



Redwin Investments

**Proposed Woodridge Lodge
Lot 619 DP 1118588 Mountain Drive,
Thredbo NSW**

Geotechnical Investigation

Our ref: 4291-1-G1 Rev 1
3 November 2021

Your trusted engineering professionals

Form 1 – Declaration and certification made by geotechnical engineer or engineering geologist in a geotechnical report.

DA Number: _____

To be submitted with a development application

You can use Form 1 to verify that the author of a geotechnical report is a geotechnical engineer or engineering geologist as defined by the Department of Planning & Environment (DP&E) Geotechnical Policy. Alternatively, where a geotechnical report has been prepared by a professional person not recognised by DP&E Geotechnical Policy, then Form 1 may be used as technical verification of the geotechnical report if signed by a geotechnical engineer or engineering geologist as defined by the DP&E Geotechnical Policy.

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

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

1. Declaration made by geotechnical engineer or engineering geologist as part of a geotechnical report

I,
Mr Ms Mrs Dr Other

First Name

Family Name

Mark

Bartel

OF

Company/organisation

AssetGeoEnviro

on this the 3rd day of November 2021

certify that I am a geotechnical engineer or engineering geologist as defined by the "Policy" and I (tick appropriate box)

- prepared the geotechnical report referenced below in accordance with the AGS 2000 and DP&E Geotechnical Policy – Kosciuszko Alpine Resorts.
- am willing to technically verify that the Geotechnical Report referenced below has been prepared in accordance the AGS 2000 and DP&E Geotechnical Policy – Kosciuszko Alpine Resorts.

2. Geotechnical Report Details

Report Title

Proposed Woodridge Lodge, Geotechnical Investigation, ref: 4291-1-G1 Rev 1

Author

Mark Bartel

Dated

3 November 2021

DA Site Address

Lot 619 DP 1118588 Mountain Drive, Thredbo NSW

DA Applicant

Redwin Investments

I am aware that the Geotechnical Report I have either prepared or am technically verifying, (referenced above) is to be submitted in support of a development application for the proposed development site (referenced above), and it's findings will be relied upon by the Consent Authority in determining the development application.

3. Checklist of essential requirements to be contained in a geotechnical risk assessment report to be submitted with a development application

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk Management Report. This checklist is to accompany the report.

Please tick appropriate box

- Risk assessment of all identifiable geotechnical hazards in accordance with AGS 2000, as per 6.1 (a) of the policy.
- Site plans with key hazards identified and other information as per 6.1 (b)
- Details of site investigation and inspections as per 6.1 (c)
- Photographs and/or drawings of the site as per 6.1 (d)
- Presentation of geotechnical model as per 6.1 (e)
- A specific conclusion as to whether the site is suitable for the development proposed on the above site, if applicable, subject to the following conditions;
 - Conditions to be provided to establish design parameters,
 - Conditions to be incorporated into the detailed design to be submitted for the construction certificate,
 - Conditions applying to the construction phase,
 - Conditions relating to ongoing management of the site/structure.

4. Signatures

Signature

Mark Bartel

Chartered professional status

CPEng 35641 NER (Civil)

Name

Mark Bartel

Date

14 April 2021

5. Contact details

Department of Planning & Environment
Alpine Resorts Team
Shop 5A, 19 Snowy River Avenue
PO Box 36, JINDABYNE 2627
Telephone: 02 6456 1733
Facsimile: 02 6456 1736
Email: alpineresorts@planning.nsw.gov.au

Document Authorisation

Proposed Woodridge Lodge Lot 619 DP 1118588 Mountain Drive, Thredbo NSW Geotechnical Investigation

Prepared for Redwin Investments

Our ref: 4291-1-G1 REV 1
3 November 2021

For and on behalf of
AssetGeoEnviro

Mark Bartel

Mark Bartel

BE, MEngSc, GMQ, CPEng, RPEQ/NER(Civil), APEC IntPE(Aus)
Managing Director | Senior Principal Geotechnical Engineer

Document Control

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Suite 2.06 / 56 Delhi Road
North Ryde NSW 2113
02 9878 6005
assetgeoenviro.com.au

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1. Introduction

1.1 General

This report presents the results of a geotechnical investigation for the above project. The investigation was commissioned on 12 March 2021 by Mr Andrew Redwin of Redwin Investments. The work was carried out in accordance with the email proposal by AssetGeoEnviro (Asset) dated 12 March 2021, reference 4291-1-P1.

