Geotechnical Investigation Report

Canomadine Creek Bridge

Geotechnical Investigation

Job No.: B21781

Submitted To:

Cabonne Council

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Cabonne Council – Canomadine Creek Bridge

REVISION CONTROL

Revision	Date	Details	Prepared By	Reviewed By
00	28/04/2023	Draft	S. Greene	D. Clarkson

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1 INTRODUCTION

At the request of Cabonne Council, Macquarie Geotechnical (MG) has carried out a Geotechnical Investigation for the proposed upgrade of Canomadine Creek Bridge on Canomadine Lane, Canowindra NSW.

The objective of the investigation is to provide a Geotechnical Investigation Report.

The comments and opinions expressed in this report are based on the ground conditions encountered during the site work including the results of tests carried out in the field and in the laboratory. However, there may be special conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report.

2 SCOPE OF INVESTIGATION

Undertake a desk study of the site to confirm the likely geological conditions of the site and to develop a geological model for the site.

Undertake Dial Before You Dig (DBYD) Search.

Mobilisation of one drill rig. Drilling, logging and sampling of two boreholes as per Table 1 below with rock coring at each borehole. In-situ testing comprised of Standard Penetration Testing (SPT) at 1.50m intervals in each borehole and Pocket Penetrometer (PP) tests on SPT split spoon samples.

Table 1: Borehole Scope

Hole ID	Eastings	Northings	Elevation RL (m)	Depth (m)
BH01	666461.0	6290944.9	355.0	13.34
BH02	666459.9	6290957.0	355.0	12.32

Samples were taken at selected intervals and at every change of strata to allow for laboratory testing at our NATA accredited laboratory in Sydney, NSW. Testing comprised of the following:

- 4No. Atterberg Limits & Linear Shrinkage Tests
- 2No. Soil Chemical Properties
- UCS Rock

2.1 Site Description

The site is located on Canomadine Lane at the bridge over Canomadine Creek, approximately 10.2km southwest of Cargo, NSW and 10.7km northeast of Canowindra, NSW.

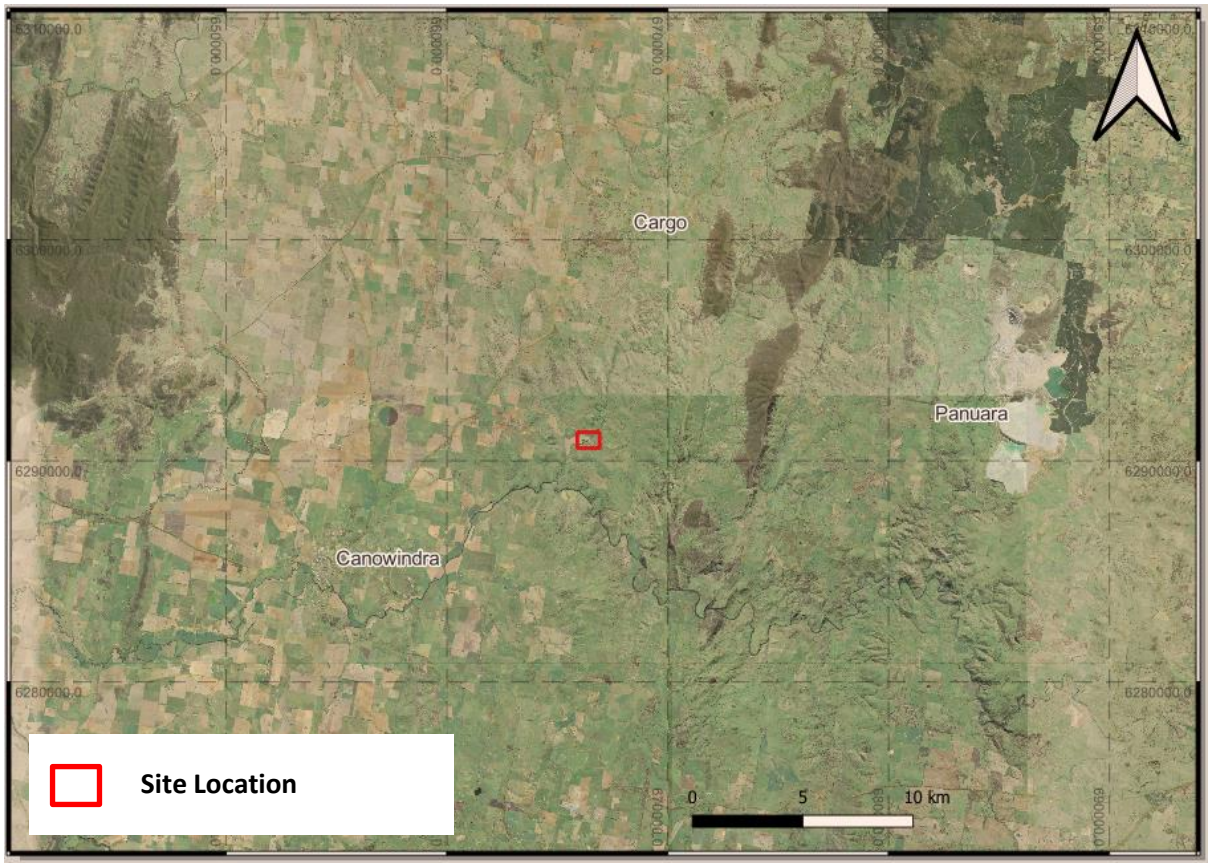

Figure 1: Site Location

2.2 Desk Study

A desk study was undertaken using readily available geological and geotechnical information and included the following:

- NSW Seamless Geology Map
- NSW Department of Primary Industries – Groundwater Bore Data.
- NSW Government SEED
- Google Earth

2.3 Regional Geology

The Geological map sheet extract is shown in Figure 2 below:

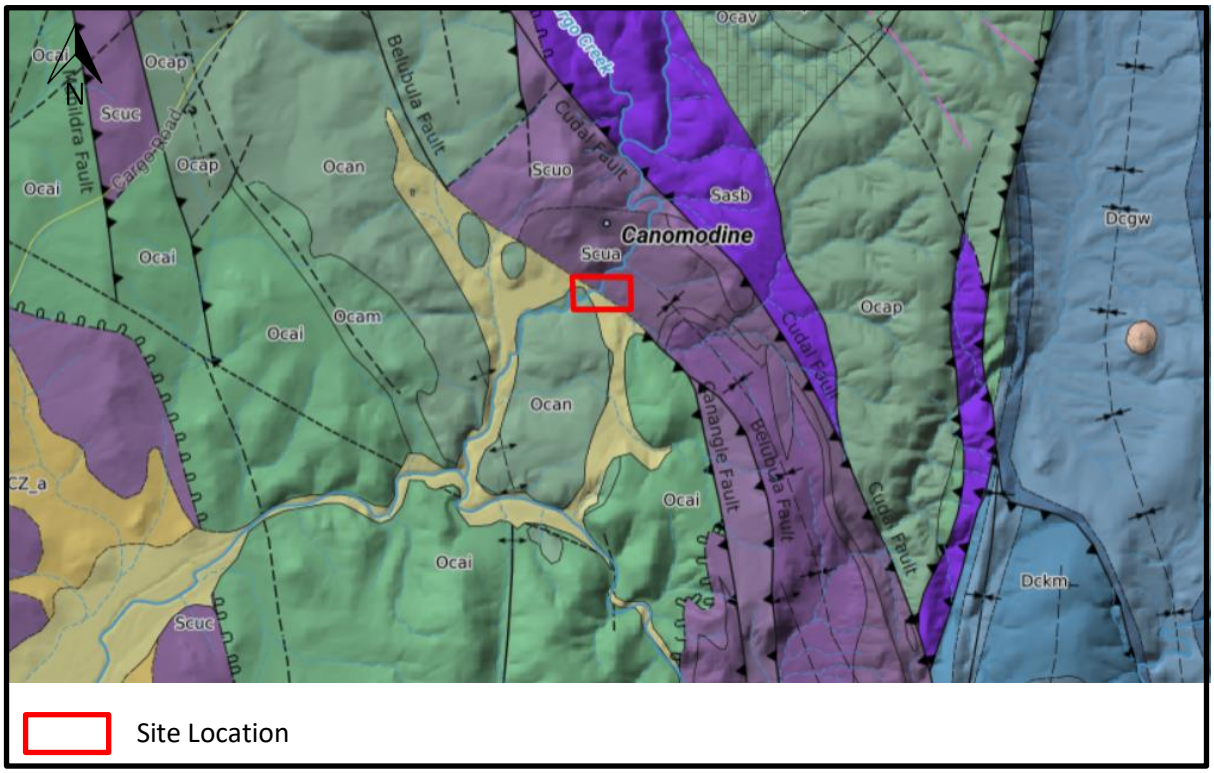

Figure 2: NSW Seamless Geological Map Sheet Extract

With reference to the NSW Seamless Geological map sheet extract, the site is underlain by the following:

Table 2: Summary of Geology

Geological Symbol	Group	Lithology
Q_af	Alluvial floodplain deposits	Silt, very fine to medium grained lithic to quartz rich sand, clay.
Scua	Avoca Valley Shale	Green and red-brown shale, coarse grained garnetiferous sandstone.
Ocan	Canomodine Limestone	Thick-bedded to massive, wackerstone, limey mudstone, minor shale and tuff.

2.3.1 Groundwater Bores

There were no records of groundwater bores located within close proximity to the site.

2.3.2 Acid Sulphate Maps

Reference is made to the NSW Government Central Resource for Sharing and Enabling Environmental Data in NSW (SEED) of Australian Acid Sulphate Soils and presented in Figure 3 below:

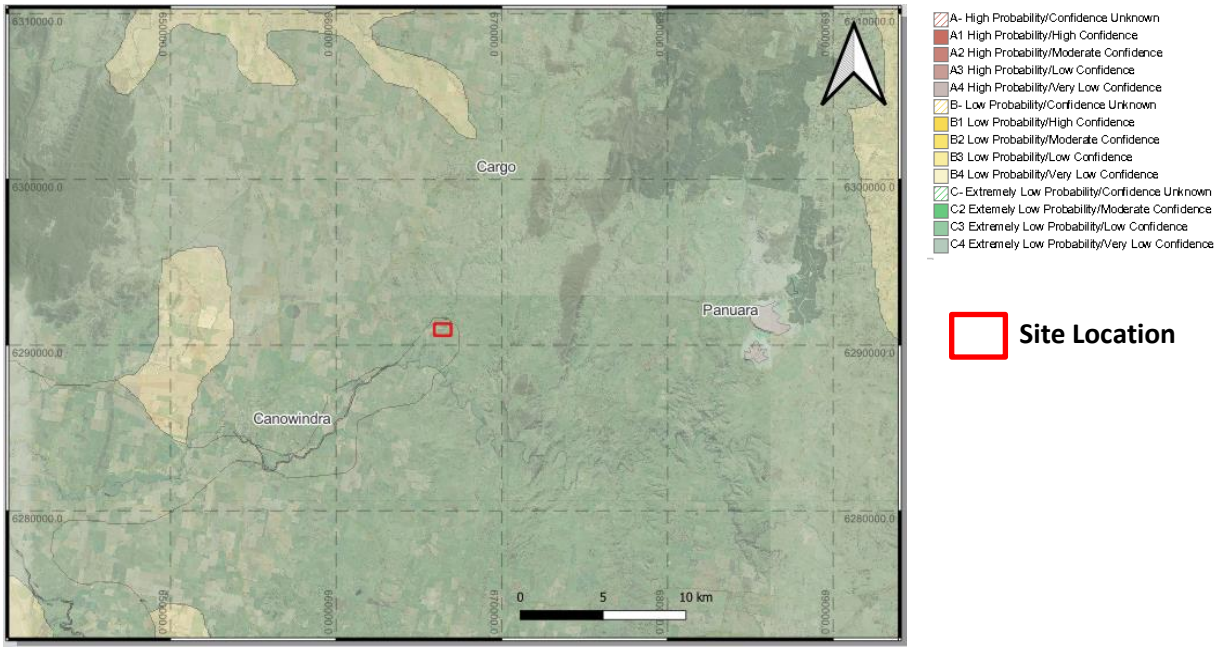

Figure 3: Acid Sulphate Risk Map

The acid sulphate map indicates an extremely low probability of acid sulphate soils within the site.

