, fine to medium. A trace of rootlets. 0.4m		0.0 – 0.4
ALLUVIAL SILT	Sandy SILT; grey mottled brown, no laminations. Soft to firm; moist; non-plastic; sand, fine to medium. 0.8m		0.4 – 0.8
LAKE SEDIMENT	SILT with minor sand; brown mottled orange, no laminations. Stiff to very stiff; moist to wet; non-plastic; sand, fine to medium. 1.6m		0.8 – 1.6
LAKE SEDIMENT	SILT with minor sand; grey, no laminations. Soft to firm; moist to wet; low plasticity; sand, fine to medium. 3.5m		1.6 – 3.5

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer (Blows per 100mm): 0 5 10 15

Total Excavation Depth = 3.5 m

COMMENT:	Pit walls stood well during excavation.	LOGGED BY:	SR
		CHECKED DATE:	23/06/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

SOAKAGE PIT LOG

EXCAVATION NUMBER: **SP 1**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	20/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	21/05/2021

Soil / Rock Type	Description	Graphic Log	Depth (m)	Groundwater / Seepage	Scala Penetrometer
TOPSOIL	Organic SILT; dark brown. Soft; moist; a trace of rootlets. 0m – 0.2m		0.0 – 0.2		
ALLUVIAL SAND	Gravelly fine to coarse SAND; brownish grey. Loose; moist; gravel, fine to medium, subrounded. 0.9m		0.2 – 0.9		
LAKE SEDIMENTS	SILT with some sand; grey. Firm to stiff; moist to wet; non-plastic. Laminated; sand, fine. 3.5m		0.9 – 3.5	NO SEEPAGE	

Total Excavation Depth = 3.5 m

COMMENT:	Soakage testing at 0.9 m depth. Soils wet to full depth of soak pit following soakage testing.	LOGGED BY:	SR
		CHECKED DATE:	15/07/2021
		SHEET:	1 of 1

GEOSOLVE
ENGINEERING CONSULTANTS

SOAKAGE PIT LOG

EXCAVATION NUMBER: **SP 2**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	20/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	21/05/2021

Soil / Rock Type	Description	Depth (m)
TOPSOIL	Organic SILT; dark brown. Soft; moist; a trace of rootlets.	0m – 0.2m
ALLUVIAL SILT	Sandy SILT; grey. Firm; moist; sand, fine.	
ALLUVIAL SAND	Fine to medium SAND with a trace of silt; grey. Loose; moist.	0.5m – 0.9m
ALLUVIAL SAND	Gravelly fine to coarse SAND; brown. Loose; moist; gravel, fine to medium, subrounded.	1m
ALLUVIAL SAND	Fine to coarse SAND with some gravel; grey, bedded. Loose; wet; gravel, fine, subrounded to subangular.	
LAKE SEDIMENTS	Sandy SILT; grey, massive. Firm; wet; sand, fine.	1.1m – 1.5m
LAKE SEDIMENTS	Fine to coarse SAND; brown grey, massive. Loose; wet.	1.8m
LAKE SEDIMENTS	SILT with a trace of sand; grey. Firm; wet; medium plasticity. Thin laminations; sand, fine to medium.	3.5m

Graphic Log

Depth (m): 0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5

Groundwater / Seepage: NO SEEPAGE

Scala Penetrometer

Total Excavation Depth = 3.5 m

COMMENT:	Soakage testing at 0.9 m depth. Soils wet to full depth of soak pit following soakage testing.	LOGGED BY:	SR
		CHECKED DATE:	15/07/2021
		SHEET:	1 of 1

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SOAKAGE PIT LOG

EXCAVATION NUMBER: **SP 3**

PROJECT:	Damper Bay, Wanaka			JOB NUMBER:	200393
LOCATION:	See Site Plan	INCLINATION:	Vertical		

EASTING:		EQUIPMENT:	8.5T excavator	OPERATOR:	Russ
NORTHING:		COORD. SYSTEM:		COMPANY:	Parcell Contracting
ELEVATION:		EXCAV. DATUM:	Existing ground level	HOLE STARTED:	20/05/2021
METHOD:	Aerial Photography	ACCURACY:	± 5 m	HOLE FINISHED:	21/05/2021

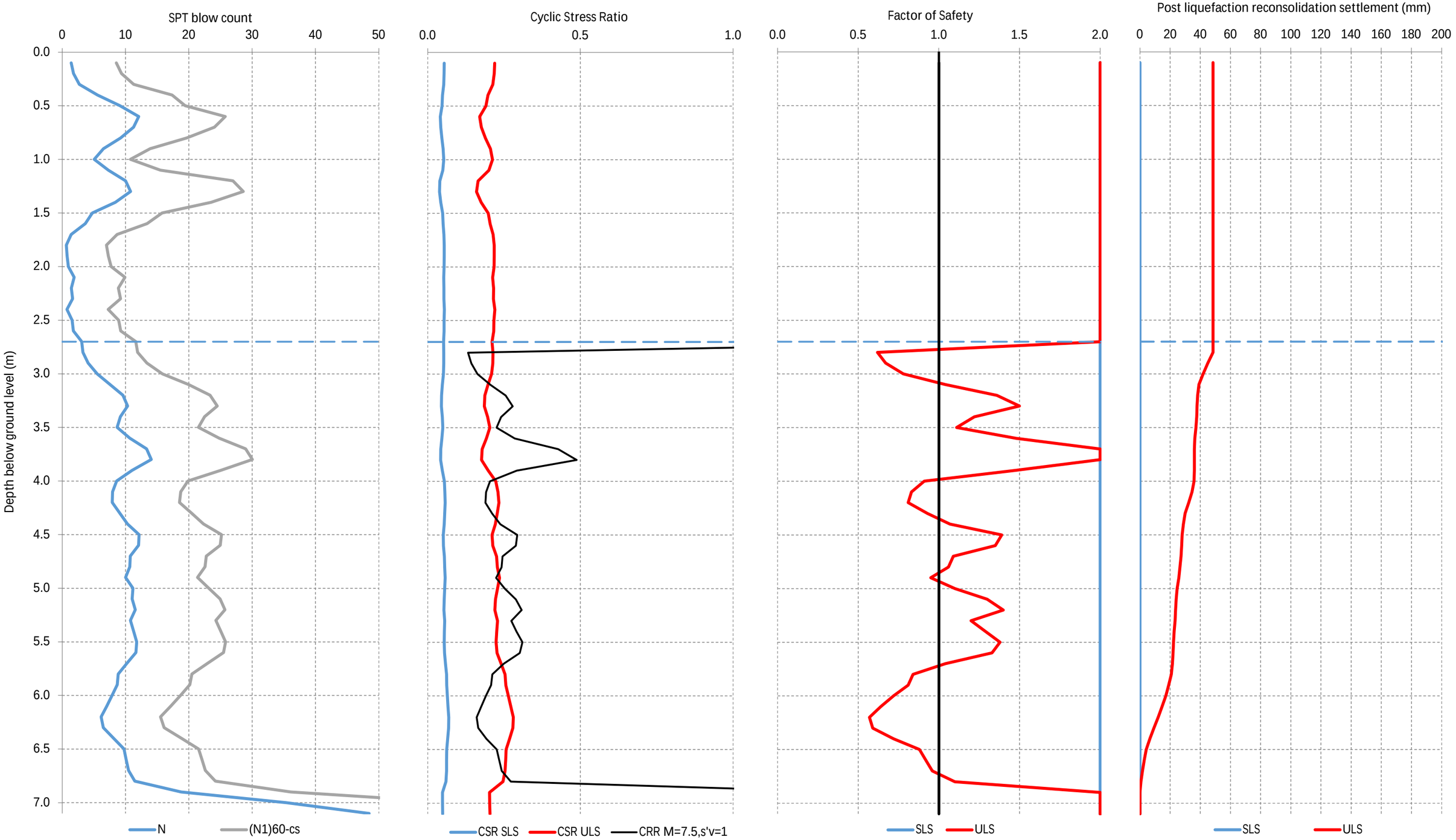
Soil / Rock Type	Description	Graphic Log	Depth (m)	Groundwater / Seepage	Scala Penetrometer
TOPSOIL	Organic SILT; dark brown. Soft; moist; a trace of rootlets. 0m – 0.2m		0.0 – 0.2		
ALLUVIAL SAND	Fine to medium SAND with a trace of silt; grey, massive. Loose; dry. 0.2m – 0.7m		0.2 – 0.7		
ALLUVIAL SAND	Gravelly fine to coarse SAND; brownish grey, massive. Loose; dry to moist; gravel, fine to medium. 0.7m – 1m		0.7 – 1.0		
LAKE SEDIMENTS	SILT with minor sand and a trace of gravel; grey. Stiff; moist; non-plastic; sand, fine; gravel, fine to medium. 1m – 1.5m		1.0 – 1.5		
LAKE SEDIMENTS	Silty fine SAND with minor gravel; grey. Medium dense; moist; gravel, fine to coarse. 1.5m – 2m		1.5 – 2.0		
LAKE SEDIMENTS	Sandy SILT; grey. Stiff; moist; non-plastic. Weak thin laminations; sand, fine. Micaceous. 2m – 3.3m		2.0 – 3.3	NO SEEPAGE	

Total Excavation Depth = 3.3 m

COMMENT:	Soakage testing at 1.0 m depth. Soils wet to full depth of soak pit following soakage testing.	LOGGED BY:	SR
		CHECKED DATE:	15/07/2021
		SHEET:	1 of 1

Appendix C: Liquefaction Analysis

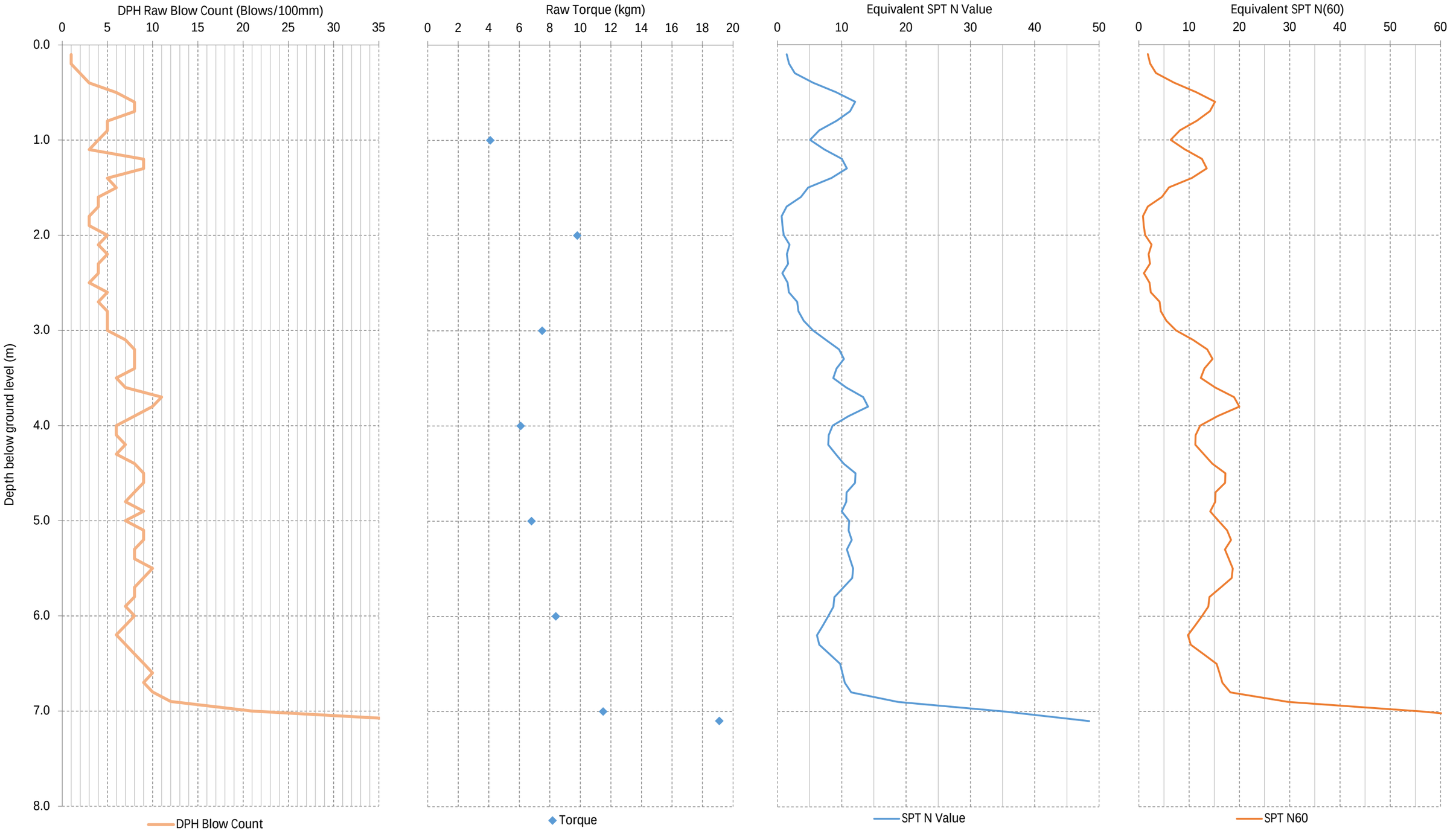
LSN (SLS)	LSN (ULS)	Crust Thickness (SLS)	Crust Thickness (ULS)
0.0	10.8	0.0	2.7



Note: Settlements as per Idriss and Boulanger (2014)

