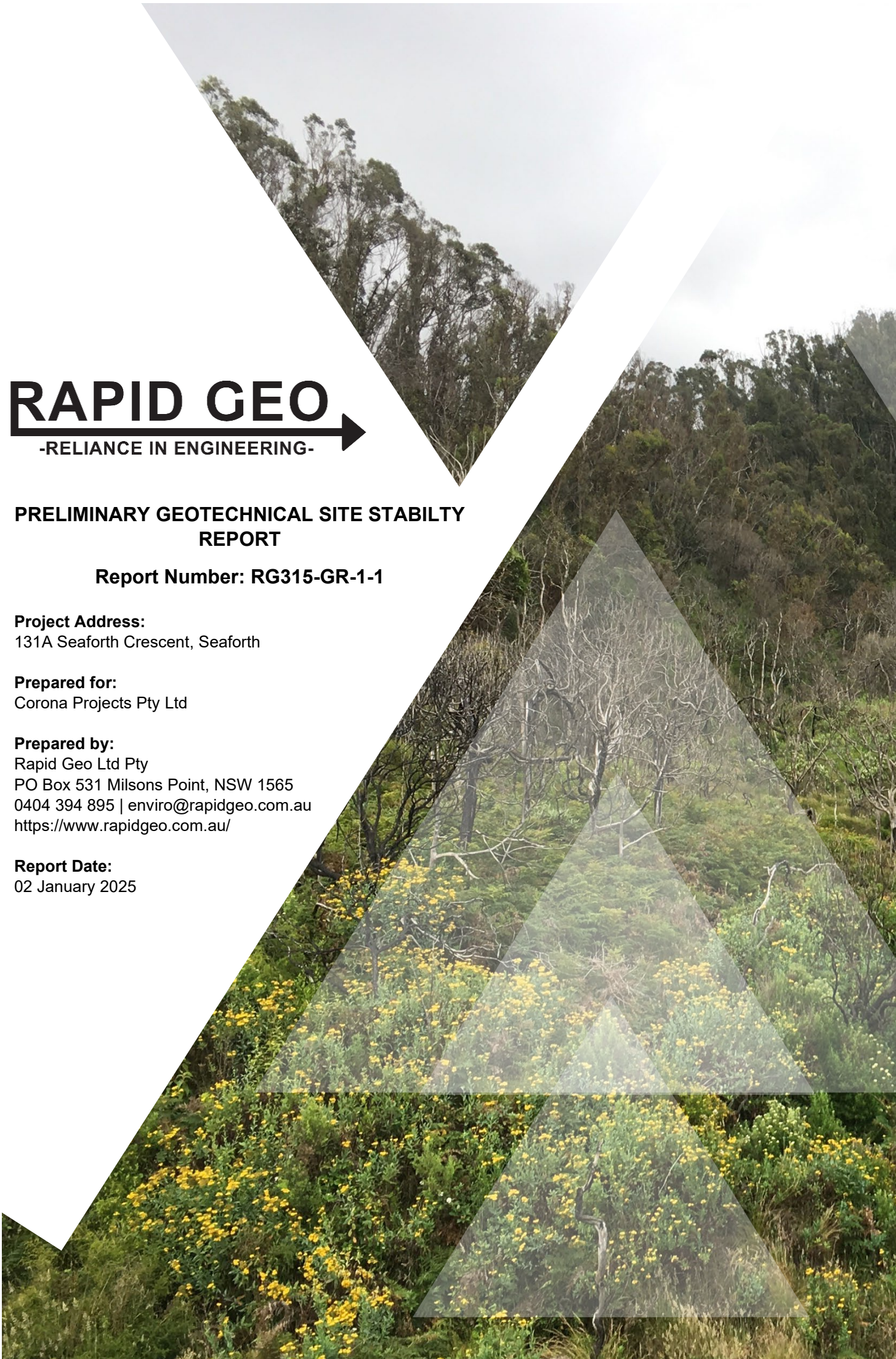

RAPID GEO

-RELIANCE IN ENGINEERING-

PRELIMINARY GEOTECHNICAL SITE STABILTY REPORT

Report Number: RG315-GR-1-1

Project Address:
131A Seaforth Crescent, Seaforth

Prepared for:
Corona Projects Pty Ltd

Prepared by:
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Report Date:
02 January 2025

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1. INTRODUCTION

This report presents the results of a geotechnical site stability assessment for the proposed development at 131a Seaforth Crescent, Seaforth.

The aim of the investigation was to provide comment on:

- Existing site conditions
- Site stability; and
- Recommended site preparation measures.

2. SITE DESCRIPTION

The site is located on the north-western portion of Seaforth Bluff overlooking Middle Harbour (refer Figure 1). The site has an undulating surface and falls towards the north-west with an overall slope angle 30°. Locally, the slope generally varies between 10° and 40° but is up to vertical in places. A three-storey house is present in the upper south-eastern portion of the site, set into the hillside. The lower north-western portion of the site is mostly covered by trees and bushes. A studio is present in the lower north-western part of the site. Numerous sandstone boulders are present at ground surface level across the site. Ground surface levels range from approximately 0 m above Australian Height Datum (AHD) (i.e. mean sea level) in the north-west to approximately 32 m AHD in the south-east.

