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Long Reef Golf Club Ltd
PO Box 182 Collaroy NSW 2097

Attention: Ben Russell

Project: Long Reef Golf Club Additions and Alterations
Site Location: Long Reef Golf Club, 2 Anzac Avenue, Collaroy NSW 2097
Reference: 18543-GR-1-1
Report Date: 3 April 2025

Memorandum: Geotechnical Landslip Risk Assessment

1 Introduction

Alliance Geotechnical Pty Ltd (Alliance) was engaged by Long Reef Golf Club (the client) to undertake a desktop review of the geotechnical consideration regarding slope risk assessment for the proposed development at Long Reef Golf Club (LRGC), 2 Anzac Avenue, Collaroy NSW (the site). The review is undertaken in accordance with Alliance Fee Proposal, ref.11904, dated 18 March 2024.

2 Background

We understand that the client plans to upgrade the existing single-storey club building, which currently serves as a members' amenities space alongside a catering and function venue.

Alliance has been provided with the following documents for our review and assessment:

- A set of architectural drawings, “DA Package”, rev P5 “DA Issue”, dated 25 February 2025.
- A set of detailed surveying plans, sheet 1 to 7, ref. 22445_DET_1A, rev A, dated 10 August 2023.

Alliance has previously completed a preliminary geotechnical investigation for the proposed development in 2023 with the results of the investigation provided in report 16968-GR-1-1, dated 22 August 2023 (‘Alliance, 2023’), which is provided within the Attachment B. The findings of ‘Alliance, 2023’ have been reproduced in this report, where relevant.

The objective of this report is to address the Clause E10 Landslip Risk requirements as per Warringah Local Environmental Plan (LEP) 2011 to support a Development Application submission.

An additional site walkover was undertaken by an Associate Geotechnical Engineer from Alliance on 27 March 2025 to document additional observations on site as part of our assessment.

3 The Proposed Development

Based on our review of available drawings, it is understood that the proposed upgrades to the existing LRGC include partial demolition, extensions to the east and west of the building, the addition of a new storey, and the construction of a new parking area and road to the east of the existing car park. No bulk excavation nor major earthworks has been planned for the proposed development.

4 Site Description & Geology

The proposed development of the existing club building is situated within Deposited Plan 1DP/1144187 within Northen Beaches LGA. The approximate site extent and the existing club building together with surrounding features are indicated in Figure 1 below.

Based on the provided survey plans, the site is generally undulating and slightly sloped (approximately 1°) towards the northeast direction, towards Fisherman Beach. The highest and lowest elevations within the site are RL 7.4m AHD and RL 5.4m AHD within the car park area at the western section, and along the eastern boundary adjacent to the public landscape area, respectively.

Figure 1 - The Site Location

The local geology map via Minview indicates the site is underlain by Pleistocene Undifferentiated Deposits which may include clay, silt, fluvial, and marine sand. Alliance geotechnical investigation in August 2023 confirms this geotechnical setting.

5 Summary of Previous Geotechnical Investigation Results

The Alliance fieldwork was carried out 11 August 2023 and included two hand augers extending to approximately 2m below ground level (m bgl), in conjunction with three Dynamic Cone Penetrometer (DCP) tests to 2.5m bgl to assess the soils consistency and density.

Based on our previous investigation, the site is underlain by a thin layer of topsoil of approximately 0.1m thick, underlain by well compacted sandy fill (encountered in BH01) of thickness 0.5m which was presented only at borehole BH01. Below the well compacted fill at borehole BH01 or the topsoil layer at BH02 lies marine deposits which consisted of medium dense to dense sand at borehole BH01 and loose clayey sand/ soft-firm clay at borehole BH02 of thickness 1.1m and 1.3m, respectively. Stiff to very stiff clay or dense to very dense

sand marine deposits are expected from 1.4mbgl and 1.7mbgl, though the extent of this layer was not substantiated during Alliance's investigation.

The full borehole logs, investigation location plan, and DCP test results can be found within Alliance previously issued report, ref. 16869-GR-1-1, dated 22 August 2023 attached in Attachment B. The boreholes elevations were approximated from online imagery (Google Earth) as the site survey plan was not provided to Alliance at the time.

