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**Mr Vic Micallef**
**212 Hudson Parade**
**Clareville NSW 2107**

Project 222043.00
30 August 2023
222043.00.R.001.Rev0
DEM:gl

Attention: Vic Micallef

Email: vicjayne48@gmail.com

**Geotechnical Assessment**
**Proposed New Dwelling**
**212 Hudson Parade, Clareville**

## 1. Introduction

This report presents the results of a geotechnical assessment carried out by Douglas Partners Pty Ltd (DP) for a proposed new dwelling at 212 Hudson Parade, Clareville. The work was carried out at the request of Mr Vic Micallef, the owner of the property.

It is understood that the project is to include a single multi-level residence split into an upper (roadside) and a lower wing with a courtyard in the middle. A pool will also be added along the western boundary between the two wings. The plans and section for the proposed development also indicate that excavations below the upper wing will be 2.7 m and between 1.2 m and 3.3 m below the lower wing.

Geotechnical assessment was carried out to provide information on subsurface conditions for preliminary design and costing and for Development Application purposes to address the requirements of the Northern Beaches (Pittwater) Council's Geotechnical Risk Management Policy (GRMP) of December 2009.

The assessment comprised detailed inspection and photography of the site and accessible adjacent areas, together with a series of Dynamic Cone Penetrometer tests (DCP's) at selected locations. Details of the field work are given in this report, together with comments relating to the inferred subsurface profile, identification, description and reporting of geotechnical hazards, as well as preliminary design parameters and construction practice.

Architectural plans for the project prepared by RJP Design (Drawings DA 000-012 and DA 200 (all Revision A dated 28 April 2023) and a survey plan by DP Surveying (Drawing 3469 dated 29 April 2022) were provided for reference in the geotechnical assessment.

## 2. Site Description and Geology

Drawing 1 (attached to this report), provides the location of selected features on the site. Colour photographs 1 to 6 on Plate 1 (also attached) depict the site at the time of DP's assessment.

The site is a trapezoid-shaped residential lot (Lot 40 D.P. 13760), located on the low, southern side of Hudson Parade, Clareville. It has a north-south length of approximately 50 m, a 10 m wide street frontage, and a 33 m wide southern boundary along the high water mark of the Pittwater foreshore.

The site slopes from approximately RL 18.5 (relative to Australian Height Datum – AHD) at the northern boundary along Hudson Parade, to RL 1.5 at southern boundary beside the Pittwater foreshore, resulting in an average slope angle of approximately 19°.

The slope angle over the top (northern) four-fifths of the site (including the existing and proposed building footprints) is in the order of 12°. The lower (southern) fifth of the site comprises a 6 m to 7 m high, vegetated steep slope (slope angle 50°to 60°) above the Pittwater foreshore (refer to Photo 1).

The site is bounded by residential lots to the east and west. Alterations and additions to the residence on the adjacent property to the east (214 Hudson Parade) were underway at the time of the assessment. DP has previously undertaken geotechnical investigation on 214 Hudson Parade and inspected bulk and footing excavations during the construction period.

The current site improvements include the main two storey, split-level brick and weatherboard residence with a metal roof residence which is centrally located on the lot. A concrete driveway descends from Hudson Parade alongside the western site boundary to a parking area and an elevated double garage beside the residence.

The upper (northern) yard typically comprises tile and gravel or landscaped terraces, separated by 0.5 m to 1 m high, sandstone flagging walls (refer to Photos 5 and 6).

Grassed terraces within the lower (southern) yard and above the steep vegetated slope are separated by 1 m high, sandstone block, brick or timber retaining walls. Concrete steps and a pathway traverse the slope to a concrete terrace and wharf at the foreshore.

A 1.5 m high, cemented sandstone block sea-wall supports the concrete terrace. A concrete boathouse is located beside Pittwater at the lower, south-eastern corner of the site.

Reference to the Sydney 1:100 000 Geological Series Sheet 9130 indicates that the site is underlain by the Newport Formation, which is the upper unit of the Narrabeen Group and typically comprises interbedded siltstone, shale, laminite and lithic to quartz-lithic sandstone. This is consistent with the topography and the bedrock observed on, and adjacent to the site, as well as in the general area.

## 3. Site Observations and Field Work

The site was inspected by a engineering geologist on 27 July 2023 and the field assessment comprised detailed geological inspection and photography of the subject site and adjoining areas as well as probing with a DCP.

