GREYWACKE
GEOTECHNICS

Preliminary Assessment

Jason Cummings

Proposed Additions and Alterations

32 Ettalong Street, Wheeler Heights NSW 2097

Project No.: JASC0727-GEO AA

23 March 2022

A: Unit 11, 6 Hume Road, Smithfield NSW 2164
E: admin@greywacke.com.au
T: 02 8798 8796
W: www.greywacke.com.au

Table of contents

Table index

Figures

Appendices

1. Introduction

1.1 General

This report presents the results of a preliminary landslip risk assessment carried out by Greywacke Geotechnics for the proposed alterations and additions at **32 Ettalong Street, Wheeler Heights NSW 2097** legally known as **Lot 61** in **DP8871**. The investigation was carried out in broad accordance with Greywacke's proposal and commissioned by Jason Cummings.

Based on the architectural drawings produced by **Hargroves Design Consultants** *(Issue G, dated 22/02/2022)*, the proposed additions and alterations will include the construction of an upper floor addition, internal and external modifications, and semi-inground swimming pool. References should be made to the architectural drawing plans for further information on the proposed development.

The site is located within a designated Landslip Risk area as per **Warringah Development Control Plan 2011**. The area is classified as **Landslip Risk Class D**, Collaroy Plateau Area Flanking Slopes 5 to 15 degrees. A preliminary assessment of the site conditions was carried out in accordance with the *CHECKLIST FOR COUNCIL'S ASSESSMENT OF SITE CONDITIONS AND NEED FOR GEOTECHNICAL REPORT IN GEOTECHNICAL CLASS B and D* areas to determine whether a geotechnical report is required.

1.2 Site Identification Details

The subject site (Lot 61 in DP8871) being considered for development is located at **32 Ettalong Street, Wheeler Heights NSW 2097**, approximately 17.5km north-east of Sydney CBD. The location of the site is marked in **Figure 3** found in **Appendix A**.

The subject site is bounded by Ettalong Street (road reserve) along its southern boundary line and neighbouring residencies occupy areas immediately adjacent to its eastern and western extents. Wheeler Heights Public School is located immediately adjacent to the northern boundary of the property.

The site is near rectangular in shape with a total site area of approximately 1,075m^2. The site is currently occupied by a multi-storey residential dwelling with a ground level garage/storage and first floor living area. Additionally, a secondary dwelling (granny flat) occupies the northern extent of the property.

1.3 Environmental Setting

1.3.1 Topography

Imagery available on the Department of Lands and Spatial Information Exchange website shows that the site is located at approximate elevations between 88 m AHD (Australian Height Datum) and 91m AHD. The site terrain generally includes falls from East to West to the width of the site. The site also comprises a central mound with falls up to 8^o towards the street and up to 3^o the rear, along the length of the property.

The topography of the surrounding area comprises undulating to rolling low hills with local relief 20m – 80m and slopes of 10%–25%. Sideslopes with narrow to wide outcropping sandstone rock benches (10m–100m), often forming broken scarps of <5m.

1.3.2 Regional geology

The 1:100,000 scale Sydney Geological Series Sheet (Geological Survey of NSW, Department of Minerals and Energy, Sheet 9030, Edition 1, 1983) indicates that the site is primarily underlain by Hawkesbury Sandstone (Rh) of Wianamatta Group, and contains medium to coarse grained quartz, sandstone with very minor shale and laminite lenses.

1.3.3 Soil Landscapes

Soil Landscapes of the Sydney 1:100,000 Sheet indicates the site belongs to Gymea (gy) subgroup. The landscape occurs extensively throughout the Hornsby Plateau and along the foreshores of Sydney Harbour and the Parramatta and Georges Rivers.

Soils – shallow to moderately deep (30cm-100cm) Yellow Earths and Earthy Sands on crests and inside of benches; shallow (<20 cm) Siliceous Sands on leading edges of benches; localised Gleyed Podzolic Soils and Yellow Podzolic Soils on shale lenses; shallow to moderately deep (<100 cm) Siliceous Sands and Leached Sands along drainage lines.

