REGIONAL GEOTECHNICAL SOLUTIONS

Jason Mckinley
PO Box 48
Hallidays Point NSW 2430

RGS03697.1 - AB
Revision 0
2 April 2025

Dear Jason

RE: Proposed Dwelling
16B The Saddle, Tallwoods Village (Lot 2 DP1279242)
Geotechnical Assessment

1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical site classification for a proposed residential dwelling that is to be located at 16B The Saddle, Tallwoods Village (Lot 2 DP1279242).

Supplied plans indicate a split level 3 bedroom dwelling is proposed supported on a combination of steel piers, pad footings, core filled concrete blocks and suspended concrete slabs. In providing this report and site classification it has been assumed that the performance expectations of AS2870-2011 are acceptable for the proposed structure.

The purpose of the assessment was to address the geotechnical issues relating to the development and to provide recommendations and advice on:

- Subsurface soil profile, including the presence of fill and the depth to weathered rock.
- Foundations, including foundation design parameters, and site classification to *AS2870-2011 Residential slabs and footings.*
- Slope instability.
- Site drainage.

2 METHODOLOGY

Fieldwork for the assessment was undertaken by RGS on the 21 February 2025 and included the following:

- Observation of site features and surrounding features relevant to the geotechnical conditions of the site.
- Logging and sampling of three boreholes within the proposed building area.
- Collection of samples for subsequent laboratory testing.

Engineering logs of the boreholes are attached. Test locations are shown on the attached Figure 1.

3 SITE CONDITIONS

The site is located within an area of moderately to steeply undulating residual terrain. The proposed dwelling will be on the mid east and southeast facing slopes of a generally north/south trending section of ridgeline. The lot occupies approximately 955m^2 and is bordered by other private residential lots to

the north and south containing dwellings, golf course land to the east and The Saddle to the west. A concrete right of way access driveway runs from The Saddle along the southern boundary of an upslope lot downslope to the east to provide battle axe access to 16B.

The site generally slopes towards the east southeast at 13° to 17°. At the time of fieldwork, the site was vegetated with overgrown grass which restricted observation of surface conditions. Shrubs and small trees are located along the northern and southern boundaries on neighbouring lots. A drainage line vegetated with large gum trees is located downslope of the eastern boundary. A pile of rubble is located on the lot downslope of the proposed dwelling footprint. Loose boulders were observed on the site surface and have been attributed to earthworks undertaken on the upslope lot. Drainage is via minor infiltration and overland flow.

An aerial image showing the location of the site and the site setting is reproduced below.

An aerial image obtained from 'Google Maps' that illustrates the site location and setting is shown above. The approximate site boundaries are shown by a red outline.

Typical site photographs are presented below.

Looking upslope to the west showing long grass and steeply sloping site.

Looking south showing typical slope angles, grass cover and neighbouring dwelling at rear.

The 1:100,000 Bulahdelah Geology map indicates that the property is located within an area underlain by the Bundook Beds which comprise grey to brown lithic sandstone & siltstone, interbedded with massive greywackes & minor conglomerate. These formations are typically overlain by residual clay soil profiles derived from these rock types.

A summary of the materials encountered within the boreholes undertaken is presented below in Table1.

Table 1: Summary of Subsurface Conditions Encountered in Boreholes

Material Name	Material Description	Depth of Material Layer (m)		
		BH1	BH2	BH3
Fill	Silty CLAY, low plasticity.	--	0 - 0.3	--
Topsoil	Silty CLAY, low plasticity, firm.	0 – 0.1	--	0 – 0.15
Slopewash	Silty CLAY, low plasticity, very stiff.	--	0.3 – 0.5	0.15 – 0.45
Residual	CLAY, medium plasticity, stiff.	0.1 – 0.75	0.5 – 0.8	0.45 – 0.8
Extremely Weathered Siltstone	Gravelly CLAY, low to medium plasticity, gravel fine to medium, very stiff to hard.	--	0.8 ≥ 1.2	--
Highly to Moderately Weathered Siltstone	Dry, medium to high strength, highly fractured to fractured.	0.75 - ≥ 0.9*	1.2 ≥ 1.4*	0.8 ≥ 0.95*

Notes: * Indicates auger refusal
-- Indicates the material was not encountered at the test location
≥ indicates the base of the material layer was not encountered

Groundwater was not encountered in any of the boreholes. Groundwater levels fluctuate because of seasonal variations, temperature, rainfall and other similar factors, the influence of which may not have been apparent at the time of the assessment.

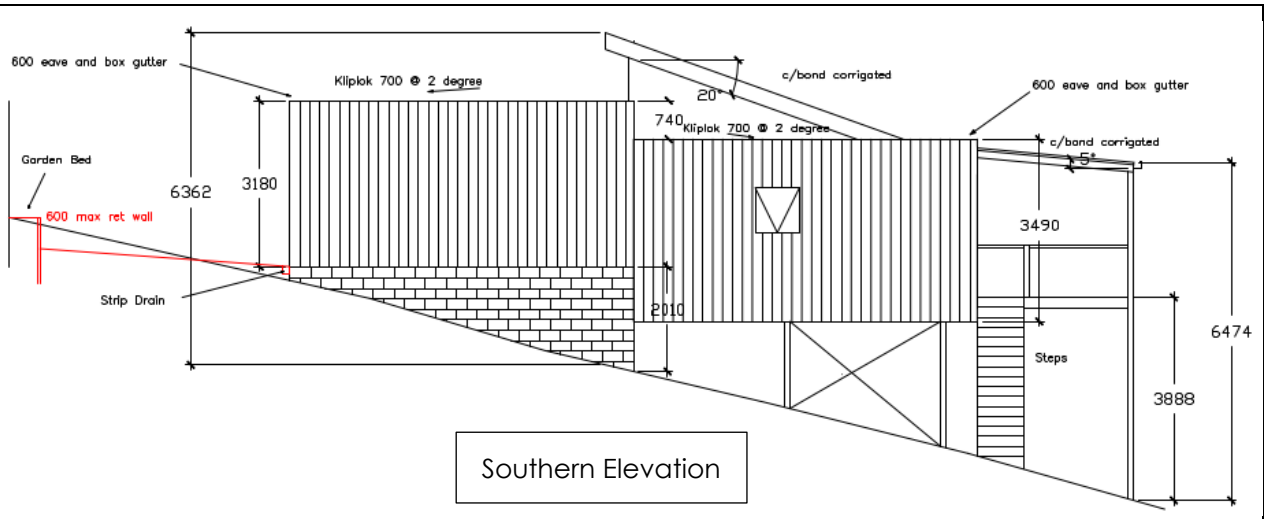
Laboratory testing on a representative sample of residual clay from BH1 (0.1 – 0.6m) revealed a shrink-swell index of 2%. RGS has encountered similar I_{ss} results on nearby lots within Tallwoods.