6 Site Walkover Observations

During Alliance's site visit on 27 March 2025, the site was observed to be generally flat, with no slope risk hazards detected. Approximately 350m east of the site, a headland with exposed rock outcrops was noted. However, given the significant distance from the proposed development, it is not expected to have any impact. Selected site photos from the visit are included in the report Attachment A.

Ground level along the northeastern site boundary drops about 1m towards the Fisherman's Beach with an average grade of approximately 20%-30% as shown in Photo 1 below. Timber sleepers were observed within some sections of the toe of the slope.

Subsurface materials within this area are expected to include fill that has possibly placed during the previous construction phases for levelling purposes. However, this would need to be confirmed during the construction phase.

Based on the provided survey and architectural drawings, the smallest offset of the existing building and proposed extension footprints are at least 2.5m away from the edge of the slope which provides sufficient offset from the batter slope.

No signs of slope instability (e.g. tension cracks along the crest or signs of existing retaining structure movement) were observed within this area.

Photo 1 - Existing Club Building Looking East at the Northeast Boundary, 27 March 2025

7 Slope Risk Assessment

It is noted that prolonged erosion, storm surges, or sea-level rise could result in progressive shoreline retreat, potentially impacting the stability of the footings located within the northeastern site boundary along the shoreline. However, it is expected for these structures to be founded on footings well below the erodible soil profile with sufficient drainage to direct surface runoff away from the footings; and as such the risk of potential soil settlement, lateral spreading, or erosion, are considered low.

The Warringah LEP 2011 landslip risk map classifies the site within Area A, “Slope less than 5 degrees.” The site and surrounding areas have a slight slope of approximately 1° towards the northeast, with no signs of slope instability hazards. Given the site’s geology and topography, which primarily consists of marine deposits over relatively flat ground, Alliance considers further slope risk assessment unnecessary.

At this stage, Alliance has not been provided with footing details for the existing buildings or proposed extensions. However, any new footings if required to be located within the slope’s zone of influence should extend beyond the slope toe as well as erosion profile to ensure long-term stability. Drainage and water runoff should also be carefully managed to prevent localised erosion around the footings.

8 Acid Sulphate Assessment

The proposed development is situated within an Acid Sulfate Soil (L4) classification zone. Any excavation work, such as pier construction or utility trenching, may require further assessment in accordance with relevant guidelines, including the NSW Acid Sulfate Soils Assessment Guidelines and EPA Waste Classification Guidelines. The Alliance Environmental team are available to assist with this assessment, if required.

9 Other Geotechnical Considerations

Alliance can provide further geotechnical recommendations on foundation, footings, geotechnical pavement design considerations, and any geotechnical concerns such as differential settlement and other potential geotechnical constraints during construction upon the client’s request.

We trust that this report suffices the client’s request for advice at this stage.

Should you have any further question, please do not hesitate to contact us.

Prepared by

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Alliance Geotechnical Pty Ltd

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Alliance Geotechnical Pty Ltd

Attachments

Attachment A - Selected site photos during Alliance site visit on 27 March 2025.
Attachment B - Previously issued Alliance Geotechnical Investigation Report 16968-GR-1-1, dated 22 August 2023.

Attachment A – Selected Site Photos During Alliance Site Walkover

Photo 2 – The Site Looking West, 27 March 2025

Photo 3 - The Site Looking Northwest, 27 March 2025

Photo 4 - The Site Looking East with Rock Outcrops at Headland Visible, 27 March 2025

Photo 5 - The Site Looking East with the Stormwater Pipe at the Western Side of the Existing Building, 27 March 2025

Photo 6 - The Site Looking East with The Shoreline Approximately 1m Lower than the Club's Ground Floor, 27 March 2025

Photo 7 - The Site Southern Section Looking North, 27 March 2025

Attachment B – Alliance Preliminary Geotechnical Investigation Report 16968-GR-1

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INTREC Management Pty Ltd

Attention: Hannah Steeds

Project: Golf Club Additions and Alterations
Site Location: Long Reef Golf Club, Collaroy NSW
Reference: 16968-GR-1-1
Report Date: 22 August 2023

Re: Site investigation, Long Reef Golf Club

1 Introduction

Alliance Geotechnical Pty Ltd (Alliance) was engaged by Intrec Management Pty Ltd (the client) to undertake a Geotechnical Investigation at Long Reef Golf Club, Collaroy NSW. The purpose of the investigation was to obtain sufficient geotechnical information on the ground conditions to inform the design of the proposed refurbishment of the existing clubhouse.