Drawings supplied to us for this investigation included:

- Architectural Plans (prepared by: Collins Pennington Architects); project: Woodridge Lodge; drawings: DA11 – Lower Floor Plan, DA12–Upper Floor Plan, and DA30 – Sections; Issue: DA1; dated: 18 May 2021).
- Contour and Detail Survey (prepared by: Kleven Spain Survey Consultants; dwg: CB2255-1; dated: 15 November 2020).

We understand that the project involves demolition of the existing two-storey lodge and construction of a new two-storey lodge on a slightly larger footprint. Excavation will be required for new footings and buried services and is anticipated to be relatively shallow (less than about 1m depth). A terrace is proposed over the garage at the front of the lodge, with earth fill and retaining walls up to about 2m high adjacent to the garage entry and tapering down to the north and south as indicated in the 3D views.

1.2 Scope of Work

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

- Landslide risk assessment as per AGS 2007¹.
- Key geotechnical constraints to the development.
- Excavation conditions, methodology and monitoring.
- Subgrade preparation and earthworks.
- Suitable foundation options.
- Allowable bearing pressure.
- Maximum allowable permanent and temporary batter slopes.

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

- A review of existing regional maps and reports relevant to the site held within our files.
- Visual observations of surface features.
- Subsurface investigation at three locations to assess the nature and consistency of subsurface soils.
- Engineering assessment and reporting.

¹ Landslide Risk Management, Australian Geomechanics, Vol 42, No. 1, March 2007.

This report must be read in conjunction with the attached “Important Information about your Geotechnical Report” in Appendix A. 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. Compliance with Geotechnical Policy

The following table indicates how this report addresses the elements in Section 4.1 of the Department of Planning Industry & Environment’s Geotechnical Policy (Policy):

Paragraph	Element	Addressed in Report
4.1 (a)	An assessment of the risk posed by all reasonably identifiable geotechnical hazards which have the potential to either individually or cumulatively impact upon people or property upon the site or related land to the proposed development in accordance with the guidelines set out in ‘Landslide Risk Management Concepts and Guidelines’ first published in the Australian Geomechanics Journal, Vol. 35 No.1, March 2000 (guidelines).	Risk assessment has been carried out by a highly experienced geotechnical practitioner and outlined in Tables A and B attached to this report.
4.1 (b)	Plans and sections of the site and related land from survey and field measurements with contours and key features identified, including the locations of the proposed development, buildings/structures on both the subject site and adjoining site, stormwater drainage, sub-surface drainage, water supply and sewerage pipelines, trees, and other identifiable geotechnical hazards.	Figure 1 – Site Locality Plan Figure 2 – Test Locations Figure 3 – Interpreted Section A–A
4.1 (c)	Details of all site inspections and site investigations and any other information used in preparation of the geotechnical report. A site inspection is required in all cases. Site investigation may require subsurface investigation; appropriate investigation may involve boreholes and/or test pit excavations or other methods necessary to adequately assess the geotechnical/geological model for the site. At Thredbo, reference may be made to the suite of existing geotechnical data and regional studies held by Kosciuszko Thredbo Pty Ltd, as part of the information to be used in assessing the site. Where similar information data exists for the other Kosciuszko Ski Resorts then this information may be similarly used in assessing the site.	Borehole and DCP logs provided in Appendix B, including Soil & Rock Explanation Sheets.
4.1 (d)	Photographs and/or drawings of the site and related land adequately illustrating all geotechnical features referred to in the geotechnical report, as well as the locations of the proposed development.	Photos included in Appendix C. Figure 1 – Site Locality Plan Figure 2 – Test Locations Figure 3 – Interpreted Section A–A

