GEOTECHNICAL ASSESSMENT REPORT

ALPINE GEOTECH

ORCHARD ROAD
WANAKA

CLIENT: ALPINE ESTATES LTD
JOB REF: G17026

DATE: 23 MAY 2016

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TABLE OF CONTENTS

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1 INTRODUCTION

This report presents the results of a geotechnical assessment carried out by Mt Iron Geodrill on behalf of Alpine Estate Ltd for the proposed new sub-division located LOT 2 DP 302568 - WITH INT IN ROW - as indicated on the attached Figure 1. The proposed development comprises 14 lot sub-division with associated roads and infrastructure.

The work was commissioned by David Reid of 3 Plus in a signed SFA, dated 27 April 2016. A site plan of the proposed development was provided by David Reid.

The scope of work for the geotechnical assessment included providing recommendations on:

- Site preparation;
- Excavation conditions;
- The suitability of the site soils for use as fill an on fill construction procedures;
- Special requirements for construction procedures and or site drainage
- Suitability for onsite waste water disposal
- Suitability for onsite storm water disposal.

Mt Iron Geodrill conducted the work in general accordance with our proposal, reference G17026 Alpine Geotech SFA dated 20 April 2016.

The following report presents the results of field investigations and laboratory testing, and provides discussion and recommendations relevant to the above scope of work.

Limitations

Findings presented as a part of this report are for the sole use of Alpine Estates Ltd and the Queenstown Lakes District Council in accordance with the specific scope and the purposes outlined above. While other parties may find this reporting useful the findings are not intended for use by other parties, and may not contain sufficient information for the purposes of other parties or other uses.

Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report.

1.1 RELATED DOCUMENTS

In this report, reference is made to the following documents:

- NZS 4431:1989 and amendments. Code of Practice for Earthfill for Residential Development.
- NZS 3604: 2011 Timber Framed Buildings
- NZS 1170.5: 2004 Structural design actions Part 5 Earthquake actions – New Zealand
- Geology of the Wakatipu area 1:250,000 QMap (Qm18), GNS Science: 2000
- QLDC GIS Webmaps
- Part D: Guidelines for the investigation and assessment of subdivisions in the Canterbury region

2 SITE INFORMATION

- The site is located to the north east of the existing Grandview development off Orchard road, Wanaka;
- The proposed development covers an area on approximately 1.98ha;
- The site is current vacant, bare land that has been used for stock grazing;
- There was bare vacant land to north, east and west of the site (at the time of investigation) with the Grandview development to the south west.

- The site topography is generally flat with minor undulations
- There are no know geotechnical reports for the site.

3 GEOLOGY

The geology of the site is mapped by the Qm18 as comprising:

OIS2 (Late Pleistocene) outwash deposits - Unweathered to slightly weathered, well sorted, sandy gravel forming large outwash terraces in Clutha catchment.

The Qmap is at a 1:250,000 scale so only details the larger units present. Site investigations have confirmed the till deposits.

No active faults were mapped in the field, however, the active Cardrona fault shown on the published Qm 18 approximately 0.7km from the site to the east.

There is a significant seismic risk to the Wanaka region when the rupture of the alpine fault system occurs; recent probability predictions estimate a magnitude 7.5 or greater is highly likely within the next 45 years. Significant ground shaking is expected from this type of event.

The site is located in an area of past glacial activity with several advance and retreat events causing the underlying bedrock to be scoured by glacial ice sheets resulting in the deposition of glacial sediments such as till over the schist bedrock and lacustrine and deltaic alluvial fan deposits.

4 FIELDWORK

Fieldwork was carried out on date and comprised of: (say what was done and how it was done, don't go into logistics)

- Review of existing data outlined in section 2;
- Air photo interpretation;
- Geological mapping or geotechnical observations of outcrops or cuttings on or near the site;
- Drilling of Four (4) shallow bores for infiltration testing;
- Six (6) Test pits;
- Field testing Eleven (11) Scalas

All field work was carried out in the full time presence of a Mt Iron Geodrill representative who located the boreholes, carried out sampling and testing and produced engineering logs of the test pits and boreholes

Test pits and boreholes were located by hand held GPS using zone 59 UTM co-ordinates, with an error of ± 3m. Approximate locations are shown on Figure 1.

5 RESULTS OF INVESTIGATION

5.1 SURFACE CONDITIONS

The surface conditions at the time of site visit were:

- No Water seeps or springs were noted at the time of the site visit;
- No Land instability was observed at the time of the site visit;
- No Evidence of erosion in natural soils.

5.2 INTERPRETED SUBSURFACE CONDITIONS

The typical soils types encountered during the field investigations have been divided into geotechnical units as summarised in Table 1. Engineering logs of the test pits and boreholes are presented in Appendix A.

TABLE 1 – SUMMARY OF GEOLOGICAL UNITS AND SOIL TYPES

UNIT	SOIL TYPE	DESCRIPTION
1	TOPSOIL	Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand, some to fine to medium grained, sub-rounded to sub angular gravel.
2	Sandy SILT / SILT	yellowish brown, moderate to high dilatancy, some fine sand.
3a	Silty GRAVEL	Silty GRAVEL: brown fine to coarse grained sub-rounded well graded gravel, moderate dilatancy silt, some fine to coarse grained sand.
3b	Sandy GRAVEL	Sandy GRAVEL: grey, fine to coarse grained sub-rounded, well graded gravel, fine to coarse grained sand.

Table 2 contains a summary of the distribution of the above geotechnical units in each borehole location.

TABLE 2 – SUMMARY OF DISTRIBUTION OF GEOLOGICAL UNITS ENCOUNTERED AT TEST PIT LOCATIONS

TEST PIT / BOREHOLE LOCATION	DEPTH ENCOUNTERED BELOW EXISTING GROUND LEVEL (m)			
	UNIT 1	UNIT 2	UNIT 3a	UNIT 3b
TP1	0.0 - 0.2	-	0.2 - 0.7	0.7 - >1.1
TP2	0.0 - 0.2	0.2 - 0.5	0.5 - 0.7	0.7 - >1.4
TP3	0.0 - 0.2	0.2 - 0.5	0.5 - 0.7	0.7 - >1.4
TP4	0.0 - 0.2	-	0.2 - 0.7	0.7 - >1.4
TP5	0.0 - 0.3	0.3 - 0.8	-	0.8 - >1.7
TP6	0.0 - 0.2	-	0.2 - 0.7	0.7 - >1.4
BH1	0.0 - 0.2	-	0.2 - >0.5	-
BH2	0.0 - 0.2	-	0.2 - >0.5	-
BH3	0.0 - 0.2	-	0.2 - >0.5	-
BH4	0.0 - 0.2	-	0.2 - >0.5	-

- not encountered, > extends below depth of investigation

BH's were only drilled to 0.5m depth to allow for infiltration testing.

5.3 EXISTING FILL

No fill was encountered on the site during the site investigation. It should be noted that we assume that there were no earthworks undertaken in that area. If it is found that the site was subject to earthworks in the past, then Mt Iron Geodrill should be advised as soon as practicable.

6 GROUNDWATER

Groundwater inflows were not observed in any of the boreholes/test pits at the time of the field investigations.

It should be noted that fluctuations in the groundwater levels can occur as a result of seasonal variations, temperature, rainfall and other similar factors, the influence of which may not have been apparent at the time of investigation.

7 DISCUSSION AND RECOMMENDATIONS

7.1 SITE PREPARATION

Site preparation and earthworks suitable for structure and pavement support should consist of:

- Prior to the placement of any new fill, the proposed areas should be stripped to remove all vegetation, topsoil, root affected or other potentially deleterious material. Stripping is generally expected to be required to depths of about 0.3m to 0.4m;
- New site fill beneath structures should be compacted to a minimum density ratio of 95% Standard Compaction within acceptable limits of optimum moisture content (OMC);
- All new fill should be supported by properly designed and constructed retaining walls or else battered at 1V:2H or flatter and protected against erosion;
- Earthworks should be in accordance with the recommendations of NZS 4431:1989 '*Earth Fill for Residential development'.*

7.2 EXCAVATION CONDITIONS

Where excavation is required, it is anticipated that all site materials could be excavated by conventional dozer blade or excavator (1.7 Tonne) bucket at least to the depths indicated on the appended logs. The depths of topsoil material, depth to rock and levels of refusal where encountered during field work are summarised in Table 2.

7.3 SUITABILITY OF SITE SOILS AS FILL

The following comments are made regarding the suitability of the site materials for reuse in filled areas:

- Where site regrade is proposed, topsoil, vegetation or other potentially deleterious material (Unit 1 topsoil) should be removed to spoil or stockpiled for reuse as landscaping materials only. Stripping is generally expected to be required to depths of about 0.4m;
- The underlying silts, sands and gravels (Units 2, 3a and 3b) should be carefully stripped as necessary and stockpiled for reuse as general site fill. It is recommended that these units be blended before use as fill;
- Exposed natural soils should be appropriately protected from erosion by suitable batter slope formation, diversion drainage to intercept overland flows and covering the exposed soils with suitable vegetation/landscaping; appropriate batter angles are detailed below in section 7.6;

- Earthworks on the site should be in accordance with the recommendations of NZS 4431:1989. From site stripping, stockpiling, fill placement, removal of surpluses off site, protection of the excavation surfaces and surface water control., should the depth of fill exceed 600mm and be supporting of structures then certification in accordance with this standard will also need to be undertaken.

7.4 NATURAL HAZARDS

The site is not considered to be at risk from flooding. No Evidence of slope instability was observed on site or the neighbouring sites.

A seismic ground shaking risk for the Wanaka region on the whole has been identified and prudent design to mitigate the risk of seismic ground shaking should be applied to all proposed structures. Design to the relevant structural and building codes is expected to mitigate this issue.

Freeze and thaw effects are relevant for the region and it is recommended that all foundations are embedded at least 0.4m below finished ground levels with careful consideration given to final ground level clearances from exterior claddings.

Overland flow is not expected. However, it is recommended that any potential overland flow paths are either piped or regraded away from the dwelling and associated landscaping structures. The proposed cut batter at the rear of the building may expose some water seepage; this can be controlled appropriately with drainage systems.