2 Fieldwork

The Alliance field work was carried out 11/8/2023 between the hours of 08:00 and 16:00 by an Alliance Experienced Geotechnical Engineer. The fieldwork consisted of the excavation of two boreholes to 2 m below ground level (bgl) and three Dynamic Cone Penetrometer (DCP) tests to 2.5 m. Care was taken to reinstate borehole locations to try match pre investigation conditions. See Appendix A.

3 Results

The encountered soil and rock profiles were documented by an experienced geotechnical engineer from Alliance generally in accordance with AS 1726 - 2017 Geotechnical Site Investigation.
A summary of the geotechnical site investigation scope at each site and borehole coordinates are presented in Table **1** 1 below.

Table 1 Summary of borehole termination depths (m)

ID	Existing Ground Surface Level (mRL)	Termination Depth (m)
BH01	~6.0	2.0
BH02	~7.0	1.9
DCP01	~6.0	1.5
DCP02	~7.0	2.25
DCP03	~6.0	2.5

The approximate borehole locations are indicated on drawing 16968-GR-1-1 in Appendix B. The borehole logs are provided in Appendix C. These results should be read in conjunction with the attached Explanatory Note

which explains the terms, abbreviations, and symbols used, together with the interpretation and limitation of the logging procedure.

The subsurface conditions encountered during drilling along with site observations have been used to summarise the subsurface geotechnical units in Table 2 below. Reference to the individual borehole log sheets attached in Appendix C should be made for a full description of the subsurface conditions encountered at each borehole location.

Table 2 - Summary of Subsurface Profile

Ground Profile	Consistency/ Strength	Depth to top of unit (m)	Thickness (m)
Topsoil	-	0.00	0.1
Fill: Sand	Loose to Well compacted	0.1	0.5
Marine: Clayey Sand	Medium dense to Dense	0.1 - 0.6	0.9 – 1.1
Marine: Sandy Clay	Firm to Hard	1.0 –1.7	>0.2 - >0.9

This site can be classified as per AS 2870 as class S, a slightly reactive clay site which may experience only slight ground movement from moisture changes.
Shallow footings are likely suitable for the proposed structure founded below the Fill material on the natural Clayey Sand/Sandy Clay.

Regards,

Sean Hannon

Experienced Geotechnical Engineer.

Appendix A: Site Photographs.

Image 1 – Material from BH02

Image 2 – BH02 Reinstatement

Image 3 – Material from BH01

Image 4 – Existing Golf Clubhouse

Appendix B: Borehole Location Plan.


Borehole Location Plan
Legend
Long Reef Golf Club
1A
1A
Anzac Ave
BH02/
DCP02
DCP03
BH01/
DCP01
Long Reef Golf Club
Long Reef Golf Club
Google Earth
N
40 m

Appendix C: Explanatory Note, Borehole logs & Dynamic Cone Penetrometer results.

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Explanatory Notes
Drill & Excavation Logs

General

Information obtained from site investigations is recorded on log sheets. Soils and very low strength rock are commonly drilled using a combination of solid-flight augers with a Tungsten-Carbide (TC) bit. Descriptions of these materials presented on the “Borehole Log” are based on a combination of regular sampling and in-situ testing. Rock coring techniques commences once material is encountered that cannot be penetrated using a combination of solid-flight augers and Tungsten-carbide bit. The "Cored Borehole Log" presents data from drilling where a core barrel has been used to recover material - commonly rock.

The "Excavation – Geological Log" presents data and drawings from exposures of soil and rock resulting from excavation of pits or trenches.

The heading of the log sheets contains information on Project Identification, Hole or Test Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The scale is presented in the depth column as metres below ground level.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is included in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures, and geological unit. Material description and classifications are based on Australian Standard Geotechnical Site Investigations: AS 1726 - 2017 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

Drilling

Drilling, Casing and Excavating

Drilling methods deployed are abbreviated as follows

Abbreviation	Method
AS	Auger Screwing
ADV	Auger Drilling with V-Bit
ADT	Auger Drilling with TC Bit
BH	Backhoe
E	Excavator
HA	Hand Auger
HQ	HQ core barrel (~63.5 mm diameter core) *
HMLC	HMLC core barrel (~63.5 mm diameter core) *
NMLC	NMLC core barrel (~51.9 mm diameter core) *
NQ	NQ core barrel (~47.6 mm diameter core) *
RR	Rock Roller
WB	Wash-bore drilling

* Core diameters are approximate and vary due to the strength of material being drilled.

