Our ref: 5862-G1
6 December 2019

M Squillacioti c/o Myson + Berkery
By email: vm@mysonberkery.com.au

Attention: Mr Vince Myson

Dear Sir,

PROPOSED ALTERATIONS & ADDITIONS, UNIT 12, SNOWSTREAM, WOODRIDGE, THREDBO, NSW
GEOTECHNICAL ASSESSMENT

1. INTRODUCTION

Further to the approval to proceed issued by Vince Myson on behalf of Mick Squillacioti on 20 November 2019, a Principal Geotechnical Engineer (Mark Green) inspected the site on behalf of AssetGeoEnviro (Asset) on 20 November 2019 to carry out geotechnical investigation.

Plans supplied to us for this assessment included:

- Detail Survey by Peter W Burns Pty Ltd, Dwg No 4128/01/01 Rev A dated 28/11/18.
- Architectural Sketch Plans of the proposed works by Myson + Berkery Architects, Job No 190222, Dwg Nos A00 "Site Analysis", A01 "Proposed GF Plan", A02 "Proposed FF Plan", A03 "Roof Plan and SE Elevation", A04 "Cross-section and SW Elevation", A05 "Current Plans".

Based on the supplied plans, the proposed alterations and additions involve building a bedroom extension over the existing patio slab to the west and a new timber deck with roof over at Finished Floor (FF) level to the south.

This letter 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. Slope instability considerations presented in this report must be read in conjunction with the attached GeoGuides for Slope Management and Maintenance.

2. REGIONAL TOPOGRAPHY & GEOLOGY

The regional topography comprises gently sloping terrain flanking the north-easterly flowing Thredbo River, with ground slopes over the land flanking the river generally ranging from 10° to 30° and some locally steeper sections, and more gentle slopes over the river shoulders (as at this site). 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.

The site lies within the G line as defined in DIPNR's "Geotechnical Policy – Kosciuszko Alpine Resorts", November 2003.

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

3. SITE INSPECTION

The site was inspected 20 November 2019.

The site is located within gently sloping ground on the northern bank of the Thredbo River, south of Friday Drive, close to Thredbo Leisure Centre.

The existing building is a 2-storey apartment with a pitched metal floor. To the west side is an existing concrete patio with gravel surfacing to the north with an informal boulder retaining wall bounding to the west. To the south of the existing building are rough grassed lawns with scattered granite boulders leading down to the nearby Thredbo River.

Two hand augered boreholes and Dynamic Cone Penetrometer (DCP) tests were constructed on the site at close to the proposed southern extension column positions (See Figure 1). The logs for these are appended to this report.

From the investigation, the subsurface conditions in the area of the rear extension are assessed to comprise:

0.0 – 0.2/0.25m	Silty Clay / Clayey Silt (topsoil), fine grained, low plasticity fines, brown, grass roots occasional gravel
0.3 – 1.0m	Sandy SILT (alluvial), low plasticity, dark brown, moist = less than plastic limit, occasional gravel, moderately dense
Below 0.9m	Completely weathered GRANITE or granite corestones – not proven

Groundwater was not observed in the boreholes during the time they remained open. It is expected that intermittent groundwater would be present within the soils overlying the weathered granite.

4. KEY GEOTECHNICAL SITE CONSTRAINTS

No significant excavation is proposed. The use of screw piled foundations has been raised if the depth to bedrock requires it.

Key geotechnical constraints to the development include variable excavation and foundation conditions. Granite corestones could be present at shallow depth at positions not investigated. These may give early refusal to screw piles if met. Recommendations for design and construction of the development are provided in the following sections.

The patio base to the west was not specifically investigated below ground. It is not likely to be a formal footing and hence supplementary footings may be required for any additional loadings.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 Earthworks

5.1.1 Excavation

The excavation for the proposed development is anticipated to be fully within soils down to top of completely weathered granite bedrock. Excavation within the soils and extremely weathered bedrock would be achievable using conventional earthmoving equipment (i.e. hydraulic excavator bucket).