7.5 PRELIMINARY BEARING CAPACITY STRESSES AND SETTLEMENT

The Scala Penetrometer results across the building platform generally show soils meet the requirements for 'good ground' in accordance with NZS3604:2011 below depths of approximately 0.3m depth below current ground surface.

There is an area around TP5 that is considered to have depth at least 0.8m of soft material which should be either designed for, removed and replaced with suitability placed and compacted engineered fill or avoided during construction of structures. The full extent of this area is unknown and further investigation may be required once the final layout of the development is known. If roads are to be constructed over this area, then it is recommended that this material be removed and replaced with suitable engineered fill.

However, it is unknown what effect any earthworks will have of the levels and bearing capacity of the finished sections. It is highly recommended that at the time of construction all foundation excavation subgrades should be inspected by a suitably qualified Geoprofessional. This is to ensure foundation conditions are as reported and the appropriate design assumptions for bearing capacity are met.

7.6 BATTER SLOPE ANGLES

Temporary and permanent batter angles are summarised in the table below up to a maximum cut height of 3.0 m in fully drained conditions. Batters greater than 3.0 m high will need specific inspection and assessment by a suitably qualified geotechnical professional during construction. Where more than one soil type is present in the batter slope the batter must still be to the slopes recommended for each type.

Should water or seepage be encountered during excavation of the proposed batters then a Geoprofessional shall assess additional slope drainage requirements. The type, spacing and details would be confirmed at that stage.

Were steeper batters than those recommended are proposed then they will be subject to specific design by a geotechnical professional.

TABLE 3 – BATTER ANGLE SUMMARY

Material Type	Temporary Construction Batters (H):(V)	Permanent Batters (H):(V) (unretained)
Engineered Fill	1:1	2:1
Soils encountered	1:1	2:1

7.7 GEOTECHNICAL SOIL PARAMETERS

Geotechnical Soil parameters for retaining design are tabulated below:

TABLE 4 – GEOTECHNICAL SOIL PARAMETERS

Soil/Rock Type	Bulk Density (kN/m^3)	Effective Cohesion (kPa)	Effective Friction Angle ($^\circ$)
Topsoil	15.5	-	25
Engineered Fill	18	0	30
Natural silt soils (Unit 2)	17	0	30
Natural gravelly soils (Unit 3a & 3b)	17	0	40

All retaining structures should be designed by a Chartered Professional Engineer and have full height of retaining drainage measures installed with a collection drain at the base, to suitable outfall to the storm water system.

8 PERMEABILITY

An assessment of the soil permeability was undertaken during the site investigation visit for the purposes of onsite storm water disposal. Two onsite permeability tests (SK1 to SK4) were conducted in soils which were considered to be representative of those across the site and likely to be suitable for storm water and waste water disposal.

SK1 to SK3 tests did not hold water in the borehole long enough to allow for testing, SK4 was undertaken by falling head method in the borehole. The value is approximate and further testing for design is recommended at the time of construction.

A summary of the results of the permeation testing are outlined in Table 5

TABLE 5 – SUMMARY OF PERMEATION TESTING

TEST LOCATION	SOIL TYPE	PERMEABILITY mm/hr	PERMEABILITY m/day
SK4	Silty Gravel	363	8.7

8.1 SUITABILITY FOR ONSITE STORM WATER DISPOSAL

Based on the results of the permeability testing it is considered that the site is suitable for onsite storm water disposal. It is considered that any area of the site could be used for soak pit installation.

However, if material different from those described in the appended borehole logs then Mt Iron Geodrill should be contacted for advice.

9 CONCLUSIONS

The proposed development is considered geotechnically suitable for the site; and as long as the above considerations in Section 7 above are followed for design and construction, no adverse geotechnical effects are expected.

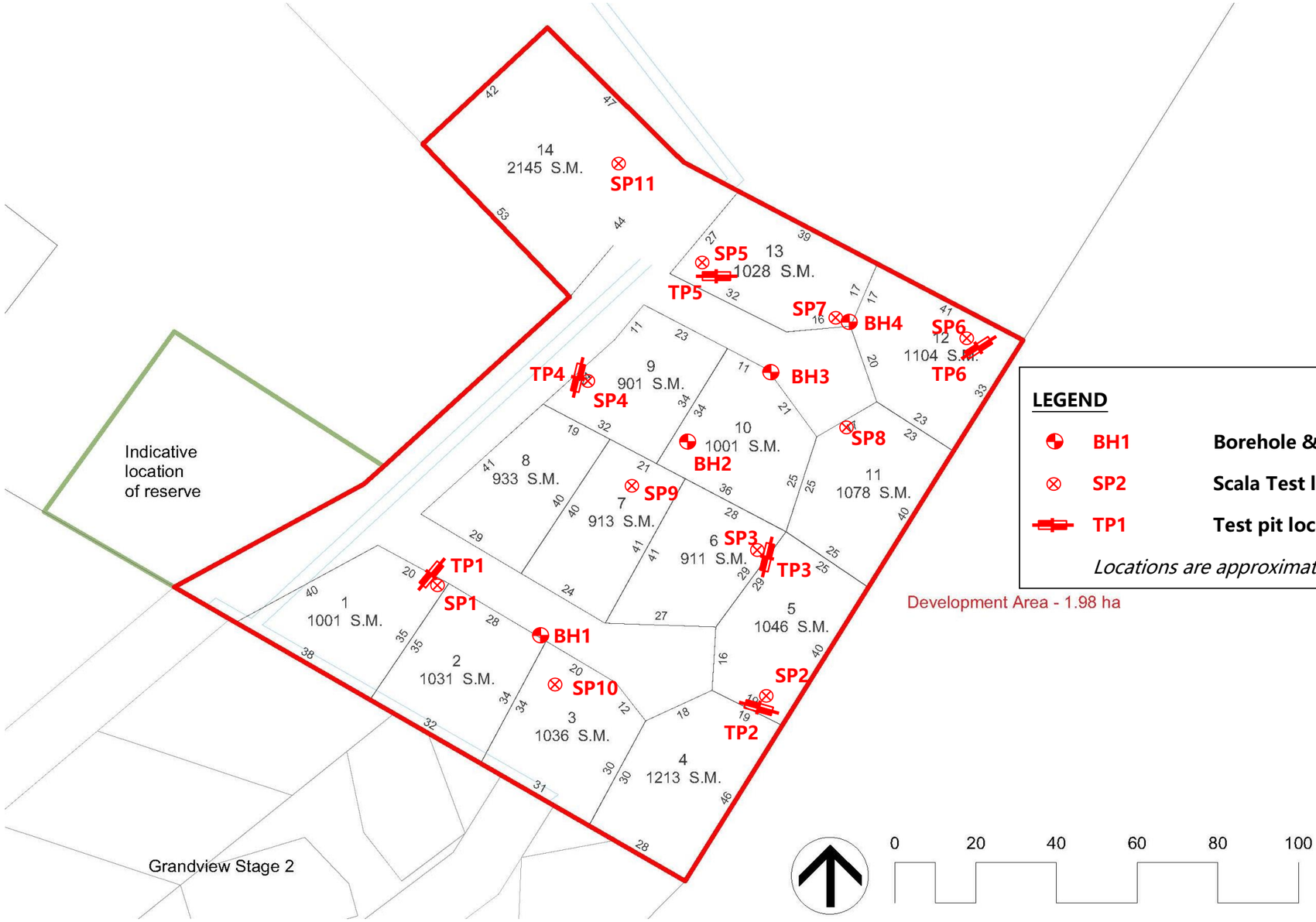
10 APPLICABILITY

This report is only to be used by the parties named above for the purpose that it was prepared and shall not be relied upon or used for any other purpose without the express written consent of the principal and Mt Iron Geodrill Ltd.

The extent of testing associated with this assessment is limited to discrete locations and variations in ground conditions can occur between and away from such locations. If subsurface conditions encountered during construction differ from those given in this report further advice should be sought without delay.

Appendix A – SITE PLANS

- Testing location plan (Figure 1)



MT IRON GEODRILL	Project: ALPINE GEOTECH Orchard Road Wanaka	Client: Alpine Estate Ltd	Drawing Title: Site investigation Plan	Scale: as shown	Drawing Number Figure 1
				Job No. G17026	Revision:

Appendix B – ENGINEERING LOGS

- Test pit logs
- Borehole logs
- Scala penetrometer test logs

TP1

TEST PIT LOG

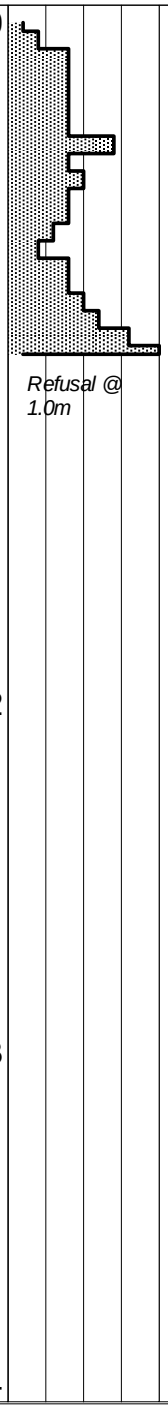
CO-ORDINATES: 352851
5047261
± m: 3m
ELEVATION: 335
DATUM: MSL / UTM

JOB NUMBER: G17026
PROJECT: ALPINE GEOTECH
LOCATION: Orchard Road, Wanaka

DATE: 09/05/2016
LOGGED BY: GT

EQUIPMENT
TYPE & MODEL: Yanmar ViO17
COMPANY: Mt Iron Geodrill
OPERATOR: G Tippett

PIT DIMENSIONS:
Wide: 0.5m Long: 2.2m



METHOD	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional
E				TOPSOIL: Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand, some to fine to medium grained, sub-rounded to sub angular gravel.	D	VSt	TOPSOIL (Unit 1)
				Silty GRAVEL: brown fine to coarse grained sub-rounded well graded gravel, moderate dilatancy silt, some fine to coarse grained sand.		D	ALLUVIUM (Unit 3a)
				Sandy GRAVEL: grey, fine to coarse grained sub-rounded, well graded gravel, fine to coarse grained sand.		VD	ALLUVIUM (Unit 3b)
				END OF HOLE @ 1.1m COLLAPSE OF MATERIAL			

