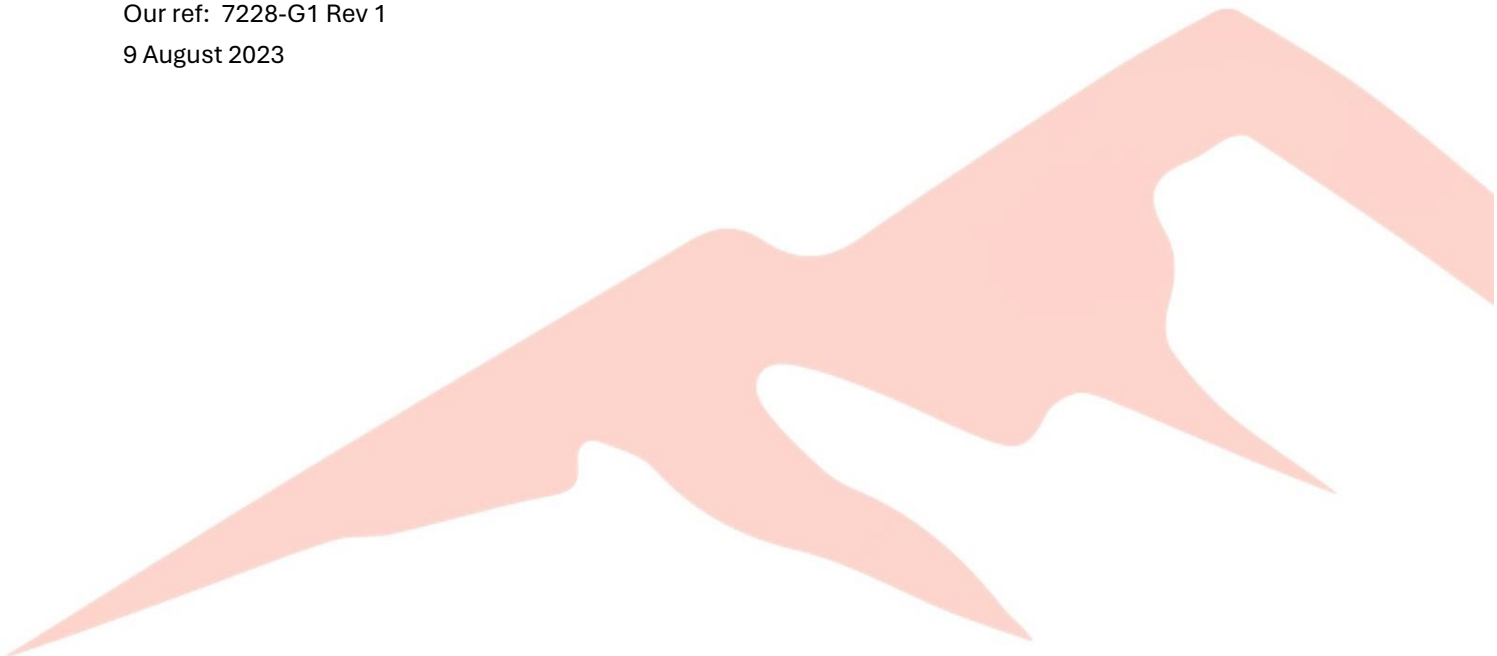
assetgeoenviro

EVT / Kosciuszko Thredbo Pty Ltd

Snowmaking and Services Corridor
Snowgums to Kareela, Thredbo NSW

Geotechnical Assessment

Our ref: 7228-G1 Rev 1
9 August 2023



Geotechnics | Groundwater | Environmental

Document Authorization

Prepared for EVT / Kosciuszko Thredbo Pty Ltd

Our ref: 7228-G1 REV 1

9 August 2023

For and on behalf of
AssetGeoEnviro

Mark Bartel

Mark Bartel
BE, MEngSc, GMQ, CPEng, RPEQ/NER(Civil), DEP/PRE (NSW)
Managing Director | Senior Principal Geotechnical Engineer

Document Control

Distribution Register

Copy	Media	Recipient	Location
1	Secure PDF	Chloe Chalk	EVT / Kosciuszko Thredbo Pty Ltd
2	Secure PDF	Mark Bartel	AssetGeoEnviro

Document Status

Rev	Revision Details	Author	Reviewer		Approved for Issue		
			Name	Initials	Name	Initials	Date
0	Initial issue	M. Bartel			M. Bartel	*MAB*	21 May 2023
1	Review comments	M. Bartel			M. Bartel	MAB	9 August 2023

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Form 4 – Minimal Impact Certification

DA Number: _____

This form may be used where minor construction works which present minimal or no geotechnical impact on the site or related land are proposed to be erected within the "G" line area of the geotechnical maps.

A geotechnical engineer or engineering geologist must inspect the site and/or review the proposed development documentation to determine if the proposed development requires a geotechnical report to be prepared to accompany the development application. Where the geotechnical engineer determines that such a report is not required then they must complete this form and attach design recommendations where required. A copy of Form 4 with design recommendation, if required, must be submitted with the development application.

Please contact the Alpine Resorts Team in Jindabyne for further information - phone 02 6456 1733.

To complete this form, please place a cross in the appropriate boxes ☐ and complete all sections.