An overhang comprising sandstone bedrock is located approximately 4 m the south-east of the existing house. The overhang extends eastwards onto the neighbouring property.

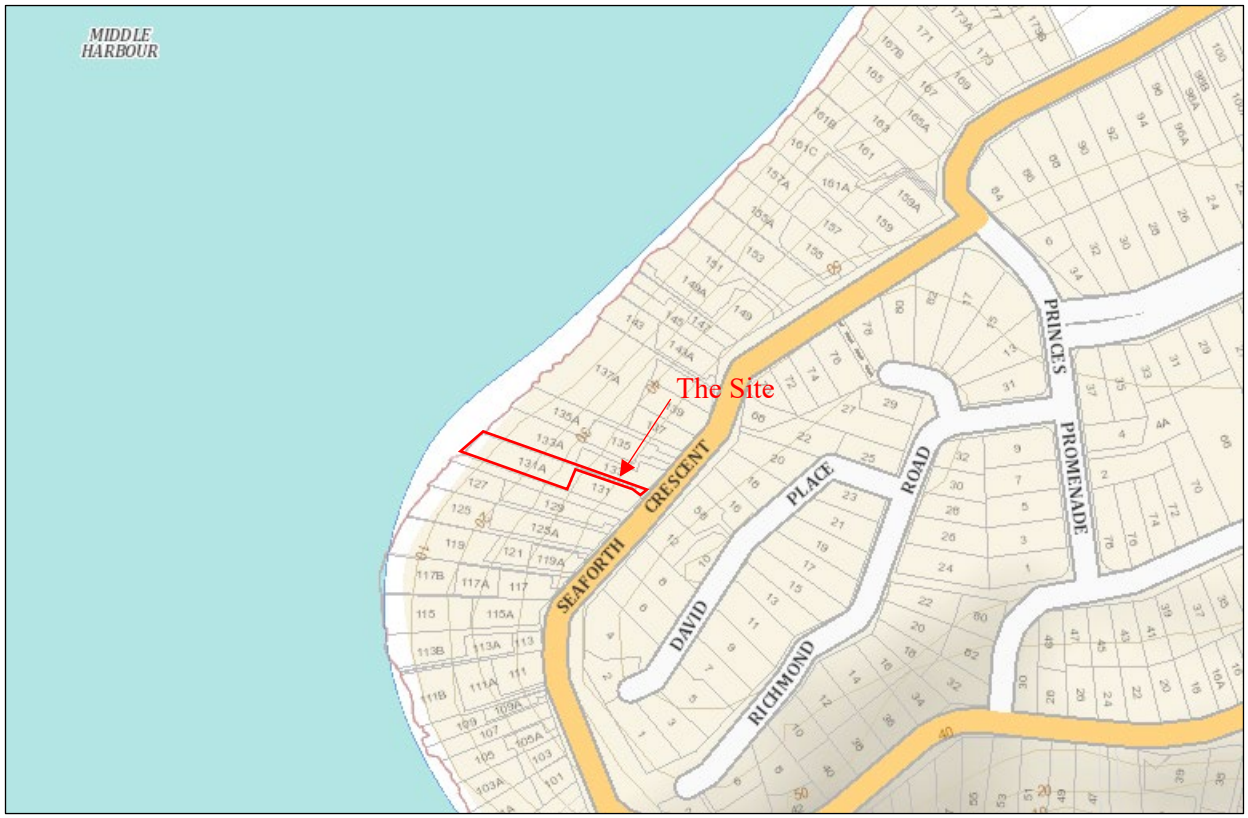

Figure 1: Site location Plan

3. PROPOSED DEVELOPMENT

It is understood that the proposed development is to comprise the construction of:

- Internal alternations to the existing house
- Extension of the house over the existing deck area to the south to create a new entrance area and study internal on Level 1
- Extension of the dwelling area over the existing balcony areas on the northern side on Levels 2 and 3

4. PUBLISHED GEOLOGY

The site is underlain by Hawkesbury Sandstone comprising medium- to coarse-grained sandstone and minor shale and laminite lenses (GSNSW, 2024). The residual soils that originate from the in-situ weathering of the Hawkesbury sandstone are generally sand rich, with variable quantities of clay, silt and gravel.

5. FIELD WORK

5.1 SCOPE

The fieldwork comprised a visual assessment of:

- The existing site conditions
- The exposed geological units present on the site
- The presence of features indicating to potential site instability.

5.2 FIELDWORK OBSERVATIONS

The site appears to be underlain by:

- A superficial layer of colluvium (slope wash) comprising sand and gravel with variable quantities of silt and clay overlying
- Hawkesbury Sandstone, comprising fine- to medium-grained cross bedded sandstone, medium to high strength, moderately weathered.

The site ground surface is undulating to terraced. Boulders of sandstone are also present on the site within the colluvium. The existing building on the site appears to be founded on sandstone bedrock, inferred to be medium to high strength. Bedding plane fractures and steeply inclined jointing within the bedrock appear to be spacings greater than 1 m.

No evidence of large-scale slope instability was observed. Numerous leaning trees and trees with curved trunks are present on the site may be the result of on-going long-term soil creep. A rock overhang is present in the upper part of the site approximately 4 m from the existing house.

