GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1 – To be submitted with Development Application

Development Application for_______Luke Driver__________________________
Name of Applicant

Address of site ________1 BELLEVARD PARADE, MONA VALE NSW 2103__________

Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report

I, __Jorge Manuel Coxixo Cabaco_____________ on behalf of ____SOILSROCK ENGINEERING PTY LTD______________
(Insert Name) (Trading or Company Name)

on this the ______5th September 2025________________ certify that I am a geotechnical engineer or engineering geologist or coastal engineer as defined by the Geotechnical Risk Management Policy for Pittwater - 2009 and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least $2million.
I:

Please mark appropriate box

X have prepared the detailed Geotechnical Report referenced below in accordance with the Australia Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009

X am willing to technically verify that the detailed Geotechnical Report referenced below has been prepared in accordance with the Australian Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009

X have examined the site and the proposed development in detail and have carried out a risk assessment in accordance with Section 6.0 of the Geotechnical Risk Management Policy for Pittwater - 2009. I confirm that the results of the risk assessment for the proposed development are in compliance with the Geotechnical Risk Management Policy for Pittwater - 2009 and further detailed geotechnical reporting is not required for the subject site.

☐ have examined the site and the proposed development/alteration in detail and I am of the opinion that the Development Application only involves Minor Development/Alteration that does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.

☐ have examined the site and the proposed development/alteration is separate from and is not affected by a Geotechnical Hazard and does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.

☐ have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

Geotechnical Report Details:

Report Title: Geotechnical Site Investigation Report For Proposed Alterations & Additions at 1 Bellevard Parade, Mona Vale NSW 2103; Ref: SRE/1444/MV/25

Report Date: 05/09/2025

Author: Jorge Manuel Coxixo Cabaco

Author's Company/Organisation: Soilsrock Engineering Pty Ltd

Documentation which relate to or are relied upon in report preparation:

Architectural Drawings prepared by ACTION PLANS, REVISION B, dated 02/07/2025
8/02/2022

I am aware that the above Geotechnical Report, prepared for the abovementioned site is to be submitted in support of a Development Application for this site and will be relied on by Pittwater Council as the basis for ensuring that the Geotechnical Risk Management aspects of the proposed development 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 …

Name …………….Jorge Manuel Coxixo Cabaco…………………………………………

Chartered Professional Status Chartered Professional Engineer_________________

Membership No. …3789414 (National Engineers Registration – Engineers Australia)..

Company………Soilsrock Engineering Pty Ltd……………………………………………

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 Driver___________________________________
Name of Applicant
Address of site ______1 BELLEVARD PARADE, MONA VALE NSW 2103_______________

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: Geotechnical Site Investigation Report For Proposed Alterations & Additions at 1 Bellevard Parade, Mona Vale NSW 2103; Ref: SRE/1444/MV/25

Report Date: 05/09/2025

Author: Jorge Manuel Coxixo Cabaco

Author's Company/Organisation: Soilsrock Engineering Pty Ltd

Please mark appropriate box

X Comprehensive site mapping conducted _____12/08/2025_______________
(date)

X Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)

X Subsurface investigation required
- ☐ No Justification …………………………………………………...
- X Yes Date conducted 12/08/2025……………………………

☐ Geotechnical model developed and reported as an inferred subsurface type-section

X Geotechnical hazards identified
- ☐ Above the site
- X On the site
- X Below the site
- ☐ Beside the site

X Geotechnical hazards described and reported

X Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- X Consequence analysis
- X Frequency analysis

X Risk calculation

X Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009

X Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009

X Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009

X Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.

X Design Life Adopted:
- ☐ 100 years
- x Other …………50 years…………………………
specify

X 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

Name ………………………Jorge Manuel Coxixo Cabaco………………………..

Chartered Professional Status……… Chartered Professional Engineer ………

Membership No. 3789414 (National Engineers Registration – Engineers Australia)

Company………… Soilsrock Engineering Pty Ltd …………

GEOTECHNICAL SITE INVESTIGATION REPORT

FOR

PROPOSED ALTERATIONS & ADDITIONS

AT

1 BELLEVARDE PARADE, MONA VALE NSW 2103

Report Prepared for: LUKE DRIVER

Project No: SRE/1444/MV/25

Date: 5/09/2025

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Distribution and Revision Register

Document details

- **Project number:** 1444
- **Document number:** SRE/1444/MV/25
- **Document title:** Geotechnical Site Investigation Assessment Report for Alterations & Additions
- **Site address:** 1 Bellevarde Parade, Mona Vale NSW 2103
- **Report prepared for:** Luke Driver

Document status and review

Revision	Prepared by	Reviewed by	Approved by	Date issued
0	KK	JC	JC	05/09/2025

Distribution of copies

Revision	Electronic	Paper	Issued to
0	1	0	LUKE DRIVER

The undersigned, on behalf of Soilsrock Engineering Pty Ltd, confirm that this document and all attached documents, drawings, and geotechnical results have been checked and reviewed for errors, omissions, and inaccuracies.

For and on behalf of

Soilsrock Engineering Pty Ltd

Jorge Cabaco

BEng MEng MIEAust CPEng NER
Principal Geotechnical Engineer
ENGINEERS AUSTRALIA
Chartered Engineer INER – National Engineers Registration No. 3789414
DESIGN PRACTITIONER REGISTRATION NSW GOVERNMENT FAIR TRADING NO. DEP0001454
PROFESSIONAL ENGINEER REGISTRATION NSW GOVERNMENT FAIR TRADING NO. PRE0001045

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APPENDIXES

1. INTRODUCTION

This report presents the findings and interpretations of a geotechnical investigation undertaken by Soilsrock Engineering Pty Ltd (SOILSROCK) for the property located at 1 Bellevarde Parade, Mona Vale, NSW 2103. The investigation was commissioned by Mr. Luke Driver, the owner of the subject property and the proponent of the proposed development.

The scope of work was undertaken in general accordance with Letter Proposal Ref: SRE/1444/MV/25, dated 11 August 2025, and subsequent email acceptance of the same date. The assessment has been carried out with reference to the Architectural Drawings prepared by ACTION PLANS, dated 30 July 2025, as supplied by the client.

The primary objective of this investigation was to characterise the existing subsurface ground conditions at the site and to provide geotechnical advice relevant to the proposed development. Specifically, the investigation addresses:

- Site and subsurface conditions
- Excavation feasibility and constraints
- Foundation design options
- Assessment of landslide and slope stability risks

The following sections of this report outline the proposed development, describe the scope and methodology of the investigation, present the factual results obtained, and provide detailed comments and geotechnical recommendations with respect to excavation, foundation design, and landslide risk mitigation.

2. PROPOSED DEVELOPMENT

Based on the architectural drawings provided by the client, the proposed development at 1 Bellevarde Parade, Mona Vale comprises alterations and additions to the existing dwelling.

At the lower ground floor level, the works will involve reconfiguration to incorporate a gym/recreation room, wine cellar, secondary living area, and the installation of a new internal floating staircase.

At the ground floor level, the proposal includes modifications to accommodate a new kitchen, dining and living areas, laundry, WC, study, garage, and storage facilities, together with associated circulation spaces.

An additional first floor level is proposed to be constructed above the existing ground floor. This level will comprise a master bedroom suite with ensuite and walk-in robe, two additional bedrooms with ensuites, a sitting room, and a new balcony.