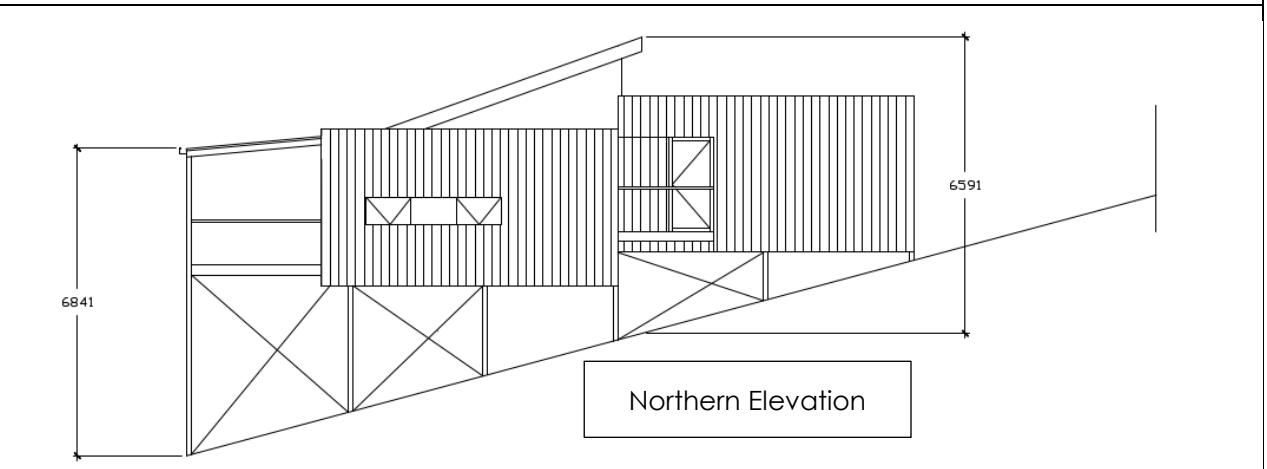
Further details of the subsurface profiles are provided on the attached Engineering Logs.

4 PROPOSED DEVELOPMENT

The drawings provided indicate a three bedroom single storey dwelling is proposed. No cut or fill is shown on the drawings within the building footprint. It is understood that the dwelling will be supported on a combination of steel piers, pad footings, core filled concrete blocks and suspended concrete slabs.

Discussion with the builder indicates the pad footings will be extended to found within weathered rock. The building appears to have been designed with consideration to the natural slopes encountered. Some details about the development are provided in the figure below.





South & North Elevation Sections of proposed development as per drawings provided to RGS

5 SLOPE STABILITY

5.1 Risk Assessment

The risk of slope instability has been assessed using the principles and procedures of the Australian Geomechanics Society Publication Practice Note Guidelines for Landslide Risk Management, 2007. This methodology represents the currently accepted state of practice for landslide risk assessment in Australia.

The slope risk assessment process involves identification of a potential slope failure event, or hazard, followed by an estimation of the likelihood of the event occurring, and the potential consequences should the event occur.

The terms used in the risk assessment process are defined below:

Hazard: A condition with the potential for causing an undesirable consequence.

Likelihood: The estimated probability that the hazardous event will occur.

Consequence: Loss or damage resulting from a hazard event.

Risk: A term combining the likelihood and consequence of an event in terms of adverse effects to property or the environment.

5.2 Hazard Identification

In terms of slope stability, the following potential hazards were assessed in relation to the site and the proposed development:

Hazard 1 – Translational failure caused by sliding of the soil or rock profile over a plane of weakness such as a clay seam, zone of water concentration within the exposed rock mass, or on the soil-rock interface. Should such a failure occur it could potentially cause moderate structural damage.

Hazard 2 – Rotational failure or toppling failure within unsupported excavations or fill batters. If such a failure was to occur it could potentially cause moderate structural damage to a structure. It is noted that no cut or fill is proposed within the proposed building footprint. A small cut approximately 0.6m depth is proposed upslope of the dwelling nearby the western property boundary.

Hazard 3 – Soil creep. Creep is an imperceptibly slow movement that takes place on sloping soil sites. It is an ongoing, natural slope process involving the progressive downslope migration of soils over the underlying rock profile.

The identified hazards are shown in Figure 2.

5.3 Risk Evaluation for Existing Site Conditions

Table 2 assesses the risk of slope instability for each of the hazards identified, using the risk assessment matrix provided in Appendix C of the Australian Geomechanics Society (AGS) publication Practice Note Guidelines for Landslide Risk Management, 2007.

A copy of the risk matrix from the AGS document is attached.

