REPORT TO

ANGELA HOLM AND ROBERT CHAPMAN

ON

GEOTECHNICAL ASSESSMENT

FOR

PROPOSED ALTERATIONS

AT

92 ADDISON ROAD, MANLY, NSW

Date: 21 December 2020

Ref: 33739BMrpt

JKGeotechnics

www.jkgeotechnics.com.au

T: +61 2 9888 5000

JK Geotechnics Pty Ltd

ABN 17 003 550 801

Report prepared by:

Matthew Pearce
Associate

Report reviewed by:

Daniel Bliss
Principal | Geotechnical Engineer

For and on behalf of
JK GEOTECHNICS
PO BOX 976
NORTH RYDE BC NSW 1670

DOCUMENT REVISION RECORD

Report Reference	Report Status	Report Date
33739BMrpt	Final Report	21 December 2020

Table of Contents

1 INTRODUCTION

This report presents the results of a geotechnical slope stability risk assessment for proposed alterations to the existing house at 92 Addison Road, Manly, NSW. The location of the site is shown in Figure 1. The assessment was commissioned by Mr Emiliano Miranda on behalf of Angela Holm and Robert Chapman and was carried out in accordance with our proposal dated 14 December 2020 (Ref. P53247BM).

From review of the Lintel Studio For Architecture Pty Ltd architectural drawings (Ref 2005_DA.01 to 09, Revision A, dated 14 December 2020), we understand the development is limited to conversion of an existing lower ground floor level storeroom to a study. These works will only involve alterations to the existing house involving widening of the opening within the side wall to form a window and reallocated doorway, construction of an internal bathroom, placement of new flooring and internal joinery for new walls to cover the existing stone walls and for desks. No excavation or fill is proposed.

We completed a preliminary assessment of site conditions, in accordance with Schedule 11 of the Manly Development Control Plan 2013 Amendment 10 [Amendment 28 August 2017]. our site inspection indicated that there appears to be more than 1m of (back)fill at the site and therefore a geotechnical assessment is required for the DA. In accordance with the requirements of the Manly DCP, the purpose of the geotechnical assessment is to assess the site for geotechnical stability hazards, and provide comments and recommendations on measures required to reduce the risk and costs of landslip and subsidence of existing areas, if applicable.

2 ASSESSMENT PROCEDURE

The stability assessment is based upon a detailed inspection by our Associate Geotechnical Engineer, Matthew Pearce on 16 December 2020, of the topographic, surface drainage and geotechnical conditions of the site and its immediate environs. These features were compared to those of other similar lots in neighbouring locations to provide a comparative basis for assessing the risk of instability affecting the proposed development. The attached Appendix A defines the terminology adopted for the risk assessment together with a flow chart illustrating the Risk Management Process based on the guidelines given in AGS 2007c (Reference 1).

The principal geotechnical features, which were measured using taped measurements and hand held clinometer, are presented on Figure 2 using an existing survey base plan (unreferenced survey). The survey datum is unknown. Reference should be made to Appendix B for an architectural section showing the profile through the site. Figure 3 defines the mapping symbols used.

No subsurface drilling or testing was completed within the agreed scope of assessment.

3 RESULTS OF ASSESSMENT

3.1 Site Description

Addison Road is located at about the mid-slope of the overall hillside falling from North Head to the town centre of Manly. However, locally the site and adjacent properties have an overall fall to the south-west since they are at the top of a localised relatively shallow drainage 'valley' that falls towards Collins Beach.

The site which is about 42m long by 7.6m wide has an overall fall of about 4° from the front to the rear. However, the main change in level is formed by a step down of about 2m from the front garden level to the Lower Ground Floor (LGF) level of the existing house. Beyond this step the site slopes at about 2° down to the rear. Surface levels range from about RL21m at the front of the site to about RL18.3m at the rear.

No 92 is a 'duplex', having an north-eastern party wall with No 94. The site contains a two-storey brick house with a front veranda and a small front garden. The house appeared to be in a sound condition with no observed cracks. The front garden and street side footpath are slightly lower than the veranda/ground floor level. At the western front corner of the house, external stone steps lead down to a side path at about the LGF level extending to the rear. The LGF walls are of mortared sandstone block construction. The LGF appears to have been cut into the hillside to achieve the same footprint as the Ground Floor level. The front garden would have been backfilled after construction of the LGF walls. The house is set back about 3.4m from the street frontage.

At the front (north-west) of the LGF is a small room used as a cellar/storeroom below the veranda above, which then steps down of about 0.4m to a second storeroom where the proposed study will be located. These rooms have sandstone block walls and concrete slab floors. The wall appears generally vertical with only very minor bulging at about the mid-point. There was little to no mortar between the sandstone blocks within in the wall. The rooms are accessed via open doorways within the external south-western wall at about the toe of the external steps.

The height difference between the cellar floor and the front garden level is about 1.4m, with this sandstone block wall being a retaining wall supporting the front garden. The lower 1.1m of this wall is damp and at the toe of the wall is a drain leading to a sump and pump. There is also ventilation from this area below the house to the storeroom to the south-east.

At the rear of the house is a paved veranda, which is about 0.3m higher than a rear concrete paved parking area. On each side of the parking area are concrete block walls along the boundaries with fencing above the walls. The walls retain the property to the north-east for a height of about 0.3m and retain the subject site above the property to the south-west also for a height of about 0.3m.

The layout and surface levels of the property to the south-west of the site, No 90, 'mirrors' those of No 92. Slopes and levels are similar across the common boundary external to the building, with fencing along the boundary. To the north-east No 94 appears also appears to mirror the site's common boundary (being the other half of a duplex) from the limited view from publicly accessible areas.

Addison Road at the front of the site has a minor fall to the west. A shared driveway at the rear of the properties has a fall of about 5° to the east. Beyond the driveway are rear gardens at a similar gradient.

3.2 Geology

The Sydney 1:100,000 geological map indicates the site is underlain by Hawkesbury Sandstone.