The details of the proposed development are illustrated in the Architectural Drawings prepared by ACTION PLANS, as referenced above.

3. SCOPE OF WORKS

The field work for investigation was carried on the 12th of August 2024 and consisted of the following:

- Dial Before You Dig (DBYD) – Conduct an online buried services search at the site before field works.
- Conduct an OH&S and walkover survey to assess local topography, geology, hydrology, and existing site conditions, including exposed soil/rock conditions, vegetation, and surface drainage.
- Conduct a geotechnical inspection of the site area and adjacent land.
- 5 x Dynamic Cone Penetrometer tests (DCP1 to DCP4) to maximum depth of 2.10m were carried out by using a 9kg Dynamic Cone Penetrometer specialised steel cone device. The testing followed the procedure as per AS 1289-1997, method 6.3.2.
- Photographic record of the site conditions.

The field work was conducted in presence of two geotechnical/civil engineers, from Soilsrock office, who observed visually the existing geotechnical conditions and recorded the in-situ test results.

4. SITE LOCATION AND DESCRIPTION

The subject site is located at 1 Bellevarde Parade, Mona Vale NSW 2103. The site belongs to the Northern Beaches Council and is legally described as lot 14 DP 8212 with an area around 700 m^2.
The project site is situated within C4- Environmental Living. It is delimited by 4 Mount Pleasant Avenue at the South of the site, at East by 3 Bellevarde Parade, at West by a 1a Bellevarde Parade, and finally at Northeast by 3 Bellevarde Parade, Mona Vale. The site is rectangular in shape. The surrounding land comprise mostly of residential dwellings.

The DCP's and photo's location are shown ***in Appendix B*** and photographs of the area are attached to this report ***in Appendix D***.

5. REGIONAL GEOLOGY

From the analysis of Geology of Sydney 1:100 000 Geological Series Sheet 9130, it is indicated that the site is located within a region of Narrabeen Group **"Rnn"** Newport Formation and Garie Formation, which is comprised of interbedded laminate shale and quartz to lithic-quartz sandstone, minor red claystone North.

A reproduction of the geological map is shown on following ***Figure 1*** and is based on a portion of the geological map of Sydney 1:100 000 Geological Series Sheet 9130 (EDITION 1) 1983 (interactive resource provided by the Geological Survey of NSW), which depicts the site geological condition.

Figure 1 – Portion of the Sydney1:100,000 Geological Series Map 9130. Site area location is highlighted in a red/black sign.

6. RESULTS AND ANALYSES OF THE INVESTIGATION

6.1 Subsurface Investigation

Five Dynamic Cone Penetrometer (DCP) tests were carried out to complement the investigation of subsurface ground conditions. The following ***Table 1*** summarised the in-situ DCP test results and ***Table 2*** describes generically the principal strata sequentially observed and interpreted by the test results carried out on site.

Table 1 - Dynamic Cone Penetrometer tests results – DCP1 to DCP5.

Depth (m)	DCP1 (Blows/ 300mm)	DCP2 (Blows/ 300mm)	DCP3 (Blows/ 300mm)	DCP4 (Blows/ 300mm)	DCP5 (Blows/ 300mm)
0.00 – 0.30	4	3	1	4	3
0.30 – 0.60	5	4	6	12	6
0.60 – 0.90	21	6	11	29	6
0.90 – 1.20	Refusal @ 1.05m	15	13	19	16
1.20 – 1.50	-	Refusal @ 1.45m	14	18 Bouncing @ 1.30m	Refusal @ 1.45m
1.50 – 1.80	-	-	21	-	-
1.80 – 2.10	-	-	Refusal @ 2.10m	-	-

Equipment & Procedure Notes:

Equipment used: 9kg hammer, 510mm drop distance, conical tip: Standard used: AS1289.6.3.2 - 1997; the total number of blows are considered for 300mm penetration steps.

DCP Notes:

- 60 blows within 300mm soil interval defined as a “refusal”, which may indicates reaching into “Very Dense” sand layer or “hard Clay” or on top of bedrock.
- “Bouncing” indicates reached top of rock or in some cases can be due to presence of a hard obstacle like steel, rubble, flouters, boulders, cobbles, cement sand layers or hard materials.

Table 2 - Geotechnical subsurface interpretation by in-situ DCP results – DCP1 to DCP5.

<table>
<tr><th>Depth (m)</th><th>DCP1
(Blows/ 300mm)</th><th>DCP2
(Blows/ 300mm)</th><th>DCP3
(Blows/ 300mm)</th><th>DCP4
(Blows/ 300mm))</th><th>DCP5
(Blows/ 300mm)</th></tr>
<tr><td>0.00 – 0.30</td><td rowspan="2">Loose Silty Sand</td><td>Very Loose Silty Sand</td><td>Very Loose Silty Sand</td><td>Loose Silty Sand</td><td>Very Loose Silty Sand</td></tr>
<tr><td>0.30 – 0.60</td><td rowspan="2">Loose Silty Sand</td><td>Loose Silty Sand</td><td>Medium Dense Silty Sand</td><td rowspan="2">Loose Silty Sand</td></tr>
<tr><td>0.60 – 0.90</td><td>Medium Dense Silty Sand</td><td rowspan="4">Medium Dense Silty Sand</td><td>Dense Silty Sand</td></tr>
<tr><td>0.90 – 1.20</td><td>Very Dense Silty Sand Refusal @ 1.05m</td><td>Medium Dense Silty Sand</td><td rowspan="2">Medium Dense Silty Sand Bouncing @ 1.30m</td><td>Medium Dense Silty Sand</td></tr>
<tr><td>1.20 – 1.50</td><td rowspan="3">-</td><td>Very Dense Silty Sand Refusal @ 1.45m</td><td>Very Dense Silty Sand Refusal @ 1.45m</td></tr>
<tr><td>1.50 – 1.80</td><td rowspan="2">-</td><td rowspan="2">-</td><td rowspan="2">-</td></tr>
<tr><td>1.80 – 2.10</td><td>Very Dense Silty Sand Refusal @ 2.10m</td></tr>
</table>

Notes: No samples were provided by DCP test, thus the geotechnical interpretation above is based only on the observation carried through the soil traces left attached to the rods and tip; this subsurface interpretation is based in DCP results obtained in table 1 and engineering judgement, it is only indicative, and some soils characteristics can be difficult to identify properly without samples. "Bouncing" indicates reached top of rock or in some cases can be due to presence of hard obstacles such as steel, rubble, flouters, boulders, cobbles, cement sand layers or any other hard materials.

The ***Table 3*** below assesses the strength of the relevant materials crossed by the DCP tests, according to in-situ test results, soil classification, visual interpretation, and extrapolation.

The geotechnical parameters interpretation and extrapolation is based and limited to DCP tests carried on site, which are only indicative for design proposes.

For detailed description of the subsurface conditions, explanation sheets about geotechnical parameters are presented in ***Appendix A***.

Table 3 - Allowable Bearing Pressure and Strength Interpreted and Extrapolated by in-situ tests.