Table 2: Slope Risk Assessment Based on AGS2007 Method

Hazard	H1 Translational slide over defect or soil-rock interface	H2 Instability within unsupported cuts and fills	H3 Soil Creep
Slope height	Up to around 2m	Up to around 1m.	Whole slope
Cause or trigger	Slope deterioration(10yr) followed by extreme rainfall event (1 in 10,000yr) event and poor site drainage.	Cut steeper than angle of repose, unsupported, high rainfall (1 in 10yr event) Leaking underground services, poor drainage, application of a load or surcharge (traffic, construction, etc) at crest of cut or fill.	Ongoing process
Proportion of slope affected	0.3	0.1	1
Element(s) at Risk	Footings, structures on property	Site occupants or structures nearby	Post development structures
Risk assessment without management or treatment			
Estimated annual probability	10^{-4}	10^{-2}	10^{-1}
Likelihood	Unlikely	Likely	Almost Certain
Consequence	Medium	Medium	Insignificant
Risk	Low	High	Low
Risk assessment with management as proposed			
Proposed treatment	Employ good hillside construction practice	All cut and fill support to be engineer designed for the slope conditions. Appropriate drainage measures.	No specific treatment proposed – minimise disturbance to existing slope and employ good hillside construction practice
Estimated annual probability	10^{-5}	10^{-5}	10^{-1}
Likelihood	Rare	Rare	Almost certain
Consequence	Medium	Medium	Insignificant
Risk	Low	Low	Low

5.4 Evaluation of Risk Level

The assessment presented in Table 2 indicates that there is a **Low** risk of slope instability for the site provided the development is undertaken in accordance with general good hillside practice (refer to attachment) and by adopting the recommendations of this report regarding maximum unsupported cut heights, batter angles, and retaining wall design.

A **Low** risk rating would normally be considered acceptable for hillside development in Australia and can be maintained by implementing good surface drainage at the site and good hillside construction practices as recommended herein. Site drainage associated with the proposed development should be designed to avoid concentrated flows in the vicinity of any proposed cuttings, areas of fill or foundations. Drainage measures should include diversion drains upslope of the development that diverts upslope runoff around the proposed building area, to discharge in a controlled manner that limits erosion downslope or to the site stormwater drainage system.

All cuts and fills must be appropriately benched and battered, supported by temporary shoring or by an engineered retaining wall. All retaining walls should include an allowance for adequate drainage behind the wall in accordance with AS4678-2002 that either discharges into the site stormwater system or further downslope from the proposed dwelling.

5.5 Recommendations in Relation to Slope Risk Management

The Australian Geomechanics Society published a series of documents providing guidelines for Landslide Risk Management in 2007. The documents included recommendations on Good Hillside Practice. It is recommended that development at this site be undertaken in accordance with good hillside practice as summarised in the attached document and the specific recommendations of this report.

Type of Structure

Piered suspended structures like those proposed that limit requirements for site cut and fill earthworks, are considered most suitable for the site conditions. It has been assumed that the performance expectations of *AS2870-2011* are acceptable for the proposed structure. The proposed development should be founded in accordance with the recommendations of this report.

Excavations and Filling

Excavations and filling at the site should be limited where possible to reduce the potential for instability of cuts and fills. Unsupported cut or fill batters up to 1.5m should not exceed 2H:1V for permanent slopes, or 1V:1H for temporary (i.e. during construction) batters. Temporary batters for retaining wall construction should be cut with an overall batter grade of no more 1V:1H for heights no greater than 1.5m. Where permanent cuts encountered soil over rock the upper soil portion of the cut should be no steeper than 1.5H:1V and the lower portion within rock should be cut no steeper than 0.75H:1V.

Any fill placed on the site must be placed on a foundation that has been benched into the slope to provide a level surface to avoid a sloping interface that could facilitate instability. All fill should be placed and compacted in accordance with the recommendations outlined in AS3798-2007 *Guidelines on Earthworks for Residential and Commercial Developments.* The edges of fill pads should be over placed and compacted prior to trimming back to the design batter to ensure compaction.

All excavations on site must comply with the Safework Australia '*Excavation Work Code of Practice*' (2020 or latest edition). Vertical batters should not be undertaken without appropriate engineer designed support measures.

Retention

All retaining walls should be designed in accordance with AS4678-2002 and must consider surcharge loading associated with slopes, future traffic, or structures above the wall. Retaining walls must be provided with free draining backfill and a slotted subsoil drain behind the wall that discharges to the site stormwater system, or else discharges well beyond the wall foundations.

Gravity or cantilever retaining walls can be designed based on a triangular lateral earth pressure distribution using the parameters provided in Table 3.

Table 3: Retaining Wall Design Parameters

Material Type	Bulk Unit Weight (kN/m^3)	Angle of Internal Friction (Φ)	Cohesion (kPa)	Active earth pressure coefficient (K_a)	Passive earth pressure coefficient (K_p)	Allowable base bearing pressure (kPa)
Topsoil / Fill /Slopewash	18	20^0	2	0.49	2.1	--
Residual Clay	19	25^0	5	0.41	2.5	100
EW to HW Siltstone	22	35^0	15	0.28	3.6	400

The earth pressure coefficients detailed in Table 3 have been calculated using Rankine's Theory. The retaining wall designer should ensure that the use of this method is appropriate for the individual retaining wall.

Maintenance of retaining structures is recommended including reduction of vegetation growing within retaining walls, and regular maintenance of groundwater weep drains.

Drainage

Runoff water should be directed to an onsite drainage system that pipes the water away from the proposed building area to discharge either to the inter allotment drainage system, or discharges downslope of all fill and retaining structures in a controlled manner that limits erosion. Drainage systems should be 'self flushing' where possible, to reduce blockages from leaves and other debris.