1. Declaration made by geotechnical engineer or engineering geologist in relation to a nil or minimal geotechnical impact assessment and site classification

I,

Mr [x] Ms ☐ Mrs ☐ Dr ☐ Other ☐

First Name	Family Name
Mark	Bartel

OF

Company/organisation

Asset Geotechnical Engineering Pty Ltd (trading as AssetGeoEnviro)

certify that I am a geotechnical engineer /engineering geologist as defined by the "Policy" and I have inspected the site and reviewed the proposed development known as

Snowmaking and Services Corridor, Snowgums to Kareela, Thredbo NSW

As a result of my site inspection and review of the following documentation

(List of documentation reviewed)

Existing Snowmaking & Services Infrastructure (Kosciuszko Thredbo Pty Ltd; rev C; 4 May 2023).
Site Plan (prepared by: Kosciuszko Thredbo Pty Ltd; revision: F; dated: 24 May 2023).
Trench Cross Section Combined – Snowmaking Services (Kosciuszko Thredbo Pty Ltd; rev: 2; 20 April 2023).

I have determined that;

- ☒ the current load-bearing capacity of the existing building will not be exceeded or adversely impacted by the proposed development, and
- ☒ the proposed works are of such a minor nature that the requirement for geotechnical advice in the form of a geotechnical report, prepared in accordance with the "Policy", is considered unnecessary for the adequate and safe design of the structural elements to be incorporated into the new works, and
- ☒ in accordance with AS 2870.1 Residential Slabs and Footings, the site is to be classified as a type

(insert classification type)

Class P

- ☒ I have attached design recommendations to be incorporated in the structural design in accordance with this site classification.

I am aware that this declaration shall be used by the Department as an essential component in granting development consent for a structure to be erected within the "G" line area (as identified on the geotechnical maps) of Kosciuszko Alpine Resorts without requiring the submission of a geotechnical report in support of the development application.

2. Signatures

Signature

Mark Bartel

Chartered professional status

CPEng 35641 NER (Civil)

Name

Mark Bartel

Date

9 August 2023

3. Contact details

Alpine Resorts Team
Shop 5A, 19 Snowy River Avenue
P O Box 36, JINDABYNE NSW 2627
Telephone: 02 6456 1733
Facsimile: 02 6456 1736
Email: alpineresorts@planning.nsw.gov.au

1. Introduction

1.1 General

This report presents the results of a geotechnical investigation for the above project. The investigation was commissioned on 18 November 2022 by Chloe Chalk of EVT / Kosciuszko Thredbo Pty Ltd, purchase order KTM0040698 dated 28 April 2023. The work was carried out in accordance with the email proposal by AssetGeoEnviro (Asset) dated 21 April 2023, reference 7228–P1. This report supersedes our previous report which was for a slightly different alignment (reference 7082–G1 dated 20 March 2023).

Documents supplied to us for this investigation comprised:

- Existing Snowmaking & Services Infrastructure (prepared by: Kosciuszko Thredbo Pty Ltd; revision: C; dated: 4 May 2023).
- Site Plan (prepared by: Kosciuszko Thredbo Pty Ltd; revision: F; dated: 24 May 2023).
- Trench Cross Section Combined – Snowmaking Services (prepared by: Kosciuszko Thredbo Pty Ltd; revision: 2; dated: 20 April 2023).

We understand that the project involves the replacement and upgrade of snowmaking mains between the Snowgums Chairlift top station and Kareela Hutte restaurant along the Village Trail ski run. The replacement mains will include air and water pipelines and replacement of hydrants. This will include the installation of short laterals to the hydrants to allow for connection into the new main. The proposal also includes the installation and upgrade of new services connections between the Black Sallees restaurant and Kareela Hutte restaurant, using the same trenching required for the snowmaking maintenance and upgrade works. This will provide improved water supply, upgraded sewer pipeline, electrical supply, and communications. The trench will be approximately 1.7 m wide by 1 m deep.

1.2 Scope of Work

The main objectives of the investigation were to assess the surface and subsurface conditions and to provide comments and recommendations relating to:

- Excavation requirements.
- Groundwater and surface water control.

The following scope of work was carried out to achieve the project objectives:

- A review of existing regional maps and reports relevant to the site held within our files, including three test pits excavated for at the top station for the Snowgums lift replacement.
- Visual observations of surface features carried out by a Senior Principal Geotechnical Engineer on 26 April 2023 accompanied by personnel from Event / Kosciuszko Thredbo Pty Ltd.
- Engineering assessment and reporting.

This report must be read in conjunction with the attached “Important Information about your Geotechnical Report. Attention is drawn to the limitations inherent in site investigations and the importance of verifying the subsurface conditions inferred herein.

2. Regional Topography

The regional topography comprises moderately to steeply sloping terrain flanking the north-easterly flowing Thredbo River, with ground slopes over the land flanking the river generally ranging from 10º to 30º and some locally steeper sections, and more gentle slopes over the river shoulders. Numerous drainage depressions and watercourses flow towards the river, with some of the persistent watercourses to the north of the river carved several metres into the underlying granite bedrock. Side slopes to creeks and watercourses are typically steeper at 20 to 35º, and typically include numerous granite boulders and cobbles.

The site lies within an area designated as "G" as defined in the maps accompanying DIPNR's "Geotechnical Policy – Kosciuszko Alpine Resorts", November 2003. However, as the development involves only minimal geotechnical impact, a full geotechnical report is not required as per the Geotechnical Policy.

3. Site Description

The site is located between Snowgums top station and Kareela Hutte which is north-west of Thredbo as shown in Figure 1. The total length of the service line is approximately 670m. It commences from the Snowgums top station and runs in a southerly direction terminating at Kareela Hutte.

The ground surface generally falls to the south-east at an overall slope of about 5° and locally up to about 15°.

A series of photographs illustrating the alignment are shown in Appendix C. The landscape is irregular with numerous granite boulders and outcrop, areas of topsoil and alpine vegetation, and several drainage lines flowing across the alignment. There are also existing shallow buried services in the vicinity with some daylighting.

4. Previous Test Pitting

Previous test pitting undertaken in October 2021 for the Snowgums replacement included three test pits at the top station. Engineering logs are provided in Appendix B together with their explanatory notes.