6. GEOTECHNICAL SITE STABILITY ASSESSMENT

Reference to the Northern Beaches Council Map of Geotechnical Areas Landslip Potential Hazards indicates that the site is located in zone G1. Zone G1 is characterised by steep slopes, generally near coastal or harbourside areas with slope angles greater than 25° where geotechnical site assessment is required.

No evidence of major active slope instability was observed on or within the vicinity of the site. Evidence of historical slope instability was observed on the site. The observed features included:

- Numerous sandstone boulders are exposed at the surface of the slope across the site, down slope, and on the slopes to the north and south of the site, with an overall which has a grade of approximately 58% (30º).
- Trees with curved trunks.
- Leaning trees.
- Undulating slope surface
- Rock overhang.

A geotechnical hazard risk assessment for the proposed works has been completed in accordance with the Australian Geomechanics Society's *Landslide Risk Management Guidelines* (2007). Four slope movement mechanisms are considered most likely to impact the proposed development and existing structures on and in the immediate vicinity of the site:

- A – Cliff overhang failure / rock fall.
- B – Shallow earth slide.
- C – Deep seated earth slide.
- D – Translational earth creep.

A preliminary conceptual site model is presented as Drawing 1 in Appendix A showing the four potential slope movement mechanisms.

The geotechnical risk calculations are detailed in Appendix C. Table 1 provides a summary of the calculations.

Table 1: Summary of Geotechnical Risk Calculations

Risk to Life				**Risk to Property**		
Slope Stability Mechanism	**Assessed Annual Probability**	**Risk (annual probability of loss of life)**	**Risk Assessment**	**Likelihood**	**Consequence**	**Assessment**
Cliff overhang failure / rock fall.	10^{-5}	1.2×10^{-8}	Tolerable risk for loss of life for the person(s). Risk level suitable for existing structures >10 years old. Risk level unsuitable for new developments	Rare	Medium	Very Low to Low
Shallow earth slide	10^{-3}	6.5×10^{-8}	Acceptable risk for loss of life for the person(s). Risk level suitable for new developments.	Possible	Insignificant	Very Low to Low
Deep seated earth slide	10^{-4}	1.7×10^{-7}		Unlikely	Minor	Very Low to Low
Translational earth creep	10^{-3}	1.7×10^{-7}		Possible	Insignificant	Very Low to Low
Notes:						

Risk to Property Level Implications:
Very High Risk - Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce to Low. Cost could be prohibitive.
High Risk - Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to
reduce risk to Low. Treatment will be costly.
Moderate Risk - May be tolerated in certain circumstances but requires investigation, planning and implementation to reduce risk to Low. Treatment options are practical.
Low Risk - Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
Very Low Risk - Acceptable. Manage by normal slope maintenance procedures.

In summary, the proposed development is considered to constitute a tolerable risk to life and a low risk to property, provided that good hill slope engineering practices are adopted and recommendations presented in this report are followed. A description of good hillslope engineering practices is provided as Attachment B.

7. COMMENTS

7.1 EXCAVATIONS

It is anticipated that soils would be readily excavatable using conventional plant and equipment. The sandstone will require the use of rock hammers. Excavations soils may be temporarily battered back at a grade of 1V:1H and in moderately weathered medium strength sandstone at a grade of 2V:1H. Steeper grades may be adopted upon confirmation by an experienced geotechnical engineer on site. It is assumed that the temporary excavation batters will remain unsupported for no more than two months. Recommended batters are subject to inspection and approval by an experienced geotechnical engineer on-site.

7.2 FOOTINGS

Any proposed footings should be founded in bedrock. Footing excavations should be inspected by a geotechnical engineer during excavation to:

- Confirm the subsurface ground conditions are as expected;
- Confirm allowable bearing capacity; and
- assess for the presence of floaters (large boulders detached from the underlying bedrock).

Where floaters are encountered, these are to be removed and replaced with mass concrete.

Spread Footings

The bedrock observed on the site comprising sandstone is assessed to be suitable for an allowable bearing pressure of 350 kPa for spread footings founded at least 0.3 m below ground surface level.

Piles

The bedrock observed on the site comprising sandstone is assessed to be suitable for an allowable bearing pressure of 700 kPa for end-bearing piles. An allowable skin friction (piles in compression) of 60 kPa may be adopted for pile with a side wall roughness of R2 or better ignoring the top 1 m. For piles experiencing uplift, an allowable skin friction of 20 kPa should be adopted.

Piles should be founded at least 0.5 m or to a depth equivalent to at least 4 pile diameters into sandstone.

7.3 Site Drainage

The near-surface soils underlying this site are prone to loss of strength when wet. Surface water run-off should be diverted away from the proposed construction areas. Ponding and infiltration of surface water should the prevented to limit the impact of associated soil softening.

Diverted flows should be directed (where possible) to a suitable stormwater system downslope of the site so as to prevent water accumulating in areas of excavations and footings. All site discharges should be passed through a filter material prior to release.

7.4 Ground Vibrations

Excavation induced ground vibrations should be monitored during excavation when using a rock hammer within the medium or higher strength sandstone, particularly when excavating the rock for the proposed lift.

It is recommended that peak particle velocities (PPV) caused by construction equipment or resulting from excavation at the site to be limited to 5 mm/s (AS 2187.2, 1993, Appendix J). Higher values may be considered subject to further assessment by a geotechnical engineer.