Regular maintenance of groundwater weep points should be undertaken.

6 SITE CLASSIFICATION

The site classification presented herein is provided on the basis that the performance expectations of AS2870-2011 are acceptable.

Due to the presence of nearby trees that may cause abnormal moisture conditions, the site is classified as **Class P**. Footings should therefore be designed based on engineering principles.

In assessing the estimated characteristic surface movement (ys) the following values have been adopted:

- Suction change at ground surface of pf 1.2.
- Depth of suction change of 1.5m.
- Crack depth multiplication factor of 0.5.
- Characteristic I_{ss} of between 1.5 to 2.5% for the residual soil and extremely weathered rock encountered.
- Some shrubs and trees are located around the lot boundaries within the zone of influence of the trees once matured.
- Bedrock is located at 1.2m depth or less.

Based on the above, the conditions encountered during fieldwork and laboratory test results, a characteristic surface movement of up to ys = 30mm is predicted, equivalent to a Class M moderately reactive site when assessed in accordance with AS2870-2011. Additional shrink - swell related

characteristic free surface movement (Yt) from the drying effects of nearby trees has been calculated and included in the total movement.

Providing the plumbing fixtures can tolerate shrink-swell related movements of up to 30mm, a performance solution for drainage installations is not considered to be required from a geotechnical perspective.

The founding of structures in differing materials is not recommended as differential movements, including shrink-swell related movements and settlement related movements can result in damage to the building. These movements can be accommodated by extending all footings to found within weathered rock. Where footings are extended to found within the underlying weathered rock, any footing beams and any building slabs will be required to be designed to be fully suspended and to account for the reactivity of any clay or clay fill beneath.

Shrink-swell related movements can be affected by alterations to the soil profile by cutting and filling, and by the suction related effects of trees close to the building area. The effects of any such cutting, filling, tree planting, or tree removal should be considered when selecting design values for differential movement across the building.

The planting of trees and shrubs in the vicinity of the building will affect the moisture profile in the vicinity of the footings. Trees or shrubs should not be planted within a distance from the building equivalent to one times the mature height of the tree, measured from the nearest footing. Garden beds directly adjacent to footings will cause abnormal moisture conditions under the footings and should also be avoided.

Site maintenance must comply with the recommendations and advice provided in CSIRO Sheet BTF18 "Foundation Maintenance and Footing Performance: A Homeowners Guide "a copy of which is which is available from the CSIRO website http://www.publish.csiro.au/pid/7076.htm

If any further earthworks are undertaken at the site, reclassification may be required.

7 CONSTRUCTION AND SITE MAINTENANCE CONSIDERATIONS

All structural footings should be founded as follows:

- All footings should be founded in at least stiff natural residual soil, weathered rock or controlled fill (i.e. placed under Level 1 construction monitoring and testing to AS3798-2007) and below all topsoil, slopewash, disturbed areas and any uncontrolled fill.
- Footings founded within stiff residual soil or fill placed under Level 1 construction monitoring and testing to AS3798-2007 can be designed based on a maximum allowable base bearing pressure of 100kPa.
- Footings founded within weathered rock can be designed on the basis of a maximum allowable base bearing pressure of 400kPa.
- All footings, edge beams and internal beams should be founded on similar materials and outside or below the zones of influence resulting from existing or future service trenches, batters and other subsurface structures.
- Should differential shrink-swell related movements be of concern for the proposed dwelling it is recommended that all footings be deepened to found uniformly on the weathered rock profile.
- Site drainage associated with the proposed development should be designed to avoid concentrated flows in the vicinity of any proposed cuttings and foundations and to discharge water downslope of the development in a controlled manner that limits erosion.
- Any foundations located within areas where tree removals, earthworks or demolition works have previously been carried out or will occur in the future will need to be taken through the disturbed

ground to be founded on the undisturbed natural ground beneath. All organic root material should be removed from within the building footprint.

- The soils and rocks in the Tallwoods area are prone to fretting and softening on exposure to air and water. It is therefore recommended that concrete be poured as soon as possible after footing excavation. If wet weather occurs prior to pouring of concrete, the base of footing excavations should be checked for the presence of loose or softened material, which should be removed prior to pouring concrete.
- Where lot filling works are proposed, all fill for the support of structures should be placed and compacted in accordance with the recommendations outlined in AS3798-2007 Guidelines on Earthworks for Residential and Commercial Developments, under Level 1 supervision, for it to be considered Controlled Fill as defined in AS2870-2011. The founding of structures on fill that is not placed in accordance with Level 1 requirements is not recommended.

Site maintenance must comply with the recommendations and advice provided in CSIRO Sheet BTF18 "*Foundation Maintenance and Footing Performance: A Homeowners Guide* "a copy of which is which is available from the CSIRO website http://www.publish.csiro.au/pid/7076.htm.

8 IMPORTANT INFORMATION

This report comprises the results of an investigation carried out for a specific purpose and client as defined in the document. The report should not be used by other parties or for purposes or projects other than those assumed and stated within the report, as it may not contain adequate or appropriate information for applications other than those assumed or advised at the time of its preparation. The contents of the report are for the sole use of the client and no responsibility or liability will be accepted to any third party. The report should not be reproduced either in part or in full, without the express permission of Regional Geotechnical Solutions Pty Ltd.

Geotechnical site investigation is based on data collection, judgment, experience, and opinion. By its nature, it is less exact than other engineering disciplines. The findings presented in this report and used as the basis for the recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

The recommended depth and properties of any soil, rock, groundwater, or other material referred to in this report is an engineering estimate based on the information available at the time of its writing. The estimate is influenced and limited by the fieldwork method and testing carried out in the site investigation, and other relevant information as has been made available. In cases where information has been provided to Regional Geotechnical Solutions for the purposes of preparing this report it has been assumed that the information is accurate and appropriate for such use. No responsibility is accepted by Regional Geotechnical Solutions for inaccuracies within any data supplied by others.

