GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER

FORM NO. 1(a) - Checklist of Requirements for Geotechnical Risk Management Report for Development Application

Development Application for Luke Anglicas
Name of Applicant
Address of site **145 McCarrs Creek Road, Church Point**

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk Management Geotechnical Report. This checklist is to accompany the Geotechnical Report and its certification (Form No. 1).

Geotechnical Report Details:

Report Title: RISK ANALYSIS & MANAGEMENT FOR PROPOSED NEW RESIDENCE AND GARAGE AT 143 McCARRS CREEK ROAD, CHURCH POINT – PX 00027

Report Date: 30th August, 2019

Author: GARTH HODGSON, REVIEWED PETER THOMPSON

Author's Company/Organisation: HODGSON CONSULTING ENGINEERS PTY LTD

Please mark appropriate box

☒ Comprehensive site mapping conducted 19/08/2019 (date)
☒ Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)
☒ Subsurface investigation required
- ☐ No Justification ....
- ☒ Yes Date conducted 19/08/2019

☒ Geotechnical model developed and reported as an inferred subsurface type-section
☒ Geotechnical hazards identified
- ☐ Above the site
- ☒ On the site
- ☐ Below the site
- ☐ Beside the site

☒ Geotechnical hazards described and reported
☒ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☒ Consequence analysis
- ☒ Frequency analysis

☒ Risk calculation
☒ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.
☒ Design Life Adopted:
- ☒ 100 years
- ☐ Other
  specify

☒ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater – 2009 have been specified
☒ Additional action to remove risk where reasonable and practical have been identified and included in the report.
☐ Risk Assessment within Bushfire Asset Protection Zone

I am aware that Pittwater Council will rely on the Geotechnical Report, to which this checklist applies, as the basis for ensuring that the geotechnical risk management aspects of the proposal have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated, and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature Peter Thompson

Name Peter Thompson

Chartered Professional Status MIE Aust CPEng

Membership No. 146800

Company Hodgson Consulting Engineers Pty Ltd

GEOTECHNICAL | CIVIL | STRUCTURAL

RISK MANAGEMENT
FOR
PROPOSED NEW RESIDENCE & GARAGE
AT
145 McCARRS CREEK ROAD, CHURCH POINT

1. INTRODUCTION.

1.1 This assessment has been prepared to accompany an application for Development Approval with Northern Beaches Council - Pittwater. The requirements of the Geotechnical Risk Management Policy for Pittwater, 2009 have been met.

1.2 The definitions used in this Report are those used in the Geotechnical Risk Management Policy for Pittwater, 2009.

1.3 The methods used in this Assessment are based on those described in Landslide Risk Management March 2007, published by the Australian Geomechanics Society and as modified by the Geotechnical Risk Management Policy for Pittwater, 2009.

1.4 The experience of the principal of Hodgson Consulting Engineers spans a time period over 25 years in the Northern Beaches Council area and Greater Sydney Region.

2. PROPOSED DEVELOPMENT.

2.1 Construct a new dwelling.

2.2 Construct new extension to the existing driveway shared with 141 McCarrs Creek Road.

2.3 Construct a new garage and turning area shared with 143 McCarrs Creek Road.

2.4 Details of the proposed development are shown on a series of architectural drawings prepared by Peter Princi Architects, Plan numbers SK01 to SK05, dated August, 2019.

3. DESCRIPTION OF SITE & SURROUNDING AREA.

3.1 The site was inspected on the 19th August 2019.

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DESCRIPTION OF SITE & SURROUNDING AREA. (Continued)

3.2 This trapezoidal shaped block is located on the high side of the road. The property has a westerly aspect. It is located near the middle of a slope that rises from the waters Browns Bay Pittwater to the ridge of the hill approximately at Minkara Road. The gradient rises across the site at angles of some 20 to 25 degrees.