Subject to the above, it is expected that plant or excavation induced ground vibrations would have no adverse impacts on the surrounding properties and infrastructure.

7.5 Slope Monitoring

It is recommended that the property owner undertake visual inspections of the house to assess for the presence of cracking within the building that may be indicative of slope movement. Additionally, it is recommended that visual inspections of the rock overhang be undertaken to monitor for signs of significant degradation of the sandstone bedrock (i.e. development of cracks and/or erosion/weathering). Additional geotechnical advice should be sought if evidence of potential slope movement is noted.

8. REFERENCES

Australian Geomechanics Society Landslide Taskforce, “Practice Note Guidelines for Landslide Risk Management – AGS 2007c”, Vol. 2 No. 1 March 2007.

GSNSW, 2024, Minview, https://minview.geoscience.nsw.gov.au, accessed 23 December 2024.

For and on behalf of Rapid Geo Pty Ltd.

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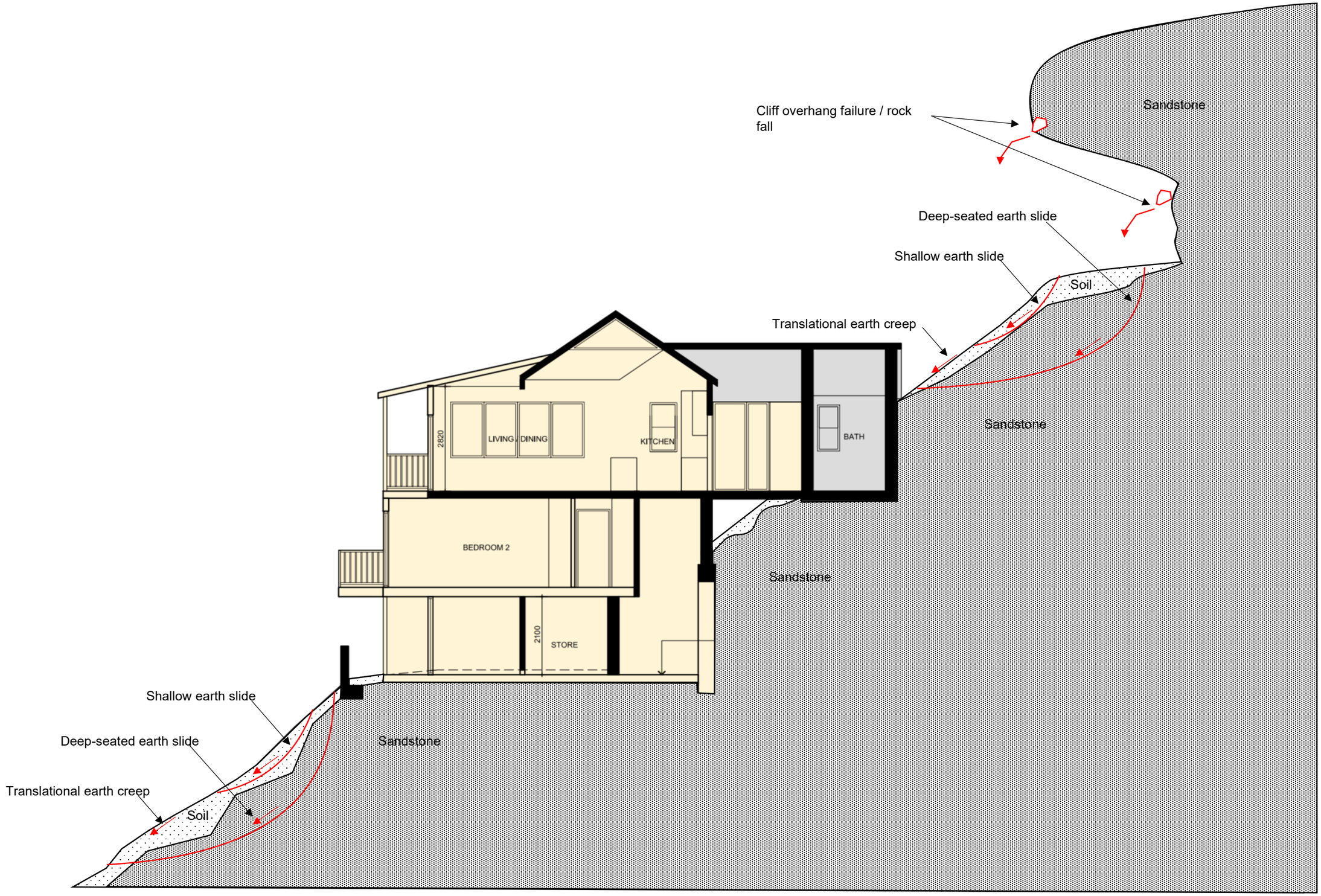
9. LIMITATIONS

This report was prepared by Rapid Geo Pty Ltd (Rapid Geo) for the exclusive use of Corona Projects, who should be the only beneficiary of this work. The scope of works undertaken for the purpose of this report is limited to those agreed with the client. Any reliance assumed by third parties on this report shall be at such parties’ own risk. Any ensuring liability resulting from use of the report by third parties cannot be transferred to Rapid Geo.