4.1 (e)	Presentation of a geological model of the site and related land showing the proposed development, including an analysis of sub-surface conditions, taking into account thickness of the topsoil, colluvium and residual soil layers, depth to underlying bedrock, and the location and depth of groundwater.	Refer Section 6.
4.1 (f)	A conclusion as to whether the site is suitable for the development proposed to be carried out either conditionally or unconditionally.	Refer Section 8.
4.1 (f) (i), (ii), (iii)	Conditions to establish the design parameters, conditions applying to the detail design to be undertaken for the construction certificate, conditions applying to the construction phase, and conditions regarding ongoing management of the site/structure.	Refer Section 9. A qualified and experienced Geotechnical Engineer is to be engaged to provide further input and review during the design development; including site visits during construction to verify the site conditions and provide advice where conditions vary from those assumed in this report. We herewith confirm that inspection may also be carried out by suitably experienced site personnel under direction of an experienced geotechnical engineer. No specific conditions are identified for ongoing management of the site / structure.

3. Regional Topography

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

The site lies within an area designated as “G” as defined in the maps accompanying DIPNR’s “Geotechnical Policy – Kosciuszko Alpine Resorts”, November 2003, and therefore a geotechnical report is required to accompany the development application as per the requirements of the Geotechnical Policy.

4. Site Description

The site is located within Thredbo, at the northern end of Valley Close as shown in Figure 1.

The local topography comprises very gently sloping terrain on the northern flank of the Thredbo River. Ground slopes over the alignment are generally less than about 5° to the south east towards the Thredbo River, and locally steeper (estimated up to about 30°, heavily vegetated) for a local creek feeding into

Merritts Creek which is located about 50m to the north of the site and flows in an easterly direction towards the Thredbo River.

The existing lodge (see Photos 1 to 8) is located at the toe of a moderate slope of about 10 to 20°, and the rear of the lodge has been cut into the slope by about 1m to 1.2m height, supported by an uncemented granite rock wall which was in overall good condition at the time of the inspection. The lodge itself was also observed to be in overall good condition at the time of the inspection.

The subsurface conditions appear to comprise a mixture of slope wash and colluvial soils derived from weathered granite, overlying residual soils and variably weathered granite.

Scattered cobbles and granite boulders are present across the landform (see Photos 2 and 3), and in the banks of local creek to the north of the site (see Photos 9 and 10).

There were no signs of slope instability or slope movement during our previous inspection on 8th April 2017 and the current fieldwork.

Groundwater conditions are unknown, but it is expected that intermittent groundwater would be present within the soils overlying the weathered granite. The local creek to the north of the site was dry at the time of the fieldwork.

5. Fieldwork

The fieldwork was undertaken on 16 March 2021 under the full-time supervision of a Senior Principal Geotechnical Engineer from Asset and included invasive investigation at three locations.

The test locations are shown in the attached Figure 2 and were set out by our Senior Principal Geotechnical Engineer relative to existing site features.

The invasive investigation included conducting Dynamic Cone Penetrometer soundings and hand augering to refusal at depths ranging from 0.3m to 0.75m.

Engineering logs are provided in Appendix B together with their explanatory notes.

6. Subsurface Conditions

6.1 Geology

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

6.2 Subsurface Conditions

The boreholes and DCP testing, and site observations, indicated a relatively consistent subsurface profile as indicated in Table 1. An interpreted section is provided in Figure 3. For a detailed description of the subsurface conditions, refer the attached engineering logs and explanatory notes. For specific design input, reference should be made to the logs and/or the specific test results, in place of the following summary and the interpreted section.