The main site observations are:

- the walls of the existing residences appear externally, to be in satisfactory condition with no major cracking noted;
- there is some cracking in a 1 m high, brick retaining wall which is located to the west of the residence and upslope of a 3500 litre rainwater tank. The cracking appears to be an old feature and the retaining wall does not appear to be near a state of imminent collapse;
- other retaining walls across the site typically appear to be in a poor to fair condition;
- it is understood that the 1 m high, timber retaining wall supporting a grassed terrace to the south of the residence was recently constructed by the property owner;
- a 1 m high, excavated soil batter below the residence is covered with geofabric (refer to Photo 3);
- the property owner reports that the sub-floor area of the residence has remained dry during recent wet weather events;
- stormwater from the garage roof and the northern edge of the existing residence is piped to the rainwater tank with the overflow apparently piped down the slope beside the western site boundary to Pittwater;
- the remainder of the residence has no guttering with stormwater discharged onto the surrounding slope;
- the current methods of stormwater disposal from the residence does not appear to have led to any significant instability on the site;
- sewerage from the residence is pumped upslope to mains at street level via a pit located beneath a grassed terrace to the south-east of the residence;
- there was no evidence of recent, significant slope instability on the steep slope above Pittwater;
- mature trees growing on the steep slope above Pittwater typically appear to be in an upright position;
- cracking in the paths, steps and retaining walls on the steep slope appears to be due to consolidation of supporting soils, downhill soil creep or tree root growth;
- the cemented sandstone block sea-wall is eroded in places but remains functional;
- there is an apparent small sandstone bedrock outcrop exposed on the grassed terrace to the south-west of the residence (refer to Photo 4);
- medium to high strength sandstone bedrock is exposed mid-height and along the toe of the steep slope;
- DCP probing across the top grassed terrace to the south of the residence and within the footprint of the proposed swimming pool reached refusal on apparent bedrock at depths ranging from

negligible to in excess of 1.2 m, with the bedrock depth apparently increasing towards the eastern site boundary; and

- based on DP's observations of bulk and footing excavations on the adjacent site to the east, it is estimated that the maximum bedrock depths across the upper portion of the site and the proposed development footprint will be in the order of 1.5 m to 2 m.

## 4. Proposed Development

It is understood that, following demolition of the existing residence, a new three-level dwelling will be constructed over a similar but slightly larger footprint. The supplied architectural drawings indicate that the construction will require excavation for a lower level to a maximum depth of approximately 4 m below slope levels (although some of this excavation is already existing below the current residence).

The construction of an in-ground swimming pool is proposed on the grassed terraces to the south of the dwelling and upslope of the steep slope.

Some groundwater and/or stormwater seepage would be expected to occur at or above the soil and rock interface following heavy or prolonged rainfall.

## 5. Comments

### 5.1 Geotechnical Model and Inferred Section

The interpreted geotechnical model for the site is shown as Cross Section A-A' on Drawing 2 and comprises a moderate then steep slope with a surface mantle of colluvial soils and a residual sandy clay soil profile (typically less than about 2 m deep) underlain by bedrock comprising low to medium strength sandstone with possible high strength zones/layers.

The bedrock may also include some siltstone interbeds and is likely to step down the slope in a series of buried ledges.

### 5.2 Stability and Slope Risk Assessment

Inspection of the general slope on the subject and adjoining lots indicated no evidence of gross, large scale slope instability in the recent past. However, there is evidence of minor settlement, soil creep or movement from tree root growth affecting some areas of pathways, steps and the low retaining walls on the site.

The soils on the steep slope above Pittwater could be subject to ongoing downhill creep and could also be susceptible to erosion if disturbed, hence care will be required to ensure concentrated surface flows are not created. Recommendations for stormwater disposal are presented in Section 5.5.

The hazards above, adjacent to and on the site have been assessed for risk to property and life using the general methodology outlined by the Australian Geomechanics Society - Landslide Risk Management Subcommittee, 2007.

For the purposes of this assessment, an acceptable level of geotechnical risk for proposed development of the site is "Low" while an accepted annual probability of loss of life for proposed development is $1 \times 10^{-6}$.

Identified hazards are summarised in Table 1, together with a qualitative assessment of likelihood, consequence and slope instability risk to property after completion of the proposed development (assuming appropriate engineering design and construction works are adopted).

**Table 1: Slope Instability Risk to Property Assessment for Proposed Development (after Construction)**

| Hazard | Likelihood | Consequence | Risk |
|---|---|---|---|
| Collapse of excavation during construction of retaining walls | Unlikely - for appropriately designed, inspected and supported temporary excavations | Medium | Low |
| Rapid collapse of final retaining walls | Rare - for engineer designed, inspected and constructed wall. | Medium | Low |
| Slow, minor creep of colluvium and soils across upper and central sections of the site | Unlikely - for appropriately designed and constructed retaining/landscaping structures. | Minor | Low |
| Slow, minor creep of colluvium and soils across lower section of site | Possible - (subject to nature of landscaping works) | Insignificant | Very Low |
| Gross slope instability | Barely Credible – relatively shallow bedrock and no evidence of past gross instability observed. | Major | Low |

For loss of life, the individual risk can be calculated from:

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

where:

- $R_{(LoL)}$ is the risk (annual probability of loss of life (death) of an individual)
- $P_{(H)}$ is the annual probability of the hazardous event (erosion/ wall failure)
- $P_{(S:H)}$ is the probability of spatial impact by the hazard (e.g. of the failure reaching the residence, taking into account the distance from a given event)
- $P_{(T:S)}$ is the temporal probability (e.g. of the adjacent area being occupied by the individual) given the spatial impact
- $V_{(D:T)}$ is the vulnerability of the individual (probability of loss of life of the individual given the impact).

