Proposed Zipline

Geotechnical Landslide Risk Assessment

Buller Ski Lifts

23 March 2026

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GHD Pty Ltd ABN 39 008 488 373
105 Hume Street, Suite 5
Wodonga, Victoria 3690, Australia
T +61 0 6043 8700 | **F** +61 2 6043 8711 | **E** abxmail@ghd.com | **ghd.com**

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1. Introduction

This report presents the geotechnical assessment and landslide risk assessment for the proposed construction of the bottom structure of a zipline at Mount Buller. The assessment will cover areas of ground disturbance at the bottom tower.

A Geotechnical Assessment accompanied by a Landslide Risk Assessment is required in support of planning applications required under the provisions of Schedule 1 to Clause 44.01 Erosion Management Overlay of the Alpine Resorts Planning Scheme.

The requirements for a Geotechnical Assessment and Landslide Risk Assessment are set out in Section 4.2 and 4.3 of the Incorporated Document *Requirements for a Geotechnical Assessment or Landslide Risk Assessment prepared in support of a planning permit application under Schedule 1 to the Erosion Management Overlay, February 2023.*

1.1 Scope

The scope of this assessment includes the following:

- Desktop review of existing documents relevant to the project area
- A site visit to confirm the current site conditions and gain an appreciation for potential landslide hazards and the subsurface conditions
- Development of relevant site plan and cross sections for the subject site
- Completion of a Geotechnical Assessment in accordance with Section 4.2 of the incorporated document to Schedule 1 to Clause 44.01
- Completion of Landslide Risk Assessment of identified geotechnical hazards at the site in accordance with Section 4.3 of the incorporated document to Schedule 1 to Clause 44.01 which includes a full qualitative assessment of the risk posed to property and a full quantitative assessment of the risk posed to life.

1.2 Assumptions and limitations

This report: has been prepared by GHD for Buller Ski Lifts and may only be used and relied on by Buller Ski Lifts for the purpose agreed between GHD and Buller Ski Lifts as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Buller Ski Lifts arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.2 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.3 Proposed development

GHD were provided with a set of design drawings for the proposed zipline. The proposed development evaluated as part of this geotechnical assessment is understood to comprise the following:

- Construction of a 12 m high launch tower at the top of the zipline, adjacent to the existing Northside Express Chairlift;
  - 3700 x 1500 mm concrete slab foundation, embedded minimum of 200 mm into weathered rock
  - DSI rod tie backs upslope of foundation, angled at 45º, embedded in 150mm micropiles. Embedded minimum 3500 mm into weathered rock
- Construction of a 3 m high base tower at the bottom of the zipline, between the existing Northside Express Chairlift and the Horse Hill Carpark;
  - Landing pad to be located on the roof of the existing Northside Express Chairlift
  - 3700 x 1500 mm concrete slab foundation embedded minimum of 200 mm into weathered rock
  - DSI rod tie backs upslope of foundation, angled at 35º, embedded in 150mm micropiles. Embedded minimum 3500 mm into weathered rock
- Based on the design drawings provided, the required earthworks are assumed to involve excavation of the slope for the tower foundations, including estimated 3 m deep batter on the upslope side, as shown in Figure 1.

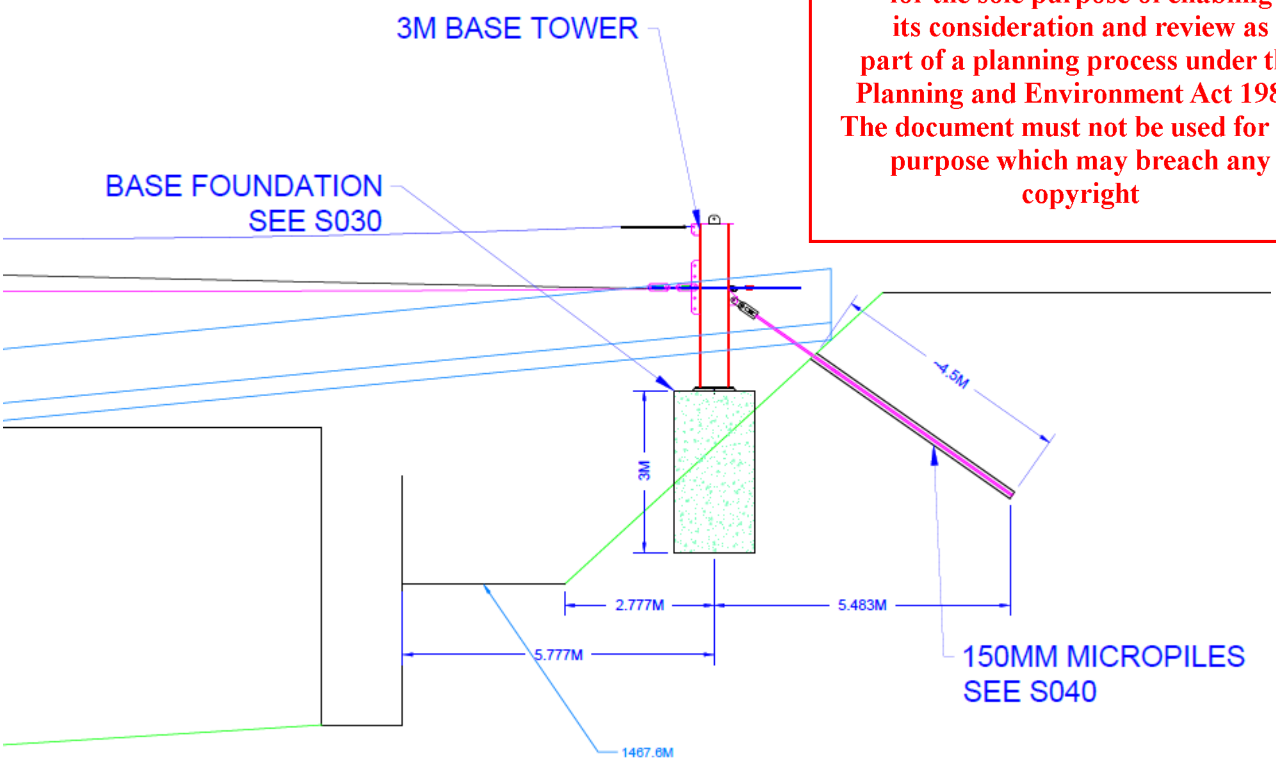


Figure 1 Extract from provided drawing A002 – illustrating construction plan for landing foundation and micropile anchors.

1.4 Regional geology

According to the Seamless Geology 1:250 000 scale map (produced by the Geological Survey of Victoria 2007-2014) (Figure 2), the upper zipline structure is situated within the Oligocene to Eocene aged Bryce Plain Basalt (Pur). The basalt is typically an olivine basalt, minor olivine tholeiite, minor hawaiite, lava flows and plugs, with interbedded sedimentary rocks.

The bottom structure is situated within the underlying Late to Middle Devonian aged Mount Stirling Granodiorite (G184), which is typically composed of a medium to coarse grained hornblende granodiorite, diorite, and gabbro. These granitic rocks intrude Ordovician Cobbannah Group (Sc) marine sandstone and mudstone which have developed a wide contact metamorphic aureole between intrusive margins. The contact rocks are typically comprised of quartzite and hornfels which are relatively resistant to erosion. These metamorphic rocks form steep slopes on the northern and western sides of the mountain. The granodiorite has formed flattened ridges and spurs on the east and south of the mountain. Figure 2 shows the granodiorite is locally overlain by remnants of formerly extensive basalt lava flows.

The basalt is underlain in places by a sedimentary unit (up to 5 m thick in places) regarded as lake/swamp/channel deposits on the original land surface prior to basalt flows. This unit was encountered in the GHD (2016) investigation weakly lithified carbonaceous mudstones to the south-east of the Burnt Hut Reservoir.