4 RISK ASSESSMENT

The assessment of site slope stability has been made using the guidelines presented in the Landslide Risk Management Concepts and Guidelines prepared by the Australian Geomechanics Society, Sub-Committee on Landslide Risk Management (Reference 1). In this regard an acceptable risk for loss of life for the person most at risk of $1x10^{-5}$ has been adopted for existing slopes/structures and $1x10^{-6}$ for new developments. For loss of property the acceptable risk should be determined by the owner, provided loss to property only affects the owners' property and does not impact on the property of others. In accordance with Reference 1 an acceptable risk of loss of property posed by existing slopes as 'Low'. Where risks posed by slope instability are considered unacceptable, remedial measures should be adopted to reduce the risk posed to an acceptable level.

Based on our site inspection we consider that the only significant hazard at the site is as follows, which is shown on Figure 2. Other very minor hazards would be present due to the changes in levels as shown on figure 2, but since these are less than 0.4m they would be inconsequential and so have not been formally assessed as part of this risk assessment.

Hazard A: Failure of the existing Lower Ground Floor stone retaining wall at front of house supporting the front garden area.

The attached Tables A and B summarise our qualitative and semi-quantitative assessment of the hazard and the risk to property and the risk to life, respectively, should instability occur. The terminology adopted for this qualitative assessment is in accordance with Table A1 given in Appendix A. The qualitative assessments are based on judgements made in the field by the geotechnical engineer and in this regard are subjective and formed in part by the engineers' previous experiences.

As shown in Table A we assess the risk to property to be "very low", which would be considered 'acceptable' in accordance with the criteria given in Reference 1. As shown in Table B, our assessed risk to life for the person most at risk is about 10^{-7}, which would also be considered 'acceptable' in accordance with Reference 1.

Provided our comments and recommendations given below are followed, the risk to both property and life for the person most a risk following the construction of the proposed alterations and additions will be unaffected.

5 COMMENTS AND RECOMMENDATIONS

There is no excavation or new footings required for this development. Comments are therefore limited to the main geotechnical hazard identified on site, the existing retaining wall at the front of the lower ground floor which supports the front garden. The front garden would have been formed by backfilling against the stone wall.

We understand from discussions with the owner, that the house is in excess of 100 years old. The retaining wall appeared to be in reasonable condition and given the lack of mortar, it would be freely draining. Our assessment is that the risks are acceptable. Furthermore, the only risk to property is to the home owner, since a failure of the wall would not impact the street infrastructure or adjacent properties. Internal provisions have already been made by the owner to deal with any seepage that may occur. No further works are required to lower the risk of instability, except to avoid surcharging the retaining wall in the future as discussed below.

The wall is clearly not an engineer designed structure and may have a relatively low 'factor of safety' against failure. Therefore, temporary surcharges such as pallets of building materials or stockpiles of soil for landscaping should not be placed within a distance of 1.5m from the front of the house (which represents about a line at about 1 Vertical in 1 Horizontal up from the toe of the wall), nor should the front garden level be raised. To do either of these would increase the risk of instability.

Our geotechnical slope stability risk assessment has shown that the risk of instability at the site is acceptable and the proposed alterations will not increase the risk to either property or life at the subject site.

6 GENERAL COMMENTS

The recommendations presented in this report include specific issues to be addressed during the construction phase of the project. In the event that any of the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and JK Geotechnics accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

Occasionally, the subsurface conditions may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

This report provides advice on geotechnical aspects for the proposed civil and structural design. As part of the documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of contract documents to confirm the intent of our recommendations has been correctly implemented.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. If there is any change in the proposed development described in this report then all recommendations should be reviewed. Copyright in this report is the property of JK Geotechnics. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

References:

[1] Australian Geomechanics Society (2007c) *'Practice Note Guidelines for Landslide Risk Management'*, Australian Geomechanics, Vol 42, No 1, March 2007, pp63-114

TABLE A: SUMMARY OF RISK ASSESSMENT TO PROPERTY

POTENTIAL LANDSLIDE HAZARD	A
	LGF Stone Retaining Wall
Assessed Likelihood	Possible
Assessed Consequence	Insignificant
Risk	Very Low
Comments	Failure would only affect the cellar, part of the garden, and possibly the veranda. Slumping would not extend to the street frontage. Warning in the form of cracking and budging of the wall would occur and repairs could then be made at that time. This assessment assumes the retaining wall remains free of surcharges in the garden, eg heavy building supplies (pallets of bricks/ stockpiles of soil).

Assumed property value $3,250,000 (source: onthehouse.com.au 18 Dec 2020)

TABLE B: SUMMARY OF RISK ASSESSMENT TO LIFE

POTENTIAL LANDSLIDE HAZARD	A	
Assessed Likelihood	Possible	
Indicative Annual Probability	10^{-3}	
Persons at risk	Person in front garden or veranda	Person in cellar
Duration of Use of area Affected (Temporal Annual Probability)	0.5hrs/week 3.0×10^{-3}	5mins/week 5.0×10^{-4}
Probability of not Evacuating Area Affected	0.5 space to step back but unlikely for advance warning signs	0.8 Little space to step back
Spatial Probability	0.25	0.5
Vulnerability to Life if Failure Occurs Whilst Person Present	0.1	0.5
Risk for Person Most at Risk	3.8×10^{-8}	$1.0 \text{ X } 10^{-7}$
Total Risk for Person Most at Risk	$1.4 \text{ X } 10^{-7}$	