The assessed individual risk to life (person most at risk) resulting from slope instability is summarised in Table 2.

**Table 2: Slope Instability Risk to Life Assessment for Proposed Development (after Construction)**

| Hazard | $P_{(H)}$ | $P_{(S:H)}$ | $P_{(T:S)}$ | $V_{(D:T)}$ | Risk $R_{(LoL)}$ |
|---|---|---|---|---|---|
| Collapse of excavation during construction of retaining walls | $10^{-4}$ | 1 | 0.1 | 0.1 | $1 \times 10^{-6}$ |
| Rapid collapse of final retaining walls | $10^{-5}$ | 1 | 0.5 | 0.1 | $5 \times 10^{-7}$ |
| Extremely slow, minor creep of colluvium and soils across upper and central sections of the site | $10^{-4}$ | 1 | 0.1 | <0.01 | $<1 \times 10^{-7}$ |
| Extremely slow, minor creep of colluvium and soils across lower section of site | $10^{-3}$ | <0.1 | 0.01 | <0.01 | $<1 \times 10^{-8}$ |
| Gross slope instability | $10^{-6}$ | 1 | 0.5 | 1 | $5 \times 10^{-7}$ |

When compared to the requirements of the AGS, it is considered that the proposed development will meet 'Acceptable Risk Management' criteria with respect to both property and life under current and foreseeable conditions.

Provided the construction is undertaken in accordance with the recommendations contained in this report, is appropriately designed and incorporates sound engineering practice, it is considered that the

project is technically feasible and that the construction would not be expected to adversely affect the overall stability of the site or negatively influence the geotechnical hazards identified in Tables 1 and 2.

## 5.3 Excavation and Retaining Structures

The architectural drawings indicate that some additional excavation into the slope will be required for the proposed lower level of the development. The maximum depth of excavation is expected to be in the order of 4 m below pre-development slope levels.

It is expected that excavation into colluvial and residual clay soils will be readily achieved using conventional hydraulically operated earthmoving equipment down to the level of low to medium strength bedrock. However, the excavation may encounter medium strength bedrock (and possibly high strength bedrock) towards the lower parts of the excavation, which will require the use of appropriate sawing, ripping, rock milling and possibly rock breaking equipment.

To date the geotechnical assessment of the site has been limited to detailed site inspection and assessment using hand held equipment. Preliminary design, subject to onsite confirmation during construction (as needed as part of Pittwater Council Form 3 requirements) may be undertaken using the information and parameters detailed below and in the following sections of this report.

The existing clayey and sandy soils are currently subject to soil creep on the lower parts of the site, and will need to be appropriately supported. Any soil remaining exposed along the crest of any excavation cannot be relied upon to stand with batter slopes exceeding 1.5:1 (H:V) and temporary and permanent support will be required where this batter slope cannot be achieved.

It is recommended that, following demolition and removal of the existing site structures, that test pits be excavated to confirm soil depths and confirm the design of temporary and permanent support measures before bulk excavation commences (particularly towards the western site boundary where the proposed excavation will be closest to the residence on the adjacent lot).

Engineer designed retaining walls should be used to retain all soils, filling or extremely weathered bedrock and particularly where the retained height is more than 1 m. Suggested retaining wall design parameters are given in Table 3.

**Table 3: Retaining Wall Design Parameters**

| Material | Earth Pressure Coefficient | | Bulk Density |
|---|---|---|---|
| | Short term | Long term | |
| Filling or sandy clay soils | 0.3 | 0.4 | 20 kN/m$^3$ |
| Sandstone/siltstone/shale - very low strength | 0.1 | 0.15 | 22 kN/m$^3$ |

It should be noted that no provision has been made in the above design parameters for water pressure acting on the walls or other surcharges or sloping ground above a wall. Drainage measures

such as free draining backfill and discharge points through all walls should be incorporated into all wall design.

Within the proposed excavation, sandstone/siltstone/shale bedrock of at least medium strength is generally expected to be able to stand near-vertically without support. However, given the locally steep, foreshore location of the site, it is possible that there may be steeply inclined stress relief joints, sub-parallel to the slope which could give rise to localised instability requiring rockbolt or other support.