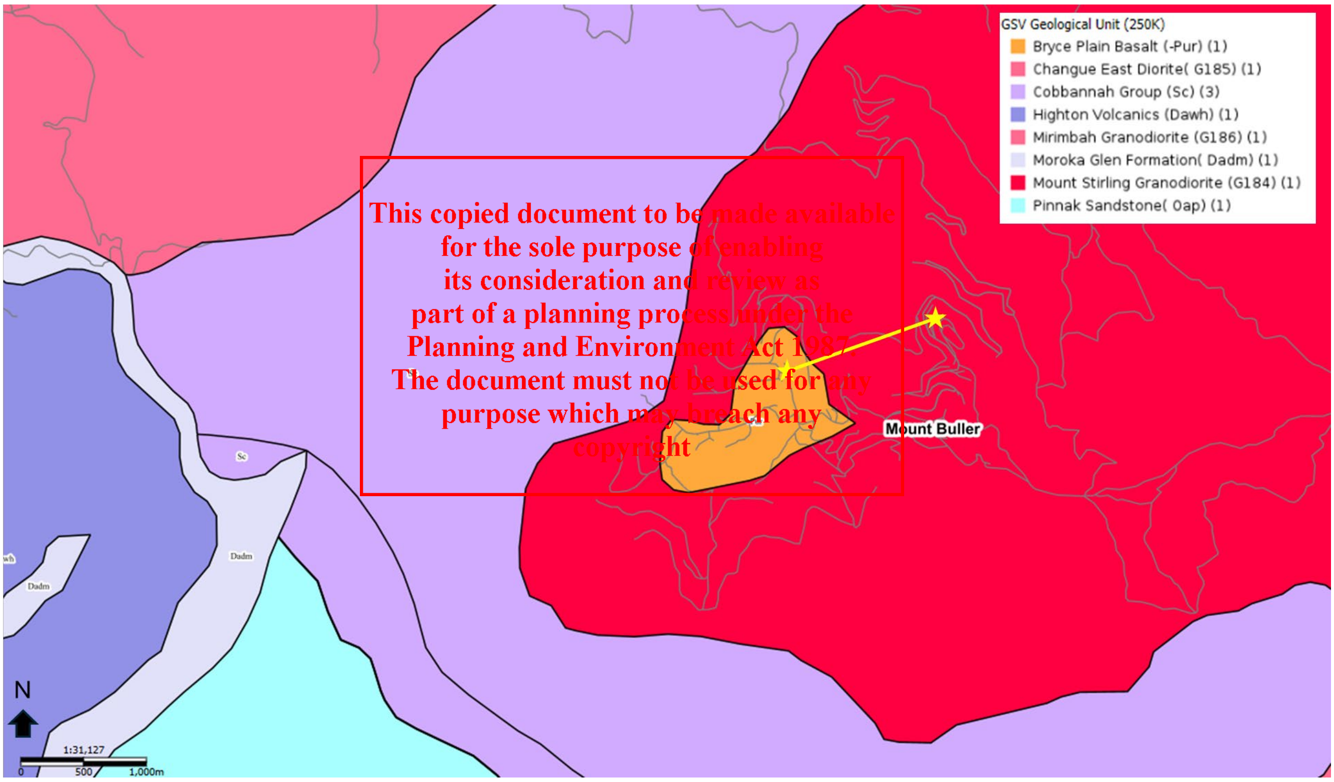


Figure 2 Regional geology of the Mount Buller region with Zipline alignment indicated by yellow markers (map excerpt from Earth Resources' GeoVic portal)

1.5 Previous geotechnical risk assessments

A resort-wide geotechnical risk assessment program for assets in the Mount Buller Resort was completed by Golder on behalf of the Department of Environment, Land, Water and Planning (DELWP; now Department of Energy, Environment and Climate Action (DEECA)) as part of the 2018-2020 alpine geotechnical risk assessment (AGRA) program. These reports are to be utilised to inform the preliminary geotechnical assessments undertaken for planning application. Several assets within the vicinity of the proposed zipline works were assessed as part of the AGRA program (Table 1) and the key hazards identified in the area are summarised in Table 2 below.

Based on a landslide inventory that was developed as part of the AGRA program, the hazard types identified by Golder at Mount Buller are summarised as follows (reproduced from Golder report):

1. **Natural Shallow Landslide** – Landslides occurring within undisturbed or natural ground, typically with a shallow sliding plane in soil or at the interface between rock and soil.
2. **Debris Flow** - Rapid movement of liquefied soil and debris down a slope.
3. **Rock Fall** - Detachment and travel down slope of rock boulders. In this report, meaning individual boulders or rock debris containing many rock particles
4. **Soil Creep** - Relates to the slow, shallow movement of near surface soils downslope. The movement is typically imperceptible to the naked eye, with movement rates measured in mm per year.
5. **Failure of Earthworks and Disturbed Ground** – Slope failures within ground disturbed by earthworks including cut and fill batters. Cut batter failures and fill batter failures.

Susceptibility mapping of the area indicates the proposed landing structure falls within the generally ‘more susceptible’ category for natural shallow landslides and soil creep, and ‘medium’ susceptibility to failure in cut and fill slopes. These classifications are determined by slope angle, as summarised in Table 2.

Risk assessments completed as part of the Golder report for five assets in the immediate vicinity of the proposed landing structure found that evaluated risk levels were at levels typically considered to be ‘acceptable’ or ‘usually acceptable’ to regulators. These assessments were conducted on the same or adjacent slopes as the proposed landing structure, and are considered to be good indicators of expected hazard at the proposed site.

The hazards identified for these assets are associated with cut and fill slopes, and retaining structures of the adjacent carparks, roads and buildings.

The cut slopes ranged from 30 to 50°, and up to 7 m high. The exposed cuttings typically consisted of soils of MW-HW granodiorite core stones in a sandy matrix (likely extremely weathered material). A typical hazard associated with this slope was considered to be a small volume, rapid shallow slide failure.

The fill batters ranged from 30-40°. The fill material was noted as mostly sandy material with granodiorite cobbles and boulders, with grass or shrub vegetation cover. A typical hazard associated with the slope was considered as a mixed soil and rock slide failure with low velocity.

Table 1 Hazards identified in the vicinity of the project area during the Golder (2020) Mount Buller resort-wide risk assessment

Location	Identified hazard	Risk level
Horse Hill – Buller Sports *Upslope of proposed zipline bottom structure*	Cut batters on the eastern and southern side of the building	**ARL5**
Horse Hill Carpark *Immediately upslope of proposed zipline bottom structure*	Failure of adjacent cut and fill batter slopes of RS/SW granodiorite with HW-MW corestones.	**ARL4**
RMB Garage and Office *On Horse Hill immediately north of proposed zipline bottom structure*	Failure of cut batter slope of RS/SW granodiorite with HW-MW corestones.	**ARL5**
Northside Express Chairlift – Base station *At proposed zipline bottom structure*	Failure of dry wall retaining wall Failure of crib wall	**ARL4**
Walkers Carpark *50m downslope of proposed zipline bottom structure*	Failure of fill slopes, failure of retaining wall	**ARL4**

*The risk levels assigned to each hazard are based on a method of assessing risk adapted from the Transport for NSW, Guide to Slope Risk Analysis, Version 4, April 2014.

The risk levels have been re-defined by Golder as the following:

ALR4: Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing inspection and maintenance is required. Reassess risks within 10 years.

ALR5: Acceptable. Manage by normal slope maintenance procedures. No requirement to reassess risks unless there are development changes or changes in usage that could alter the risk profile.

Table 2 Summary of criteria used to develop susceptibility maps for hazards identified at the proposed zipline bottom structure (reproduced from Golder 2020)

Hazard type	Susceptibility level	Terrain attributes	Criteria
Natural shallow landslides	More susceptible	Slope angle	>26°
	Low	Slope angle	All other areas
Soil creep	More susceptible	Slope angle	>26°
	Low	Slope angle	All other areas
Cuts in soil	High	Slope angle	>34°
	Medium	Slope angle	26° - 34° in soil
	Low	Slope angle	Below 26°
Fills in soil	High	Slope angle	>34°
	Medium	Slope angle	26° - 34° in soil
	Low	Slope angle	Below 26°

2. Geotechnical site assessment

2.1 General

The following methodology has been undertaken to assess the existing conditions at the site and inform the preliminary geotechnical assessment:

– A review of the geological conditions anticipated at the site
– A desktop review of pre-existing geotechnical investigation reports and geotechnical assessments completed in the vicinity of the proposed zipline
– A review of aerial imagery and Lidar Hillshade imagery encompassing the proposed zipline development
– A site visit undertaken on 10 February 2026 by a Senior Engineering Geologist and Geologist to observe the current site conditions at the proposed zipline bottom tower. Site photographs obtained during the visit are presented in Section 2.2

2.2 Existing conditions

The proposed works consist of a zipline running parallel to the existing Northside Express Chairlift on the eastern side of Mount Buller.

The proposed zipline launch structure is situated on the slope adjacent to the top of the Northside Express Chairlift, outside of the EMO boundary (Figure 3) and therefore does not require a geotechnical and landslide risk assessment. During the site visit, the proposed launch structure location was inspected. The proposed location is positioned on a fill slope up to 20º, composed predominantly of non-engineered boulder fill likely sourced from local excavation works within the granodiorite. The fill depth at the proposed launch structure is expected to be approximately 5 m. No obvious signs of failures or instability in the fill slope were observed. The natural material immediately downslope showed no obvious indication of instability. Given the proposed position outside the EMO and no observed failures, further geotechnical and landslide risk assessment has not been undertaken for the top zipline structure.

The proposed zipline landing structure is situated inside the EMO boundary (Figure 3), and therefore requires a geotechnical and landslide risk assessment. The slope of the proposed construction is a cut and fill slope, located between the downslope Northside Express Chairlift and the upslope Horse Hill carpark (Figure 4). The slope has been altered by cut and fill activities for the carpark, chairlift, and access footpath. The carpark is understood to have been constructed in the early 1980s, followed by upgrades to the Northside Express Chairlift and presumed development of the slope around the same time period. The base of the slope is supported by a ~3.4 m tall crib wall (Figure 4), behind which the un-engineered fill looks to be composed of granodiorite boulders and weathered soils, likely sourced from the local cut/excavation works. No obvious evidence of instability or failure was observed of the crib wall, which appears to be in apparent good condition.