Gymea Landscape (Erosional) – Undulating to rolling rises and low hills on Hawkesbury Sandstone. Local relief 20–80 m, slopes 10–25%. Rock outcrop <25%. Broad convex crests, moderately inclined side slopes with wide benches, localised rock outcrop on low broken scarps. Extensively cleared open-forest (dry sclerophyll forest) and eucalypt woodland.

Limitations – Localised steep slopes, high soil erosion hazard, rock outcrop, shallow highly permeable soil, very low soil fertility.

Erosion Hazard – The erosion hazard for non-concentrated flows is generally high to very high but can range from moderate to extreme. Calculated soil loss for the first twelve months of development range up to 19 t/ha for topsoil and 464 t/ha for subsoil. Soil erosion hazard for concentrated flows is high to extreme.

2. Methodology

2.1 Preliminaries and Field Assessment

In accordance with Greywacke Geotechnics occupational health and safety policy, a Safe Work Method Statement (SWMS) was prepared prior to conducting fieldwork. All site staff were briefed on the requirements set out in the plan by the supervising geotechnical engineer.

The Geotechnical site investigation was carried out on 16th March 2022 and comprised of a brief walkover for visual assessment of site conditions. The investigation included the following:

- Desktop review of publicly available historical information and field inspection of the site and the surrounding area to discover if the site or the adjacent properties have a history of slope instability.
- A brief walk over of the site by a Greywacke engineer and the client on the day of the field assessment to determine the surface condition and identify any possible hazard areas and surrounding landscape.
- Visual assessment of the site and the surrounding area for indicators of slope instability, such as surface weathering and erosion, rock falls / topples, structural damage on the existing properties, verticality of the trees and poles, and wedge failures along bedrock discontinuities etc.

Field assessment records included photos of the existing building and backyard, surrounding properties, street poles and trees to assist with reporting.

2.2 Visual Observations

During our field assessment, key geological and topographic features have been noted. The following observations were made, and selected site photos are in **Table 1** below.

- The site is sloping down from East to West to the width of the site. The site also comprises a central mound with falls up to 8º towards the street and up to 3º the rear, along the length of the property.
- The existing residency appears to be in good condition with no visual signs of structural distress. It appears that the existing structure is supported on sandstone bedrock (Photo **1 and Photo 3**).
- Neighbouring buildings appear to be in good condition with no visible visual signs of structural distress.
- The trunks of mature trees and power poles in the vicinity of the proposed development site are generally upright and straight.
- Well defined sandstone bedrock outcrops are observed within the lower level and backyard of the existing house.

  The sandstone bedrock observed was grey to pale brown, with estimated medium to high strength rock (**Photo 2 and 3**).

Table 1 Selected site photos.

	***Photo 1:*** The front of the existing dwelling.
	**Photo 2:** Photo taken from the rear of residency along the eastern extent showing exposed sandstone bedrock outcrops.
	**Photo 3:** Exposed sandstone bedrock supporting brick pad footing of the existing dwelling.

3. Landslip Risk Assessment

3.1 General

The preliminary landslip risk assessment is required by the Northern Beaches Council and carried out in accordance with Section E10 of **Warringah Development Control Plan 2011 (**CHECKLIST FOR COUNCIL'S ASSESSMENT OF SITE CONDITIONS AND NEED FOR GEOTECHNICAL REPORT IN GEOTECHNICAL CLASS B and D) as previously mentioned.

3.2 Landslip Risk Class

The proposed site is classified as Landslip Risk Classification D and a map excerpt of the Warringah Landslip Risk Map is provided in **Figure 1** below.