Depth Range (m)	Material Conditions	Strength Friction Angle ϕ / °	Allowable Extrapolated Bearing Pressure (kPa)
Based on DCP1 Test Results			
0.00 - 0.60	Loose Silty Sand	25	50
0.60 - 0.90	Medium Dense Silty Sand	30	100
0.90 – 1.05	Very Dense Silty Sand	40	500
Based on DCP2 Test Results			
0.00 –0.30	Very Loose Silty Sand	NR	NR
0.30 –0.90	Loose Silty Sand	25	50
0.90 –1.20	Medium Dense Silty Sand	30	100
1.20 –1.45	Very Dense Silty Sand	40	500
Based on DCP3 Test Results			
0.00 –0.30	Very Loose Silty Sand	NR	NR
0.30 –0.60	Loose Silty Sand	25	50
0.60 –1.80	Medium Dense Silty Sand	30	100
1.80 –2.10	Very Dense Silty Sand	40	500
Based on DCP4 Test Results			
0.00 –0.30	Loose Silty Sand	NR	NR
0.30 –0.60	Medium Dense Silty Sand	30	100
0.60 –0.90	Dense Silty Sand	35	300
0.90 –1.30	Medium Dense Silty Sand	30	100
Based on DCP5 Test Results			
0.00 –0.30	Very Loose Silty Sand	NR	NR
0.30 –0.90	Loose Silty Sand	25	50
0.90 –1.20	Medium Dense Silty Sand	30	100
1.20 –1.45	Very Dense Silty Sand	40	500

Notes:

- The geotechnical parameters interpretation and extrapolation is based and limited to the DCP test carried on site, which are only indicative for design proposes.
- The depth ranges of geological units as shown in the table are average thickness based on DCP test results obtained. It is understood that the subsurface conditions can vary from places to places.
- NR – Not Recommended.

As indicated within the table above, one of the DCP's tests recorded "bouncing" (DCP4), the DCP rods were bouncing at the end of the tests which indicate that the top of the rock was reached.

The DCP tests indicates that the site is underlying by silty sandy soils which directs probably to sandstone/shale as indicated within the Regional Geology referred above as well as the visual inspection on the side, therefore the following ***Table 4*** indicates the interpreted and inferred geotechnical parameters for rock if encountered during excavations for construction. The following rock parameters are given for the lowest rock quality; regarding the hand methods by DCP tests are not able to investigate the rock in deep.

Table 4 – Recommended Geotechnical Parameters for Rock

Foundation Stratum	Allowable End Bearing Pressure (kPa)	Ultimate End Bearing Pressure (kPa)	Ultimate Shaft Adhesion (kPa)	Typical Elastic Modulus (MPa)
Class V	700	3,000	50	50

Notes:

- Rock Classification and bearing pressures based on P.J.N Pells "Substance and Mass Properties for The Design of Engineering Structures in The Hawkesbury Sandstone" AGM Vol No. 39 September 2004
- Ultimate end bearing pressures values occur at large settlements (>5% of minimum footing dimensions)
- Ultimate shaft adhesion values to depend on clean socket of roughness category R2 or better. Values may have to be reduced because of smear.
- Shaft adhesion applicable to the design of CFA or bored piles, uncased over the rock socket length, where adequate sidewall cleanliness and roughness are achieved.

6.2 Groundwater

According to the Geotechnical investigation groundwater was not recorded on the DCP tests rods when extracted from the ground. However, groundwater can be investigated properly by further geo-hydrological assessment using a proper drilling and standpipe installation to monitor groundwater if required.

7. LANDSLIP RISK ASSESSMENT

The site is mostly located within an “Geotechnical Hazard H1 and Geotechnical Hazard H2 “, accordingly with the Pittwater Geotechnical Hazard Map from Northern Beaches online Mapping.

A reproduction of the Pittwater Geotechnical Hazard Map is shown in ***Figure 2*** and is based on a portion of the Landslide Risk Mapping from Northern Beaches Mapping, which shows the site geological condition as follow:

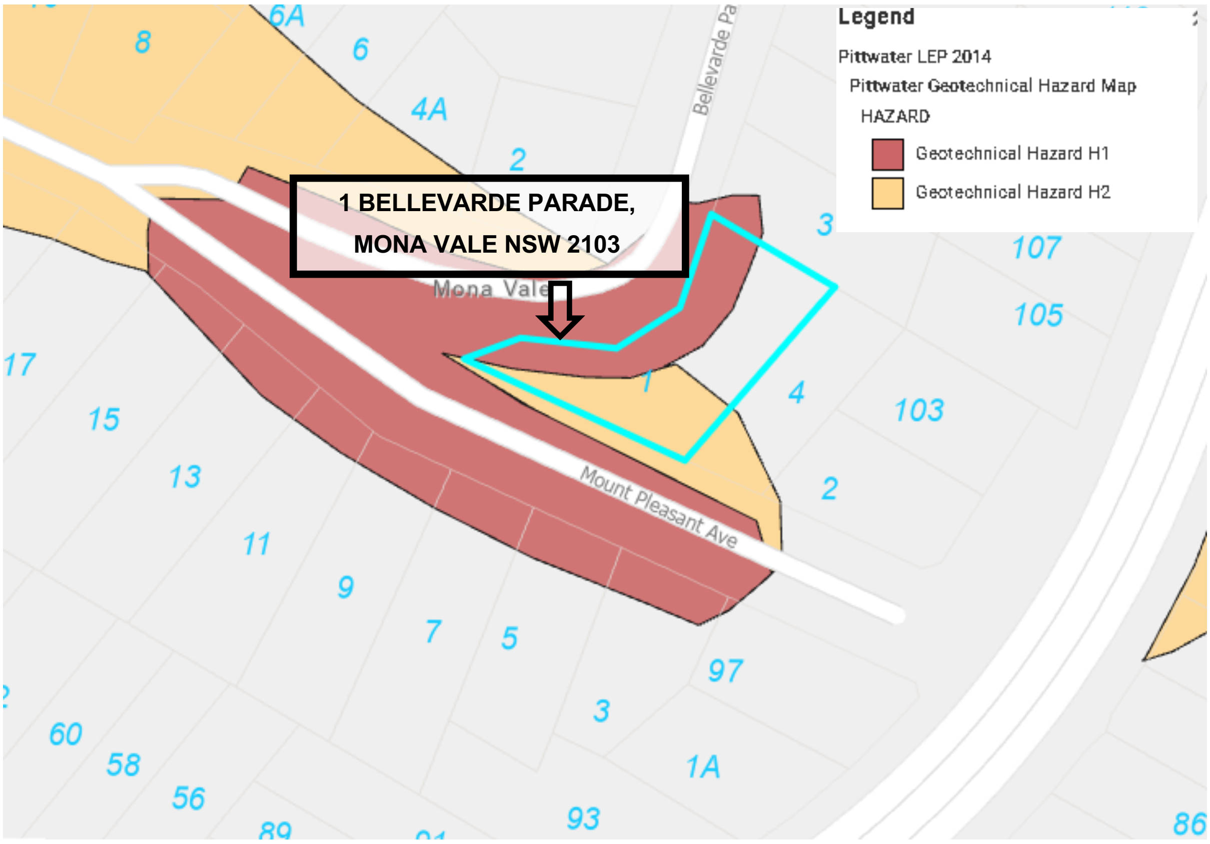

Figure 2 – Portion of the Pittwater Geotechnical Hazard Map. Site area is highlighted in Blue.