Table 1 - Generalised Site Geotechnical Model

Unit	Origin	Description	Depth to Top of Unit ¹ (m)	Unit Thickness ¹ (m)
1	Topsoil	Silty SAND, fine to medium grained, grey, some organic matter, moist, very dense	0.0	0.1
2	Slope-wash	Clayey SAND, fine to medium grained, grey/brown, moist, loose to medium dense to very dense	0.1	0.0 to 0.6
3	Residual	Clayey SAND, fine to medium grained, grey/brown, moist, very dense	0.1 to 0.7	0.1 to 0.4
4	Boulders	GRANITE	0.3 to 0.75	Not established

Notes:

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

6.3 Groundwater

Groundwater was not observed in the boreholes during excavation or the time they remained open. Merritts Creek was observed to be dry at the time of the fieldwork.

7. Discussions & Recommendations

7.1 Key Geotechnical Site Constraints

The development will generally require shallow footing excavation for the proposed building and associated retaining walls and will also include filling of up to about 2m height for the terrace over and adjacent to the garage at the front of the building.

Key geotechnical constraints include excavation conditions, subgrade (foundation) conditions, and hazards related to landslide risk. Recommendations for design and construction of the development are provided in the following sections.

7.2 Landslide Risk Assessment

A landslide risk assessment has been carried out for this site using the methods of AGS 2007².

The basis of the preliminary assessment undertaken for this site and important factors relating to slope conditions and the impacts of the development that commonly influence landslide risks are discussed in the attached "Important Information about your Landslide Risk Assessment", and the attached GeoGuides.

The preliminary assessment has been carried out by:

- Consideration of the likely slope failure mechanisms and the likely initiating circumstances that could affect the elements at the site. The type and mode of landslide failure has also been classified.
- **Risk to Property.** For each case, the likely consequences with respect to future development have been considered. The current assessed probability of occurrence of each event has been estimated

² Landslide Risk Management, Australian Geomechanics, Vol 42, No. 1, March 2007.

on a qualitative basis. The consequences and probability of occurrence have been combined for each case to provide the risk assessment.

- **Risk to Life.** For each case, the risk for the person most at risk is assessed based on multiplying the indicative annual probability of the occurrence of the hazard, the probability of spatial impact, the temporal probability, the vulnerability, and the probability of not evacuating. The risk is then compared with acceptable and tolerable risk criteria.

The following general potential hazards/events are identified for this site and relate to slope instability:

A slump in Merritts Creek bank

For the hazards / events identified, the elements that are at risk are the external yard to the building and property. The building itself and the filled terrace are sufficiently remote from the potential hazard that it would not be affected. Table A provides our preliminary risk assessment for the site with respect to risk to property, and Table B provides our preliminary risk assessment for the site with respect to risk to life.

Where development takes into consideration the possible failure mechanisms and adopts good engineering practice for hillside development, it is envisaged that the outcome of such a development would be a **Very low** risk assessed with respect to property and the risk with respect to life would be **Acceptable**.

The development should be carried out in accordance with good engineering practice that is described in the attached GeoGuides, and in accordance with the general recommendations in the following sections.

7.3 Footings

Footings should be founded on dense or better natural sands or may also be founded on cobbles and boulders encountered beneath the site. An allowable bearing pressure of 200kPa may be adopted for design purposes.

Pile footings are not considered necessary.

An experienced Geotechnical Engineer should review footing designs to check that the recommendations of the geotechnical report have been included.

7.4 Earthworks

7.4.1 Excavation

The excavation for the footings and service trenches is anticipated to be predominantly with sandy soils which could be readily excavated using conventional earthmoving equipment (e.g. hydraulic excavator). Some larger cobbles and boulders should be anticipated, which could be removed with suitably sized excavators.

7.4.2 Subgrade Preparation

The following general recommendations are provided for subgrade preparation:

- Excavate to design subgrade level.
- Footing subgrade on dense sandy soils is not expected to require any further preparation.

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.