If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of **Regional Geotechnical Solutions Pty Ltd**

Prepared by

James Dowling

Senior Technical Officer

Reviewed by

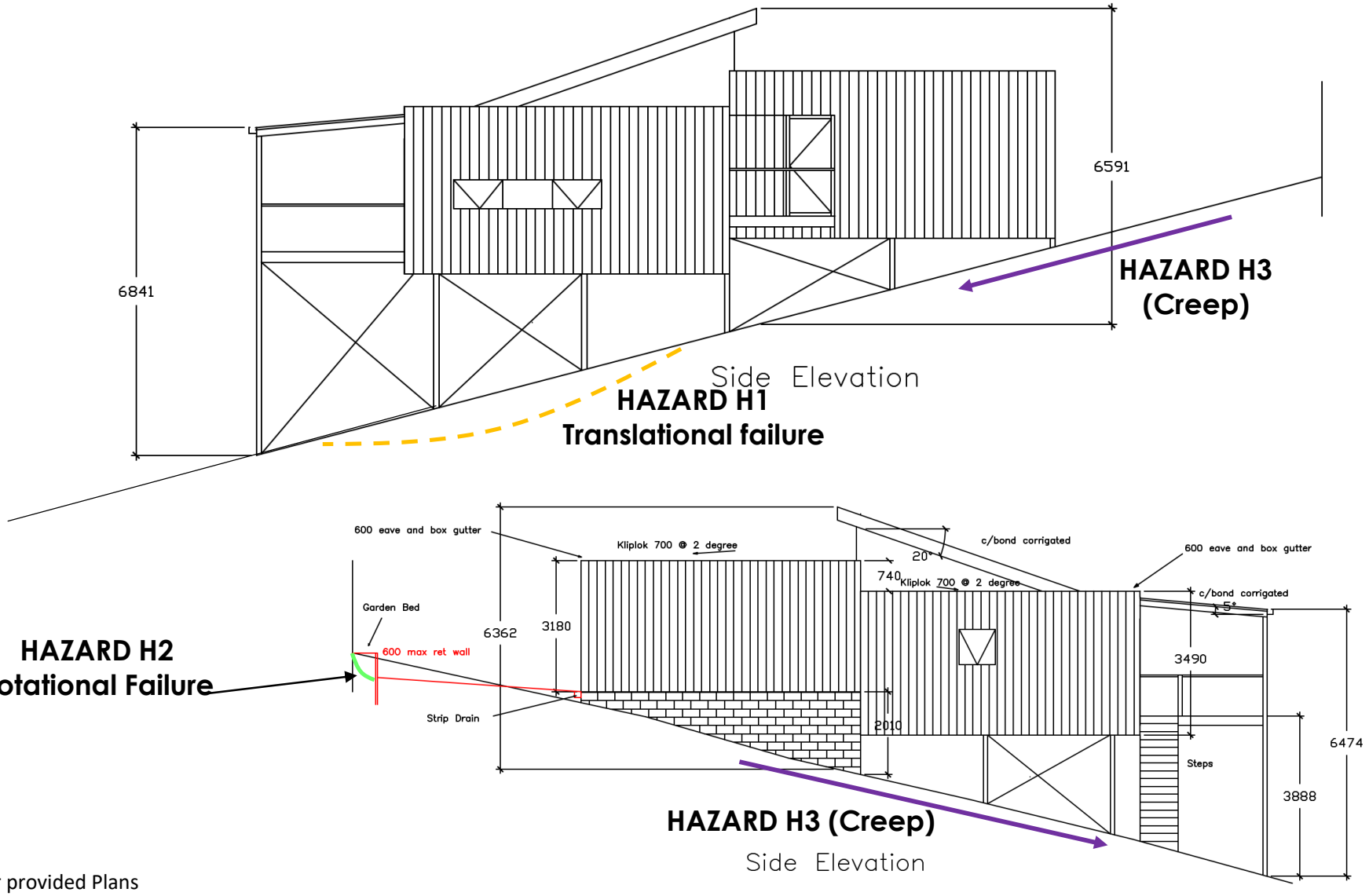
Simon Keen

Associate Geotechnical Engineer

Attachments:

- Figure 1
- Figure2
- Soil & Rock Explanation Sheets
- Engineering Logs
- Laboratory Test Results
- Slope matrix and information on hillside development

REGIONAL GEOTECHNICAL SOLUTIONS	Client	Jason McKinley	Job No.	RGS03697.1
	Project:	Proposed Dwelling 16B The Saddle, Tallwoods Village	Drawn By:	JD
			Date:	31-Mar-25
	Title:	Borehole Location Plan	Drawing No.	**Figure 1**



*As per provided Plans

REGIONAL GEOTECHNICAL SOLUTIONS	**Client:**	Jason McKinley	Job No. RGS03697.1
	Project:	Proposed Dwelling	Drawn By: JD
			Scale: NTS
		16B The Saddle, Tallwoods Village	Date: 1-Apr-25
	Title:	Cross section with examples of identified hazards	Drawing No. **Figure 2**

Soil Description Explanation Sheet

REGIONAL GEOTECHNICAL SOLUTIONS

The following summary of the description and classification of soils used by Regional Geotechnical Solutions Pty Ltd (RGS) in this report are based on Australia Standard AS1726-2017 'Geotechnical Site Investigations'. When describing soils, the dominant component is shown in upper case and secondary components are shown in lower case. Soil descriptions, in general, will contain soil type, plasticity or particle size/shape, colour, secondary components, consistency or density, moisture and inclusions, along with other relevant additional observations.