Drilling Fluid/Water

The drilling fluid used is identified and loss of return to the surface estimated as a percentage. It is introduced to assist with the drill process, in particular, when core drilling. The introduction of drill fluid/water does not allow for accurate identification of water seepages.

Drilling Penetration/Drill Depth

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

Abbreviation	Description
VE	Very Easy
E	Easy
F	Firm
H	Hard
VH	Very Hard

Groundwater Levels

Date of measurement is shown.


Standing water level measured in completed borehole


Level taken during or immediately after drilling


Groundwater inflow water level

Samples/Tests

Samples collected and testing undertaken are abbreviated as follows

Abbreviation	Test
ES	Environmental Sample
DS	Disturbed Sample
BS	Bulk Sample
U50	Undisturbed (50 mm diameter)
C	Core Sample
SPT	Standard Penetration Test
N	Result of SPT (*sample taken)
VS	Vane Shear Test
IMP	Borehole Impression Device
PBT	Plate Bearing Test
PZ	Piezometer Installation
HP	Hand Penetrometer Test
HB	Hammer Bouncing

Excavation Logs

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the "Structure and other Observations" column. The depth of the base of excavation (for the logged section) at the appropriate depth in the "Material Description" column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added. Photos are recommended.

Material Description – Soil

Material Description - In accordance with AS 1726-2017

Classification Symbol - In accordance with the Unified Classification System (AS 1726-2017).

Abbreviation	Typical Name
GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels.
GM	Silty gravels, gravel-sand-silt mixtures.
GC	Clayey gravels, gravel-sand-clay mixtures.
SW	Well graded sands, gravelly sands, little or no fines.
SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
SM	Silty sand, sand-silt mixtures.
SC	Clayey sands, sand-clay mixtures.
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
CL, CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL	Organic silts and organic silty clays of low plasticity. *
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, clastic silts.
CH	Inorganic clays of high plasticity, fat clays.
OH	Organic clays of medium to high plasticity, organic silts. *
Pt	Peat and other highly organic soils. *

* Additional details may be provided in accordance with the Von Post classification system (1922).

Organic Soils – Identification using laboratory testing:

Material	Organic Content - % of dry mass
Inorganic	<2
Organic Soil	<2 ≤ 25
Peat	> 25

Organic Soils – Descriptive terms for the degree of decomposition of peat:

Term	Decomposition	Remains	Squeeze
Fibrous	Little or none	Clearly recognizable	Only water No solid
Pseudo-fibrous	Moderate	Mixture of fibrous and amorphous	Turbid water < 50% solids
Amorphous	Full	Not recognizable	Paste > 50% solids

Particle Characteristics – Definitions are as follows:

Fraction	Component (& subdivision)		Size (mm)
Oversize	**Boulders**		> 200
	Cobbles		> 63 ≤ 200
Coarse grained soils	**Gravel**	Coarse	> 19 ≤ 63
		Medium	> 6.7 ≤ 19
		Fine	> 2.36 ≤ 6.7
	Sand	Coarse	> 0.6 ≤ 2.36
		Medium	> 0.2 ≤ 0.6
		Fine	> 0.075 ≤ 0.21
Fine grained soils	**Silt**		0.002 ≤ 0.075
	Clay		< 0.002

Secondary and minor soil components

In coarse grained soils – The proportions of secondary and minor components are generally estimated from a visual and tactile assessment of the soils. Descriptions for secondary and minor soil components in coarse grained soils are as follows.

Designation of components	Percentage fines	Terminology (as applicable)	Percentage accessory coarse fraction	Terminology (as applicable)
Minor	≤ 5	Trace clay / silt	≤ 5	Trace sand / gravel
	> 5 ≤12	With clay / silt	> 5 ≤12	With sand / gravel
Secondary	> 12	Silty or clayey	> 30	Sandy or gravelly

Descriptions for secondary and minor soil components in fine grained soils are as follows.