5. Subsurface Conditions

5.1 Geology

The 1:250,000 Tallangatta Geological Map indicates the site is underlain by Silurian aged intrusive granite.

5.2 Subsurface Conditions

The test pit logs indicated that the subsurface materials are quite variable, and include the following generalised geotechnical units as shown in Table 1. For a detailed description of the subsurface conditions, refer the attached engineering logs and explanatory notes. For specific design input, reference should be made to the logs and/or the specific test results, in place of the following summary.

Table 1 – Generalised Site Geotechnical Model

Unit	Origin	Description	Unit Thickness [1] (m)
1	Topsoil	Sandy SILT, medium plasticity, dark grey, grass roots, moist, firm, occasional flat boulder up to 0.8 m size within topsoil matrix. Encountered in TP 7, 8, 9.	0.1 – 0.7
2	Colluvium/ Slopewash	CLAY, medium plasticity, dark brown, some granite cobbles, moist = Wp, stiff. Encountered in TP 7, 8.	>0.4 – 0.8
3	Residual	Sandy SILT/Silty SAND, low plasticity, fine to medium grained sand, light brown, some granite fragments to 100 mm size, extremely weathered. Encountered in TP 8, 9.	0.4 – >1.1
4	Bedrock	GRANITE, extremely weathered (practical refusal).	– –

Notes:

1. The unit thicknesses are based on the information from the test locations only and do not necessarily represent the maximum and minimum values across the site.

The above geotechnical units are expected to be encountered along the alignment with variation in thicknesses to be expected. There may also be some local fill associated with previous ski slope and mountain bike track development, expected to be relatively shallow (i.e., less than about 0.5 m).

5.3 Groundwater

Groundwater was not observed in the test pits during excavation or the time they remained open.

6. Discussions & Recommendations

6.1 Key Geotechnical Site Constraints

The development will generally require trenching to a target depth of 1m for the service pipeline.

The test pitting and site observations has indicated that the subsurface conditions are variable along the route including a range of soil types with large cobbles and small boulders present. Whilst practical refusal was not encountered in the three test pits around the top station, it is expected that practical refusal would be encountered at various locations along the service pipeline trench particularly where numerous granite boulders are observed. It is noted that the excavator used for the test pitting was of relatively small size (1.7 tonnes), whereas the excavator to be used for excavation of the trenching will likely be of the order of 15 tonnes, which is expected to be able to excavate beyond refusal of the excavator used for the investigation.

Key geotechnical constraints include excavation conditions, existing services, and surface water. Recommendations for the development are provided in the following sections.

6.2 Earthworks

6.2.1 Excavation

The excavation for the proposed development is anticipated to be within soils of variable nature and composition as indicated by the test pit logs and through granite boulders and granite bedrock. Bedrock

that would require hammering or blasting was not encountered in the three test pits at the top station but could be encountered within locations along the service trench. Some larger cobbles and small boulders could be anticipated, which could be removed with suitably sized excavators.

6.2.2 Subgrade Preparation

No specific subgrade preparation recommendations are provided given the expected relatively good founding conditions and the minimal impact of the trench and services on the existing ground. Further geotechnical advice should be sought if soft ground is encountered during the excavation works.

6.2.3 Filling

The services designer is to advise filling requirements for the bedding materials and filling around and immediately above the services. Other filling should be placed in horizontal layers over prepared subgrade and compacted as per Table 2. Given that the development is of low geotechnical impact, assessment of the compaction achieved should be carried out by visual assessment by suitably experienced personnel.

Table 2 – Compaction Specifications

Parameter	Cohesive Fill	Non-Cohesive Fill
Fill layer thickness (loose measurement)	0.2m	0.2m
Density	≥ 95% Std	≥ 70% ID
Moisture content during compaction	± 2% of optimum	Moist but not wet

6.2.4 Batter Slopes

Given the shallow nature of the trenching (i.e., 1m deep), practically, vertical cuts may be carried out. If sidewall collapse occurs in locations, it may be necessary to widen the trench.

6.3 Surface Water and Groundwater Control

The site observations indicated there are several drainage lines that the service trench will cross. At the top station, groundwater was not encountered during the previous test pitting investigation but could be present at various locations along the route alignment.

Temporary surface water diversions will be required where cutting the sections of trenching through the drainage lines. Where groundwater is encountered within trench excavations, temporary diversion downslope will be required until the affected section of trench can be completed.

7. Site Suitability

We herewith conclude that the site is geotechnically suitable for the development provided that the development is carried out in accordance with the recommendations and advice in this report including the following Development Approval Conditions.