While Rapid Geo takes all reasonable due care and diligence, we offer no absolute warranty for the material underneath or between the locations sampled and investigated. Unless otherwise stated, Rapid Geo has made no effort to verify the validity of the information gathered from external sources, and assumes it provides a reliable foundation for the assessment. The findings of this report are based on site conditions existing at the time of the investigation. Rapid Geo does not assume any liability for site conditions unobserved or inaccessible at the time of the investigation. Ground conditions between test locations may vary from those revealed by this investigation. Further geotechnical advice should be sought should the ground conditions vary from those revealed by this investigation.

Appendix A: Drawing 1 – Preliminary Conceptual Site Model

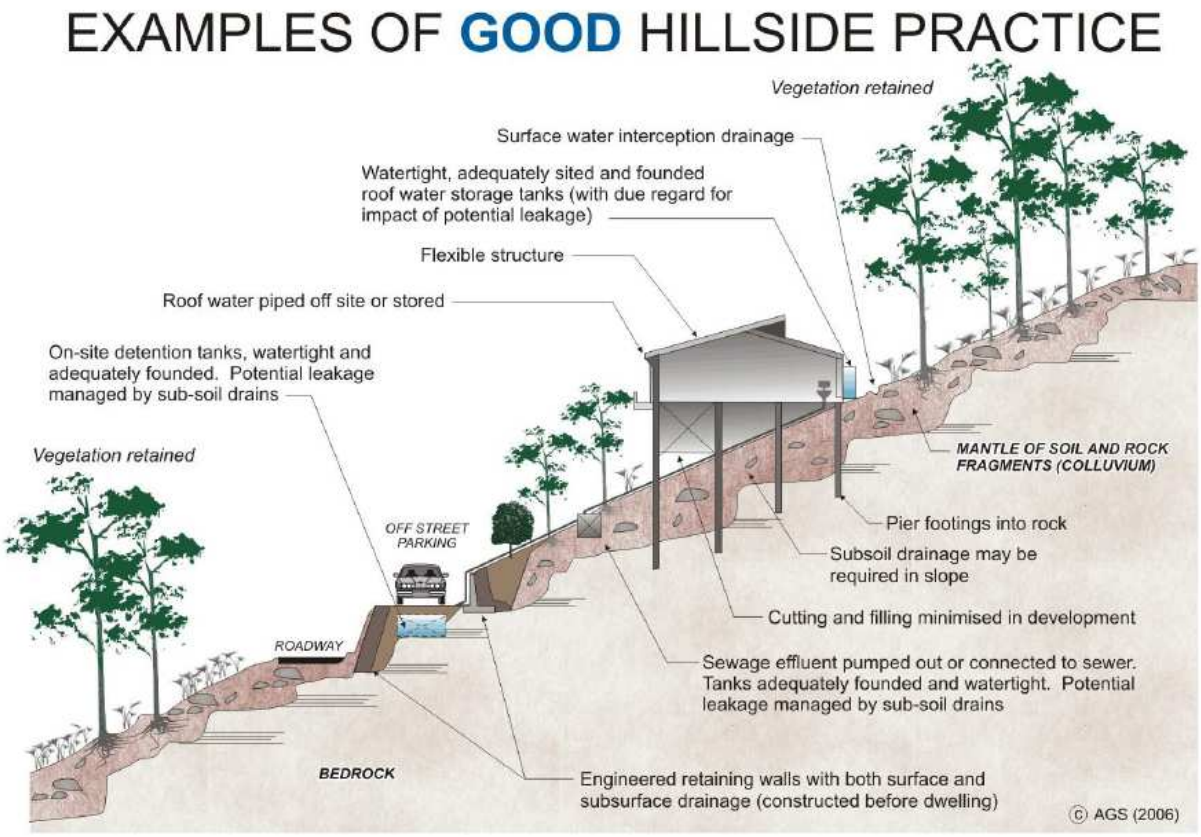


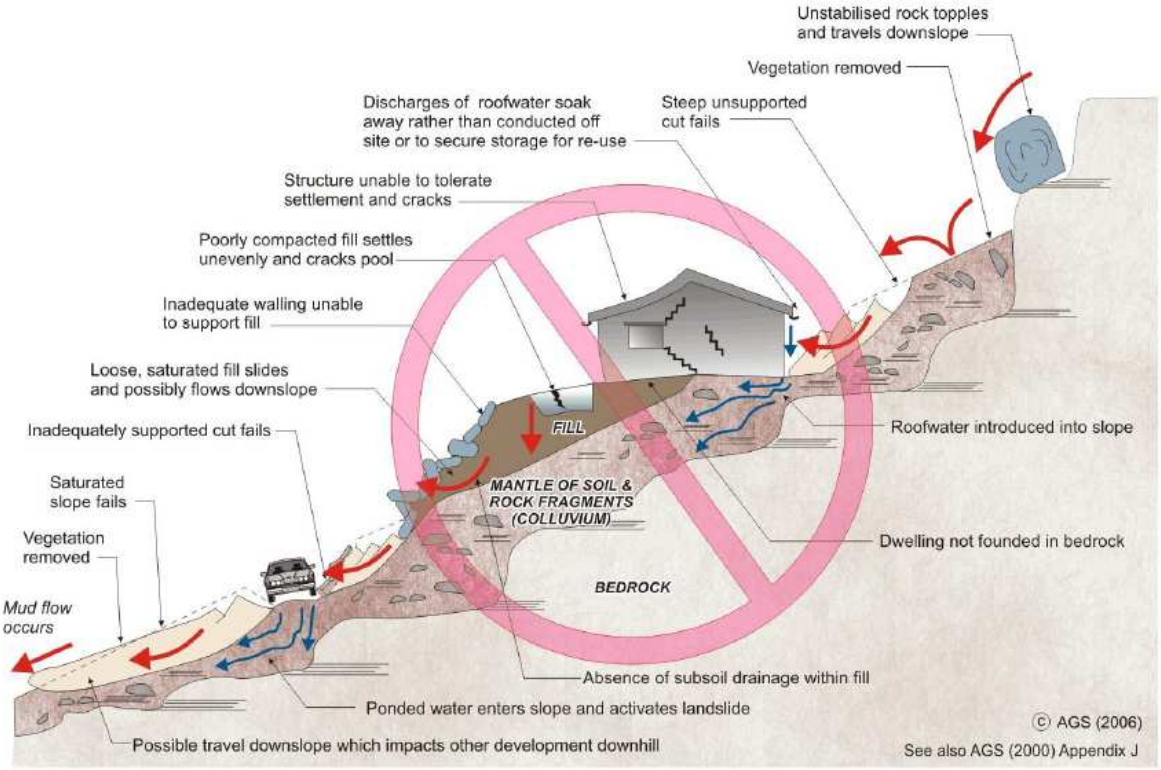
Client Name: Corona Projects	Title: Preliminary Conceptual Site Model		Rapid Geo
Project Name: Site Stability Assessment	Drawing Number: 1		
Project Address: 131A Seaforth Crescent, Seaforth	Figure Date: 2 January 2025		
Source: Corona Projects drawings titled Elevations, Sections and Existing Floor Plans	Report Number: RG315-GR-1-1		

Appendix B: Hillside Construction Guidelines (AGS, 2007)

APPENDIX G - SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

	GOOD ENGINEERING PRACTICE	*POOR ENGINEERING PRACTICE*
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminatory bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	


EXAMPLES OF GOOD HILLSIDE PRACTICE
Vegetation retained
Surface water interception drainage
Watertight, adequately sited and founded roof water storage tanks (with due regard for impact of potential leakage)
Flexible structure
Roof water piped off site or stored
On-site detention tanks, watertight and adequately founded. Potential leakage managed by sub-soil drains
Vegetation retained
MANTLE OF SOIL AND ROCK FRAGMENTS (COLLUVIUM)
OFF STREET PARKING
Pier footings into rock
Subsoil drainage may be required in slope
Cutting and filling minimised in development
ROADWAY
Sewage effluent pumped out or connected to sewer. Tanks adequately founded and watertight. Potential leakage managed by sub-soil drains
BEDROCK
Engineered retaining walls with both surface and subsurface drainage (constructed before dwelling)