3.3 Access to the block is via the concrete driveway to the north of the property that provides access to 141 McCarrs Creek Road, Photo 1. From the McCarrs Creek road the steep road reserve cut batter rises to the front boundary. The cut batter is well vegetated and in some locations the exposed weathered shales of the Narrabeen Group of rocks is visible, Photo 2. There are numerous small to large trees spread over the block and medium dense undergrowth with displaced joint blocks (rock floaters) littered over the site, Photo 3. From the front boundary there is small level area where the slope rises consistently towards the rear boundary and to a rock ledge. The rock ledge has rock floaters on top and eroded overhangs in some locations and is approximately halfway up the property, Photos 4 & 5. The vegetated slope then continues to the rear boundary. A natural water course running adjacent along the southern side boundary is in the neighbouring reserve. Erosion of the road reserve batter by the watercourse was observed at the time of our inspection. This erosion should be motored and Council if informed of any changes especially after heavy rainfall events.

3.4 The adjoining properties have similar topography and geomorphology and most of them have been developed for some time. These adjoining properties are mapped as H1 hazard areas on Council's Geotechnical Hazard Map. Our observations indicate the surrounding slopes do not present a significant risk of instability to the subject property.

4. GEOLOGY OF THE SITE.

4.1 The Sydney geological series sheet, at a scale of 1:100,000 indicates the site is underlain by interbedded sandstones, siltstones and shales of the Upper Narrabeen Group which outcrop in the water course. The Narrabeen Group Rocks are Late Permian to Middle Triassic in age with the early rocks not outcropping in the area under discussion. The materials from which the rocks were formed consist of gravels, coarse to fine sands, silts and clays. They were deposited in a riverine type environment with larger floods causing fans of finer materials. The direction of deposition changed during the period of formation. The lower beds are very variable with the variations decreasing as the junction with the Hawkesbury Sandstones is approached. This is marked by the highest of

4. GEOLOGY OF THE SITE. (Continued)

persistent shale beds over thicker sandstone beds which are similar in composition to the Hawkesbury Sandstones.

4.2 The slope materials are colluvial in origin at the surface and became residual with depth. They consist of sandy loam topsoil over sandy clays and clays with rock fragments and some floaters through out the profile. The sandy clays and clays merge into the weathered zone of the under lying rocks at depths expected to be in the range 0.5 to 2.0 metres or deeper where filling has been carried out.

5. SUBSURFACE INVESTIGATION AND SITE CLASSIFICATION.

5.1 Based on visual observation the site is considered consistent with adjacent local sites previously inspected and reported and accordingly physical subsurface investigation has not been conducted at this stage on this proposed development however conditional that it remains subject to ongoing inspection during excavation and construction.

5.2 SITE CLASSIFICATION.

The natural soil profile of the existing site is classified Class M, defined as 'Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes' as defined by AS 2870 - 2011. Where bedrock is encountered the site is classified as Class A.

6. DRAINAGE OF THE SITE.

6.1 ON THE SITE.

The site is naturally well drained with surface and subsurface runoff draining toward the front western boundary. No natural watercourses were observed on site.

6.2 SURROUNDING AREA.

Overland stormwater flow entering the site from the adjoining properties was not evident. Normal overland runoff could enter the site from above during heavy or extended rainfall

7. GEOTECHNICAL HAZARDS.

7.1 ABOVE THE SITE.

No geotechnical hazards likely to adversely affect the subject property were observed above the site.

7.2 ON THE SITE.

7.2.1 The site is classed slip affected under Council's Policy and a H1 Hazard. A failure of the slope across the property is considered to be a potential hazard **(HAZARD ONE)**.

7.2.2 The excavations for the proposed garage are approximately 5.0m in depth. A possible failure of the cut batter during excavation is considered to be a potential hazard **(HAZARD TWO)**.

7.3 BELOW THE SITE.

No geotechnical hazards likely to adversely affect the subject property were observed below the site.

7.4 BESIDE THE SITE.

The areas beside the site have similar elevation and geomorphology to the subject property. No geotechnical hazards likely to adversely affect the subject property were observed beside the site.