A footpath cuts through the mid-slope allowing foot traffic between the carpark and chairlift. A 1.0-1.5 m tall dry wall is located at the edge of the footpath. The material behind the dry wall is uncertain, expected to be extremely weathered soils of granodiorite with some possible overlying fill material (Figure 5). Based on site observations and previous investigation descriptions, the slope material is expected to be granodiorite core stones in a sandy matrix. Visual assessment of the dry wall suggests some blocks have been dislodged in places, and there is some minor localised bulging. The dry wall condition is variable, appearing to be composed of loosely packed blocks upslope, and downslope being supported by grout between the blocks and drainage holes. Given the dry wall is approximately ~40 years old, it appears in apparent good condition.

The cut and fill slope at the location of the proposed zipline base tower is approximately 25-30º, and is heavily vegetated with shrubs and trees. The adjacent unaltered slope was observed to be approximately 30-32º with no observed failures or signs of obvious instability.

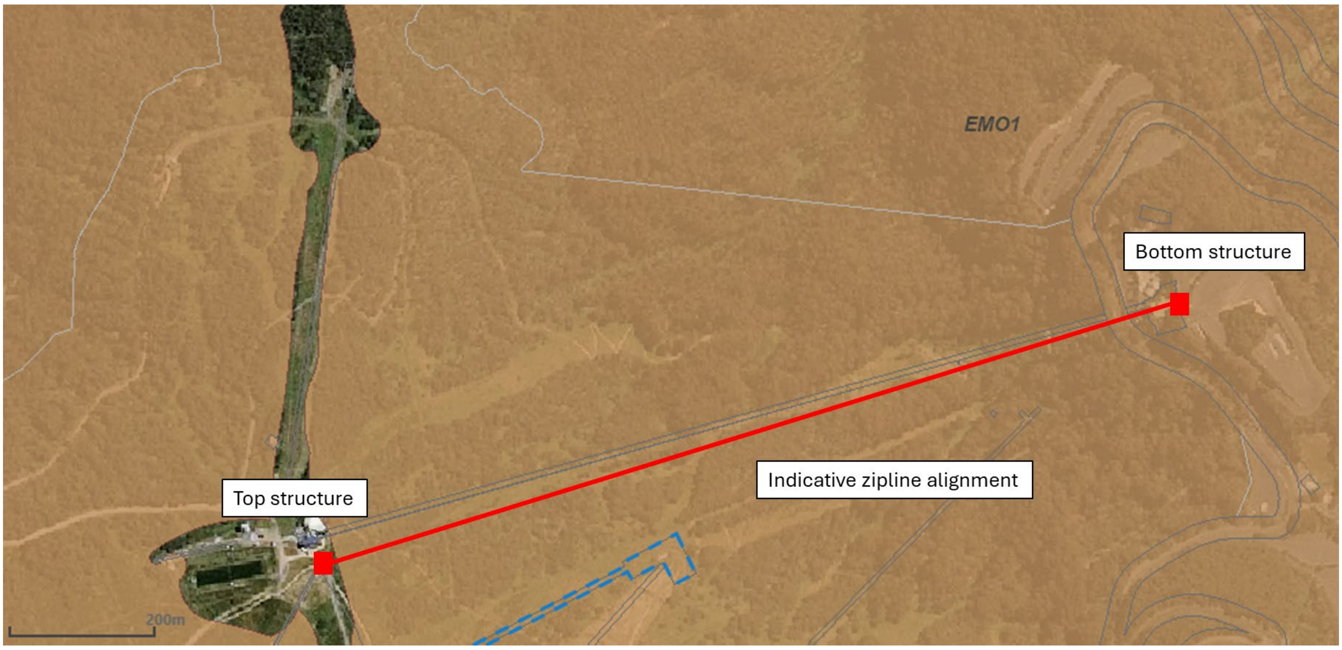


Figure 3 Location of proposed zipline structures relevant to the mapped EMO boundary.

Figure 4 *Left – location of zipline bottom structure. Right – crib wall at base of slope.*

Figure 5 *Dry wall downslope of proposed zipline landing structure. Minor blocks dislodged, some sections grouted with drainage pipes.*

2.3 Subsurface conditions

The subsurface conditions at the proposed bottom zipline structure is expected to be extremely weathered soils of granodiorite, with some possible un-engineered fill associated with cut and fill activities of the carpark and chairlift. This material is likely to be composed of weathered granodiorite corestones within a sandy matrix. Fill material is likely composed of similar material, locally sourced. Underlying this is expected to be granodiorite. The weathered profile of the granodiorite was observed at a cutting upslope in the carpark to be highly variable. Figure 8 illustrates the highly variable profile, where extremely weathered soils were observed to a depth of 8-10m, immediately adjacent to an outcrop with highly weathered granodiorite rock at surface. Shearing and deposition of quartz and iron in defects was observed.

The construction drawings provided to GHD indicate a 3 m deep concrete foundation and specifies embedment of the foundation slab 200 mm into weathered rock. The excavation is therefore expected to encounter extremely weathered material and possible fill, and weathered granodiorite rock. Given the highly variable weathering profile and reporting of granodiorite corestones in soil strength material, a deeper embedment may be required to ensure that the foundations are embedded in competent bedrock and not a localised corestone.

GHD is aware that Civil Test has undertaken some geotechnical investigations at the site, but have not been provided with the report.

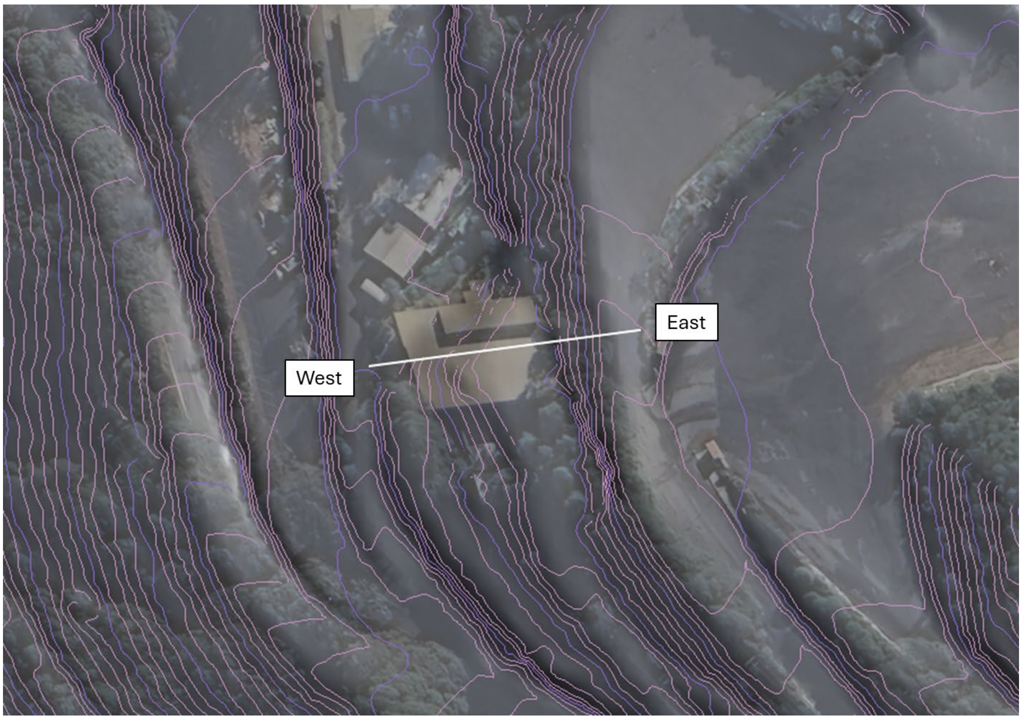


Figure 6 Aeiral photo overlain on LiDAR topography showing location of East-West cross section through proposed bottom zipline structure.