© AGS (2006)


EXAMPLES OF POOR HILLSIDE PRACTICE
Unstabilised rock topples and travels downslope
Vegetation removed
Discharges of roofwater soak away rather than conducted off site or to secure storage for re-use
Steep unsupported cut fails
Structure unable to tolerate settlement and cracks
Poorly compacted fill settles unevenly and cracks pool
Inadequate walling unable to support fill
Loose, saturated fill slides and possibly flows downslope
Inadequately supported cut fails
FILL
Roofwater introduced into slope
Saturated slope fails
MANTLE OF SOIL & ROCK FRAGMENTS (COLLUVIUM)
Vegetation removed
Dwelling not founded in bedrock
BEDROCK
Mud flow occurs
Absence of subsoil drainage within fill
Ponded water enters slope and activates landslide
Possible travel downslope which impacts other development downhill
© AGS (2006)
See also AGS (2000) Appendix J

Appendix C: Geotechnical Risk Calculations

Hazard Type:	Cliff failure / rock fall	$P_{(H)}$ Annual probability of landslide:	0.00001

INDICATIVE VALUE	RECURRENCE INTERVAL	DESCRIPTION	DESCRIPTOR	LEVEL
10^{-1}	10 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	100 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	1000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	10,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	100,000 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

FACTOR	DESCRIPTION	UNITS	RANGE	VALUE
W_1	Likely slide/fall width	m		1
W_2	Width of allotment / investigation area	m		16.6
W_3	Width of dwelling / investigation element	m		11
L_{1Min}	Minimum run-out length	m		1
L_{1Max}	Maximum run-out length	m		5
L_2	Length of allotment / investigation area	m		30
L_3	Length of dwelling / investigation element	m		10
L_{PMin}	Probability of runout being 0 - 1 m long		(0 - 1)	0.60
L_{PMax}	Probability of runout being 1 - 5 m long		(0 - 1)	0.40
W_F	Likelihood of across slope strike on risk element		(0 - 1)	0.72
$L_{F\ Min}$	Likelihood of downslope strike on risk element for minimum run-out distance		(0 - 1)	0.37
$L_{F\ Max}$	Likelihood of downslope strike on risk element for maximum run-out distance		(0 - 1)	0.50
$L_{F\ Design}$	Likelihood of downslope strike (integrated) on risk element run-out distance		(0 - 1)	0.42
$P_{(S:H)}$	Probablity of spatial impact impacting building location taking into account travel distance and travel direction:			**0.30**