8. RISK ASSESSMENT.

8.1 ABOVE THE SITE.

As no geotechnical hazards likely to adversely affect the subject site were observed above the site, no risk analysis is required.

8.2 ON THE SITE.

8.2.1 HAZARD ONE Qualitative Risk Assessment on Property

The block is located near the middle of a slope that rises from the waters Browns Bay Pittwater to the ridge of the hill approximately at Minkara Road. The gradient rises across the site at angles of some 20 to 25 degrees. There was no evidence of slumping or slope instability on the subject

8. RISK ASSESSMENT. (Continued)

property. The likelihood of the slope failing and impacting on the house is assessed as 'Unlikely' (10^{-4}). The consequences to property of such a failure are assessed as 'Medium' (20%). The risk to property is 'Low' (2×10^{-5}).

8.2.2 HAZARD ONE Quantitative Risk Assessment on Life

For loss of life, risk can be calculated as follows:
$\mathbf{R_{(LoI)} = P_{(H)} \times P_{(SH)} \times P_{(TS)} \times V_{(DT)}}$ (See Appendix for full explanation of terms)

8.2.2.1 Annual Probability

Competent rock is encountered at relatively shallow depths across the block. No evidence of significant movement was observed on the site.
$\mathbf{P_{(H)}} = 0.0001$/annum

8.2.2.2 Probability of Spatial Impact

The house is located near the middle of the slope.
$\mathbf{P_{(SH)}} = 0.15$

8.2.2.3 Possibility of the Location Being Occupied During Failure

The average household is taken to be occupied by 4 people. It is estimated that 1 person is in the house for 20 hours a day, 7 days a week. It is estimated 3 people are in the house 12 hours a day, 5 days a week.
For the person most at risk:

$$\frac{20}{24} x \frac{7}{7} = 0.83$$

$\mathbf{P_{(TS)}} = 0.83$

8.2.2.4 Probability of Loss of Life on Impact of Failure

Based on the volume of land sliding and its likely velocity when it fails, it is estimated that the vulnerability of a person to being killed in the house when a landslide occurs is 0.2
$\mathbf{V_{(DT)}} = 0.2$

8.2.2.5 Risk Estimation

$\mathbf{R_{(LoI)}} = 0.0001 \times 0.15 \times 0.83 \times 0.2$
$= 0.00000249$
$\mathbf{R_{(LoI)}} = 2.49 \times 10^{-6}$/annum **NOTE:** This level of risk is **'ACCEPTABLE'** provided the recommendations given in **Section 10** are undertaken.

8. RISK ASSESSMENT. (Continued)

8.2.3 HAZARD TWO Qualitative Risk Assessment on Property

The excavation for the proposed garage is to be cut into the existing slope with a depth of approximately 5.0m. Provided the recommendations in Section 10 are followed the likelihood of the excavations for the proposed garage and swimming pool collapsing and impacting on the work site and neighbouring properties is assessed as 'Unlikely' (10^{-4}). The consequences to property of such a failure are assessed as 'Medium' (20%). The risk to property is 'Low' (5×10^{-6}).

8.2.4 HAZARD TWO Quantitative Risk Assessment on Life

For loss of life, risk can be calculated as follows:
$\mathbf{R_{(Lol)} = P_{(H)} \times P_{(SH)} \times P_{(TS)} \times V_{(DT)}}$ (See Appendix for full explanation of terms)

8.2.4.1 Annual Probability

The excavation will be predominately through competent shale bedrock at depths of greater than 1.0 to 1.5 metres.
$\mathbf{P_{(H)}} = 0.0001$/annum

8.2.4.2 Probability of Spatial Impact

People working below the cut.
$\mathbf{P_{(SH)}} = 0.15$

8.2.4.3 Possibility of the Location Being Occupied During Failure

The average worksite is taken to be occupied by 6 people. It is estimated that 1 person is below the cut for 8 hours a day, 6 days a week. It is estimated 5 people are in the house 5 hours a day, 5 days a week.
For the person most at risk:
$$\frac{8}{24} x \frac{6}{7} = 0.29$$
$\mathbf{P_{(TS)}} = 0.29$