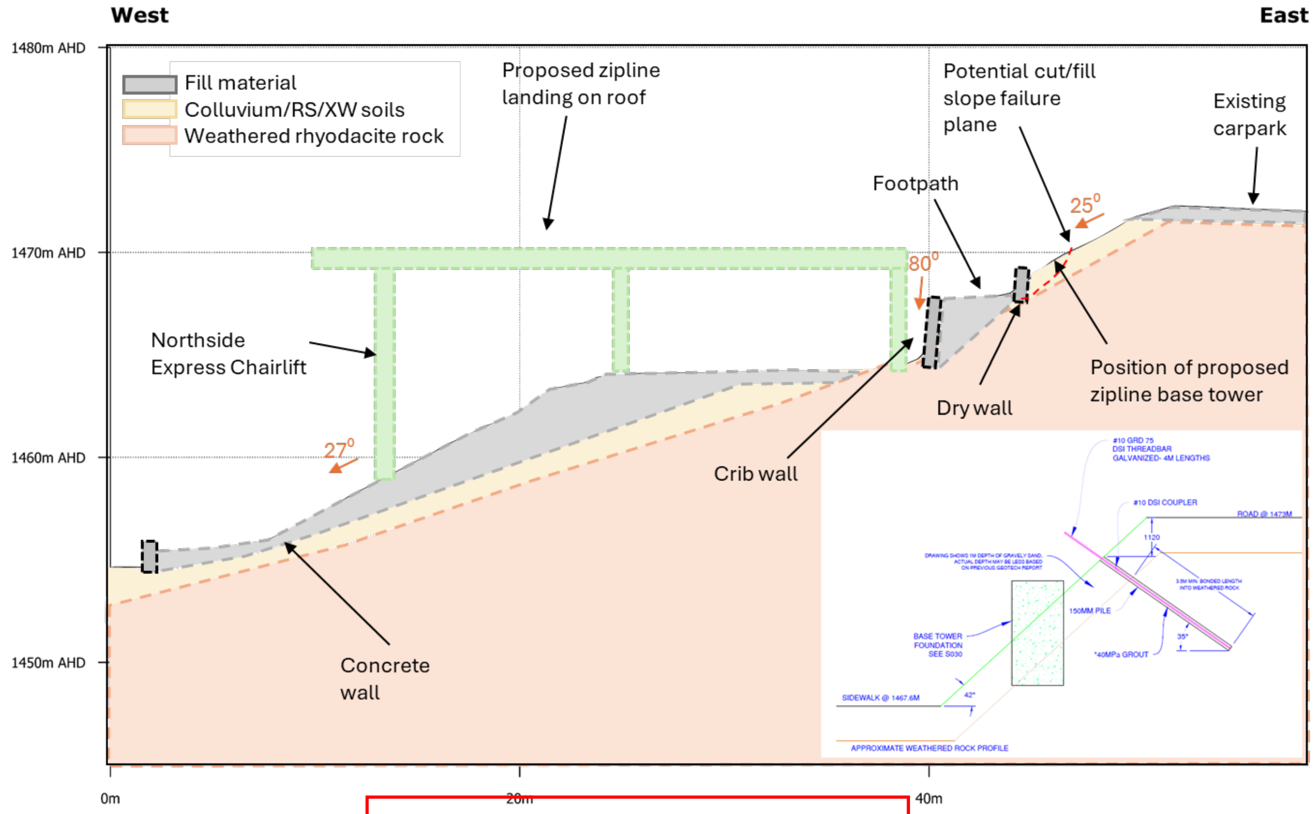


Figure 7 *East-West cross section through location of proposed bottom zipline structure, showing indicative existing structures and estimated sub-surface materials.*

Figure 8 *Variable weathering profile of the granodiorite observed at Horse Hill Carpark. Left – extremely weathered soil profile to ~10m. Right – variable profile of Highly weathered to extremely weathered soil profile.*

2.4 Geotechnical site hazards

Our assessment of the site (desktop and site visit) did not identify obvious evidence of possible or past landsliding on the slopes of the proposed zipline tower, nor immediately above or below the proposed tower location.

Based on our assessment, a single conceivable hazard has been identified at the proposed landing structure. The hazard is summarised in Table 3, and illustrated in Figure 7, and has been considered as part of the landslide risk assessment.

Table 3 Summary of identified hazard

Hazard	Location	Approximate length of slope hazard present	Characteristics
Failure of cut slope behind dry wall	Existing cut slope behind dry wall. Slope approximately ~25-30°. Located upslope of the Northside Express Chairlift, between the footpath and Horse Hill Carpark.	50 m	Some minor bulging of dry wall from soil creep, and dislodgement of blocks. Dry wall is 0.5-2.0 m high, stone wall with mortar and drainage holes in some sections. Appears non-engineered, and above fill slope is approximately ~25-30 and heavily vegetated with shrubs and trees. Likely to be typically small scale <5 m^3 (up to 2-3 m wide) but could be potentially larger where slope is >3 m height (e.g. temporary cut slopes during construction). Small volume, rapid shallow slide failure. Generally triggered by heavy rainfall, adverse groundwater conditions or poor construction techniques. No evidence of failures or instability on existing slope.

3. Landslide risk assessment

3.1 Landslide risk management framework

The 1998 Thredbo landslide, in which 18 people were killed, highlighted the challenges faced from building upon steep slopes and led to the development of the Australian Geomechanics Society Landslide Risk Management Guidelines, published in 2007 and now commonly referred to as AGS (2007). The suite of guidelines is recognised nationally (Australia) and internationally as world-leading practice. The reader of this report is encouraged to consult the freely available Landslide Risk Management guidelines (LRM) resources which can be accessed at: https://landsliderisk.org.

The 'Practice Note Guidelines for Landslide Risk Management' (AGS 2007c), provides technical guidance in relation to the processes and tasks undertaken by geotechnical practitioners who prepare LRM reports including appropriate methods and techniques. The Practice Note is a statement of what constitutes good practice by a competent practitioner for LRM, including defensible and up to date methodologies and provides guidance on the quality of assessment and reporting, including the outcomes to be achieved and how they are to be achieved.

The framework for landslide risk management is presented in Figure 9 and represents a framework widely used internationally.

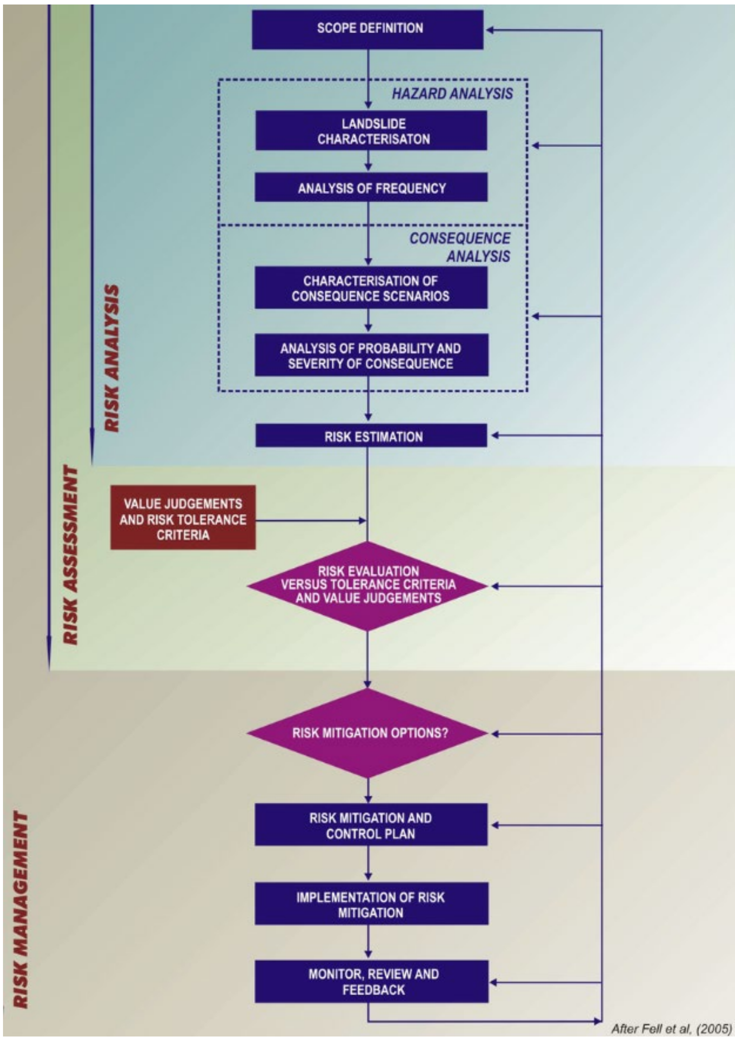


Figure 9 Framework for landslide risk management

3.2 Qualitative risk assessment

3.2.1 General

A qualitative assessment has been undertaken for the proposed upgrades. This is an assessment of the "Likelihood" and "Consequence" using descriptors provided in the Australian Geomechanics Society (AGS) Guidelines for Landslide Risk Management (2007).

The estimated likelihood and consequence have been used to derive a risk rating from the risk matrix presented in the AGS (2007) guidelines and reproduced below.

The report reviews and assesses the geotechnical risks identified at the proposed project site in accordance with Clause 44.01 (and its incorporate document) of the EMO and Australian Geomechanics, 'Practice Note Guidelines for Landslide Risk Management', Vol 42 No. 1, March 2007.

In accordance with Table 1 of the EMO Schedule 1 the maximum tolerable risk to property is as follows for the slope upgrades:

Table 4 Tolerable risk to property

New Development Type	Maximum Qualitative Tolerable Risk
Essential facilities, including medical facilities, emergency service facilities, designated emergency shelters and facilities, buildings and facilities containing toxic or explosive materials in sufficient quantity capable of causing hazardous conditions that extend beyond the property boundaries	Low
All other new development, including residential and commercial buildings	Moderate

Based on the above, a maximum qualitative tolerable risk of Moderate is required for the proposed development

3.2.2 Likelihood of failure

The likelihoods of occurrence of the identified hazards are presented below. These ratings are qualitative estimates of how likely a failure is without consideration of the *consequences* of this failure. The assessment of the likelihood of failure for the hazards has been determined based on the following factors:

– Observations made of existing site conditions
– Review of existing data
– Engineering geology experience

Appendix B contains details of the qualitative descriptors used for likelihood of failure from AGS (2007).