Similarly, where there are intersecting joints, highly weathered zones within the rock mass or pockets of deeper soil cover, there could be a potential for local block or minor slip failures. Such features will require localised support such as rockbolts, underpinning or the application of shotcrete.

Regular inspections during the progress of all excavation work, by an experienced geotechnical professional, will be required and it is recommended that inspection be carried out at no greater than 1.5 m vertical intervals to delineate areas of potential instability for additional slope support works and stabilisation.

## 5.4 Foundations

The subsurface profile across the site is likely to be quite variable, comprising colluvial soils (sand and sandy clay), residual sandy clay and bedrock. The depth to bedrock, as well as the nature and strength of bedrock, will be variable which is considered typical of a stepped bedrock profile developed on the Newport Formation.

It is recommended that all foundations are taken down to and also be either socketed (or dowelled) into the underlying, in situ bedrock. Foundations are likely to comprise both pad and strip footings as well as short piles should there be deep soil or colluvial depths. A design allowable bearing pressure (ABP) of up to 1000 kPa is considered appropriate for bedrock (sandstone and siltstone) of at least low strength together with pile bond strengths of at least 100 kPa. It is likely that a higher ABP for the bedrock may be possible, subject to geotechnical inspection during construction.

Inspection of footing excavations for all retaining walls and the foundations for the residence, prior to pouring of concrete, will be required to enable completion of a Pittwater Council GRMP Form 3 (Final Geotechnical Certificate – Post Construction Geotechnical Certificate) to obtain a final occupation and Building Certificate upon completion of the works.

It is anticipated that observation during the drilling of bored pier footings will also be necessary where such footings are required, potentially for the lower level retaining walls and the swimming pool footings.

### 5.5 Stormwater Disposal and Site Drainage

The soils on the site are potentially susceptible to erosion due to concentrated surface water flows and it is therefore recommended that appropriate surface runoff control measures are incorporated into the design of the works.

All roof water, any concentrated surface flows created by the proposed works and excess/overflow water from any water tanks must be discharged from site in a controlled manner using a piped stormwater system, preferably to the southern foreshore for discharge to Pittwater.

All drainage lines, including those behind retaining structures, should include inspection ports to permit periodic maintenance/clearing by the owners.

## 6. Conditions Relating to Design and Construction Monitoring

To comply with Pittwater Council conditions which are part of the design, construction, and post-construction certificate requirements of the GRMP, it will be necessary for DP to complete:

**Form 2B** this will comprise review of all structural drawings to confirm they address geotechnical issues of this report, and

**Form 3** which requires the progressive inspection of all new footing excavations and bulk excavations into the slope to confirm compliance to design, with respect to allowable bearing pressure and stability.

## 7. Design Life and Requirement for Maintenance and Inspection

DP interprets the reference to design life requirements, as specified within the GRMP, to refer to structural elements designed to retain the subject slope and maintain the risk of instability within acceptable limits.

Specific structures that may affect the maintenance of site stability in relation to the proposed development on this site are considered to comprise:

- the proposed stormwater surface drains and buried pipes leading to the stormwater disposal system; and
- proposed retaining walls on the site.

In order to attain a structural life of 100 years as required by the Council Policy, it may be necessary for the structural engineer to incorporate appropriate construction detailing and for the property owner to adopt and implement a maintenance and inspection programme.

A typical programme for developments on sloping sites is given in Table 4.

**Table 4: Recommended Maintenance and Inspection Programme**

| Structure | Maintenance/Inspection Task | Frequency |
|---|---|---|
| Stormwater drains, subsoil drains, pipes and pits | Owner to inspect to ensure that the drains, pipes and pits are free of debris and sediment build-up. Clear surface grates of vegetation/litter build-up. | Every year or following each significant rainfall event. |
| Existing or proposed retaining walls | Owner to check walls for deviation from "as-constructed" condition. | Every two to three years or following each significant rainfall event. |

Where changes to site conditions are identified during the maintenance and inspection programme, reference should be made to a relevant professional (e.g. structural engineer or geotechnical engineer).

## 8. Limitations

Douglas Partners (DP) has prepared this report for this project at 212 Hudson Parade, Clareville in accordance with DP's proposal 222043.00.P.001.Rev 0 dated 10 May 2023, and acceptance received from Mr Vic Micallef. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Mr Vic Micallef and his agents for this project only and for the purposes as described in the report.