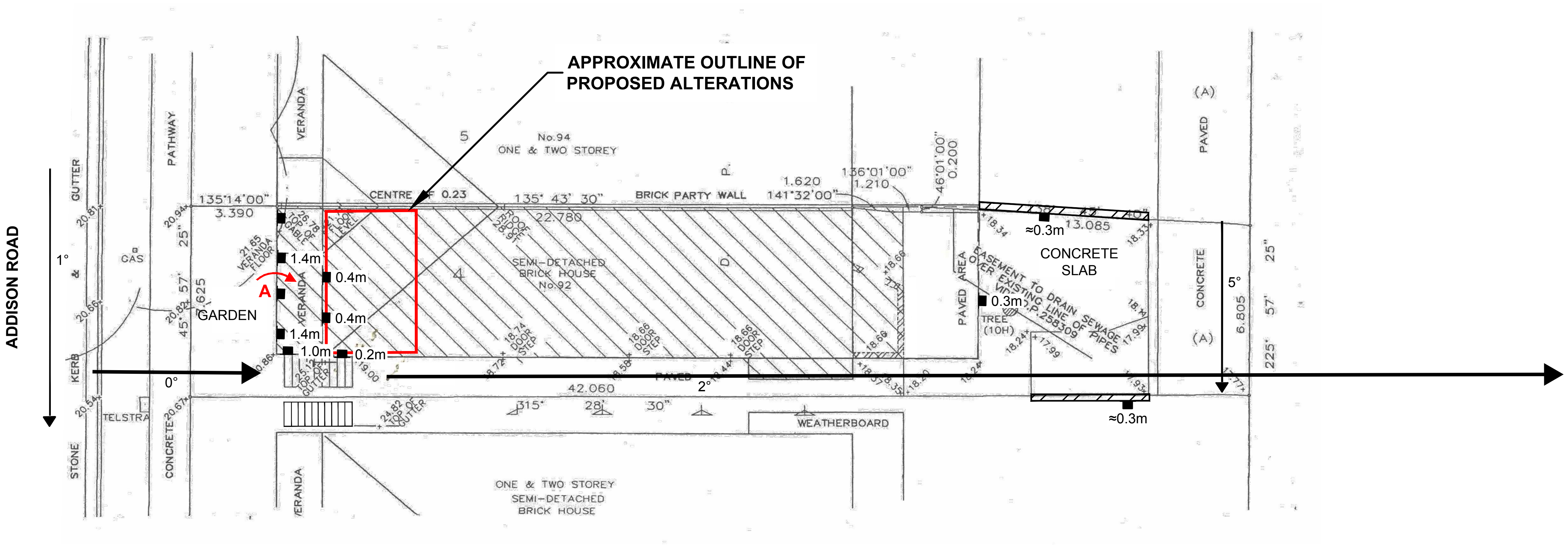
AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the JK Geotechnics report.

Title:	**SITE LOCATION PLAN**
Location:	92 ADDISON STREET, MANLY, NSW
Report No: 33739BM	Figure No: 1

JKGeotechnics

PLOT DATE: 18/12/2020 11:20:29 AM DWG FILE: Y:\33000'S\33739BM MANLY\CAD\33739BM.DWG



LEGEND

A GEOTECHNICAL HAZARD

SCALE 1:200 @A3 METRES (0 2 4 6 8 10)	Title:	GEOTECHNICAL MAPPING AND HAZARD PLAN	
	Location:	92 ADDISON STREET, MANLY, NSW	
	Report No:	33739BM	Figure No: 2
This plan should be read in conjunction with the JK Geotechnics report.		JKGeotechnics	

PLOT DATE: 18/12/2020 11:20:17 AM DWG FILE: Y:\33000'S\33739BM MANLY\CAD\33739BM.DWG

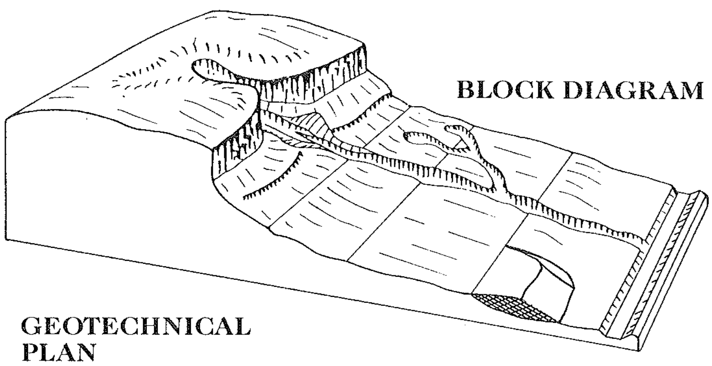
TOPOGRAPHY

Symbol	*Ground Profile*		
		convex concave	well defined or angular break of slope
		convex concave	poorly defined or smooth change of slope
	breaks of slope changes of slope		convex and concave too close together to allow the use of separate symbols
	sharp rounded		ridge crest
3	Cliff or escarpment or sharp break 40° or more (estimated height in metres)		
15 10 8	Uniform Slope Concave Slope Convex Slope		Slope direction and angle (Degrees)
	Top Bottom		Cut or fill slope, arrows pointing down slope
	Hummocky or irregular ground		

OTHER FEATURES

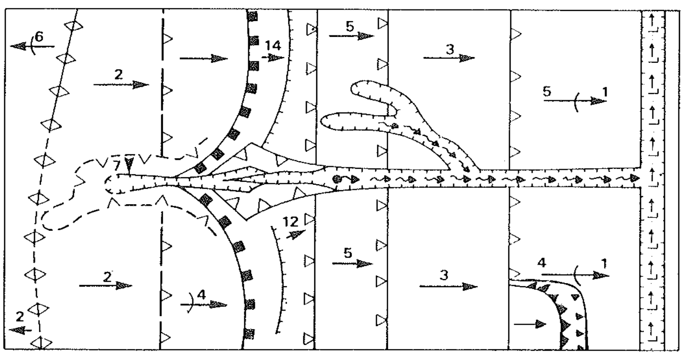
- Boulder
- Seepage/spring
- Swallow hole for runoff
- Natural water course
- Open drain, unlined
- Open drain, lined
- Fenceline
- Property boundary
- Dry Stone Wall
- J —— J 200 Major joint in rock face (opening in millimetres)
- – T – T – 10 Tension crack (opening in millimetres)
- Masonry or concrete wall
- Ponding water
- Boggy or swampy area

EXAMPLE OF USE OF TOPOGRAPHIC SYMBOLS:



BLOCK DIAGRAM

GEOTECHNICAL PLAN



(After Gardiner, V & Dackombe, R.V. (1983), Geomorphological Field Manual; George Allen & Unwin).