Particle Size Distribution		
Components	**Subdivision**	**Size (mm)**
Boulders		>200
Cobbles		63 - 200
Gravel	Coarse	19 - 63
	Medium	6.7 - 19
	Fine	2.36 - 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21
Silt		0.002 - 0.075
Clay		<0.002

Secondary & Minor Components			
Terminology	**Coarse Grained Soil**		**Fine Grained Soil**
	% Fines	**% Coarse**	**% Coarse**
Trace	≤5	≤15	≤15
With	>5, ≤12	>15, ≤30	>15, ≤30
Secondary	>12	>30	>30

Consistency			
Term	**Abbr.**	**Undrained Shear Strength (kPa)**	**Unconfined Compressive Strength (kPa)**
Very Soft	VS	<12	<24
Soft	S	12 - 25	25 – 50
Firm	F	25 - 50	50 – 100
Stiff	St	50 - 100	100 – 200
Very Stiff	VSt	100 - 200	200 – 400
Hard	H	>200	>400
Friable	Fb	Crumbles or powders under pressure	

Relative Density (Non-Cohesive Soils)		
Term	**Abbr.**	**Relative Density (%)**
Very Loose	VL	≤15
Loose	L	>15 and ≤35
Medium Dense	MD	>35 and ≤65
Dense	D	>65 and ≤85
Very Dense	VD	>85

Plasticity		
Term	**Range of Liquid Limit (Silt)**	**Range of Liquid Limit (Clay)**
Non-Plastic	Not applicable	Not applicable
Low Plasticity	≤50	≤35
Medium Plasticity	Not applicable	>35 and ≤50
High Plasticity	>50	>50

Moisture (Coarse Grained)	
Term	**Description**
Wet (W)	Feels cool, darkened and free water forms when handling
Moist (M)	Feels cool, slightly darkened, tends to stick together
Dry (D)	Non-cohesive and free-running

Moisture (Fine Grained)	
Term	**Description**
W < PL	Dry of Plastic Limit
w ≈ PL	Near Plastic Limit
W > PL	Wet of Plastic Limit

Soil Origin	
Term	**Description**
Fill	Any material placed by anthropogenic processes.
Topsoil	Near-surface soil often with high levels of organic material
Slopewash	Soils moved down a slope by gravity aided by non-channelled running water
Alluvial	Deposited by streams and rivers
Colluvial	Deposited by gravity, generally in gullies or at the base of slopes
Aeolian	Deposited by wind
Marine	Deposited in a marine environment
Lacustrine	Deposited in freshwater lakes
Estuarine	Deposited in coastal estuaries, including sediments carried by inflowing rivers and tidal currents
Residual	Formed in-situ through weathering of geological formations. No longer retains any visible structure of parent material
Extremely Weathered Material	Formed in-situ through weathering of geological formations. Retains structure of parent rock material but with soil strength.

Rock Description Explanation Sheet

REGIONAL GEOTECHNICAL SOLUTIONS

The following summary of the description and classification of rocks used in this report by Regional Geotechnical Solutions Pty Ltd (RGS) are based on Australia Standard AS1726-2017 'Geotechnical Site Investigations'. Material is described as a rock if it cannot be remoulded by hand in field conditions or when water is added. Rock descriptions, in general, will contain rock type, grain size, structure, colour, degree of weathering, strength, minor components and where applicable, the defect types, inclination, roughness and coating/infill.

Rock Description	
Sedimentary	Sedimentary rocks are deposited in beds, have grains that are cemented together and may be interbedded with varying sediment types.
Igneous	Igneous rocks are formed from molten rock and have a crystalline structure. Typically massive, with some exhibiting flow banding.
Metamorphic	Metamorphic rocks are formed when rocks are subject to significant heat and/or pressure. Commonly have direction fabric (e.g. foliation) although some are massive.
Simple rock names are often used in the absence of petrographic assessment. When rock cannot be precisely classified, the simple rock name should be chosen by considering the nature and shape of grains or crystals, the texture and fabric of the rock, the geological structure and setting along with geological map and/or knowledge of the area.	

Grain Size			
Rock Type	**Fine (F)**	**Medium (M)**	**Coarse (C)**
Sedimentary	0.06 – 0.2	0.2 – 0.6	0.6 – 2.0
Igneous / Metamorphic	<0.06	0.06 – 2.0	>2.0

Fabric & Texture		
Rock Type	**Term**	**Description**
Sedimentary	Bedding	Layering produced by changes in sedimentation. May be defined by grain size, colour etc.
	Lamination	Like bedding but developed in thin layers, typically less than 20mm.
Metamorphic	Foliation	Parallel arrangement of minerals due to metamorphic processes.
	Cleavage	A type of foliation developed in fine grained metamorphic rocks
Igneous	Flow Banding	Layering produced during flow of partially solidified igneous rock, causing crystals to become oriented.
The above terms are common terms for describing the type of texture and/or fabric in rock material. Other terms may be used.		

Degree of Fracturing	
Term	**Fracture Spacing (mm)**
Fragmented	<20
Highly Fractured	20 – 40
Fractured	40 – 200
Slightly Fractured	200 – 1,000
Unbroken	Core does not contain fractures

Rock Strength			
Term	**Abbr.**	**UCS (MPa)**	**Point Load, $I_{s(50)}$ (MPa)**
Very Low Strength	VL	0.6 – 2	0.03 – 0.1
Low Strength	L	2 - 6	0.1 – 0.3
Medium Strength	M	6 - 20	0.3 – 1.0
High Strength	H	20 - 60	1 – 3
Very High Strength	VH	60 - 200	3 – 10
Extremely High Strength	EH	>200	> 10
In absence of UCS testing or Point Load Testing a field assessment is made to adopt a strength classification.			