Designation of components	Percentage coarse grained soils	Terminology (as applicable)
Minor	≤ 5	Trace sand / gravel / silt / clay
	> 5 ≤12	With sand / gravel / silt / clay
Secondary	> 30	Sandy / gravelly / silty / clayey

Plasticity Terms - Definitions for fine grained soils are as follows:

Descriptive Term	Range of Liquid Limit for silt	Range of Liquid Limit for clay
Low Plasticity	≤ 50	≤ 35
Medium Plasticity	N/A	> 35 ≤50
High Plasticity	> 50	> 50

Particle Characteristics

Particle shape and angularity are estimated from a visual assessment of coarse-grained soil particle characteristics. Terminology used includes the following:

Particle shape – spherical, platy, elongated,

Particle angularity – angular, sub-angular, sub-rounded, rounded.

Moisture Condition – Abbreviations are as follows:

D	Dry, looks and feels dry.
M	Moist, No free water on remoulding.
W	Wet, free water on remoulding.

Moisture content of fine-grained soils is based on judgement of the soils moisture content relative to the plastic and liquid limit as follows:

MC < PL	Moist, dry of plastic limit.
MC ≈ PL	Moist, near plastic limit.
MC > PL	Moist, wet of plastic limit.
MC ≈ LL	Wet, near liquid limit.
MC > LL	Wet of liquid limit.

Consistency - of cohesive soils in accordance with AS 1726-2017, Table 11 are abbreviated as follows:

Consistency Term	Abbreviation	Indicative Undrained Shear Strength Range (kPa)
Very Soft	**VS**	< 12
Soft	**S**	12 ≤ 25
Firm	**F**	25 ≤ 50
Stiff	**St**	50 ≤ 100
Very Stiff	**VSt**	100 ≤ 200
Hard	**H**	≥ 200
Friable	**Fr**	-

Density Index (%) of granular soils is estimated or is based on SPT results. Abbreviations are as follows:

Description	Abbreviation	Relative Density	SPT N
Very Loose	**VL**	< 15%	0 - 4
Loose	**L**	15 - 35%	4 - 10
Medium Dense	**MD**	35 - 65%	10 - 30
Dense	**D**	65 - 85%	30 - 50
Very Dense	**VD**	> 85%	> 50

Structures – Fissuring and other defects are described in accordance with AS 1726-2017 using the terminology for rock defects

Origin – Where practicable an assessment is provided of the probable origin of the soil, e.g. fill, topsoil, alluvium, colluvium, residual soil.

MATERIAL DESCRIPTION - ROCK

Material Description – In accordance with AS 1726-2017

Rock Naming – Where possible conventional geological names are used within the logs. Engineering properties cannot be inferred directly from the rock names in the table, but the use of a particular name provides an indicative range of characteristics to the reader. Lithological identification of rock is provided to appreciate the geology of an area, to correlate geological profiles seen in boreholes or to distinguish boulders from bedrock.

Grain Size – Grain size is done in accordance with AS1726-2017 as follows:

For sedimentary rock:

Coarse grained	Mainly 0.6mm to 2mm
Medium grained	Mainly 0.2mmto 0.6mm
Fine grained	Mainly 0.06mm to 0.2mm

For igneous and metamorphic rock:

Coarse grained	Mainly greater than 2 mm
Medium grained	Mainly 0.6mm to 2mm
Fine grained	Mainly less than 2mm

Colour - Rock colour is described in the moist condition.

Texture and Fabric

Frequently used terms:

Sedimentary Rock	Metamorphic Rock	Igneous
Bedded	Banded	Amorphous
Cross-bedded	Cleaved	Crystalline
Folded	Folded	Flow banded
Graded	Foliated	Folded
Interbedded	Gneissose	Lineated
Laminated	Lineated	Massive
Massive	Schistose	Porphyritic

Bedding and fabric:

Description	Spacing
Very Thickly Bedded	> 2m
Thickly Bedded	0.6m to 2m
Medium Bedded	0.2m to 0.6m
Thinly Bedded	60mm to 200mm
Very Thinly Bedded	20mm to 60mm
Thickly Laminated	6mm to 20mm
Thinly Laminated	< 6mm

Degree of development:

Massive	No layering or fabric. Rock is homogeneous.
Indistinct	Layering or fabric just visible, There is little effect on strength properties.
Distinct	Layering or fabric obvious. The rock may break more easily parallel to the fabric.