If excavation within the deeper, less weathered bedrock will likely require the use of ripper tooth fitted to a hydraulic excavator bucket, a dozer fitted with ripper tooth, or a hydraulic hammer fitted to an excavator, possibly supplemented by rock saw and rock splitting techniques. The use of low energy explosives in water filled core holes can be utilised to loosen any deeper excavation.

5.1.2 Vibration Management

Australian Standard AS 2187: Part 2-2006 recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they "are applicable to Australian conditions". The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where the minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration that are considered in the standard include demolition, blasting (carried out during mineral extraction or construction excavation), piling, ground treatments (e.g. compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

For residential structures, BS 7385 recommends vibration criteria of 7.5 mm/s to 10 mm/s for frequencies between 4 Hz and 15 Hz, and 10 mm/s to 25 mm/s for frequencies between 15 Hz to 40 Hz and above. These values would normally be applicable for new residential structures or residential structures in good condition. Higher values would normally apply to commercial structures, and more conservative criteria would normally apply to heritage structures.

However, structures can withstand vibration levels significantly higher than those required to maintain comfort for their occupants. Human comfort is therefore likely to be the critical factor in vibration management.

Excavation methods should be adopted which limit ground vibrations at the adjoining developments to not more than 10mm/sec. Vibration monitoring is recommended to verify that this is achieved. However, if the contractor adopts methods and/or equipment in accordance with the recommendations in Table 1 for a ground vibration limit of 5mm/sec, vibration monitoring may not be required.

The limits of 5mm/sec and 10mm/sec are expected to be achievable if rock breaker equipment or other excavation methods are restricted as indicated in Table 1.

Table 1 – Recommendations for Rock Breaking Equipment

Distance from adjoining structure (m)	Maximum Peak Particle Velocity 5mm/sec		Maximum Peak Particle Velocity 10mm/sec*	
	Equipment	Operating Limit (% of Maximum Capacity)	Equipment	Operating Limit (% of Maximum Capacity)
1.5 to 2.5	Hand operated jackhammer only	100	300 kg rock hammer	50
2.5 to 5.0	300 kg rock hammer	50	300 kg rock hammer or 600 kg rock hammer	100 50
5.0 to 10.0	300 kg rock hammer or 600 kg rock hammer	100 50	600 kg rock hammer or 900 kg rock hammer	100 50

* Vibration monitoring is recommended for 10mm/sec vibration limit.

At all times, the excavation equipment must be operated by experienced personnel, per the manufacturer's instructions, and in a manner, consistent with minimising vibration effects.

Use of other techniques (e.g. chemical rock splitting, rock sawing), although less productive, would reduce or possibly eliminate risks of damage to adjoining property through vibration effects transmitted via the ground. Such techniques may be considered if an alternative to rock breaking is necessary. If rock sawing is carried out around excavation boundaries in not less than 1m deep lifts, a 900kg rock hammer could be used at up to 100% maximum operating capacity with an assessed peak particle velocity not exceeding 5 mm/sec, subject to observation and confirmation by a Geotechnical Engineer at the commencement of excavation.

It should be noted that vibrations that are below threshold levels for building damage may be experienced at adjoining developments. Rock excavation methodology should also consider acceptable noise limits as per the “Interim Construction Noise Guideline” (NSW EPA).

5.1.3 Subgrade Preparation

The following general recommendations are provided for subgrade preparation for earthworks, pavements, slab-on-ground construction, and minor structures:

- Strip existing fill and topsoil. Remove unsuitable materials from the site (e.g. material containing deleterious matter). Stockpile remainder for re-use as landscaping material or remove from site.
- Excavate natural soils and rock, stockpiling for re-use as engineered fill or remove to spoil. Rock could be stockpiled separately from clayey soils, for select use beneath pavements.
- Where rock is exposed in bulk excavation level beneath pavements, rip a further 150mm.
- Where rock is exposed at footing invert level, it should be free of loose, “drummy" and softened material before concrete is poured.
- Where soil is exposed in bulk excavation level, compact the upper 150mm depth to a density index (AS1289.5.6.1–1998) not less than 80%. Areas which show visible heave under compaction equipment should be over-excavated a further 0.3m and replaced with approved fill compacted to a density index not less than 80%.