Weathering		
Term	**Abbr.**	**Definition**
Extremely Weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and fabric of original rock are still visible
Highly Weathered	HW	Whole of rock material is discoloured, and rock strength is significantly changed. Some minerals have weathered to clay. Original colour is not recognisable due to iron staining, bleaching etc.
Moderately Weathered	MW	Whole of rock material is discoloured, with minor change to strength of fresh rock. Original colour is not recognisable due to iron staining, bleaching etc.
Slightly Weathered	SW	Rock is partially discoloured with staining or bleach along joints. Minimal or no change of strength from fresh rock.
Fresh	Fr	Rock shows no sign of decomposition of minerals or colour changes

Features, Inclusions & Minor Components	
Term	**Description**
Gas Bubbles	Vesicles if empty; amygdules if mineralized. Found in igneous rocks.
Veins	A sheet-like inclusion, can consist of quartz, calcite or other minerals
Cross-Bedding	Layering at an angle to the main bedding plane
Clast or Matrix Supported	Relevant to conglomerates and breccia. Clast supported is when clasts (i.e. gravel/cobbles) are in contact with each other and the matrix is filling the voids. Matrix supported is when clasts are not in contact and the matrix surrounds each clast.
The above terms are some common features, inclusions and minor components in rock material, however, other terms may be used.	

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1

CLIENT: Jason McKinley
PAGE: 1 of 1
PROJECT NAME: Proposed Dwelling
JOB NO: RGS03697.1
SITE LOCATION: 16B The Saddle, Tallwoods
LOGGED BY: RW
TEST LOCATION: Refer to Figure 1
DATE: 21/2/25

DRILL TYPE: UMDR
EASTING: 453174 m
SURFACE RL: 52.7 m
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING: 6453686 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	0.10m	52.6			CL	**Silty CLAY:** Low plasticity, dark brown, with some fine grained gravel, trace of sand, fine to medium grained, trace of grass roots.	M > w_P				TOPSOIL
							0.10m					
						Cl	**CLAY:** Medium plasticity, pale brown/ pale orange brown, pale grey, with some sand, fine to medium grained, trace of gravel, fine to medium grained.		St - VSt			RESIDUAL
				0.2						HP	130	
			52.4									
		U50		0.4								
			52.2							HP	190	
		0.60m		0.6								
			52.0							HP	220	
							0.75m					
				0.8			**SILTSTONE:** Pale orange brown/ grey/ pale grey, dry, medium to high strength, highly to moderately weathered, fractured.	D				HIGHLY TO MODERATELY WEATHERED SILTSTONE
			51.8				0.90m					
							Hole Terminated at 0.90 m Refusal on Rock					
				1.0								
			51.6									
				1.2								
			51.4									
				1.4								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH2

CLIENT: Jason McKinley
PAGE: 1 of 1
PROJECT NAME: Proposed Dwelling
JOB NO: RGS03697.1
SITE LOCATION: 16B The Saddle, Tallwoods
LOGGED BY: RW
TEST LOCATION: Refer to Figure 1
DATE: 21/2/25

DRILL TYPE: UMDR
EASTING: 453185 m
SURFACE RL: 50.8 m
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING: 6453686 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered		50.6	0.2		CL	**FILL:** Silty CLAY, low plasticity, brown. dark brown with some sand and gravel, fine to coarse grained, trace cobbles.	M < w_P	VSt	HP	350	FILL
			50.4	0.4		CL	0.30m **Silty CLAY:** Low plasticity, dark brown with some gravel, fine to medium grained, trace of sand, fine to medium grained.	M < w_P	VSt			SLOPEWASH
			50.2	0.6		Cl	0.50m **CLAY:** Medium plasticity, pale brown/ pale orange brown/ pale grey, trace of sand, fine to medium grained.	M > w_P	St	HP	120	RESIDUAL
			50.0	0.8			0.80m			HP	200	
			49.8	1.0		CL	**Gravelly CLAY:** Low to medium plasticity, pale grey/ pale brown, gravel, fine to medium grained, trace of sand, fine to medium grained.	M < w_P	VSt - H			EXTREMELY WEATHERED SILTSTONE
			49.6	1.2			1.20m **SILTSTONE:** Pale orange brown/ grey/ pale grey, moist, medium to high strength, highly fractured, highly weathered.	M				HIGHLY WEATHERED SILTSTONE
			49.4	1.4			1.40m Hole Terminated at 1.40 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH3

CLIENT: Jason McKinley
PAGE: 1 of 1
PROJECT NAME: Proposed Dwelling
JOB NO: RGS03697.1
SITE LOCATION: 16B The Saddle, Tallwoods
LOGGED BY: RW
TEST LOCATION: Refer to Figure 1
DATE: 21/2/25

DRILL TYPE: UMDR
EASTING: 453185 m
SURFACE RL: 49.5 m
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING: 6453683 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered		49.4	0.0		CL	**Silty CLAY:** Low plasticity, dark brown, some gravel, fine to medium grained, trace of grass roots.	M < w_P				TOPSOIL
				0.15m								
				0.2		CL	**Silty CLAY:** Low plasticity, brown/ dark grey with some gravel, fine to medium grained, trace of sand, fine to medium grained.	M < w_P	VSt - H			SLOPEWASH
			49.2							HP	>600	
				0.4								
				0.45m								
			49.0			CI	**CLAY:** Medium plasticity, pale brown/ pale orange brown/ pale grey, with some sand, fine to medium grained, trace of gravel, fine to medium grained.	M > w_P	St	HP	180	RESIDUAL
				0.6						HP	180	
			48.8							HP	190	
				0.8								
				0.80m								
			48.6				**SILTSTONE:** Pale orange brown/ grey/ pale grey, dry, medium to high strength, fractured, highly weathered.	D				HIGHLY TO MODERATELY WEATHERED SILTSTONE
				0.95m								
				1.0			Hole Terminated at 0.95 m Refusal on Rock					
			48.4									
				1.2								
			48.2									
				1.4								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Material Test Report