Some hazards have been identified and assessed for risk to property and life using the general methodology outline by the Australian Geomechanics Society (Landslide Risk Management AGS Subcommittee 2007 – Refer to ***Appendix E***), the risk assessment is outlined on the following ***Table 5***.

Table 5 – Geotechnical Hazards Summary Risk Analyses

HAZARDS	*Qualitative Measures of likelihood	*Qualitative Measures of Consequences to Property	*Risk to Property	*Risks To Life	*Level Risk Implications
H1. Soil creek Ground movements causing cracking on the existing residential building and structures when heavy rain events occur	**Rare - (annual probability $P_{(H)} = 10^{-5}$)	Minor (5%)	Very Low ($2.5\text{x}10^{-05}$)	$1.5\text{x}10^{-7}$/annum	***Risk Acceptable
H2. Soil erosion weakens tree roots and causes trees falling and potential landslides which disturbs the building	**Rare - (annual probability $P_{(H)} = 10^{-5}$)	Minor (5%)	Very Low ($1.3\text{x}10^{-05}$)	$1.0\text{x}10^{-7}$/annum	***Risk Acceptable
Soil erosion exposes rock boulders and outcrops and causes potential rockfall.	**Rare - (annual probability $P_{(H)} = 10^{-5}$)	Minor (5%)	Very Low ($1.1\text{x}10^{-05}$)	$3.6\text{x}10^{-7}$/annum	***Risk Acceptable

Note: *Refer to Australian Geo-Mechanics Vol. 42 No. 1 March 2007, for full explanation of terms above.

**Likelihood assumes appropriate engineering design and construction methodologies and on-site assessment and approval by a geotechnical engineer.

Level of Risk Acceptable: AGS Suggested Tolerable loss of life individual risk = 10^{-4} /annum for existing slope/development (Appendix E***). Risk level is acceptable provided the comments and recommendations on this report are followed and provided that periodic geotechnical inspections are conducted to ensure long-term stability, particularly during and after prolonged or heavy rainfall, when the likelihood of slope instability may increase.

Following the above, it is considered that the current site meets "Acceptable Risk Management" criteria with respect to both property and life under current and foreseeable conditions. As indicated by the DCP tests results, it is also noted the soils consists of silty sands present on the proposed development area are at depths range from 1.05m to 2.10m.

To maintain a good hillside construction practice, the following are recommended for the proposed development (refer to ***Appendix F***):

- Appropriate surface water drainage must be installed to avoid excessive water infiltration through the ground.
- Appropriate roof water piped and connected properly to the stormwater street systems to avoid excess water infiltration through the ground.
- Piles and footings must be socket into competent rock to allow for landslide risk.

- Cutting and filling should be minimized to reduce site disturbance within a landslide risk area.
- Sewage effluent pumped out or connected to sewer tanks shall be adequately founded and watertight.

8. COMMENTS AND RECOMMENDATIONS

Further to the results above, the comments and recommendations are as follow:

- Accordingly with the information given by the architectural drawings indicates that an additional first floor will be constructed above the existing two storey building, and in addition internal renovations for the existing floor levels are as well included. This development it is expected that the additional floor level and internal renovations will significantly increase the existing loads of these existing two floors and consequently the whole building.
- It is unknow, the existing foundations type (probably footings) and sizes of the existing foundations, therefore it is recommended that pit tests are undertaken to expose the footings to determine the depth of the underside/base of the footings and carry out DCP tests to determine the allowable bearing pressures at where the existing footings are discharging the loads. Those works can be undertaken at the start of the construction works after demolition of the internal structures.
- It is not recommended to use the existing foundations of the building if they are strip and pad footings and if they are founded in soils to take the additional loads required by the new additional first floor and internal renovations, since if the existing footings probably are founded at shallow depths, they could it be founded within weak geotechnical conditions comprising loose to medium dense sands. The allowable bearing capacity of those sandy soils foundations seems to be insufficient to take the additional loads.
- If the existing foundations are footings and founded into the sandy soils, it is recommended to underpinning and enlarge those footings combining with micropiles socket into the rock materials, a mini drilling rig will be necessary to install the micropiles from the outside of the building.
- An alternative feasible option, should the existing foundations consist of shallow footings bearing on sandy soils, is the construction of independent reinforced concrete or structural steel columns supported on footings above piles socket into rock materials. The design of this system shall be undertaken by the project structural engineer, ensuring that the allowable bearing pressures interpreted herein are adequate for the anticipated first-floor renovation loads. These independent columns

must be interconnected with horizontal reinforced concrete or steel beams to provide a stable framework for supporting the new first-floor loading. Consequently, all additional loads from the first-floor structure will be transferred exclusively to this newly constructed system of columns and footings/piles, located aside of the existing footprint of the existing building footings/walls. The existing strip footings of the building shall remain structurally independent and shall not be subjected to any additional loads arising from the new first-floor level.

- Regardless of the foundation remediation design ultimately adopted, all footings of the same structure must be constructed within the same type of founding material (i.e., either entirely within soils or entirely within rock). It is not recommended that the foundations of the same building be partially founded in soil and partially in rock, as this may result in excessive short-term and long-term differential settlements.
- Once the structural loads and footing designs have been finalised, a detailed settlement analysis should be undertaken to verify the suitability and long-term performance of the adopted foundation remediation solution.
- All footings and piles excavations must be properly dewatered, cleaned, and free of loose or disturbed material prior to concrete placement. The time interval between excavation and concrete pouring shall be kept to a minimum. Where delays are anticipated, it is recommended that the excavation base be protected by the immediate placement of a concrete blinding layer with a minimum characteristic strength of 25 MPa, to mitigate any potential loosening or deterioration of the founding material.
- All foundations shall be designed and constructed in accordance with AS 2870–2011 – Residential Slabs and Footings.
- The foundations of the entire building must be installed and socket to ensure stability of the footing/pile in competent solid rock materials (loose or debris materials must be removed prior to footing construction) to prevent against landslide regarding the property is located on the high Geotechnical Hazard H1 and Geotechnical Hazard H2 within the Pittwater Geotechnical Hazard Northern Beaches online Mapping.

Further to the above, additional geotechnical input is required and summarized as follow:

- Pit Testing: Conduct pit tests both around and within the existing dwelling to determine the dimensions of the existing footings and to assess the bearing pressures of the foundations. This information will assist in the appropriate design of the foundations considering the additional loading imposed by the proposed first-floor construction.
- Geotechnical Monitoring (if required): Implement a geotechnical monitoring program, where required, to manage and verify that vibration and noise levels remain within

acceptable limits, thereby minimising potential impacts on neighbouring residential buildings prior to and during demolition and construction works.

- Dilapidation Reporting (if required): Prepare dilapidation reports for adjoining residential properties prior to demolition works, documenting the existing condition of structures and features to protect all parties from potential disputes.
- Geotechnical Site Inspections: Undertake geotechnical site inspections during footing and pile excavations to confirm the adequacy of the soil and/or rock bearing capacities at foundation levels.
- Compaction/Density Testing: Perform density testing to verify the quality and compliance of all engineered fill material, where required.

The geotechnical bearing pressures recommended in this report are derived from conditions observed at the specific testing locations and depths investigated. It should be noted, however, that subsurface conditions may vary across other areas of the site, and consequently, the founding depths and bearing capacities for foundations may also differ from those reported.