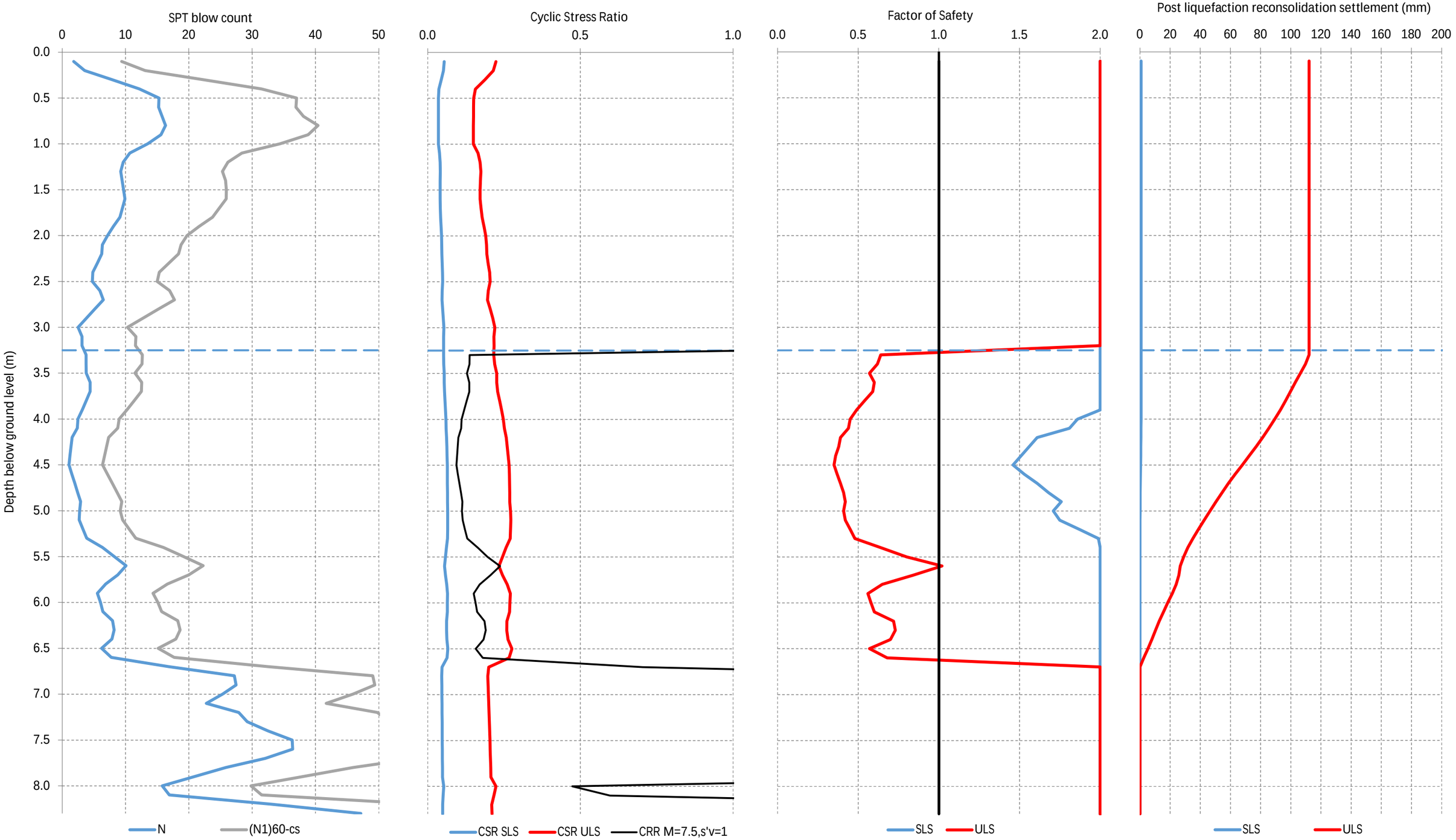
GEOSOLVE

PROJECT	200393 - JEADamper
DESCRIPTION	Liquefaction Analysis
LOCATION	Damper Bay, Mt Aspiring Rd, Wanaka
CLIENT	John Edmonds & Associates
TEST NUMBER	DPH1
DATE	5/05/2021
LOGGED BY	RC
ANALYSED BY	RC
CHECKED BY	Enter on Input



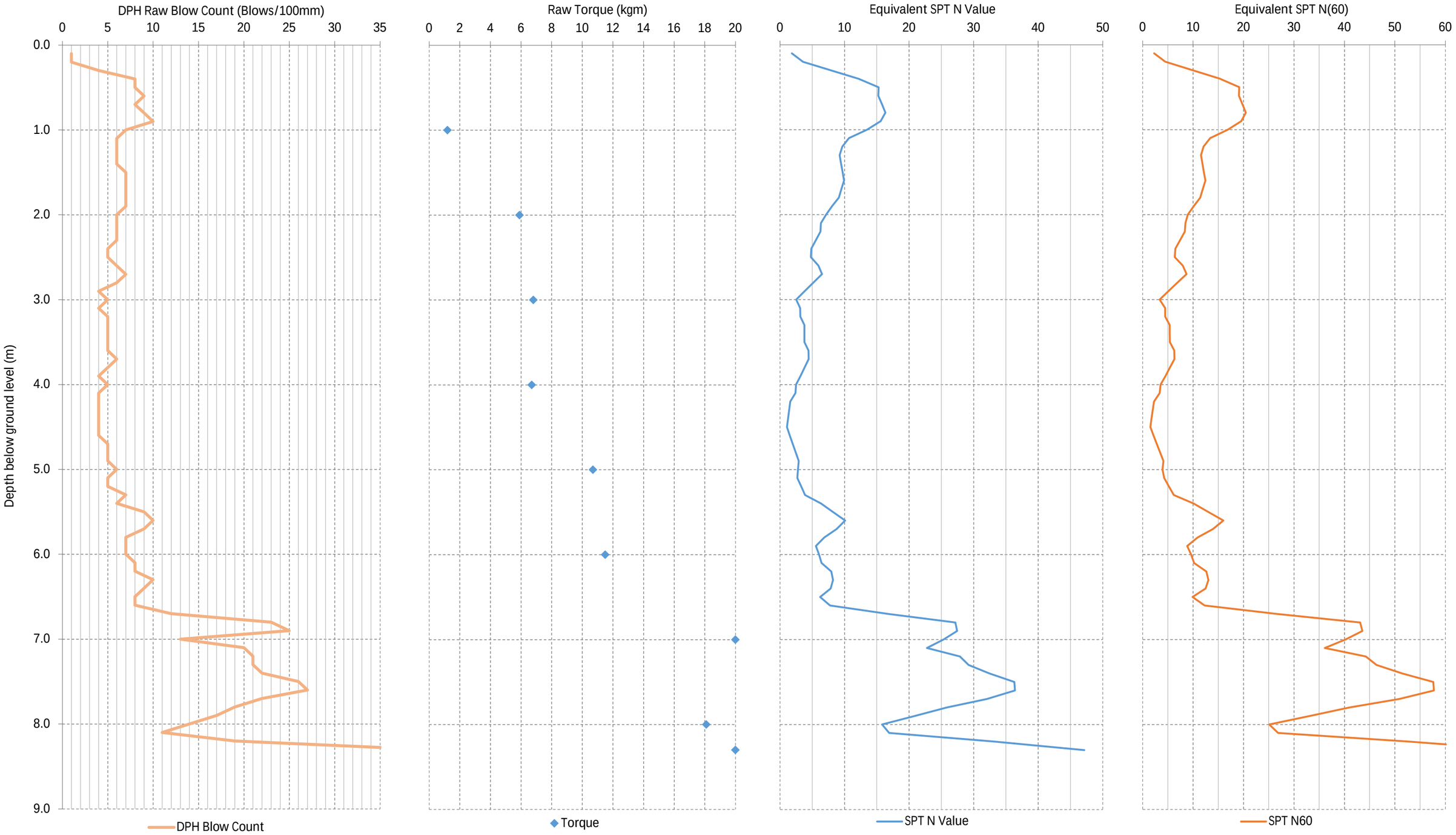
GEOSOLVE	PROJECT	200393 - JEADamper	CLIENT: John Edmonds & Associates
	DESCRIPTION	Liquefaction Analysis	TEST NUMBER: DPH1
	LOCATION	Damper Bay, Mt Aspiring Rd, Wanaka	DATE: 5/05/2021
			LOGGED BY: RC
			ANALYSED BY: RC
			CHECKED BY: Enter on Input

LSN (SLS)	LSN (ULS)	Crust Thickness (SLS)	Crust Thickness (ULS)
0.2	24.4	0.0	3.2



Note: Settlements as per Idriss and Boulanger (2014)

GEOSOLVE	PROJECT	200393 - JEADamper	CLIENT: John Edmonds & Associates
	DESCRIPTION	Liquefaction Analysis	TEST NUMBER: DPH2
	LOCATION	Damper Bay, Mt Aspiring Rd, Wanaka	DATE: 5/05/2021
			LOGGED BY: RC
			ANALYSED BY: RC
			CHECKED BY: Enter on Input



PROJECT	200393 - JEADamper	CLIENT	John Edmonds & Associates
DESCRIPTION	Liquefaction Analysis	TEST NUMBER	DPH2
LOCATION	Damper Bay, Mt Aspiring Rd, Wanaka	DATE	5/05/2021
		LOGGED BY	RC
		ANALYSED BY	RC
		CHECKED BY	Enter on Input

Appendix C - Liquefaction Analysis

General

Liquefaction occurs when susceptible, saturated soils attempt to move to a denser state under cyclic shearing. In this report, liquefaction is defined as when pore pressures rise to reach the overburden stress. When this occurs, the following effects can happen at flat sites:

- loss of strength;
- ejection of material under pressure to the ground surface; and
- post-liquefaction volumetric densification as the materials reconsolidate.

In addition, sloping sites or sites with a 'free face' may experience lateral spreading or movement.

Liquefaction Susceptibility

Soils susceptible to liquefaction have the following characteristics:

- Saturated. Below the ground water level;
- Have "sand like" behaviour[9]; and
- Are in loose or medium dense condition.

Soils which are susceptible to liquefaction require a certain level of earthquake shaking (trigger) to cause them to liquefy. Denser soils require more intense and/or longer duration of shaking (higher trigger) than less dense soil.

Analysis Method

Liquefaction analyses were undertaken on the test data using the Boulanger & Idriss (2014)[7] deterministic method.

Assessment of Consequences of Liquefaction

The following can be assessed to estimate the consequences of liquefaction at this site:

- Crust thickness.
- Liquefaction severity index.
- Free field settlements.
- Lateral spread.

Crust Thickness

The non-liquefiable upper layer of soils (crust) provides some protection against ground surface damage as a result of liquefaction. The thicker the crust, the less ground surface damage is expected with significant protection provided by thicknesses of more than 5 m.

[9] "Geotechnical earthquake engineering practice: Module 1 Guideline for the identification, assessment and mitigation of liquefaction hazards", Rev 0, July 2010. New Zealand Geotechnical Society. This document states that soil with: Fc <30%, or; Fc >30% and PI < 7% (where Fc= percent passing a 0.075mm sieve and PI=plasticity index) is considered as "sand-like" and is susceptible to liquefaction.

Empirical correlations have been developed by Ishihara[10] to quantify the thickness of non-liquefiable crust required to prevent the formation of sand boils resulting from the liquefaction of underlying soil layers. These correlations indicate that for a given thickness of liquefiable soil, as the peak ground acceleration increases a greater thickness of non-liquefiable soil is required to prevent liquefaction damage from manifesting on the surface.

Liquefaction Severity Number

Liquefaction severity number (LSN) is a single value which can be calculated from a liquefaction assessment considering the thickness density and depth of liquefiable layers and the intensity of earthquake shaking. Based on observations of ground surface damage in Christchurch an indicative correlation has been developed between ground surface damage from liquefaction and LSN as described below.

As the LSN increases, so does the risk of severe effects on the land and structure. In general, the following surface effects are considered likely at sites with various LSN values.

Table 1C - Liquefaction Severity Number

LSN	Effects
0 – 10	Little to no expression of liquefaction, minor effects
10 – 20	Minor expression of liquefaction, some sand boils
20 – 30	Moderate expression of liquefaction, with sand boils and some structural damage
30 – 40	Moderate to severe expression of liquefaction, settlement can cause structural damage
40 – 50	Major expression of liquefaction, undulations and damage to ground surface, severe total and differential settlement of structures
> 50	Severe damage, extensive evidence of liquefaction at surface, severe total and differential settlements affecting structures, damage to services

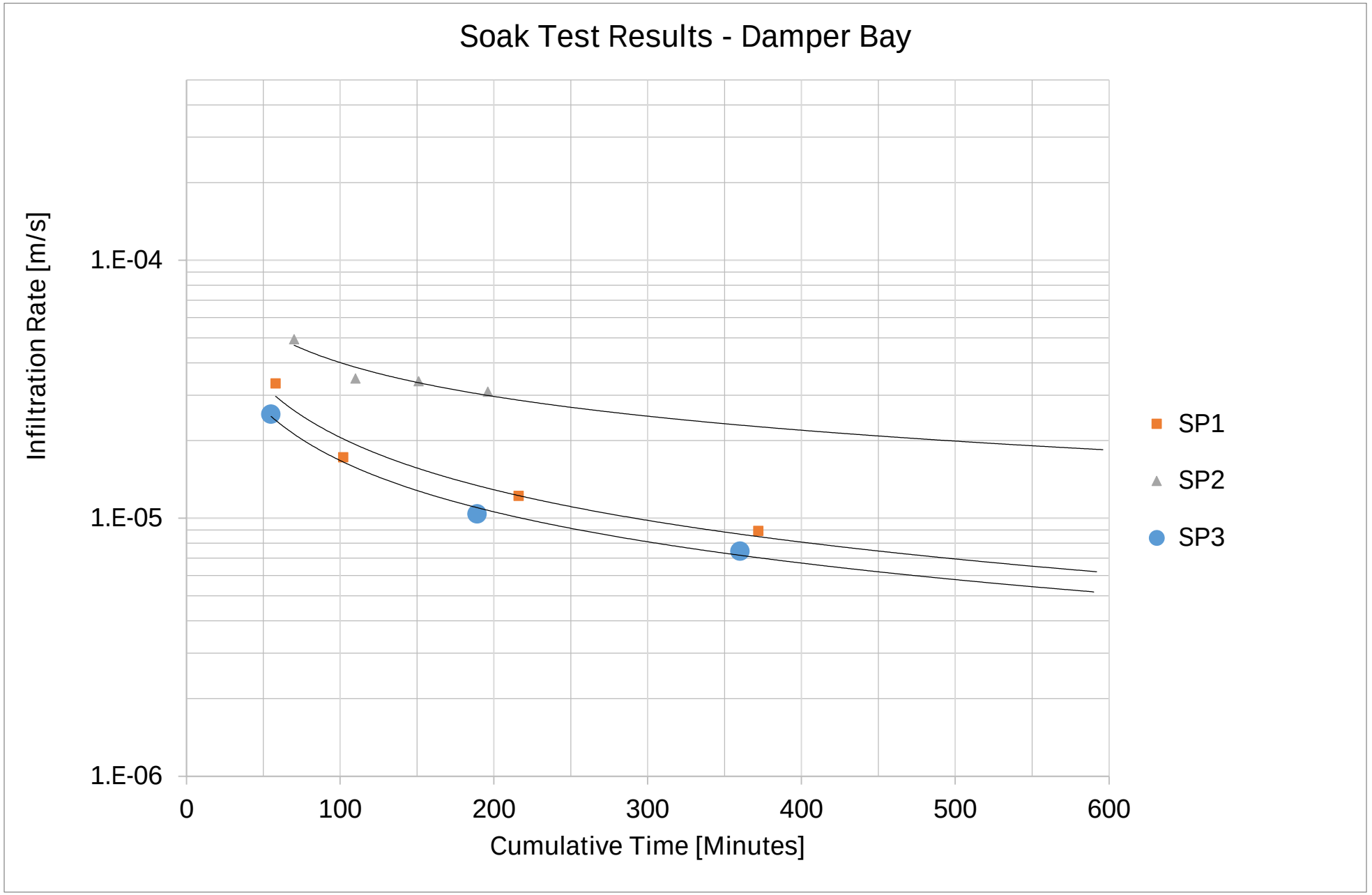
Free Field Settlements

This describes the settlement of ground not occupied by a building, occurring due to dissipation of excess pore water pressure generated during earthquake shaking. Where appropriate, we have estimated reconsolidation settlement of any potentially liquefiable layers using the methodology recommended by Idriss & Boulanger (2014)[7].

A component of building settlement may also occur due to yield of any liquefied founding soils. This component of settlement is very difficult to predict and depends on the interaction of the building and the soil it is founded on.

[10] Ishihara, K. (1985). “Stability of natural deposits during earthquakes,” Theme lecture, Proc. 11th Int. Conf. On Soil Mechanics and Foundation Engineering, San Francisco, 2, 321-376pp.