2.3.3 Topography

The topography of the site is moderately dipping to the north, approximately perpendicular to Mitchell Creek, from 353m to 367m above sea level. Canadomine Creek is a meandering tributary which flows into Belubula River to the south-west.

2.4 Fieldwork

Fieldwork was undertaken on the 3rd April to 5th April 2023 by a team of Drillers and Engineering Geologist from our Bathurst and Sydney offices. The fieldwork was undertaken in accordance with our proposal and AS1726 (2017) Geotechnical Site Investigation.

2.4.1 Service Location

Macquarie Geotechnical obtained underground services and utility plans through 'Before You Dig (BYD)' services.

2.4.2 Survey

The test locations were surveyed using a handheld GPS with co-ordinates recorded in MGA Zone 55 format.

2.4.3 Boreholes

The boreholes were drilled at locations nominated by Macquarie Geotechnical and are summarised in Figure 4.

Figure 4: Borehole Location Plan

A track mounted Hanjin D&B 8D rig was used to drill two (2) boreholes to depths of up to 13.34m. Drilling comprised of 115mm diameter solid flight auger and HQ3 coring. In-situ testing comprised of Standard Penetration Testing (SPT) at 1.50m intervals in each borehole and Pocket Penetrometer (PP) tests on SPT split spoon samples.

The boreholes were backfilled with arising's and reinstated on completion.

The borehole logs and photographs are presented in Appendix C.

2.5 Sampling

The sampling was undertaken in accordance with AS1289 1.2.1 and based on that defined in the proposal and considered the engineering requirements of the investigation and the nature of the materials encountered.

2.6 In-Situ Testing

In-situ testing as specified by our proposal was carried out in the exploratory holes in accordance with the techniques outlined in the relevant Australian Standards and Macquarie Geotechnical Quality procedures. The results are presented on the relevant exploratory hole logs in Appendix C.

2.6.1 Standard Penetration Testing

Standard Penetration Tests (SPT) were carried out in the boreholes with techniques outlined in AS1289 6.3.1 in order to determine the relative density and consistency of the strata encountered. The SPT "N" value (number of blows per 300mm penetration) or the blow count/penetration were recorded for each test.

2.7 Laboratory Testing

The samples were returned to Macquarie Geotechnical NATA accredited laboratory at Sydney for further assessment and testing. A summary of the laboratory tests is provided in Table 3 below.

Table 3: Summary of Laboratory Tests

Hole ID	Depth (m)	Laboratory Test
BH01	1.00 – 1.50	AS1289 3.1.1 & 3.4.1 – Atterberg Limits and Linear Shrinkage
	2.50 – 3.00	AS1289 3.1.1 & 3.4.1 – Atterberg Limits and Linear Shrinkage
		APHA pH, SO4, Cl & EC
	8.67 – 8.87	UCS
BH02	0.50 – 1.50	AS1289 3.1.1 & 3.4.1 – Atterberg Limits and Linear Shrinkage
	2.00 – 3.50	AS1289 3.1.1 & 3.4.1 – Atterberg Limits and Linear Shrinkage
		APHA pH, SO4, Cl & EC
	11.24 – 11.44	UCS

3 EXISTING SUBSURFACE CONDITIONS

The subsurface conditions encountered in the boreholes are presented in detail in the attached borehole logs (refer Appendix C). The subsurface conditions encountered in all boreholes are broadly summarised in Table 4 below.

3.1 Exploratory Hole Summary

Table 4: Summary of Boreholes (BH01 and BH02)

-	BH01	BH02
Material Description	**Depth (m)**	
TOPSOIL	-	0.00 – 0.10
Gravelly SAND (FILL)	0.00 – 1.95	-
Sandy silty CLAY (ALLUVIAL)	1.95 – 6.50	0.10 – 1.00
Silty CLAY (ALLUVIAL)	-	1.00 – 3.00
Gravelly CLAY (RESIDUAL)	6.50 – 7.20	3.00 – 3.27
MUDSTONE (XW)	7.20 – 7.90	-
MUDSTONE (HW-MW)	-	3.27 – 8.27
MUDSTONE (MW)	7.90 – 8.45	-
MUDSTONE (SW)	8.45 – 13.34	8.27 – 12.32
Total Depth (m)	13.34 (LOI)	12.32 (LOI)
Groundwater Observation (m)	2.70	NFGWO

Note: Please refer to borehole logs in Appendix C for detailed descriptions.
MW – Moderately Weathered, SW – Slightly Weathered, F – Fresh.
LOI – Limit of Investigation.
NFGWO – No Free Groundwater Observed.

3.2 Groundwater

The comments on groundwater are based on the observations made at the time of the investigation. Groundwater was observed as a slow inflow at a depth of 2.70m within borehole BH01 during soil drilling. No observations of groundwater during BH02 works, this may have been masked by the use of rotary core drilling.

Seasonal variation in groundwater may be encountered and shall be considered as part of design process.

4 LABORATORY TEST RESULTS

The laboratory tests were carried out on the samples nominated by Macquarie Geotechnical. The summary of test results is shown in Tables 5 to 7 below.

Table 5: Laboratory Test Results – Classification

Hole ID	Depth (m)	Sample Description (USCS)	Atterberg Limits			Linear Shrinkage (%)
			LL (%)	PL (%)	PI (%)	
BH01	1.00 – 1.50	Clayey SAND*	25	17	8	4.0
BH01	2.50 – 3.00	Clayey SAND*	28	18	10	6.5
BH02	0.50 – 1.50	Silty CLAY*	32	19	13	9.5
BH02	2.00 – 2.50	Silty CLAY*	42	19	23	11.0

Note: * Visual description, USCS – Unified Soil Classification System.

Table 6: Laboratory Test Results – Soil Chemical Properties

Hole ID	Depth (m)	Sample Description*	Soil Chemical Properties (SCP)			
			pH	SO_4 (ppm)	Cl (ppm)	Electrical Conductivity (µS/cm)
BH01	2.50 – 3.00	Sandy silty CLAY*	7.9	20	<10	80
BH02	2.00 – 2.50	Silty CLAY*	8.0	<10	<10	74

Note: * Visual description; SO_4 – Sulphate, Cl – Chloride.

Table 7: Laboratory Test Results – Uniaxial Compressive Strength (MPa)

Hole ID	Depth (m)	Uniaxial Compressive Strength (MPa)
BH01	8.67 – 8.87	23.0
BH02	11.24 – 11.44	6.5

5 GEOTECHNICAL ASSESSMENT

5.1 Site Classification

The classification of a site involves a number of geotechnical factors such as depth of bedrock, the nature and extent of subsurface soils and any specific problems (slope stability, soft soils, filling, reactivity, etc).

In accordance with AS2870 2011 the proposed development site is classified as “Class M” and will have an anticipated surface movement (Ys) of 25 - 35 mm.

An appropriate footing system should be designed in accordance with the above code to accommodate these anticipated movements. The possibility of additional movements, due to abnormal moisture variations, should be minimised by proper "site management" procedures.

It should be noted that this assessment is based on site conditions being represented by the natural soil profile. Any change in conditions noted during development, including cut or fill should be referred to Macquarie Geotechnical for appropriate inspection and assessment.

The above classifications, based on AS2870 which relates to construction of residential dwellings, is not technically correct for the type of structures proposed and therefore it is given as a guide only with respect to soil reactivity.

5.2 Foundations

The investigation indicates that the ground conditions generally comprised of sequences of alluvial soil overlying weathered calcareous mudstone.

5.2.1 Geotechnical Design Parameters

Based on our investigation, and our experience in this region, we recommend the following geotechnical design parameters.

Table 8: Estimated Geotechnical Engineering Parameters

Depth (m)	Soil Description	Unit Weight (KN/m3)	Angle of Friction (degrees)		Cohesion (KPa)		Concrete to Soil Friction Angle δ (degrees)
			Drained ϕ’	Undrained ϕ	Drained c’	Undrained Cu	
Varying Depth	Clayey gravelly SAND (FILL)*	18	30	30	0	-	23
	Sandy silty CLAY – Soft to Firm	17	17	0	0	12	13
	Gravelly CLAY – Hard	20	32	32	0	200	25

Table 9: Bearing Pressure

Depth (m)	Soil Description	Allowable Bearing Pressure (KPa)	Ultimate Bearing Pressure (KPa)	Modulus of Subgrade Reaction (MN/m3)
Varying Depth	Clayey gravelly SAND (FILL)*	-	-	4
	Sandy silty CLAY – Soft to Firm	20	60	2
	Gravelly CLAY – Hard	340	1020	40

Table 10: Pile Design Parameters

Depth (m)	Soil Description	Ultimate End Bearing Pressure (KPa)	Serviceability End Bearing Pressure (KPa)	Ultimate Shaft Adhesion (KPa)	Modulus of Subgrade Reaction (MN/m^3)	
					Vertical	Horizontal
Varying Depth	Clayey gravelly SAND (FILL)*	-	-	-	4	8
	Sandy silty CLAY – Soft to Firm	-	-	4	2	4
	Gravelly CLAY – Hard	1800	600	60	70	140
	Mudstone (EW)	3000	700	75	120	240
	Mudstone (HW)	3000	1000	150	120	240
	Mudstone (MW)	9000	3000	350	240	480
	Mudstone (SW)	30000	6000	600	1200	2400

Note: EW – Extremely Weathered, HW – Highly Weathered, MW – Moderately Weathered, SW – Slightly Weathered.
* No skin friction support should be derived from the existing fill material.
Preliminary design parameters to be confirmed by a detailed design analysis.
Pile design parameters based on bored piles.
A bearing capacity factor Nc equal to 9 for clay can be used provided that the pile has been embedded at least to a depth of five diameters into the bearing stratum.
Socket roughness of R2 or better.
For strong rock, the pile carrying capacity should not be greater than the safe load on the material of the pile at the point of minimum cross section.

For foundations bearing on soil or rock, weaker soil or rock layers present below the base of the foundation within the zone of influence of the foundation should be taken into account in the design of the foundation.

5.3 Geotechnical Strength Reduction Factor (AS2159)

The geotechnical strength reduction factor for pile design is defined in the Piling Code. Selection of the geotechnical strength reduction factor (ϕ_g) is based on a series of individual risk ratings (IRR) which are weighted and lead to an average risk rating (ARR). The individual risk ratings and final value of (ϕ_g) depend on the following factors:

- Site: the type, quantity and quality of testing.
- Design: design methods and parameter selection.
- Installation: construction control and monitoring.
- Pile testing regime.
- Redundancy.

Without clear details about the pile type, design method, testing regime and other construction factors it is not possible to calculate the appropriate (ϕ_g) value. Assuming no pile testing, limited specialist geotechnical supervision during construction, and the limited/basic investigation and testing, an ϕ_g value of 0.48 is considered appropriate.

Nevertheless, with geotechnical supervision and pile integrity testing ϕ_g value can be increase to 0.52.

5.3.1 Foundation Settlements

For shallow foundations bearing on the alluvial or residual soils the total and differential settlements are expected to be within 25mm provided that the allowable bearing capacities are not exceeded. For deep foundations bearing on the underlying bedrock the total and differential settlements are expected to be within 25mm provided that the allowable bearing capacities are not exceeded.

5.3.2 Shallow Foundations

If it is proposed to use shallow foundations on fill material, then the existing ground should be excavated to remove any soft, organic or moisture affected materials. The exposed subgrade should then be compacted to a minimum dry density ratio of 98% relative to standard compaction at a moisture ratio of 60 - 90% of the optimum moisture content. The prepared subgrade shall then be proof rolled to identify any soft spots to remedy it. Fill material can then be placed and compacted to 98% relative to standard compaction at a moisture ratio of 60 - 90% of the optimum moisture content in maximum 250mm loose thickness layers up to design level. An allowable bearing capacity of 150kPa can be assumed for the compacted fill material.