Accordingly, it is strongly recommended that during excavation and foundation installation, the works be inspected by a suitably qualified and experienced professional, such as a registered geotechnical engineer. This inspection should confirm the adequacy of the excavation conditions, verify founding levels, and provide approval prior to the placement of foundations.

9. VIBRATION CONTROL DURING DEMOLITION AND CONSTRUCTION

It is recommended that demolition and construction activities be undertaken using methods that limit ground vibrations to a maximum Peak Particle Velocity (PPV) of 5 mm/s at adjacent structures.

Where neighbouring buildings are identified as being in a weakened or fragile condition, a more conservative vibration limit of 3 mm/s PPV should be applied to minimise the risk of structural damage.

If there is potential for vibration levels to approach or exceed the recommended thresholds, the implementation of a vibration monitoring plan is advised. Such a plan should establish baseline vibration levels, include real-time monitoring during works, and ensure that construction methods are adjusted as necessary to maintain compliance with the recommended limits.

10. WASTE CLASSIFICATION AND DISPOSAL REQUIREMENTS

Prior to the off-site disposal of any excavated materials, a formal waste classification assessment must be undertaken in accordance with the *NSW Environment Protection Authority (EPA) Waste Classification Guidelines* (November 2014), and the requirements of the *Protection of the Environment Operations Act 1997 (POEO Act)*.

This process requires environmental sampling and chemical laboratory analysis of both fill materials and excavated natural soils and/or rock (including but not limited to GSW, VENM, or ENM), where such materials are proposed to be removed from the site. The scope, type, and extent of testing to be undertaken will be determined by the proposed end use or disposal destination of the spoil, as well as the relevant regulatory requirements for the receiving site.

It is the responsibility of the contractor and/or site operator to ensure that all excavated spoil is appropriately classified and managed in compliance with the above legislation and guidelines before any off-site disposal is carried out.

11. EXCAVATION AND CONSTRUCTION DISCLAIMER

No excavation or construction works are to commence on site without the formal written appointment, approval and involvement of the Project Geotechnical Engineer. Soilsrock Engineering cannot accept responsibility for any landslide, accident, or instability that occurs if works proceed without such approval.

The Project Geotechnical Engineer must:

- Inspect the site prior to and during excavation and foundation construction to verify ground conditions, approve founding levels, and ensure excavation safety.
- Review and approve all designs for foundations, retaining walls, and other ground-related structures before construction.
- Carry out an initial geotechnical inspection of existing ground conditions before demolition, excavation, or construction works commence. These inspections are considered **Hold Points** and must be requested by the builder before work any work starting.

If demolition, excavation, or construction works commence without a Project Geotechnical Engineer properly appointed to review ground conditions and monitor works, Soilsrock Engineering cannot be held liable for changes in site conditions caused by inclement weather, groundwater variations, or pre-existing unstable ground that was not inspected immediately prior to works.

12. ONGOING SLOPE MONITORING DISCLAIMER

For potential landslip could occur due to excavation or existing slopes, and to ensure long-term stability, periodic inspections by a geotechnical engineer are recommended. These inspections should be conducted especially during and after prolonged or heavy rainfall, when the risk of slope instability may be elevated.

13. LIMITATIONS

The site geotechnical investigation undertaken for the present report is an estimate and interpretation of the characteristics of the soil and rock of the subsurface conditions encountered during the test locations investigated. Geological and geotechnical conditions can be unpredictable or can reveal unforeseen conditions, in other test locations investigated no matter how comprehensive the investigation is.

Excavation works must not start on site without the approval in writing of the geotechnical engineer, if any landslide or other accident occurs due to excavations starting without the geotechnical engineer site inspections and approval, the geotechnical engineer cannot be responsible for that reason.

This present report analyses and forms an engineering model interpretation and opinion of the actual subsurface conditions of the points where the tests were carried. The selected in-situ tests results are indicative of actual conditions encountered. Recommendations are given based on the data testing results and visual interpretation carried by professional geotechnical and geological engineers from this office. Interpretation of the present report by others may differ from the interpretation given, there is the risk the report may be misinterpreted and Soilsrock cannot be held responsible for this.

If the demolition, excavation and construction works starting on site without a Project Geotechnical Engineer be properly appointed to check all ground works and foundations designs and observe existing ground conditions immediately prior works started, Soilsrock Engineers cannot be held responsible if ground conditions changing due to inclement weather or any other reason, or if any existing structural and ground conditions are not suitable and not safe for the works to starting without a proper geotechnical site inspection be carried out prior any works to start.

Geotechnical reports rely on factual interpreted and judgement of information based on professional visual interpretation of soils and rock samples, in situ tests and sampling tests, which has some uncertainty due to changing unexpected ground conditions and it is far less exact than other design disciplines. Soilsrock Engineering accepts no responsibility if different unexpected ground conditions occur in locations where the investigations were not carried out.

14. COPYRIGHT AND USE OF REPORT

This report is prepared solely for the commissioning client for the stated purpose. It must not be used by Council, builders, contractors, or other third parties without the client's full payment of associated fees and without the written consent of Soilsrock Engineering. The report is not valid if altered, partially reproduced, or relied upon outside its intended context.

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APPENDIX A

GEOTECHNICAL EXPLANATORY NOTES

APPENDIX A – GEOTECHNICAL EXPLANATORY NOTES

The following geotechnical notes are provided, to give a better understanding of the description and classification methods and field procedures used for the interpretation and compilation of this report which is entirely based on the AS 1726-1993 – Geotechnical Investigations.

INVESTIGATIONS METHODS

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3m for a backhoe and up to 6m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site. Samples can be taken from the test pits for soils testing and analyses.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 3000mm or large in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-125mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be mixed with soils from the sides of the hole. Information from the drilling (as a distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Dynamic Cone Penetromer Tests

Dynamic penetrometer tests (DCP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rood penetrates the soil the number of blows required to penetrate each successive 300mm depth are recorded. Normally there is a depth limitation of 1.2m, but this may be extended in certain conditions by the use of extension rods. A 16mm diameter rod with a 20mm diameter cone end is driven using a 9kg hammer dropping 510mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities. Also Correlations with SPT tests can be made for Cohesion less and cohesive soils.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Proposes – Test 6.3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube under the impact of a 63kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments equal to 450mm in total. The first 150mm increment it not considered for the so-called “N” value (standard penetration resistance), which is taken from the number of blows of the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm may not be practicable and the test will be discontinued. The results are represented in the following example:

- In the case where full penetration is obtained with successive blow counts for each 150mm as follow:
  - 1st Increment (150mm) = 2 blows
  - 2nd Increment (150mm) = 8 blows
  - 3rd Increment (150mm) = 15 blows
  - Representation – 2,8,15 “N” Value = 23
- In the case where the test is discontinued before the full penetration:
  - 1st Increment (150mm) = 20 blows
  - 2nd Increment (100mm) = 40 blows – test interrupted
  - 3rd Increment (150mm) = not carried – test refusal
  - Representation – 20, 40/100 mm “N” Value = 40

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Correlation between DCP vs SPT for Cohesionless Soils

DCP (Blows/300mm)	SPT Value (Blows/300mm)	RELATIVE DENSITY
0-3	0-4	Very Loose
3-9	4-10	Loose
9-24	10-30	Medium Dense
24-45	30-50	Dense
>45	>50	Very Dense

Correlation Between DCP vs SPT for Cohesive Soils

DCP (Blows/300mm)	SPT Value (Blows/300mm)	CONSISTENCY
0-3	0-2	Very Soft
3-6	2-5	Soft
6-9	5-10	Medium/Firm
9-21	10-20	Stiff
21-36	20-40	Very Stiff
>36	>40	Hard

Continuous Diamond Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally affective only in cohesive soils.