Appendix D: Soakage Graphs and QLDC Onsite Wastewater Disposal Site and Soils Assessment



Document Set ID: 6987704
Version: 1, Version Date: 31/08/2021

Onsite Wastewater Disposal Site & Soils Assessment

Use for Subdivision or Land Use Resource Consent

The design standard for waste water treatment and effluent disposal systems is AS/NZS 1547:2012. All references in this form relate to this standard.

Applications should provide sufficient information to demonstrate that all lots will be capable of accommodating an on-site system.

Site Description

Property Owner: Second Star Limited

Location Address: Damper Bay, Mount Aspiring Rd, Wanaka

Legal Description (eg Lot3 DP1234) : Lot 1 DP 337193

List any existing consents related to waste disposal on the site: N/A

General description of development / source of waste water: Visitor accommodation development comprising main arrival building, 2 guest buildings, an owners building and a meditation room.

The number and size of the lots being created: N/A

Site Assessment (refer to Tables R1 & R2 for setback distances to site features)

Land use: Rural

Topography: Gently sloping

Slope angle: 1°-10°

Aspect: North and northeast

Vegetation cover: Grass and farm crop

Areas of potential ponding: N/A

Ephemeral streams: A dry overland flow path

Drainage patterns and overland paths: As indicated by the GeoSolve site plan

Flood potential (show with return period on site plan) N/A

Distance to nearest water body 400 m

Water bores with 50m (reference ORC Maps) N/A

Other Site Features

Slope stability assessment details – summarise any areas unsuitable for waste water irrigation. (Attach report if applicable):

No slope stability issues identified

(Highest potential) Depth to ground water:

Summer 2.5 m

Winter 2.5 m

Information Source Based on results from site investigation

What is the potential for waste water to short circuit through permeable soils to surface and / or ground water?

Low, the alluvial silt and lake sediment that underlies the site has low permeability and depth to bedrock is relatively shallow across the site.

Soil Investigation (Appendix C)

Field investigation date: 3, 5 and 19-21 May 2021

Number of test pit bores (C3.5.4): 17

Soil investigation addendum to be attached that includes a plan showing test pit or bore location, log results and photos of the site profile.

If fill material was encountered during the soil investigation state how this will impact on the waste water system:

No fill material encountered

Average depth of topsoil: 0.3 m

Indicative permeability (Appendix G) : 0.19-0.86 m/day

Percolation test method (refer to B6 for applicability) : Open soak pit test
(attach report if applicable)

Soil Category *(Table 5.1)*	Soil Texture *(Appendix E)*	Drainage	Tick One
1	Gravel and sands	Rapid	
2	Sandy loams	Free	
3	Loams	Good	
4	Clay loams	Moderate	x
5	Light clays	Moderate to slow	
6	Medium to heavy clays	Slow	

Reasons for placing in stated category: Soil and grain size and permeability observed in testing

Multiple soil types tested, See Section 10 of GeoSolve report for details.

Loading rate, DLR (Table L1):

Explanation for proposed loading rate:

Recommendations from site and soils assessment

Specify any design constraints
Specify any areas unsuitable for location of the disposal field
Specify any unsuitable treatment and/or disposal systems
Propose suitable mitigation to enable successful effluent treatment

The design will need to take into consideration the proximity to the overland flow path shown on the GeoSolve site plan. Design to be completed by others.

Attachments Checklist

- ☐ Copy of existing consents
- ☑ Soil investigation addendum
- ☑ To scale site plan, the following must be included on the plan:
  - Buildings
  - Boundaries
  - Retaining Walls
  - Embankments
  - Water bodies
  - Flood potential
  - Other septic tanks / treatment systems
  - Water bores
  - Existing and proposed trees and shrubs
  - Direction of ground water flow
  - North arrow

Note that an Otago Regional Council (ORC) consent may also be required to discharge domestic waste water to land if any of the following apply:

- Daily discharge volume exceeds 2,000 litres per day
- Discharge will occur in a groundwater protection zone
- Discharge will occur within 50 metres of a surface water body (natural or manmade)
- Discharge will occur within 50 metres of an existing bore/well
- Discharge will result in a direct discharge into a drain/water ace/ground water
- Discharge may runoff onto another persons' property

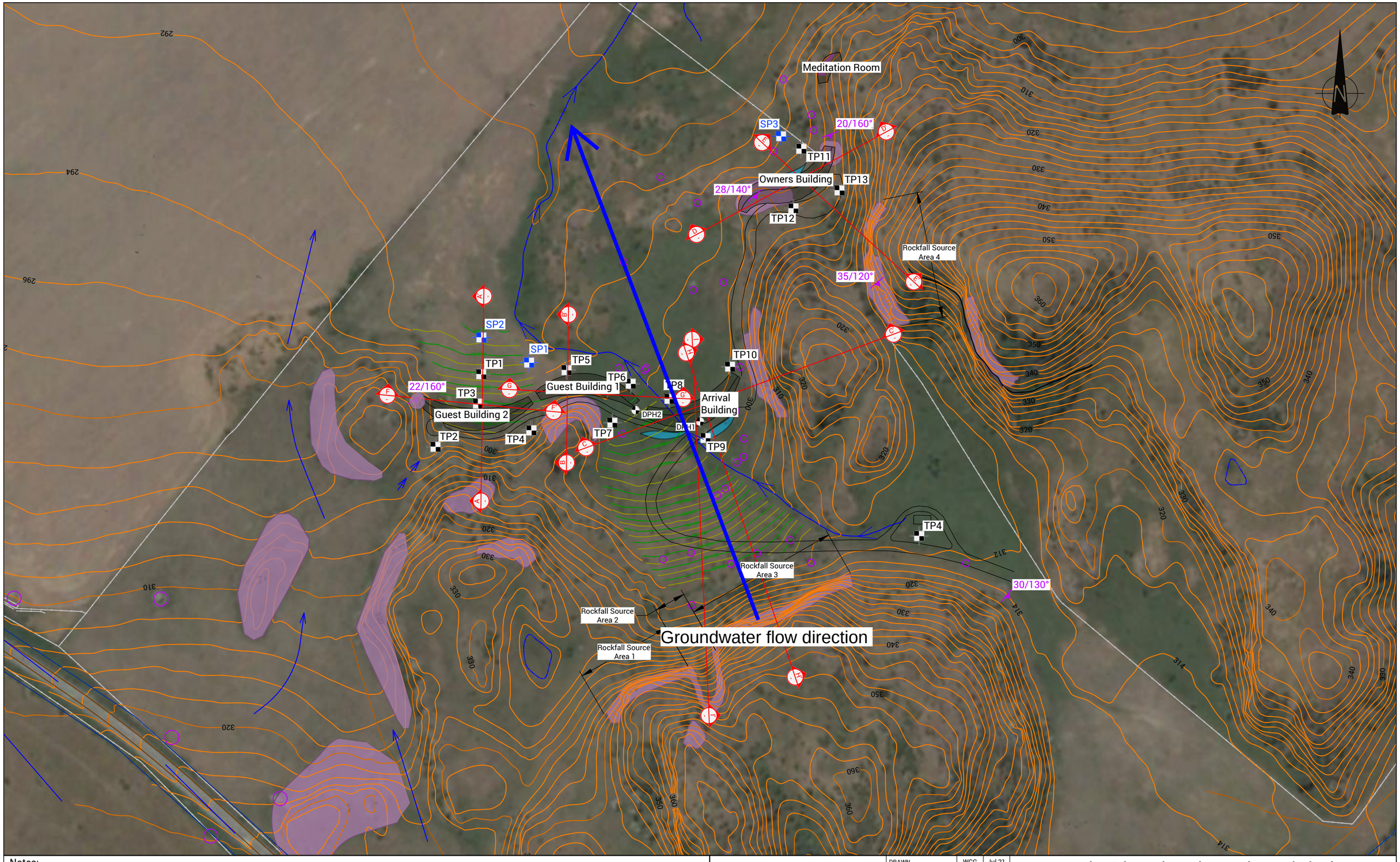
If any of these apply then we recommend that you correspond with the ORC;

Otago Regional Council
"The Station" (upstairs)
Cnr. Camp and Shotover Streets
P O Box 958
Queenstown 9300

Tel: 03 442 5681

I believe to the best of my knowledge that the information provided in this assessment is true and complete. I have the necessary experience and qualifications as defined in Section 3.3 AS/NZS 1547:2012 to undertake this assessment in accordance with the requirements of AS/NZS 1547:2012:

Company:	GeoSolve Ltd
Email:	mstemland@geosolve.co.nz
Phone number:	0211707097
Name:	Marte Stemland
Signature:	Mark Stemland
Date:	30/07/2021



Notes:
1. These drawings have been prepared for the benefit of John Edmonds and Associates Limited with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Legend:

Rockfall Boulder

Proposed Pond

Approximate location of Schist outcrops adjacent to the proposed development

SCALE 1:2000

0 20 40 60 80 100 (m)

GEOSOLVE
Level 1, 70 MacAndrew Road, South Dunedin
www.geosolve.co.nz

DRAWN	WCG	Jul.21
DRAFTING CHECKED		
APPROVED		
CADFILE: 200393.dwg		
SCALES (AT A3 SIZE): 1:2000		
PROJECT No: 200393		

John Edmonds and Associates Limited

Damper Bay (Lot 1 DP 337193)

Geotechnical Inputs

Site Plan

FIG No: Appendix A, Figure 1a

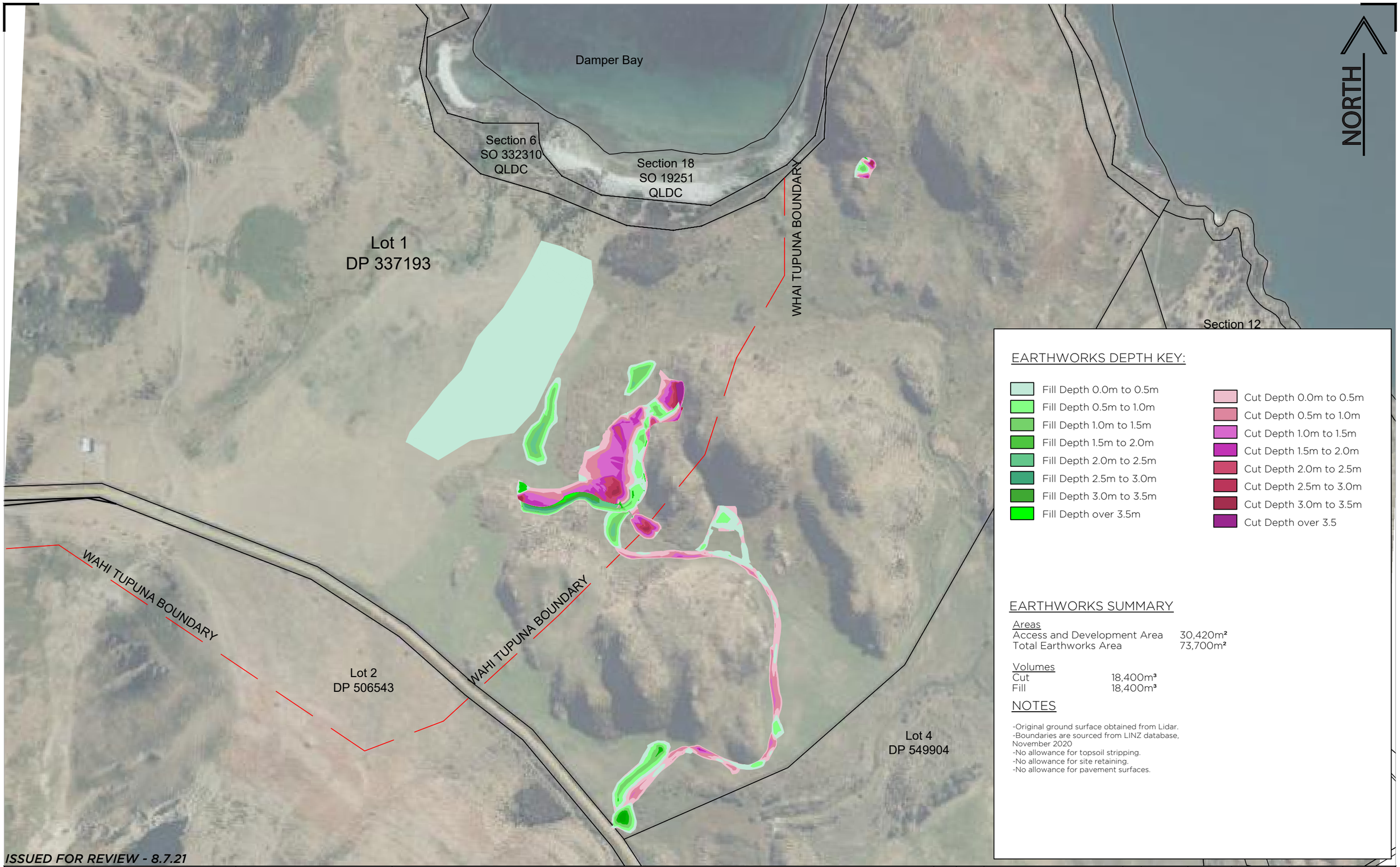
REV. 0

Appendix E: QRA Results

			5/08/2021 SR Rev1
	GEOSOLVE	**Damper Bay- JEA** **Rockfall**	

	Annual probability of RF					**Probabilities**					
Calculation	**Seismic**		**Rainfall**		**Person Most at Risk**	**Probability of spatial impact**	**Probability of person present**	**Vulnerability**	**Rainfall conditions AIFR**	**Seismic Conditions AFIR**	**Total AIFR (i.e rainfall & seismic)**
	Proportional notation (1 in x years)	**Scientific notation**	**Proportional notation (1 in x years)**	**Scientific notation**							
Source Area 1-3	5.00E+01	2.00E-02	2.50E+01	4.00E-02	Resident	1.12E-05	8.00E-01	5.00E-02	1.79E-08	8.96E-09	2.69E-08
Source Area 4-OwnersCabin	5.00E+01	2.00E-02	2.50E+01	4.00E-02	Resident	4.59E-03	8.00E-01	2.00E-01	2.93E-05	1.47E-05	4.40E-05

Appendix F: Earthworks Plan



EARTHWORKS DEPTH KEY:

- Fill Depth 0.0m to 0.5m
- Fill Depth 0.5m to 1.0m
- Fill Depth 1.0m to 1.5m
- Fill Depth 1.5m to 2.0m
- Fill Depth 2.0m to 2.5m
- Fill Depth 2.5m to 3.0m
- Fill Depth 3.0m to 3.5m
- Fill Depth over 3.5m
- Cut Depth 0.0m to 0.5m
- Cut Depth 0.5m to 1.0m
- Cut Depth 1.0m to 1.5m
- Cut Depth 1.5m to 2.0m
- Cut Depth 2.0m to 2.5m
- Cut Depth 2.5m to 3.0m
- Cut Depth 3.0m to 3.5m
- Cut Depth over 3.5

EARTHWORKS SUMMARY

Areas

Access and Development Area	30,420m²
Total Earthworks Area	73,700m²

Volumes

Cut	18,400m³
Fill	18,400m³

NOTES

-Original ground surface obtained from Lidar.
-Boundaries are sourced from LINZ database, November 2020
-No allowance for topsoil stripping.
-No allowance for site retaining.
-No allowance for pavement surfaces.