METHOD:
- N Natural Exposure
- X Existing Excavation
- E Excavator
- HA Hand Auger

SAMPLES:
- U50 Undisturded Sample 50mm Diameter
- D Disturbed Sample
- V Vane Shear (kPa)
- Bs Bulk Disturded Sample
- E Environmental Sample

MOISTURE:
- D Dry
- M Moist
- W Wet
- S Saturated

CONSISTENCY / DENSITY:
- VS Very Soft
- S Soft
- F Firm
- St Stiff
- VSt Very Stiff
- H Hard
- Fb Friable
- VL Very Loose
- L Loose
- MD Medium Dense
- D Dense
- VD Very Dense

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
- ◁ Water Inflow
- ▼ Standing Water Level
- ▽ Estimated High Water Level

TP2

TEST PIT LOG

CO-ORDINATES: 352914
5047226
± m: 3m
ELEVATION: 333
DATUM: MSL / UTM

JOB NUMBER: G17026
PROJECT: ALPINE GEOTECH
LOCATION: Orchard Road, Wanaka

DATE: 09/05/2016
LOGGED BY: GT

EQUIPMENT
TYPE & MODEL: Yanmar ViO17
COMPANY: Mt Iron Geodrill
OPERATOR: G Tippett

PIT DIMENSIONS:
Wide: 0.5m Long: 2.0m

METHOD	DEPTH (m)	BLOWS/50mm	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional	DEPTH (m)
E	0	Refusal @ 0.35m				TOPSOIL: Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand.	D	VSt	TOPSOIL (Unit 1)	0
						SILT: yellowish brown, moderate to high dilatancy, some fine sand		H	AEOLIAN (Unit 2)	
						Silty GRAVEL: brown fine to coarse grained sub-rounded well graded gravel, moderate dilatancy silt, some fine to coarse grained sand.		D - VD	ALLUVIUM (Unit 3a)	
	1					Sandy GRAVEL: grey, fine to coarse grained sub-rounded, well graded gravel, fine to coarse grained sand.			ALLUVIUM (Unit 3b)	1
	2					END OF HOLE @ 1.4m COLLAPSE OF MATERIAL				2
	3									3
	4									4

METHOD:
- N Natural Exposure
- X Existing Excavation
- E Excavator
- HA Hand Auger

SAMPLES:
- U50 Undisturded Sample 50mm Diameter
- D Disturbed Sample
- V Vane Shear (kPa)
- Bs Bulk Disturded Sample
- E Environmental Sample

MOISTURE:
- D Dry
- M Moist
- W Wet
- S Saturated

CONSISTENCY / DENSITY:
- VS Very Soft
- S Soft
- F Firm
- St Stiff
- VSt Very Stiff
- H Hard
- Fb Friable
- VL Very Loose
- L Loose
- MD Medium Dense
- D Dense
- VD Very Dense

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
- ◁ Water Inflow
- ▼ Standing Water Level
- ▽ Estimated High Water Level

TP3

TEST PIT LOG

CO-ORDINATES: 352911
5047277
± m: 3m
ELEVATION: 335
DATUM: MSL / UTM

JOB NUMBER: G17026
PROJECT: ALPINE GEOTECH
LOCATION: Orchard Road, Wanaka

DATE: 09/05/2016
LOGGED BY: GT

EQUIPMENT
TYPE & MODEL: Yanmar ViO17
COMPANY: Mt Iron Geodrill
OPERATOR: G Tippett

PIT DIMENSIONS:
Wide: 0.5m Long: 2.1m

METHOD	DEPTH (m)	BLOWS/50mm (0 5 10)	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional
E	0					TOPSOIL: Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand.	D	St	TOPSOIL (Unit 1)
						SILT: yellowish brown, moderate to high dilatancy, some fine sand			AEOLIAN (Unit 2)
						Silty GRAVEL: brown fine to coarse grained sub-rounded well graded gravel, moderate dilatancy silt, some fine to coarse grained sand.		MD	ALLUVIUM (Unit 3a)
	1	*Refusal @ 0.95m*				Sandy GRAVEL: grey, fine to coarse grained sub-rounded, well graded gravel, fine to coarse grained sand.		VD	
						END OF HOLE @ 1.4m COLLAPSE OF MATERIAL			
	2								
	3								
	4								

METHOD:
N Natural Exposure
X Existing Excavation
E Excavator
HA Hand Auger

SAMPLES:
U50 Undisturded Sample 50mm Diameter
D Disturbed Sample
V Vane Shear (kPa)
Bs Bulk Disturded Sample
E Environmental Sample

MOISTURE:
D Dry
M Moist
W Wet
S Saturated

CONSISTENCY / DENSITY:
VS Very Soft
S Soft
F Firm
St Stiff
VSt Very Stiff
H Hard
Fb Friable
VL Very Loose
L Loose
MD Medium Dense
D Dense
VD Very Dense

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
◁ Water Inflow
▼ Standing Water Level
▽ Estimated High Water Level

TP4

TEST PIT LOG

CO-ORDINATES: 352895
5047326
± m: 3m
ELEVATION: 335
DATUM: MSL / UTM

JOB NUMBER: G17026
PROJECT: ALPINE GEOTECH
LOCATION: Orchard Road, Wanaka

DATE: 09/05/2016
LOGGED BY: GT

EQUIPMENT
TYPE & MODEL: Yanmar ViO17
COMPANY: Mt Iron Geodrill
OPERATOR: G Tippett

PIT DIMENSIONS:
Wide: 0.5m Long: 1.8m

METHOD	DEPTH (m)	BLOWS/50mm	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional	DEPTH (m)
E	0	*Refusal @ 0.30m*				TOPSOIL: Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand, some to fine to medium grained, sub-rounded to sub angular gravel.	D	St	TOPSOIL (Unit 1)	0
						Silty GRAVEL: brown fine to coarse grained sub-rounded well graded gravel, moderate dilatancy silt, some fine to coarse grained sand.			ALLUVIUM (Unit 3a)	
	1					Sandy GRAVEL: grey, fine to coarse grained sub-rounded, well graded gravel, fine to coarse grained sand.		D - VD	ALLUVIUM (Unit 3b)	1
	2					END OF HOLE @ 1.4m COLLAPSE OF MATERIAL				2
	3									3
	4									4

METHOD:
- N Natural Exposure
- X Existing Excavation
- E Excavator
- HA Hand Auger

SAMPLES:
- U50 Undisturded Sample 50mm Diameter
- D Disturbed Sample
- V Vane Shear (kPa)
- Bs Bulk Disturded Sample
- E Environmental Sample

MOISTURE:
- D Dry
- M Moist
- W Wet
- S Saturated

CONSISTENCY / DENSITY:

VS	Very Soft	VL	Very Loose
S	Soft	L	Loose
F	Firm	MD	Medium Dense
St	Stiff	D	Dense
VSt	Very Stiff	VD	Very Dense
H	Hard		
Fb	Friable		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
- ◁ Water Inflow
- ▼ Standing Water Level
- ▽ Estimated High Water Level

TP5

TEST PIT LOG

CO-ORDINATES: 352949
5047362
± m: 3m
ELEVATION: 335
DATUM: MSL / UTM

JOB NUMBER: G17026
PROJECT: ALPINE GEOTECH
LOCATION: Orchard Road, Wanaka

DATE: 09/05/2016
LOGGED BY: GT

EQUIPMENT
TYPE & MODEL: Yanmar ViO17
COMPANY: Mt Iron Geodrill
OPERATOR: G Tippett

PIT DIMENSIONS:
Wide: 0.5m Long: 2.1m

METHOD	DEPTH (m)	BLOWS/50mm	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional
E	0					TOPSOIL: Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand.	M	F	TOPSOIL (Unit 1)
				V		SILT: yellowish brown, moderate to high dilatancy, fine grained sand. Shear Vane: P=138kPa, R=22kPa		St	AEOLIAN (Unit 2)
	1					Sandy GRAVEL: grey, fine to coarse grained sub-rounded, well graded gravel, fine to coarse grained sand.	D	MD D VD	ALLUVIUM (Unit 3b)
	2					END OF HOLE @ 1.7m LIMIT OF MACHINE			
	3								
	4								

Refusal @ 1.35m

METHOD:
- N Natural Exposure
- X Existing Excavation
- E Excavator
- HA Hand Auger

SAMPLES:
- U50 Undisturded Sample 50mm Diameter
- D Disturbed Sample
- V Vane Shear (kPa)
- Bs Bulk Disturded Sample
- E Environmental Sample

MOISTURE:
- D Dry
- M Moist
- W Wet
- S Saturated

CONSISTENCY / DENSITY:
- VS Very Soft
- S Soft
- F Firm
- St Stiff
- VSt Very Stiff
- H Hard
- Fb Friable
- VL Very Loose
- L Loose
- MD Medium Dense
- D Dense
- VD Very Dense

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
- ◁ Water Inflow
- ▼ Standing Water Level
- ▽ Estimated High Water Level

TP6

TEST PIT LOG

CO-ORDINATES: 352995
5047356
± m: 3m
ELEVATION: 335
DATUM: MSL / UTM

JOB NUMBER: G17026
PROJECT: ALPINE GEOTECH
LOCATION: Orchard Road, Wanaka

DATE: 09/05/2016
LOGGED BY: GT

EQUIPMENT
TYPE & MODEL: Yanmar ViO17
COMPANY: Mt Iron Geodrill
OPERATOR: G Tippett

PIT DIMENSIONS:
Wide: 0.5m Long: 2.2m

METHOD	DEPTH (m)	BLOWS/50mm (0 5 10)	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional	DEPTH (m)
E	0	*Refusal @ 0.70m*				TOPSOIL: Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand, some to fine to medium grained, sub-rounded to sub angular gravel.	D	F	TOPSOIL (Unit 1)	0
						Silty GRAVEL: brown fine to coarse grained sub-rounded well graded gravel, moderate dilatancy silt, some fine to coarse grained sand.		MD	ALLUVIUM (Unit 3a)	
								D		
	1					Sandy GRAVEL: grey, fine to coarse grained sub-rounded, well graded gravel, fine to coarse grained sand.		VD	ALLUVIUM (Unit 3b)	1
	2					END OF HOLE @ 1.5m COLLAPSE OF MATERIAL				2
	3									3
	4									4