DESCRIPTION AND CLASSIFICATIONS METHODS FOR SOILS AND ROCK

Descriptions include strength or density, colour, structure, soil or rock type and inclusions.

SOIL DESCRIPTIONS

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 – 200
Gravel	0.6 – 63
Sand	0.075 – 0.6
Silt	0.002 – 0.075
Clay	<0.002

Type	Sand & Gravel Particle size
Coarse gravel	36mm – 19mm
Medium gravel	19mm – 6.7mm
Fine gravel	6.7mm – 2.36mm
Coarse sand	2.36mm – 600µm
Medium sand	600µm – 212µm
Fine sand	212µm – 75µm

The proportions of secondary constituents of soils are described as:

Coarse grained soils		Fine grained soils	
%Fines	Modifier	%Coarse	Modifier
≤5	Omit, or use 'trace'	≤15	Omit, or use 'trace'
>5 - ≤12	Describe as 'with clay/silt' as applicable	>15 - ≤30	Describe as 'with clay/silt' as applicable
>12	Describe as 'with silty/clayey' as applicable	>30	Describe as 'with silty/clayey' as applicable

Definitions of grading terms used are:

- Well graded – a good representation of all particle sizes.
- Poorly graded – an excess or deficiency of particular sizes within specified range.
- Uniformly graded – an excess of a particular particle size.
- Gap graded – a deficiency of a particular particle size with the range.

Cohesive Soils

Cohesive soils, such as clays, are classified on the basics of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defines as follows:

Description	Abbreviation	Undrained shears strength (kPa)
Very soft	vs	≤12
Soft	s	>12 – ≤25
Firm	f	>25 – ≤50
Stiff	st	>50 – ≤100
Very stiff	vst	>100 – ≤200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basics of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT), or dynamic penetrometers (PSP). The relative density terms are given below:

Relative density	Abbreviation	Density index %
Very loose	vl	≤15
Loose	l	>15 – ≤35
Medium dense	md	>35 – ≤65
Dense	d	>65 – ≤85
Very dense	vd	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil – derived from in-situ weathering of the underlying rock.
- Transported soils – formed somewhere else and transported by nature to the site.
- Filling – moved by man.

Transported soils may be further subdivided into:

- Alluvium – river deposits.
- Lacustrine – lake deposits.
- Aeolian – wind deposits.
- Littoral – beach deposits.
- Estuarine – tidal river deposits.
- Talus – coarse colluvium.
- Slopwash or Colluvium – transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

ROCK DESCRIPTIONS

Rock Strength

Rock strength is defined by the Point Load Strength (Is50) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standards 1726. The terms used to describe rocks strength are as follow:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx. Unconfined Compressive Strength MPa*
Extremely low	EL	≤0.03	<0.6
Very low	VL	>0.03 – ≤0.1	0.6 – 2
Low	L	>0.1 – ≤0.3	2 – 6
Medium	M	>0.3 – ≤1.0	6 – 20
High	H	>1 – ≤3	20 – 60
Very high	VH	>3 – ≤10	60 – 200
Extremely high	EH	>10	>200

*Assumes a ratio of 20:1 for UCS to Is(50)

Degree of Weathering

The degree of weathering of rocks is classified as follows:

Term	Abbreviation	Description
Residual	RS	Soil developed on extremely weathered rock; the mass structure and substance are no longer evident.
Extremely weathered	XW	Rock is weathered to such an extent that it has ‘soil’ properties, i.e. it either disintegrates or can be remoulded in water, but the texture of the original rock is still evident.
Distinctly weathered	DW	Staining and discolouration of rock substance has taken place.
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20mm
Highly fragmented	Core lengths of 20 – 40mm with some fragments
Fractured	Core lengths of 40 – 200mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200 – 400mm with some shorter and longer sections
Unbroken	Core lengths mostly >1000mm

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$RQD\,\% = \frac{cumulativelengthof\,'sound'coresections\ \geq 100mmlong}{totaldrilledlenghtofsectionbeingassessed}$$

Where ‘sound’ rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation or RQD.

Rock Quality Designation

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6mm
Laminated	6mm to 20mm
Very thinly bedded	20mm to 60mm
Thinly bedded	60mm to 0.2m
Medium Bedded	0.2m to 0.6m
Thickly bedded	0.6m to 2m
Very thickly bedded	> 2m

LOG SYMBOLS

Moisture Condition - Cohesive Soils:

MC > PL – Moisture content estimated to be greater than plastic limit
MC = PL - Moisture content estimated to be approximately equal to plastic limit
MC < PL - Moisture content estimated to be less than plastic limit

Moisture Condition - Cohesionless Soils:

D – Dry – Runs freely through fingers
M – Moist – Does not run freely but no free water visible on soil surface
W – Wet – Free water visible on soil surface

Strength (Consistency) - Cohesive Soils:

VS – Very Soft – Unconfined compressive strength less than 25 kPa
S – Soft – Unconfined compressive strength 25-50 kPa
F – Firm – Unconfined compressive strength 50-100 kPa
St – Stiff – Unconfined compressive strength 100-200 kPa
VSt – Very Stiff – Unconfined compressive strength 200-400 kPa
H – Hard - Unconfined compressive strength greater than 400 kPa

Density Index/Relative Density - Cohesionless Soils

Symbol	Density Index (ID)	Range %	SPT "N" Value Range (Blows/300mm)
VL	Very Loose	<15	0-4
L	Loose	15-35	4-10
MD	Medium Dense	35-65	10-30
D	Dense	65-85	30-50
VD	Very Dense	>85	>50