GEOTECHNICAL MAPPING SYMBOLS

JKGeotechnics

Report No. 33739BM Figure No. 3

APPENDIX A

LANDSLIDE RISK

MANAGEMENT

TERMINOLOGY

LANDSLIDE RISK MANAGEMENT

Definition of Terms and Landslide Risk

Risk Terminology	Description
Acceptable Risk	A risk for which, for the purposes of life or work, we are prepared to accept as it is with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable.
Annual Exceedance Probability (AEP)	The estimated probability that an event of specified magnitude will be exceeded in any year.
Consequence	The outcomes or potential outcomes arising from the occurrence of a landslide expressed qualitatively or quantitatively, in terms of loss, disadvantage or gain, damage, injury or loss of life.
Elements at Risk	The population, buildings and engineering works, economic activities, public services utilities, infrastructure and environmental features in the area potentially affected by landslides.
Frequency	A measure of likelihood expressed as the number of occurrences of an event in a given time. See also 'Likelihood' and 'Probability'.
Hazard	A condition with the potential for causing an undesirable consequence (the landslide). The description of landslide hazard should include the location, volume (or area), classification and velocity of the potential landslides and any resultant detached material, and the likelihood of their occurrence within a given period of time.
Individual Risk to Life	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.
Landslide Activity	The stage of development of a landslide; pre failure when the slope is strained throughout but is essentially intact; failure characterised by the formation of a continuous surface of rupture; post failure which includes movement from just after failure to when it essentially stops; and reactivation when the slope slides along one or several pre-existing surfaces of rupture. Reactivation may be occasional (eg. seasonal) or continuous (in which case the slide is 'active').
Landslide Intensity	A set of spatially distributed parameters related to the destructive power of a landslide. The parameters may be described quantitatively or qualitatively and may include maximum movement velocity, total displacement, differential displacement, depth of the moving mass, peak discharge per unit width, or kinetic energy per unit area.
Landslide Risk	The AGS Australian GeoGuide LR7 (AGS, 2007e) should be referred to for an explanation of Landslide Risk.
Landslide Susceptibility	The classification, and volume (or area) of landslides which exist or potentially may occur in an area or may travel or retrogress onto it. Susceptibility may also include a description of the velocity and intensity of the existing or potential landsliding.
Likelihood	Used as a qualitative description of probability or frequency.
Probability	A measure of the degree of certainty. This measure has a value between zero (impossibility) and 1.0 (certainty). It is an estimate of the likelihood of the magnitude of the uncertain quantity, or the likelihood of the occurrence of the uncertain future event. These are two main interpretations: (i) Statistical – frequency or fraction – The outcome of a repetitive experiment of some kind like flipping coins. It includes also the idea of population variability. Such a number is called an 'objective' or relative frequentist probability because it exists in the real world and is in principle measurable by doing the experiment.

Risk Terminology	Description
Probability *(continued)*	(ii) Subjective probability (degree of belief) – Quantified measure of belief, judgment, or confidence in the likelihood of an outcome, obtained by considering all available information honestly, fairly, and with a minimum of bias. Subjective probability is affected by the state of understanding of a process, judgment regarding an evaluation, or the quality and quantity of information. It may change over time as the state of knowledge changes.
Qualitative Risk Analysis	An analysis which uses word form, descriptive or numeric rating scales to describe the magnitude of potential consequences and the likelihood that those consequences will occur.
Quantitative Risk Analysis	An analysis based on numerical values of the probability, vulnerability and consequences and resulting in a numerical value of the risk.
Risk	A measure of the probability and severity of an adverse effect to health, property or the environment. Risk is often estimated by the product of probability x consequences. However, a more general interpretation of risk involves a comparison of the probability and consequences in a non-product form.
Risk Analysis	The use of available information to estimate the risk to individual, population, property, or the environment, from hazards. Risk analyses generally contain the following steps: scope definition, hazard identification and risk estimation.
Risk Assessment	The process of risk analysis and risk evaluation.
Risk Control or Risk Treatment	The process of decision-making for managing risk and the implementation or enforcement of risk mitigation measures and the re-evaluation of its effectiveness from time to time, using the results of risk assessment as one input.
Risk Estimation	The process used to produce a measure of the level of health, property or environmental risks being analysed. Risk estimation contains the following steps: frequency analysis, consequence analysis and their integration.
Risk Evaluation	The stage at which values and judgments enter the decision process, explicitly or implicitly, by including consideration of the importance of the estimated risks and the associated social, environmental and economic consequences, in order to identify a range of alternatives for managing the risks.
Risk Management	The complete process of risk assessment and risk control (or risk treatment).
Societal Risk	The risk of multiple fatalities or injuries in society as a whole: one where society would have to carry the burden of a landslide causing a number of deaths, injuries, financial, environmental and other losses.
Susceptibility	See 'Landslide Susceptibility'.
Temporal Spatial Probability	The probability that the element at risk is in the area affected by the landsliding, at the time of the landslide.
Tolerable Risk	A risk within a range that society can live with so as to secure certain net benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if possible.
Vulnerability	The degree of loss to a given element or set of elements within the area affected by the landslide hazard. It is expressed on a scale of 0 (no loss) to 1 (total loss). For property, the loss will be the value of the damage relative to the value of the property; for persons, it will be the probability that a particular life (the element at risk) will be lost, given the person(s) is affected by the landslide.

NOTE: Reference should be made to Figure A1 which shows the inter-relationship of many of these terms and the relevant portion of Landslide Risk Management.

Reference should also be made to the paper referenced below for Landslide Terminology and more detailed discussion of the above terminology.