It should not be used by or be relied upon for other projects or purposes on the same or another site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations

or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires a risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Yours faithfully
**Douglas Partners Pty Ltd**

Reviewed by

pp

**David Murray**
Senior Associate

**Hugh Burbidge**
Principal

Attachments:
Notes About this Report
Drawings 1 & 2
Plate 1 – Photos 1 to 6
Landslide Risk Management Concepts and Guidelines
Northern Beaches (Pittwater) Council Forms 1 and 1a

# About this Report

Douglas Partners

## Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

## Copyright



## Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

## Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

## Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

# *About this Report*

## Site Anomalies

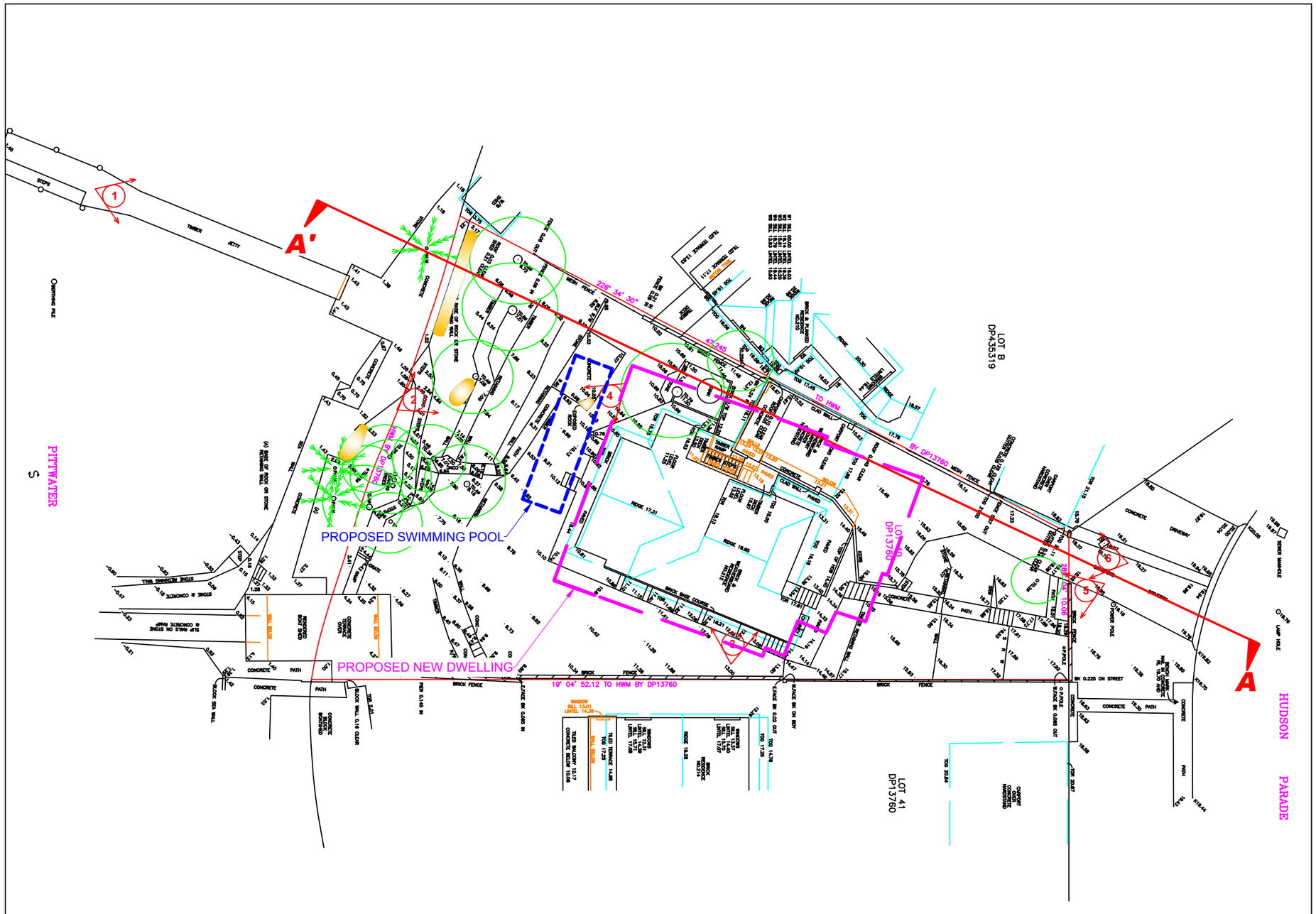
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

## Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

## Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.