5.3.3 Deep Foundations

Piles should be bored to found in the underlying mudstone. It is likely that a rock auger or coring bucket will be required for piles that are designed to be socketed into the underlying bedrock. Provision should be made for temporary casing of bored piles below groundwater level.

5.4 Excavation and Stability

Excavation of the alluvial and residual soils is expected to be straightforward using traditional excavation equipment. For temporary work conditions above groundwater level, benching in the cohesive soils or slope angles of 1V:1H in the non-cohesive soils is considered appropriate for the materials. For temporary work conditions below groundwater level excavation support will be required. For permanent conditions slope angles of 1V:2H is considered appropriate, subject to a slope stability assessment.

5.5 Aggressive Soils

We refer to Table 6.4.2 (c) Exposure Classification for Concrete Piles AS2159 – 2009 'Piling – Design and Installation'.

The soil condition is classified as 'Condition – A' and 'Condition – B'. The test results indicate very low levels of Sulphates (<10 - 20 ppm), Chlorides (<10 ppm) and a pH (7.9 – 8.0). Therefore, the soils at this site are classified as Mild due to the presence of groundwater.

6 CONCLUSION

The findings of our report were based on our fieldwork, in-situ testing, laboratory testing and technical assessment for this site.

We trust the foregoing is sufficient for your present purposes, and if you have any questions please contact the undersigned.

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Attached: Limitations of Geotechnical Site Investigation.
References: Australian Standard 1726 – 2017 Geotechnical Site Investigations

LIMITATIONS OF GEOTECHNICAL SITE INVESTIGATION

Scope of Services

This report has been prepared for the Client in accordance with the Services Engagement Form (SEF), between the Client and Macquarie Geotechnical.

Reliance on Data

Macquarie Geotechnical has relied upon data and other information provided by the Client and other individuals. Macquarie Geotechnical has not verified the accuracy or completeness of the data, except as otherwise stated in the report. Recommendations in the report are based on the data.

Macquarie Geotechnical will not be liable in relation to incorrect recommendations should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed.

Geotechnical Investigation

Findings of Geotechnical Investigations are based extensively on judgment and experience. Geotechnical reports are prepared to meet the specific needs of individual clients. This report was prepared expressly for the Client and expressly for the Clients purposes.

This report is based on a subsurface investigation, which was designed for project-specific factors. Unless further geotechnical advice is obtained this report cannot be applied to an adjacent site nor can it be used when the nature of any proposed development is changed.

Limitations of Site investigation

As a result of the limited number of sub-surface excavations or boreholes there is the possibility that variations may occur between test locations. The investigation undertaken is an estimate of the general profile of the subsurface conditions. The data derived from the investigation and laboratory testing are extrapolated across the site to form a geological model. This geological model infers the subsurface conditions and their likely behavior with regard to the proposed development.

The actual conditions at the site might differ from those inferred to exist.

No subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

Time Dependence

This report is based on conditions, which existed at the time of subsurface exploration. Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report.

Macquarie Geotechnical should be kept appraised of any such events, and should be consulted for further geotechnical advice if any changes are noted.

Avoid Misinterpretation

A geotechnical engineer or engineering geologist should be retained to work with other design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

No part of this report should be separated from the Final Report.

Sub-surface Logs

Sub-surface logs are developed by geoscientific professionals based upon their interpretation of field logs and laboratory evaluation of field samples. These logs should not under any circumstances be redrawn for inclusion in any drawings.

Geotechnical Involvement During Construction

During construction, excavation frequently exposes subsurface conditions. Geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendations and should make their own enquiries and obtain independent advice in relation to such matters

Macquarie Geotechnical assumes no responsibility and will not be liable to any other person or organisations for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisations arising from matters dealt with or conclusions expressed in the report.

Other limitations

Macquarie Geotechnical will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

Other Information

For further information reference should be made to "Guidelines for the Provision of Geotechnical Information in Construction Contracts" published by the Institution of Engineers Australia, 1987.

Appendix A – Geotechnical Explanatory Notes

MACQUARIE GEOTECH

Geotechnical Explanatory Notes

Soil Description

In engineering terms soil includes every type of uncemented or partially cemented inorganic material found in the ground. In practice, if the material can be remoulded by hand in its field condition or in water it is described as a soil. The dominant soil constituent is given in capital letters, with secondary textures in lower case. The dominant feature is assessed from the Unified Soil Classification system and a soil symbol is used to define a soil layer as follows:

UNIFIED SOIL CLASSIFICATION

The appropriate symbols are selected on the result of visual examination, field tests and available laboratory tests, such as, sieve analysis, liquid limit and plasticity index.

USC Symbol	Description
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand
ML	Silt of low plasticity
CL	Clay of low plasticity
OL	Organic soil of low plasticity
MH	Silt of high plasticity
CH	Clay of high plasticity
OH	Organic soil of high plasticity
Pt	Peaty Soil

MOISTURE CONDITION

Dry – Cohesive soils are friable or powdery
Cohesionless soil grains are free-running

Moist – Soil feels cool, darkened in colour
Cohesive soils can be moulded
Cohesionless soil grains tend to adhere

Wet – Cohesive soils usually weakened
Free water forms on hands when handling

For cohesive soils the following codes may also be used:

MC>PL Moisture Content greater than the Plastic Limit.
MC~PL Moisture Content near the Plastic Limit.
MC<PL Moisture Content less than the Plastic Limit.

PLASTICITY

The potential for soil to undergo change in volume with moisture change is assessed from its degree of plasticity. The classification of the degree of plasticity in terms of the Liquid Limit (LL) is as follows:

Description of Plasticity	LL (%)
Low	<35
Medium	35 to 50
High	>50

COHESIVE SOILS – CONSISTENCY

The consistency of a cohesive soil is defined by descriptive terminology such as very soft, soft, firm, stiff, very stiff and hard. These terms are assessed by the shear strength of the soil as observed visually, by the pocket penetrometer values and by resistance to deformation to hand moulding.

A Pocket Penetrometer may be used in the field or the laboratory to provide approximate assessment of unconfined compressive strength of cohesive soils. The values are recorded in kPa, as follows:

Strength	Symbol	Pocket Penetrometer Reading (kPa)
Very Soft	VS	< 25
Soft	S	20 to 50
Firm	F	50 to 100
Stiff	St	100 to 200
Very Stiff	VSt	200 to 400
Hard	H	> 400

MACQUARIE GEOTECH

COHESIONLESS SOILS – RELATIVE DENSITY

Relative density terms such as very loose, loose, medium, dense and very dense are used to describe silty and sandy material, and these are usually based on resistance to drilling penetration or the Standard Penetration Test (SPT) 'N' values. Other condition terms, such as friable, powdery or crumbly may also be used.

The Standard Penetration Test (SPT) is carried out in accordance with AS 1289, 6.3.1. For completed tests the number of blows required to drive the split spoon sampler 300 mm are recorded as the N value. For incomplete tests the number of blows and the penetration beyond the seating depth of 150 mm are recorded. If the 150 mm seating penetration is not achieved the number of blows to achieve the measured penetration is recorded. SPT correlations may be subject to corrections for overburden pressure and equipment type.

Term	Symbol	Density Index	N Value (blows/0.3 m)
Very Loose	VL	0 to 15	0 to 4
Loose	L	15 to 35	4 to 10
Medium Dense	MD	35 to 65	10 to 30
Dense	D	65 to 85	30 to 50
Very Dense	VD	>85	>50

COHESIONLESS SOILS PARTICLE SIZE DESCRIPTIVE TERMS

Name	Subdivision	Size
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	19 mm to 63 mm
	medium	6.7 mm to 19 mm
	fine	2.36 mm to 6.7 mm
Sand	coarse	600 μm to 2.36 mm
	medium	210 μm to 600 μm
	fine	75 μm to 210 μm

Rock Description

The rock is described with strength and weathering symbols as shown below. Other features such as bedding and dip angle are given.

ROCK QUALITY

The fracture spacing is shown where applicable and the Rock Quality Designation (RQD) or Total Core Recovery (TCR) is given where:

$$\text{RQD (\%)} = \frac{\text{Sum of Axial lengths of core > 100mm long}}{\text{total length considered}}$$

$$\text{TCR (\%)} = \frac{\text{length of core recovered}}{\text{length of core run}}$$

ROCK STRENGTH

Rock strength is described using AS1726 and ISRM – Commission on Standardisation of Laboratory and Field Tests, "Suggested method of determining the Uniaxial Compressive Strength of Rock materials and the Point Load Index", as follows:

Term	Symbol	Point Load Index $I_{s(50)}$ (MPa)
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	>10

ROCK MATERIAL WEATHERING

Rock weathering is described using the following abbreviation and definitions used in AS1726:

Abbreviation	Term
RS	Residual soil
XW	Extremely weathered
DW	Distinctly weathered
HW	Highly weathered
MW	Moderately weathered
SW	Slightly weathered
FR	Fresh

MACQUARIE GEOTECH

DEFECT SPACING/BEDDING THICKNESS

Measured at right angles to defects of same set or bedding.

Term	Defect Spacing	Bedding
Extremely closely spaced	<6 mm	Thinly Laminated
	6 to 20 mm	Laminated
Very closely spaced	20 to 60 mm	Very Thin
Closely spaced	0.06 to 0.2 m	Thin
Moderately widely spaced	0.2 to 0.6 m	Medium
Widely spaced	0.6 to 2 m	Thick
Very widely spaced	>2 m	Very Thick

DEFECT DESCRIPTION

Type:	Description
B	Bedding
F	Fault
C	Cleavage
J	Joint
S	Shear Zone
D	Drill break

Planarity/Roughness:

Class	Description
I	rough or irregular, stepped
II	smooth, stepped
III	slickensided, stepped
IV	rough or irregular, undulating
V	smooth, undulating
VI	slickensided, undulating
VII	rough or irregular, planar
VIII	smooth, planar
IX	slickensided, planar

The inclination if defects are measured from perpendicular to the core axis.

WATER


Water level at date shown


Partial water loss


Water inflow


Complete water loss

Groundwater not observed: The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

Groundwater not encountered: The borehole/test pit was dry soon after excavation, however groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

Graphic Symbols for Soils and Rocks

Typical symbols for soils and rocks are as follows. Combinations of these symbols may be used to indicated mixed materials such as clayey sand.

Soil Symbols

Main components


CLAY - CL


CLAY - CH


SAND


GRAVEL


BOULDERS / COBBLES


TOPSOIL


SILT

Minor Components


Clayey


Silty


Sandy


Gravelly

Other


FILL


BITUMEN


CONCRETE

Rock Symbols

Sedimentary Rocks


SANDSTONE


SILTSTONE


CLAYSTONE, MUDSTONE


SHALE


LAMINITE


ASPHALT


LIMESTONE


CONGLOMERATE

Igneous Rocks


GRANITE


BASALT


UNDIFFERENTIATED IGNEOUS

Metamorphic Rocks


SLATE, PHYLLITE, SCHIST


GNEISS

QUARTZITE

MACQUARIE GEOTECH

Engineering Classification of Shales and Sandstones in the Sydney Region – A Summary Guide

The Sydney Rock Class classification system is based on rock strength, defect spacing and allowable seams as set out below. All three factors must be satisfied.

CLASSIFICATION FOR SANDSTONE

Class	Uniaxial Compressive Strength (MPa)	Defect Spacing (mm)	Allowable Seams (%)
I	>24	>600	<1.5
II	>12	>600	<3
III	>7	>200	<5
IV	>2	>60	<10
V	>1	N.A.	N.A.

CLASSIFICATION FOR SHALE

Class	Uniaxial Compressive Strength (MPa)	Defect Spacing (mm)	Allowable Seams (%)
I	>16	>600	<2
II	>7	>200	<4
III	>2	>60	<8
IV	>1	>20	<25
V	>1	N.A.	N.A.

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UNIAXIAL COMPRESSIVE STRENGTH (UCS)

For expedience in field/construction situations the uniaxial (unconfined) compressive strength of the rock is often inferred, or assessed using the point load strength index (Is_{50}) test (AS 4133.4.1 – 1993). For Sydney Basin sedimentary rocks the uniaxial compressive strength is typically about 20 x (Is_{50}) but the multiplier may range from about 10 to 30 depending on the rock type and characteristics. In the absence of UCS tests, the assigned Sydney Rock Class classification may therefore include rock strengths outside the nominated UCS range.