Any waste soils being removed from the site must be classified in accordance with current regulatory authority requirements to enable appropriate disposal to an appropriately licensed landfill facility. Asset can provide further advice on this matter if required.

5.1.4 Filling

Where filing is required, place in horizontal layers over prepared subgrade and compact as per Table 2.

Table 2 – Compaction Specifications

Parameter	Cohesive Fill	Non Cohesive Fill
Fill layer thickness (loose measurement): • Within 1.5m of the rear of retaining walls • Elsewhere	 0.2m 0.3m	 0.2m 0.3m
Density: • Beneath Pavements • Beneath Structures • Upper 150mm of subgrade	 ≥ 95% Std ≥ 98% Std ≥ 100% Std	 ≥ 70% ID ≥ 80% ID ≥ 80% ID
Moisture content during compaction	± 2% of optimum	Moist but not wet

Filling within 1.5m of the rear of any retaining walls should be compacted using lightweight equipment (e.g. hand-operated plate compactor or ride-on compactor not more than 3 tonnes static weight) to limit compaction-induced lateral pressures.

Any soils to be imported onto the site for backfilling and reinstatement of excavated areas should be free of contamination and deleterious material and should include appropriate validation documentation in accordance with current regulatory authority requirements which confirms its suitability for the proposed land use. Asset can provide further advice on this matter if required.

5.1.5 Batter Slopes

Recommended maximum slopes for permanent and temporary batters are presented in Table 3.

Table 3 – Recommended Maximum Dry Batter Slopes

Unit	Maximum Batter Slope (H : V)	
	Permanent	Temporary
Alluvial Sandy Silt	2 : 1	1 : 1
Completely Decomposed Granite	1.5 : 1	0.75 : 1
Moderately Decomposed or better Granite	vertical *	vertical *

* subject to inspection by a Geotechnical Engineer and carrying out remedial works as recommended (e.g. shotcrete, rock bolting).

5.2 Site Classification

Where footings are founded on the underlying completely decomposed granite bedrock, then footings may be designed and constructed in accordance with the requirements in AS2870-2011 for a Class A site.

Footings should also be designed as per the recommendations in Section 5.3.

The classification and footing recommendations given above and in Section 5.3 are provided on the basis that the performance expectations set out in Appendix B of AS2870–2011 are acceptable and that future site maintenance is in accordance with CSIRO BTF 18, a copy of which is attached.

5.3 Footings

Suitable footings might comprise a slab on ground for the basement area and pier and beam footings supporting the upper building loads. Where some footings are taken to bedrock, it is recommended that all footings are founded on bedrock to reduce the risk of differential settlement due to variable founding conditions.

Edge beams for slabs, pad footings, and rock-socketed piles may be designed for the parameters in Table 4.

Table 4 – Footing Design Parameters

Founding Stratum	Maximum Allowable (Serviceability) Values (kPa)			Ultimate Strength Limit State Values (kPa)			
	End Bearing	Shaft Friction – Compression #	Shaft Friction – Tension	End Bearing	Shaft Friction – Compression #	Shaft Friction – Tension*	Typical E_{field} MPa
Medium Dense Sandy Silt	75	-	-	225	-	-	5
Completely Decomposed Granite	600	60	30	1,800	180	90	50
Moderately Decomposed or better Granite	1,000	100	50	3,000	300	150	250

Note:

* Uplift capacity of piles in tension loading should also be checked for inverted cone pull out mechanism.

clean socket of roughness category R2 or better is assumed

In accordance with AS2159-2009 "Piling–Design and Installation", for limit state design, the ultimate geotechnical pile capacity shall be multiplied by a geotechnical reduction factor (Φg). This factor is derived from an Average Risk Rating (ARR) which considers geotechnical uncertainties, redundancy of the foundation system, construction supervision, and the quantity and type of pile testing (if any). Where testing is undertaken, or more comprehensive ground investigation is carried out, it may be possible to adopt a larger Φg value that results in a more economical pile design. Further geotechnical advice will be required in consultation with the pile designer and piling contractor, to develop an appropriate Φg value.