**Locality Plan**

## LEGEND

- Sandstone Bedrock Outcrop
- Approximate Footprint of Proposed New Dwelling
- Approximate Footprint of Proposed Swimming Pool
- Cross Section A-A' (Refer to Drawing 2)
- ① Photo number with direction of view

NOTE:
1: Base Survey Plan from DP Surveying, Reference 3469 (Dated 29.04.2022)

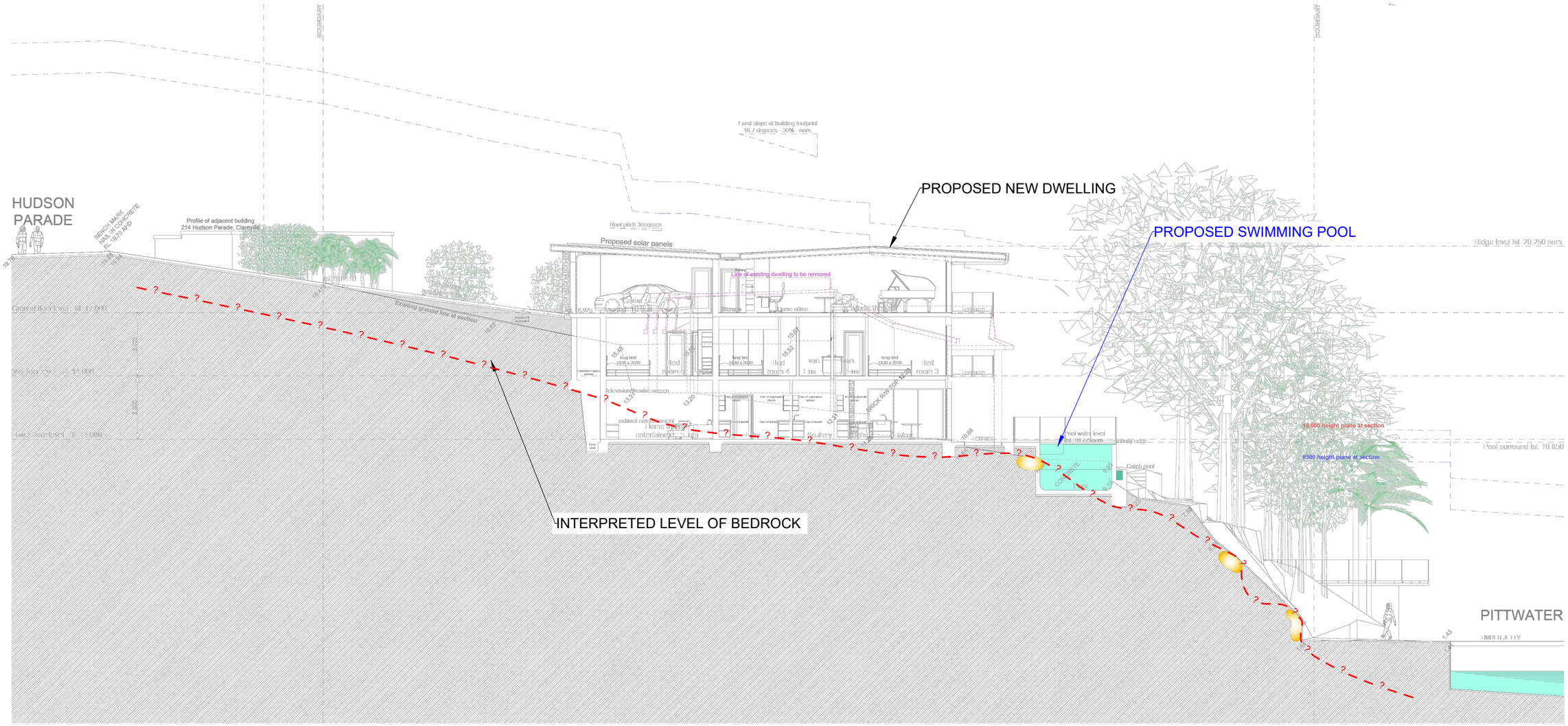
0 1 2 4 6 8 10 15 20 30m
1:300 @ A3

**Douglas Partners**
*Geotechnics / Environment / Groundwater*

| | | | |
|---|---|---|---|
| CLIENT: Mr Vic Micallef | | TITLE: **Geotechnical Features** | PROJECT No: 222043.00 |
| OFFICE: Sydney | DRAWN BY: MN | **Proposed New Dwelling** | DRAWING No: 1 |
| SCALE: 1:300 @ A3 | DATE: 25.08.2023 | **212 Hudson Parade, Clareville** | REVISION: 0 |

A

A'




NOTE:
1: Base Section Plan from RJK Design, Job: J and V, Drawing No. 011,Revision B (Dated 25.08.2023)

0 1 2 3 4 6 8 10 15 20m
1:200 @ A3

**LEGEND**

Sandstone Bedrock Outcrop

Interpreted Bedrock Level

| | | | |
|---|---|---|---|
| Douglas Partners Geotechnics / Environment / Groundwater | CLIENT: Mr Vic Micallef | TITLE: **Cross Section A-A'** **Proposed New Dwelling** **212 Hudson Parade, Clareville** | PROJECT No: 222043.00 |
| | OFFICE: Sydney DRAWN BY: MN | | DRAWING No: 2 |
| | SCALE: 1:200 @ A3 DATE: 25.08.2023 | | REVISION: 0 |