DEFECT SPACING

The terms relate to spacing of natural fractures in NMLC, NQ and HQ diamond drill cores and have the following definitions:

Defect Spacing (mm)	Terms Used to Describe Defect Spacing[1]
>2000	Very widely spaced
600 – 2000	Widely spaced
200 – 600	Moderately spaced
60 – 200	Closely spaced
20 – 60	Very closely spaced
<20	Extremely closely spaced

[1]After ISO/CD14689 and ISRM.

ALLOWABLE SEAMS

Seams include clay, fragmented, highly weathered or similar zones, usually sub-parallel to the loaded surface. The limits suggested in the tables relate to a defined zone of influence. For pad footings, the zone of influence is defined as 1.5 times the least footing dimension. For socketed footings, the zone includes the length of the socket plus a further depth equal to the width of the footing. For tunnel or excavation assessment purposes the defects are assessed over a length of core of similar characteristics.

Source: Based on Pells et al (1978), as revised by Pells et al (1998).
Pells, P.J.N, Mostyn, G. and Walker, B.F. – Foundations on Sandstone and Shale in the Sydney Region. Australian Geomechanics Journal, No 33 Part 3, December 1998.

MACQUARIE GEOTECH

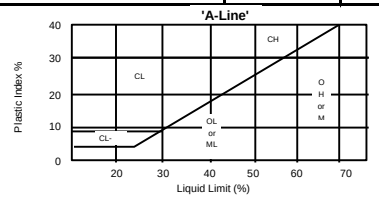
Summary of Soil Logging Procedures

Coarse Material: grain size - colour - particle shape - secondary components - minor constituents - moisture condition - relative density - origin - additional observations.

Fine Material: plasticity - colour - secondary components - minor constituents - moisture w.r.t. plasticity - consistency - origin - additional observations.

Guide to the Description, Identification and Classification of Soils

Major Divisions				SYMBOL	Typical Names
> 200mm	BOULDERS				
60 to 200mm	COBBLES				
COARSE GRAINED SOILS	More than 65% by dry mass less than 63mm is greater that 0.075mm	GRAVEL	More than 50% of coarse fraction > 2.36mm	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.
		Gravelly Soils		GM	Silty gravels, gravel-sand-silt mixtures.
				GC	Clayey gravels, gravel-sand-clay mixtures
		SANDS	More than 50% of coarse fraction < 2.36mm	SW	Well-graded sands, gravelly sands, little or no fines.
				SP	Poorly graded sands and gravelly sands; little or no fines, uniform sands.
		Sandy Soils		SM	Silty sands, sand-silt mixtures.
				SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	More than 35% by dry mass less than 60mm is less than 0.076mm	Liquid Limit < 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays.
				OL	Organic silts and organic silty clays of low plasticity.
		Liquid Limit > 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays.
				OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS				Pt	Peat and other highly organic soils.



Grain sizes			
Gravel		Sand	
Coarse -	63 to 19mm	Coarse -	2.36 to 0.6mm
Medium -	19 to 6.7 mm	Medium -	0.6 to 0.21mm
Fine -	6.7 to 2.36mm	Fine -	0.21 to 0.075mm

GEOLOGICAL ORIGIN:-

Fill - artificial soils / deposits
Alluvial - soils deposited by the action of water
Aeolian - soils deposited by the action of wind
Topsoil - soils supporting plant life containing significant organic content
Residual - soils derived from insitu weathering of parent rock.
Colluvial - transported debris usually unsorted, loose and deposited

Field Identification of Fine Grained Soils - Silt or Clay?

Dry Strength - Allow the soil to dry completely and then test its strength by breaking and crumbling between the fingers.
High dry strength - Clays; Very slight dry strength - Silts.

Toughness Test - the soil is rolled by hand into a thread about 3mm in diameter. The thread is then folded and re-rolled repeatedly until it has dried sufficiently to break into lumps. In this condition inorganic clays are fairly stiff and tough while inorganic silts produce a weak and often soft thread which may be difficult to form and readily breaks and crumbles.

Dilatancy Test - Add sufficient water to the soil, held in the palm of the hand, to make it soft but not sticky. Shake horizontally, striking vigorously against the other hand several times. Dilatancy is indicated by the appearance of a shiny film on the surface of the soil. If the soil is then squeezed or pressed with the fingers, the surface becomes dull as the soil stiffens and eventually crumbles. These reactions are pronounced only for predominantly silt size material. Plastic clays give no reaction.

Descriptive Terms for Material Portions

COARSE GRAINED SOILS		FINE GRAINED SOILS	
% Fines	*Term/Modifier*	*% Coarse*	*Term/Modifier*
≤ 5	Omit, or use "trace"	≤ 15	Omit, or use "trace"
> 5, ≤ 12	"with clay/silt" as applicable	> 15, ≤ 30	"with sand/gravel" as applicable
> 12	Prefix soil as "silty/clayey"	> 30	Prefix as "sandy/gravelly"

Moisture Condition

for non-cohesive soils:

Dry -	runs freely through fingers.
Moist -	does not run freely but no free water visible on soil surface.
Wet -	free water visible on soil surface.

for cohesive soils:

MC > PL	Moisture content estimated to be greater than the plastic limit.
MC ~ PL	Moisture content estimated to be approximately equal to the plastic limit. The soil can be moulded
MC < PL	Moisture content estimated to be less than the plastic limit. The soil is hard and friable, or powdery.

The plastic limit (PL) is defined as the moisture content (percentage) at which the soil crumbles when rolled into threads of 3mm dia.

Consistency - For Clays & Silts

Description	*UCS(kPa)*	*Field guide to consistency*
Very soft	< 25	Exudes between the fingers when squeezed in hand
Soft	25 - 50	Can be moulded by light finger pressure
Firm	50 - 100	Can be moulded by strong finger pressure
Stiff	100 - 200	Cannot be moulded by fingers. Can be indented by thumb.
Very stiff	200 - 400	Can be indented by thumb nail
Hard	> 400	Can be indented with difficulty by thumb nail
Friable	-	Crumbles or powders when scraped by thumbnail

Relative Density for Gravels and Sands

Description	*SPT "N" Value*	*Density Index (ID) Range %*
Very loose	0 - 4	< 15
Loose	4 - 10	15 - 35
Medium dense	10 - 30	35 - 65
Dense	30 - 50	65 - 85
Very dense	> 50	> 85

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Summary of Rock Logging Procedures

Description order: constituents - rock name - grain size - colour - weathering - strength - minor constituents - additional observations.
- minor constituents - moisture w.r.t. plasticity - consistency - origin - additional observations.

Definition - Sedimentary Rock

Conglomerate	more than 50% of the rock consists of gravel (>2mm) sized fragments
Sandstone	more than 50% of the rock consists of sand (0.06 to 2mm) sized grains
Siltstone	more than 50% of the rock consists of silt sized granular particles and the rock is not laminated
Claystone	more than 50% of the rock consists of clay or mica material and the rock is not laminated
Shale	more than 50% of the rock consists of clay or silt sized particles and the rock is laminated

Weathering

Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a change in volume but the soil has not significantly transported.
Extremely Weathered	EW	Rock is weathered to such an extent that it has 'soil' properties; ie. it either disintegrates or can be remoulded, in water.
Distinctly Weathered	DW	**Highly Weathered (HW)** - Rock is wholly discoloured and rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals **Moderately Weathered (MW)** - The whole of the rock is discoloured, usually by iron staining and bleaching. Shows little or no change in rock strength.
Slightly Weathered	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	FR	Rock shows no sign of decomposition or staining.

Stratification

thinly laminated	<6mm	medium bedded	0.2 - 0.6m
laminated	6 - 20mm	thickly bedded	0.6 - 2m
very thinly bedded	20 - 60mm	very thickly bedded	>2m
thinly bedded	60mm - 0.2m		

Discontinuities

order of description: depth - type - orientation - spacing - roughness / planarity - thickness - coating

	Type	Class	Roughness/Planarity	Class	Roughness/Planarity
B	Bedding	I	rough or irregular, stepped	VI	slickensided, undulating
F	Fault	II	smooth, stepped	VII	rough or irregular, planar
C	Cleavage	III	slickensided, stepped	VIII	smooth, planar
J	Joint	IV	rough or irregular, undulating	IX	slickensided, planar
S	Shear Zone	V	smooth, undulating		
D	Drill break				

Rock Strength

Term		Is (50)	Field Guide
		0.03	
Very low	VL		Material crumbles under firm blows with sharp end of pick; can be peeled with knive. Pieces up to 30mm thick can be broken by finger pressure.
		0.1	
Low	L		A piece of core 150 mm long x 50 mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
		0.3	
Medium	M		A piece of core 150 mm long x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.
		1	
High	H		A piece of core 150 mm long x 50 mm dia. core cannot be broken by unaided hands, can be slightly scratched or scored with knife.
		3	
Very High	VH		A piece of core 150 mm long x 50 mm dia. May be broken readily with hand held hammer. Cannot be scratched with pen knife.
		10	
Extremely High	EH		A piece of core 150 mm long x 50 mm dia. Is difficult to break with hand held hammer. Rings when struck with a hammer.

* - rock strength defined by point load strength (Is 50) in direction normal to bedding

Degree of fracturing

fragmented	The core is comprised primarily of fragments of length less than 20mm, and mostly of width less than the core diameter
highly fractured	Core lengths are generally less than 20mm - 40mm with occasional fragments.
fractured	Core lengths are mainly 30mm - 100mm with occasional shorter and longer lengths
slightly fractured	Core lengths are generally 300mm - 1000mm with occasional longer sections and shorter sections of 100mm -- 300mm.
unbroken	The core does not contain any fracture.

- spacing of all types of natural fractures, but not artificial breaks, in cored bores.

The fracture spacing is shown where applicable and the Rock Quality Designation is given by: RQD (%) = sum of unbroken core pieces 100 mm or longer

Appendix B – Site Plan & Borehole Locations

N

Legend

Testing Locations

Google Roads Overlay

NSW Six Map

MACQUARIE GEOTECH

3 Watt Drive, Bathurst NSW 2795
P: 02 6332 2011 F: 02 6334 4213 E: macgeo@macgeo.com.au

Client: Cabonne Council

Project: Canomodine Bridge

Location: Canowindra, NSW

Drawn: CG | Checked: JB | Date: 30/4/2023

0 20 40 60 80

Metres - Scale 1:1,200

Vertical to Horizontal Scale 1 : 1
Co-ordinate Reference System - EPSG: 4326 WGS: 84

JOB NO B21781

Macquarie Geotechnical Ltd
Geotechnical Investigation Locality Map

Drawing Number: B21781 - REV0

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Appendix C – Borehole Logs

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Borehole No.

BH01

Engineering Log - Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	04/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra	Completed:	05/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666461.0 m E 6290944.9 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Hole Diameter:		Bearing:		Datum:	AHD	Operator:	TH

Drilling Information									Soil Description				Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
				1 D 0.50-1.00 m					SP	FILL Gravelly SAND: fine to coarse grained, pale orange, brown; gravel sub-rounded to sub-angular, fine to coarse-grained.		L		FILL
									SP	FILL Clayey SAND gravel: fine to coarse grained, dark orange, brown; clay low plasticity; gravel sub-rounded to sub-angular, fine to coarse-grained.				
				2 D 1.00-1.50 m		354.0	1				D	L		
				1 SPT 1.50 m 1, 2, 4 N=6 PP 1.50 m =10 - 30 kPa									×	
				3 D 2.00-2.50 m		353.0	2		CI	Sandy Silty CLAY gravel: medium plasticity, dark grey, brown; sand fine to coarse-grained; gravel sub-rounded to sub-angular, fine to medium-grained.	w<PL			ALLUVIAL SOIL
				4 D 2.50-3.00 m							w~PL	S		
				2 SPT 3.00 m 1, 1, 2 N=3		352.0	3							
				5 D 3.50-4.00 m					CH	Silty CLAY with sand trace gravel: high plasticity, dark brown; sand fine to coarse-grained; gravel sub-rounded to sub-angular, fine to medium-grained.				
				6 D 4.00-4.50 m		351.0	4				w<LL	S		
				3 SPT 4.50 m 2, 2, 2 N=4										

Method
AS - Auger Screwing
RR - Rock Roller
WB- Washbore

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U(x) - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
pp - Pocket Penetrometer (UCS kPa)
x=size in mm

Moisture Condition
D - Dry
M - Moist
W - Wet

Plastic Limit
w < PL
w = PL
w > PL
w = LL
w > LL

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
AS1726:2017

MACQUARIE GEOTECH

Borehole No.