8.2.4.4 Probability of Loss of Life on Impact of Failure

Based on the volume of the batter that could fail and its likely velocity when it hits the worksite, it is estimated that the vulnerability of a person to being killed in the house when a landslide occurs is 0.2
$\mathbf{V_{(DT)}} = 0.2$

8. RISK ASSESSMENT. (Continued)

8.2.4.5 Risk Estimation

$R_{(LoI)}$ = 0.0001 x 0.15 x 0.29 x 0.2
= 0.00000087

$R_{(LoI)}$ = 8.7 x 10^{-7}/annum **NOTE:** This level of risk is **'ACCEPTABLE'** provided the recommendations given in **Section 10** are undertaken.

8.3 BELOW THE SITE.

8.3.1 As no geotechnical hazards likely to adversely affect the subject site were observed below the site, no risk analysis is required.

8.4 BESIDE THE SITE.

8.4.1 As no geotechnical hazards likely to adversely affect the subject site were observed beside the site, no risk analysis is required.

9. SUITABILITY OF DEVELOPMENT FOR SITE.

9.1 GENERAL COMMENTS.

The proposed developments are suitable for the site.

9.2 GEOTECHNICAL COMMENTS.

No geotechnical hazards will be created by the completion of the proposed development in accordance with the requirements of this Report and good engineering and building practice.

9.3 CONCLUSIONS.

The site and the proposed development can achieve the Acceptable Risk Management criteria outlined in the Pittwater Interim Geotechnical Risk Policy provided the recommendations given in **Section 10** are undertaken.

10. RISK MANAGEMENT.

10.1. TYPE OF STRUCTURE.

The proposed structures are considered suitable for this site.

10. RISK MANAGEMENT. (Continued)

10.2. EXCAVATIONS.

10.2.1 All excavation recommendations as outlined below should be read in conjunction with Safe Work Australia's *'Excavation Work – Code of Practice'*, published October, 2013.

10.2.2 The excavation for the proposed garage will require an excavation of approximately 5.0m deep. The excavation is expected to be through fill material, sandy loam topsoil and clays in the top 1.0 to 1.5 metres. The lower part of the excavation is expected to be through weathered shale.

10.2.3 Any unconsolidated soil portions of the cut are to be supported by permanent engineered retaining walls. The weathered shale part of the cut will stand near vertical for short periods of time but is weather dependent. Temporary or permanent support is to be assessed and designed by the structural Engineer. All retaining walls are to be constructed as soon as possible.

10.2.4 All excavated materials left onsite will need to comply with the conditions in **Section 10.3** or be retained by an engineer designed retaining wall or structure.

10.2.5 All excavated material is to be removed from the site in accordance with current Office of Environment and Heritage (OEH) regulations.

10.3. FILLS.

10.3.1 If filling is required, all fills are to be placed in layers not more than 250 mm thick and compacted to not less than 95% of Standard Optimum Dry Density at plus or minus 2% of Standard Optimum Moisture Content.

10.3.2 The fill batters are to be not steeper than 1 vertical to 1.7 horizontal or they are to be supported by properly designed and constructed retaining walls.

10.4. FOUNDATION MATERIALS AND FOOTINGS.

It is recommended that the footings for the proposed development be taken to the weathered rock of the natural profile. The design allowable bearing pressure is 550kPa for spread footings or shallow piers. It is expected that material of sufficient bearing capacity will be found approximately 1.0 – 2.0m from existing surface levels. All foundation excavations are to be taken to material of a similar consistency to minimise the potential for differential settlement.

Note: The local geology is comprised of highly variable interbedded clays, shales and sandstones, with abundant detached joint blocks and sandstone floaters at surface and in the upper profile. Conditions may alter significantly across short distances. This variability should be anticipated and accounted for in the design and construction of any new foundations.

10.5. STORM WATER DRAINAGE.

All storm water runoff from the development is to be connected to the existing storm water system for the block through any tanks or onsite detention systems that may be required by the regulating authorities. This drainage work is to comply with the relevant Australian standards (AS/NZS 3500 Plumbing and Drainage).