3.2.3 Consequence of failure

Consequences of the hazard identified above have been estimated based on observations of existing site conditions. Potential consequences of failure include:

– Impacts on the existing and proposed new infrastructure. Further detail provided in Table 6

For the hazards identified, the associated consequences to proposed alignments have been estimated based on the qualitative descriptors presented in AGS (2007) and included in Appendix B.

3.2.4 Risk rating for property

The following matrix (Table 5) has been used to rate the risk for each of the hazards identified, based on the estimated likelihood and consequence. The risk matrix is reproduced from AGS (2007). Risk ratings for each of the hazards identified are summarised in Table 6, along with recommended control measures to mitigate these risks where applicable.

Table 5 Risk matrix

		Consequences				
		Catastrophic	**Major**	**Medium**	**Minor**	**Insignificant**
Likelihood	Almost Certain	VH	VH	VH	H	M or L
	Likely	VH	VH	H	M	L
	Possible	VH	H	M	M	VL
	Unlikely	H	M	L	L	VL
	Rare	M	L	L	VL	VL
	Barely Credible	L	VL	VL	VL	VL

Table 6 Risk rating to property

Hazard	Location	Initial Risk Rating			Control Measures	Residual Risk Rating		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Existing Conditions								
Failure of cut slope behind dry wall <5 m³ (up to 2-3 m wide)	Existing cut slope behind dry wall. Between the footpath and Horse Hill Carpark.	**Unlikely** No failure observed of the ~40 year old structure. Some minor dislodging of blocks and minor bulging from soil creep. Drainage system visible.	**Minor** May require removal of material from footpath and slope, and reinstatement of a portion of the dry wall and slope. May damage wooden fence at edge of footpath, requiring repair. Not expected to cause damage to the chairlift infrastructure.	**Low**	N/A	N/A	N/A	N/A
During Construction								
Failure of cut slope behind dry wall <5 m³ (up to 2-3 m wide)	Existing cut slope behind dry wall. Between the footpath and Horse Hill Carpark.	**Possible** If construction works are undertaken following significant rainfall events. If temporary cut/fill batter angles are unsuitable with respect to subsurface conditions. If cut/fill slopes are excessively loaded beyond the design of the fill and dry wall.	**Minor** Failure may result in damage to earthworks related machinery and result in project delays. May require minor reinstatement of a portion of the slope and dry wall. May damage wooden fence at edge of footpath, requiring repair. Not expected to cause damage to the chairlift infrastructure.	**Medium**	Construction works should not take place following significant rainfall event. Surface water runoff to be controlled during construction works to avoid saturation of fill slope. Appropriate shoring and protection of the slope and dry wall during disturbance and loading of the slope. Appropriate design of temporary cut/fill batter angles with respect to sub-surface conditions.	**Unlikely** No failure observed of the ~40 year old structure. Some minor dislodging of blocks and minor bulging from soil creep. Drainage system visible.	**Minor** Failure may result in damage to earthworks related machinery and result in project delays. May require minor reinstatement of a portion of the slope and dry wall. May damage wooden fence at edge of footpath, requiring repair. Not expected to cause damage to the chairlift infrastructure.	**Low**
Post Construction								

Hazard	Location	Initial Risk Rating			Control Measures	Residual Risk Rating		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Failure of cut slope behind dry wall <5 m^3 (up to 2-3 m wide)	Existing cut slope behind dry wall. Between the footpath and Horse Hill Carpark.	**Possible** No failure observed of the ~40 year old structure. Some minor dislodging of blocks and minor bulging. Draining system visible. If cut/fill slopes are excessively loaded by the new zipline structure beyond the design of the fill and dry wall.	**Minor** May require minor stabilisation works for zipline base structure. Size of failure not expected to cause failure of the zipline base structure. May require removal of material from footpath and slope, and reinstatement of a portion of the dry wall and slope. May damage wooden fence at edge of footpath, requiring repair. Not expected to cause damage to the chairlift infrastructure.	**Medium**	Installation of suitable surface water/ground water drainage of fill slope. Appropriate design of any altered fill batter angles with respect to sub-surface conditions. Suitable embedment of infrastructure into competent rock. Suitable geotechnical investigation and stability assessment undertaken for excessive loading of slope.	**Unlikely** No failure observed of the ~40 year old structure. Some minor dislodging of blocks and minor bulging from soil creep. Drainage system visible.	**Minor** May require minor stabilisation works for zipline base structure. Size of failure not expected to cause failure of the zipline base structure. May require minor reinstatement of a portion of the slope and drywall. May damage wooden fence at edge of footpath, requiring repair. Not expected to cause damage to the chairlift infrastructure.	**Low**

3.3 Quantitative landslide risk assessment

3.3.1 Risk estimation methodology (static element at risk)

The individual risk to life is defined as the risk of fatality or injury to any identifiable (named) individual who lives within the zone impacted by the landslide; or who follows a particular pattern of life that might subject him or her to the consequences of the landslide. In this assessment static elements are assumed to be individuals working on the slopes during construction. The risk of 'loss-of-life' for static elements has been estimated using guidance provided in the AGS (2007c) guidelines. The risk of 'loss-of-life' to an individual is calculated from:

$$R_{(LoL)} = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(D:T)} \quad (1)$$

Where:

$R_{(LoL)}$ is the risk (annual probability of death of an individual).

$P_{(H)}$ is the annual probability of the landslide (event).

$P_{(S:H)}$ is the probability of spatial impact of the event impacting an individual taking into account the travel distance and travel direction given the event. For example, the probability of an individual in a building or on a construction site being impacted by a rockfall / landslide at a given location.

$P_{(T:S)}$ is the temporal spatial probability (e.g. of the building or location being occupied by the individual at the time of impact) given the spatial impact and allowing for the possibility of evacuation given there is warning of the event occurrence.

$V_{(D:T)}$ is the vulnerability of the individual (probability of loss of life of the individual given the impact).

3.3.2 Landslide risk assessment uncertainty

The process of risk assessment involves estimation of likelihood, consequence and risks based on available information for the study site. By its very nature, much of the data, including historical and current inventories, may be incomplete whilst an understanding of the triggering events has a degree of uncertainty attached to it. Judgement is required to estimate the nature and size of potential hazards, their frequency of occurrence and their impact on a variety of elements at risk. As these judgements are based on the knowledge, experience and understanding of the assessor, it is not unusual for different assessors to make different judgements about the level of risk.

While the basis for the judgements contained in this report are well documented, and the levels of risk considered to be good representations of reality, the accuracy and precision of the process should not be overestimated and should always be used in an appropriate manner in combination with risk management including mitigation and treatment options. Generally, the levels of likelihoods and risks should be thought of as being within a range of typically +/- half an order of magnitude.

3.3.3 Elements at risk

For the purpose of the risk assessment, we have based our assumptions of the elements at risk on information provided by the client (Buller Ski Lifts) as well as background knowledge of general slope construction methods and chairlift usage. The elements at risk are summarised in Table 7.

The patterns of use presented are an attempt at representing the main types of repetitive or "high exposure" patterns of use of the site. We acknowledge that specific individuals may have different patterns of use, however it is the intent that their exposure time would be equal or less.

This assessment identifies only static elements at risk, who's assumed usage patterns are used to estimate the average amount of time spent at the site in a year, or the temporal probability $P_{(T:S)}$ (Section 3.3.6).

The following assumptions have been made while estimating the usage patterns of the various elements at risk:

– The zipline will be operational for 11 months of the year (7 days per week in winter and 3 days per week in summer), totalling approximately 196 operational days per year, between the hours of 09:00 and 17:00.
– The zipline will be used for an average of 150 traverses per day (maximum 420). Assume an average queue time of 15 minutes, and a majority of users are children, therefore an adult non-user is queuing with them. Therefore 320 people queue per day for a period of 30 minutes.
– The Northside Chairlift will be operational when the zipline is operational, with approximately 350 rides per day in Summer (70 users averaging 5 runs each), and an average of 1200 rides per day in winter (peaking at 2800 rides per day). The chairlift services skiers, mountain bikers, and zipline users throughout the year.

Table 7 Summary of static elements at risk

Elements at risk	Comments
Construction worker	A construction worker will be at the site on average, 8 hours a day, 5 days a week for approximately 10 weeks. A total number of approximately 10 workers could be on the site at any one time. It is assumed a total of 10 workers will use the site during the construction period.
Visitor queuing for chairlift at base of slope	Assume an individual uses the chairlift 5 times per day, and waits in line for 15 minutes at each use.
Worker at chairlift	Stands at the base of the slope beyond the crib wall, for 8 hours a day, 5 days a week through the winter period, and 3 days a week through the summer period.