Settlements for footings on rock are anticipated to be about 1% of the minimum footing dimension, based on serviceability parameters as per Table 4. Settlements for pad footings on medium dense sandy silt are anticipated to be up to about 25mm where loading does not exceed the maximum allowable values.

Options for piles include:

Bored Piles. It assessed that the construction of sockets would require the use of a truck-mounted drilling rig. It is also assessed that the bored pile holes would not require liners to support the overburden soils, although some over break and minor fretting should be allowed for. Groundwater may be expected within bored pile holes and dewatering by a down-hole pump may be required to limit softening of the bases prior to concreting.

Continuous Flight Auger (CFA) Piles. CFA piles are constructed by drilling a hollow-stemmed continuous flight auger to the required founding depth. Concrete is then injected under pressure through the auger stem as the auger is extracted from the soil. The reinforcing cage is then inserted upon completion of the concreting process. Pile diameters vary from 300mm to 1200mm. Drilled spoil is produced during CFA piling, and must subsequently be removed from the site. CFA piles are considered non-displacement piles as defined in AS2159.

Steel Screw Piles. Hollow-stemmed steel piles fitted with a single or double helix at the tip are installed using specially modified hydraulic excavators. Shaft diameters typically vary from 90mm to 220mm and helix diameters vary from 350mm to 600mm. Single pile capacities range from 2 to 65 tonnes.

Driven piles are not likely to be suitable as environmental factors including noise and vibration are likely to be unacceptable for the adjacent development.

5.4 Groundwater Control

Limited groundwater observations have been made for this investigation. The observations indicate that groundwater is unlikely to be a constraint to the proposed development. However, good practice should be followed to cater for potential groundwater, such as designing retaining walls with adequate subsoil drainage. Further geotechnical advice must be sought if significant groundwater is encountered during construction.

5.4.1 Underpinning

Where excavations (e.g. for new footings) extend below the 'zone of influence' of existing footings, then underpinning will be required. The 'zone of influence' is defined as a line extending downwards and outwards from the toe of the existing footing at an angle which is dependent on the nature and condition of the foundation soils. For the granite bedrock anticipated beneath the existing footings, an angle of 45°may be adopted. Further investigation of existing footing depths is recommended by carrying out inspection at the commencement of construction. The timing/programme of geotechnical inspections for further assessment of footings adjacent to proposed excavation should be nominated by the Geotechnical Engineer prior to the commencement of bulk excavation.

The assessment of adjacent footings should include assessment of soil or filling depths along the site boundaries that could require support during construction.

The design of underpinning measures and/or excavation support must be carried out by a suitably experienced and qualified structural/civil engineer.

6. 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 may have included geotechnical recommendations for design and construction of temporary works (e.g. temporary batter slopes or temporary shoring of excavations). Such temporary works are expected to perform adequately for a relatively short period of time only, which could range from a few weeks (for temporary batter slopes) up to six months (for temporary shoring). This time period depends on a range of factors including but not limited to: site geology; groundwater conditions; weather conditions; design criteria; and level of care taken during construction. If there are factors which prevent temporary works from being completed and/or which require temporary works to function for periods longer than originally designed, further advice must be sought from the Geotechnical Engineer and Structural Engineer.

Please do not hesitate to contact the undersigned if you have any questions regarding this report or if you require further assistance.

For and on behalf of
AssetGeoEnviro

Mark Green
BSc (Hons) MIEAus CPEng NER CGeol FGS APEC IntPE(Aus)
Principal Geotechnical Engineer

Encl: *Figure 1 Test Locations*
Important Information about your Geotechnical Report
Explanation Sheets
Engineering Logs
Form 4