METHOD:
N Natural Exposure
X Existing Excavation
E Excavator
HA Hand Auger

SAMPLES:
U50 Undisturded Sample 50mm Diameter
D Disturbed Sample
V Vane Shear (kPa)
Bs Bulk Disturded Sample
E Environmental Sample

MOISTURE:
D Dry
M Moist
W Wet
S Saturated

CONSISTENCY / DENSITY:
VS Very Soft
S Soft
F Firm
St Stiff
VSt Very Stiff
H Hard
Fb Friable
VL Very Loose
L Loose
MD Medium Dense
D Dense
VD Very Dense

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:
◁ Water Inflow
▼ Standing Water Level
▽ Estimated High Water Level

BH1

BOREHOLE LOG

JOB NUMBER:	G17026	PROJECT:	ALPINE GEOTECH	EQUIPMENT TYPE & MODEL:	Yanmar ViO17
CO-ORDINATES:	352856 5047255	LOCATION:	Orchard Road Wanaka	COMPANY:	Mt Iron Geodrill
± m:	3m	DATE:	09/05/2016	OPERATOR:	G Tippett
ELEVATION:	335	LOGGED BY:	GT	BOREHOLE DIAMETER:	200mm
DATUM:	MSL / UTM				

METHOD	DEPTH (m)	BLOWS/50mm (0 5 10)	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional	DEPTH (m)
AD	0					TOPSOIL: Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand, some to fine to medium grained, sub-rounded to sub angular gravel.	D	St	TOPSOIL (Unit 1)	0
						Silty GRAVEL: brown fine to coarse grained sub-rounded well graded gravel, moderate dilatancy silt, some fine to coarse grained sand.		D	ALLUVIUM (Unit 3a)	
	1					END OF HOLE @ 0.5m Depth of Investigation				1
	2									2
	3									3
	4									4

METHOD:

AS	Auger screwing
AD	Auger drilling
RR	Roller/Tricone
CB	Claw / Blade bit
TC	TC bit
HA	Hand auger

SAMPLES:

U50	Undisturded Sample 50mm Diameter
D	Disturbed Sample
V	Vane Shear (kPa)
Bs	Bulk Disturded Sample
E	Environmental Sample

MOISTURE:

D	Dry
M	Moist
W	Wet
S	Saturated

CONSISTENCY / DENSITY:

VS	Very Soft	VL	Very Loose
S	Soft	L	Loose
F	Firm	MD	Medium Dense
St	Stiff	D	Dense
VSt	Very Stiff	VD	Very Dense
H	Hard		
Fb	Friable		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:

◁	Water Inflow
▼	Standing Water Level
▽	Estimated High Water Level

BH2

BOREHOLE LOG

JOB NUMBER:	G17026	PROJECT:	ALPINE GEOTECH	EQUIPMENT TYPE & MODEL:	Yanmar ViO17
CO-ORDINATES:	352913 5047299	LOCATION:	Orchard Road Wanaka	COMPANY:	Mt Iron Geodrill
± m:	3m	DATE:	09/05/2016	OPERATOR:	G Tippett
ELEVATION:	335	LOGGED BY:	GT	BOREHOLE DIAMETER:	200mm
DATUM:	MSL / UTM				

METHOD	DEPTH (m)	BLOWS/50mm (0 5 10)	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional
AD	0					TOPSOIL: Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand, some to fine to medium grained, sub-rounded to sub angular gravel.	D	St	TOPSOIL (Unit 1)
						Silty GRAVEL: brown fine to coarse grained sub-rounded well graded gravel, moderate dilatancy silt, some fine to coarse grained sand.		D	ALLUVIUM (Unit 3a)
	1					END OF HOLE @ 0.5m Depth of Investigation			
	2								
	3								
	4								

METHOD:

AS	Auger screwing
AD	Auger drilling
RR	Roller/Tricone
CB	Claw / Blade bit
TC	TC bit
HA	Hand auger

SAMPLES:

U50	Undisturded Sample 50mm Diameter
D	Disturbed Sample
V	Vane Shear (kPa)
Bs	Bulk Disturded Sample
E	Environmental Sample

MOISTURE:

D	Dry
M	Moist
W	Wet
S	Saturated

CONSISTENCY / DENSITY:

VS	Very Soft	VL	Very Loose
S	Soft	L	Loose
F	Firm	MD	Medium Dense
St	Stiff	D	Dense
VSt	Very Stiff	VD	Very Dense
H	Hard		
Fb	Friable		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

WATER:

◁	Water Inflow
▼	Standing Water Level
▽	Estimated High Water Level

BH3

BOREHOLE LOG

JOB NUMBER:	G17026	PROJECT:	ALPINE GEOTECH	EQUIPMENT TYPE & MODEL:	Yanmar ViO17
CO-ORDINATES:	352934 5047319	LOCATION:	Orchard Road Wanaka	COMPANY:	Mt Iron Geodrill
± m:	3m	DATE:	09/05/2016	OPERATOR:	G Tippett
ELEVATION:	335	LOGGED BY:	GT	BOREHOLE DIAMETER:	200mm
DATUM:	MSL / UTM				

METHOD	DEPTH (m)	BLOWS/50mm (0 5 10)	WATER	SAMPLES	GRAPHIC	DESRIPTION: Soil Name, Plasticity or Particle Characteristics, Colour, Secondary Components & Minor Components	MOSITURE	CONSISTENCY DENSITY	Structure and Additional Observations Geological / Depositional
AD	0					TOPSOIL: Sandy SILT; dark brown, organic, moderate dilatancy silt, fine to medium grained sand, some to fine to medium grained, sub-rounded to sub angular gravel.	D	St	TOPSOIL (Unit 1)
						Silty GRAVEL: brown fine to coarse grained sub-rounded well graded gravel, moderate dilatancy silt, some fine to coarse grained sand.		D	ALLUVIUM (Unit 3a)
	1					END OF HOLE @ 0.5m Depth of Investigation			
	2								
	3								
	4								

METHOD:

AS	Auger screwing
AD	Auger drilling
RR	Roller/Tricone
CB	Claw / Blade bit
TC	TC bit
HA	Hand auger

SAMPLES:

U50	Undisturded Sample 50mm Diameter
D	Disturbed Sample
V	Vane Shear (kPa)
Bs	Bulk Disturded Sample
E	Environmental Sample

MOISTURE:

D	Dry
M	Moist
W	Wet
S	Saturated

CONSISTENCY / DENSITY:

VS	Very Soft	VL	Very Loose
S	Soft	L	Loose
F	Firm	MD	Medium Dense
St	Stiff	D	Dense
VSt	Very Stiff	VD	Very Dense
H	Hard		
Fb	Friable		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

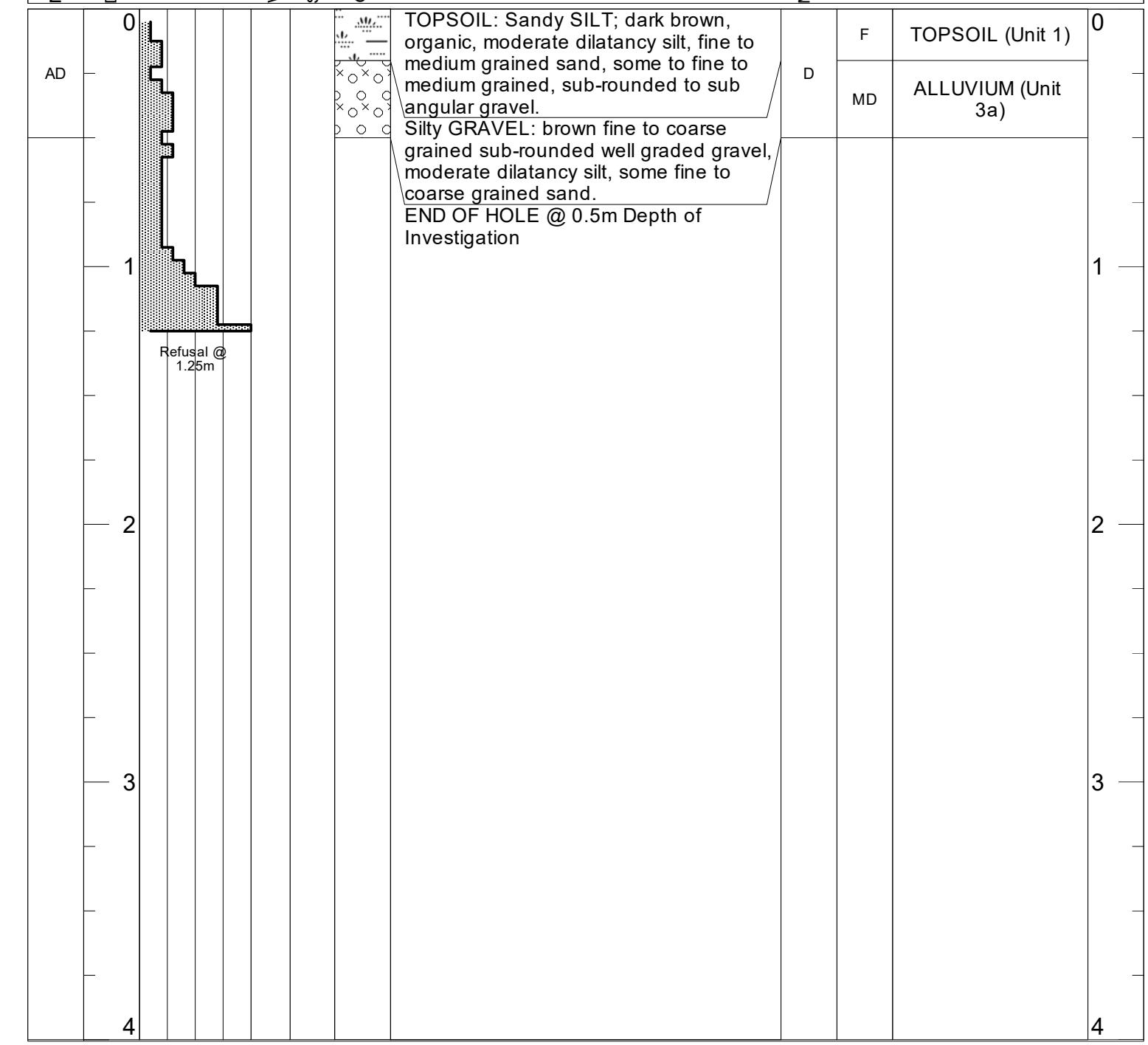
WATER:

◁	Water Inflow
▼	Standing Water Level
▽	Estimated High Water Level

BH4

BOREHOLE LOG

JOB NUMBER:	G17026	PROJECT:	ALPINE GEOTECH	EQUIPMENT TYPE & MODEL:	Yanmar ViO17
CO-ORDINATES:	352970 5047362	LOCATION:	Orchard Road Wanaka	COMPANY:	Mt Iron Geodrill
± m:	3m	DATE:	09/05/2016	OPERATOR:	G Tippett
ELEVATION:	335	LOGGED BY:	GT	BOREHOLE DIAMETER:	200mm
DATUM:	MSL / UTM				



METHOD:		SAMPLES:		MOISTURE:		CONSISTENCY / DENSITY:			
AS	Auger screwing	U50	Undisturded Sample 50mm Diameter	D	Dry	VS	Very Soft	VL	Very Loose
AD	Auger drilling	D	Disturbed Sample	M	Moist	S	Soft	L	Loose
RR	Roller/Tricone	V	Vane Shear (kPa)	W	Wet	F	Firm	MD	Medium Dense
CB	Claw / Blade bit	Bs	Bulk Disturded Sample	S	Saturated	St	Stiff	D	Dense
TC	TC bit	E	Environmental Sample			VSt	Very Stiff	VD	Very Dense
HA	Hand auger					H	Hard		
						Fb	Friable		

NOTE:
A scala result of 2.5 blows per 50mm is equivelent to a geotechnical ultimate bearing capacity of 300kPa in accordance with NZS 3604-2011, Section 3.3.7.

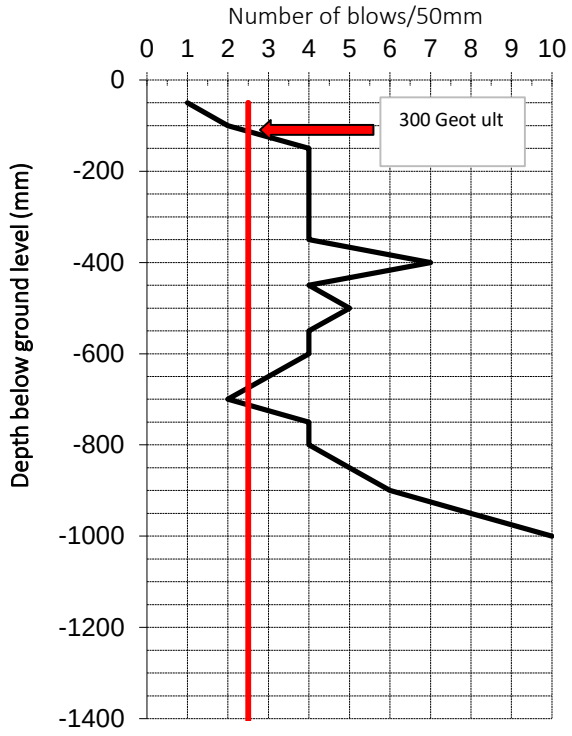
WATER:
- ◁ Water Inflow
- ▼ Standing Water Level
- ▽ Estimated High Water Level

SCALA PENETROMETER RESULTS

JOB NUMBER:	G17026	PROJECT:	ALPINE GEOTECH
		LOCATION:	Orchard Road, Wanaka
CO-ORDINATES:	mE	DATE:	9-May-16
See attached plan	mN	OPERATOR:	GT

Note: No Friction correction has been applied to the field results. 5 Blows per 100mm is considered compliance with NZS3604 3.3.7

SP1



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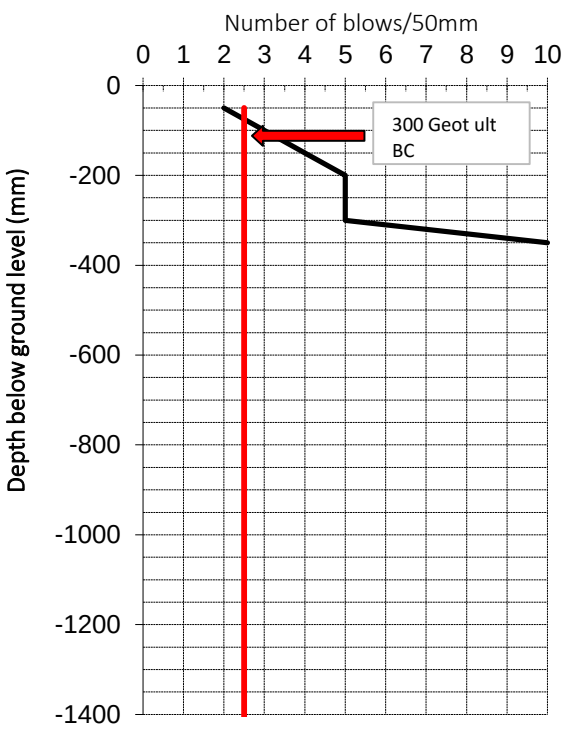

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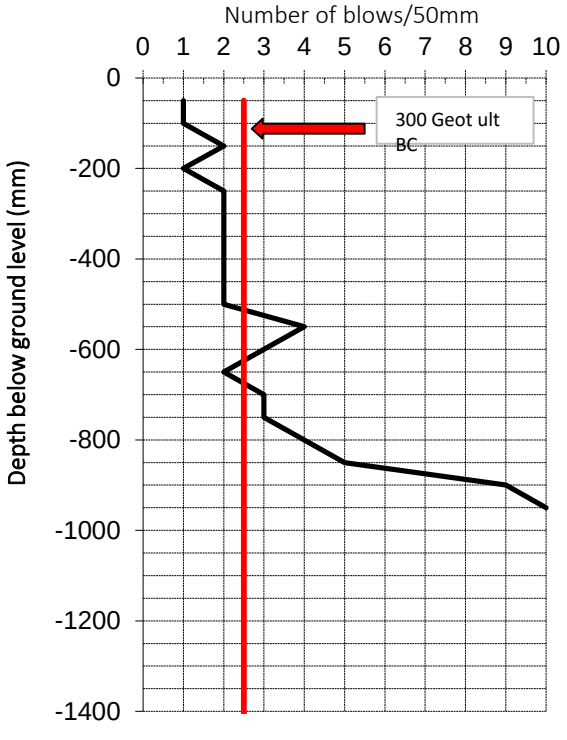

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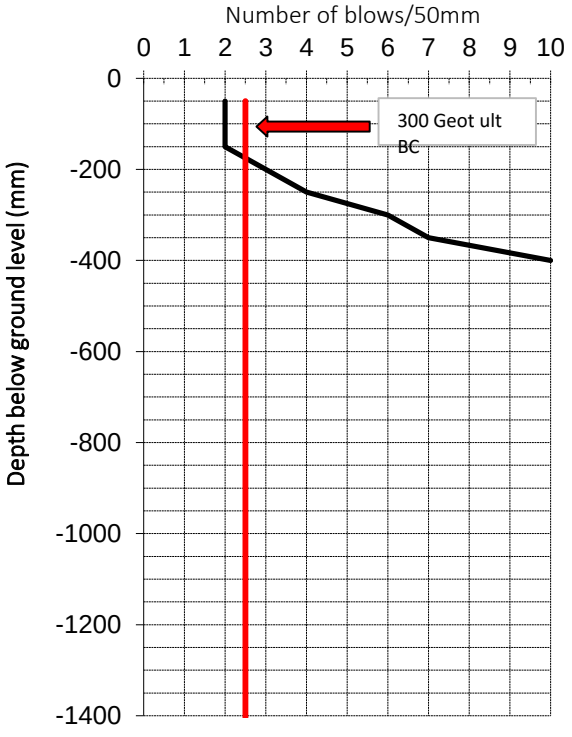
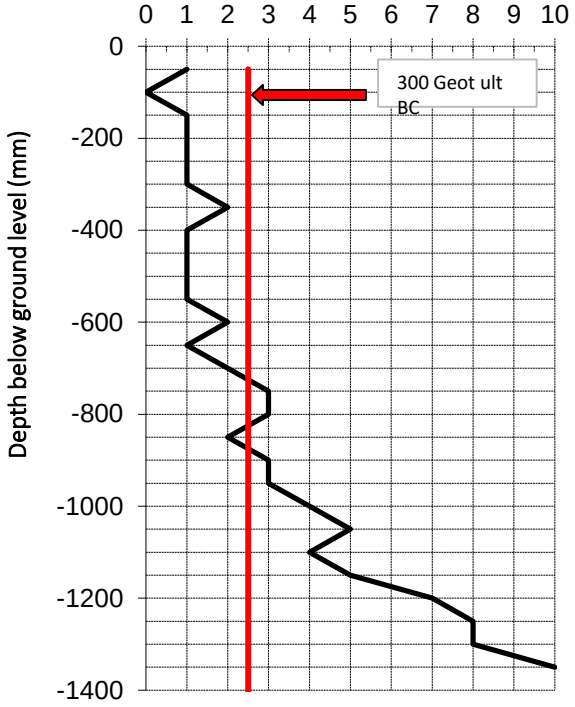


SCALA PENETROMETER RESULTS

JOB NUMBER:	G17026	PROJECT:	ALPINE GEOTECH
		LOCATION:	Orchard Road, Wanaka
CO-ORDINATES:	mE	DATE:	9-May-16
See attached plan	mN	OPERATOR:	GT

Note: No Friction correction has been applied to the field results. 5 Blows per 100mm is considered compliance with NZS3604 3.3.7