Features, inclusions, and minor components - Features, inclusions and minor components within the rock material shall be described where those features could be significant such as gas bubbles, mineral veins, carbonaceous material, salts, swelling minerals, mineral inclusions, ironstone or carbonate bands, cross-stratification, or minerals the readily oxidise upon atmospheric exposure.

Moisture content - Where possible descriptions are made by the feel and appearance of the rock using one according to following terms:

Dry	Looks and feels dry.
Moist	Feels cool, darkened in colour, but no water is visible on the surface.
Wet	Feels cool, darkened in colour, water film or droplets visible on the surface.

The moisture content of rock cored with water may not be representative of its in-situ condition.

Durability – Descriptions of the materials durability such as tendency to develop cracks, break into smaller pieces or disintegrate upon exposure to air or in contact with water are provided where observed.

Rock Material Strength – The strength of the rock material is based on uniaxial compressive strength (UCS). The following terms are used:

Term / Abbreviation		Description	UCS (MPa)	Point Load Strength Index (MPa)
Very Low	**VL**	Crumbles under firm blow with sharp end of pick, can be peeled with a knife; too hard to cut a triaxial by hand; 30mm pieces can be broken by hand.	0.6 – 2	0.03 – 0.1
Low	**L**	Easily scored with a knifed; indentations 1-3mm show with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.	2 – 6	0.1 – 0.3
Medium	**M**	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.	6 – 20	0.3 – 1
High	**H**	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.	20 – 60	1 – 3
Very High	**VH**	Hand specimen breaks with pick after more than one blow; rock rings under hammer.	60 – 200	3 – 10
Extremely High	**EH**	Specimen requires many blows with geological pick to break into intact materials; rock rings under hammer.	> 200	> 10

Strengths are estimated and where possible supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical logs as follows:

D	Diametral Point Load Test
A	Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown. Point Load Strength Index test results are presented as $I_{s\,(50)}$ values in MPa.

Weathering – Weathering classification assists in identification but does not imply engineering properties. Descriptions are as follows:

Term / Abbreviation		Description
Residual Soil	**RS**	Material has soil properties. Mass structure and material texture and fabric of original rock not visible, but the soil has not been significantly transported.
Extremely Weathered	**EW**	Material has soil properties. Mass structure, material texture and fabric of original rock are still visible.
Highly Weathered	**HW**	Material is completely discoloured, significant decrease in strength from fresh rock.
Moderately Weathered	**MW**	Material is `completely discoloured, little or no change of strength from fresh rock.
Slightly Weathered	**SW**	Partly stained or discoloured, little or no change to strength from fresh rock.
Fresh	**FR**	No signs of mineral decomposition or colour change.

Alteration – Physical and chemical changes of the rock material due to geological processes by fluids at depth at pressures and temperatures above atmospheric conditions. Unlike weathering, alteration shows no relationship to topography and may occur at any depth. When altered materials are recognized, the following terms are used:

Term / Abbreviation				Description
Extremely Altered		**XA**		Material has soil properties. Structure, texture, and fabric of original rock are still visible. The rock name is replaced with the name of the parent material, e.g., Extremely Altered basalt. Soil descriptive terms are used.
Highly Altered	**Distinctly altered**	**HA**	**DA**	The whole of the rock material is discoloured. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be higher or lower due to loss of minerals or precipitation of secondary minerals in pores.
Moderately Altered	**Distinctly altered**	**MA**	**DA**	The whole of the rock material is discoloured. Little or no change of strength from fresh rock. The term 'Distinctly Altered' is used where it is not practicable to distinguish between 'Highly Altered' and 'Moderately Altered'. Distinctly Altered is defined as follows: - The rock may be highly discoloured; - Porosity may be higher due to mineral loss; or may be lower due to precipitation of secondary minerals in pores; and - Some change of rock strength.
Slightly Altered		**S**		Rock is slightly discoloured. Little or no change of strength from fresh rock.

Alteration is only described in the context of the project where it has relevance to the civil and structural design.