ISSUED FOR REVIEW - 8.7.21

JEA TOWN PLANNERS & SURVEYORS
Level 2, 38 Shotover Street
PO Box 95, Queenstown, 9300

CLIENT: DAMPER

NOTES:
- ALL DIMENSIONS SHOWN ARE IN METERS UNLESS SHOWN OTHERWISE.
- CHECK ELECTRONIC DATA AGAINST LATEST HARD COPY VERSION.
- COPYRIGHT ON THIS DRAWING IS RESERVED.
- THIS PLAN MAY BE SUBJECT TO FINAL SURVEY.

PROPOSED EARTHWORKS DAMPER BAY

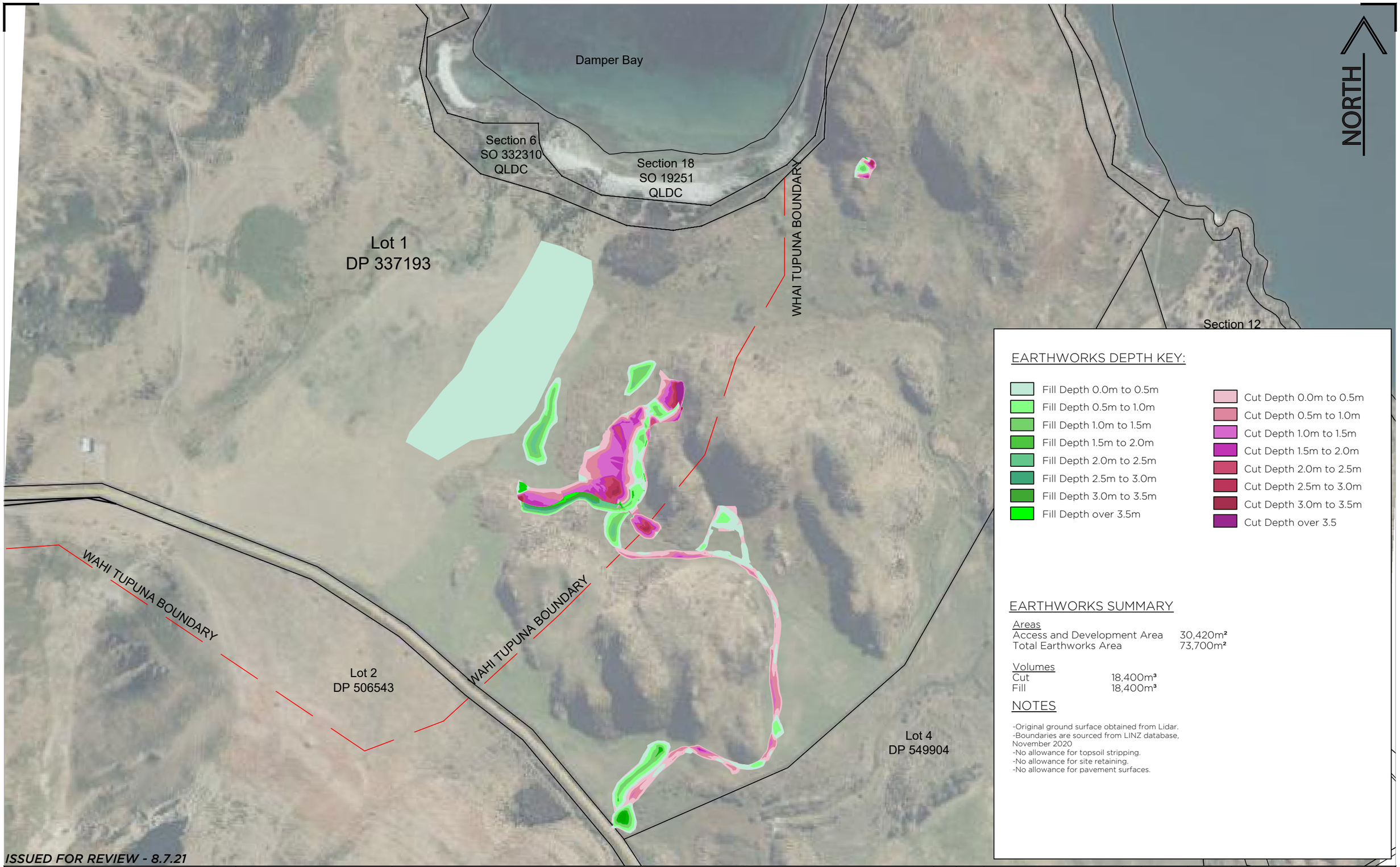
REV.	DATE	REVISION DETAILS	BY
A	8.7.21	Updates	CW

SURVEYED	SIGNED	DATE	JOB NO.	DRAWING NO.
-	-	-	15047	04.01

DRAWN	CHECKED	DATE	SCALE
CW	CW	18.6.21	1:5000m @ A3

DATUM & LEVEL: LINDAS PEAK - DVD1958 | REV.: A

S:\Clients\2015\15047 - Damper\Survey\cad\15047.04.01A Earthworks.dwg Plotted: 08.07.2021



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- Fill Depth 0.0m to 0.5m
- Fill Depth 0.5m to 1.0m
- Fill Depth 1.0m to 1.5m
- Fill Depth 1.5m to 2.0m
- Fill Depth 2.0m to 2.5m
- Fill Depth 2.5m to 3.0m
- Fill Depth 3.0m to 3.5m
- Fill Depth over 3.5m
- Cut Depth 0.0m to 0.5m
- Cut Depth 0.5m to 1.0m
- Cut Depth 1.0m to 1.5m
- Cut Depth 1.5m to 2.0m
- Cut Depth 2.0m to 2.5m
- Cut Depth 3.0m to 3.5m
- Cut Depth over 3.5

EARTHWORKS SUMMARY

Areas

Access and Development Area	30,420m²
Total Earthworks Area	73,700m²

Volumes

Cut	18,400m³
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NOTES

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-No allowance for topsoil stripping.
-No allowance for site retaining.
-No allowance for pavement surfaces.

ISSUED FOR REVIEW - 8.7.21

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PROPOSED EARTHWORKS DAMPER BAY

REV.	DATE	REVISION DETAILS	BY
A	8.7.21	Updates	CW

SURVEYED	SIGNED	DATE	JOB NO.	DRAWING NO.
-	-	-	15047	04.01

DRAWN	CHECKED	DATE	SCALE
CW	CW	18.6.21	1:5000m @ A3

DATUM & LEVEL: LINDAS PEAK - DVD1958 | REV.: A

S:\Clients\2015\15047 - Damper\Survey\cad\15047.04.01A Earthworks.dwg Plotted: 08.07.2021

Project Number: 6-XZ665.00

Damper Bay

Preliminary Site Investigation

17 May 2021

CONFIDENTIAL

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Document Details:

Date: May 2021
Reference: 6-XZ665.00
Status: Final

Prepared by

Bond, Lisa (allab0)
2021.05.17
14:31:33 +12'00'

Lisa Bond CEnvP
Principal Consultant - Environmental

Reviewed by

James Gladwin CEnvP
Senior Environmental Scientist

Approved for release by

Robert Bond
Work Group Manager – Geotechnical & Environmental

Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
1	17/05/2021	L Bond	J Gladwin	R Bond	Final

Revision Details

Revision	Details
1	Final for issue

Contents

List of Figures

List of Tables

Appendices

Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for John Edmonds & Associates ('**Client**') in relation to a Preliminary Site Investigation ('**Purpose**') and in accordance with the Short form Agreement dated 28 April 2021]. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

In preparing the Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('**Client Data'**) provided by or on behalf of the Client. Except as otherwise stated in the Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable in relation to incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

Report Checklist

Summary contaminated sites report checklist					
Report contained in this document	☒	☐	☐	☐	☐
Report sections and information to be presented	**PSI**	**DSI**	**RAP**	**SVR**	**MMP**
Executive summary	☒	☐	☐	☐	☐
Scope of work	☒	☐	☐	☐	☐
Site identification	☒	☐	☐	☐	☐
Site history	☒	S	S	S	S
Site condition and surrounding environment	☒	S	S	S	S
Geology and hydrology	A	☐	S	S	S
Sampling and analysis plan and sampling methodology	A	☐	X	☐	☐
Field quality assurance and quality control (QA/QC)	N	☐	X	☐	S
Laboratory QA/QC	N	☐	X	☐	X
QA/QC data evaluation	N	☐	X	☐	X
Basis for guideline values	☒	☐	☐	☐	☐
Results	A	☐	☐	☐	S
Site characterisation	☒	☐	☐	☐	☐
Remedial actions	X	X	☐	S	S
Validation	X	X	X	☐	S
Contaminated materials management plan (CMMP)	X	X	☐	S	S
Ongoing site monitoring	X	X	X	N	☐
Conclusions and recommendations	☒	☐	☐	☐	☐

- Key:
- PSI - preliminary site investigation report SIR detailed site investigation report
- RAP - site remedial action plan
- SVR - site validation report
- MMP - ongoing monitoring and management plan
- A - Readily available information should be included
- S - A summary of this section's details will be adequate if detailed information has been included in an available referenced report
- N - Include only if no further site investigation is to be undertaken
- X - Not applicable and can be omitted.
-
- (MfE. Contaminated Land management guidelines No. 1. 2011a)

Executive Summary

A Preliminary Site Investigation (PSI) has been undertaken in order to assess the potential for contamination to be present at Lot 1 DP 337193, Wanaka Mount Aspiring Rd, near Wanaka (the Site). It is understood that the site is located on a mixture of natural scrub land and production land with the proposed development to comprise a land use change for commercial use.

Taking into consideration the information herein, it is considered more likely than not that the risk to human health associated with potential contamination derived from historic and ongoing activities across the site and from adjacent activities is considered to be LOW.

Taking into consideration development proposals for commercial purposes, it is considered highly unlikely that there will be an unacceptable risk to human health associated with the proposed land use change and subsequent development on site.

As no HAIL activities are noted to have occurred or be occurring on the site the NES does not apply to any land use change or future ground disturbance associated with its development.

Recommendations

Based on the findings of this PSI report WSP recommends the following:

- This PSI report is submitted to the consenting authority.
- Should any other ground conditions be encountered that are not covered herein a Suitably Qualified and Experience Practitioner (SQEP) specialising in contaminated land assessment should be consulted in order to assess the risks to human health and sensitive receptors.

1 Introduction

A Preliminary Site Investigation (PSI) has been undertaken in order to assess the potential for contamination to be present at Lot 1 DP 337193, Damper Bay, near Wanaka (the Site). This PSI has been commissioned as part of the proposed subdivision, land use change and development.

It is understood that the site is located on production land with the proposed development to comprise subdivision and land use change for residential dwellings.

1.1 Objective

This report has been prepared in order to assess the risks to human health associated with potential ground contamination across the site with respect to a resource consent application for a land use change. This assessment will focus on determining whether Hazardous Activities and Industries List (HAIL) activities have been undertaken on the site as defined by the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS) and the likely risks associated with proposed activity.

1.2 Scope of Work

In order to achieve the objective, set out above, the following scope of works was undertaken:

- A review of the site history from aerial photographs and anecdotal evidence,
- A site inspection and walkover,
- A review of documented data from Queenstown Lakes District Council (QLDC) and Otago Regional Council (ORC) with respect to the site,
- Assessment of the geological and hydrogeological conditions for the site and
- Characterisation of the site to determine the environmental and human health risks associated with the site along with recommendations for further work should it be deemed necessary.

2 Site Location

The site is located at Lot 1 DP 337193, Wanaka – Mount Aspiring Road approximately 6.5km north west of Wanaka Lake front as shown on Figure 1 below. Site details are provided in Table 1, with details of the site and surrounding properties shown in Figure 2.

Planted farmland is present to the west of the proposed development areas with the remaining surrounds comprising open rural scrubland with rocky outcrops.

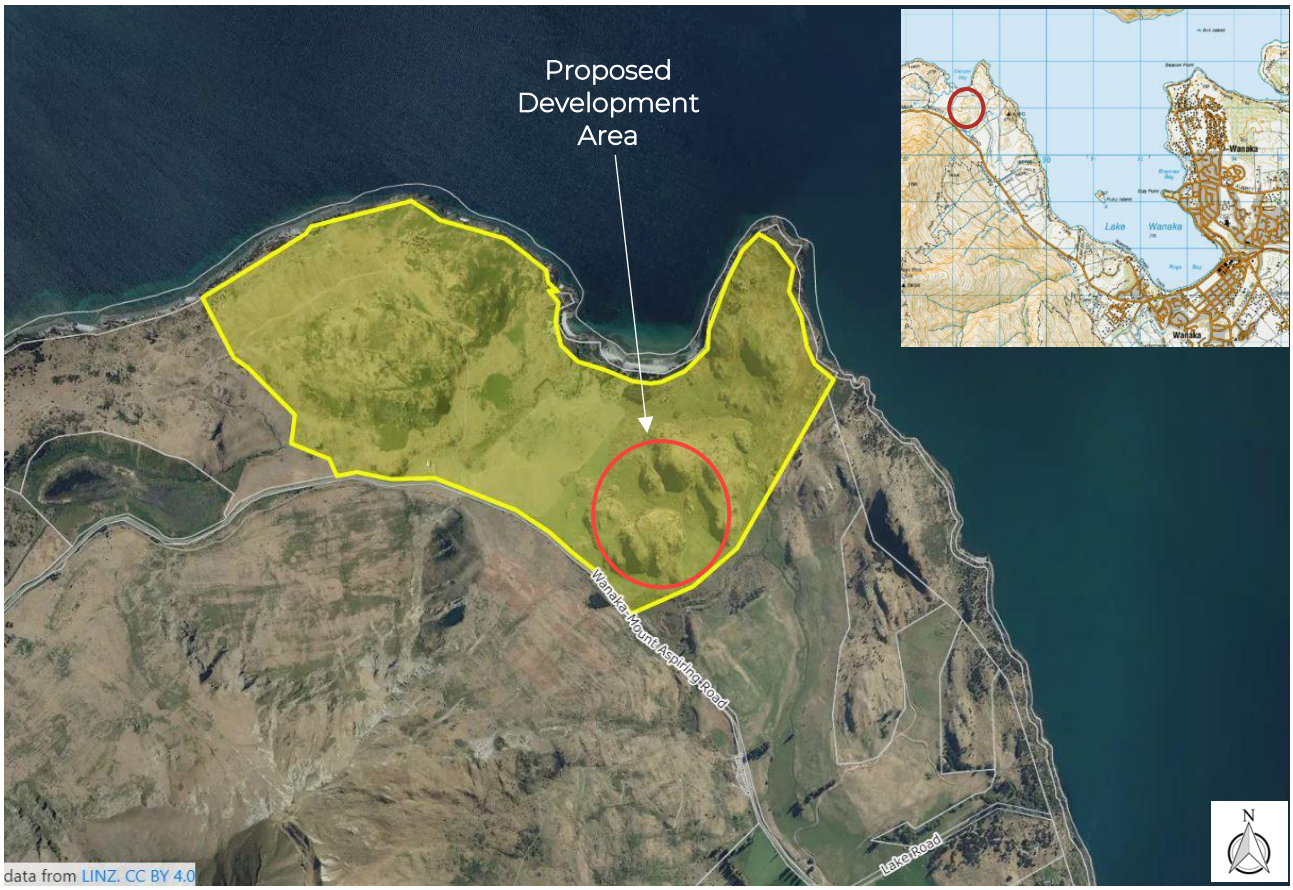


Figure 1: Site Location Plan (source LINZ 2021)