SP5



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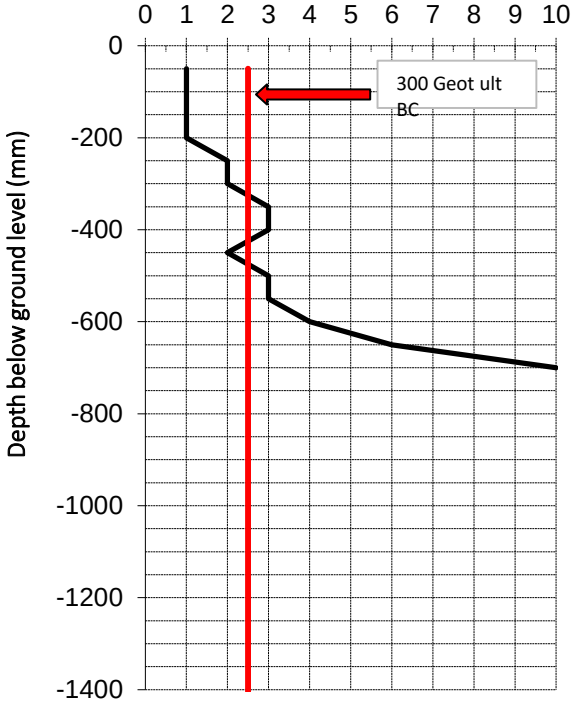

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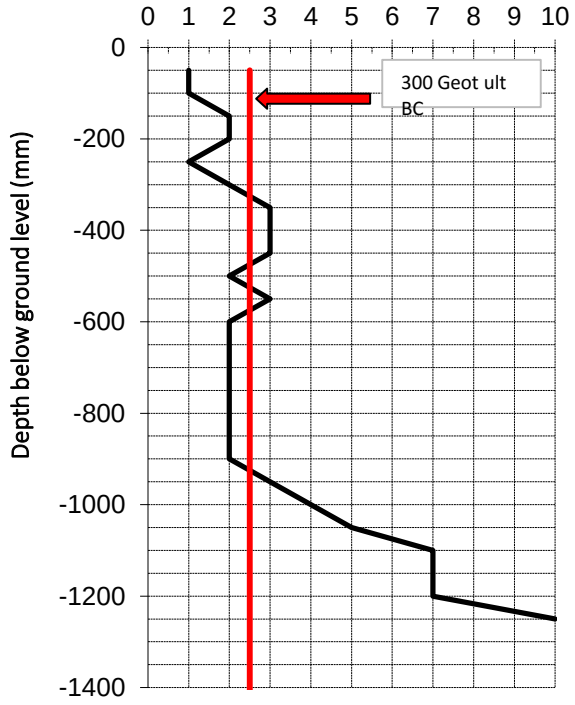

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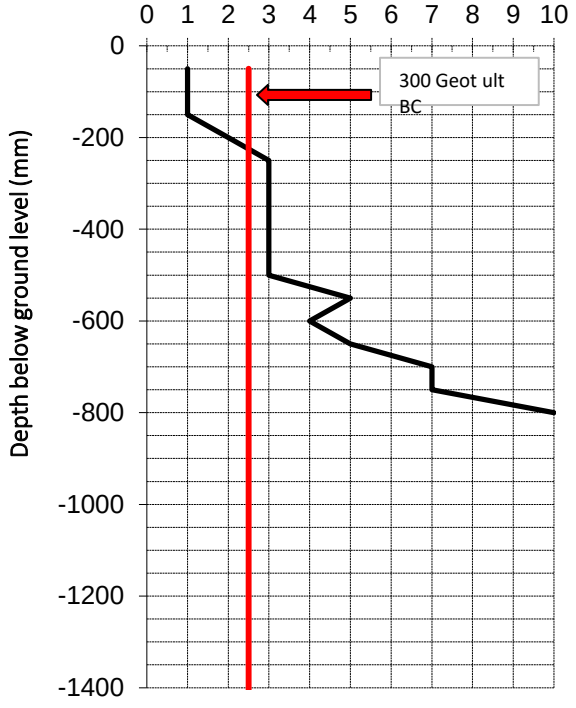
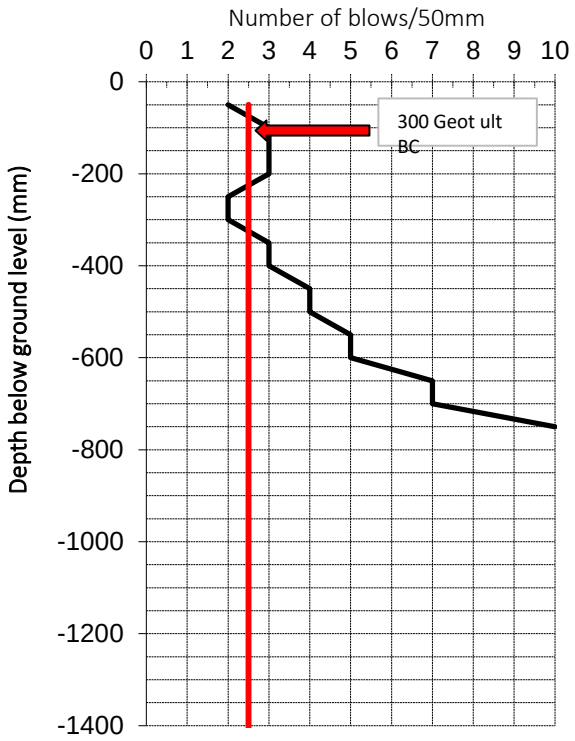


SCALA PENETROMETER RESULTS

JOB NUMBER:	G17026	PROJECT:	ALPINE GEOTECH
		LOCATION:	Orchard Road, Wanaka
CO-ORDINATES:	mE	DATE:	9-May-16
See attached plan	mN	OPERATOR:	GT

Note: No Friction correction has been applied to the field results. 5 Blows per 100mm is considered compliance with NZS3604 3.3.7

SP9



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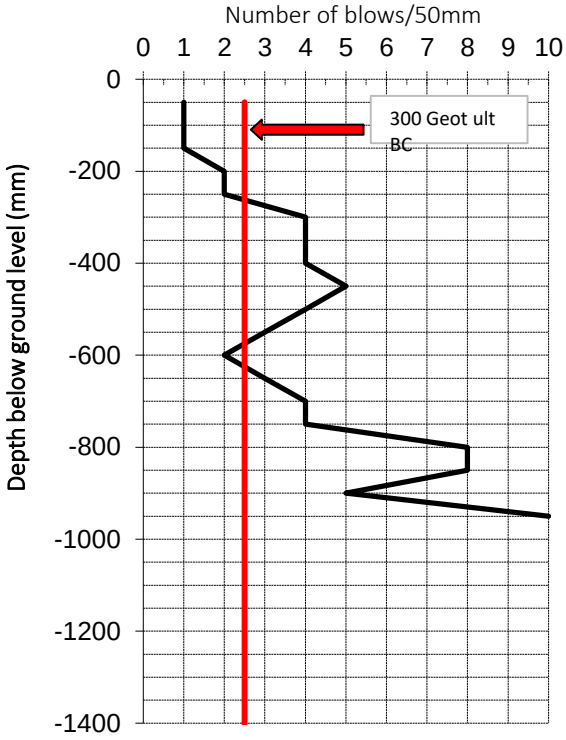
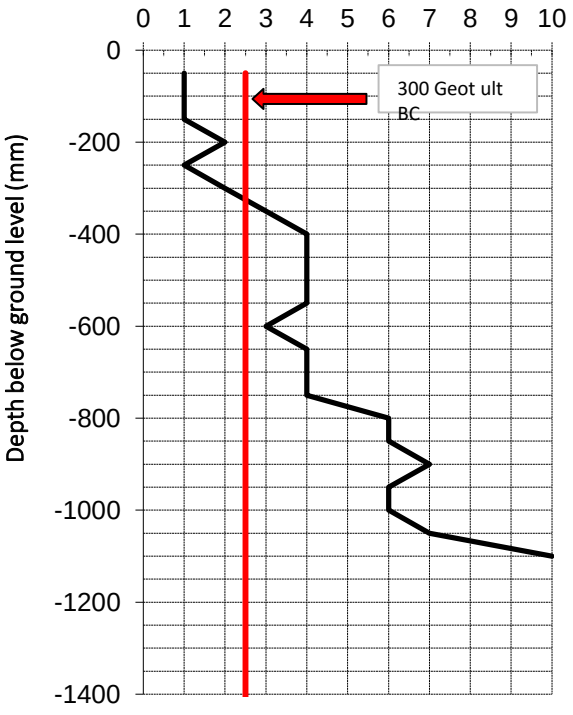


SP11



Private Bag 50072, Queenstown 9348, New Zealand
QUEENSTOWN, 10 Gorge Road, Phone +64 3 441 0499, Fax +64 3 450 2223
WANAKA, 47 Ardmore Street, Phone +64 3 443 0024, Fax +64 3 450 2223

QUEENSTOWN LAKES DISTRICT COUNCIL

www.qldc.govt.nz

1 November 2017

Your Ref: Wanaka South Development

Dear Mark Tutty,

Water and wastewater service modelling has been undertaken for the proposed Wanaka South SHA development (see attached).

Water supply modelling identifies that potable water will be available with the planned Beacon Point trunk main installation. This infrastructure is planned for 2020-2021 and is currently being investigated for expediting. The decrease in Bright Skies SHA lots from that modelled (353) to the propose number of lots (267) is insignificant to the modelling conclusions.

Wastewater modelling shows that negative impacts on the downstream wastewater network is expected with the Wanaka South development. Proposed upgrades to the Gordon Road Pump station will be required to mitigate these impacts.

Yours sincerely

Andrew Tipene

Infrastructure Development Engineer

WATERSHED

28 September 2017

Queenstown Lakes District Council
10 Gorge Road
Queenstown

Dear Mark Baker,

SOUTH WANAKA DEVELOPMENTS

As per your request, we have undertaken hydraulic modelling to develop a water supply layout for the proposed developments of Gordon's Land, Alpine Estates, Bright Sky and Tussock Rise, with respect to achieving the levels of service required by Queenstown Lakes District Council now and into the future.

DEMAND ASSESSMENT

The demand has been assessed based on information provided from the various developers as tabulated and referenced below.