Defect Descriptions

General and Detailed Descriptions – Defect descriptions are provided to suit project requirements. Generalized descriptions are used for some projects where it is unnecessary to describe each individual defect in a rock mass, or where multiple similar defects are present which are too numerous to log individually. The part of the rock mass to which this applies is delineated.

Detailed descriptions are given of defects judged to be particularly significant in the context of the project. For example, crushed seams in an apparently unstable slope. As a minimum, general descriptions outlining the number of defect sets within the rock mass and their broad characteristics are provided where it is possible to do so.

Defect Type – Defect abbreviations are as follows:

BP	Bedding parting	**SSM**	Sheared seam	**DB**	Drilling break
JT	Joint	**CS**	Crushed seam	**HB**	Handling break
SS	Shear surface	**SM**	Infilled seam		
SZ	Sheared zone	**EWS**	Extremely weathered seam		

Sheared surfaces, sheared zones, sheared seams, and crushed seams are generally faults in geological terms.

Defect Orientation

For oriented core: The dip and dip direction are recorded as a two-digit and three-digit number separated by a slash, are collected e.g., 50°/240° and there is not core loss that could obscure core orientation. If alternative measurements are made, such as dip and strike or dip direction relative to magnetic north this shall be documented.

For non-oriented core: The dip is recorded as a two-digit number, e.g., 10°. In vertical boreholes the dip is generally measured relative to the horizontal plan. If the borehole is inclined the dip is generally measured from the core axis.

Surface Roughness – Defect surface roughness is described as follows:

VR	**Very rough**	Many large surface irregularities with amplitude generally more than 1 mm.
RO	**Rough**	Many small surface irregularities with amplitude generally less than 1 mm.
SO	**Smooth**	Smooth to touch. Few or no surface irregularities.
PO	**Polished**	Shiny smooth surface
SK	**Slickensided**	Grooved or striated surface, usually polished.

Surface Shape – Defect surface roughness is described as follows:

PL	**Planar**	The defect does not vary in orientation.
CU	**Curved**	The defect has a gradual change in orientation
UN	**Undulating**	The defect has a wavy surface.
ST	**Stepped**	The defect has one or more well defined steps
IR	**Irregular**	The defect has many sharp changes of orientation

Defect Infilling – Common abbreviation as follows:

Ca	Calcite	**Fe**	Iron Oxide	**Qz**	Quartz
Cy	Clay	**MS**	Secondary mineral	**X**	Carbonaceous

Defect Coatings and Seam Composition - Coatings are described using the following terms:

CN	**Clean**	No visible coating.
SN	**Stained**	No visible coating but surfaces are discoloured.
VN	**Veneered**	A visible coating of soil or mineral, too thin to measure; may ne patchy.
CO	**Coating**	A visible coating up to 1 mm thick. Soil in-fill greater than 1 mm shall be described using defect terms (e.g., infilled seam). Defects greater than 1 mm aperture containing rock material great described as a vein.

Defect Spacing, Length, Openness and Thickness – Described directly in millimetres and metres. In general descriptions, half order of magnitude categories is used, e.g. joint spacing typically 100 mm to 300 mm, sheared zones 1m to 3m thick.

Depending on project requirements and the scale of observation, spacing may be described as the mean spacing within a set of defects, or as the spacing between all defects within the rock mass. Where spacing is measured within a specific set of defects, measurements shall be made perpendicular to the defect set.

Where significant, the nature of the defect end condition is recorded in the context of the scale of the exposure.

Block Shape – Where it is considered significant, block shape should be described using terms given in Table 23, AS 1725:2017.

Stratigraphic Unit – Geological maps related to the project are used for the designation of lithological formation name and, where possible geological unit name, e.g., Bringelly Shale, Potts Hill Sandstone Member.

Core Loss – Core loss occurs when material is lost during the drilling process It is shown at the bottom of the run unless otherwise indicated where core loss is known.

Total Core Recovery – The percentage of rock recovered excluding core loss per core run.

Defect Spacing – The spacing of successive defects or the mean spacing for relatively broken core.

Fracture Index – Which is the number defects per metre of core.

Rock Quality Designation (RQD) – The percentage of sound core pieces of 100mm or greater per core run and is calculated using Deere et al. (1989) method.

Rock Classification System – For design purpose, Sydney Rock Mass Classification System (Pells et al. 1998, 2019) is adopted.