BH01

Engineering Log - Borehole

Project No.: B21781

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Hole Diameter:		Bearing:		Datum:	AHD	Operator:	TH

Drilling Information									Soil Description				Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
				7 D 5.00-5.50 m					CH	Silty CLAY with sand trace gravel: high plasticity, dark brown; sand fine to coarse-grained; gravel sub-rounded to sub-angular, fine to medium-grained. *(continued)*				ALLUVIAL SOIL
				8 D 5.50-6.00 m							w<LL	S		
				4 SPT 6.00 m 3, 11, 3 N=14		349.0	6							
				9 D 6.50-7.00 m					CL	Gravelly CLAY trace sand: low plasticity, dark brown, grey; gravel sub-rounded to sub-angular, fine to coarse-grained; sand fine to coarse-grained.				EXTREMELY WEATHERED MATERIAL 6.50: recovered as soil
						348.0	7				w<PL	St		
										Continued on cored borehole sheet				
						347.0	8							
						346.0	9							

Method
AS - Auger Screwing
RR - Rock Roller
WB- Washbore

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U(x) - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
pp - Pocket Penetrometer (UCS kPa)
x=size in mm

Moisture Condition
D - Dry
M - Moist
W - Wet

Plastic Limit
w < PL
w = PL
w > PL
w = LL
w > LL

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
AS1726:2017

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BH01

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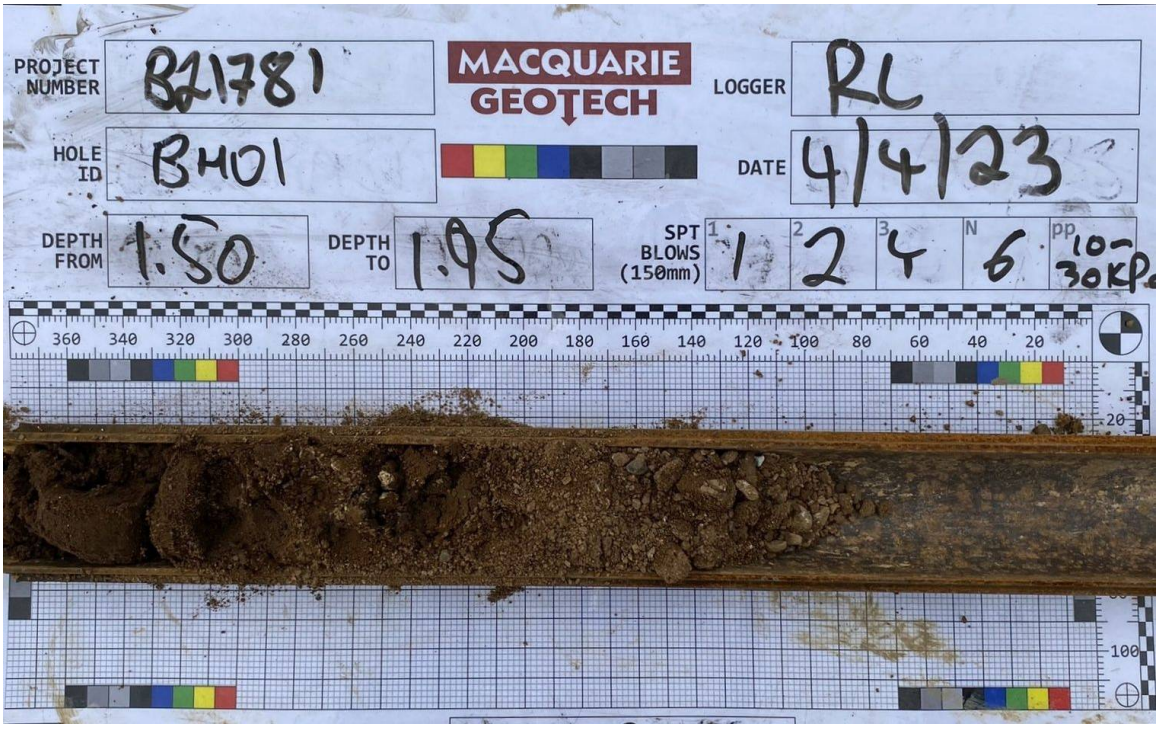
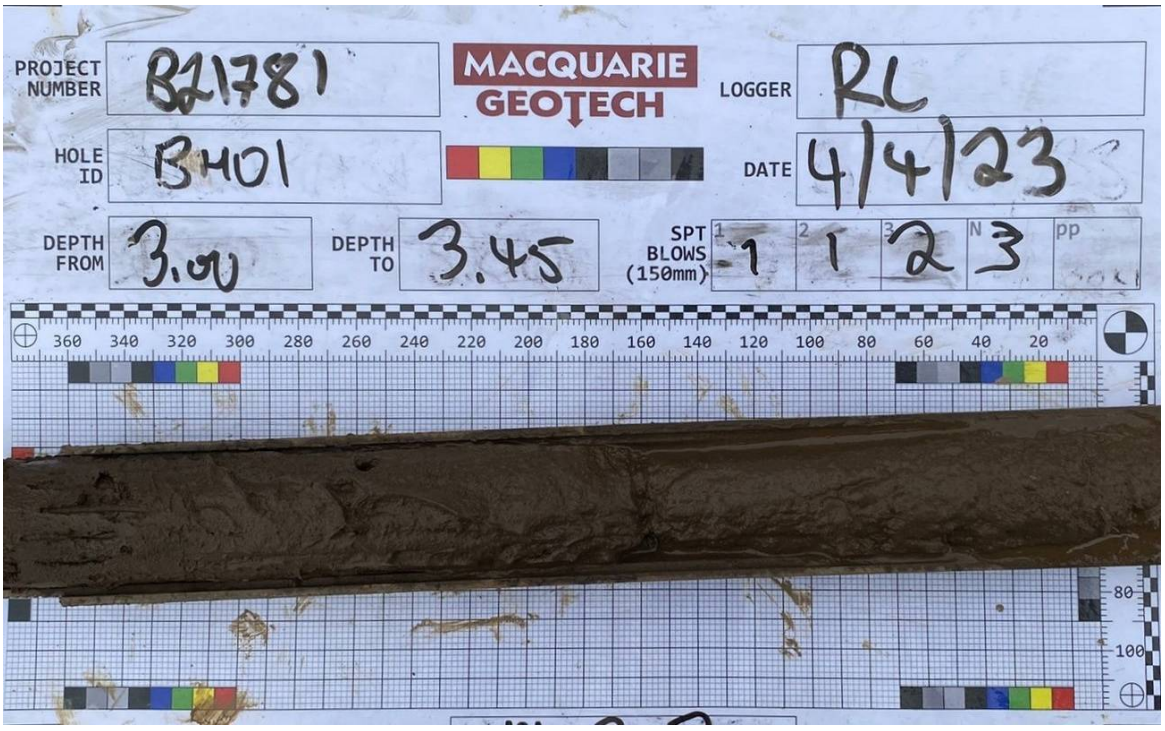


BH01 Depth Range: 1.50 - 1.95 m



BH01 Depth Range: 3.00 - 3.45 m

MACQUARIE GEOTECH

Borehole No.

BH01

Engineering Log - Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	04/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra	Completed:	05/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666461.0 m E 6290944.9 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m	
Hole Diameter:		Bearing:		Datum:	AHD	Operator: TH

BH01 Depth Range: 4.50 - 4.95 m

BH01 Depth Range: 6.00 - 6.45 m

MACQUARIE GEOTECH

Cored Borehole No.

BH01

Engineering Log - Cored Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	04/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra (NSW, Australia)	Completed:	05/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666461.0 m E 6290944.9 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Barrel Type and Length:		Bearing:		Datum:	AHD	Operator:	TH

Drilling Information								***Rock Substance***				***Rock Mass Defects***			
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength Is(50) ● - Axial ○ - Diametral (soil) VL L M H VH EH	Defect Spacing (mm) 30 100 300 1000 3000	Visual	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling Particular	General
					349.0	6								
					348.0	7.00m		Continued from non-cored borehole sheet						
			100	0		7		NO CORE 0.43m (7.00-7.43)						
						7.43m								
								MUDSTONE WITH CALCITE: dark brown, grey, massive, occasional irregular calcite veins throughout.	XW					
					347.0	8			MW				JT, 15°, IR, RF JT, 80°, IR, RF	
			100	90									JT, 20°, IR, RF	
						8.45m								
								MUDSTONE WITH CALCITE: dark grey, massive, frequent irregular calcite veins throughout, up to 5mm thick, possibly carbonaceous.					JT, 30°, IR, RF	
					346.0	9							JT, 80°, IR, RF	
									SW				JT, 25°, IR, RF	
			100	98									JT, 30°, IR, RF	
													JT, 75°, IR, RF	

Method
AS - Auger Screwing
WB- Washbore
HQ3 HQ3 Core Barrel
NQ3 NQ3 Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
DW - Distinctly Weathered
XW - Extremely Weathered
RS - Residual Soil

Strength
(indirect tensile strength)
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

MACQUARIE GEOTECH

Cored Borehole No.

BH01

Engineering Log - Cored Borehole

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			100	98	344.0	11		MUDSTONE WITH CALCITE: dark grey, massive, frequent irregular calcite veins throughout, up to 5mm thick, possibly carbonaceous.*(continued)*	SW				JT, 75°, IR, RF JT, 50°, IR, RF JT, 75°, IR, RF JT, 45°, IR, RF	
					343.0	12								
						12.16m 12.20m		NO CORE 0.04m (12.16-12.20)						
			100	100	342.0	13							JT, 35°, IR, RF JT, 35°, IR, RF	
						13.34m		Hole Terminated at 13.34 m Target depth						
					341.0	14								

Method
AS - Auger Screwing
WB- Washbore
HQ3 HQ3 Core Barrel
NQ3 NQ3 Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
DW - Distinctly Weathered
XW - Extremely Weathered
RS - Residual Soil

Strength
(indirect tensile strength)
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

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Cored Borehole No.

BH01

Engineering Log - Cored Borehole

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Hole Position:	666461.0 m E 6290944.9 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Barrel Type and Length:		Bearing:		Datum:	AHD	Operator:	TH

PointID : BH01 Depth Range: 7.00 - 11.00 m

PointID : BH01 Depth Range: 11.00 - 13.34 m

LOCA: BH02
PGID: BH02_001
PUB: 23050114

MACQUARIE GEOTECH

Borehole No.