Figure 1 Warringah Landslip Risk Map Excerpt

3.3 Assessment

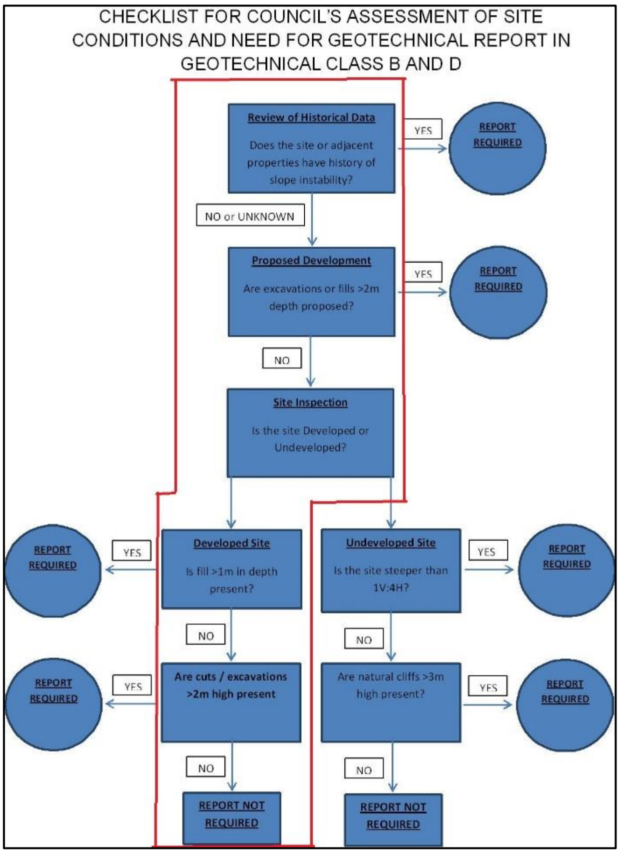
This slope risk/stability assessment is based on a desktop review of publicly available historical data and detailed a visual assessment of the topographic, surface drainage, geological conditions and environmental conditions in the vicinity of the proposed development site.

During our field assessment, key indicators of slope instability were **not** evident across the site during the fieldwork (e.g. rock falls / topples, block slides on weak layers, wedge failures along bedrock discontinuities, mass soil / rock movement etc.). Furthermore, it appears that the trunks of the mature trees and power poles in the vicinity of the proposed development site are generally upright and straight, indicating relatively well drained stable slope conditions.

No features likely to result in large-scale instability were identified at the proposed development site. The site is naturally drained towards the southern and western boundary lines along the length of the property. Stormwater outlets or on-site detention system were not evident within the property, however provision for storm water drainage has been accounted for at street level.

The checklist provided in Section E10 of **Warringah Development Control Plan 2011** has been reproduced in **Figure 2** and applied to this project as below;

Figure 2 Site Condition Checklist



History of Landslip	**No**
Excavation/Fill >2.0m	**No**
Site Developed	**Yes**
Existing Fill >1.0m	**No**
Existing Excavation >2.0m	**No**
Report Required	**NO**

Based on the outcome of the field assessment, it is considered that a detailed Landslip Risk Assessment is **not** required for this development.

Based on the results of the investigations and the presence of shallow bedrock, the overall risk of slope instability across the proposed development site is **very low** for excavations up to 2.0m. As such, the proposed development site is considered **suitable** for construction. Nevertheless, the proposed development should be carried out in accordance with good hillside practice (refer **Appendix B**).

4. Limitations

This report has been prepared by Greywacke Geotechnics (Greywacke) for Jason Cummings (Client) and may only be used and relied on by the Client for the purpose agreed between Greywacke and the Client.

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

The services undertaken by Greywacke 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. Greywacke 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.

Greywacke has prepared this report based on information provided by the Client and others who provided information to Greywacke, which Greywacke has not independently verified or checked beyond the agreed scope of work. Greywacke does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

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 site conditions found at the specific sample points.

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

Site conditions may change after the date of this report. Greywacke does not accept responsibility arising from, or in connection with, any change to the site conditions. Greywacke is also not responsible for updating this report if the site conditions change.