Table 1: Development Details

Development	No. of Residential Lots / Commercial / Industrial Area	Reference
Gordons Land	80	23 lot consented refer email 31 Aug 2017 Robin Patterson indicating 80 ultimate for Gordon
Alpine Estate	100	PPG Group Job. No. W5082, Drawing no. 01V, Sheet 01 Date 20/01/2017
Bright Skies SHA	353	Common Ground Lot Yield – Density drawing 21/9/2017
Tussock Rise	60,000m^2	PPG Group Job No. W5085 Drawing 003 sheet 100 revision C 18/9/2017

The key design parameters outlined in Queenstown Lakes District Council Land Development and Subdivision Code of Practice (2015) are as follows:

- Daily consumption of 700 L/p/day
- Number of people per dwelling = 3
- Peak Day Demand (over a 12-month period) = Average Day Demand x PF:
  - (a) PF = 1.5 for populations over 10,000;
  - (b) PF = 2 for populations below 2,000.
- Peak Hourly Demand = Average Hourly Demand (on peak day) x PF (over a 24-hour period):
  - (a) PF = 2 for populations over 10,000;
  - (b) PF = 5 for populations below 2,000.
- Firefighting demands as specified in SNZ PAS 4509
- Commercial / Industrial demands are assessed on a consumption figure of 12m^3/Ha/Day

The firefighting classification for the Tussock Rise industrial area will be assessed as FW4 100L/s.

Table 2 shows the demand calculation for each of the developments.

Table 2: Average and Peak Day Demand Calculations

Development Stage	No. of Residential Lots / Area	Population	Average Demand (L/s)	Peak Daily Demand (L/s)
Gordons Land	80	240	1.94	3.89
Alpine Estate	100	300	2.43	4.86
Bright Skies SHA	353	1059	~~8.58~~	~~17.16~~
Tussock Rise	60,000m^2		0.84	0.84
Total	**533 / 60,000**	**1599**	**13.79**	**26.75**

Peak Hour Demand

The peak hour factor can be considered in several different ways.

- The peak hour factor for the Beacon Point area derived during the calibration of the hydraulic model is 1.437.
- The standard domestic equivalent profile has a peak hour factor of 2.3.
- The suggested design peak hour factor is 5 for population less than 2000, or 2 for populations greater than 10,000.

The per capita demand assessed during the model calibration matches well with the design criteria, therefore it is reasonable to assume that a similar peak hour factor would also apply and not the design value of 5 for a population less than 2000.

Therefore for the purposes of assessing these subdivisions, the domestic equivalent profile has been used applying a peak hour factor of 2.3. This should still be conservative with the derived factor at 1.437. For commercial / industrial areas a standard commercial profile uses a peak hour factor of 2.25.

LEVELS OF SERVICE

The levels of service agreed upon with QLDC for the current system performance assessment as part of the model development and calibration project are outlined below:

- The minimum service pressure is 200-300kpa
- The maximum service pressures is 700-800kpa

These levels of service along with the requirements of the Fire Fighting Water Supplies Code of Practice form the basis for the system performance analysis.

Queenstown Lakes District Council does not prescribe any level of service criteria relating to pipe head loss, generally speaking pipe head loss per unit length for new pipes should ideally be < 2 m/km, or 2- 5 m/km for normal operation.

EXISTING SYSTEM PERFOMANCE

With the commissioning of the new 300mm watermain through the Three Parks subdivision and the new upgrades on Anderson Road the existing network meets the levels of service. It should be noted that the Cardrona Valley Road area is reliant on the single 200mm feed along Golf Course road which is beginning to experience higher head losses.

WANAKA NETWORK STRATEGY

The Wanaka network strategy identifies the creation of a new high level zone for south west Wanaka. This zone will initially be fed through new trunk mains from the Beacon Point Reservoir. In the future the zone will be supplied from proposed new reservoir to the west, commonly referred to as the Hawthenden reservoir. The new reservoir will be at a similar elevation to the Beacon Point reservoir.

The proposed eastern boundary for the new high level zone will run between Ballantyne Road and Cardrona Valley Road. This will mean the new zone boundary will run through the Gordon's Land, Alpine Estates, and Bright Sky Development area.

The QLDC adopted growth figures for this area projects the total ultimate number of lots to be 323. This is lower than the total number of lots put forward for this analysis at 533 plus the commercial development of Tussock Rise.

PROPOSED INFRASTRUTURE REQUIREMENTS

The infrastructure requirements for Gordon's Land, Alpine Estates, Bright Sky and Tussock development have been based around the proposed collector and distributor roads for the area with consideration to the future zone boundary. The road layout was provided in shapefile format by Patterson Pitt Group limited.

The hydraulic model of the Wanaka water supply network has been used to ensure the proposed distributor watermain main layout meets the levels of service set out by QLDC for pressures, pipe head loss and firefighting requirements for the current day, and the ultimate future scenario.

Figure 1 shows the proposed development areas with the key road layout. Figure 2 shows the proposed network layout to service the development areas.

Bright Sky and Tussock Rise Infrastructure

The Tussock Rise industrial area will be supplied via a 150mm diameter watermain from Gordon Road through to Connell Terrace.

The Bright Sky development will be supplied via a 150mm from Gordon Road through the main development road to Frederick Street, with a secondary 100mm connection.

Gordon Land and Alpine Estate Infrastructure

The Gordon Land will be supplied via a 150mm watermain along Gordon Road. Alpine Estates will be supplied via a 150mm link from Gordon Road through to the existing 150mm watermain at 71 Cardrona Valley Road.

Two zone valves are proposed as part of this trunk reticulation, one on Gordon Road where it borders the Bright Sky Development Area, and the other between Bright Sky and Alpine Estates. This zone boundary should also be establish within any secondary network pipes.

Enterprise Drive Infrastructure

A 150mm watermain has been recommended through the Enterprise Drive development land however the size of this watermain should be confirmed once more detailed information becomes available on the development of this block.

MODEL ASSESSMENT

The additional demand in the Cardrona Valley Road area resulting from the proposed developments, increases head losses through the 200mm watermain on Golf Course Road. The Wanaka water network strategy proposes new trunk mains from Beacon Point Reservoir through Anderson Road, McPherson Street, Golf Course Road and extending further west through the Alpha series development over to Studholme Road and Wanaka Mt Aspiring Road.

To alleviate issues with levels of service the section of trunk main through Golf Course Road must be brought forward to enable development of the Gordon Road and Alpine Estate blocks and allow for the creation of the new high level zone eastern boundary to be formed.

The alternative would be to bring a larger watermain than proposed (estimated 300mm diameter), through the Bright Sky, Alpine Estates and Gordon Road areas from Ballantyne Road to Cardrona Valley Road. However this is not in keeping with the long term objective of the network and creating the new high level zone in the west. The construction of this main would need to occur from east to west and prior to development of the western areas to ensure levels of services are not compromised by increasing head loss through the 200mm on Golf Course Road. It would also have the potential to create water quality concerns in the future once the high zone was established.

SUMMARY

The hydraulic model is a representation of the physical water supply system and as noted in the model development and calibration report it has limitation to its accuracy. The demands and peaking factors used to assess the development are based on assumptions and the actual finally water demands may vary.

It is recommended the proposed sizing and layout as shown in Figure 2 is followed for the key watermains within the new development area. This layout is based on the section of

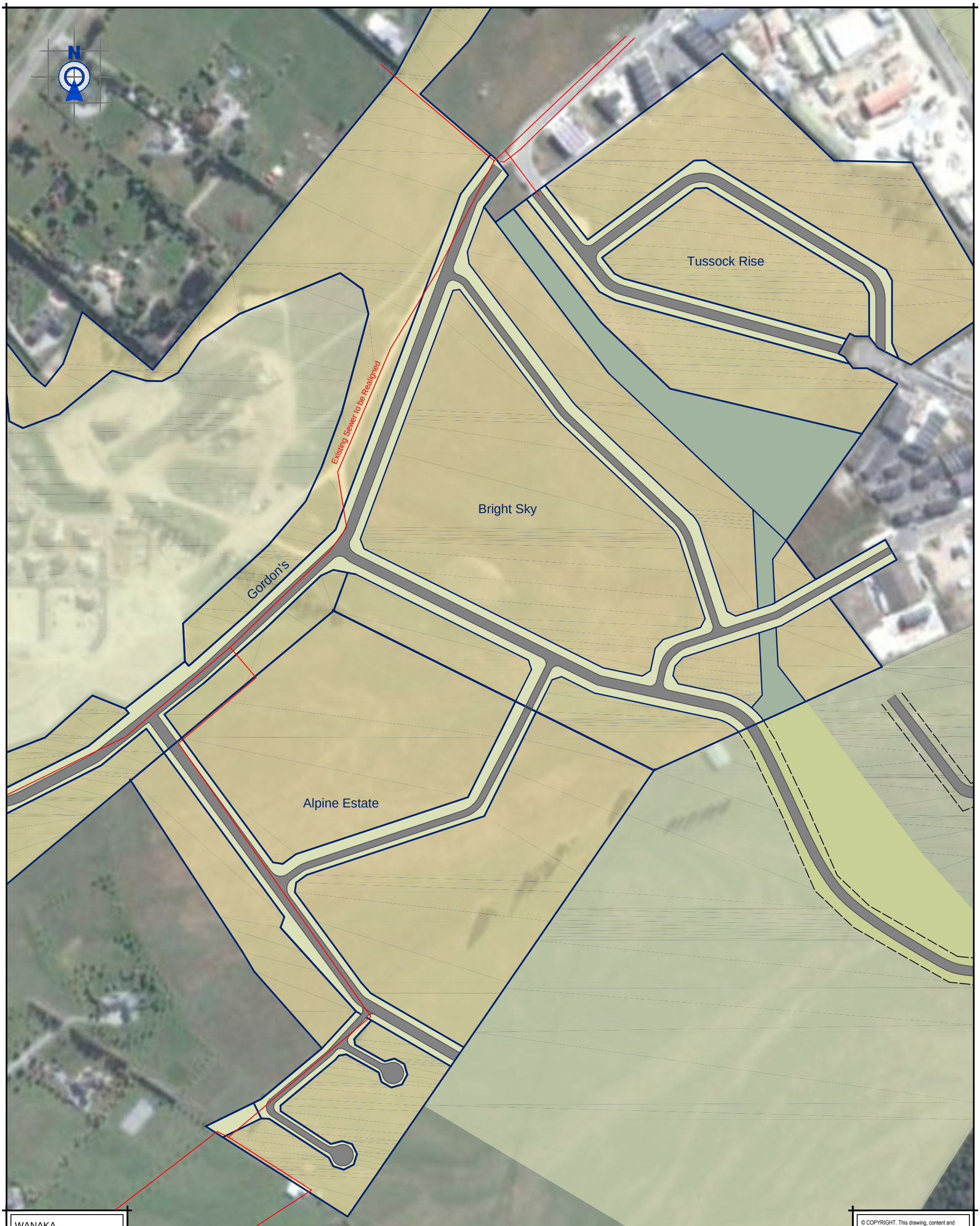
500mm watermain through Golf Course Road, forming part of the future trunk network, being brought forward to coincide with development in this area.