10.6. SUBSURFACE DRAINAGE.

Any retaining walls are to be back filled with non-cohesive free draining material to provide a drainage layer immediately behind the wall. The free draining material is to be separated from the ground materials by geotextile fabric.

10.7. INSPECTIONS.

It is essential that the foundation materials of all footing excavations be inspected and approved before concrete is placed. This includes retaining wall footings. Failure to advise the geotechnical engineer for these inspections could delay or stop the issuance of relevant certificates.

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11. GEOTECHNICAL CONDITIONS FOR ISSUE OF CONSTRUCTION CERTIFICATE.

It is recommended that the following geotechnical conditions be applied to the Development Approval:-

The work is to be carried out in accordance with the Risk Management Report PX 00027 dated 30th August, 2019.

The Geotechnical Engineer is to inspect and approve the foundation materials of any footing excavations before concrete is placed.

12. GEOTECHNICAL CONDITIONS FOR ISSUE OF OCCUPATION CERTIFICATE.

The Geotechnical Engineer is to certify the following geotechnical aspects of the development:-

The work has been carried out in accordance with the Risk Management Report PX 00027 dated 30th August, 2019.

The Geotechnical Engineer inspected and approved the foundation material of all footing excavations.

13. RISK ANALYSIS SUMMARY.

HAZARDS	Hazard One	Hazard Two
TYPE	The site is classed slip affected under Council's Policy. A failure of the slope across the property is considered to be a potential hazard.	The excavation for the proposed garage is approximately 5.0m in depth. A possible failure of the cut batter during excavation is considered to be a potential hazard.
LIKELIHOOD	'Unlikely' (10^{-4})	'Unlikely' (10^{-4})
CONSEQUENCES TO PROPERTY	'Medium' (20%)	'Medium' (20%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Low' (2×10^{-5})
RISK TO LIFE	2.49×10^{-6}/annum	8.7×10^{-7}/annum
COMMENTS	This level of risk is **'ACCEPTABLE'** provided the conditions in **Section 10** are followed.	This level of risk is **'ACCEPTABLE'** provided the conditions in **Section 10** are followed.

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Garth Hodgson MIE Aust
Member No. 2211514
Civil/Geotechnical & Structural Engineer