For and On Behalf of
Greywacke Geotechnics

Charbel Bahi
Geotechnical Engineer

Reviewed by:

Kadir Oncu
Senior Geotechnical Engineer
NSW Registered Design Practitioner

5. References

1. Geological Survey of NSW, Department of Minerals and Energy, *Sydney 1:100,000 scale Geological Series Sheet,* Sheet 9130 Edition 1, 1983;
2. Soil Conservation Service, NSW, *Sydney 1:100,000 scale Soil Landscape Series Sheet,* Sheet 9130;
3. Standards Australia, *AS 1726-2017 'Geotechnical site investigations', 2017*
4. P.J.N. Pells, G. Mostyn and B.F. Walker, *Foundations on Sandstone and Shale in the Sydney Region,* Australian Geomechanics, December 1998, pp 17-29;
5. Warringah Development Control Plan 2011, Section E10, *CHECKLIST FOR COUNCIL'S ASSESSMENT OF SITE CONDITIONS AND NEED FOR GEOTECHNICAL REPORT IN GEOTECHNICAL CLASS B and D*;
6. Department of Lands and Spatial Information Exchange, NSW, Map data 202, https://maps.six.nsw.gov.au/;
7. Australian Geomechanics Society, "The Australian GeoGuides for Slope Management and Maintenance", Volume 42 No.1, March 2007;

APPENDICES

Appendix A – Figures

GREYWACKE GEOTECHNICS	
GEOTECHNICAL SITE INVESTIGATION - TEST LOCATION PLAN	
Paper Size	A3
Scale	NTS

LEGEND

- Site Location
- Proposed Alterations & Additions Area

Client:	Jason Cummings
Project:	Proposed Alterations & Additions
Location:	32 Ettalong Street, Wheeler Heights 2097

Job Number:	JASC0727 - GEO AA
Revision:	A
Drawn:	N/A
Date:	23-Mar-22

Figure 3

NOTE: The aerial photo view of the site is sourced from third party providers and may not be current and should not be relied upon

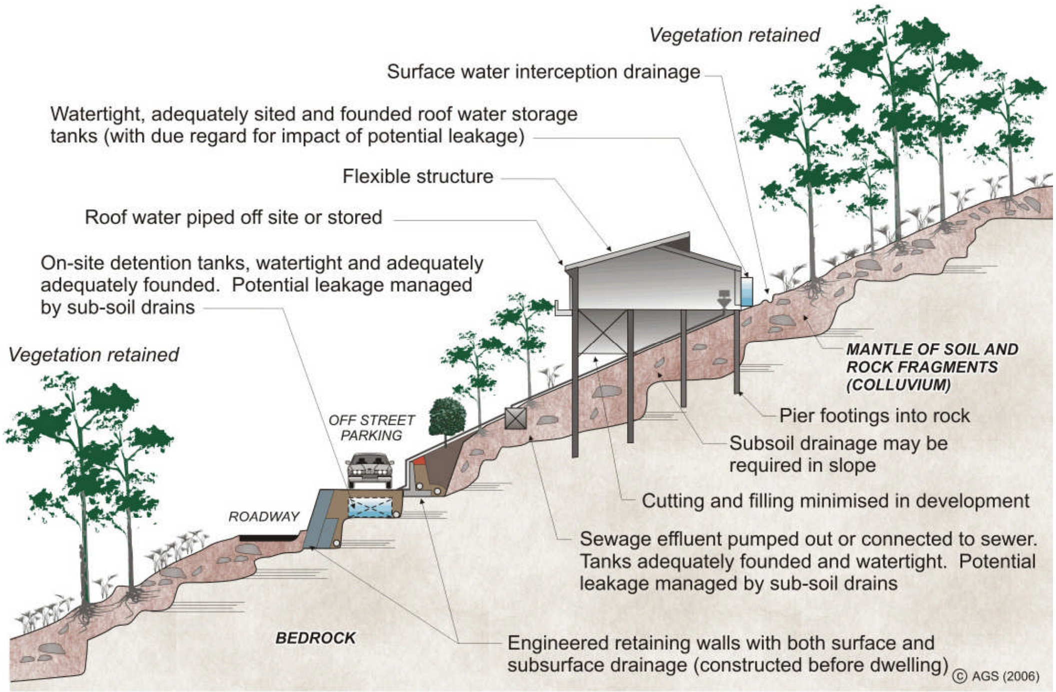
Appendix B – Extracts from the Australian Geomechanics Society Good Hillside Practice

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.

EXAMPLES FOR **GOOD** HILLSIDE CONSTRUCTION PRACTICE



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 due to 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 fulfill the same purpose (GeoGuide LR5).