Table 1: Site Details

Site Address	No Address	
Territorial Authority	Queenstown Lakes District Council	
Owner	Second Star Limited	
Legal Description	Lot 1 Deposited Plan 337193	
Title	152547	
Valuation No.	290661-22803	
Approximate total site area	1,929,601 m^2	193 ha

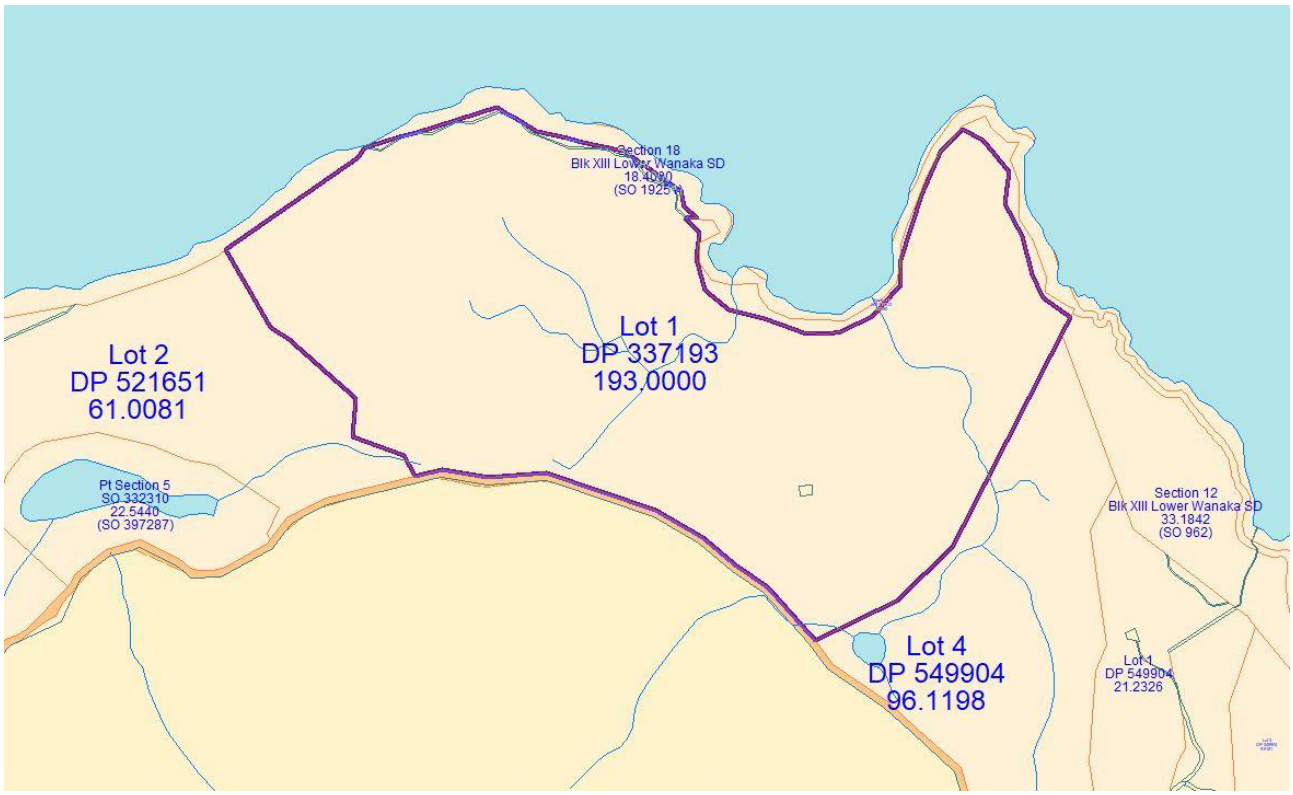


Figure 2: Quickmap extract of site and surrounds

3 Site Description

3.1 Site History

Details of the site history have been gained from a review of multiple sources including historical aerial photographs obtained from Google Earth (Google, 2021) and Retrolens (LINZ, 2021), historical topographical maps from Maps Past (MapsPast, 2021) and a review of the QLDC and Otago Regional Council (ORC) databases.

3.1.1 Historical Aerial Photographs

Two historic maps (1939 and 1949) obtained from Maps Past, and six historical aerials dating from 1956 were available to view on Retrolens; an additional four aerials were available from Google Earth (2005 – 2017).

A summary of observations made following the review of historical aerials is presented in Table 2. Aerials are presented in Appendix A.

Table 2: Summary of historical aerial photographs

Year	Observations
1939 *Maps Past*	The site area is not indicated to have been subdivided at this time. Subdivision does appear to have occurred to the south east of the site
1958 *Retrolens*	No significant changes to land parcels appear to have occurred at this time
1956 *Retrolens*	This is the first available aerial photograph. The site appears to be rough open land with rocky outcrops present. Damper Bay is visible to the north east of the site. To the south lies a pond/water feature adjacent to the Wanaka – Mount Aspiring Road.
1966 *Retrolens*	No significant changes to the site or surrounds noted
1974 *Retrolens*	No significant changes noted to the site. The pond to the south east of the site appears to be low/dry at this time with an irrigation race or stream noted to flow from the pond in an easterly direction.
1983 *Retrolens*	No significant changes to the site area. The field to the west of the development site appears to have been planted with crops.
1983 *Retrolens*	No significant changes to the site area. The field to the west of the development site appears to have been planted with crops.
1984 *Retrolens*	No significant changes to the site areas. To the west of the site there appears to be a track leading from Wanaka – Mount Aspiring Road north-eastwards to Damper Bay.
2003 *Google Earth*	A short track is noted on the western side of the site area at this time. This track appears to follow the contours of the rocky outcrops ending at an area which may be an ephemeral stream.
2005 *Google Earth*	The site and surrounds are well vegetated at this time. However, no evidence of crop planting is visible on the field to the west
2011 *Google Earth*	No significant changes to the site or surrounds. The pond to the south east appears to be nearly dry at this time.
2020 *Google Earth*	No significant changes to the site or surrounds are visible at this time. The field to the west of the site appears to have been ploughed with tracks noted across the paddock.

3.1.2 Council Records

A review of the Information held by QLDC has revealed that the site is located within a Rural General Area. The eastern side of the section is designated as being an Outstanding Natural Landscape area and being an area surrounding Te Poutu Te Raki (Matukituki River delta, Glendhu Bay and surrounds). The proposed development site appears to be outside of this area, however this should be confirmed by a planner.

Two resource consents are noted for the site area. Details of these consents are summarised in Table 3.

Type of Consent	Date	Consent No	Details
Resource	2012	RM100512	Subdivision to create 3 Lots, each with residential building platforms and land use consent for additional dwellings with no building platforms on Wanaka Mount Aspiring Road, Wanaka. Hearing closed
	2013	RM130417	Queenstown Lakes District Council - To Create A ROW Over Lot 1 DP 337193 In Favour Of QLDC. (Part of the Glendhu Bay track) Right of Way granted with conditions

3.1.1 HAIL Database Search

A review of the online HAIL database held by ORC has revealed that the site does not currently appear on the database. No HAIL sites are present on the database within 2km of the site.

3.1.2 Heritage

The Heritage New Zealand Pouhere Taonga Act 2014 makes it unlawful for any person to modify or destroy, or cause to be modified or destroyed, the whole or any part of an archaeological site without the prior authority of Heritage New Zealand.

In order to establish the heritage status of the site the Heritage New Zealand database was consulted. The site was not found on the database.

3.2 Geology

The geology of the site is shown on the 1:250,000 scale GNS Geology Web Map extract (GNS Science, 2021) as shown in Figure 3.

This map indicates the majority of the site is underlain by basement metamorphic rocks generally comprising segregated pelitic schist with subordinate psammitic schist; minor greenschist and metachert.

The southern section of the site where access to the development is envisaged is underlain by Late Pleistocene glacier deposits. This generally comprises unsorted bouldery clay-rich gravel (till) with minor banded silt and sand lenses.

To the west of the site the geology comprises Holocene lake deposits, made up of well sorted, fresh, rounded, fine to medium gravels which are located in benches and storm beach ridges around the major lakes (Lake Wanaka).

A review of the GNS Active Faults Database indicates that the nearest active fault is the Highland Fault (#8187) which runs north to south approximately 6.5km southwest of the site. There is no further information available relating to this fault. (GNS Science, 2021)

Figure 3: Extract from GNS Webmaps (accessed May 2021)

3.3 Hydrology and Hydrogeology

The site is not located within a known Aquifer catchment. The Wanaka Basin Cardrona Gravel Aquifer is located approximately 3.5km south east of the site. One borehole was identified within the site boundary, approximately 200m west of the proposed development area. This is indicated to be for domestic use with groundwater present at 4.70m bgl.

Groundwater flow is likely to be in an northerly direction towards Lake Wanaka with which it is likely to be in continuity with.

Lake Wanaka is located on the northern boundary of the site, approximately 350m north of the proposed development area.

3.4 Topography

The site is located on an area of rocky outcrops with an undulating landscape. The proposed development area is present at the base of these rocky outcrops in an area which is earmarked by an ephemeral streamline which winds its way towards Lake Wanaka to the north. The stream bed was dry during the site inspection.

4 Site Inspection

4.1 Site Condition and Surrounding Environment

A site inspection was carried out by a WSP SQEP on 23 April 2021. A number of photos were taken of the site and its surrounds, these can be seen within Appendix B.

Access to the site is currently through a field which has been sown with swedes. The proposed access route is not currently accessible by vehicle.

The proposed development area on the site is located between rocky outcrops. The landscape generally dips to the north west within this area before sloping northwards towards Lake Wanaka at the fence line with the adjacent sown field.

Evidence that stock had been present within the area was noted however no visual signs of any historic buildings, pens or other anthropogenic structures were evident with the exception of fence lines which were well maintained.

No visual or olfactory evidence of potentially contaminating activities were noted during the site inspection. No vegetation die back was noted.

The western part of the proposed development area was noted to have been planted with swedes, however no indication that the application of fertiliser or pesticides was noted with the crop likely to be used as a winter feed for stock.

5 Assessment of HAIL Activities

On the basis of the currently available information along with the findings from the site inspection, the presence of HAIL activities on site are NOT considered likely to have occurred.

As no potential sources of contaminants are present on the site, a conceptual site model is not needed to assess potential source, pathway and receptor relationships for the site.

6 Site Characterisation

The purpose of this preliminary site investigation was to provide an assessment of the historical and current land uses to determine whether activities have, more likely than not, resulted in contamination of the soil that may be hazardous to human health.

On the basis of a review of information currently available, as well as observations made during the site inspection, our assessment of the site is as follows:

- The site is predominately a rural general with some areas put across for production land;
- The site is surrounded by non-intensive farmland and areas classified as outstanding natural landscape;
- The site is proposed for a land use change with the associated development of a low impact commercial spa retreat and associated residence;
- The underlying geology comprises pelitic schist underneath the majority of the site;
- The site is not situated on a known aquifer catchment;
- No obvious signs of vegetation dieback were noted in any location across the site;
- No HAIL activities are known to have occurred within 2km of the site; and
- No evidence of HAIL activities is noted either on or adjacent to the proposed development area.

Potential human health risks have been evaluated using the Likelihood and Consequence scales tabulated in Table 6, to determine a risk level – low, moderate, high, very high or extreme. The assessed risk level allows prioritisation of investigations and assessment measures.

Table 3: Likelihood and consequence scale

	Consequence				
Likelihood	Insignificant	Minor	Medium	Major	Catastrophic
Almost certain	Moderate	Moderate	Very High	Extreme	Extreme
Likely	Low	Moderate	High	Very High	Extreme
Possible	Low	Moderate	Moderate	Very High	Very High
Unlikely	Low	Low	Moderate	High	Very High
Rare	Low	Low	Low	Moderate	High

The risks to human health have been assessed on the basis of the historical activities which may have occurred on specific areas on or off the site and can be split into the following activities:

- Production Land: The adjacent site is currently being used as low intensity production land (growing feedstock for winter grazing) therefore the broadacre application of agrochemicals is considered highly unlikely.

Taking into consideration the information herein, it is considered more likely than not that the risk to human health associated with potential contamination derived from historic and ongoing activities across the site and from adjacent activities is considered to be LOW.

7 Conclusions and Recommendations

The PSI has identified that no HAIL activities have occurred across the proposed development area of the site which comprises an area of natural landscape. Through the desktop study and site walkover the risks to human health associated with potential soil borne contaminants has been assessed as LOW.

Taking into consideration development proposals along with the end use for commercial purposes, it is considered highly unlikely that there will be a risk to human health associated with the proposed land use change and subsequent development on site.

No HAIL activities are considered to have been or be occurring on the site and as such the **NES does not apply** to the site.

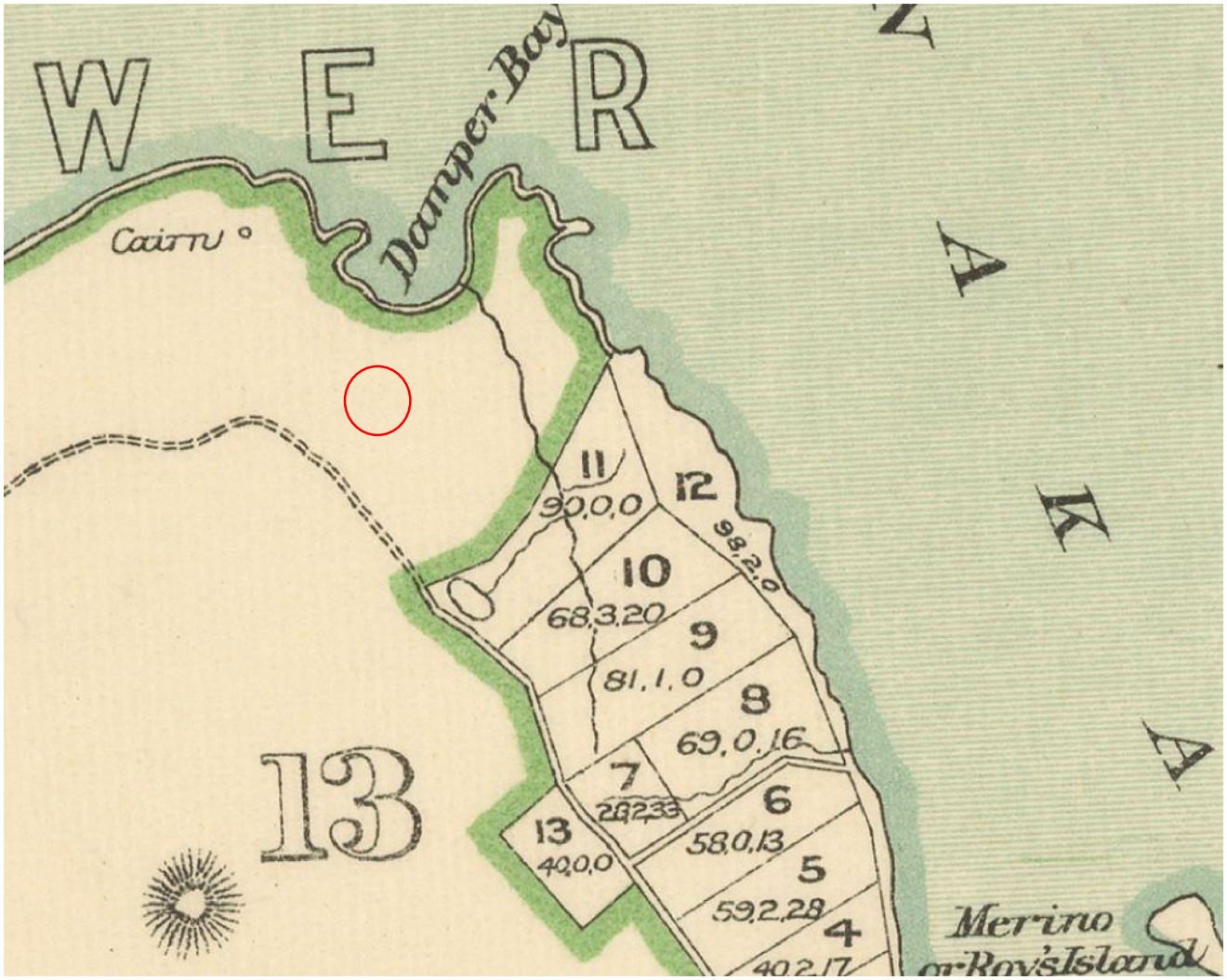
Recommendations

Based on the findings of this PSI report WSP recommends the following:

- This PSI report is submitted to the consenting authority.
- Should any other ground conditions be encountered that are not covered herein a Suitably Qualified and Experience Practitioner (SQEP) specialising in contaminated land assessment should be consulted in order to assess the risks to human health and sensitive receptors.