Peter Thompson MIE Aust CPEng
Member No. 146800
Civil/Geotechnical Engineer

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

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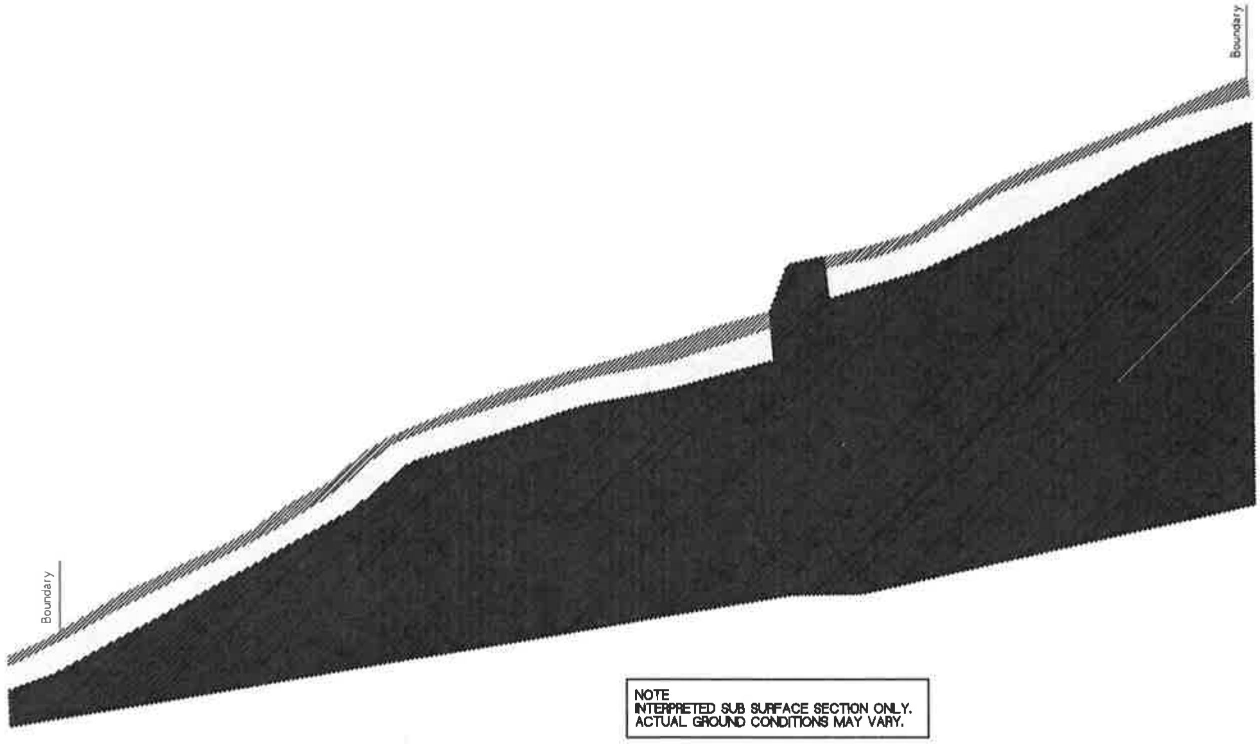
SITE PLAN – HAZARDS –	
Job No: PX 00028	Address: 145 McCARRS CREEK ROAD CHURCH POINT NSW
Scale: NTS	



NOTE
INTERPRETED SUB SURFACE SECTION ONLY.
ACTUAL GROUND CONDITIONS MAY VARY.

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TYPE SECTION	
Job No PX 00028	Address 145 McCARRS CREEK ROAD CHURCH POINT NSW
Scale NTS	

STRATA PROFILE LEGEND

- Fill
- Sandy Topsoil
- Sandy Clay
- Narrabeen Group Rocks
- Hawkesbury Sandstone

7 RISK ESTIMATION

7.1 QUANTITATIVE RISK ESTIMATION

Quantitative risk estimation involves integration of the frequency analysis and the consequences.
For property, the risk can be calculated from:
$\mathbf{R_{(Prop)} = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(Prop:S)} \times E}$ **(1)**

Where
$\mathbf{R_{(Prop)}}$ is the risk (annual loss of property value).

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

$\mathbf{P_{(S:H)}}$ is the probability of spatial impact by the landslide on the property, taking into account the travel distance and travel direction.

$\mathbf{P_{(T:S)}}$ is the temporal spatial probability. For houses and other buildings $\mathbf{P_{(T:S)}}$= 1.0. For Vehicles and other moving elements at risk1.0< $\mathbf{P_{(T:S)}}$ >0.

$\mathbf{V_{(Prop:S)}}$ is the vulnerability of the property to the spatial impact (proportion of property value lost).

E is the element at risk (e.g. the value or net present value of the property).
For loss of life, the individual risk can be calculated from:

$\mathbf{R_{(LoL)} = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(D:T)}}$ **(2)**
Where

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

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

$\mathbf{P_{(S:H)}}$ is the probability of spatial impact of the landslide impacting a building (location) taking into account the travel distance and travel direction given the event.

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

$\mathbf{V_{(D:T)}}$ is the vulnerability of the individual (probability of loss of life of the individual given the impact).
A full risk analysis involves consideration of all landslide hazards for the site (e.g. large, deep seated landsliding, smaller slides, boulder falls, debris flows) and all the elements at risk.

For comparison with tolerable risk criteria, the individual risk from all the landslide hazards affecting the person most at risk, or the property, should be summed.

The assessment must clearly state whether it pertains to 'as existing' conditions or following implementation of recommended risk mitigation measures, thereby giving the 'residual risk'.