BH02

Page 1 of 6

Engineering Log - Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	03/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra	Completed:	03/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666459.9 m E 6290957.0 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Hole Diameter:		Bearing:		Datum:	AHD	Operator:	TH

Drilling Information									*Soil Description*				*Observations*
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/T				1 D 0.10-0.50 m 1					CL CI	TOPSOIL Gravelly Sandy CLAY: low plasticity, dark brown; sand fine to coarse-grained; gravel fine to coarse-grained, sub-rounded to sub-angular.	D	S		TOPSOIL
				2 D 0.50-1.50 m SPT 0.50 m 2, 2, 3 N=5 PP 0.50 m =30 - 50 kPa						Sandy Silty CLAY with gravel: medium plasticity, dark orange, brown; sand fine to coarse-grained; gravel fine to medium-grained, sub-rounded to sub-angular.	w<PL	F	×	ALLUVIAL SOIL
						354.0	1							
				2 SPT 1.50 m 1, 1, 2, N=3 PP 1.50 m =10 - 30 kPa 3 D 2.00-2.50 m					CH	Silty CLAY with sand: high plasticity, brown, black; sand fine-grained.			×	
						353.0	2			2.00-2.50: Clay medium plasticity	w~PL	S		
						352.0	3			Continued on cored borehole sheet				
						351.0	4							

Method
AS - Auger Screwing
RR - Rock Roller
WB- Washbore

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U(x) - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
pp - Pocket Penetrometer (UCS kPa)
x=size in mm

Moisture Condition
D - Dry
M - Moist
W - Wet

Plastic Limit
w < PL
w = PL
w > PL
w = LL
w > LL

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
AS1726:2017

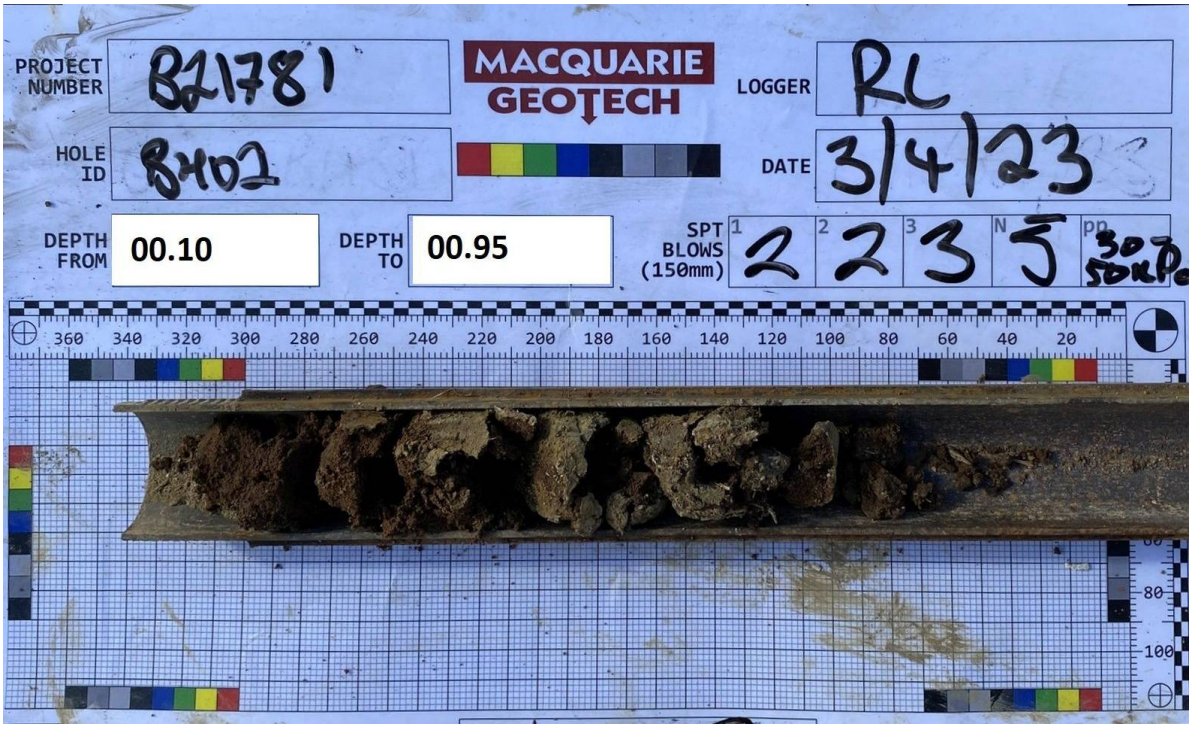
MACQUARIE GEOTECH

Engineering Log - Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	03/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra	Completed:	03/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666459.9 m E 6290957.0 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m	
Hole Diameter:		Bearing:		Datum:	AHD	Operator: TH



BH02 Depth Range: 0.10 - 0.95 m

BH02 Depth Range: 1.50 - 1.95 m

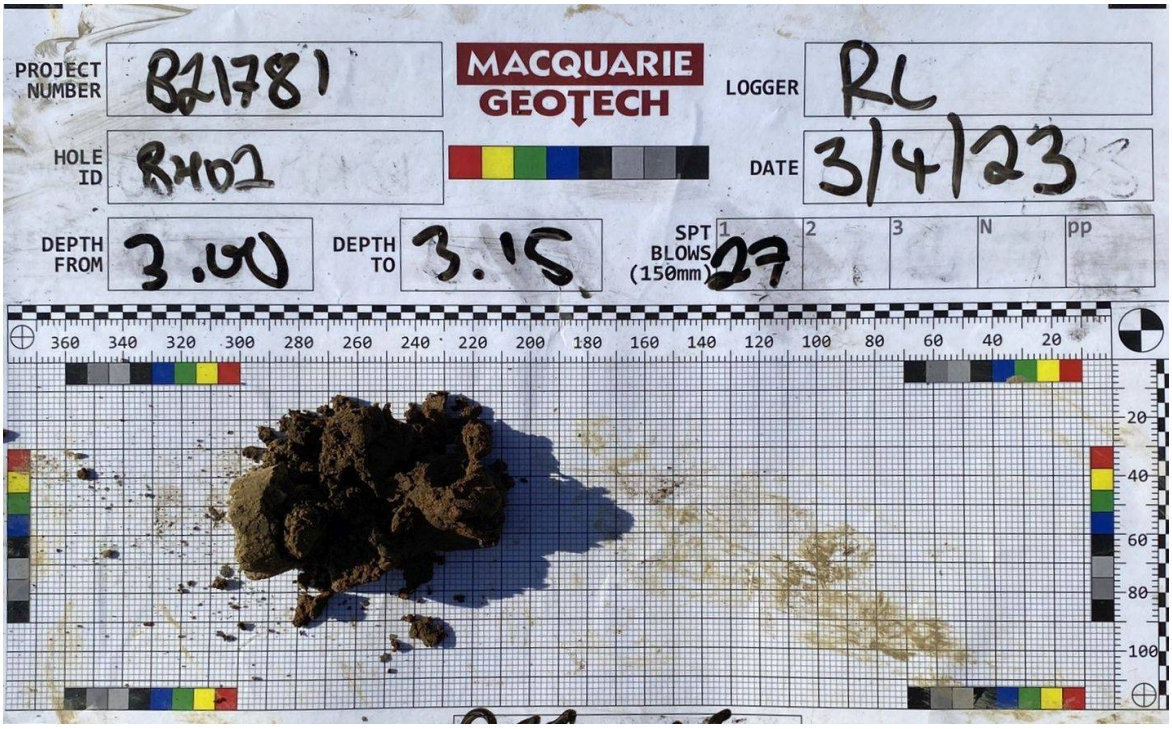
MACQUARIE GEOTECH

Engineering Log - Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	03/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra	Completed:	03/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666459.9 m E 6290957.0 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Hole Diameter:		Bearing:		Datum:	AHD	Operator:	TH



BH02 Depth Range: 3.00 - 3.15 m

MACQUARIE GEOTECH

Cored Borehole No.

BH02

Engineering Log - Cored Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	03/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra (NSW, Australia)	Completed:	03/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666459.9 m E 6290957.0 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Barrel Type and Length:		Bearing:		Datum:	AHD	Operator:	TH

Drilling Information | ***Rock Substance*** | ***Rock Mass Defects***

Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength Is(50) ● - Axial ○ - Diametral (soil) VL L M H VH EH	Defect Spacing (mm) 30 100 300 1000 3000	Visual	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling Particular	General
					354.0	1								
					353.0	2								
HQ3			100 27/150mm 0	0	352.0	3.00m 3		Continued from non-cored borehole sheet						
						3.15m		NO CORE 0.15m (3.00-3.15)						
						3.27m		Gravelly CLAY with sand: grey, brown; gravel fine to coarse-grained, sub-rounded to angular; sand fine to coarse-grained; hard; w~PL.	RS					
			100	111	351.0	4		LIMESTONE: dark brown, grey, massive, frequent irregular calcite veins throughout, possibly tuffaceous.	MW				JT, 35°, IR, RF JT, 15°, IR, RF JT, 25°, IR, RF JT, 25°, IR, RF FZ	
			100	97					HW					

Method
AS - Auger Screwing
WB- Washbore
HQ3 HQ3 Core Barrel
NQ3 NQ3 Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
DW - Distinctly Weathered
XW - Extremely Weathered
RS - Residual Soil

Strength
(indirect tensile strength)
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

MACQUARIE GEOTECH

Cored Borehole No.

BH02

Engineering Log - Cored Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	03/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra (NSW, Australia)	Completed:	03/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666459.9 m E 6290957.0 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Barrel Type and Length:		Bearing:		Datum:	AHD	Operator:	TH

Drilling Information								Rock Substance				Rock Mass Defects		
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength Is(50) ● - Axial ○ - Diametral (soil) VL L M H VH EH	Defect Spacing (mm) 30 100 300 1000 3000	Visual	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling Particular	General
HQ3			100	97	349.0	6		LIMESTONE: dark brown, grey, massive, frequent irregular calcite veins throughout, possibly tuffaceous.*(continued)*	HW HW HW				JT, 20°, IR, RF JT, 20°, IR, RF FZ	
						6.32m		NO CORE 0.95m (6.32-7.27)				NO CORE		
			100	68	348.0	7								
						7.27m		LIMESTONE: dark grey, massive, frequent irregular calcite veins throughout.	HW MW				JT, 15°, IR, RF JT, 20°, IR, RF	
					347.0	8							8.12: gravelly clay	
						8.27m		LIMESTONE: dark grey, massive, frequent irregular calcite veins throughout.	SW					
			100	100	346.0	9							JT, 20°, IR, RF	

Method
AS - Auger Screwing
WB- Washbore
HQ3 HQ3 Core Barrel
NQ3 NQ3 Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
DW - Distinctly Weathered
XW - Extremely Weathered
RS - Residual Soil

Strength
(indirect tensile strength)
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

MACQUARIE GEOTECH

Cored Borehole No.

BH02

Engineering Log - Cored Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	03/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra (NSW, Australia)	Completed:	03/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666459.9 m E 6290957.0 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Barrel Type and Length:		Bearing:		Datum:	AHD	Operator:	TH

Drilling Information								***Rock Substance***			***Rock Mass Defects***		
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength Is(50) ● - Axial ○ - Diametral (soil) VL L M H VH EH	Defect Spacing (mm) 30 100 300 1000 3000	Visual	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling Particular / General
HQ3			100	100	344.0	11		LIMESTONE: dark grey, massive, frequent irregular calcite veins throughout.*(continued)*	SW				JT, 75°, IR, RF JT, 50°, IR, RF
					343.0	12							
						12.32m		Hole Terminated at 12.32 m Target depth					
					342.0	13							
					341.0	14							

Method
AS - Auger Screwing
WB- Washbore
HQ3 HQ3 Core Barrel
NQ3 NQ3 Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
DW - Distinctly Weathered
XW - Extremely Weathered
RS - Residual Soil

Strength
(indirect tensile strength)
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

MACQUARIE GEOTECH

Cored Borehole No.

BH02

Engineering Log - Cored Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	03/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra (NSW, Australia)	Completed:	03/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666459.9 m E 6290957.0 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Barrel Type and Length:		Bearing:		Datum:	AHD	Operator:	TH

PointID : BH02 Depth Range: 3.00 - 7.00 m

PointID : BH02 Depth Range: 7.00 - 11.00 m

MACQUARIE GEOTECH

Cored Borehole No.