FACTOR	DESCRIPTION	VALUE
T_1	Percentage of time person(s) are on-site	10%
T_2	Percentage of dwelling / element that person(s) occupy	8%
$P_{(T:S)}$	Temporal spatial probability given the spatial impact:	**0.008**
$V_{(V:D)}$	Vulnerability of the individual (ie. probability of loss of life given the impact)	**0.50**

CASE	DESCRIPTION	DATA RANGE	RECOMMENDED VALUE	COMMENTS
Person in open space	If struck by a rockfall	0.1 - 0.7	0.50	May be injured but unlikely to cause death
	If buried by debris	0.8 - 1.0	1.00	Death by asphyxia almost certain
	If not buried	0.1 - 0.5	0.10	High chance of survival
Person in a vehicle	If vehicle is buried / crushed	0.9 - 1.0	1.00	Death is almost certain
	If the vehicle is damaged only	0.0 - 0.3	0.30	High chance of survival
Persons in building	If the building collapses	0.9 - 1.0	1.00	Dealth is almost certain
	If the building is inundated with debris and the person is buried	0.8 - 1.0	1.00	Death is highly likely
	If the debris strikes the building only	0.0 - 0.1	0.05	Very high chance of survival

RISK EVALUATION

$V_{(D:T)}$ Risk (annual probability of loss of life of an individual): **1.21E-08**

Risk Assessment: **Acceptable risk for loss of life for the person(s). Risk level suitable for new developments.**

Hazard Type:	Shallow Earth Slide	$P_{(H)}$ Annual probability of landslide:	1.00E-03

INDICATIVE VALUE	RECURRENCE INTERVAL	DESCRIPTION	DESCRIPTOR	LEVEL
10^{-1}	10 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	100 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	1000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	10,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	100,000 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

FACTOR	DESCRIPTION	UNITS	RANGE	VALUE
W_1	Likely slide/fall width	m		2
W_2	Width of allotment / investigation area	m		16.6
W_3	Width of dwelling / investigation element	m		11
L_{1Min}	Minimum run-out length	m		1
L_{1Max}	Maximum run-out length	m		10
L_2	Length of allotment / investigation area	m		30
L_3	Length of dwelling / investigation element	m		10
L_{PMin}	Probability of runout being 0 - 1 m long		(0 - 1)	0.70
L_{PMax}	Probability of runout being 1 - 10 m long		(0 - 1)	0.30
W_F	Likelihood of across slope strike on risk element		(0 - 1)	0.78
$L_{F\ Min}$	Likelihood of downslope strike on risk element for minimum run-out distance		(0 - 1)	0.37
$L_{F\ Max}$	Likelihood of downslope strike on risk element for maximum run-out distance		(0 - 1)	1.00
$L_{F\ Design}$	Likelihood of downslope strike (integrated) on risk element run-out distance		(0 - 1)	0.56
$\mathbf{P}_{(S:H)}$	Probablity of spatial impact impacting building location taking into account travel distance and travel direction:			0.44

FACTOR	DESCRIPTION	VALUE
T_1	Percentage of time person(s) are on-site	10%
T_2	Percentage of dwelling / element that person(s) occupy	3%
$\mathbf{P}_{(T:S)}$	Temporal spatial probability given the spatial impact:	**0.003**
$\mathbf{V}_{(V:D)}$	Vulnerability of the individual (ie. probability of loss of life given the impact)	**0.05**

CASE	DESCRIPTION	DATA RANGE	RECOMMENDED VALUE	COMMENTS
Person in open space	If struck by a rockfall	0.1 - 0.7	0.50	May be injured but unlikely to cause death
	If buried by debris	0.8 - 1.0	1.00	Death by asphyxia almost certain
	If not buried	0.1 - 0.5	0.10	High chance of survival
Person in a vehicle	If vehicle is buried / crushed	0.9 - 1.0	1.00	Death is almost certain
	If the vehicle is damaged only	0.0 - 0.3	0.30	High chance of survival
Persons in building	If the building collapses	0.9 - 1.0	1.00	Dealth is almost certain
	If the building is inundated with debris and the person is buried	0.8 - 1.0	1.00	Death is highly likely
	If the debris strikes the building only	0.0 - 0.1	0.05	Very high chance of survival

RISK EVALUATION

$\mathbf{V}_{(D:T)}$ Risk (annual probability of loss of life of an individual): **6.54E-08**

Risk Assessment: **Acceptable risk for loss of life for the person(s). Risk level suitable for new developments.**

Hazard Type:	Deep Seated Earth Slide	$P_{(H)}$ Annual probability of landslide:	0.0001

INDICATIVE VALUE	RECURRENCE INTERVAL	DESCRIPTION	DESCRIPTOR	LEVEL
10^{-1}	10 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	100 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	1000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	10,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	100,000 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