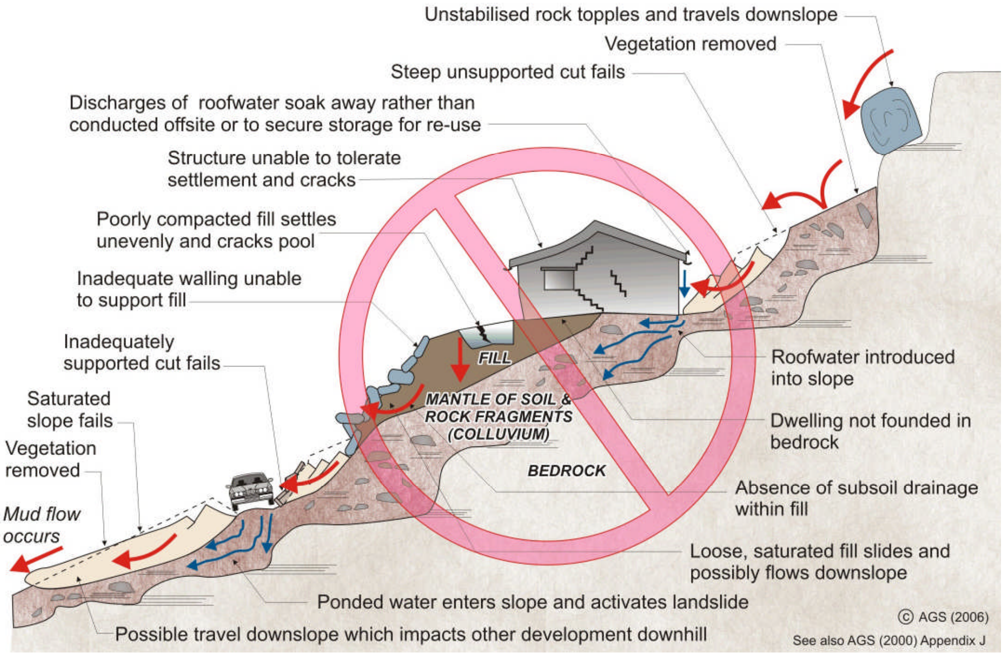
Surface loads - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide 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.

EXAMPLES FOR **POOR** HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES POOR?

Roadways and parking areas - are unsurfaced and lack proper table drains (gutters) causing surface water to pond and soaks into the ground.

Cut and fill - has been used to balance earthworks quantities and level the site leaving unstable cut faces and added large surface loads to the ground. Failure to compact the fill properly has led to settlement, which will probably continue for several years after completion. The house and pool have been built on the fill and have settled with it and cracked. Leakage from the cracked pool and the applied surface loads from the fill have combined to cause landslides.

Retaining walls - have been avoided, to minimise cost, and hand placed rock walls used instead. Without applying engineering design principles, the walls have failed to provide the required support to the ground and have failed, creating a very dangerous situation.

A heavy, rigid, house - has been built on shallow, conventional, footings. Not only has the brickwork cracked because of the resulting ground movements, but it has also become involved in a man-made landslide.

Soak-away drainage - has been used for sewage and surface water run-off from roofs and pavements. This water soaks into the ground and raises the water table (GeoGuide LR5). Subsoil drains that run along the contours should be avoided for the same reason. If felt necessary, subsoil drains should run steeply downhill in a chevron, or herringbone, pattern. This may conflict with the requirements for effluent and surface water disposal (GeoGuide LR9) and if so, you will need to seek professional advice.

Rock debris - from landslides higher up on the slope seems likely to pass through the site. Such locations are often referred to by geotechnical practitioners as "debris flow paths". Rock is normally even denser than ordinary fill, so even quite modest boulders are likely to weigh many tonnes and do a lot of damage once they start to roll. Boulders have been known to travel hundreds of metres downhill leaving behind a trail of destruction.

Vegetation - has been completely cleared, leading to a possible rise in the water table and increased landslide risk (GeoGuide LR5).