3.3.4 Landslide likelihood $P_{(H)}$

The probability of occurrence for landslide hazards at the site $P_{(H)}$ is based on a combination of GHD's site observations and a review of background information for the Mount Buller Resort including the Golder (2020) report. The Golder (2020) risk assessment estimated the 'baseline' likelihood for each hazard identified in the Mt Buller Resorts (Figure 10), noting the data available allowed for qualitative estimation of likelihood only. Note: the likelihood ratings relate to annual probability of occurrence as further described in the Golder report.

Consideration	Baseline Annual Probability of Hazard Occurring Mount Buller	
Natural shallow landslide	Unlikely	L4
Cuts in soil	Possible	L3
Cuts in rock	Unlikely	L4
Fills in soil	Likely to Possible	L2 - L3
Fills in rock	Rare	L5
Debris flows	Rare	L5 – L6
Rock falls	Rare	L5 – L6
Soil creep	Unlikely	L4

Figure 10 Baseline annual probability of hazard occurring estimated by Golders (2020) for each identified hazard in the Falls Creek resort

Given the lack of data with respect to previous failure events at the site, and the potential factors considered that may contribute to the likelihood of the hazard occurring, a more conservative likelihood estimate has been adopted as summarised in Table 8.

Table 8 Landslide hazard likelihood values

Hazard	Likelihood $P_{(H)}$
Shallow failures in cut slope behind dry wall	10^{-3}

3.3.5 Probability of spatial impact ($P_{(S:H)}$)

3.3.5.1 Partitioning of spatial impact

The AGS (2007) definition of spatial probability $P_{(S:H)}$ is described as the probability of spatial impact by the landslide on the element at risk, given the landslide occurs and taking into account the travel direction, travel distance or "reach" and the width of the event, as compared to the total width of the site. These factors are combined into a single spatial probability value as follows:

$$P_{(S:H)} = P_{(S':H'1)} \times P_{(S':H'2)} \times P_{(S':H'3)}$$

Where:

$P_{(S':H'1)}$ is the probability that a landslide hazard will travel in the direction of the element at risk. In this instance, given the hazards are assumed occur on the slopes adjacent to the proposed zipline base structure, this is assigned a value of 1 at all times.

$P_{(S':H'2)}$ is the probability that the landslide will reach the element at risk. The values are assigned in Table 9

$P_{(S':H'3)}$ is the probability that a landslide hazard occurs from the slopes adjacent to a specific section of the slope where a static element (i.e. individual) is located. This conditional probability is estimated using the ratio between the width of the hazard (i.e. landslide width) and the length of the slope potentially subject to that hazard. As discussed in Table 3 the hazard is only expected to occur along a portion of the slope. The values assigned are presented in Table 10.

Table 9 Estimated $P_{(S':H'2)}$ values

Element at risk	$P_{(S':H'2)}$	Comment
Construction worker	1.0	In the absence of specific records of previous events and the potential occurrence of these hazards as a result of construction, it is assumed if a hazard were to occur it would reach the zipline base structure/construction area. A value of 1 is assigned.
Worker at the Northside Express chairlift	0.5	Given the distance between the slope and the chairlift, and separation by fence, it is assumed that if a hazard were to occur, it would not necessarily reach the chairlift work area. A value of 0.5 is assigned.
Visitor waiting to use the chairlift	0.5	Given the distance between the slope and the chairlift, and separation by fence, it is assumed that if a hazard were to occur, it would not necessarily reach the chairlift work area. A value of 0.5 is assigned.

Table 10 Estimated $P_{(S':H'3)}$ values

Hazard	Approximate width of hazard	Approximate length of slope affected	$P_{(S':H'3)}$
Shallow failures in cut slope behind dry wall	3 m	50 m	0.06

3.3.6 Temporal probability ($P_{(T:S)}$)

The risk assessment process requires a number of judgements to be made in relation to the exposure to risks of individuals at the site. The exposure of individuals to hazards has been estimated based on information provided by Buller Ski Lifts and assumed patterns of use.

The static elements at risk considered are workers during construction, workers at the Northside Express chairlift, and visitors waiting in line to use the chairlift.

A summary of adopted temporal probabilities $P_{(T:S)}$ are presented in Table 11.

Table 11 Temporal probability values

Element at risk	Temporal probability ($P_{(T:S)}$)	Comment
Construction worker	0.046	Assume for a construction worker: - On average 8 hours a day at the site - 5 days a week for approximately 10 weeks
Worker at the Northside Express chairlift	0.179	Assume for a full-time worker: - On average 8 hours a day at the chairlift - 5 days a week (112 days) for winter usage - 3 days a week (84 days) for summer usage
Visitor waiting to use the chairlift	0.001	Assume for a regular user: - Waits in line for 15 minutes per use - Uses the lift 5 times per day - Visits for a week a year (7 days)

3.3.7 Vulnerability ($V_{(D:T)}$)

The AGS definition of vulnerability is "the probability that a particular life (the element at risk) will be lost, given the person(s) is affected by the landslide".

A summary of adopted vulnerability values $V_{(D:T)}$ are presented in Table 12.

Table 12 Vulnerability values

Element at risk	Hazard	Vulnerability ($V_{(D:T)}$)	Comment
Static element - construction workers	Shallow failures in cut slope behind dry wall	0.7	Person standing immediately downslope or on the slope during construction, impacted by mixture of soil and rock fill material. May sustain serious or life-threatening injuries. Potentially little to no opportunity to move away from the hazard.
Static element – chairlift workers	Shallow failures in cut slope behind dry wall	0.2	Person standing below crib wall, may be impacted by runout material that breaches the wooden fence. Expect some opportunity to step back away from hazard.
Static element – visitors waiting in line	Shallow failures in cut slope behind dry wall	0.2	Person standing below crib wall, may be impacted by runout material that breaches the wooden fence. Expect some opportunity to step back away from hazard.

3.3.8 Risk evaluation

3.3.8.1 Individual risk

The risk estimation results for the hazards assessed in this report are presented in Table 13. The main objectives of risk evaluation are typically to compare the assessed risk to risk levels that are acceptable or tolerable to the community, and therefore to decide whether to accept, tolerate or treat the risks and to set priorities for remediation.

Schedule 1 to clause 44.01 of the EMO states that risk from a landslip needs to achieve a Tolerable Risk. The maximum tolerable risk is defined: "For loss of life, the person(s) most at risk, is taken as having a probability of no greater than 10^{-5} (1:100,000) per year calculated in accordance with the *Australian Geomechanics Society Practice Note Guidelines for Landslide Risk Management*".

It is important to distinguish between ‘acceptable risks’ and ‘tolerable risks’. AGS (2007c) states that tolerable risks are risks within a range that society can live with so as to secure certain benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if practicable. Acceptable risks are risks which everyone affected by is prepared to accept. Acceptable risks are usually considered to be one order of magnitude lower than tolerable risks.

Table 13 provides a risk evaluation against the AGS tolerable risk criteria for static elements, for a number of different use scenarios. All scenarios considered fall into the “acceptable” risk category.

Table 13 Static elements at risk (AGS (2007))

Hazard	Element at risk	Annual probability of landslide hazard	Spatial probability			Temporal spatial probability	Vulnerability of individual impacted	Risk, individual most at risk	Risk evaluation
		$P_{(H)}$	$P_{(S':H'1)}$	$P_{(S':H'2)}$	$P_{(S':H'3)}$	$P_{(T:S)}$	$V_{(D:T)}$	$R_{(LoL)}$	
Shallow failures in cut slope behind dry wall	Construction workers	1×10^{-3}	1	1	0.06	0.046	0.7	1.9×10^{-6}	Acceptable
Shallow failures in cut slope behind dry wall	Chairlift workers	1×10^{-3}	1	0.5	0.06	0.179	0.2	1.1×10^{-6}	Acceptable
Shallow failures in cut slope behind dry wall	Visitors waiting in line	1×10^{-3}	1	0.5	0.06	0.001	0.2	6.0×10^{-9}	Acceptable

[1] The risk of this hazard has not been assessed as it is not considered relevant to the elements at risk.
*Assessment uses the AGS 2007 suggested risk evaluation criteria.

3.3.8.2 Societal risk

AGS (2007c) does not provide guidance for the estimation or "tolerability" of risk to loss of life from a societal perspective. NPWS (2023) provides a methodology for assessing societal risk and recommends that these risks be plotted in the form of an F-N plot, where F is the cumulative risk to society of the loss of "N" or more lives. It also provides guidance on risk evaluation criteria, with risk assigned to one of three categories: acceptable, tolerable and unacceptable. However rather than the thresholds being static values, they vary with N, with the rationale for this being that generally, a society's tolerance for any given risk event is inversely proportional to the number of fatalities it is likely to cause. The following equations are used to calculate both F and N.