BH02

Engineering Log - Cored Borehole

Project No.: B21781

Client:	Cabonne Council	Commenced:	03/04/2023
Project Name:	Canomadine Creek Bridge - Canomadine Lane, Canowindra (NSW, Australia)	Completed:	03/04/2023
Hole Location:	Canomadine Lane	Logged By:	R.C
Hole Position:	666459.9 m E 6290957.0 m N MGA94 Zone 55	Checked By:	C.G

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	355.00 m		
Barrel Type and Length:		Bearing:		Datum:	AHD	Operator:	TH

PointID : BH02 Depth Range: 11.00 - 12.32 m

Appendix D – Laboratoty Test Results

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 320987

Client Details

Client	Macquarie Geotech
Attention	Jasper Haines
Address	3 Watt Dr, Bathurst, NSW, 2795

Sample Details

Your Reference	**S23130-1 Canomadine Creek Bridge GI**
Number of Samples	2 Soil
Date samples received	17/04/2023
Date completed instructions received	17/04/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	24/04/2023
Date of Issue	24/04/2023

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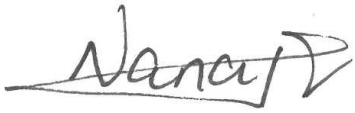
Results Approved By
Diego Bigolin, Inorganics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

Soil Aggressivity			
Our Reference		320987-1	320987-2
Your Reference	UNITS	S85291	S85294
Sample ID		OUT.HUT BH01 2.50-3.00m	BAD.HAM BH02 2.00-2.50m
Date Sampled		04/04/2023	04/04/2023
Type of sample		Soil	Soil
pH 1:5 soil:water	pH Units	7.9	8.0
Electrical Conductivity 1:5 soil:water	µS/cm	80	74
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	20	<10

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Soil Aggressivity						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	99	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	109	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	100	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

pH/EC:
Samples were out of the recommended holding time for this analysis.

SOIL CLASSIFICATION REPORT

Client	Cabbone Shire	**Source**	ANT.HUT BH01 1.00-1.50m
Address		**Sample Description**	Clayey SAND
Project	Canomadine Creek Bridge GI	**Report No.**	S85290-PI
Job No.	S23130-1	**Lab No.**	S85290

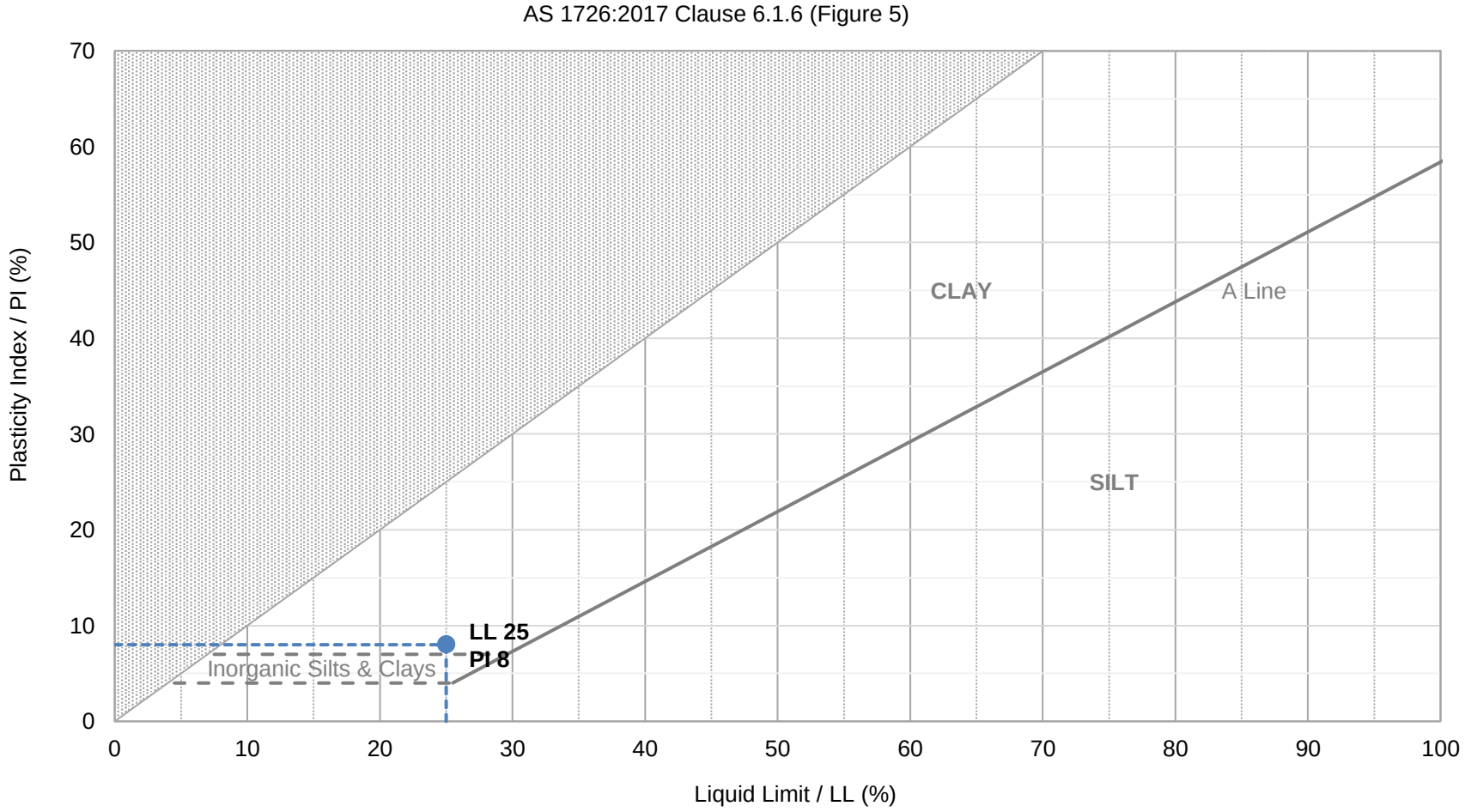
Test Procedure

- ☑ AS1289 3.1.1 Liquid Limit - Four point Casagrande method
- ☐ AS1289 3.1.2 Liquid Limit - One point Casagrande method
- ☑ AS1289 3.2.1 Plastic Limit - Standard method
- ☑ AS1289 3.3.1 Calculation of the Plasticity Index
- ☑ AS1289 3.4.1 Linear Shrinkage - Standard method

Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	4/04/2023
Preparation	Prepared in accordance with the test method	**Date Tested**	21/04/2023

Plasticity Chart for Classification of Fine-Grained Soils

AS 1726:2017 Clause 6.1.6 (Figure 5)



Preparation		Results	
Method of Preparation	**Dry Sieved**	Liquid Limit / LL (%)	**25**
History of the Sample	**Air Dried**	Plastic Limit (%)	**17**
		Plasticity Index / PI (%)	**8**
		Linear Shrinkage (%)	**4.0**
		Condition upon Drying	**Linear**

Notes

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The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. This document shall not be reproduced, except in full. Results relate only to the samples tested.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Jacob Lloyd

26/04/2023

Date:

Macquarie Geotechnical
14 Carter St
Lidcombe NSW 2141

SOIL CLASSIFICATION REPORT

Client	Cabbone Shire	**Source**	OUT.HUT BH01 2.50-3.00m
Address		**Sample Description**	Clayey SAND
Project	Canomadine Creek Bridge GI	**Report No.**	S85291-PI
Job No.	S23130-1	**Lab No.**	S85291

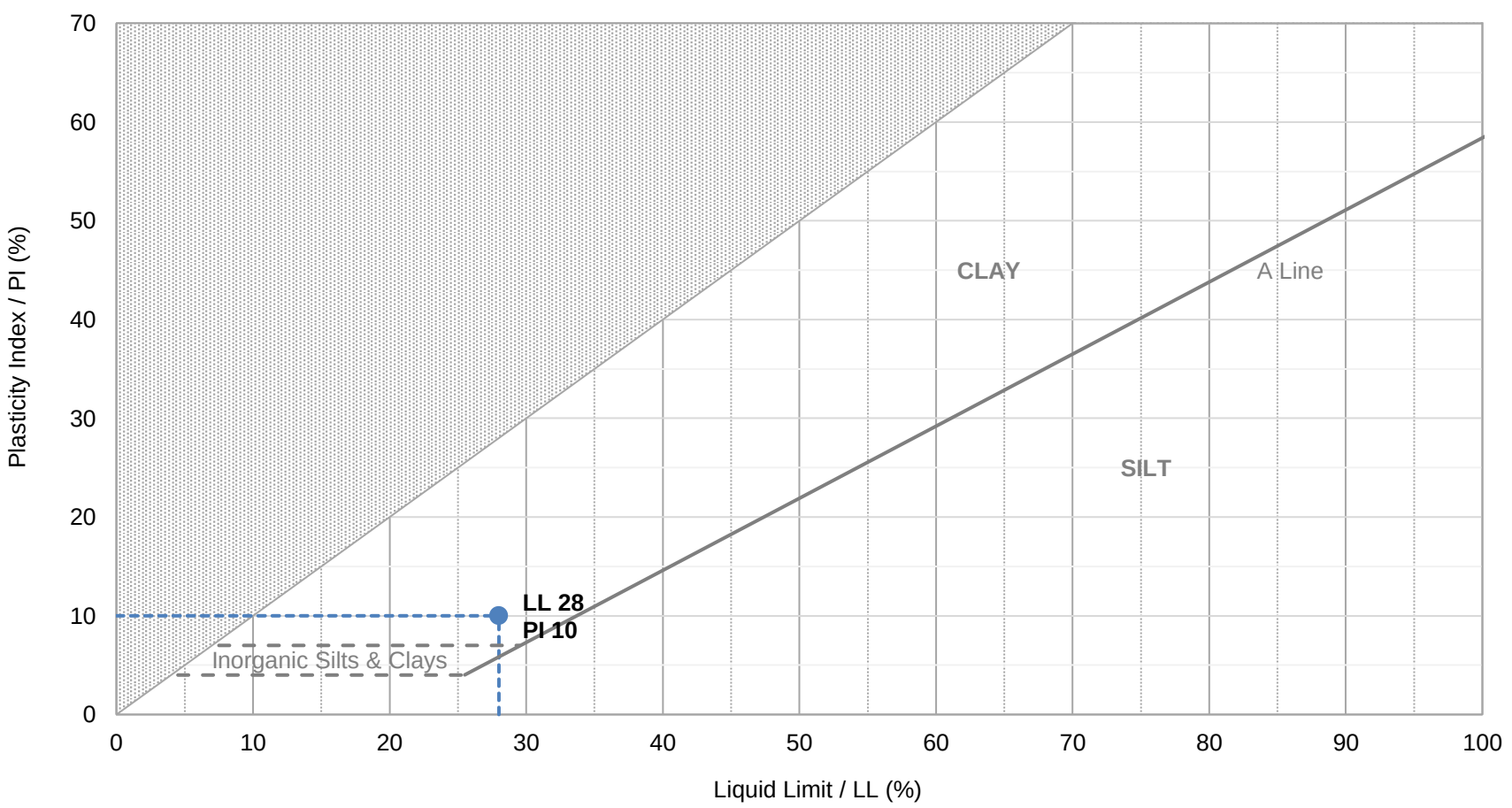
Test Procedure

- ☑ AS1289 3.1.1 Liquid Limit - Four point Casagrande method
- ☐ AS1289 3.1.2 Liquid Limit - One point Casagrande method
- ☑ AS1289 3.2.1 Plastic Limit - Standard method
- ☑ AS1289 3.3.1 Calculation of the Plasticity Index
- ☑ AS1289 3.4.1 Linear Shrinkage - Standard method

Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	4/04/2023
Preparation	Prepared in accordance with the test method	**Date Tested**	20/04/2023

Plasticity Chart for Classification of Fine-Grained Soils

AS 1726:2017 Clause 6.1.6 (Figure 5)



Preparation		**Results**	
Method of Preparation	**Dry Sieved**	Liquid Limit / LL (%)	**28**
History of the Sample	**Air Dried**	Plastic Limit (%)	**18**
		Plasticity Index / PI (%)	**10**
		Linear Shrinkage (%)	**6.5**
		Condition upon Drying	**Linear**

Notes

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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Jacob Lloyd

26/04/2023

Date:

Macquarie Geotechnical
14 Carter St
Lidcombe NSW 2141

Uniaxial Compressive Strength

Client	Cabbone Shire Council	**Sample Source**	BH01 8.67-8.87m
Address	PO Box 17, Molong, NSW 2886	**Sample Description**	Rock Core
Project	Canomadine Creek Bridge GI	**Report #**	S85292-UCS
Job #	S23130-1	**Sample #**	S85292

Test Procedure	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	4/04/2023
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition
Sample Curing	-	**Testing Machine**	Matest 2000 kN Compression Machine

Uniaxial Compressive Strength 23 MPa

Date Tested:	17/04/2023		Moisture Content:	0.5	%
Specimen Height:	165.8	mm	Duration of Test:	688	seconds
Average Specimen Diameter:	61.0	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Mixed mode				
Other Pertinent Observations:					

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The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. This document shall not be reproduced, except in full.