Appendix A
Historical Information

1939

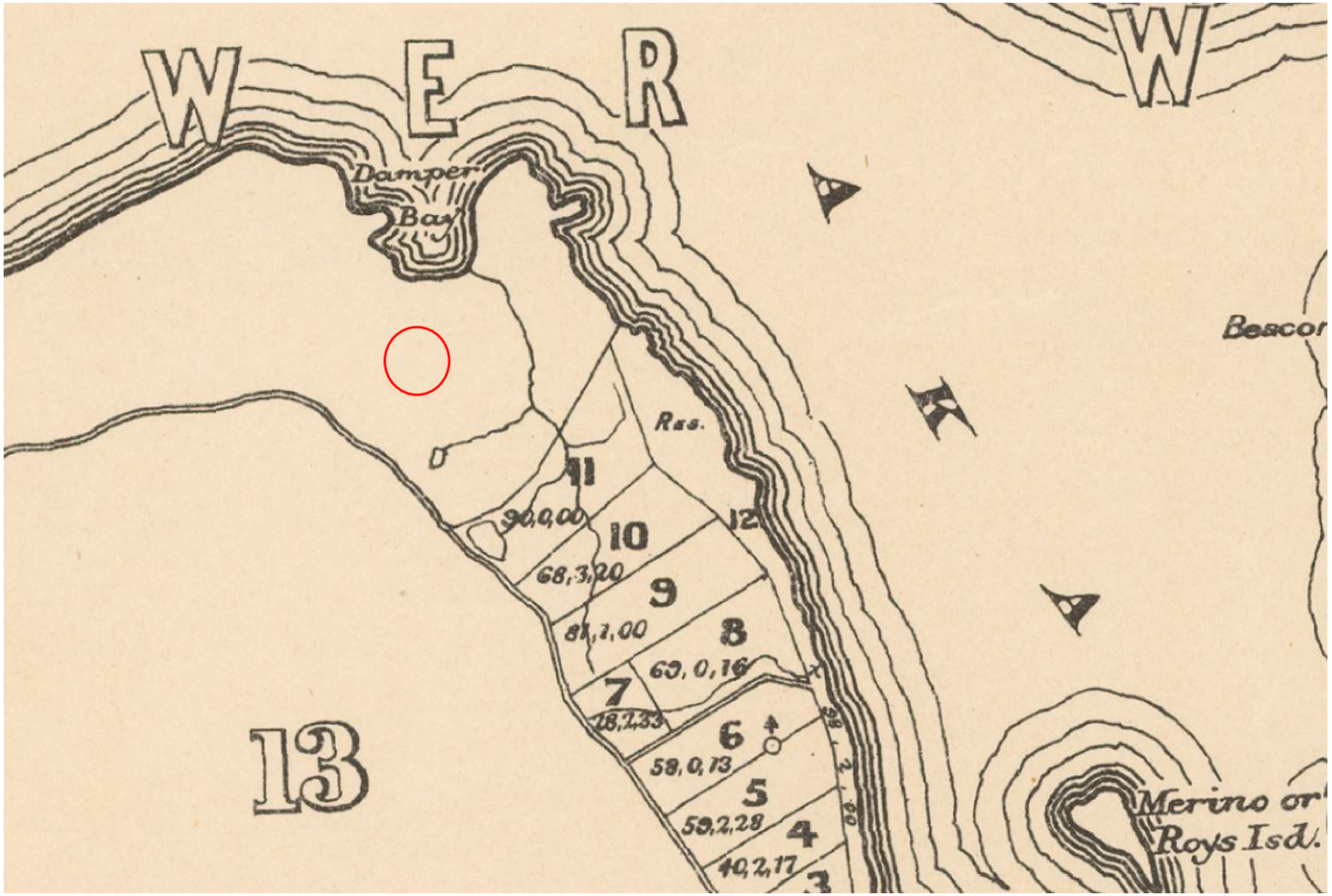


N

Approximate Site Location

Image Courtesy of Maps Past

1949



N

Approximate Site Location

Image Courtesy of Maps Past

1956

Approximate Site Location

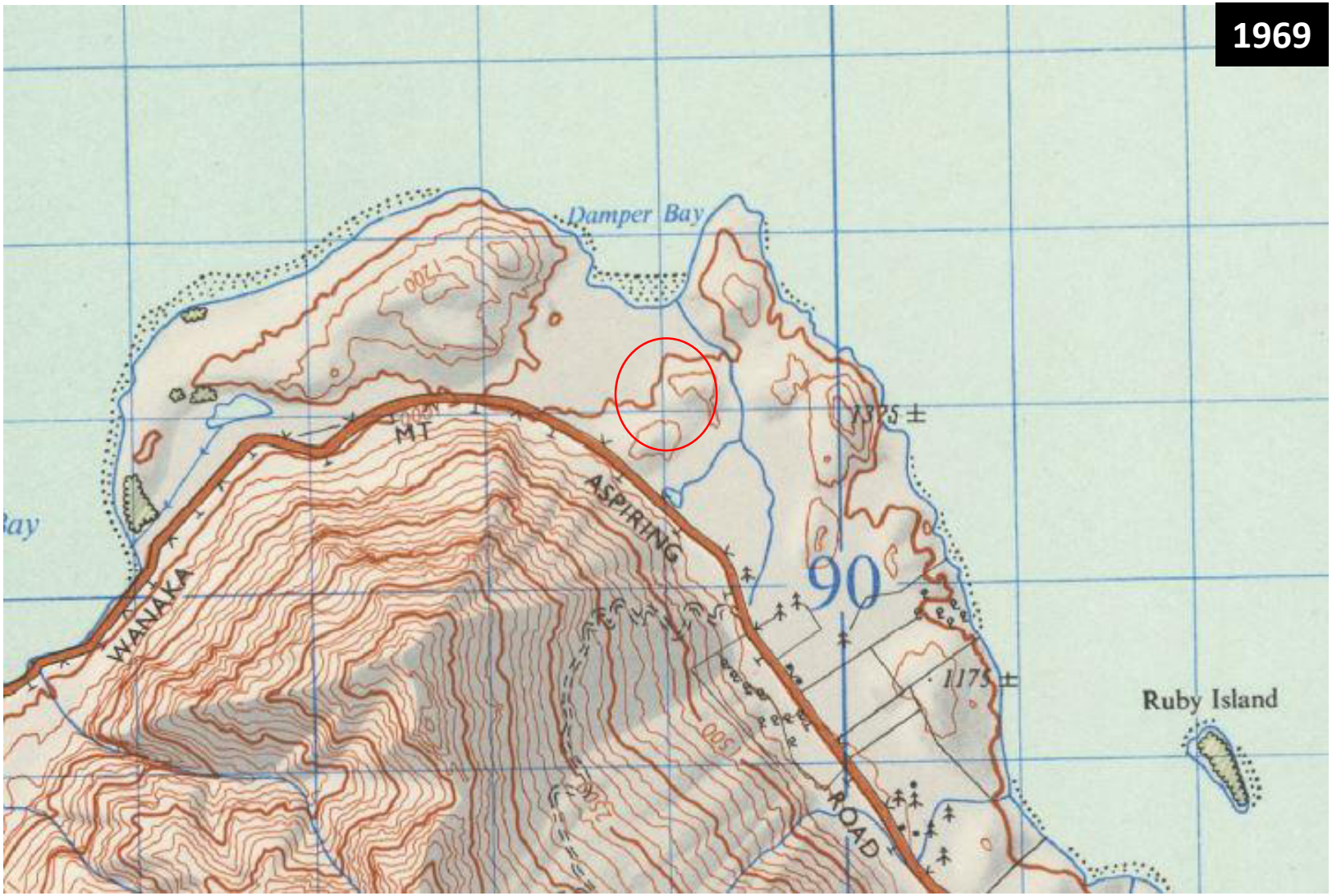
Image Courtesy of Retrolens/LINZ

N

Approximate Site Location

Image Courtesy of Retrolens/LINZ

1969



N

Approximate Site Location

Image Courtesy of Maps Past

Approximate Site Location

Image Courtesy of Retrolens/LINZ

1983

N

Approximate Site Location

Image Courtesy of Retrolens/LINZ

1984

N

Approximate Site Location

Image Courtesy of Retrolens/LINZ

2003

N

Approximate Site Location

Image Courtesy of Retrolens/LINZ

Image Courtesy of Google Earth

2011

N

Approximate Site Location

Image Courtesy of Google Earth

2017

N

Approximate Site Location

Image Courtesy of Google Earth

Image Courtesy of Google Earth

Appendix B
Site Photographs

PHOTOGRAPHIC LOG

Client Name	Site Location	Project No.
JEA	Damper Bay, Wanaka	6-XZ665.00

Photo No.	Date
1	23/04/2021

Description

Looking south east
Proposed development area with profile pole.

Photo No.	Date
2	23/04/2021

Description

Looking east.
Proposed development area

	PHOTOGRAPHIC LOG	
Client Name JEA	**Site Location** Damper Bay, Wanaka	**Project No.** 6-XZ665.00

Photo No.	Date
3	23/04/2021

Description

Looking north.
Proposed development area

Photo No.	Date
4	23/04/2021

Description

Looking south east across proposed accessway

	PHOTOGRAPHIC LOG	
Client Name JEA	**Site Location** Damper Bay, Wanaka	**Project No.** 6-XZ665.00

Photo No.	**Date**
5	23/04/2021

Description

Looking west

Photo No.	**Date**
6	23/04/2021

Description

Looking south across proposed development area

wsp.com/nz

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Hotel, Tourism & Leisure Consultants
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www.horwathhtl.co.nz

12 August 2021

John Edmonds & Associates Ltd
Level 2, 36 Shotover Street
Queenstown

via email: john.edmonds@jea.co.nz

Dear John

Proposed Damper Bay Lodge, Wanaka

Thank you for requesting our comments regarding the strategic, economic and community benefits of the proposed Damper Bay Luxury Lodge near Wanaka.

In order to give appropriate context, we have provided comments in relation to several matters, as follows:

1. Tourism Outlook for New Zealand
2. Tourism Outlook for Wanaka and Queenstown Lakes District
3. Government Strategy for New Zealand Tourism Industry
4. Wanaka Regional Tourism Strategy
5. Characteristics of New Zealand Luxury Lodges
6. Characteristics of Luxury Lodge Guests
7. Benefits of Luxury Lodges and Alignment with Tourism Strategies
8. Conclusion – Strategic Market Opportunity for Wanaka.

1. Tourism Outlook for New Zealand

The tourism industry was New Zealand's second largest foreign exchange earner in 2019-20. It is currently the most impacted industry by COVID-19 and will remain so at least until the international border re-opens.

Some New Zealand visitor destinations have been hit harder than others because they have been increasingly reliant on international visitors. These locations include Wanaka and Queenstown.

In the world context, New Zealand is a relatively distant and low volume visitor destination for most international airlines. This may mean that, in the short to medium-term at least, the number of direct airline routes and frequency of flights to New Zealand is significantly less than it was prior to COVID-19, and particularly so if our border is slower to open than other countries.

Prior to the pandemic, there were an increasing number of private jets bringing visitors directly to New Zealand. Queenstown International Airport has two private jet ground handlers who facilitate services and facilities for private and charter jet clients.

In 2019, Tourism Economics (a subsidiary of international research firm Oxford Economics) had forecasted luxury travel to growth at a rate almost a third greater than travel overall.

The luxury travel market is projected to be the first segment of the global travel market to recover from the pandemic. This will be of great importance to, and provides significant opportunities for, the recovery and future of the New Zealand visitor industry.

There is good reason to believe that New Zealand's reputation as a highly desirable or even 'ideal' destination globally will be enhanced as a result of New Zealand's response to the pandemic.

We expect this will especially apply to luxury travellers who can choose to visit anywhere in the world and who are not highly influenced by concerns over the cost of travel or prices charged for premium visitor products and experiences.

2. Tourism Outlook for Wanaka and Queenstown Lakes District

At present, Wanaka has no five star or luxury hotels and just two lodges that are classified by Qualmark (the quality assurance unit of Tourism New Zealand (TNZ)) as Luxury Lodges, and therefore promoted by TNZ. These are:

1. Minaret Station Alpine Loge, located near Minaret Peaks, north-west of Wanaka. It has four chalets and is only accessible by helicopter.
2. Mahu Whenua, with four suites, located approximately 20 km west of Wanaka, south of Glendhu Bay.

In addition, Whare Kea Lodge has six luxury suites as well as a luxury Chalet also accessible only by helicopter.

All three lodges are situated on pristine private land, attracting luxury travellers from around the world and supporting the local Wanaka community.

There are three Qualmark-rated Luxury Lodges promoted by TNZ which are located near Queenstown, these being Matakauri Lodge, Blanket Bay and Eichardt's Private Hotel. There are several other exclusive lodges offering boutique accommodation near Queenstown.

Prior to COVID-19, demand for Luxury Lodges in the Queenstown Lakes District Council was very high, with lodges fully booked well in advance during the summer season.

The Queenstown Lakes District has long been regarded as the 'Jewel in the Crown' of the New Zealand tourism industry. Its stunning geography and the many visitor

attractions and activities around Queenstown and Wanaka have made the region very popular with luxury and mainstream visitors alike.

There is little doubt that the region will remain popular with mainstream visitors and demand will recover once the international borders reopens. However, the volume of visitors prior to COVID-19 had been putting pressure on the district's infrastructure and causing some dissatisfaction amongst some of its residents.

The destination could be at risk of losing some of its exclusivity in the luxury travel market with fears that too many visitors may "kill the goose that lays the golden egg".