This appendix is an extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007, which discusses the matter more fully.

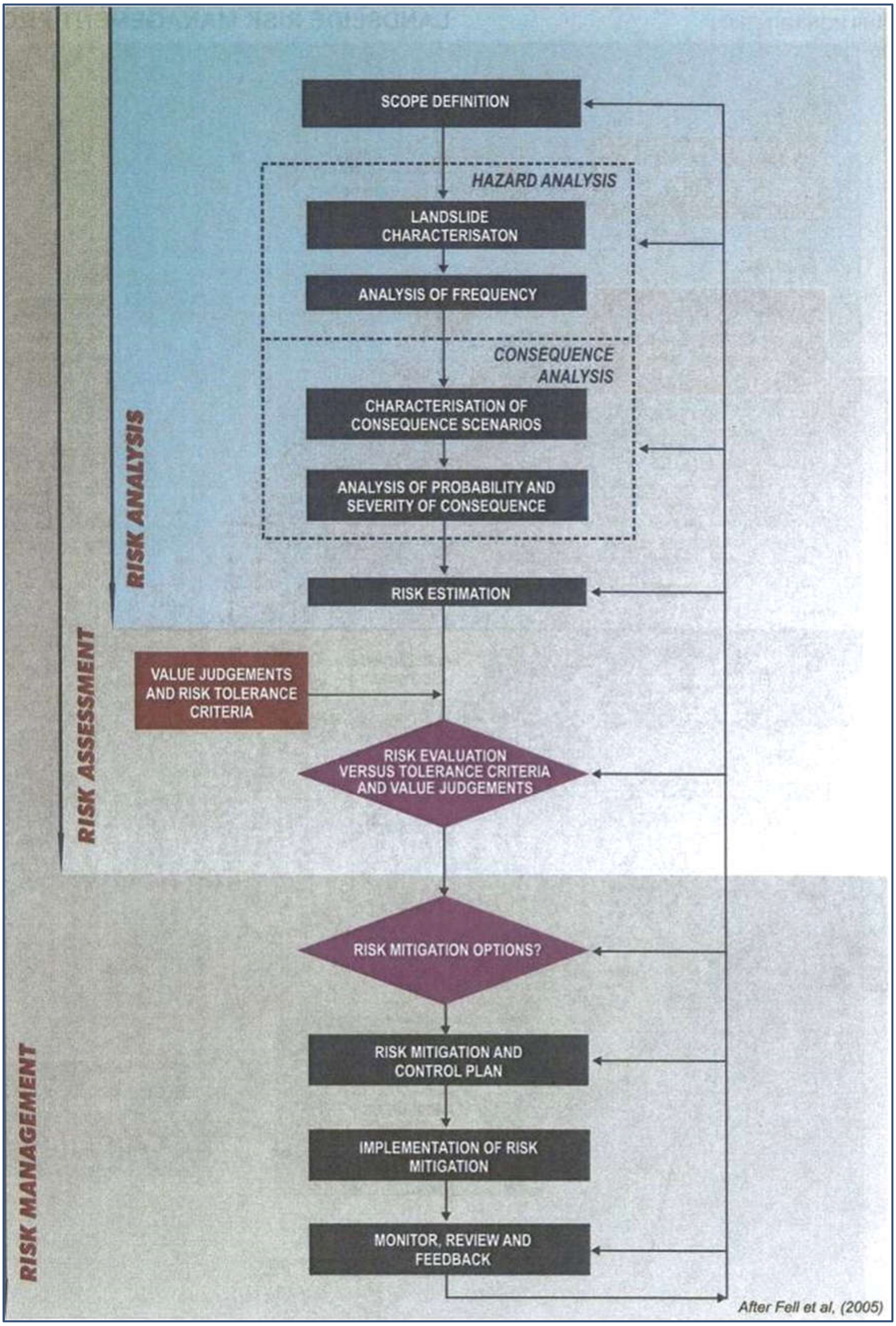


FIGURE A1: Flowchart for Landslide Risk Management.

This figure is an extract from GUIDELINE FOR LANDSLIDE SUSCEPTIBILITY, HAZARD AND RISK ZONING FOR LAND USE PLANNING, as presented in Australian Geomechanics Vol 42, No 1, March 2007, which discusses the matter more fully.

TABLE A1: 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}	5×10^{-2}	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	5×10^{-3}	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	5×10^{-4}	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	5×10^{-5}	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	5×10^{-2}	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.

Extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007, which discusses the matter more fully.

TABLE A1: LANDSLIDE RISK ASSESSMENT
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) 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.

Extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007, which discusses the matter more fully.

AUSTRALIAN GEOGUIDE LR2 (LANDSLIDES)

What is a Landslide?

Any movement of a mass of rock, debris, or earth, down a slope, constitutes a "landslide". Landslides take many forms, some of which are illustrated. More information can be obtained from Geoscience Australia, or by visiting its Australian landslide Database at www.ga.gov.au/urban/factsheets/landslide.jsp. Aspects of the impact of landslides on buildings are dealt with in the book "Guideline Document Landslide Hazards" published by the Australian Building Codes Board and referenced in the Building Code of Australia. This document can be purchased over the internet at the Australian Building Codes Board's website www.abcb.gov.au.

Landslides vary in size. They can be small and localised or very large, sometimes extending for kilometres and involving millions of tonnes of soil or rock. It is important to realise that even a 1 cubic metre boulder of soil, or rock, weighs at least 2 tonnes. If it falls, or slides, it is large enough to kill a person, crush a car, or cause serious structural damage to a house. The material in a landslide may travel downhill well beyond the point where the failure first occurred, leaving destruction in its wake. It may also leave an unstable slope in the ground behind it, which has the potential to fall again, causing the landslide to extend (regress) uphill, or expand sideways. For all these reasons, both "potential" and "actual" landslides must be taken very seriously. The present a real threat to life and property and require proper management.