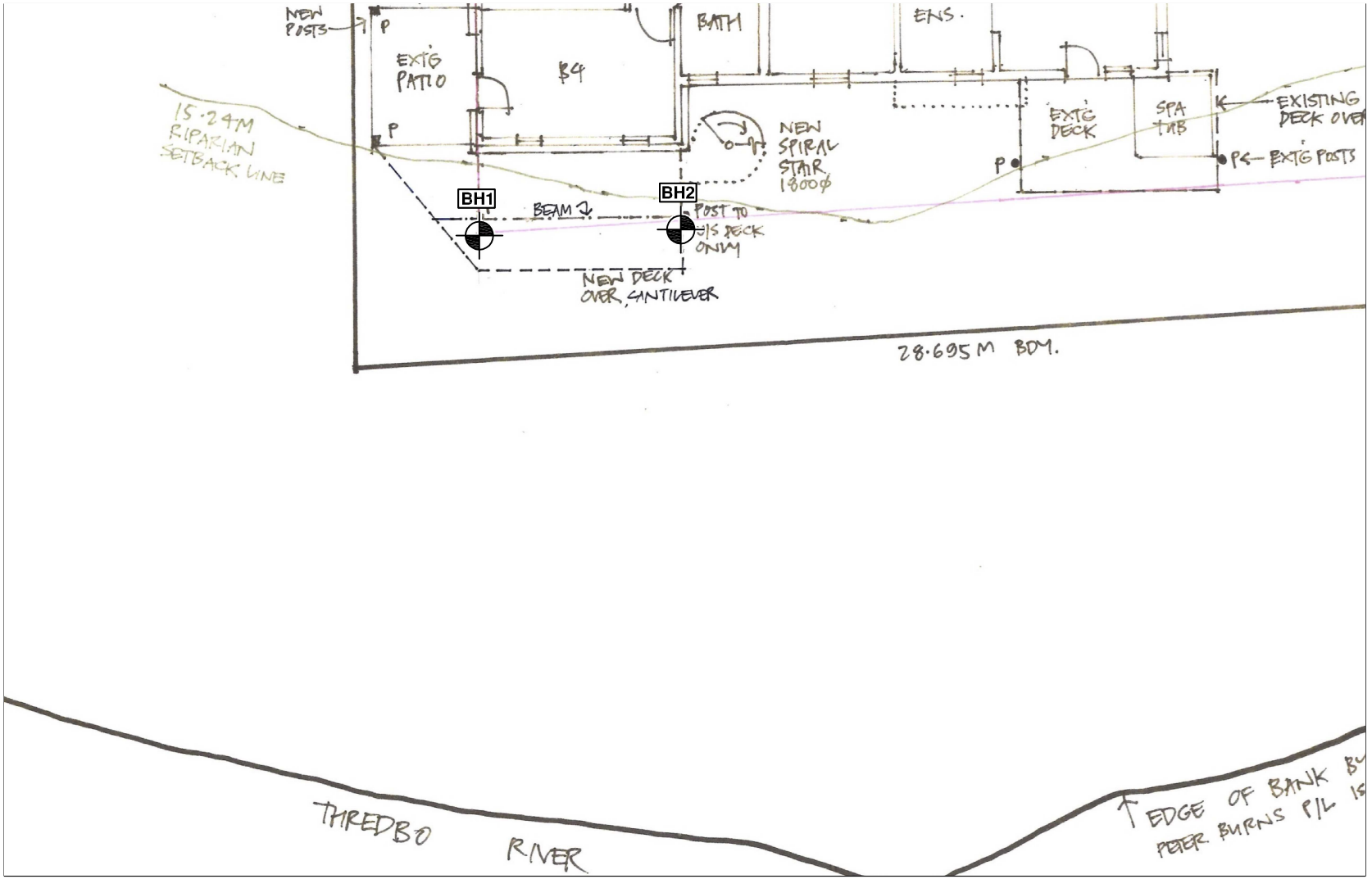
DOCUMENT CONTROL

Distribution Register

Copy	Media	Recipient	Location
1	Secure PDF	Vince Myson	Myson + Berkery Architects
2	Secure PDF	Mark Bartel	Asset Geotechnical Engineering

Document Status

Rev	Revision Details	Author	Reviewer		Approved for Issue		
			Name	Initials	Name	Initials	Date
0	Initial issue	M. Green	M. Bartel	MAB	M. Bartel	MAB	6 December 2019



KEY

Borehole/DCP

APPROXIMATE ONLY – SUBJECT TO DETAIL SURVEY.