8. Limitations

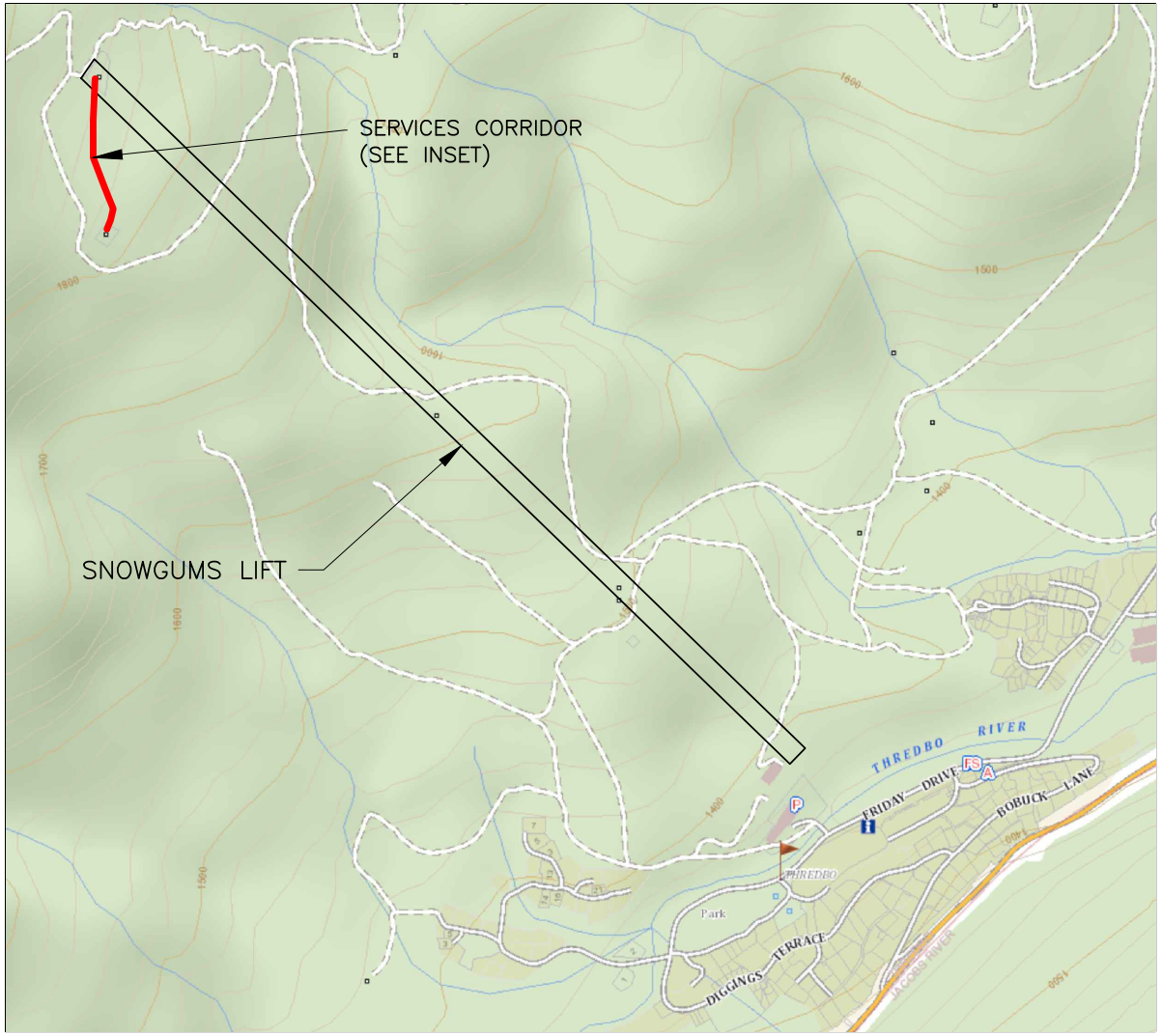
In addition to the limitations inherent in site investigations (refer to the attached Information Sheets), it must be pointed out that the recommendations in this report are based on assessed subsurface conditions from limited investigations.

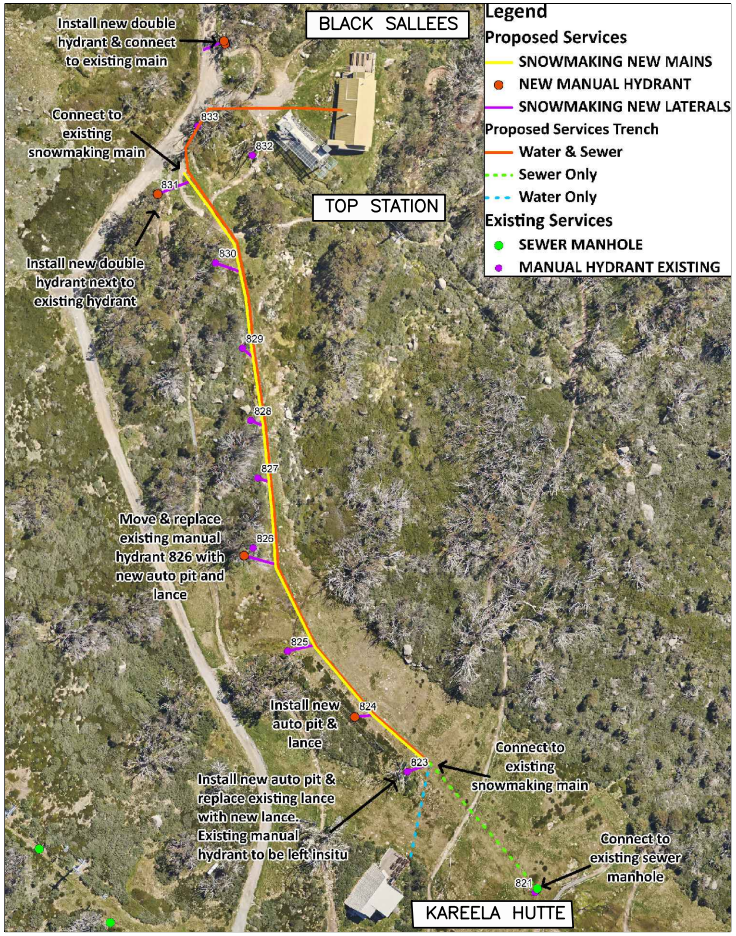
This report and details for the proposed development should be submitted to relevant regulatory authorities that have an interest in the property (e.g., Department of Planning) or are responsible for services that may be within or adjacent to the site for their review.

Asset accepts no liability where our recommendations are not followed or are only partially followed. The document “Important Information about your Geotechnical Report” in Appendix A provides additional information about the uses and limitations of this report.

Figures

Figure 1 – Site Locality
Figure 2 – Site Plan and Test Locations





INSET (NOT TO SCALE)

APPROXIMATE ONLY – SUBJECT TO DETAIL SURVEY.
SOURCE: SIX MAPS.