Identification of landslide risk is a complex task and must be undertaken by a geotechnical practitioner (GeoGuide LR1) with specialist experience in slope stability assessment and slope stabilisation.

What Causes a Landslide?

Landslides occur as a result of local geological and groundwater conditions, but can be exacerbated by inappropriate development (GeoGuide LR8), exceptional weather, earthquakes and other factors. Some slopes and cliffs never seem to change, but are actually on the verge of failing. Others, often moderate slopes (Table 1), move continuously, but so slowly that it is not apparent to a casual observer. In both cases, small changes in conditions can trigger a landslide with series consequences. Wetting up of the ground (which may involve a rise in groundwater table) is the single most important cause of landslides (GeoGuide LR5). This is why they often occur during, or soon after, heavy rain. Inappropriate development often results in small scale landslides which are very expensive in human terms because of the proximity of housing and people.

Does a Landslide Affect You?

Any slope, cliff, cutting, or fill embankment may be a hazard which has the potential to impact on people, property, roads and services. Some tell-tale signs that might indicate that a landslide is occurring are listed below:

- Open cracks, or steps, along contours
- Groundwater seepage, or springs
- Bulging in the lower part of the slope
- Hummocky ground
- trees leaning down slope, or with exposed roots
- debris/fallen rocks at the foot of a cliff
- tilted power poles, or fences
- cracked or distorted structures

These indications of instability may be seen on almost any slope and are not necessarily confined to the steeper ones (Table 1). Advice should be sought from a geotechnical practitioner if any of them are observed. Landslides do not respect property boundaries. As mentioned above they can "run-out" from above, "regress" from below, or expand sideways, so a landslide hazard affecting your property may actually exist on someone else's land.

Local councils are usually aware of slope instability problems within their jurisdiction and often have specific development and maintenance requirements. **Your local council is the first place to make enquiries if you are responsible for any sort of development or own or occupy property on or near sloping land or a cliff.**

TABLE 1 – Slope Descriptions

Appearance	Slope Angle	Maximum Gradient	Slope Characteristics
Gentle	0° - 10°	1 on 6	Easy walking.
Moderate	10° - 18°	1 on 3	Walkable. Can drive and manoeuvre a car on driveway.
Steep	18° - 27°	1 on 2	Walkable with effort. Possible to drive straight up or down roughened concrete driveway, but cannot practically manoeuvre a car.
Very Steep	27° - 45°	1 on 1	Can only climb slope by clutching at vegetation, rocks, etc.
Extreme	45° - 64°	1 on 0.5	Need rope access to climb slope.
Cliff	64° - 84°	1 on 0.1	Appears vertical. Can abseil down.
Vertical or Overhang	84° - 90±°	Infinite	Appears to overhang. Abseiler likely to lose contact with the face.

Some typical landslides which could affect residential housing are illustrated below:

Rotational or circular slip failures (Figure 1) - can occur on moderate to very steep soil and weathered rock slopes (Table 1). The sliding surface of the moving mass tends to be deep seated. Tension cracks may open at the top of the slope and bulging may occur at the toe. The ground may move in discrete "steps" separated by long periods without movement. More rapid movement may occur after heavy rain.

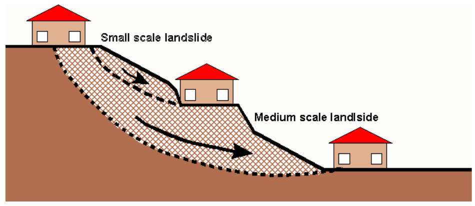


Figure 1

Translational slip failures (Figure 2) - tend to occur on moderate to very steep slopes (Table 1) where soil, or weak rock, overlies stronger strata. The sliding mass is often relatively shallow. It can move, or deform slowly (creep) over long periods of time. Extensive linear cracks and hummocks sometimes form along the contours. The sliding mass may accelerate after heavy rain.

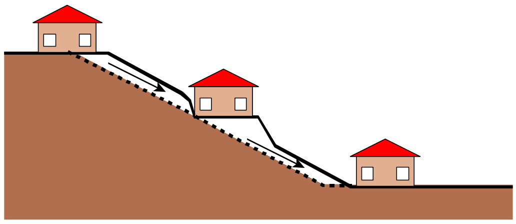


Figure 2

Wedge failures (Figure 3) - normally only occur on extreme slopes, or cliffs (Table 1), where discontinuities in the rock are inclined steeply downwards out of the face.

Rock falls (Figure 3) - tend to occur from cliffs and overhangs (Table 1).

Cliffs may remain, apparently unchanged, for hundreds of years. Collections of boulders at the foot of a cliff may indicate that rock falls are ongoing. Wedge failures and rock falls do not "creep". Familiarity with a particular local situation can instil a false sense of security since failure, when it occurs, is usually sudden and catastrophic.

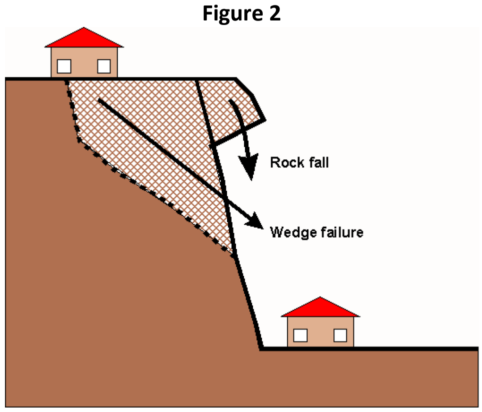


Figure 3

Debris flows and mud slides (Figure 4) - may occur in the foothills of ranges, where erosion has formed valleys which slope down to the plains below. The valley bottoms are often lined with loose eroded material (debris) which can "flow" if it becomes saturated during and after heavy rain. Debris flows are likely to occur with little warning; they travel a long way and often involve large volumes of soil. The consequences can be devastating.