Static elements at risk:

$$F = P_{(H)} \times P_{(S:H)}$$

Where $P_{(H)}$ and $P_{(S:H)}$ are as outlined in Table 13.

$$N = e_s \times P_{(T:S)} \times V_{(D:T)}$$

Where:

e_s is the maximum number of people that could be present where the hazard occurs, usually the maximum number of people that can occupy the element at risk, for example maximum number of people in a building. $P_{(T:S)}$ and $V_{(D:T)}$ are as outlined in Table 13.

The adopted N values for this assessment are presented in Table 14. The F-N chart for the elements at risk for each hazard are shown on Figure 11. The estimated societal risks for all elements at risk are within the "acceptable" or "tolerable" categories, as defined by NPWS (2023).

Table 14 Adopted N values

Element at risk	Hazard	F value	N fatality value	Comments/assumptions	Societal risk evaluation
Construction workers	Shallow failures in cut slope behind dry wall	6×10^{-5}	0.064	Based on the estimated size and nature of the hazard and assuming 2 construction workers could be stood next to one another at any time.	Tolerable
Chairlift workers	Shallow failures in cut slope behind dry wall	3×10^{-5}	0.036	Based on the estimated size and nature of the hazard and assuming a single chairlift worker will be standing in close proximity to the hazard	Acceptable
Visitors waiting in line	Shallow failures in cut slope behind dry wall	3×10^{-5}	6.0×10^{-4}	Based on the estimated size and nature of the hazard and assuming visitors waiting in line will be standing next to each other, possibly impacting 3 people.	Acceptable

*Assessment uses the NPWS (2023) suggested societal risk evaluation criteria.

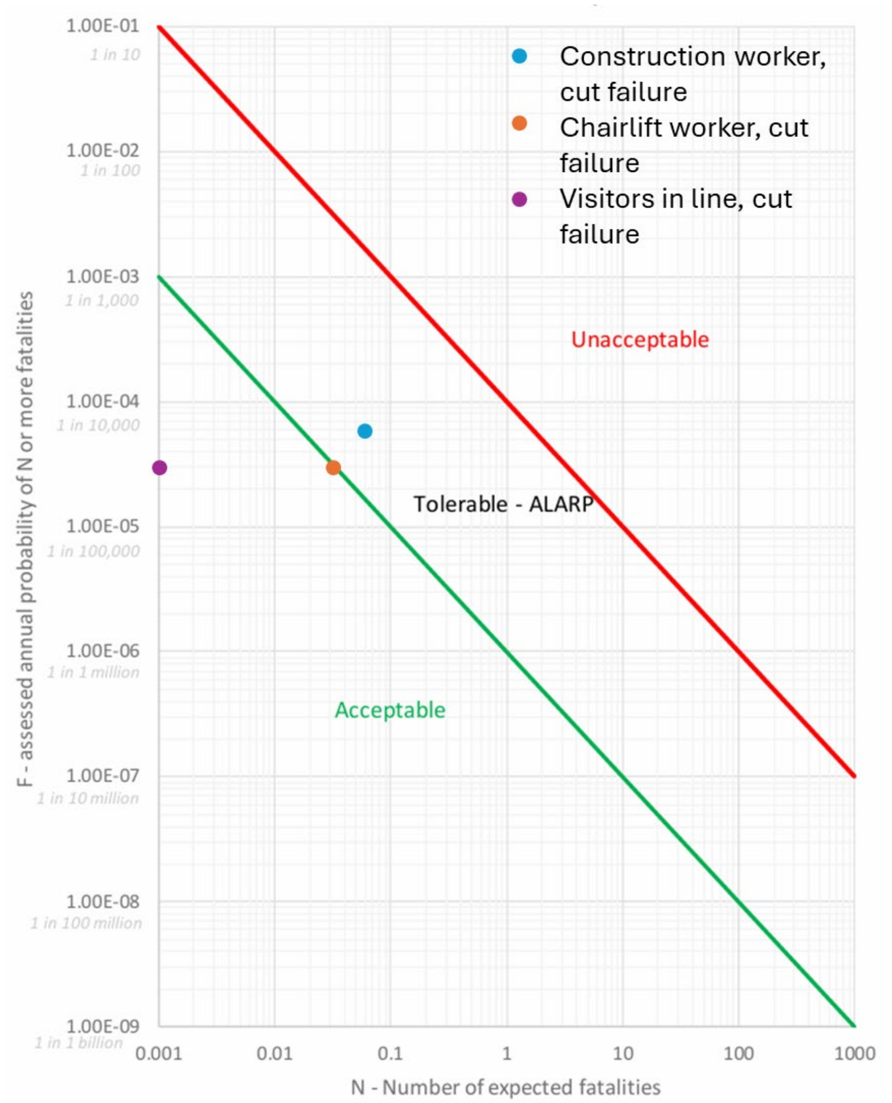


Figure 11 *F-N plot for static elements at risk*

4. Summary and recommendations

Based on the results of our desktop review and site assessment, a single credible landslide hazard has been identified to be associated with the proposed zipline base tower infrastructure and the surrounding slopes. The risk associated with the identified hazard to both the zipline infrastructure (risk to property) and frequent users of the area including staff and visitors (risk to life) has been estimated in line with Clause 44.01 (and its incorporate document) of the Erosion Management Overlay, adopting guidance based on Australian Geomechanics, 'Practice Note Guidelines for Landslide Risk Management', Vol 42 No. 1, March 2007 and New South Wales Parks and Wildlife Service (NPWS) "Guidelines for Quantitative Risk to Life Calculations for Landslides" (NPWS, 2023).

Low to moderate risks were evaluated for the qualitative risk assessment (risk to property) and "acceptable" or "tolerable" risks were evaluated for the quantitative risk assessment (risk to life), which meet the criteria outlined in the EMO. The societal risk evaluation indicates risks that are "tolerable" during construction phase and "acceptable" during on-going usage.

Although the estimated risks associated with the landslide hazard are considered acceptable/tolerable, due to inherent uncertainties in our assessment and the known historical site conditions, it would be considered good practice to reduce and manage these risks by implementing some the risk control measures discussed to reduce the risks to as low as reasonably practicable including:

- Undertake a suitable geotechnical assessment and stability analysis for excessive loads prior to commencing construction works, and ensure design and construction methodology is consistent with the outcomes.
- Geotechnical sub-surface investigations should target the position of the proposed base and launch towers, to determine the weathering profile of the granodiorite and ensure that the foundation slab and tie-backs are embedded a suitable distance into competent rock.
- Employ good development practices for building on hillsides as outlined in AGS (2007) Landslide Risk Management. An extract from this AGS guide is provided in Appendix A.
- Construction recommendations:
  - Geotechnical advice should be sought throughout the construction to provide assessment on the stability of batter excavations for tower foundations (particularly where batter heights are >2 m and batter angles are >2H:1V).
  - Ensure construction does not take place during or immediately after heavy rainfall events. Ensure surface water is channelled away from the project area and is not able to flow unmitigated across exposed slope faces.
  - Where excessive fill (>3 m) is to be placed (such as against tower foundation slabs), a geotechnical assessment of the foundation conditions should be undertaken to assess suitability.
  - Earthworks design (including proposed method to tie into foundation) and specification documentation should be completed prior to construction which should be reviewed by a qualified geotechnical practitioner to determine its suitability for the proposed end use.
  - Specific safe work statements for construction including geotechnical inspections of the excavated materials must be included during the full period of the construction
  - If site won material is proposed for use in the earthworks, an assessment should be undertaken to determine its suitability for use with respect to the specification.
  - Loose boulders should be removed during construction and should not be left near slope crests or on moderate to steep slopes above trail and road infrastructure.
  - Retention or replacement of vegetation on the slope to improve slope stability.
  - Retention or installation of suitable sub-surface drainage behind the retaining wall to prevent saturation of slope inducing instability.