0 1:3000@A4 100m

issue	date	description
B	9.8.23	Updated site plan
A	21.5.23	INITIAL ISSUE

assetgeoenviro
2.06/56 Delhi Rd
North Ryde NSW 2113
t: 02 9878 6005
e: info@assetgeoenviro.com.au

PROPOSED SNOWMAKING AND SERVICES CORRIDOR
SNOWGUMS TO KAREELA, THREDBO NSW
for EVT/KOSCIUSZKO THREDBO

SITE LOCALITY

drawn: MAB
date: 9.8.2023
checked: MAB
scale: AS SHOWN

job no.: 7228
fig: 1
issue: B

APPROXIMATE ONLY – SUBJECT TO DETAIL SURVEY.

SOURCE: SIX MAPS

THIS DRAWING IS USED TO ILLUSTRATE TEST LOCATIONS ONLY, AND MUST NOT BE USED FOR ANY OTHER PURPOSE. COPYRIGHT OF SOURCE DRAWING REMAINS WITH SIX MAPS.

0 1:400 @ A4 25m

LEGEND

Test Pit Location

issue	date	description
A	21.5.23	INITIAL ISSUE

assetgeoenviro
2.06/56 Delhi Rd
North Ryde NSW 2113
t: 02 9878 6005
e: info@assetgeoenviro.com.au

PROPOSED SNOWMAKING AND SERVICES CORRIDOR
SNOWGUMS TO KAREELA, THREDBO NSW
for EVT/KOSCIUSZKO THREDBO

TEST LOCATION – TOP STATION

drawn: MAB
date: 21.5.2023
checked: MAB
scale: 1:400 A4

job no.: 7228
fig: 2
issue: A

Appendix A

Important Information about your Geotechnical Report

Important Information about your Geotechnical Report

SCOPE OF SERVICES

The geotechnical report ("the report") has been prepared in accordance with the scope of services as set out in the contract, or as otherwise agreed, between the Client and Asset Geotechnical Engineering Pty Ltd ("Asset"), for the specific site investigated. The scope of work may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

The report should not be used if there have been changes to the project, without first consulting with Asset to assess if the report's recommendations are still valid. Asset does not accept responsibility for problems that occur due to project changes if they are not consulted.

RELIANCE ON DATA

Asset has relied on data provided by the Client and other individuals and organizations, to prepare the report. Such data may include surveys, analyses, designs, maps, and plans. Asset has not verified the accuracy or completeness of the data except as stated in the report. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations ("conclusions") are based in whole or part on the data, Asset will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented, or otherwise not fully disclosed to Asset.

GEOTECHNICAL ENGINEERING

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared for a specific client, for a specific project and to meet specific needs, and may not be adequate for other clients or other purposes (e.g., a report prepared for a consulting civil engineer may not be adequate for a construction contractor). The report should not be used for other than its intended purpose without seeking additional geotechnical advice. Also, unless further geotechnical advice is obtained, the report cannot be used where the nature and/or details of the proposed development are changed.

LIMITATIONS OF SITE INVESTIGATION

The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model, and an engineering opinion is rendered about overall subsurface conditions and their likely behavior regarding the proposed development. Despite investigation, the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The engineering logs are the subjective interpretation of subsurface conditions at a particular location and time, made by trained personnel. The actual interface between materials may be more gradual or abrupt than a report indicates.

Therefore, the recommendations in the report can only be regarded as preliminary. Asset should be retained during the project implementation to assess if the report's recommendations are valid and whether changes should be considered as the project proceeds.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions can be modified by changing natural forces or man-made influences. The report is based on conditions that existed at the time of subsurface exploration. Construction operations adjacent to the site, and natural events such as floods, or ground water fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. Asset should be kept appraised of any such events and should be consulted to determine if any additional tests are necessary.

VERIFICATION OF SITE CONDITIONS

Where ground conditions encountered at the site differ significantly from those anticipated in the report, either due to natural variability of subsurface conditions or construction activities, it is a condition of the report that Asset be notified of any variations and be provided with an opportunity to review the recommendations of this report. Recognition of change of soil and rock conditions requires experience, and it is recommended that a suitably experienced geotechnical engineer be engaged to visit the site with sufficient frequency to detect if conditions have changed significantly.

REPRODUCTION OF REPORTS

This report is the subject of copyright and shall not be reproduced either totally or in part without the express permission of this Company. Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included to minimize the likelihood of misinterpretation from logs.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the Client and no other party. Asset assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of Asset or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own inquiries and obtain independent advice in relation to such matters.

DATA MUST NOT BE SEPARATED FROM THE REPORT

The report as a whole presents the site assessment and must not be copied in part or altered in any way.

Logs, figures, drawings, test results etc. included in our reports are developed by professionals based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

PARTIAL USE OF REPORT

Where the recommendations of the report are only partially followed, there may be significant implications for the project and could lead to problems. Consult Asset if you are not intending to follow all the report recommendations, to assess what the implications could be. Asset does not accept responsibility for problems that develop where the report recommendations have only been partially followed if they have not been consulted.

OTHER LIMITATIONS

Asset will not be liable to update or revise the report to consider any events or emergent circumstances or fact occurring or becoming apparent after the date of the report.