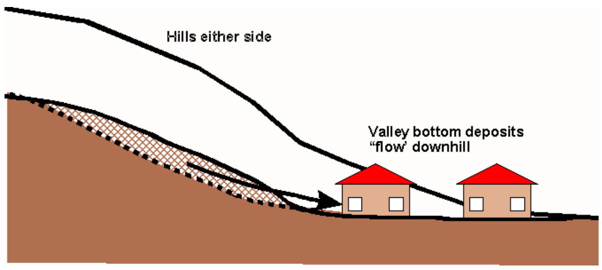


Figure 4

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

- GeoGuide LR1 - Introduction
- GeoGuide LR3 - Soil Slopes
- GeoGuide LR4 - Rock Slopes
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR8 - Hillside Construction
- 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.

AUSTRALIAN GEOGUIDE LR7 (LANDSLIDE RISK)

Concept of Risk

Risk is a familiar term, but what does it really mean? It can be defined as *"a measure of the probability and severity of an adverse effect to health, property, or the environment."* This definition may seem a bit complicated. In relation to landslides, geotechnical practitioners (see GeoGuide LR1) are required to assess risk in terms of the likelihood that a particular landslide will occur and the possible consequences. This is called landslide risk assessment. The consequences of a landslide are many and varied, but our concerns normally focus on loss of, or damage to, property and loss of life.

Landslide Risk Assessment

Some local councils in Australia are aware of the potential for landslides within their jurisdiction and have responded by designating specific "landslide hazard zones". Development in these areas is normally covered by special regulations. If you are contemplating building, or buying an existing house, particularly in a hilly area, or near cliffs, then go first for information to your local council.

Landslide risk assessment must be undertaken by a geotechnical practitioner. It may involve visual inspection, geological mapping, geotechnical investigation and monitoring to identify:

- potential landslides (there may be more than one that could impact on your site);
- the likelihood that they will occur;
- the damage that could result;
- the cost of disruption and repairs; and
- the extent to which lives could be lost.

Risk assessment is a predictive exercise, but since the ground and the processes involved are complex, prediction tends to lack precision. If you commission a landslide risk assessment for a particular site you should expect to receive a report prepared in accordance with current professional guidelines and in a form that is acceptable to your local council, or planning authority.

Risk to Property

Table 1 indicates the terms used to describe risk to property. Each risk level depends on an assessment of how likely a landslide is to occur and its consequences in dollar terms. "Likelihood" is the chance of it happening in any one year, as indicated in Table 2. "Consequences" are related to the cost of the repairs and temporary loss of use if the landslide occurs. These two factors are combined by the geotechnical practitioner to determine the Qualitative Risk.

TABLE 2 – LIKELIHOOD

Likelihood	Annual Probability
Almost Certain	1:10
Likely	1:100
Possible	1:1,000
Unlikely	1:10,000
Rare	1:100,000
Barely credible	1:1,000,000

The terms "unacceptable", "may be tolerable" etc. in Table 1 indicate how most people react to an assessed risk level. However, some people will always be more prepared, or better able, to tolerate a higher risk level than others.

Some local councils and planning authorities stipulate a maximum tolerable risk level of risk to property for developments within their jurisdictions. In these situations the risk must be assessed by a geotechnical practitioner. If stabilisation works are needed to meet the stipulated requirements these will normally have to be carried out as part of the development, or consent will be withheld.

TABLE 1 – RISK TO PROPERTY

Qualitative Risk		Significance - Geotechnical engineering requirements
Very high	VH	**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 the value of the property.
High	H	**Unacceptable** without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable level. Work would cost a substantial sum in relation to the value of the property.
Moderate	M	**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 possible.
Low	L	**Usually acceptable** to regulators. Where treatment has been needed to reduce the risk to this level, ongoing maintenance is required.
Very Low	VL	**Acceptable**. Manage by normal slope maintenance procedures.

Risk to Life

Most of us have some difficulty grappling with the concept of risk and deciding whether, or not, we are prepared to accept it. However, without doing any sort of analysis, or commissioning a report from an "expert", we all take risks every day. One of them is the risk of being killed in an accident. This is worth thinking about, because it tells us a lot about ourselves and can help to put an assessed risk into a meaningful context. By identifying activities that we either are, or are not, prepared to engage in, we can get some indication of the maximum level of risk that we are prepared to take. This knowledge can help us to decide whether we really are able to accept a particular risk, or to tolerate a particular likelihood of loss, or damage, to our property (Table 2).

In Table 3, data from NSW for the years 1998 to 2002, and other sources, is presented. A risk of 1 in 100,000 means that, in any one year, 1 person is killed for every 100,000 people undertaking that particular activity. The NSW data assumes that the whole population undertakes the activity. That is, we are all at risk of being killed in a fire, or of choking on our food, but it is reasonable to assume that only people who go deep sea fishing run a risk of being killed while doing it.

It can be seen that the risks of dying as a result of falling, using a motor vehicle, or engaging in water-related activities (including bathing) are all greater than 1:100,000 and yet few people actively avoid situations where these risks are present. Some people are averse to flying and yet it represents a lower risk than choking to death on food. The data also indicate that, even when the risk of dying as a consequence of a particular event is very small, it could still happen to any one of us today. If this were not so, there would be no risk at all and clearly that is not the case.

In NSW, the planning authorities consider that 1:1,000,000 is the maximum tolerable risk for domestic housing built near an obvious hazard, such as a chemical factory. Although not specifically considered in the NSW guidelines there is little difference between the hazard presented by a neighbouring factory and a landslide: both have the capacity to destroy life and property and both are always present.