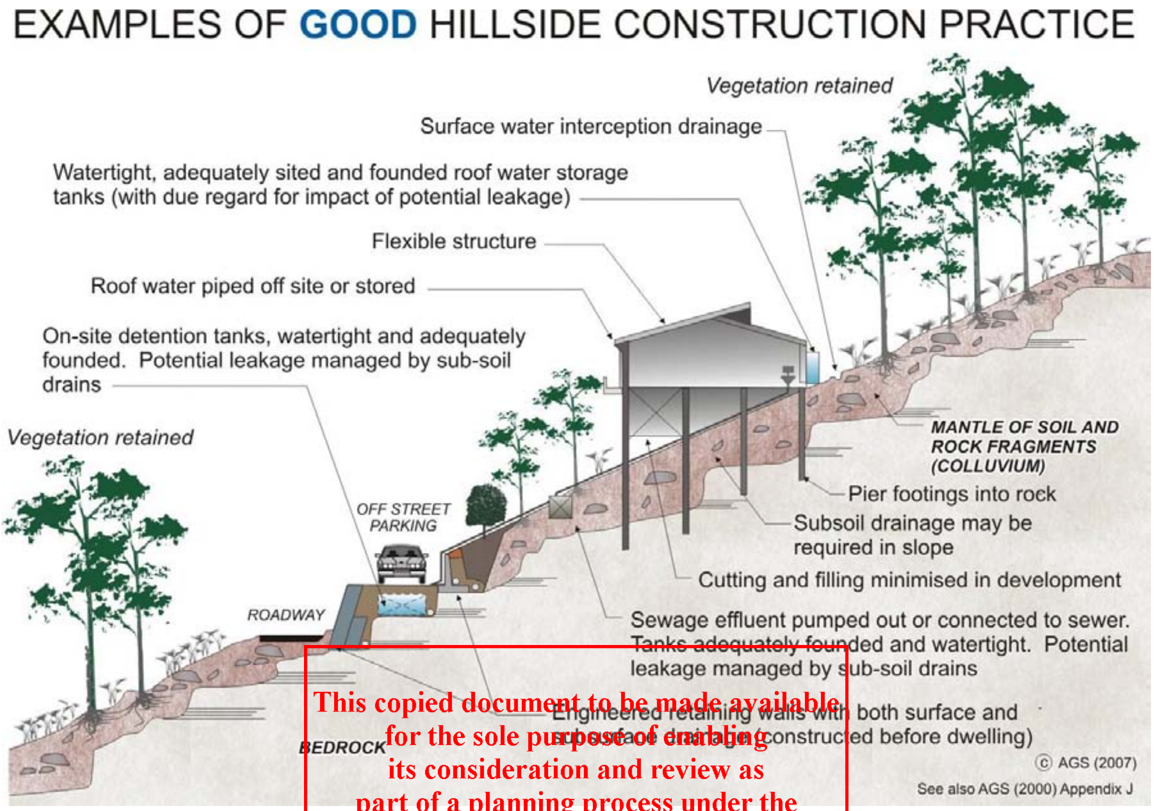
Appendix A

Good Hillside Practise (Extract from AGS (2007) Landslide Risk Management)

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

HILLSIDE CONSTRUCTION PRACTICE

Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.



WHY ARE THESE PRACTICES GOOD?

Roadways and parking areas - are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

Cuttings - are supported by retaining walls (GeoGuide LR6).

Retaining walls - are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that in level ground. Retaining walls must be designed taking these forces into account.

Sewage - whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

Surface water - from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfil the same purpose (GeoGuide LR5).

Surface loads - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

Flexible structures - have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

ADOPT GOOD PRACTICE ON HILLSIDE SITES

Appendix B

Qualitative terminology for use in assessing risk to property

APPENDIX C: LANDSLIDE RISK ASSESSMENT

QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	**Notional Boundary**					
10^{-1}	$5x10^{-2}$	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	$5x10^{-3}$	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	$5x10^{-4}$	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	$5x10^{-5}$	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	$5x10^{-6}$	100,000 years	200,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10^{-6}		1,000,000 years		The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not *vice versa*.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage		Description	Descriptor	Level
Indicative Value	**Notional Boundary**			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%	40%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	10%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	1%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%		Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.

(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.

(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not vice versa

APPENDIX C: – QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A – ALMOST CERTAIN	10^{-1}	VH	VH	VH	H	M or **L** (5)
B - LIKELY	10^{-2}	VH	VH	H	M	**L**
C - POSSIBLE	10^{-3}	VH	H	M	M	**VL**
D - UNLIKELY	10^{-4}	H	M	**L**	**L**	**VL**
E - RARE	10^{-5}	M	**L**	**L**	**VL**	**VL**
F - BARELY CREDIBLE	10^{-6}	**L**	**VL**	**VL**	**VL**	**VL**

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.

(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		Example Implications (7)
VH	VERY HIGH RISK	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.
H	HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	MODERATE RISK	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L	LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.

Appendix C

Geotechnical Declaration and Verification (Form A)

FORM	A	Geotechnical Declaration and Verification Development Application

Office Use Only

Yarra Ranges Council

To be submitted with planning application. It must accompany the Geotechnical Assessment and/or Landslip Risk Assessment.
This form is essential to verify that the Geotechnical Assessment and/or Landslip Risk Assessment has been prepared in accordance with Cl 44.01 of the Yarra Ranges Planning Scheme and that the author of the Assessment/s is a geotechnical engineer or engineering geologist as defined by this clause.

Section 1 Related Application

Planning Application Number	TBC
Site Address	Mount Buller Alpine Resorts
Applicant	Buller Ski Lifts

Section 2 Geotechnical Assessment and/or Landslip Risk Assessment

Details	Report Title:	Proposed Zipline, Geotechnical Landslide Risk Assessment		
	Author's Company/ Organisation Name:	GHD	Report Reference No:	
	Author:	C. Peryer	Dated:	23 / 03 / 2026

Section 3 Checklist

Geotechnical Requirements (Tick as appropriate, either Yes or No)

The following checklist covers the minimum requirements to be addressed in a Geotechnical Assessment and/or Landslip Risk Assessment. The report must also cover any additional matters required by Clause44.01. This checklist must accompany each report. Each item is to be cross-referenced to the section or page of the Geotechnical Assessment and/or Landslip Risk Assessment which addresses that item.

Yes	No	
X		A review of readily available history of slope instability in the site or related land as per <Section 1.5
X		An assessment of the risk posed by all reasonably identifiable geotechnical hazards as per <Section 2.4, Section 3
X		Plans and sections of the site and related land as per <Section 2.3
X		Presentation of a geological model as per <Section 2.3
X		Photographs and/or drawings of the site as per <Section 2.2
X		A conclusion as to whether the site is suitable for the development proposed to be carried out either conditionally or unconditionally as per <Section 4
		If any items above are ticked No, an explanation is to be included in the report to justify why. <*Add reference*>

Is the approval subject to recommendations and conditions relevant to?:

Yes	No	
X		Selection and construction of footing systems,
X		Earthworks,
X		Surface and sub surface drainage,
	X	Recommendations for the selection of structural systems consistent with the geotechnical assessment of the risk,
	X	Any conditions that may be required for the ongoing mitigation and maintenance of the site and the proposal, from a geotechnical viewpoint,
	X	Highlighting and detailing the inspection regime to provide the <PCA> and builder with adequate notification for all necessary inspections.
	X	State Design life adopted: Years

Note: <Add reference>: Add in the relevant section or page number of the listed Geotechnical Assessment and/or Landslip Risk Assessment which addresses each item.

FORM A

Geotechnical Declaration and Verification Development Application

Section 4 List of Drawings referenced in Geotechnical Assessment and/or Landslip Risk Assessment

Design Documents

Description	Plan or Document No.	Revision or Version No.	Date	Author
Mt Buller Zipline Skyline Package	A001	Rev0	04-03-2026	SCD
Mt Buller Zipline Skyline Package	A002	Rev0	04-03-2026	SCD
Mt Buller Zipline Skyline Package	S010	Rev0	28-01-2026	SCD
Mt Buller Zipline Skyline Package	S020	Rev0	28-01-2026	SCD
Mt Buller Zipline Skyline Package	S030	Rev0	28-01-2026	SCD
Mt Buller Zipline Skyline Package	S040	Rev0	20-02-2026	SCD
Mt Buller Zipline Skyline Package	S050	Rev0	28-01-2026	SCD

Section 5 Declaration

Declaration (Tick all that apply)

I am a geotechnical engineer or engineering geologist as defined by the Yarra Ranges Planning Scheme and on behalf of the company below,:

Yes		
[X]	No [ ]	I am aware that the Geotechnical Assessment and/or Landslip Risk Assessment I have either prepared or am technically verifying (referenced above) is to be submitted in a support of a planning application for the proposed development site (referenced above) and its findings will be relied upon by the Shire of Yarra Ranges in determining the planning application.
[X]	N/A [ ]	I prepared the Geotechnical Assessment and/or Landslip Risk Assessment referenced above in accordance with the Yarra Ranges Planning Scheme. and the AGS Guidelines 2007 as defined in the planning scheme.
[X]	N/A [ ]	I technically verify that the Geotechnical Assessment and/or Landslip Risk Assessment referenced above has been prepared in accordance with the AGS (2007c) as amended and the Yarra Ranges Planning Scheme .
[X]	No [ ] N/A [ ]	I technically verify that the Landslip Risk Assessment prepared for the planning application for the site confirms the land can meet the tolerable risk criteria specified in the schedule to Clause 44.01 of the Yarra Ranges Planning Scheme taking into account the total development and site disturbances proposed.

Section 6 Geotechnical Engineer or Engineering Geologist Details

Company/ Organisation Name	GHD	
Name (Company Representative)	Surname: Hunter	Dr /Mr /Mrs /Ms /Miss: Mr
	Given Names: Andrew	
	Chartered Professional Status: RPGeo	Registration No:
Signature	A. Hunter	Dated: 24 / 03 / 2026

REGISTERED PROFESSIONAL GEOSCIENTIST AUSTRALIAN INSTITUTE OF GEOSCIENTISTS ANDREW HUNTER RPGeo No: 10078

Reference: AGS (2007c) *"Practice Note Guidelines for Landslide Risk Management"*. Australian Geomechanics Society, Australian Geomechanics, V42, .N1, March 2007.

Note: N/A = Not Applicable.