We trust this report meet your requirements. Please contact Charlotte Broadbent on 021766475 charlotte.broadbent@wse.co.nz if you wish to discuss any aspects of this report further.

Regards,

Charlotte Broadbent

Director / Senior Civil Engineer



WANAKA
19 Reece Crescent
or P.O. Box 283
Wanaka 9343
T 03 443 0110
E wanaka@ppgroup.co.nz

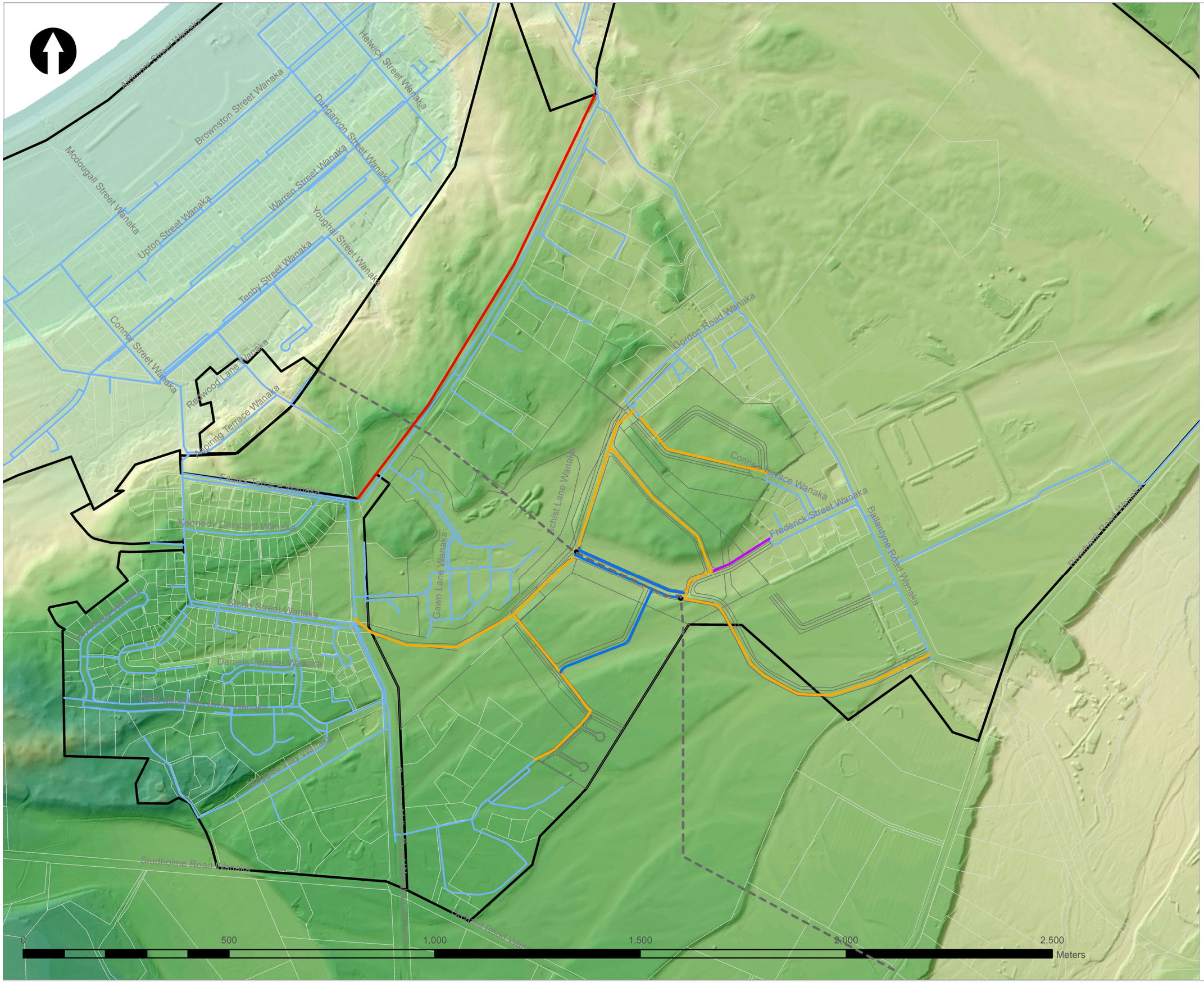
PATERSONPITTSGROUP
Your Land Professionals
www.ppgroup.co.nz
0800 PPGROUP

Client & Location:
Bright Sky Ltd
Wanaka

Purpose & Drawing Title:
Roading Layout
Lots 1 DP 477622, 2 DP 477622 and 2 DP 498936

Surveyed by:	-	Original Size:	Scale:
Designed by:	-	A3	1:3000 @ A3
Drawn by:	KMG		DO NOT SCALE
Checked by:	RLP		
Approved by:	RLP		
Job No: W5093 03A		Sheet No: 100	Revision No: A
			Date Created: 28/08/2017

L:\DATA\5000\5093 BRIGHT SKY LTD GRANT BISSET\ACAD\W5093 03A ROADING LAYOUT 170828.DWG



Wanaka
Water Supply Zone
South Wanaka Developments

Proposed Infrastructure
Figure 2

WATERSHED

Version: A
Drawn By: CRB
Date: 02/10/2017
Reviewed By: -

PATERSONPITTSGROUP

STORMWATER DESIGN PHILOSOPHY REPORT
LOT 1 DP 477622, FREDERICK STREET WANAKA

For

BRIGHT SKY LTD

Prepared by Paterson Pitts Limited Partnership W5093

24th January, 2018

Scope

This report outlines the stormwater philosophies for large scale subdivision over part Lot 1 DP 477622.

Background

The site is currently vacant bare land that has been used for grazing stock. Topology is rolling with an existing low lying remnant flow path running east west through the site discharging at the end of Frederick street. North of the existing flow path is a significant south facing slope.

A geotechnical report has not yet been undertaken for the site, however geotechnical reports to the south of the site (Lot 2 DP 498936) indicate that soakage is good. Geotechnical reports to the north if the site (Lot 2 DP 477622) indicate that soakage is poor.

Design Constraints

The existing flow path running east west through site currently provides secondary flow path for a significantly large upstream catchment. This will need to be retained to ensure a secondary flow path for all stormwater is maintained. Furthermore the same flow path is protected by easement in favor of the retirement village.

The gradient of the existing flow path is close to minimum, thus limiting the amount of fill that can be placed over the low lying area.

Stormwater Design

There is a requirement under the QLDC code of practice to match pre and post development stormwater flows and that will be shown as achieved in the engineering design for this development. A geotechnical assessment will need to be submitted as part of the design to confirm areas that are suitable for onsite stormwater disposal.

Wherever possible stormwater disposal to ground will be utilized within lots and carriageways. Where soakage is not deemed suitable for stormwater disposal to ground, stormwater will be piped to a suitable attenuation area.

A new road is proposed in the location of the existing flow path to ensure the existing flow path is maintained. The Frederick Street end of the flow path is considered a suitable location for a stormwater attenuation system if the soakage allows. This area is to be duly reserved for such purposes.

Conclusion

The proposed subdivision of Lot 1 DP 477622 can be successfully completed by utilizing the above stormwater philosophies. By matching pre and post development flows, disposing of stormwater to ground where possible and maintaining existing flow path, it is considered any stormwater effects of the subdivision can be easily mitigated.

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Attention: Deborah Lind

Dear Deborah

[#T4102] Wanaka South Wastewater Infrastructure

This letter details the results of the wastewater modelling for a number of developers in Wanaka South.

Background

Beca Limited have been engaged by Queenstown Lakes District Council to model four new developments that are planned upstream of Gordon Road pump station, Wanaka. The modelling will show whether the existing wastewater network will cope with the new developments.

The developments are Alpine Estate, Bright Sky, Gordon's, and Tussock Rise. Bright Sky is expected to be between 120 and 267 lots, and Tussock Rise is expected to be between 22 lots of industrial units.

Assumptions

We have assumed that each industrial unit will be Medium Industrial Use based on the QLDC Land Development and Subdivision Code of Practice.

We have based the minimum number of lots on the Bright Sky development having 120 lots. The maximum number of lots are Bright Sky having 267 lots. Alpine Estate will have 110 lots, and Gordon Land will have 80 lots.

Design Horizon Checks

We have run the model for a number of scenarios, with the 2058 design horizon.

Without Development

Four manholes flood in the network upstream of the Gordon Road Pump Station, including the pump station itself.

With Minimum Number of Lots and Medium Industrial Use

When we added the developments, one extra manhole flooded. The previous manholes that flood, have an increased flooding volume. The total flooding volume without the development is 109m^3, and with the development is 493m^3.

With Maximum Number of Lots and Medium Industrial Use

When we increased the development to the maximum, one manhole flooded during dry weather. The flood volume is 17m^3.

During wet weather, five manholes flooded. The total flooding volume with the maximum development is 551m^3.

With Maximum Number of Lots and Heavy Industrial Use

When we increased the Industrial Use to Heavy, no extra manholes flooded during dry weather. However, the flood volume has increased for the manhole that does flood. The flood volume is 18m^3.

During wet weather five manholes flooded. The total flooding volume with the maximum development and Heavy Industrial Use is 580m^3.

Conclusion

Upgrades to the Gordon Road Pump Station are currently being considered as part of the Wanaka Masterplan. The extra flooding from the new developments will have an impact on these upgrades.

Please let me know if you have any questions.

Yours sincerely

T Myers

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on behalf of

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