TABLE 3 – RISK TO LIFE

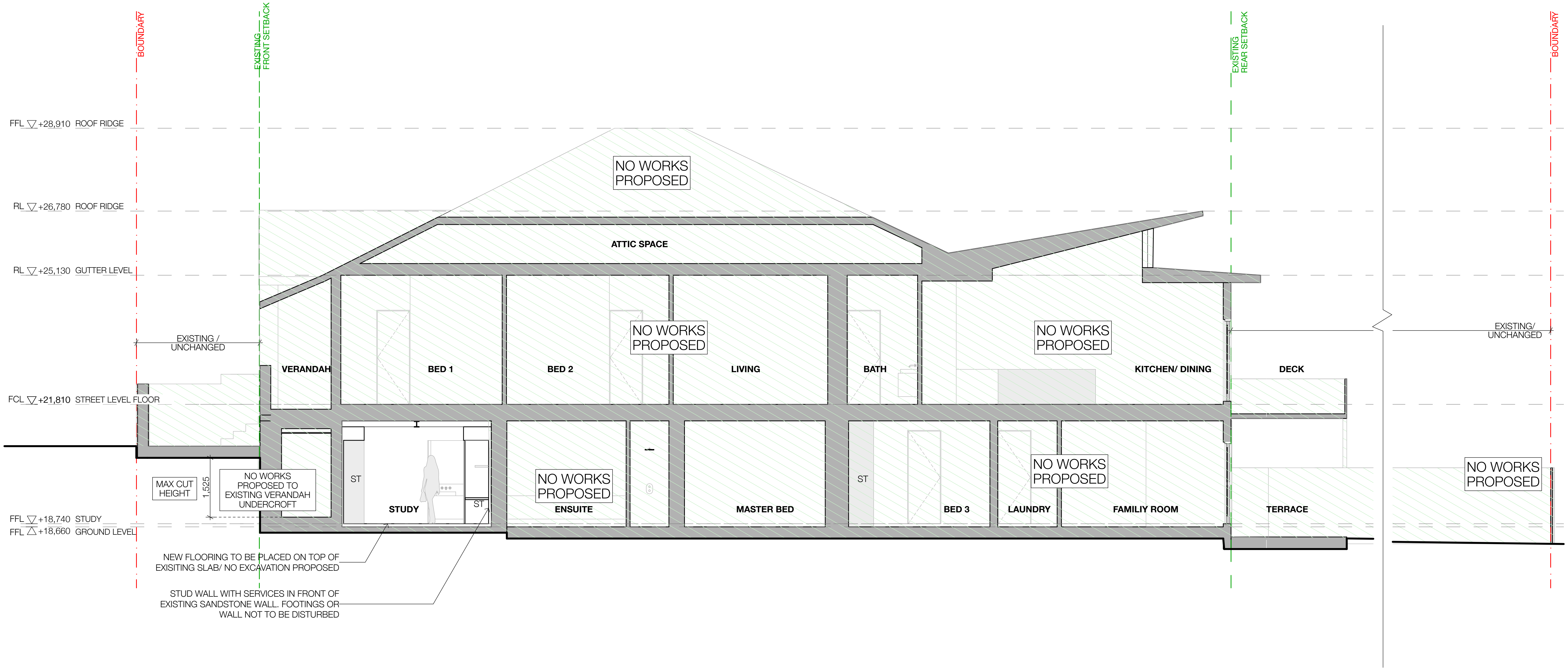
Risk (deaths per participant per year)	**Activity/Event Leading to Death** (NSW data unless noted)
1:1,000	Deep sea fishing (UK)
1:1,000 to 1:10,000	Motor cycling, horse riding, ultra-light flying (Canada)
1:23,000	Motor vehicle use
1:30,000	Fall
1:70,000	Drowning
1:180,000	Fire/burn
1:660,000	Choking on food
1:1,000,000	Scheduled airlines (Canada)
1:2,300,000	Train travel
1:32,000,000	Lightning strike

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

- GeoGuide LR1 - Introduction
- GeoGuide LR3 - Soil Slopes
- GeoGuide LR4 - Rock Slopes
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR8 - Hillside Construction
- 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.

APPENDIX B



2 SECTION A
1:100

GENERAL CODES		FINISHES CODES	
AHD	AUSTRALIAN HEIGHT DATUM	CONC-	CONCRETE TYPE -
D-	DOOR TYPE-	F-	FENCE TYPE -
EX	EXISTING	FT-	FLOOR TILE TYPE-
FCL	FINISHED CEILING LEVEL	PAV-	PAVER TYPE
FFL	FINISHED FLOOR LEVEL	PS-	PAINTED STEEL TYPE-
RL	REDUCED LEVEL	ST	STORAGE
TOF	TOP OF FENCE	TD-	TIMBER DECK TYPE-
TOW	TOP OF WALL	TF-	TIMBER FLOORING TYPE-
W-	WINDOW TYPE	DP-	DOWN PIPE TYPE

LEGEND-DEMOLITION AND NEW

- EXISTING CONSTRUCTION
- TO BE DEMOLISHED
- NEW CONSTRUCTION
- NO WORKS PROPOSED

LINTEL

LINTEL STUDIO
FOR ARCHITECTURE PTY LTD

7/2 Carr St.
Coogee NSW 2034
Australia
T +61 2 9211 3211
F +61 2 9211 7762
www.lintelstudio.com.au

Nominated Architect Emiliano Miranda 10022

NOTES:

-This drawing is for DA purposes only.
-All levels relative to measurements taken on site.
-Refer to client provided drawings for information relating to existing site data.
-Verify all dimensions on site prior to commencement of work.
-Refer all discrepancies immediately to the Architect for determination.
-Use figured dimensions in preference to scaling.

DATE	REV.	ISSUE
14/12/20	A	FOR DA

REFERENCES:

- SURVEY PLAN BY **CMS SURVEYORS**
- SEE AND VARIATION TO CLAUSE 4.4 BY **PLACE DESIGN GROUP**
- FINISHES SCHEDULE BY **LINTEL**

DRAWN/CHECKED:EM / EM

PROJECT: 2005
MANLY WORK FROM HOME

CLIENT:
Angela Holm & Robert Chapman

92 Addison Road,
Manly 2095 NSW
LOT 4 DP258309

DRAWING
SECTION A

SCALE:
1:100 @A3

DRAWING NO.
2005_DA.07

REV.
A