DON'T CUT CORNERS ON HILLSIDE SITES - OBTAIN ADVICE FROM A GEOTECHNICAL PRACTITIONER

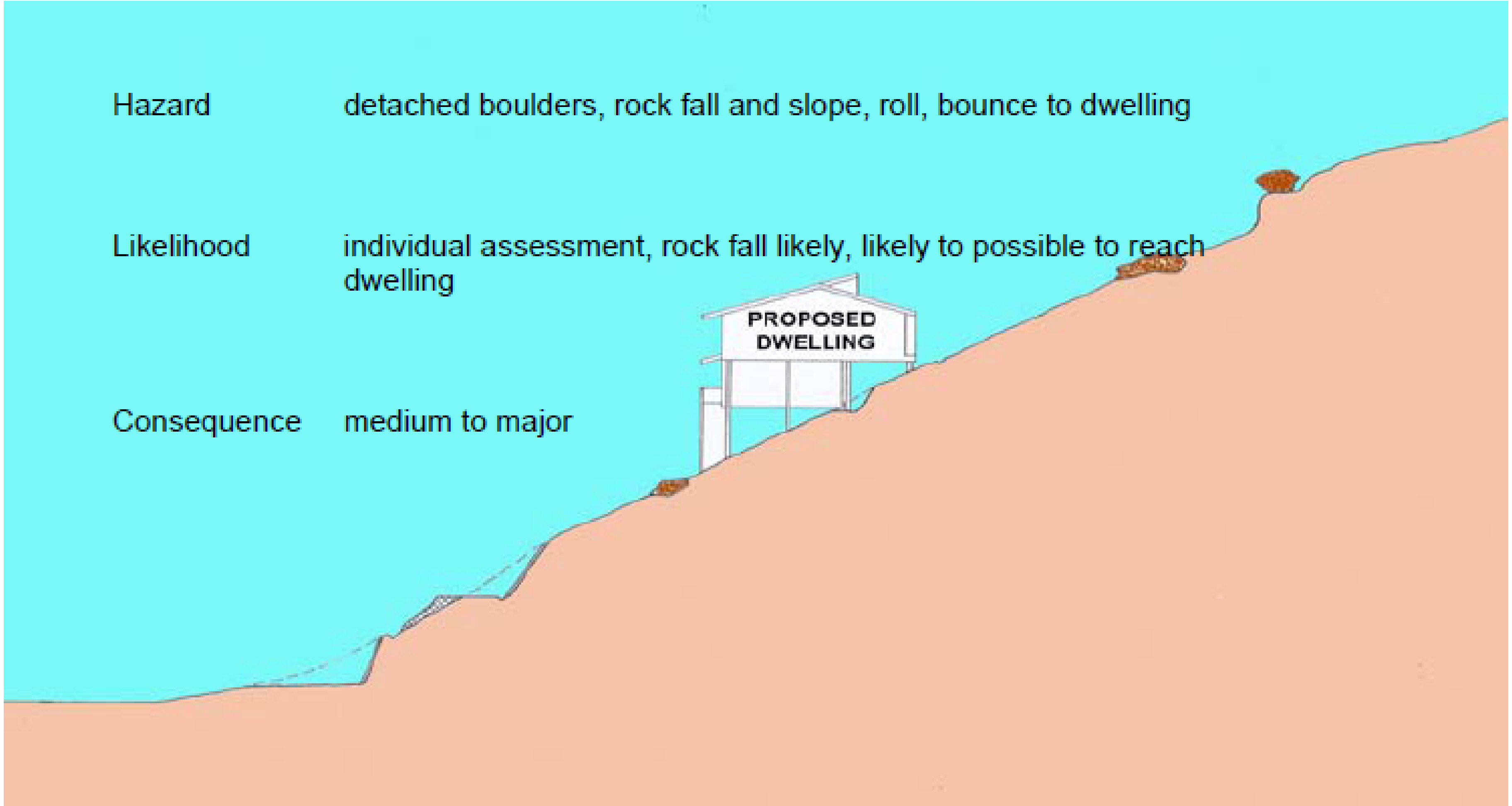
More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

Landslide Risk Assessment Process

Example - Qualitative landslide risk assessment for property (Source: Walker (2002))



www.greywacke.com.au

GREYWACKE
GEOTECHNICS