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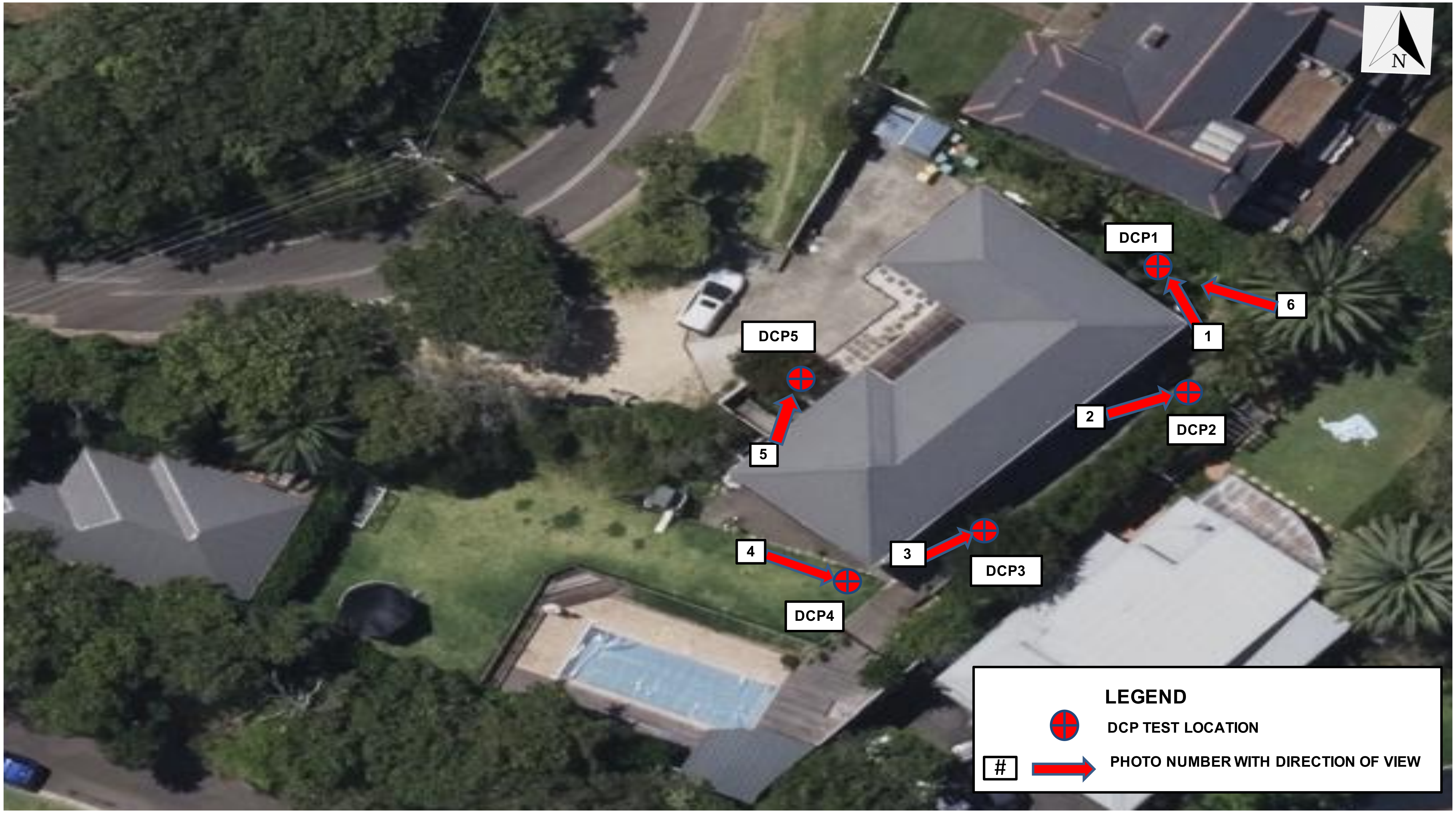
APPENDIX B

DCP TESTS & SITE PHOTOS LOCATION PLAN

1 BELLEVARDE PARADE, MONA VALE NSW 2103



SOURCE: : SIX MAP Dated 29/08/2025

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M: 0457 115 044 | T: (02) 9982 2629
Email: info@soilsrock.com.au
www.soilsrock.com.au

TITLE:	DCP TESTS & SITE PHOTOS LOCATION PLAN	Revision	Date	**Date:** 29/08/2025	**By:** KK
SITE ADDRESS:	1 BELLEVARDE PARADE, MONAVALE NSW 2103			**Scale:** NTS	**Approved:** JC
CLIENT:	LUKE DRIVER			**Project No.:** SRE/1444/MV/25	**Appendix:** B

APPENDIX C

DCP TESTS GRAPHIC

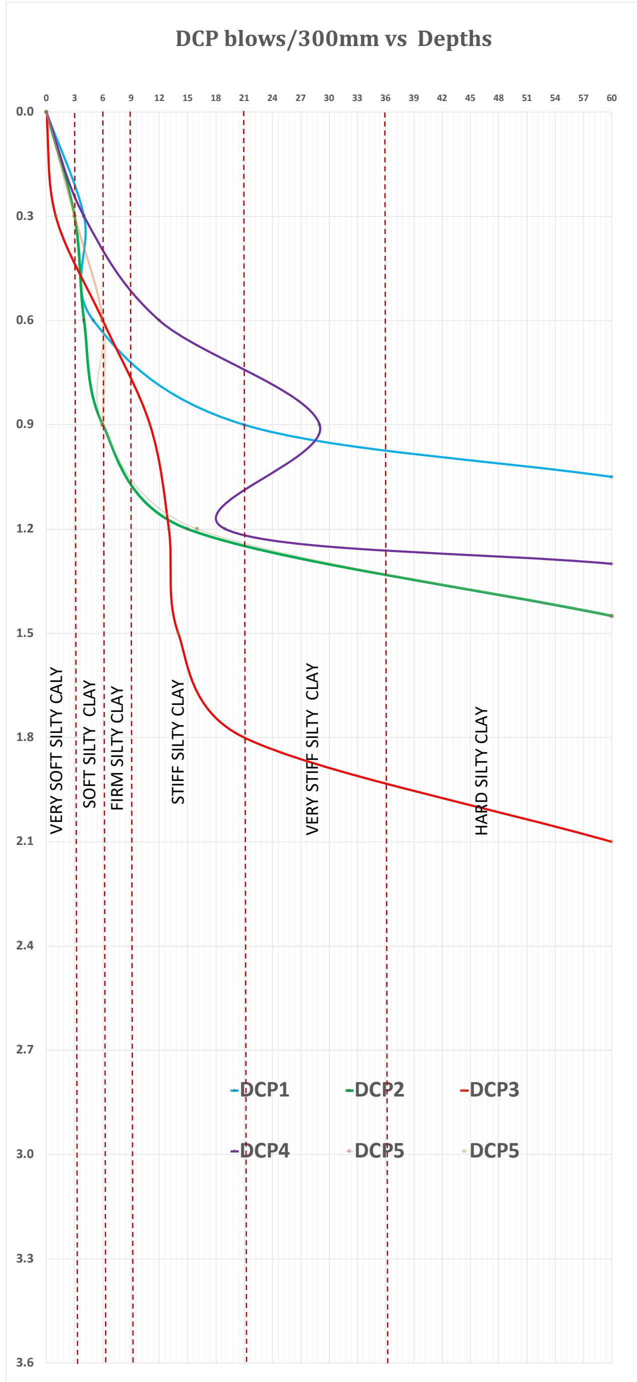
IN-SITU DCP TESTS RESULT SUMMARY (DYNAMIC CONE PENETROMETER TEST)

CLIENT:	LUKE DRIVER	**PAGE:**	1 of 1
PROJECT:	GEOTECHNICAL SITE INVESTIGATION REPORT	**TESTING DATE:**	12/08/2025
LOCATION:	1 BELLEVARDE PARADE, MONAVALE NSW 2103	**LOGGED/CHECKED BY:**	KK/JC
DATE:	29/08/2025	**Standards:**	AS 1289.6.3.2 - 1997
PROJECT NO.:	SRE/1444/MV/25		