Authorised Signatory:

Chris Lloyd

NATA Accredited Laboratory Number: 14874

Date: 18/04/2023

Macquarie Geotechnical
14 Carter St
Lidcombe NSW 2141

Uniaxial Compressive Strength

Client	Cabbone Shire Council	**Sample Source**	BH02 11.24-11.44m
Address	PO Box 17, Molong, NSW 2886	**Sample Description**	Rock Core
Project	Canomadine Creek Bridge GI	**Report #**	S85293-UCS
Job #	S23130-1	**Sample #**	S85293

Test Procedure	AS 4133.4.2.2 Determination of uniaxial compressive strength-Rock strength less than 50 MPa		
Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	4/04/2023
Storage History	Sealed	**Storage Environment**	Sealed at as received moisture condition
Sample Curing	-	**Testing Machine**	Matest 2000 kN Compression Machine

Uniaxial Compressive Strength 6.5 MPa

Date Tested:	17/04/2023		Moisture Content:	1.5	%
Specimen Height:	162.5	mm	Duration of Test:	639	seconds
Average Specimen Diameter:	60.8	mm	Rate of Displacement:	< 0.1	mm/min
Failure Type:	Single shear plane				
Other Pertinent Observations:					

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14 Carter St
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SOIL CLASSIFICATION REPORT

Client	Cabbone Shire	**Source**	BAD.HAM BH02 2.00-2.50m
Address		**Sample Description**	Silty CLAY
Project	Canomadine Creek Bridge GI	**Report No.**	S85294-PI
Job No.	S23130-1	**Lab No.**	S85294

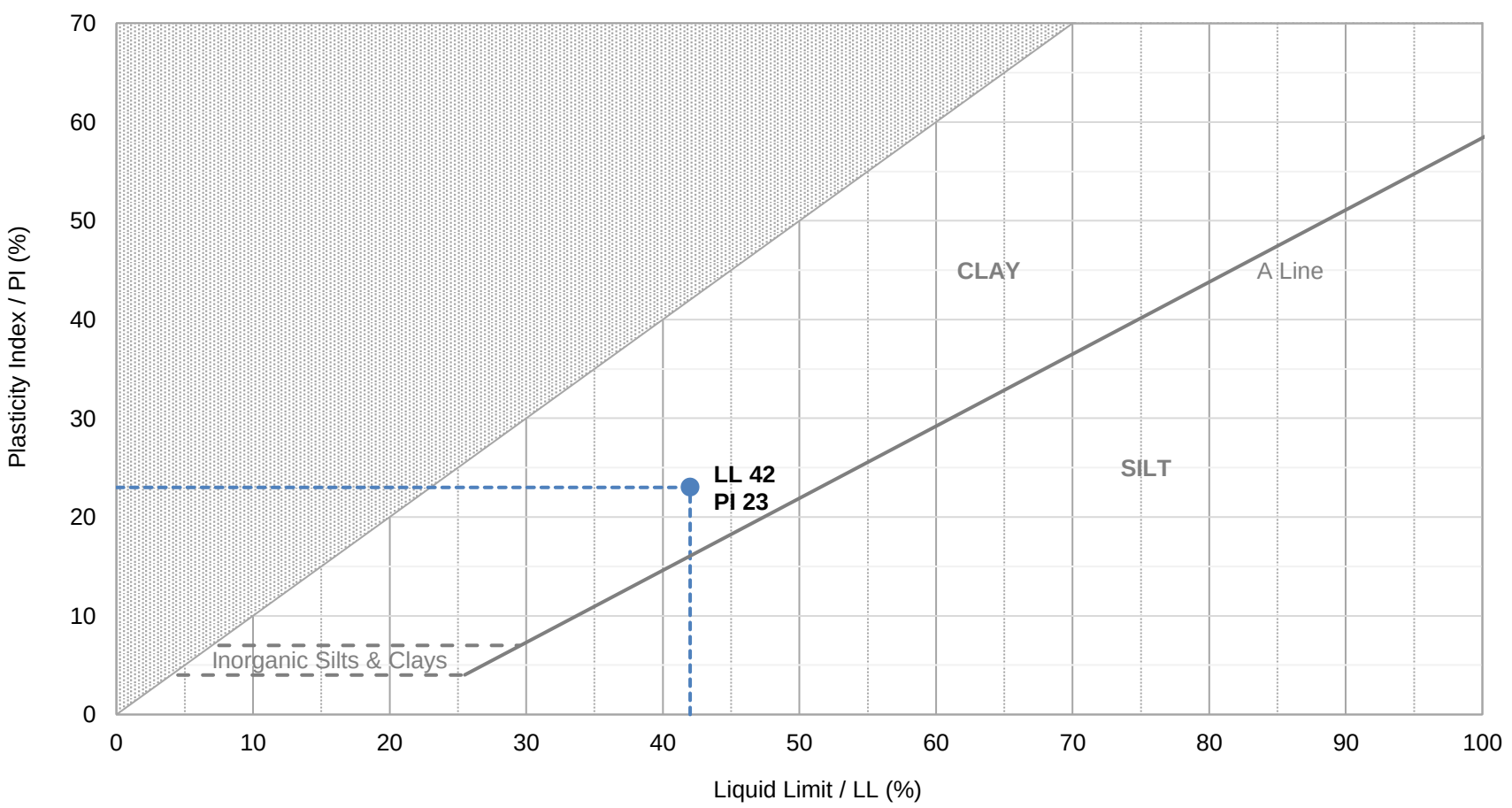
Test Procedure

- ☑ AS1289 3.1.1 Liquid Limit - Four point Casagrande method
- ☐ AS1289 3.1.2 Liquid Limit - One point Casagrande method
- ☑ AS1289 3.2.1 Plastic Limit - Standard method
- ☑ AS1289 3.3.1 Calculation of the Plasticity Index
- ☑ AS1289 3.4.1 Linear Shrinkage - Standard method

Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	4/04/2023
Preparation	Prepared in accordance with the test method	**Date Tested**	21/04/2023

Plasticity Chart for Classification of Fine-Grained Soils

AS 1726:2017 Clause 6.1.6 (Figure 5)



Preparation		Results	
Method of Preparation	**Dry Sieved**	Liquid Limit / LL (%)	**42**
History of the Sample	**Air Dried**	Plastic Limit (%)	**19**
		Plasticity Index / PI (%)	**23**
		Linear Shrinkage (%)	**11.0**
		Condition upon Drying	**Linear**

Notes

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Authorised Signatory:

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26/04/2023

Date:

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Lidcombe NSW 2141

SOIL CLASSIFICATION REPORT

Client	Cabbone Shire	**Source**	GET.MEG BH02 0.50-1.50m
Address		**Sample Description**	Silty CLAY
Project	Canomadine Creek Bridge GI	**Report No.**	S85295-PI
Job No.	S23130-1	**Lab No.**	S85295

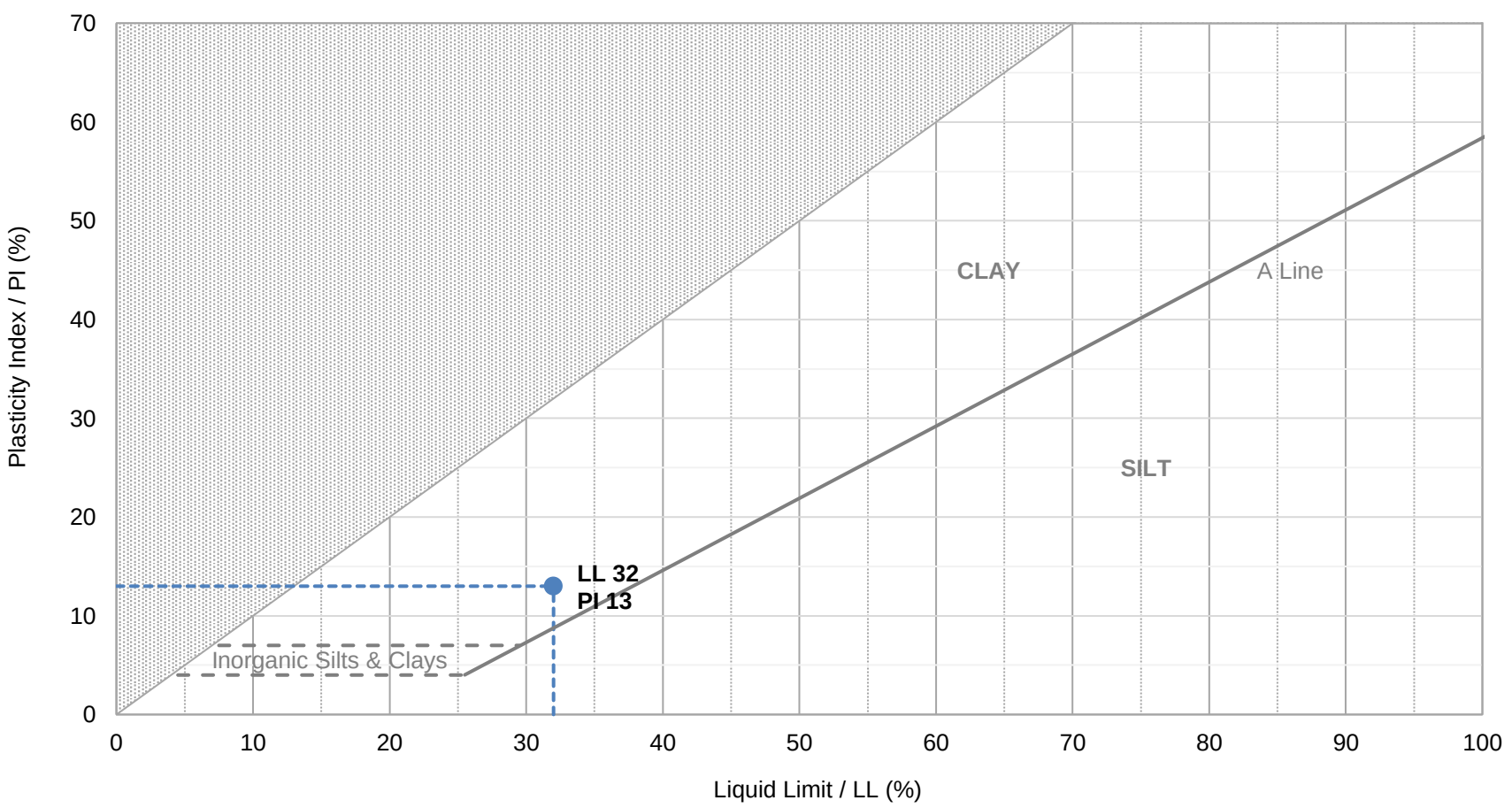
Test Procedure

- ☑ AS1289 3.1.1 Liquid Limit - Four point Casagrande method
- ☐ AS1289 3.1.2 Liquid Limit - One point Casagrande method
- ☑ AS1289 3.2.1 Plastic Limit - Standard method
- ☑ AS1289 3.3.1 Calculation of the Plasticity Index
- ☑ AS1289 3.4.1 Linear Shrinkage - Standard method

Sampling	Sampled by Client - results apply to the sample as received	**Date Sampled**	4/04/2023
Preparation	Prepared in accordance with the test method	**Date Tested**	24/04/2023

Plasticity Chart for Classification of Fine-Grained Soils

AS 1726:2017 Clause 6.1.6 (Figure 5)



Preparation		**Results**	
Method of Preparation	**Dry Sieved**	Liquid Limit / LL (%)	**32**
History of the Sample	**Air Dried**	Plastic Limit (%)	**19**
		Plasticity Index / PI (%)	**13**
		Linear Shrinkage (%)	**9.5**
		Condition upon Drying	**Linear**

Notes

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27/04/2023

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