Until now, Wanaka has, to a large extent, been spared from such "over-tourism", partly because of the lack of large-scale visitor accommodation infrastructure, and partly because of its relative remoteness from Queenstown International Airport.

The destination's future success will require a clear vision and strategy in relation to what type of visitor destination it wants to be.

3. Government Strategy for New Zealand Tourism Industry

The Government's core strategic goal for the tourism industry[1] is to "enrich New Zealand-Aotearoa through sustainable tourism growth".

The Government wants tourism growth to be productive, sustainable and inclusive. The Strategy outlines a framework around five themes to achieve the goal. The themes and desired outcomes are:

Theme	Desired Outcome
The Economy	Tourism sector productivity improves the economy
The Environment	Tourism protects, restores & champions NZ's natural environment and cultural & historic heritage
International and Domestic Visitors	New Zealand delivers exceptional visitor experiences
New Zealanders and our communities	New Zealanders' lives are improved by tourism
Regions	Tourism supports thriving & sustainable regions

The pandemic has accelerated a rethink about the sustainability of previous levels of growth in visitor numbers, and the social benefits and challenges this has brought to visitor destinations and communities.

[1] "New Zealand–Aotearoa Government Tourism Strategy" published jointly by the Ministry of Business, Innovation and Employment (MBIE) and the Department of Conservation (DOC), May 2019

The benefits and costs of the tourism economy do not always fall to the same entities / communities of interest, which has often led to under-investment in visitor infrastructure to support both visitors and local communities.

Visitor growth has created some infrastructure pressures, overcrowding in some popular locations, increased pressure on some roads and environmental impacts. There have also been challenges in promoting tourism as a career (eg: relatively low wages, job insecurity, etc). The government now wants people working in tourism to transition into higher value jobs and improve the productivity of the sector.

In March 2021[2], the Minister of Tourism proposed a programme to "build back tourism better". The key principles of the programme include:

- elevate 'Brand New Zealand' so that New Zealand is seen as one of the most aspirational global travel destinations
- the cost and negative impacts associated with tourism must be mitigated or priced into the visitor experience, and not funded by New Zealand rate and tax payers.

An important rationale for enhancing 'Brand New Zealand' is to support the move to a higher value visitor. The Minister would like to "establish New Zealand as the #1 destination for unparalleled quality and safety, against which others are measured, and New Zealanders are proud of what our country offers to the world".

For each Regional Tourism Organisation (RTO), the aim is to develop a regional proposition that delivers exceptional experiences for international and domestic visitors.

Tourism New Zealand (TNZ) is the Crown Entity (Government agency) responsible for marketing New Zealand to the world as a visitor destination. TNZ's Statement of Intent (SOI) published in June 2021 and which details TNZ's strategic priorities over the four years to 2026. The SOI is aligned with Government's priorities and emphasises the great importance of enriching Aotearoa through the contribution of visitors and the importance of visitor quality rather than the quantity of visitors.

The SOI states "We want New Zealand to be seen as one of the world's most aspirational travel destinations for high-quality visitors. High-quality visitors are defined by more than the money they spend – we define this audience by the way they contribute to our natural environment, culture, society and economy. The high-quality visitor is determined by the type of visitor, their scope of activities, travel across seasons and regions, environmental consciousness and engagement with our local culture and communities. We want visitors who contribute more than they take from New Zealand as evidenced by the qualities above."

The contributions of the targeted high-quality visitors are further described as:

1. Economy: visitors that make a significant contribution to the New Zealand economy
2. Society: visitors that make communities thrive through jobs, shared knowledge and physical and mental wellbeing

[2] Cabinet paper "Direction for Tourism", Office of the Minister of Tourism, 10 March 2021

3. Culture: visitors where the tourism story and experience preserve and enhance New Zealand's values, culture and heritage
4. Nature: visitors who contribute to the maintenance, restoration and nourishment of the natural environment.

Key geographic and target markets identified by TNZ include: New Zealand, Australia, USA, China and Business Events. Regions such as Europe are also described as being an important part of a diverse, resilient market portfolio.

Business Events are identified as a critical market in view of the significant new infrastructure that will open in New Zealand in the next few years and the counter-seasonal visitation pattern of this market. Furthermore, Business Events are an important market to bring knowledge into the country and allows New Zealanders to share knowledge with the world.

TNZ has had a "Premium Sector Strategy" since 2014. The Strategy documents TNZ's goal to increase the number of high value visitors to New Zealand and delivers on TNZ's wider market and SOI objectives. The Strategy identifies target High Net-Worth Individuals (HNWI) in the Very High and Ultra High Net-Worth tiers – those with more than US$5 million in liquid assets and who purchase luxury itineraries of $20k–$100k+.

The target objective of the Strategy is to increase luxury sector spending by heightening the awareness of, and strengthening, New Zealand's image as a luxury destination.

TNZ works closely with Luxury Lodges of New Zealand Ltd which represents a portfolio of approximately 30 highly qualified unique properties.

4. Wanaka Regional Tourism Strategy

Lake Wanaka Tourism (LWT) is the Regional Tourism Organisation (RTO) formed as an Incorporated Society in 1993 to market the Wanaka region as a visitor destination to the domestic and international markets.

In 2019 LWT published its Strategic Plan "Towards 2028". The document identifies that the core long-term activities of LWT focus on:

- attracting higher value visitors
- smoothing out seasonality
- improving business capability
- advocating for the needs of the tourism industry and visitors to Wanaka
- ensuring tourism contributes positively to the region.

LWT's strategic priorities, informed by member workshops held in 2018, are:

1. communicate a clear, compelling and differentiated brand identity
2. achieve balance for our member businesses, host community and environment

3. support all our people in realising their potential to deliver an exceptional visitor experience
4. guardianship and protection of our natural, built and cultural resources for the benefit of current and future generations.

Priority 2 (achieving balance) includes the following additional detailed objectives:

- target higher and interest-based sectors / markets to grow visitor value over volume and attract visitors who spend more and stay longer
- target visitors to travel in shoulder season to spread demand and smooth out seasonality effects
- cultivate a balanced mix of markets for resiliency
- introduce broader visitor sector success measures such as:
    - spend across sectors and seasons
    - visitor Net Promoter Score (NPS)
    - resident NPS (align with QLDC)
    - environmental indicators.

In relation to the targeting of higher spending markets, LWT has set a goad of increasing annual visitor spending growth at double the rate (4%) of visitor volume growth (2%).

Luxury Lodge guests will be the target segment that will assist in achieving this goal more than any other segments.

5. Characteristics of New Zealand Luxury Lodges

Section 5 describes typical characteristics of Luxury Lodges and their guests and identifies how a Luxury Lodge development such as the one proposed aligns very well with the Government, TNZ and LWT's tourism strategies.

The Oxford Dictionary defines luxury with characteristics of comfort, elegance, desirability and rareness. The last characteristic is something that most commentators agree upon, with rarity often seen as the essence of luxury.

In a class of their own, Luxury Lodges are extremely accommodating and cater for the tastes and expectations of the most discerning visitor. Lodge guests have their every need taken care of. They dine on fine gourmet cuisine and enjoy the highest standard of hosting and guest facilities. These unique properties offer the pleasures of things from spa treatments, private golf, wilderness adventures and above all, a connection to the land and people around them, to give guests a genuine experience of place.

Luxury Lodges are typically small in size with most lodges accommodating between 10 and 40 guests in 3–15 rooms / suites or other types of accommodation units. Rates generally start from around $1,500 per night up to $50,000 for the most exclusive accommodation. They typically include most meals and other essential items in the room rate.

The current trend for luxury travel experiences is very much geared to how it makes people feel (healthy, enriched, well balanced, loved) rather than about how it displays their wealth or makes them feel indulged.

Local experience is 'king' in these experiences. Design should reflect a sense of place, rather than an international 'brand look'. Local cuisine and customised local experiences that have a 'personal touch' are essential.

6. Characteristics of Luxury Lodge Guests

Primary luxury markets identified by TNZ are USA, UK, Germany, Singapore, Hong Kong and Australia. Luxury travellers are far from the 'average' or 'typical' travellers from these markets. The typical profile of a luxury traveller is as follows:

- travel by air rather than by land (tend to be 'time poor')
- travel as couples or in small family groups, never as part of large tour groups
- tend to use limousine services rather than regular taxis or rental cars
- tend to be 'silver' or 'baby boomer' demographic, rather than younger
- enjoy peacefulness and serenity much more than action and adventure
- value high quality memorable travel experiences rather than glitz and glamour
- expect discretion and privacy
- expect recognition of their personal preferences and wishes – ie: bespoke travel arrangements customised to their personal preferences
- enjoy 'genuine' local experiences
- want to engage with / meet / learn about and understand local people, culture, and history, rather than participating in packaged experiences targeted at groups.

A key component in providing accommodation for such guests is matching the high quality of the physical product with a commensurate level of guest services and amenities. This implies the provision of more than just luxury accommodation (eg: luxury private homes / residences) but associated services including:

- on-site food and beverage service (at least breakfast and dinner, but also probably lunch service)
- concierge services (eg: activity and attraction bookings, transport / airport transfers)
- personal butler services (in some cases)
- personal chauffer and guiding services.

Sustainable travel has become increasingly important to luxury travellers who more than ever are seeking travel experiences that support local economies and preserve cultural heritage. Global luxury travel advisors, such as Virtuoso, are actively promoting

destinations and activities that provide more meaningful experiences and help travellers to explore the planet responsibly.

A key measure of the 'footprint' of luxury travellers is their high level of expenditure in local communities. This includes the expenditure of the lodge itself, including its expenditure on salaries and wages, and purchases of supplies and services in the local community.

7. Benefits of Luxury Lodges and Alignment with Tourism Strategies

The proposed Luxury Lodge at Damper Bay will add needed accommodation supply at the premium end of the market, a "reason to visit" Wanaka for luxury visitors and will support the government, TNZ, and LWT's strategies: targeting high-quality and high-value visitors.

The primary benefits of the lodge are the extent to which it will support the local economy and community.

We expect a lodge of the proposed size to employ between 15-30 people, all of whom will need to be highly skilled and trained to deliver the required quality of facilities and services. Most if not all employees will be local New Zealanders who have the background and passion to deliver a genuine, authentic Kiwi visitor experience. These jobs will be well paid, at rates well above the average of the accommodation and food services industry and in line with the government's tourism employment strategy.

According to Barton Consulting, a UK group specialising in the luxury and prestige sectors, around 90% of businesses in the luxury travel sector are small, independent operations, as opposed to large corporations. This is very much aligned with the nature of the typical tourism businesses in Wanaka and the rest of New Zealand.

The lodge will require support services from a wide range of local business and trades people, from electricians and florists to suppliers of local wellness products, foods and wines.

Some people may dismiss luxury travel as something which is experienced only by a very small group of people and is all about privacy and privilege, with guests secluding themselves in suites and huts and enjoying it all on their own. However, this is a very stereotypical and one-dimensional view.

Luxury travellers are engaging. They dine in local restaurants. They purchase products and services in the local economy – and a significant amount. Luxury travellers therefore contribute a significantly disproportionate amount to local visitor economies around the globe.

Visitors to the Damper Bay Lodge will engage in a wide range of activities, purchase high quality / high value products and services at local businesses such as:

- private limousine, cruise and air transport services

- local art galleries and private art tours (Wanaka has a vibrant arts community of painters, sculptors, photographers, carvers, writers and more)
- visits to makers of local food and beverages, such as a honey farm, cheese factory, wineries, craft breweries, distilleries
- private guided tours with local tour operators
- providers of Māori and other cultural experiences
- specialty restaurants
- quality retail outlets.

Luxury travellers can spend thousands of dollars per day on these types of activities, contributing significantly more to the local economy (per person) than ordinary visitors.

Not all activities luxury travellers engage in need to be of a "luxury" standard. Rather, many visitors prefer to blend in with the locals, seeking authentic experiences.

Nevertheless, they do appreciate quality which requires businesses that want to service this market to employ and train highly skilled people and pay above average wages. The luxury travel market has been, and continues to be, a catalyst for the development of high quality, sustainable tourism related businesses and jobs.

There is a strong opportunity for the Damper Bay Lodge to be designed and operated so as to have a net carbon zero (or better) impact on the natural environment. This is already reflected in the architectural concept drawings for the Lodge.

Assisted by the health and wellness element of the concept design, and assuming local New Zealanders are encouraged to visit during the low and shoulder seasons, we expect that the proposed lodge could achieve good occupancy throughout the year.

This will allow the lodge to provide steady employment for its staff and business to the local community, as opposed to the strong seasonal demand patterns caused by mainstream visitors.

Communities in luxury travel destinations often experience a great sense of pride by being recognised as unique, visited by the 'rich and famous', presented awards and included in various publications as a luxury destination.

Research has also shown a strong correlation between destinations that are popular with luxury travellers and the value of real-state. Luxury travel destinations attract further wealth to the community, providing much needed rates income to local authorities that can be used to provide additional services to the wider community.

Apart from the immediate economic impact, the luxury travel segment has a longer lasting impact on the New Zealand and local economy. According to TNZ, research shows that 32% of international Luxury Lodge customers have returned to New Zealand at least once over the subsequent five years.

Furthermore, several High Net Worth visitors have made significant investments in New Zealand businesses and property after their visits. Experiences of luxury travellers will provide them with a return story worth sharing among their exclusive networks which may lead to more visits and/or overseas investment.

Based on their motivations and interests as described earlier, luxury travellers visiting the lodge are also much more likely to engage in activities that broaden cultural and environmental awareness, supporting local conservation and other sustainability initiatives.

8. Conclusion – Strategic Market Opportunity for Wanaka

The exponential growth of tourism into the Southern Lakes region over the past decade has been well publicised. Until the COVID-19 pandemic, the rate of growth resulted in considerable pressures on Queenstown's infrastructure, housing shortages and dissatisfaction amongst some local residents. This was experienced to a much smaller extent in Wanaka.

However, Wanaka's geography and natural beauty has the potential to become just as popular, if not more popular, than Queenstown. Without strong destination management, and well-considered product development consistent with LWT's objectives, Wanaka's popularity as a visitor destination could result in similar problems and an undesirable situation from the perspective of Wanaka residents.

By increasing the quality of its product offering and value of its visitors, Wanaka as a visitor destination has the opportunity to retain much of its unique character while also experiencing the many benefits that tourism can bring.

Developments such as the proposed Damper Bay Lodge will contribute disproportionately to achieving a sustainable future for Wanaka tourism.

Yours faithfully
HORWATH HTL LIMITED

Stephen Hamilton
Director

IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an appeal under section 120 of the Act

BETWEEN **UPPER CLUTHA ENVIRONMENTAL SOCIETY INCORPORATED**

(RMA 0934/03)

Appellant

AND **QUEENSTOWN LAKES DISTRICT COUNCIL**

Respondent

AND **D & V McRAE**

BEFORE THE ENVIRONMENT COURT

Environment Judge J R Jackson (sitting alone under section 279 of the Act)

IN CHAMBERS at CHRISTCHURCH

CONSENT ORDER

[1] The Court has read and considered the appeal and the memorandum of the parties dated 24 March 2004.

[2] No other person has given notice of an intention to become a party or to be heard under section 274 of the Act.