7.4.3 Filling

Filling should be placed in horizontal layers over prepared subgrade and compacted 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	0.2m	0.2m
• Elsewhere	0.3m	0.3m
Density:		
• Beneath Pavements	≥ 95% Std	≥ 70% ID
• Beneath Structures	≥ 98% Std	≥ 80% ID
• Upper 150mm of subgrade	≥ 100% Std	≥ 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.

Filling to create new batter slopes should be over-placed (i.e. extend beyond the design line and level), compacted, then trimmed back to the design line and level, so that the trimmed surface contains compacted material that conforms to the above specification.

7.4.4 Batter Slopes

Given the shallow nature of trenching for services (anticipated to be not more than about 1m deep) and footing excavations for the building (anticipated to be not more than about 1m, deep), practically, vertical cuts may be carried out if sidewalls remain stable during construction.

Permanent batters for the terrace area should be vegetated or otherwise protected to control the risk of erosion.

7.5 Groundwater Control

Limited groundwater observations made for this investigation are described in Section 6.3. The observations indicate that groundwater is unlikely to be a constraint to the proposed development. Good practice should be followed if groundwater seepage is encountered during construction, such as installation of subsoil drainage. Further geotechnical advice must be sought if significant groundwater is encountered during construction.

8. Site Suitability

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

9. Recommended Development Approval Conditions

The following conditions should be included with the development approval:

(i) Conditions to be provided to establish the design parameters

The development shall be carried out in accordance with the requirements and recommendations of the Geotechnical Investigation by AssetGeoEnviro dated 3 November 2021 (Ref 4429-1-G1 Rev 1), and in accordance with further geotechnical assessment and advice to be provided during design development and construction as required.

(ii) Conditions applying to the detailed design to be undertaken for the construction certificate

Structural design and civil details (drainage, earthworks) relating to the geotechnical aspects of the proposed development shall be checked and certified by a suitably qualified and experienced Geotechnical Engineer as being in accordance with the geotechnical recommendations.

(iii) Conditions applying to the construction

During construction, inspection shall be carried out by a suitably qualified and experienced geotechnical engineer or by suitably experienced site personnel under direction of an experienced geotechnical engineer, at the following stages, to ensure that the requirements of the geotechnical report are followed:

- a) Footing excavations shall be inspected after preparation.

(iv) Conditions regarding ongoing management of the site/structure

No specific conditions are identified for ongoing management of the site / structure.

10. 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.

It is recommended that a qualified and experienced Geotechnical Engineer be engaged to provide further input and review during the design development; including site visits during construction (either in-person or by remote with assistance of suitably experienced site personnel) to verify the site conditions and provide advice where conditions vary from those assumed in this report.

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 only, which could range from a few days (for temporary batter slopes) up to six months (for temporary shoring). This 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.

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

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

Landslide Risk Assessment Tables

Table A – Risk to Property
Table B – Risk to Life

Figures

- Figure 1 – Site Locality
- Figure 2 – Test Locations
- Figure 3 – Interpreted Section A–A

Appendix A

Important Information about your Geotechnical Report
Important Information about your Landslide Risk Assessment
GeoGuides (pp1-17)

Appendix B

Soil & Rock Explanation Sheets
Borehole Logs
DCP Logs

Appendix C

Site Photos



Photo 1
View of front of lodge
from Valley Close,
looking south-west



Photo 2
Continuation of
Photo 1, looking west



Photo 3
Continuation of
Photo 2, looking
north-west



Photo 4
View of rear of lodge,
looking north/north-
east



Photo 5
View of rear of lodge,
looking north-east



Photo 6
View of rear of lodge
showing spa to north,
looking east. Creek
located to north (left)
of site



Photo 7
View of rear of lodge
looking east
(continuation of
Photo 6)



Photo 8
View of rear of lodge
looking south-east
(continuation of
Photo 7)



Photo 9
View of creek bed to north of property, looking south-east



Photo 10
View of creek bank viewed from base of creek, existing lodge shown in background, looking approx. south