Equipment: 9kg Dynamic Cone Penetrometer

Soil Type: SILTY CLAY

Item	Depth (m)	Np (blows/300mm) - Interpretation				
		DCP1	DCP2	DCP3	DCP4	DCP5
1	0.0 - 0.3	4	3	1	4	3
2	0.3 - 0.6	5	4	6	12	6
3	0.6 - 0.9	21	6	11	29	6
4	0.9 - 1.2	Refusal @ 1.05m	15	13	19	16
5	1.2 - 1.5		Refusal @ 1.45m	14	18 Bouncing @ 1.30m	Refusal @ 1.45m
6	1.5 - 1.8			21		
7	1.8 - 2.1			Refusal @ 2.10m		
8	2.1 - 2.4					
9	2.4 - 2.7					
10	2.7 - 3.0					
11	3.0 - 3.3					
12	3.3 - 3.6					
13	3.6 - 3.9					
14	3.9 - 4.2					
15	4.2 - 4.5					
16	4.5 - 4.8					
17	4.8 - 5.1					
18	5.1 - 5.4					
19	5.4 - 4.5					
20						
21						
22						
23						
24						
25						



Comments: **By conducting in-situ Dynamic Cone Penetration (DCP), the blow number (Np) per 300mm has been recorded and shown on the table above.**

APPENDIX D

SITE PHOTOS

soilsrock	**CLIENT:**	LUKE DRIVER	**PAGE:**	1 of 1
	PROJECT:	GEOTECHNICAL SITE INVESTIGATION REPORT	**DATE RECORD:**	12/08/2025
	LOCATION:	1 BELLEVARDE PARADE, MONA VALE NSW 2103		
	DATE:	30/08/2025	**LOGGED BY:**	KK
	PROJECT NO.:	SRE/1444/MV/25	**CHECKED BY:**	JC

SITE PHOTOGRAPHS

Photo 1 - Northwest view of DCP1 test location.

Photo 2 - Northeast view of DCP2 test location.

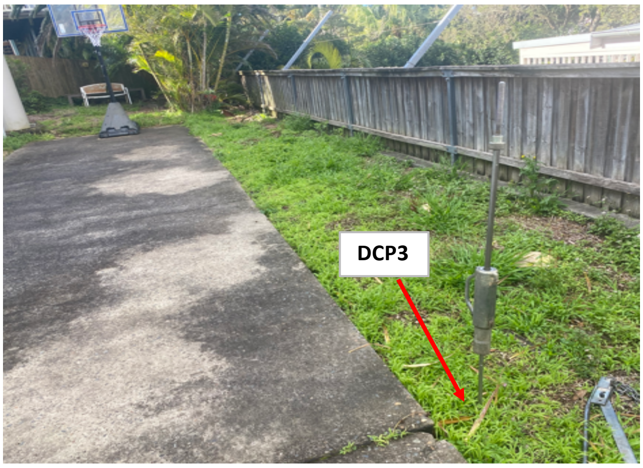


Photo 3 - Northeast view of DCP3 test location.

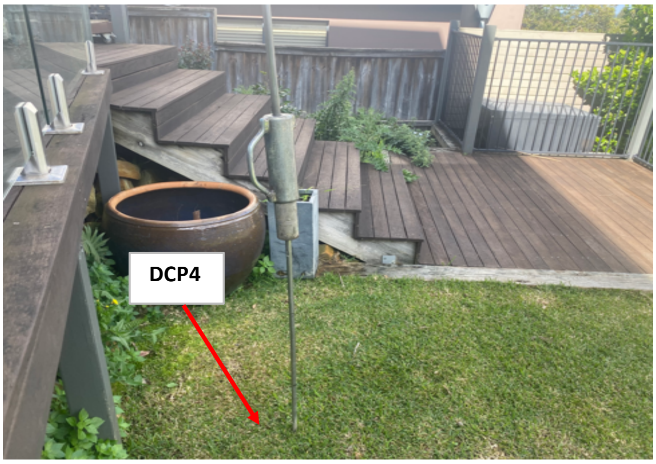


Photo 4 - Southeast view of DCP4 test Location.

Photo 5 - Northeast view of DCP5 test location.

Photo 6 - Northwest view of the back of the property

APPENDIX E

LANDSLIDE RISK ASSSSMENT TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

(PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007 AGS

(AUSTRALIAN GEOMECANICS SOCIETY)

APPENDIX C: 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}	$5x10^{-2}$	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	$5x10^{-3}$	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	$5x10^{-4}$	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	$5x10^{-5}$	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	$5x10^{-6}$	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

APPENDIX C: – 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) For 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.

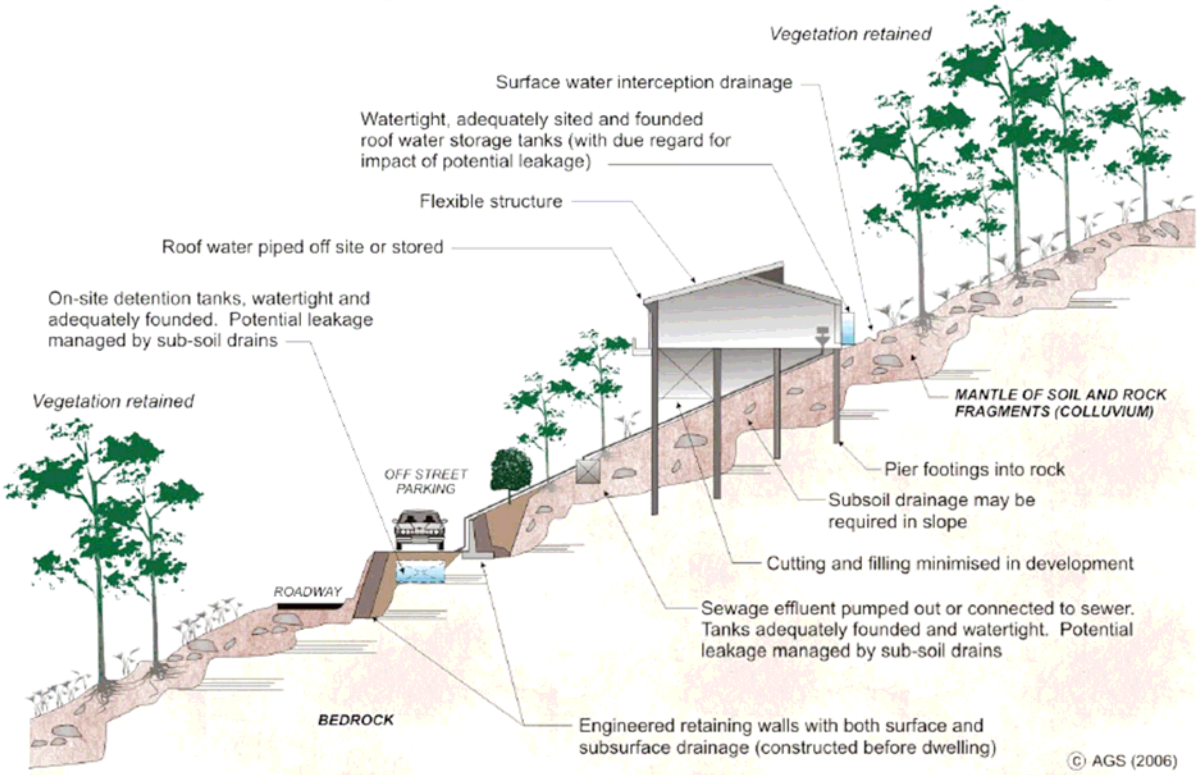
APPENDIX F

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT AGS 2007 AGS – APPENDIX G – SOME GUIDELINES FOR HILLSIDE CONSTRUCTION INTRODUCTION

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



EXAMPLES OF POOR HILLSIDE PRACTICE