Appendix B

Soil & Rock Explanation Sheets
Test Pit Logs

Soil and Rock Explanation Sheets (1 of 2)

Log Abbreviations & Notes

METHOD

borehole logs		excavation logs	
AS	auger screw *	NE	natural excavation
AD	auger drill *	HE	hand excavation
RR	roller / tricone	BH	backhoe bucket
W	washbore	EX	excavator bucket
CT	cable tool	DZ	dozer blade
HA	hand auger	R	ripper tooth
D	diatube		
B	blade / blank bit		
V	V-bit		
T	TC-bit		

* bit shown by suffix e.g. ADV

coring
NMLC, NQ, PQ, HQ

SUPPORT

borehole logs		*excavation logs*	
N	nil	N	nil
M	mud	S	shoring
C	casing	B	benched
NQ	NQ rods		

CORE—LIFT

casing installed

barrel withdrawn

NOTES, SAMPLES, TESTS

D	disturbed
B	bulk disturbed
U50	thin-walled sample, 50mm diameter
HP	hand penetrometer (kPa)
SV	shear vane test (kPa)
DCP	dynamic cone penetrometer (blows per 100mm penetration)
SPT	standard penetration test
N*	SPT value (blows per 300mm) * denotes sample taken
Nc	SPT with solid cone
R	refusal of DCP or SPT

USCS SYMBOLS

GW	Gravel and gravel-sand mixtures, little or no fines.
GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels
GM	Gravel-silt mixtures and gravel-sand-silt mixtures.
GC	Gravel-clay mixtures and gravel-sand-clay mixtures.
SW	Sand and gravel-sand mixtures, little or no fines.
SP	Sand and gravel sand mixtures, little or no fines.
SM	Sand-silt mixtures.
SC	Sand-clay mixtures.
ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity.
CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays.
OL	Organic silts
MH	Inorganic silts
CH	Inorganic clays of high plasticity.
OH	Organic clays of medium to high plasticity, organic silt
PT	Peat, highly organic soils.

MOISTURE CONDITION

D	dry
M	moist
W	wet
Wp	plastic limit
Wl	liquid limit

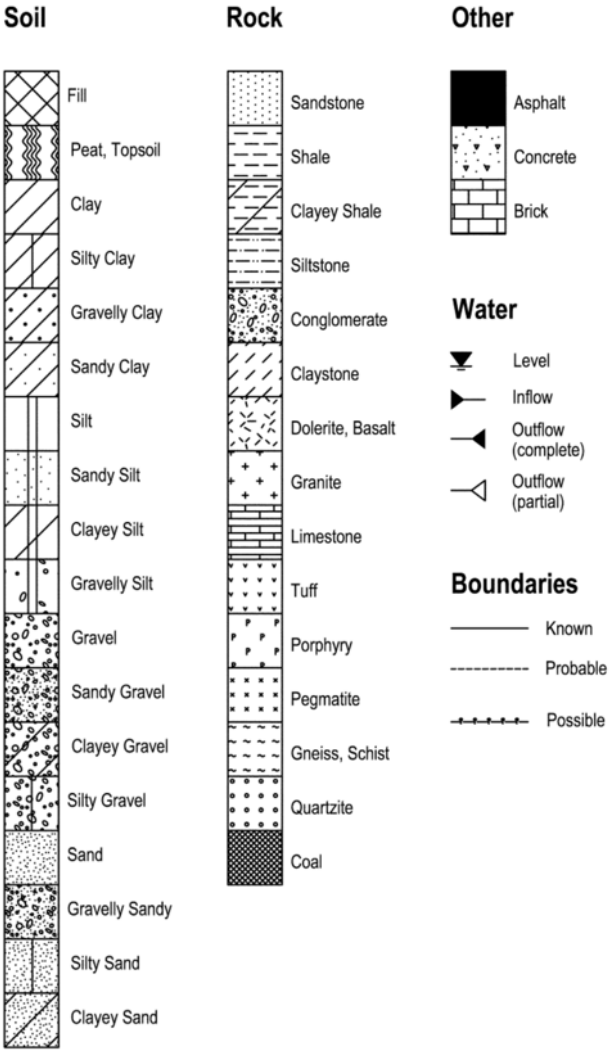
CONSISTENCY

VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable

DENSITY INDEX

VL	very loose
L	loose
MD	medium dense
D	dense
VD	very dense

Graphic Log



WEATHERING

XW	extremely weathered
HW	highly weathered
MW	moderately weathered
SW	slightly weathered
FR	fresh

STRENGTH

VL	very low
L	low
M	medium
H	high
VH	very high
EH	extremely high

RQD (%)

= sum of intact core pieces > 2 x diameter x 100
total length of core run drilled

DEFECTS:

type		*coating*	
JT	joint	cl	clean
PT	parting	st	stained
SZ	shear zone	ve	veneer
SM	seam	co	coating

shape		*roughness*	
pl	planar	po	polished
cu	curved	sl	slickensided
un	undulating	sm	smooth
st	stepped	ro	rough
ir	irregular	vr	very rough

inclination
measured above axis and perpendicular to core

Soil and Rock Explanation Sheets (2 of 2)

AS1726-2017

Soils and rock are described in the following terms, which are broadly in accordance with AS1726-2017.

Soil

MOISTURE CONDITION

Term	Description
Dry	Looks and feels dry. Fine grained and cemented soils are hard, friable or powdery. Uncemented coarse grained soils run freely through hand.
Moist	Soil feels cool and darkened in colour. Fine grained soils can be moulded. Coarse soils tend to cohere.
Wet	As for moist, but with free water forming on hand.

Moisture content of cohesive soils may also be described in relation to plastic limit (W_P) or liquid limit (W_L) [>> much greater than, > greater than, < less than, << much less than].