SOURCE: SITE SURVEY (PREPARED BY: MYSON & BERKERY ARCHITECTS PTY LTD; DATED: 26/02/19)

0 1:150 A4 5m

issue	date	description
A	25.11.19	INITIAL ISSUE

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PROPOSED ALTERATIONS & ADDITIONS
SNOWSTREAM 12, WOODRIDGE,
THREDBO NSW.
for
MYSON BERKERY

TEST LOCATIONS

drawn: WY
date: 25.11.2019
checked: MAG
scale: 1:150 A4

job no.: 5862
fig: 1
issue: A

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 with regard to 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 or not 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 in order 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 of 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 take into account any events or emergent circumstances or fact occurring or becoming apparent after the date of the report.

Soil and Rock Explanation Sheets (1 of 2)

LOG ABBREVIATIONS AND 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

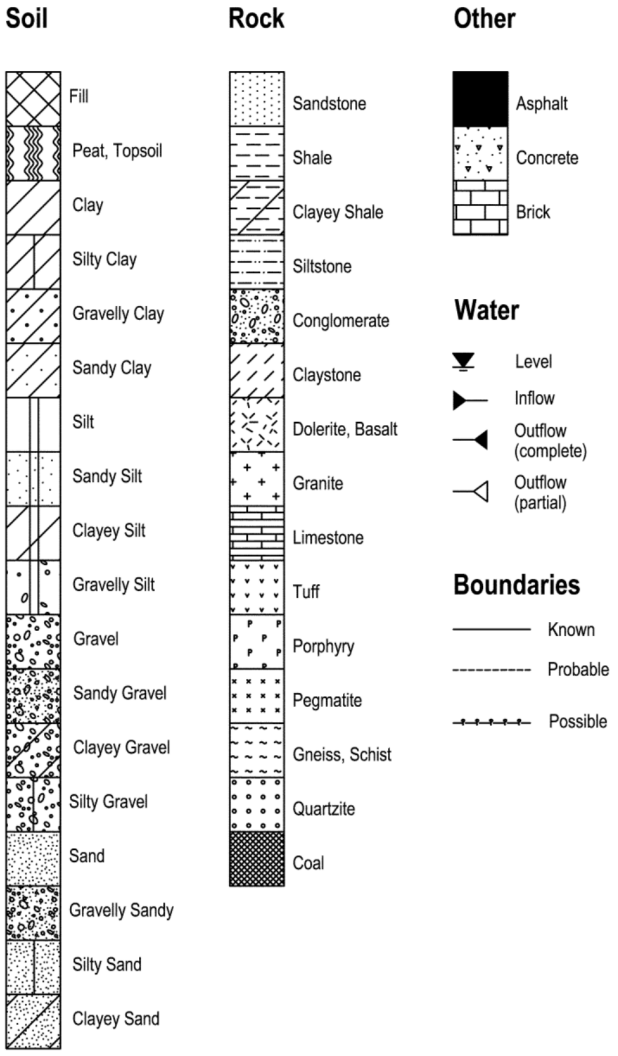
CONSISTENCY

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 / total length of core run drilled x 100

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 COURSE 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.
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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.

Borehole Log

BH no:	**BH1**
sheet:	1 of 1
job no.:	5862

client:	Myson Berkery	**started:**	20.11.2019
principal:		**finished:**	20.11.2019
project:	Proposed Alterations & Additions	**logged:**	WY
location:	Snowstream 12, Woodridge, Thredbo NSW	**checked:**	MAG
equipment:	HA/DCP	**RL surface:**	approx.
diameter:	75mm **inclination:** -90° **bearing:** --- **E:** **N:**	**datum:**	

drilling information | **material information**

method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	USCS symbol	material description (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
HA / DCP	N	None observed					CL	Topsoil(grass over), silty CLAY, brown; with some roots	<<Wp	F		Topsoil
										St		
					0.25		ML	Sandy SILT, moderately compact, dark brown; with occasional gravel, subrounded.	<Wp			Alluvium
					0.5							
										F		
										S		
DCP					0.9			HA terminated at 0.9m, due to refusal on presumed granite bedrock or coarse buried bowlders.		VSt		
					1.0					H		
					1.2			DCP terminated at 1.2m, due to refusal on presumed granite bedrock or coarse buried bowlders. Borehole No: BH1 terminated at 1.2m				
					1.5							
					2.0							