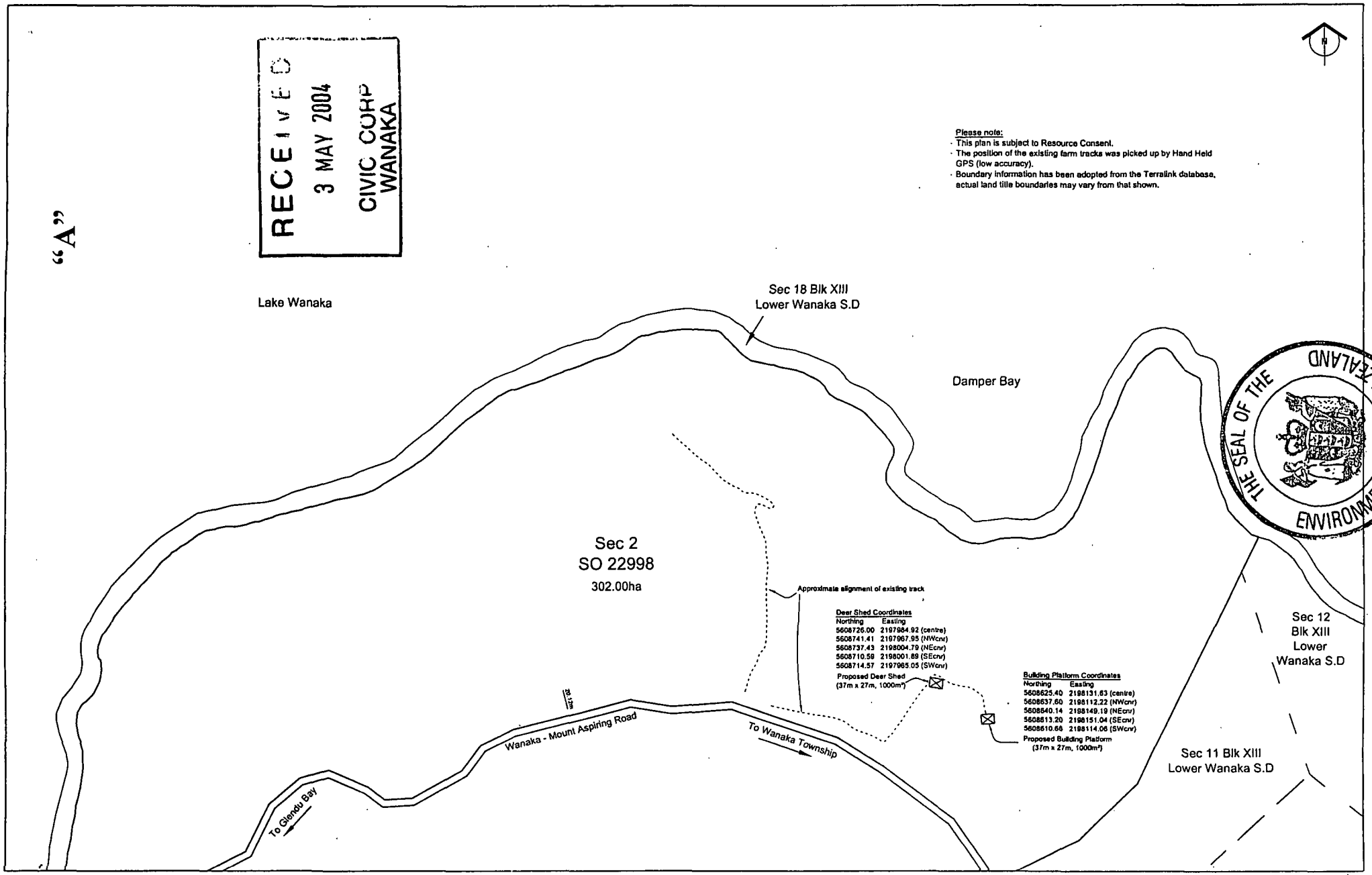
[3] In signing this consent order the Court has not considered the merits of the solution agreed by the parties (and in particular whether it achieves the purpose of the Act) but only confirmed that:

(a) All of the parties to the proceeding have executed the memorandum requesting this order; and

"A"

RECEIVED
3 MAY 2004
CIVIC CORP
WANAKA

Please note:
- This plan is subject to Resource Consent.
- The position of the existing farm tracks was picked up by Hand Held GPS (low accuracy).
- Boundary information has been adopted from the Terralink database, actual land title boundaries may vary from that shown.



THE SEAL OF THE NEW ZEALAND ENVIRONMENT COURT

CLARK FORTUNE McDONALD & ASSOCIATES
REGISTERED LAND SURVEYORS LAND DEVELOPMENT & RESOURCE MANAGEMENT CONSULTANTS
Dunmore Street, P.O.Box 550, Wanaka
Tel. (03)443-4448, Fax (03)443-4445, Email g.Lawn@xtra.co.nz

ISSUE	COMMENTS	BY	DATE
1.	John Kyle - Mitchell Partnerships	CPH	18.03.04
2.	John Kyle - Mitchell Partnerships	CPH	23.03.04
3.	John Kyle & Michael Parker	CPH	24.03.04

Proposed Building Platform on Sec 2 SO22998

PROJECT: Damper Bay/Alpha Burn
PRINCIPAL: C/- Mitchell Partnerships

APPROVED:
DESIGN:
CHECKED:
DRAWN: CPH

REVISION	COMMENTS	BY	DATE
A	UPDATE BUILDING PLATFORMS	MP	23-03-04
B	PLATFORM COORDINATES ERCNR	CPH	24-03-04
C	MP CORNER COORDINATES SHOWN	CPH	31-03-04

SURVEY: CPH
FB
SCALE 1:5000 @A1
1:10000 @A3
JOB No. 8701

LEVEL:
LB
DATUM: NZMG
Rev. C
DRAWING 8701-6

MACALISTER TODD PHILLIPS BODKINS
BARRISTERS • SOLICITORS • NOTARIES

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QUEENSTOWN, NEW ZEALAND DXZP95001
Trust Account No. BNZ020948-0108606-00
also practising at **ALEXANDRA CROMWELL and WANAKA**

RECEIVED
0 8 APR 2004
CivicCorp

6 April 2004

Mr M E Parker
P O Box 1052
QUEENSTOWN

RECEIVED
1 4 APR 2004
CIVIC CORP
WANAKA

Dear Sir

UPPER CLUTHA ENVIRONMENTAL SOCIETY V QUEENSTOWN LAKES DISTRICT COUNCIL - RMA0934/03 (Our Ref: 293182-205)

We advise that at the Council's Regulatory Committee meeting held on 6 April 2004, the Council resolved to enter into the Memorandum of Consent to resolve this Appeal.

We are now enclosing the Memorandum signed for and on behalf of the Council by our Mr Todd in order that you may file the same with the Environment Court.

Yours faithfully
MACALISTER TODD PHILLIPS BODKINS

J E Macdonald
Principal

Email: jmacdonald@mactodd.co.nz
Mobile: 027 473 0874
Direct Dial: 441 0127

cc: Civic Corporation Limited
Private Bag
QUEENSTOWN

Attention: Andrew Henderson

For your information

Before the Environment Court **RMA No. 0934/03**

In the Matter	of an Appeal pursuant to section 120 of the Resource Management Act 1991
Between	Upper Clutha Environmental Society Inc
	Appellant
And	Queenstown Lakes District Council
	Respondent
And	D & V McRae
	Applicant

MEMORANDUM OF CONSENT BY PARTIES TO THIS APPEAL

PRESENTED FOR FILING BY :

M E Parker
Chester Building
PO Box 1052
QUEENSTOWN
Phone: (03) 442 6337
Fax: (03) 442 6338

MAY IT PLEASE THE COURT:

[1] The Appellant has brought this appeal under Section 120 of the Resource Management Act 1991 against a decision of the Queenstown-Lakes District Council (the Respondent) dated 20 November 2003 ("the Decision") whereby the Applicants, D and V McRae, were granted subdivision consent to subdivide Alpha Burn Station into two allotments, Lot 1 comprising 214 hectares, and land use consent for a residential building platform within Lot 1, with Lot 2 comprising the balance. The decision was designated RM 030249(a).

[2] By virtue of negotiations between the parties to this appeal it has been agreed that the aforementioned proposed residential building platform be moved from the position indicated by the plan referred to Condition 1 in the Decision to the position indicated by the Plan annexed hereto marked "A",("the amended location") and which plan will be substituted for that in the said Condition 1.

[3] The applicant has arranged for registered surveyors to place pegs at each corner of the proposed residential building platform in the position shown on attached Plan A. These pegs have been inspected by the appellant and the appellant agrees with the position of the residential building platform as marked by these pegs. The GPS coordinates of the four corners of the proposed residential building platform are also shown on Plan A.

[4] The applicant has arranged for registered surveyors to place pegs at each corner of the proposed deer shed in the position shown on attached Plan A. These pegs have been inspected by the appellant and the appellant agrees with the position of the deer shed as marked by these pegs. The GPS coordinates of the four corners of the proposed deer shed are also shown on Plan A.

[5] The Appellant and the Applicant have agreed on the amended locations and the Appellant hereby indicates that as long as all the remaining conditions of consent RM 030249(a) remain the same in relation to the land use consent, other than Condition 1 thereto which will necessarily be changed as recorded in Paragraph

[2] above, all of its concerns and grounds of appeal raised herein will be satisfied.

[6] For their part, the Applicants agree to the changes and amendments referred to in paragraphs [2] and [3] and[4] above.

[7] The Respondent Council has considered the above and believes that the amended position of the residential building platform is appropriate and accordingly also agrees to the amendments referred to in paragraphs [2] and [3] and [4] above.

[8] All the parties are therefore in agreement and respectfully invite the Court to approve this Consent Memorandum.

Dated this 24TH day of March 2004.

Julian Haworth President,
For and on behalf of the **Upper Clutha Environmental Society Inc**

G M Todd
Counsel for **Queenstown-Lakes District Council**

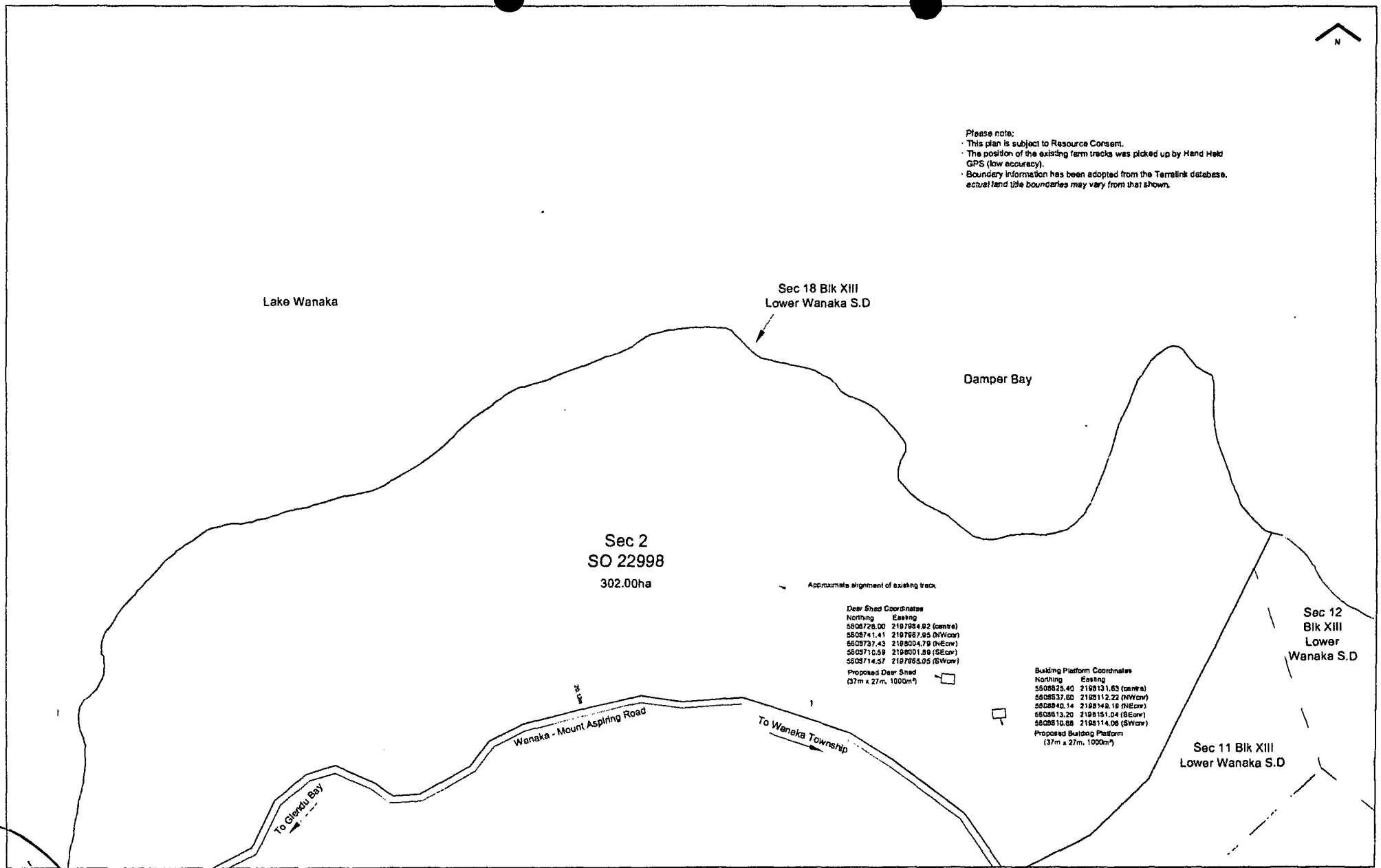
D McRae

Applicant

V C McRae

V McRae

Applicant



CLARK FORTUNE McDONALD & ASSOCIATES		Proposed Building Platform on Sec 2 SO22998	Damper Bay/Alpha Burn C/- Mitchell Partnerships		1:5000 @A1 1:10000 @A3 NZMG 8701 8701-6

AURORA ENERGY LIMITED
PO Box 5140, Dunedin 9058
PH 0800 22 00 05
WEB www.auroraenergy.co.nz

11/5/22021

Craig Woodcock
JE&A

Sent via email only: craig.woodcock@jea.co.nz

Dear Craig

ELECTRICITY SUPPLY AVAILABILITY FOR A PROPOSED SIX DWELLING DEVLEOPMENT.
550 WANAKA MOUNT ASPIRING ROAD WANAKA. LOT 1 DP 337193

Thank you for your inquiry outlining the above proposed development.

Subject to technical, legal and commercial requirements, Aurora Energy can make a Point of Supply[1] (PoS) available for this development.

Disclaimer

This letter confirms that a PoS **can** be made available. This letter **does not** imply that a PoS is available now, or that Aurora Energy will make a PoS available at its cost.

Next Steps

To arrange an electricity connection to the Aurora Energy network, a connection application will be required. General and technical requirements for electricity connections are contained in Aurora Energy's Network Connection Standard. Connection application forms and the Network Connection Standard are available from www.auroraenergy.co.nz.

Yours sincerely

Niel Frear

CUSTOMER INITIATED WORKS MANAGER

[1] Point of Supply is defined in section 2(3) of the Electricity Act 1993.