CONSISTENCY OF FINE-GRAINED SOILS

Term	Su (kPa)	Term	Su (kPa)
Very soft	< 12	Very Stiff	>100 – ≤200
Soft	>12 – ≤25	Hard	> 200
Firm	>25 – ≤50	Friable	–
Stiff	>50 – ≤100		

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Term	Density Index (%)	Term	Density Index (%)
Very Loose	< 15	Dense	65 – 85
Loose	15 – 35	Very Dense	>85
Medium Dense	35 – 65		

PARTICLE SIZE

Name	Subdivision	Size (mm)
Boulders		> 200
Cobbles		63 – 200
Gravel	coarse	19 – 63
	medium	6.7 – 19
	fine	2.36 – 6.7
Sand	coarse	0.6 – 2.36
	medium	0.21 – 0.6
	fine	0.075 – 0.21
Silt & Clay		< 0.075

MINOR COMPONENTS

Term	Proportion by Mass:	
	coarse grained	*fine grained*
Trace	≤ 15%	≤ 5%
With	>15% – ≤30%	>5% – ≤12%

SOIL ZONING

Layers	Continuous across exposures or sample.
Lenses	Discontinuous, lenticular shaped zones.
Pockets	Irregular shape zones of different material.

SOIL CEMENTING

Weakly	Easily broken up by hand pressure in water or air.
Moderately	Effort is required to break up by hand in water or in air.

USCS SYMBOLS

Symbol	Description
GW	Gravel and gravel-sand mixtures, little or no fines.
GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels.
GM	Gravel-silt mixtures and gravel-sand-silt mixtures.
GC	Gravel-clay mixtures and gravel-sand-clay mixtures.
SW	Sand and gravel-sand mixtures, little or no fines.
SP	Sand and gravel sand mixtures, little or no fines.
SM	Sand-silt mixtures.
SC	Sand-clay mixtures.
ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity.
CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays.
OL	Organic silts
MH	Inorganic silts
CH	Inorganic clays of high plasticity.
OH	Organic clays of medium to high plasticity, organic silt
PT	Peat, highly organic soils.

Rock

SEDIMENTARY ROCK TYPE DEFINITIONS

Rock Type	Definition (more than 50% of rock consists of …..)
Conglomerate	... gravel sized (>2mm) fragments.
Sandstone	... sand sized (0.06 to 2mm) grains.
Siltstone	... silt sized (<0.06mm) particles, rock is not laminated.
Claystone	... clay, rock is not laminated.
Shale	... silt or clay sized particles, rock is laminated.

LAYERING

Term	Description
Massive	No layering apparent.
Poorly Developed	Layering just visible. Little effect on properties.
Well Developed	Layering distinct. Rock breaks more easily parallel to layering.

STRUCTURE

Term	Spacing (mm)	Term	Spacing
Thinly laminated	<6	Medium bedded	200 – 600
Laminated	6 – 20	Thickly bedded	600 – 2,000
Very thinly bedded	20 – 60	Very thickly bedded	> 2,000
Thinly bedded	60 – 200		

STRENGTH (NOTE: Is50 = Point Load Strength Index)

Term	Is50 (MPa)	Term	Is50 (MPa)
Extremely Low	<0.03	High	1.0 – 3.0
Very low	0.03 – 0.1	Very High	3.0 – 10.0
Low	0.1 – 0.3	Extremely High	>10.0
Medium	0.3 – 1.0		

WEATHERING

Term	Description
Residual Soil	Material is weathered to an extent that it has soil properties. Rock structures are no longer visible, but the soil has not been significantly transported.
Extremely …..	Material is weathered to the extent that it has soil properties. Mass structures, material texture & fabric of original rock is still visible.
Highly …..	Rock strength is significantly changed by weathering; rock is discolored, usually by iron staining or bleaching. Some primary minerals have weathered to clay minerals.
Moderately …..	Rock strength shows little or no change of strength from fresh rock; rock may be discolored.
Slightly …..	Rock is partially discolored but shows little or no change of strength from fresh rock.
Fresh	Rock shows no signs of decomposition or staining.

DEFECT DESCRIPTION

Type	
Joint	A surface or crack across which the rock has little or no tensile strength. May be open or closed.
Parting	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering/bedding. May be open or closed.
Sheared Zone	Zone of rock substance with roughly parallel, near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects.
Seam	Seam with deposited soil (infill), extremely weathered insitu rock (XW), or disoriented usually angular fragments of the host rock (crushed).
Shape	
Planar	Consistent orientation.
Curved	Gradual change in orientation.
Undulating	Wavy surface.
Stepped	One or more well defined steps.
Irregular	Many sharp changes in orientation.
Roughness	
Polished	Shiny smooth surface.
Slickensided	Grooved or striated surface, usually polished.
Smooth	Smooth to touch. Few or no surface irregularities.
Rough	Many small surface irregularities (amplitude generally <1mm). Feels like fine to coarse sandpaper.
Very Rough	Many large surface irregularities, amplitude generally >1mm. Feels like very coarse sandpaper.
Coating	
Clean	No visible coating or discolouring.
Stained	No visible coating but surfaces are discolored.
Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
Coating	Visible coating =1mm thick. Thicker soil material described as seam.

Excavation Log

EX no:	**TP8**
sheet:	1 of 1
job no.:	6749-1

client:	KT-EVT	**started:**	1.12.2021
principal:		**finished:**	1.12.2021
project:	Proposed New Snowgums lift	**logged:**	AT
location:	Thredbo NSW	**checked:**	MAB
equipment:		**RL surface:**	
dimensions:	**E:** **N:**	**datum:**	AHD

excavation information | **material information**

method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	USCS symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	hand penetro-meter kPa (100 200 300 400)	structure and additional observations
EX	N	None Observed					MLC-CLM	TOPSOIL, Silty CLAY/ Clayey SILT, low to medium plasticity	D	L-MD?		TOPSOIL.
					0.2		SM/SC	FILL, Silty, clayey SAND, fine to coarse grained sand, dark brown, grass and tree roots, granite boulders up to 150mm to 270mm in size.		MD?		FILL. Appeared to be well-compacted.
					0.5							
					0.8		SC	Clayey SAND, medium to coarse grained, brown/ pale brown, assessed as completely weathered granite bedrock.		D?		GRANITE BEDROCK.
					1.0							
					1.3			Excavator reached practical refusal @ 0.6m on extremely weathered Granite bedrock. Excavation No: TP8 terminated at 1.3m				
					1.5							