5862 BH LOGS.GPJ 25/11/19

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED — Borehole Log - Revision 10

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Borehole Log

BH no:	**BH2**
sheet:	1 of 1
job no.:	5862

client:	Myson Berkery	**started:**	20.11.2019
principal:		**finished:**	20.11.2019
project:	Proposed Alterations & Additions	**logged:**	WY
location:	Snowstream 12, Woodridge, Thredbo NSW	**checked:**	MAG
equipment:	HA/DCP	**RL surface:**	approx.
diameter:	75mm **inclination:** -90° **bearing:** --- **E:** **N:**	**datum:**	

drilling information | **material information**

method	support	water	notes samples, tests, etc	RL	depth metres	graphic log	USCS symbol	material description (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
HA / DCP	N	None observed					ML	Topsoil(grass over), Clayey SILT, brown; with occasional gravel and some roots	<<Wp	F		Topsoil
										VSt		
					0.2		ML	Sandy SILT, moderately compact, dark brown, slightly clayey; with occasional gravel.	<Wp	St		Alluvium
										F		
										St		
					0.5					F		
										VSt		
										H		
										VSt		
DCP					0.9			HA terminated at 0.9m, due to refusal on presumed granite bedrock or coarse buried bowlders.		H		
					1.0							
					1			DCP terminated at 1.0m, due to refusal on presumed granite bedrock or coarse buried bowlders. Borehole No: BH2 terminated at 1m				
					1.5							
					2.0							

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

Borehole Log - Revision 10

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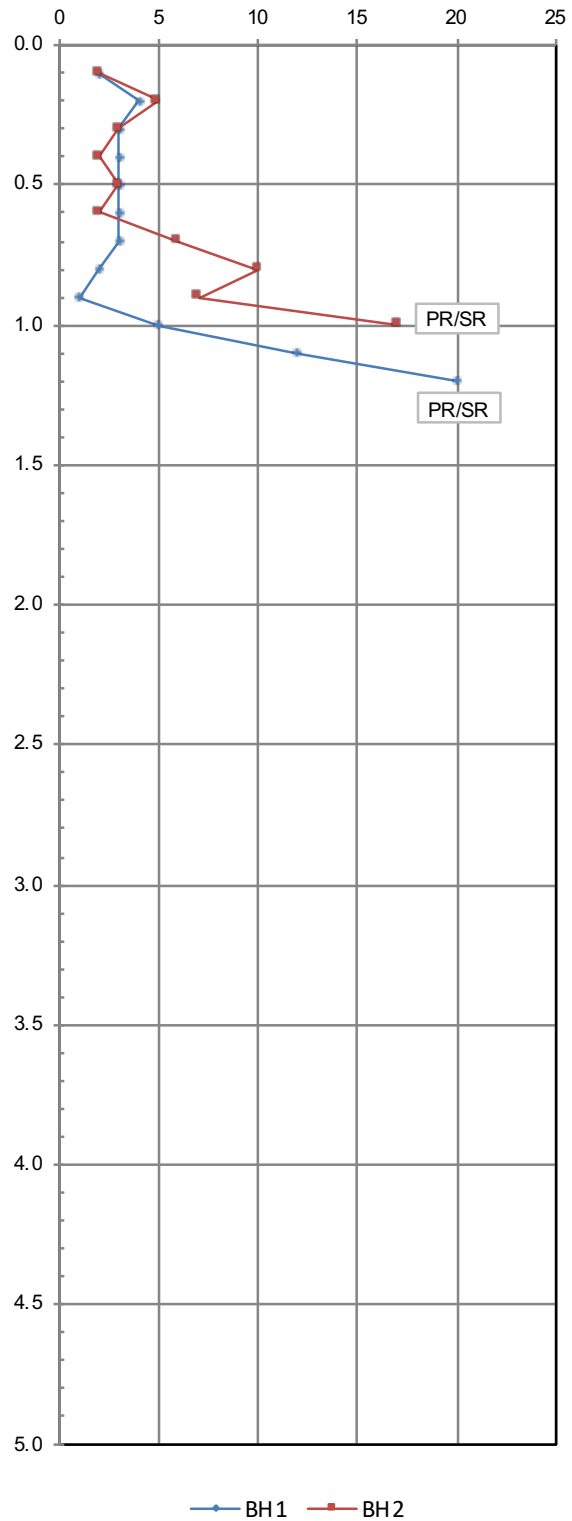
Dynamic Cone Penetrometer