Photo 1: View of site from Pittwater

Photo 2: Sandstone bedrock exposed on steep slope above Pittwater

Photo 3: Batter slope below residence covered with geo-fabric

Photo 4: Possible sandstone bedrock exposed near south-west corner of existing residence

Photo 5: View of site from Hudson Parade

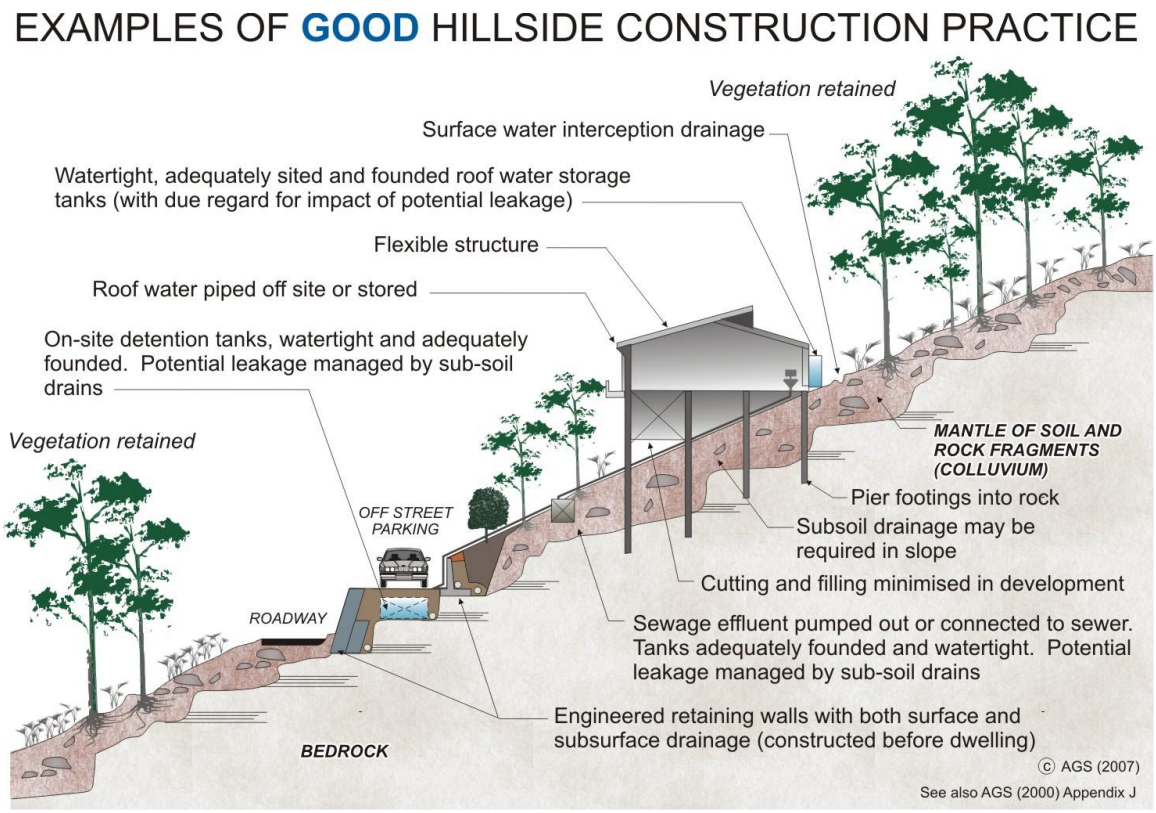
Photo 6: View of site from Hudson Parade

| | | | | | |
|---|---|---|---|---|---|
| Douglas Partners<br>Geotechnics / Environment / Groundwater | CLIENT: Mr Vic Micallef | | TITLE: **Site Photographs**<br>**Geotechnical Assessment - Proposed New Dwelling**<br>**212 Hudson Parade, Clareville** | PROJECT No: | 222043 |
| | OFFICE: Sydney | DRAWN BY: DEM | | PLATE No: | 1 |
| | SCALE: NA | DATE: 27 Jul 2023 | | REVISION: | A |

# AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

## HILLSIDE CONSTRUCTION PRACTICE

Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.




### WHY ARE THESE PRACTICES GOOD?

**Roadways and parking areas -** are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

**Cuttings -** are supported by retaining walls (GeoGuide LR6).

**Retaining walls -** are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that in level ground. Retaining walls must be designed taking these forces into account.