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Excavation Log

EX no:	**TP9**
sheet:	1 of 1
job no.:	6749-1

client:	KT-EVT	**started:**	1.12.2021
principal:		**finished:**	1.12.2021
project:	Proposed New Snowgums lift	**logged:**	AT
location:	Thredbo NSW	**checked:**	MAB
equipment:		**RL surface:**	
dimensions:	**E:** **N:**	**datum:**	AHD

excavation information | **material information**

method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	USCS symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	hand penetro-meter kPa (100 200 300 400)	structure and additional observations
EX	N	None Observed					SM	TOPSOIL, Silty SAND with traces of clay, fine to medium grained, dark grey/ dark brown, grass roots, organic matter intrusion, low plasticity fines.	D	L-MD?		TOPSOIL.
					0.2		SM	FILL, Silty, clayey SAND, fine to coarse sand, dark grey/ dark brown, organic matter intrusion, low plasticity fines, granite boulders of up to 0.1m to 0.15m in size.		MD?		TOPSOIL/FILL.
					0.5							
					0.7		SC	Clayey SAND, medium to coarse grained, brown/ pale brown, assessed as completely weathered granite bedrock.		D-VD?		GRANITE BEDROCK.
					1.0							
					1			Excavator reached practical refusal @ 1.0m on extremely weathered Granite bedrock. Excavation No: TP9 terminated at 1m				
					1.5							

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Excavation Log

EX no:	**TP10**
sheet:	1 of 1
job no.:	6749-1

client:	KT-EVT	**started:**	1.12.2021
principal:		**finished:**	1.12.2021
project:	Proposed New Snowgums lift	**logged:**	AT
location:	Thredbo NSW	**checked:**	MAB
equipment:		**RL surface:**	
dimensions:	**E:** **N:**	**datum:**	AHD

excavation information | **material information**

method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	USCS symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	hand penetro-meter kPa (100 200 300 400)	structure and additional observations
EX	N	None Observed					SM	TOPSOIL, Silty SAND with traces of clay, fine to medium grained, dark grey/ dark brown, grass roots, organic matter intrusion, low plasticity fines.	D	L-MD?		TOPSOIL.
					0.15		SM/SC	FILL, Silty, clayey SAND, fine to coarse sand, dark grey/ dark brown, organic matter intrusion, low plasticity fines, granite boulders of up to 0.15m in size.		MD?		FILL. Appeared to be well-compacted.
					0.5							
					0.6		SC	Clayey SAND, medium to coarse grained, brown/ pale brown, assessed as completely weathered granite bedrock.		D-VD?		GRANITE BEDROCK. Slow Digging with depth.
					1.0							
					1			Excavator reached practical refusal @ 1.0m on extremely weathered Granite bedrock. Excavation No: TP10 terminated at 1m				
					1.5							

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Appendix C

Site Photos

Photo 1

View of slope south-west of Black Salles

Photo 2

Wet area adjacent to route. New alignment located within the disturbed ski run adjacent.

Photo 3

Wet area above Kareela Hutte.
Source: Kosciuszko Thredbo Pty Ltd.

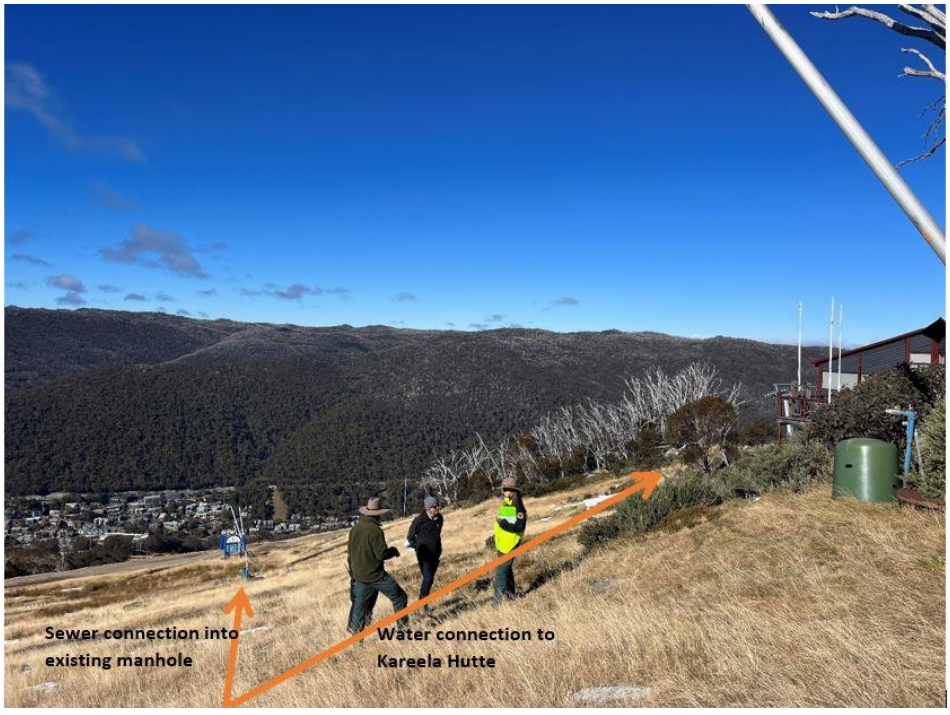

Photo 4

View of service trench entry to Kareela Hutte.
Source: Kosciuszko Thredbo Pty Ltd

Photo 5

View of northern side of Kareela Hutte where service trench will approach.