FACTOR	DESCRIPTION	UNITS	RANGE	VALUE
W_1	Likely slide/fall width	m		5
W_2	Width of allotment / investigation area	m		16.6
W_3	Width of dwelling / investigation element	m		11
L_{1Min}	Minimum run-out length	m		1
L_{1Max}	Maximum run-out length	m		10
L_2	Length of allotment / investigation area	m		30
L_3	Length of dwelling / investigation element	m		10
L_{PMin}	Probability of runout being 0 - 1 m long		(0 - 1)	0.70
L_{PMax}	Probability of runout being 1 - 10 m long		(0 - 1)	0.30
W_F	Likelihood of across slope strike on risk element		(0 - 1)	1.00
$L_{F\ Min}$	Likelihood of downslope strike on risk element for minimum run-out distance		(0 - 1)	0.37
$L_{F\ Max}$	Likelihood of downslope strike on risk element for maximum run-out distance		(0 - 1)	1.00
$L_{F\ Design}$	Likelihood of downslope strike (integrated) on risk element run-out distance		(0 - 1)	0.56
$\mathbf{P}_{(S:H)}$	Probablity of spatial impact impacting building location taking into account travel distance and travel direction:			**0.56**

FACTOR	DESCRIPTION	VALUE
T_1	Percentage of time person(s) are on-site	10%
T_2	Percentage of dwelling / element that person(s) occupy	3%
$\mathbf{P}_{(T:S)}$	Temporal spatial probability given the spatial impact:	**0.003**
$\mathbf{V}_{(V:D)}$	Vulnerability of the individual (ie. probability of loss of life given the impact)	**1.00**

CASE	DESCRIPTION	DATA RANGE	RECOMMENDED VALUE	COMMENTS
Person in open space	If struck by a rockfall	0.1 - 0.7	0.50	May be injured but unlikely to cause death
	If buried by debris	0.8 - 1.0	1.00	Death by asphyxia almost certain
	If not buried	0.1 - 0.5	0.10	High chance of survival
Person in a vehicle	If vehicle is buried / crushed	0.9 - 1.0	1.00	Death is almost certain
	If the vehicle is damaged only	0.0 - 0.3	0.30	High chance of survival
Persons in building	If the building collapses	0.9 - 1.0	1.00	Dealth is almost certain
	If the building is inundated with debris and the person is buried	0.8 - 1.0	1.00	Death is highly likely
	If the debris strikes the building only	0.0 - 0.1	0.05	Very high chance of survival

RISK EVALUATION

$\mathbf{V}_{(D:T)}$ Risk (annual probability of loss of life of an individual): **1.67E-07**

Risk Assessment: **Acceptable risk for loss of life for the person(s). Risk level suitable for new developments.**

Hazard Type:	Translational Earth Creep	$P_{(H)}$ Annual probability of landslide:	0.001

INDICATIVE VALUE	RECURRENCE INTERVAL	DESCRIPTION	DESCRIPTOR	LEVEL
10^{-1}	10 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	100 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	1000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	10,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	100,000 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

FACTOR	DESCRIPTION	UNITS	RANGE	VALUE
W_1	Likely slide/fall width	m		10
W_2	Width of allotment / investigation area	m		16.6
W_3	Width of dwelling / investigation element	m		11
L_{1Min}	Minimum run-out length	m		1
L_{1Max}	Maximum run-out length	m		10
L_2	Length of allotment / investigation area	m		30
L_3	Length of dwelling / investigation element	m		10
L_{PMin}	Probability of runout being 0 - 1 m long		(0 - 1)	0.90
L_{PMax}	Probability of runout being 1 - 10 m long		(0 - 1)	0.10
W_F	Likelihood of across slope strike on risk element		(0 - 1)	1.00
$L_{F\ Min}$	Likelihood of downslope strike on risk element for minimum run-out distance		(0 - 1)	0.37
$L_{F\ Max}$	Likelihood of downslope strike on risk element for maximum run-out distance		(0 - 1)	1.00
$L_{F\ Design}$	Likelihood of downslope strike (integrated) on risk element run-out distance		(0 - 1)	0.43
$\mathbf{P}_{(S:H)}$	Probablity of spatial impact impacting building location taking into account travel distance and travel direction:			**0.43**

FACTOR	DESCRIPTION	VALUE
T_1	Percentage of time person(s) are on-site	10%
T_2	Percentage of dwelling / element that person(s) occupy	8%
$\mathbf{P}_{(T:S)}$	Temporal spatial probability given the spatial impact:	**0.01**
$\mathbf{V}_{(V:D)}$	Vulnerability of the individual (ie. probability of loss of life given the impact)	**0.05**

CASE	DESCRIPTION	DATA RANGE	RECOMMENDED VALUE	COMMENTS
Person in open space	If struck by a rockfall	0.1 - 0.7	0.50	May be injured but unlikely to cause death
	If buried by debris	0.8 - 1.0	1.00	Death by asphyxia almost certain
	If not buried	0.1 - 0.5	0.10	High chance of survival
Person in a vehicle	If vehicle is buried / crushed	0.9 - 1.0	1.00	Death is almost certain
	If the vehicle is damaged only	0.0 - 0.3	0.30	High chance of survival
Persons in building	If the building collapses	0.9 - 1.0	1.00	Dealth is almost certain
	If the building is inundated with debris and the person is buried	0.8 - 1.0	1.00	Death is highly likely
	If the debris strikes the building only	0.0 - 0.1	0.05	Very high chance of survival

RISK EVALUATION

$\mathbf{V}_{(D:T)}$ Risk (annual probability of loss of life of an individual): **1.72E-07**

Risk Assessment: **Acceptable risk for loss of life for the person(s). Risk level suitable for new developments.**