**Sewage -** whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

**Surface water -** from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfil the same purpose (GeoGuide LR5).

**Surface loads** - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

**Flexible structures -** have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

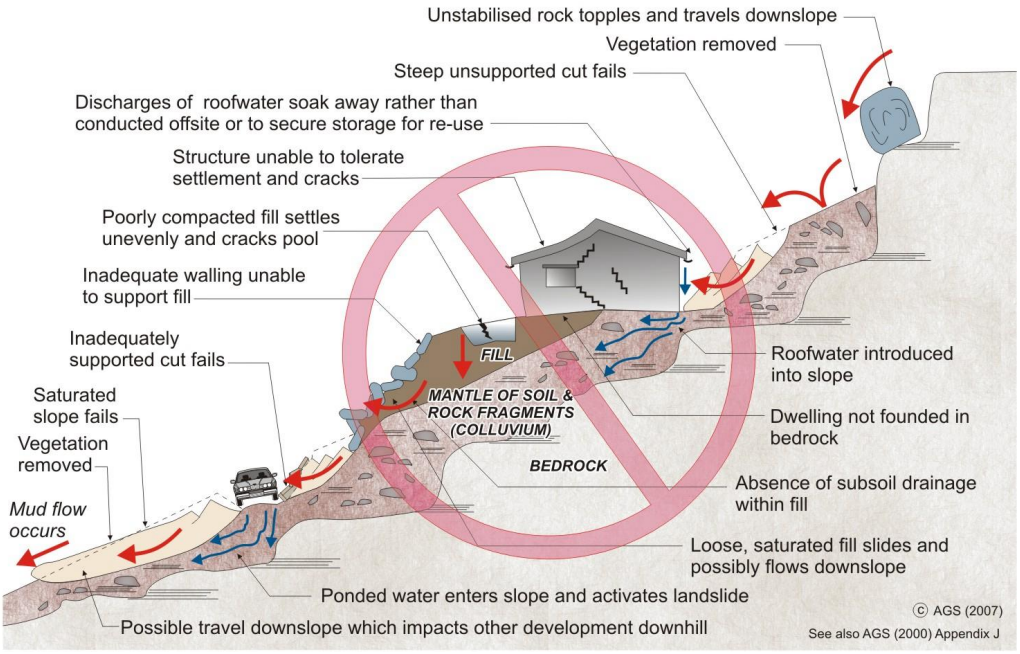
**Vegetation clearance -** on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

**ADOPT GOOD PRACTICE ON HILLSIDE SITES**

# AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

## EXAMPLES OF **POOR** HILLSIDE CONSTRUCTION PRACTICE




### WHY ARE THESE PRACTICES POOR?

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

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

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

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

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

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

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

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

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

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

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

# PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

## 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.

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

**Development Application for** Mr Vic Micallef
Name of Applicant

**Address of site** 212 Hudson Parade, Clareville

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

*I,* _____ *on behalf of* _____
(Insert Name) (Trading or Company Name)

on this the 25 August 2023 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 $10million.

I:
**Please mark appropriate box**

- ə 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
- ə ✓ 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
- ə 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.
- ə 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.
- ə 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.
- ə ~~have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report~~

**Geotechnical Report Details:**

Report Title: Geotechnical Assessment - Proposed New Dwelling
Report Date: 25 August 2023
:
Author: David Murray
Author's Company/Organisation: Douglas Partners P/L

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

- Site Survey by DP Surveying (Drawing 3469 dated 29/4/22)
- Arch Dwgs DA 000-012 + DA 200 (all Rev B dated 25/8/23)

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 ..... Bruce McPherson

Chartered Professional Status..... CPEng NER

Membership No. ..... 350625

Company..... Douglas Partners 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** Mr Vic Micallef
Name of Applicant
**Address of site** 212 Hudson Parade, Clareville

*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 Assessment - Proposed New Dwelling
Report Date: 25 August 2023
Author: David Murray
**Author's Company/Organisation:** Douglas Partners P/L

**Please mark appropriate box**

- ✓ Comprehensive site mapping conducted 27/7/23 (date)
- ✓ Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)
- ✓ Subsurface investigation required
  - No Justification .....
  - ✓ Yes Date conducted 27/7/23
- ✓ Geotechnical model developed and reported as an inferred subsurface type-section
- Geotechnical hazards identified
  - Above the site
  - ✓ On the site
  - Below the site
  - Beside the site
- ✓ Geotechnical hazards described and reported
- ✓ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
  - ✓ Consequence analysis
  - ✓ Frequency analysis
- ✓ Risk calculation
- ✓ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ✓ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ✓ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009
- ✓ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.
- Design Life Adopted:
  - ✓ 100 years
  - Other .....
    specify
- ✓ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater - 2009 have been specified
- ✓ Additional action to remove risk where reasonable and practical have been identified and included in the report.
- ~~Risk assessment within Bushfire Asset Protection Zone.~~

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

Signature .....
Name ..... Bruce McPherson
Chartered Professional Status ..... CPEng, NER
Membership No. ..... 350625
Company ..... Douglas Partners Pty Ltd