Sheet:	1 of 1
Job No:	5862

client:	Myson Berkery	**started:**	20.11.2019
principal:		**finished:**	20.11.2019
project:	Proposed Alterations & Additions	**logged:**	MAG
location:	Snowstream 12, Woodridge, Thredbo NSW	**checked:**	MAB
equipment:	9kg hammer, 510mm drop, cone tip		
standard:	AS1289.6.3.2-1997		

Depth (m)	Test Results (blows / 100mm) BH1	BH2
0.00 – 0.10	2	2
0.10 – 0.20	4	5
0.20 – 0.30	3	3
0.30 – 0.40	3	2
0.40 – 0.50	3	3
0.50 – 0.60	3	2
0.60 – 0.70	3	6
0.70 – 0.80	2	10
0.80 – 0.90	1	7
0.90 – 1.00	5	17
1.00 – 1.10	12	PR/SR
1.10 – 1.20	20	
1.20 – 1.30	PR/SR	
1.30 – 1.40		
1.40 – 1.50		
1.50 – 1.60		
1.60 – 1.70		
1.70 – 1.80		
1.80 – 1.90		
1.90 – 2.00		
2.00 – 2.10		
2.10 – 2.20		
2.20 – 2.30		
2.30 – 2.40		
2.40 – 2.50		
2.50 – 2.60		
2.60 – 2.70		
2.70 – 2.80		
2.80 – 2.90		
2.90 – 3.00		
3.00 – 3.10		
3.10 – 3.20		
3.20 – 3.30		
3.30 – 3.40		
3.40 – 3.50		
3.50 – 3.60		
3.60 – 3.70		
3.70 – 3.80		
3.80 – 3.90		
3.90 – 4.00		
4.00 – 4.10		
4.10 – 4.20		
4.20 – 4.30		
4.30 – 4.40		
4.40 – 4.50		
4.50 – 4.60		
4.60 – 4.70		
4.70 – 4.80		
4.80 – 4.90		
4.90 – 5.00		

Plot (blows / 100mm vs depth)



Notes:
RL = ground surface level (m) AHD
TD = target depth, PR = practical refusal (15+ blows per 100mm), SR = "solid" refusal (no further penetration and "solid" ringing sound from slide hammer)

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Department of
Infrastructure, Planning and Natural Resources

Geotechnical Policy – Kosciuszko Alpine Resorts
Form 4 – Minimal Impact Certification

Date received: ____/____/____ DA no: _____

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 Assessments Team in Jindabyne for further information. Phone 02 6456 1733.

To complete this form, please place a cross in the boxes ☐ and fill out the white 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 ☑ Ms ☐ Mrs ☐ Dr ☐ Other

Mark Anthony

Family name

Green

OF

Company/organisation

Asset Geotechnical Engineering P/L

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

Proposed extensions to 12 Snowstreams, Woodridge Thredbo, NSW

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

(List of documentation reviewed)

Architectural Sketch Plans of the proposed works by Myson + Berkery Architects, Job No 190222

Drawings A00, A01, A02, A03, A04 & A05.

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)

A

- ☑ 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.

4. Signatures

Signature

Name

Mark Anthony Green

Chartered professional status

CPEng, NER CGeol FGS

Date

4 December 2019

5. Contact details

Alpine Resorts Assessments team
Snowy River Avenue
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e: alpineresorts_assessments@dipnr.nsw.gov.au