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BH No: BH01
Sheet: 1 of 1
Job No: 16968

Borehole Log

Client: Intec Management Pty Ltd
Project: Golf Club Additions + Alterations
Location: Long Reef Golf Club Collaroy, NSW 2097
Hole Location: See Plan
Started: 11/08/2023
Finished: 11/08/2023
Borehole Size: 50 mm

Rig Type: HA
Hole Location E, N
Driller: SH
Logged: SH
RL Surface: 6.0m
Contractor: Alliance
Bearing: 0°
Checked:

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
HA	Not Encountered		6.0	0.0		-	TOPSOIL, 100mm.	5 18 17 13 10 5 3 2 4 5		-	-	TOPSOIL
			5.5	0.5		-	FILL: SAND, fine to coarse grained, light brown, trace fine subangular sandstone gravel, very well compacted.			D	D	FILL
			5.0	1.0		SC	Clayey SAND, fine to coarse grained, dark brown, medium plasticity clay.			D - M	D	MARINE
			4.5	1.5							MD - L	
			4.0	2.0		Cl	Sandy CLAY, medium plasticity, dark brown, fine to coarse grained sand.			MC ~ PL	St	
			3.5	2.5			Target depth reached. Borehole BH01 terminated at 2m					
			3.0	3.0								
			2.5	3.5								
			2.0	4.0								
			1.5	4.5								
			1.0	5.0								

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BH No: BH02
Sheet: 1 of 1
Job No: 16968

Borehole Log

Client: Intec Management Pty Ltd
Project: Golf Club Additions + Alterations
Location: Long Reef Golf Club Collaroy, NSW 2097
Hole Location: See Plan
Started: 11/08/2023
Finished: 11/08/2023
Borehole Size: 50 mm

Rig Type: HA
Hole Location E, N
Driller: SH
Logged: SH
RL Surface: 7.0m
Contractor: Alliance
Bearing: 0°
Checked:

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	DCP per 150mm (2 4 9 18)	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
HA	Not Encountered		6.5	0.5		-	TOPSOIL, 100mm.	2 3 3 2 2 2 2 2 2 2 6 6 8 10		-	-	TOPSOIL
						SC	Clayey SAND, fine to medium grained, dark brown, medium plasticity clay.			M	L - MD	MARINE
			6.0	1.0		CI	Sandy CLAY, medium plasticity, brown, fine to coarse grained sand.			MC ~ PL	S - F	
			5.5	1.5							St - H	
			5.0	2.0			Target depth reached. Borehole BH02 terminated at 1.9m	9 20 20				
			4.5	2.5								
			4.0	3.0								
			3.5	3.5								
			3.0	4.0								
			2.5	4.5								
			2.0	5.0								

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Dynamic Cone Penetrometer (DCP) Test Report

Client	Intrec Management Pty Ltd	**Report Number**	16968-1-1
Project Name	Long Reef Golf Club alterations and additions	**Project Number**	16968
Project Location	Anzac Avenue, Collaroy, NSW 2097	**Date Tested**	11/8/2023
Test Method	AS 1289.6.3.2		

Test Number	**DCP-01**	**DCP-02**	**DCP-03**
Test Locations	**See Drawing in Report 16968-1-1**	**See Drawing in Report 16968-1-1**	**See Drawing in Report 16968-1-1**
Surface Material	Topsoil	Topsoil	Topsoil
Surface Conditions	Dry	Dry	Dry
Approximated RL (m AHD)			
0.00 – 0.15	5	2	4
0.15 – 0.30	18	3	4
0.30 – 0.45	17	3	4
0.45 – 0.60	13	2	13
0.60 – 0.75	10	2	15
0.75 – 0.90	5	2	9
0.90 – 1.05	3	1	9
1.05 – 1.20	2	2	6
1.20 – 1.35	4	2	7
1.35 – 1.50	5	6	9
1.50 – 1.65		6	9
1.65 – 1.80		8	10
1.80 – 1.95		10	11
1.95 – 2.10		9	11
2.1 – 2.25		20	11
2.25 – 2.4		20/100	15
2.4 – 2.55			

Notes: This test report is intended to be read in conjunction with the geotechnical report by Alliance Geotechnical (16968 -GR– 1- 1).