Qualtest LABORATORY (NSW) PTY LTD
Newcastle Laboratory
2 Murray Dwyer Circuit Mayfield West NSW 2304
Phone: (02) 4968 4468
Email: brentcullen@qualtest.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA WORLD RECOGNISED ACCREDITATION

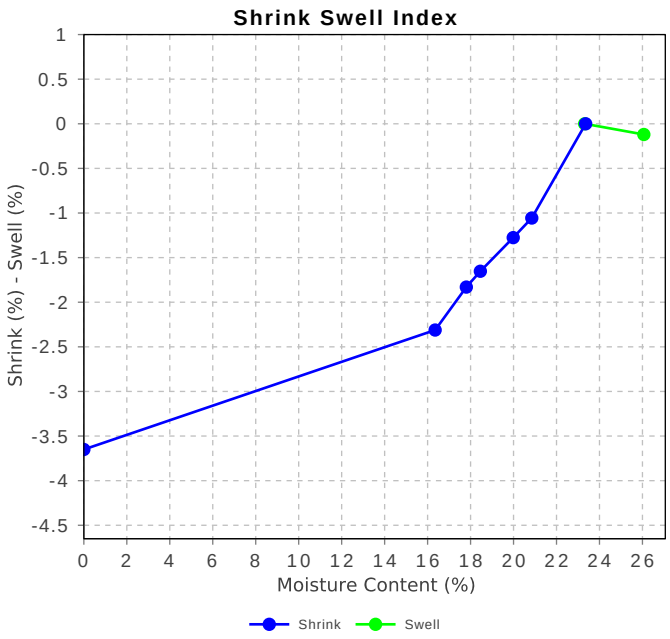
Approved Signatory: Brent Cullen
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number:	**MNC16P-0001-220**
Issue Number:	1
Date Issued:	10/03/2025
Client:	Regional Geotechnical Solutions Pty Ltd
	44 Bent Street, Wingham NSW 2429
Project Number:	MNC16P-0001
Project Name:	Various Testing
Project Location:	16b The Saddle, Tallwoods
Client Reference:	RGS03697.1
Work Request:	8839
Sample Number:	NEW25S-8839A
Date Sampled:	25/02/2025
Dates Tested:	27/02/2025 - 04/03/2025
Sampling Method:	Sampled by Client
	The results apply to the sample as received
Sample Location:	**BH1 - (0.1 - 0.6m)**
Material:	Insitu
Material Source:	On-Site

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**2.0**
Visual Description	Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**3.7**
Estimated % by volume of significant inert inclusions	3
Cracking	Moderately Cracked
Crumbling	No
Moisture Content (%)	23.4

Swell Test	
Initial Pocket Penetrometer (kPa)	180
Final Pocket Penetrometer (kPa)	320
Initial Moisture Content (%)	23.3
Final Moisture Content (%)	26.1
Swell (%)	**-0.1**
* Accreditation does not cover the performance of pocket penetrometer readings.	



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

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

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**

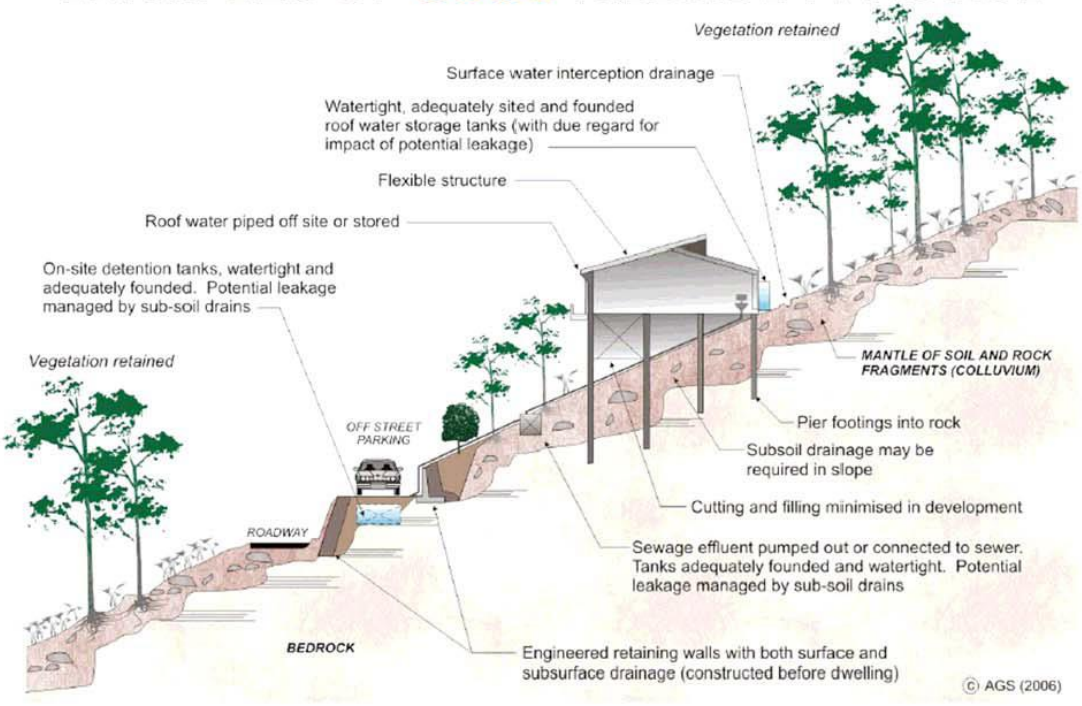
Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.
(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

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.

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE