



Douglas Partners

Geotechnics | Environment | Groundwater

Interim Report on
Geotechnical Investigation

Proposed Murwillumbah Education Campus
Murwillumbah High School, 86 Riverview Street,
Murwillumbah

Prepared for
Built (NSW) Pty Ltd

Project 203033.02
October 2021

Integrated Practical Solutions



Document History

Document details

Project No.	203033.02	Document No.	R.001.Rev0
Document title	Report on Geotechnical Investigation Proposed Murwillumbah Education Campus		
Site address	Murwillumbah High School, 86 Riverview Street, Murwillumbah		
Report prepared for	Built (NSW) Pty Ltd		
File name	203033.02.R.001.Rev0.docx		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Beau McDonald	Chris Bell	20 October 2021

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	Alex Christofides, Built (NSW) Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

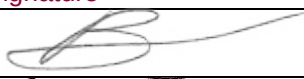
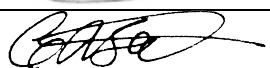
Signature	Date
Author 	20 October 2021
Reviewer 	20 October 2021

Table of Contents

	Page
1. Introduction.....	1
2. Site Description	2
3. Regional Geology.....	4
4. Field Work Methods	4
5. Field Work Results	4
6. Previous Investigations	6
6.1 Field Work.....	6
6.1.1 Field Work Results (DP, 2020)	6
6.1.2 Field Work Results (DP, 2021)	7
6.2 Laboratory Testing	8
7. Comments	9
7.1 Site Classification.....	9
7.2 Earthquake Classification	10
7.3 Excavatability	10
7.4 Re-Use of Cut Materials and Workability.....	11
7.5 Subgrade Preparation and Fill Placement or Recompaction.....	11
7.6 Batter Slopes	12
7.7 Geotechnical Retaining Wall Parameters	13
7.8 Foundations	14
7.8.1 General	14
7.8.2 High Level Footings	15
7.8.3 Piled Foundation	16
7.9 Geotechnical Pavement Design Parameters.....	18
7.10 Soil Aggressivity.....	19
8. Limitations	19
9. References	20

Appendix A:	About This Report
	Sampling Methods
	Soil and Rock Descriptions
	Symbols and Abbreviations
Appendix B:	Drawing 1 – Site and Test Location Plan

Drawing 2 – Previous Borehole Locations

Appendix C: Borehole Logs and Rock Core Photographs

Appendix D: Previous Investigation Borehole Logs

Appendix E: Laboratory Test Results

Report on Geotechnical Investigation

Proposed Murwillumbah Education Campus

Murwillumbah High School, 86 Riverview Street, Murwillumbah

1. Introduction

This interim report presents the results of a geotechnical investigation undertaken for a proposed Murwillumbah Education Campus (MEC) at Murwillumbah High School, 86 Riverview Street, Murwillumbah. The investigation was commissioned in an email dated 22 September 2021 by Alex Christofides of Built (NSW) Pty Ltd (Built) and was undertaken in accordance with Douglas Partners Pty Ltd's (DP's) proposal 203033.02.P.001.Rev01 dated 21 September 2021 as a variation under the terms and conditions of Built's "Consultancy Agreement" agreement No. 13777000B dated 6 April 2021 with changes mutually agreed upon.

It is understood the MEC project includes demolition and refurbishment of existing structures and the construction of four new educational buildings (designated Buildings 1, 2, 3 and 4) and associated carparking areas, refer Drawing 1 in Appendix B. The four structures are proposed to be between three and four levels. Client supplied information indicates that column loads up to approximately 2400 kN are anticipated. Bulk earthworks cut and fill levels are anticipated to be up to approximately 4 m depth.

DP has carried out two previous 'shallow' geotechnical investigations at this site (DP, 2020 and DP, 2021). The results and comments provided in the previous investigations are incorporated (where applicable) into this report.

The aim of the investigation was to assess the subsurface soil and groundwater conditions across the site and review the previous DP investigation reports in order to provide comment on:

- subsurface conditions, including groundwater;
- earthworks and site preparation, including comment on excavatability, material re-use, compaction and working platform requirements;
- site classification in accordance with AS 2870 (2011);
- earthquake site classification in accordance with AS 1170.4 (2007);
- indicative temporary and permanent batter slopes;
- geotechnical retaining wall design parameters;
- suitable foundation types and allowable bearing, end bearing, shaft adhesion and lateral pressures and associated settlements;
- soil and groundwater aggressivity against buried steel and concrete; and
- geotechnical pavement and slab-on-ground design parameters.

At the time of preparation of this interim report, due to time constraints, all of the proposed boreholes were not completed; once field work is completed, at a later date, a final report will be prepared.

The investigation included the drilling of seven boreholes and review of the previous DP investigations (DP, 2020 and DP, 2021). The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

This report must be read in conjunction with the attached notes “About this Report” and any other attachments and must be kept in its entirety without the separation of individual pages or sections.

2. Site Description

Murwillumbah High School (MHS) is bound by: Riverview Street to the north west; High School Lane and residential structures to the north; grassland/farmland to the south west and south; and sports fields to the east (refer Drawing 1 in Appendix B). The borehole locations were generally located near existing school structures and comprised: a carpark area and existing school buildings to the north; a sports field in the south; farmland and areas of well-maintained grass to the west. At the time of investigation, the overall site topography sloped downward from west to east.

Figures 1 to 3 indicate typical site conditions encountered at the time of investigation.



Figure 1: Typical site conditions during investigation facing south near Bore 105.



Figure 2: Typical site conditions during investigation looking west at drill rig set up at Bore 103.



Figure 3: Typical site conditions during investigation looking west at drill rig set up at Bore 105.

3. Regional Geology

Reference to the Geological Survey of New South Wales, Tweed Heads Sheet, 1:250 000 scale indicated the site is located within Neranleigh-Fernvale beds typically comprising *'feldspathic and lithic meta-arenite, metasiltstone and conglomerate proximal turbidites, with structurally intercalated or stratigraphically underlying chert, jasper and basic metavolcanics'*.

The natural subsurface conditions encountered during the field work (refer Section 5) are in general agreement with the above published geology and previous DP investigations (DP, 2020 and DP, 2021).

4. Field Work Methods

The investigation comprised the drilling and sampling of seven boreholes (designated Bores 100, 101, 103 to 105, 108 and 109), using either a large truck mounted drilling rig or track mounted drilling rig utilising solid flight auger, mud rotary and NMLC rock coring methods. The boreholes were drilled to depths of between 14.0 m and 30.25 m. Standard penetration tests (SPTs) were generally carried out at 1.5 m or 3.0 m depth intervals during drilling. NMLC coring was carried out when suitable rock was encountered in the boreholes. Strata identification was carried out through observation and tactile assessment of auger cuttings, recovered SPT samples and rock core. On completion of drilling, the boreholes were backfilled using drilling spoil and Bore 109 was sealed with coldmix asphalt.

The UTM coordinates at the borehole locations were determined using a hand held GPS unit (accurate to approximately 5 m), and the ground surface levels were interpolated from the client supplied survey and are recorded on the attached borehole logs in Appendix C. The approximate borehole locations are indicated on Drawing 1 in Appendix B.

All field work was supervised by a DP geotechnical engineer who logged the boreholes and collected samples for visual and tactile assessment.

5. Field Work Results

The subsurface conditions encountered in the boreholes are described in detail on the borehole logs in Appendix C and are summarised in Table 1.

Table 1: Summary of Subsurface Conditions

Bore	Strata/Depth Range (m) ⁽ⁱ⁾					
	Topsoil/Fill	Residual Clays			Metasiltstone	
		Stiff	Very Stiff	Hard	Very low and low strength	Medium strength (or stronger)
100	0.0 – 0.15	0.15 – 4.5	4.5 – 7.0	–	7.0 – 10.5	10.5 – 14.0 ⁽ⁱⁱ⁾

Bore	Strata/Depth Range (m) ⁽ⁱ⁾					
	Topsoil/Fill	Residual Clays			Metasiltstone	
		Stiff	Very Stiff	Hard	Very low and low strength	Medium strength (or stronger)
101	0.0 – 0.3	0.3 – 6.0	6.0 – 9.0	9.0 – 12.2	12.2 – 15.4	15.4 – 18.86 ⁽ⁱⁱ⁾
103	0.0 – 0.2	0.2 – 2.7	2.7 – 8.9	8.9 – 16.0	16.0 – 19.36 ⁽ⁱⁱⁱ⁾	–
104	0.0 – 0.1	0.1 – 3.0	3.0 – 9.0	9.0 – 16.5 21.24 – 24.5	16.5 – 21.24 24.5 – 26.0	26.0 – 27.7 ⁽ⁱⁱ⁾
105	0.0 – 0.1	0.1 – 1.5 15.0 – 19.5	1.5 – 7.5 12.5 – 15.0	7.5 – 12.5 19.5 – 23.7	23.7 – 24.7	24.7 – 28.0 ⁽ⁱⁱ⁾
108	0.0 – 0.35 ^(iv)	0.35 – 1.5	1.5 – 6.2	6.2 – 19.0	19.0 – 22.5	22.5 – 25.8 ⁽ⁱⁱ⁾
109	0.0 – 0.1 ^(v)	0.1 – 2.0 ^(vi) 2.0 – 5.5	5.5 – 14.5	14.5 – 20.5	20.5 – 26.5	26.5 – 30.35 ⁽ⁱⁱ⁾

- Notes
- (i) All depths were measured from existing site level at the time of the investigation.
 - (ii) Limit of investigation.
 - (iii) Limit of investigation due to time constraints.
 - (iv) Comprising existing pavement (approximately 100 mm asphaltic concrete over 250 m sandy gravel fill).
 - (v) Overlain with 100 mm gravel fill;.
 - (vi) Firm residual clay strength consistency.

In the absence of compaction control documentation to confirm the gravel fill in Bore 108 and 109 was placed in accordance with AS 3798 (2007), the fill should be deemed 'uncontrolled' fill.

Free groundwater was encountered at 3.8 m depth in Bore 103 while auger drilling and was not encountered during auger drilling (i.e. prior the introduction of water for mud rotary drilling) in the remaining boreholes. It should be noted that groundwater depths and ground moisture conditions are affected by climatic conditions, soil permeability, surface and subsurface drainage and human influences and will therefore vary with time. Seepage may also occur along the fill/natural and soil/weathered rock interface during and after periods of wet weather. Further investigation comprising the installation of groundwater monitoring wells will be required to confirm on site groundwater levels, if required.

6. Previous Investigations

6.1 Field Work

The field work for the previous investigations (DP, 2020 and DP, 2021) comprised 19 boreholes across the MHS site to depths of between 1.8 m and 5.95 m. The subsurface conditions encountered are detailed in the attached borehole logs in Appendix D and are summarised in Sections 6.1.1 and 6.1.2. The approximate borehole locations are indicated on Drawing 2 in Appendix B.

It should be noted that the nomenclature used for the boreholes carried out during the previous DP investigation include a year subscript for reference throughout this report.

It should also be noted, that groundwater conditions vary as mentioned in Section 5 above.

6.1.1 Field Work Results (DP, 2020)

Table 2: Summary of Subsurface Conditions during DP (2020)

Bore	Strata/Depth Range (m) ⁽ⁱ⁾						
	Fill	Silty Sand - loose	Silty Clay/Sandy Clay				Metasiltstone – very low strength (or stronger)
			Firm (locally soft to firm)	Stiff	Very stiff	Hard	
1 ₍₂₀₎	0.0 – 0.1 ⁽ⁱⁱⁱ⁾	–	–	0.1 – 5.0 ⁽ⁱⁱ⁾	–	–	–
2 ₍₂₀₎	0.0 – 1.0	–	1.0 – 6.0	6.0 – 6.5 ⁽ⁱⁱ⁾	–	–	–
3 ₍₂₀₎	0.0 – 0.5	–	0.5 – 2.3	2.3 – 5.0 ⁽ⁱⁱ⁾	–	–	–
4 ₍₂₀₎	–	0.0 – 0.2	0.2 – 2.5	2.5 – 5.0 ⁽ⁱⁱ⁾	–	–	–
5 ₍₂₀₎	0.0 – 0.1	–	–	0.1 – 1.3	–	1.3 – 5.0 ⁽ⁱⁱ⁾	–
6 ₍₂₀₎	0.0 – 1.3	–	–	–	1.3 – 2.4	–	2.4 – 2.9 ⁽ⁱⁱ⁾
7 ₍₂₀₎	0.0 – 0.9	–	0.9 – 4.0	–	4.0 – 5.0 ⁽ⁱⁱ⁾	–	–
8 ₍₂₀₎	0.0 – 0.9	0.9 – 1.1	1.1 – 1.3	1.3 – 2.4	2.4 – 2.8 ⁽ⁱⁱ⁾	–	–
9 ₍₂₀₎	0.0 – 1.8	–	1.8 – 2.2	2.2 – 4.1	–	4.1 – 5.0 ⁽ⁱⁱ⁾	–
10 ₍₂₀₎	0.0 – 0.8	–	–	–	–	0.8 – 1.0 ^(iv)	1.0 – 2.93 ⁽ⁱⁱ⁾
11 ₍₂₀₎	0.0 – 0.7	–	–	0.7 – 1.0	1.0 – 1.8 ⁽ⁱⁱ⁾	–	–
12 ₍₂₀₎	0.0 – 0.4	–	–	–	0.4 – 1.9 ⁽ⁱⁱ⁾	–	–

Notes (i) All depths were measured from existing site level at the time of the investigation.

(ii) Limit of investigation

(iii) Topsoil

(iv) Gravelly Clay

The fill encountered generally comprised silty/sandy clay and silty/gravelly sand. It is probable that the fill encountered adjacent to school structures was placed under 'controlled' conditions as part of the building platform construction. However, in the absence of documentation to confirm the fill was

engineered and placed under 'controlled' conditions and meets the requirements of structural fill as defined in AS 3798 (2007), it must be deemed 'uncontrolled'.

Free groundwater was encountered during auger drilling within Bore 7 during at 3.7 m depth, and seepage was observed within Bore 2 at 0.9 m depth. No groundwater was encountered in the remaining boreholes.

6.1.2 Field Work Results (DP, 2021)

Table 3: Summary of Subsurface Conditions during DP (2021)

Bore	Strata/Depth Range (m) ⁽ⁱ⁾							
	Topsoil	Fill	Silty Clay					Metasiltstone – very low strength
			Soft	Firm to Stiff	Stiff	Very Stiff	Hard	
1 ₍₂₁₎	0.0 – 0.05	–	–	–	0.05 – 0.5	0.5 – 1.0 ⁽ⁱⁱⁱ⁾	–	–
2 ₍₂₁₎	–	0.0 – 0.2	–	0.2 – 1.3	–	–	1.3 – 3.6	3.6 – 4.14 ⁽ⁱⁱ⁾
3 ₍₂₁₎	0.0 – 0.05	–	–	–	0.05 – 1.8	1.8 – 4.45 ⁽ⁱⁱ⁾	–	–
4 ₍₂₁₎	0.0 – 0.1 ^(iv)	–	–	–	0.01 – 4.45 ⁽ⁱⁱ⁾	–	–	–
5 ₍₂₁₎	0.0 – 0.1	–	–	0.1 – 1.6	1.6 – 2.0 ⁽ⁱⁱ⁾	–	–	–
6 ₍₂₁₎	0.0 – 0.1 ^(iv)	0.1 – 1.9	–	1.9 – 2.2	2.2 – 3.5	3.5 – 5.95 ⁽ⁱⁱ⁾	–	–
7 ₍₂₁₎	0.0 – 0.15 ^(iv)	–	0.15 – 1.2	1.2 – 1.5	1.5 – 1.7	1.7 – 2.8	2.8 – 4.28	–

- Notes (i) All depths were measured from existing site level at the time of the investigation.
 (ii) Limit of investigation.
 (iii) Push tube refusal. Limit of investigation.
 (iv) Topsoil Fill.

The encountered fill comprised gravelly sand in Bore 2₍₂₁₎, and silty clay in Bore 6₍₂₁₎. The fill appeared moderately compacted. It is probable that the fill encountered adjacent to the school structures was placed under 'controlled' conditions as part of the building platform construction. However, in the absence of documentation to confirm the fill was engineered and placed under 'controlled' conditions and meets the requirements of structural fill as defined in AS 3798 (2007), it must be deemed 'uncontrolled'.

Free groundwater was not encountered during the investigation.

6.2 Laboratory Testing

Geotechnical laboratory testing comprised particle size distribution (PSD), Atterberg limits and linear shrinkage (AL/LS), soil aggressivity and electrical conductivity tests. California bearing ratio (CBR) tests were carried out on two bulk samples compacted to approximately 100% standard dry density ratio at the estimated optimum moisture content (OMC) for standard compaction, and soaked for four days under a surcharge loading of 4.5 kg prior to penetration.

The detailed laboratory test report sheets are attached in Appendix E, and the results are summarised in Tables 4 to 6. As mentioned above, the borehole nomenclature has been modified for this report and care should be taken when reading the previous laboratory test results, borehole logs and borehole locations.

Table 4: Results of Atterberg Limits, Linear Shrinkage, Particle Size Distribution and Soaked CBR Testing (DP, 2020 and 2021)

Bore	Depth (m)	W _F (%)	W _L (%)	PI (%)	LS (%)	Clay/Silt (%)	Sand (%)	Gravel (%)	SMDD (t/m ³)	OMC (%)	Swell (%)	CBR (%)
2	0.1 – 0.8	17.7	31.0	13.0	7.5	78	19	3	1.69	18.0	0.5	11
3	0.5 – 1.0	10.5	22.0	5.0	5.0	74	21	5	1.88	12.5	0.5	9
7	1.0 – 1.2	–	79.0	55.0	21.5	92	8	0	–	–	–	–
11	0.8 – 1.0	–	63.0	37.0	14.5	91	9	0	–	–	–	–
3 ₍₂₁₎	0.1 – 0.7	20.3	45	19	13.5	55	44	1	1.61	22.0	0.5	9.0
6 ₍₂₁₎	0.1 – 0.8	17.7	41	18	10.5	68	27	5	1.63	22.0	0.5	5.0

Legend: W_F – field moisture content W_L – liquid limit
 W_P – plastic limit PI – plasticity index
 LS – linear shrinkage SMDD – standard maximum dry density
 OMC – optimum moisture content for Standard compaction
 CBR – California bearing ratio at approximately 100% SMDD after four day soak
 “–” – not tested

Table 5: Summary of Soil Aggressivity and Electrical Conductivity Test Results (DP, 2020)

Bore	Depth (m)	Material Description	pH	Moisture Content (%)	Sulfate (mg/kg)	Chloride ^(*) (mg/kg)	Electrical Conductivity (1:5) (μS/cm)
1	1.8 – 2.0	Silty Clay	4.9	24.4	20	10	16
2	0.1 – 0.3	Fill – Silty Clay	5.2	21.3	30	10	19
2	1.1 – 1.2	Silty Clay	5.4	24.0	20	<10	11
8	0.3 – 0.4	Fill – Silty Sand	6.9	7.7	<10	<10	13

Notes: * Sulfate as SO₄²⁻

Table 6: Summary of Soil Aggressivity and Resistivity Test Results (DP, 2021)

Bore	Depth (m)	Material Description	pH	Moisture Content (%)	Sulfate (mg/kg)	Chloride ⁽ⁱ⁾ (mg/kg)	Resistivity ⁽ⁱⁱ⁾ (ohm.cm)
1 ₍₂₁₎	0.5	Silty Clay	5.2	38.5	50	<10	50,000
4 ₍₂₁₎	0.2	Silty Clay	4.7	31.2	30	<10	55,600
4 ₍₂₁₎	1.3	Silty Clay	4.8	35.4	50	10	41,700
6 ₍₂₁₎	0.3	Sandy Fill	5.2	36.3	40	<10	58,800
6 ₍₂₁₎	1.9	Silty Clay	5.4	39.2	<10	<10	66,700
7 ₍₂₁₎	0.1	Silty Clay	7.1	34.5	<10	<10	43,500
7 ₍₂₁₎	0.5	Silty Clay	7.1	29.5	<10	<10	40,000

 Notes: (i) Sulfate as SO_4^{2-} (ii) At 25°C

7. Comments

7.1 Site Classification

Site classification of foundation soil reactivity in accordance with AS 2870 (2011) strictly only applies to residential buildings up to two-storeys and to other buildings of similar size, loading and flexibility. Such classification provides an indication of the propensity of the ground surface to move with seasonal variation in moisture and has been used (along with general climatic zoning and general experience) to assess the potential depth of seasonal cracking.

In strict accordance with AS 2870 (2011), due to the presence of 'uncontrolled' fill and near surface soils with a bearing pressure less than 100 kPa, the site (as a whole) in its present state would be given a 'Class P' classification and will require design by engineering principles. Parts of the site, however, have shallow fill and soil with adequate allowable bearing pressure and individual building pads in those locations could be reclassified accordingly. Cut and fill earthworks will also potentially change the classification. The below is therefore provided for preliminary information purposes only.

To provide an indication of the reactive nature of the existing site soils, the results of the plasticity tests were compared to an in-house database of plasticity and shrink-swell index (I_{ss}) values to infer a presumptive I_{ss} values of 2% per ΔpF for the clayey fill between 1.0% and 5.5% per ΔpF for the residual clay samples tested. These presumptive values were input into DP's in-house program REACTIVE, to calculate the characteristic surface movement (y_s) values in general accordance with AS 2870. AS 2870 provides recommended values of change in suction (Δu) depth of suction (H_s) for major and regional centres throughout Australia, but not Murwillumbah. Based on published data by Chan and Mostyn (2009) relating climatic conditions to suction, a value of 1.2 pF was adopted for Δu and 1.5 m for H_s in the REACTIVE calculations. This is based on a 'alpine/wet coastal' climatic zone. A cracking depth of 0.75 m was used in the analysis, based on 0.5 H_s .

If it weren't for the existing 'Class P' classification, the results of the analysis for the existing site soils indicate the potential for site classifications ranging from 'Class M' to 'Class H2' across the site. Where fill is proposed, there is a potential for a more severe classification, subject to the depth and

reactivity of the proposed fill material. It is noted that the above estimate is based on a full depth cohesive profile, and the y_s values may be less where profile includes granular soils (e.g. sand or gravel).

As a preliminary guide only, based on the proposed building footprints indicated in Drawing 1 and preliminary bulk earthworks plans, the following preliminary y_s values have been estimated giving a range of site classifications for each of the building footprints as below:

- Buildings 1 and 2 – 30 mm to 100 mm, consistent with a 'Class M' to 'Class E' classification, considering placement of up to 4 m depth of site won clayey fill;
- Building 3 – 60 mm to 90 mm, consistent with a 'Class H2' to 'Class E' classification, considering placement of up to 1 m depth of site won clayey fill; and
- Building 4 – 60 mm to 70 mm, consistent with a 'Class H2' to 'Class E' classification, considering placement of up to 3 m depth of clayey fill.

The above preliminary y_s values can generally be reduced where site won clayey fill material is replaced with inert granular fill. If consideration is given to importation of inert fill material, then DP should be contacted for further assessment and advice.

If 'abnormal' soil moisture conditions are experienced at the site, the site would be classified as 'Class P' which would require more extensive foundation works to avoid adverse foundation performance. Abnormal soil moisture conditions are defined in AS 2870 (Clause 1.3.3).

The above results indicate good practice in design, construction and management of the site will be required to accommodate the potential site movements. In particular, good surface and subsurface drainage will be required, along with limits on landscaping and adequate moisture preparations. CSIRO (2003) on site management for homeowners provides useful advice for this site.

Final site classification will be a function of the building pad geometry and reactivity of the material comprising the building pad. The above indicative y_s values are intended as a guide and a final classification assessment will be required following completion of bulk earthworks at the site.

It is further noted that the proposed bulk earthworks excavations up to 4 m depth are below the depth of seasonal moisture change, and site classification will be of particular importance to high level footings founded close to existing ground surface levels.

7.2 Earthquake Classification

With reference to AS 1170.4 (2007), Murwillumbah is located in an area where the Hazard Factor (Z) is indicated to be 0.09. Based on the results of the site investigation, it is recommended that a site sub-soil classification of "Class Ce – Shallow Soil Site" be adopted, in accordance with the definitions presented in Section 4.2 – Class Definitions.

7.3 Excavatability

Based on the conditions encountered within the depth of the boreholes, it is assessed that bulk excavation within the potential excavation depths (i.e. up to 4 m depth) may be undertaken by small sized excavation plant such as 12 to 20 tonne hydraulic excavators. Larger plant may be used for higher production rates. Excavation of any very low strength (or stronger) metasiltstone would require larger plant, fitted with ripping tines and rock breakers for confined and detailed excavation.

It should be noted that the above excavatability estimates are based on materials encountered at the test locations only and that conditions may prove more difficult (or easier) for excavatability beyond these test locations.

Rock breakers may also be required for removal of buried concrete, if encountered.

7.4 Re-Use of Cut Materials and Workability

Based on the results of the boreholes, it is expected that the material won from excavation will predominantly comprise topsoil, granular and clayey fill and residual clays.

It is expected that the excavated materials (except any topsoil) could all be re-used as structural fill. Such re-use is contingent upon the fill being free of any unsuitable and organically rich materials, particle size distribution being controlled along with moisture content, and upon minimum placement and compaction requirements being met, as indicated in Section 7.5. Any topsoil should be stripped and stockpiled for subsequent reuse.

Care should be taken not to over-wet any clayey soils which can lead to problems associated with trafficability and workability. Clay soils should not be over-compacted (i.e. not more than 102% standard) or placed dry of optimum, as this can lead to future swelling and softening under changes to moisture content or inundation from water. Clay subgrades should be promptly overlaid with 150 mm of select granular fill (minimum CBR 15%) to reduce potential wetting and trafficability problems.

If clayey fill is proposed to be used in fill platforms beneath any structures, it is recommended that high plasticity cohesive material be placed at depth and well graded, granular material (if available) be placed close to founding levels. This will reduce the effects of seasonal moisture change and foundation soil reactivity and will improve surface trafficability.

The existing fill and clay materials on site are expected to be untrafficable to tyred vehicles during and after periods of rainfall or other increases in subgrade moisture content, and hence, the use of tracked plant may be preferable. Soils which become wet will need to be allowed to dry out or be replaced.

7.5 Subgrade Preparation and Fill Placement or Recomposition

Where upper level footings are to be used and on-ground slabs are adopted, it is recommended that the following site preparation be carried out for structural foundations and pavement subgrades:

- Removal of any deleterious, 'uncontrolled' fill, topsoil, wet or highly compressible material, or material rich in organics or root matter. Localised 'uncontrolled' fill was encountered up to 1.9 m depth on the site. If the fill or any firm (or softer) clays are left in place, then suspension of footings and slabs on pile foundations is recommended.

- Test roll the subgrade beneath any proposed fill or structure, in order to detect the presence of any further soft or loose zones, which should be ripped, dried and recompacted, or excavated and replaced with compacted select fill as appropriate. Test rolling should be carried out with a smooth drum roller with a minimum static weight of 12 tonne. The tined natural foundation soil should be compacted to a minimum dry density ratio of 98% Standard.
- Assess moisture content of any underlying clay subgrade, which should be adjusted to within 2% of OMC, where OMC is the optimum moisture content at standard compaction.
- Place approved fill in layers not exceeding 300 mm loose thickness, with each layer compacted to a minimum dry density ratio of 98% standard. It is recommended that the upper 1 m depth of fill for any fill which is required to support building footings be compacted to a minimum dry density ratio of 100% Standard compaction; this higher compaction should extend at least 1 m distance beyond the proposed structure footprint.
- Control compaction of clays as over-compacted clays (i.e. minimum dry density ratio of >102% standard) may swell significantly and lose strength if they are wetted after compaction, potentially changing the site classification and reducing subgrade strengths assumed in design, and therefore should be avoided.
- Seal or cover any compacted clay fill at or close to footing formation level as soon as practicable, to reduce the opportunity for occurrence of desiccation and cracking (refer Section 7.4 above).
- Undertake 'Level 1' inspection and testing as detailed in AS 3798 (2007) where new fill is required to support structures or pavements.

The above procedures will require geotechnical inspection and testing services to be employed during construction.

7.6 Batter Slopes

Unsurcharged batter slopes cut up to 3 m high in the profiles encountered during the field work, may be preliminarily designed for temporary and long term conditions as indicated in Table 7.

Table 7: Indicative Unsurcharged Batter Slopes

Material	Safe Batter Slope (H:V)	
	Short Term	Long Term ⁽ⁱⁱ⁾
'Uncontrolled' fill and localised soft and firm clay	2:1	3:1
'Controlled' fill ⁽ⁱ⁾ and stiff (or stronger) clays	1:1	2:1

Notes:

⁽ⁱ⁾ Assuming controlled fill is undertaken in accordance with the recommendations of this report.

⁽ⁱⁱ⁾ Long term slopes in soil would require surface protection to reduce the risk of erosion potential. Steeper values may be possible, subject to detailed stability analysis.

Batter slopes may need to be flattened to 3H:1V or less, to allow vehicular access for maintenance of slopes etc. Additionally, as fine grained soils are prevalent at the site, it is recommended that all batters incorporate drainage at the crest and toe, and be covered with topsoil and vegetation to provide long term erosion protection.

Temporary excavations up to 1 m deep may remain near vertical for short periods of time (i.e. up to one day), provided moisture conditions are favourable at the time of construction and provided there are no loads, services, structures or traffic located within a distance from the crest of the batter equal to the slope height.

Steeper batters may be possible with the inclusion of passive nails/dowels or soil anchors and surface protection but would be subject to detailed stability assessment.

The above temporary batter slopes are suggested with respect to slope stability only, and do not allow for lateral stress relaxation which may result in movement of nearby inground services. If such services are settlement-sensitive and are located near the crest of the cut face, then the excavation may have to be positively supported.

7.7 Geotechnical Retaining Wall Parameters

It is recommended that all retaining structures be engineer-designed and constructed to adhere to the following load patterns and procedures:

- 'Active' conditions (K_a) should be adopted for soil lateral pressures where rotational movement or flexing of the top of the wall is permitted or possible.
- 'At rest' conditions (K_o) should be adopted for soil lateral pressures where rotational movement or flexing of the top of the wall is not possible or not desirable, and hence 'active' conditions (K_a) cannot develop.

Depending upon the material to be retained behind the wall, for single propped or cantilevered walls up to 3 m in height the lateral pressure coefficients given in Table 8 are recommended for design using triangular pressure distributions. These factors are ultimate and should be appropriately factored. For higher walls detailed analysis should be undertaken using soil strength parameters; DP should be contacted for advice if these are required.

Table 8: Earth Pressure Coefficients (non-sloping backfill/ground) for Single Propped or Cantilevered Walls up to 3 m High

Material	Unit Weight (kN/m ³)	K_o	K_a	K_p
'Uncontrolled' fill and localised soft and firm clay	20	0.65	0.50	2.0
'Controlled' Fill ⁽ⁱ⁾ and stiff (or stronger) clay	20	0.55	0.40	2.5
Metasiltstone	22	0.45	0.30	3.0

Note (i) Assuming controlled fill is placed under Level 1 inspection and testing by DP in accordance with the recommendations of this report and AS 3798 (2007).

For design of retaining walls:

- Ignore passive resistance (K_p) at the toe in the zone where future disturbance (e.g. service trenches) could occur.
- Due allowance should be made for surcharge loads (over and above the lateral earth pressure coefficients presented above) where the finished ground level above retaining walls is above horizontal and where additional loading is likely to be applied from existing or future upslope structures, or from traffic.
- Allowance should be made for wall loading caused by flooding or inundation, as appropriate. Such flooding may penetrate up to 0.75 m depth (i.e. approximately $0.5H_s$ as defined in AS 2870) into cracks behind the wall and will result in a triangular distribution of load near the top of the wall equal to overall depth of water times density of water.
- Drainage material behind the wall (as above) should be installed for the full height of the wall, for a width of at least 0.3 m, be free draining and granular, and have a perforated or slotted drainage pipe at the heel of the wall and should be connected to subfloor drainage and directed to localised sumps for pumping removal as required.
- It is recommended that provision be made in design for build-up of hydrostatic pressure behind the wall, as described above, unless full wall height drainage is installed behind the wall.
- High level footings for retaining walls can be designed using the allowable bearing pressures presented in Section 7.8.2 reduced by one third to allow for the effects lateral loads.

Reactive clay has the potential to exert significantly higher pressures than those indicated in Table 8 when swelling and should be excluded from the zone behind the wall extending up from the heel of the wall at 1H:1V. Material in this zone should only comprise low plasticity materials. Over-compacted dry clay fill (ie dry density ratio >102% standard at moisture more than 2% below OMC) can experience swell and should be avoided in this zone.

It is recommended that a factor of safety of 2.0 be adopted for overturning and sliding stability, and 1.5 for global stability.

For limit state design methods, the ultimate parameters provided in Table 8 and above will need to be factored in accordance with AS 4678 (2002). Guidance on the selection of material strength partial factors is provided in Section 5.2 of AS 4678 (2002) and is dependent upon the nature and state of the natural in-situ soil/rock or fill material.

7.8 Foundations

7.8.1 General

Based on the structural loads, high level footings are not considered suitable for the anticipated column loads associated with the proposed three to four level buildings, however, may be used for local smaller loads or structures. High level footings must found below any existing 'uncontrolled' fill and 'soft' strata (that extended up to about 2 m in part of the site), otherwise the use of deeper piled footings (refer Section 7.8.3) would be required. Where 'uncontrolled' fill or 'soft' strata are present, slabs should be fully suspended on footings founded below these materials.

Piled footings would also be required where high level footings provide insufficient bearing pressure and/or unacceptable settlements. Where footings are founded in materials of differing compressibility, there is potential for differential settlement across the structure, which must be accounted for in design through careful articulation and choice of construction materials for use in the structures. If the structures are susceptible to differential movements, then it is recommended all footings be founded in the same material, whether through the use of piled footings, or a combination of high level footings and piles and over excavation and use of mass concrete blinding to founding level.

It is essential that foundation excavations be inspected by experienced DP personnel to ensure the design parameters adopted are suitable for ground conditions and to ensure that there is no soft or loose material remaining at the base of the excavations. Ground conditions can vary, and it is essential that adequate provision be made throughout the project to vary foundations to suit differing ground conditions.

7.8.2 High Level Footings

High level pad footings up to 2 m wide and strip footings up to 1 m wide may be designed using the allowable values indicated in Table 9.

Over excavation and replacement with mass concrete backfill to footing founding level could be adopted where the existing 'uncontrolled' fill or unsuitable strata is deep, where practical, otherwise piled foundations are recommended.

Structural footing and slab design should consider the final lot classification which needs to be assessed following bulk earthworks and include appropriate stiffening for the classifications.

Table 9: Maximum Allowable High Level Footing Design Pressures

Material Description	Allowable Bearing Pressure (kPa)
'Uncontrolled' fill and soft and firm clay	Not recommended
'Controlled' fill ⁽ⁱ⁾ and stiff clay	100
Very stiff clay	200
Hard clay	400
Very low strength Metasiltstone	600

Note (i) Assuming 'controlled' fill is placed under 'Level 1' inspection and testing by DP in accordance with the recommendations of this report AS 3798 and good practice guidelines.

For high level footings sized and loaded as above, it is considered that settlements under such applied loading will be less than 1% to 2% of footing width. Where footings wider than 2 m are adopted, specific assessment based on actual applied pressure and ground conditions at that location is recommended to assess specific settlement characteristics.

In addition to the above estimated settlement, the long term settlement of any bulk fill and underlying soft and firm soils if present (as discussed earlier in this report) must be added if filling is proposed. Where bulk fill is placed under 'controlled' conditions, there is potential for 'creep' of the fill material as the fill settles over time under self-weight. Such creep settlement is expected to be in the order of approximately 0.5% to 1% of the fill thickness over a period of 10 to 20 years for well compacted clay fill and less for granular fill. DP should be contacted for further advice/assessment, if required.

7.8.3 Piled Foundation

7.8.3.1 General

Where high level footings are not suitable, options for piled foundations could comprise bored, CFA or driven piles. Bored piles may require the use of temporary or sacrificial liners and pumps to control water inflow with a cleaning bucket to ensure base cleanliness prior to concreting where groundwater is present. Further uncased bored piles may be prone to collapse in granular material (encountered in thin bands during the investigation) and sacrificial or temporary liners may be required. Ground vibrations and noise associated with the installation of driven piles will need to be considered. CFA grout injected piles are essentially vibration free but more costly to install but could be an option if bored or driven piling options are unsuitable.

It is recommended that advice be sought from an experienced piling contractor regarding the choice of pile installation and to assess the issues of potential vibration damage. It would also be prudent to undertake a building condition survey (i.e. a dilapidation report) prior to undertaking any works at the site.

Pile capacities and suitable pile types should be confirmed by prospective piling contractors based on their particular equipment. Experience indicates that settlements of well constructed piles (loaded as per below) are unlikely to exceed the order of 1% of the pile diameter.

Groundwater inflow into excavations may occur if the work is preceded by significant wet weather, and piling contractors should include a provision for the use of temporary steel liners, drilling muds, cleaning buckets and to remove groundwater, if required.

It is essential that foundation excavations (where applicable) be inspected by experienced geotechnical personnel to ensure the design parameters adopted are suitable for the ground conditions and to ensure that there is no soft or loose material remaining at the base of the excavations or smear on the side walls. Ground conditions can vary, and it is essential that adequate provision be made throughout the project to vary foundations to suit differing ground conditions.

7.8.3.2 Bored and CFA Piles

Bored and CFA piles founding at least two pile diameters into the relevant founding strata can be designed using the allowable parameters given in Table 10.

Table 10: Allowable Bored and CFA Pile Design Pressures

Material Description	Allowable Shaft Adhesion (kPa)⁽ⁱ⁾⁽ⁱⁱ⁾	Allowable End Bearing (kPa)
-----------------------------	---	--

Material Description	Allowable Shaft Adhesion (kPa) ⁽ⁱ⁾⁽ⁱⁱ⁾	Allowable End Bearing (kPa)
'Uncontrolled' and 'Controlled' fill and soft and firm clays	Not Recommended	
Stiff clays	15	170
Very stiff clays	20	340
Hard clays	20	700
Very low and low strength Metasiltstone	75	800
Medium strength (or stronger) Metasiltstone	350	3500

- Notes (i) It is recommended that the upper 0.75 m or 1.5 times pile diameter or depth of "uncontrolled" fill (whichever is greater), be ignored in pile shaft adhesion calculations due to the effects of load development and seasonal moisture variation.
- (ii) Ignore if temporary or sacrificial liners are used during construction.

For limit state design, the above allowable bearing pressures should be multiplied by the adopted factor of safety of 2.5 to equate to ultimate values. A geotechnical strength reduction factor (ϕ_g) of 0.45 is recommended for limit state design of piles in accordance with AS 2159 (2009). This is based on the data presented in this report, the method of soil strength assessment used in this investigation and after assessing the overall design average risk rating (ARR) for the site, design and installation risk factors anticipated. Higher values of ϕ_g may be applied if additional investigation is carried out at the site or if selected piles are to be subjected to confirmatory load testing.

Pile capacities and suitable pile types should be confirmed by prospective piling contractors based on their particular equipment. Experience indicates that settlements of well constructed piles (loaded as per below) are unlikely to exceed the order of 1% of the pile diameter.

Groundwater inflow into excavations may occur if the work is preceded by significant wet weather, and piling contractors should include a provision for the use of temporary steel liners, drilling muds, cleaning buckets and to remove groundwater, if required.

7.8.3.3 Driven Piles

Driven precast concrete piles would need to be driven to found in the hard clays or preferably driven to refusal in the underlying weathered rock. Piles driven to refusal in weathered rock would be expected to achieve their full structural capacity; piles driven to found in the hard clays could be preliminarily designed using the parameters in Table 10. Driving in hard clays would likely generate significant resistance with hard driving stress and additional vibrations for which predrilling could be adopted to reduce the effects. Further to this, driven piles can be prone to premature set in very stiff and hard clays and allowance should be made to restrike piles after several days to confirm adequate founding has been achieved.

As indicated before, ground vibrations and noise associated with the installation of driven piles will need to be considered.

In order to achieve their ultimate geotechnical capacities precast concrete piles will need to be driven to 'set' which will require driving the piles to weathered rock, approximately anticipated below the following depths based on the subsurface conditions encountered during the investigations:

- Building 1 – 7 m and 16 m;
- Building 2 – 16 m;
- Building 3 – 19 m and 24 m; and
- Building 4 – 19 m and 21 m.

Where piles are driven to refusal in rock with the hammers regularly used by piling contractors in South-East Queensland (i.e. 'Junttan' or 'Banut' rigs), the capacity of the pile can be considered as a structural member. The design geotechnical strengths ($R_{d,g}$) given in Table 11 below are commonly assigned when piles are driven to refusal using the abovementioned piling hammers and when the capacity is verified by dynamic testing.

Table 11: Precast Concrete Pile Capacities

Pile Section	Ultimate Factored Single Pile Design Geotechnical Strength ($R_{d,g}$)*
300 mm x 300 mm	1300 – 1450 kN
350 mm x 350 mm	2200 – 2500 kN
400 mm x 400 mm	3200 – 3500 kN

* assuming no eccentricity of load

7.9 Geotechnical Pavement Design Parameters

The results of the 4-day soaked CBR tests on a residual clay sample recovered from Bore 3 and a clayey fill samples recovered from Bore 6, compacted to a dry density ratio of approximately 100% standard compaction at close to optimum moisture content indicated CBR values of 9% and 5%, respectively. It is noted that values represent ideal conditions in the laboratory and if excavation at the site, or re-use of materials won from site, results in pavements and slab-on-ground for wheel loads being constructed on subgrade material similar to the samples tested, then a CBR value of 5% and modulus of subgrade reaction (k) of 35 kPa/mm is suggested for preliminary design.

Once earthworks have been completed, samples and tests should be undertaken on the subgrade to confirm design values and pavement depths. For loaded areas of different proportion of different load intensity to standard wheel loads, DP should be contacted for further advice.

The above suggested CBR values are based on the assumption that any topsoil will be stripped prior to pavement construction. It is also contingent upon adequate site preparation by test rolling (to detect any unsuitable soft or loose material) and subgrade compaction to a minimum dry density ratio of 98% Standard compaction.

Where fill in excess of 1 m depth is placed under 'controlled' conditions at the site, then a subgrade CBR value for that material could be used subject to confirmation by laboratory testing. For fill depths

of less than 1 m, the Japan Road Association (1989) method of assessing a weighted subgrade strength as follows, can be used:

$$CBR_w = (D_F \times CBR_F^{0.33} + (1-D_F) \times CBR_S^{0.33})^3$$

where:

CBR_w	=	weighted subgrade CBR (%)
D_F	=	depth of filling (m)
CBR_F	=	CBR of filling material
CBR_S	=	CBR of subgrade material

On-ground building floor slabs (i.e. floating slabs) should be detailed so they can accommodate potential ground movements, including settlements and shrink-swell movements. Dowelling of floor slabs will minimise differential movements between adjacent slabs.

The above recommendations are based on the provision and maintenance of adequate surface and subsurface drainage.

7.10 Soil Aggressivity

Based on the results of laboratory aggressivity testing (Table 3, above) and the groundwater conditions, the exposure classifications for the soils tested are assessed to be 'mild' for buried concrete above the groundwater table and "moderate" below the groundwater table. The exposure classifications are assessed to be 'non-aggressive' for buried steel above the groundwater and 'mild' below the groundwater table in accordance with AS 2159 (2009).

8. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 86 Riverview Street, Murwillumbah in accordance with DP's proposal 203033.02.P.001.Rev01 dated 21 September 2021. The investigation was commissioned in an email dated 22 September 2021 by Alex Christofides of Built (NSW) Pty Ltd (Built). The work was carried out under the terms and conditions of Built's "Consultancy Agreement" agreement No. 13777000B dated 6 April 2021 with changes mutually agreed upon. This report is provided for the exclusive use of Built (NSW) Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

DP's advice is based upon the conditions encountered during this investigation and DP's previous investigations (DP, 2020 and DP, 2021). The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

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

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

Douglas Partners Pty Ltd

9. References

AS 2159. (2009). *Piling - Design and Installation*. Standards Australia.

AS 2870. (2011). *Residential Slabs and Footings*. Standards Australia.

AS 3798. (2007). *Guidelines on Earthworks for Commercial and Residential Developments*. Standards Australia.

AS 4678. (2002). *Earth-retaining structures*. Standards Australia.

Chan and Mostyn. (2009). *Climatic Factors for AS2870 for New South Wales*. I Chan and G Mostyn.

DP. (2019). *Report on Preliminary Geotechnical Investigation, Propsoed School Structures, Murwillumbah High School, Murwillumbah*. Douglas Partners Pty Ltd, Project 98199.00 dated May 2020.

DP. (2021). *Report on Preliminary Geotechnical Investigation, Propsoed School Structures, Murwillumbah High School, 86 Riverview Street, Murwillumbah*. Douglas Partners Pty Ltd, Project Number 203033.00 dated May 2021.

Appendix A

About This Report
Sampling Methods
Soil and Rock Descriptions
Symbols and Abbreviations

About this Report

Douglas Partners



Introduction

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

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

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

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

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

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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



Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $IS_{(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

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

* Assumes a ratio of 20:1 for UCS to $IS_{(50)}$. It should be noted that the UCS to $IS_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Residual Soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.
<i>Note: If HW and MW cannot be differentiated use DW (see below)</i>		
Distinctly weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.

Rock Descriptions

Degree of Fracturing

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

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

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

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

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

Stratification Spacing

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

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



Sampling

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

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

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

Test Pits

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

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

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

Standard Penetration Tests

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

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:
4,6,7
N=13
- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:
15, 30/40 mm

Sampling Methods

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.



Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

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

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 - 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

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

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 - 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)

- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)

- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

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

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

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

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

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

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;

- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
Soil tends to stick together.
Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- 'Moist, dry of plastic limit' or 'w < PL' (i.e. hard and friable or powdery).
- 'Moist, near plastic limit' or 'w ≈ PL' (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- 'Moist, wet of plastic limit' or 'w > PL' (i.e. soils usually weakened and free water forms on the hands when handling).
- 'Wet' or 'w ≈ LL' (i.e. near the liquid limit).
- 'Wet' or 'w > LL' (i.e. wet of the liquid limit).

Symbols & Abbreviations

Douglas Partners



Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U ₅₀	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

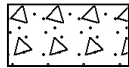
General



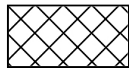
Asphalt



Road base



Concrete



Filling

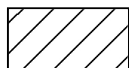
Soils



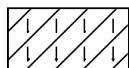
Topsoil



Peat



Clay



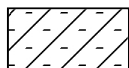
Silty clay



Sandy clay



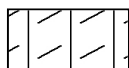
Gravelly clay



Shaly clay



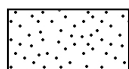
Silt



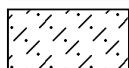
Clayey silt



Sandy silt



Sand



Clayey sand



Silty sand



Gravel



Sandy gravel



Cobbles, boulders



Talus

Sedimentary Rocks



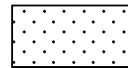
Boulder conglomerate



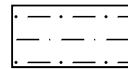
Conglomerate



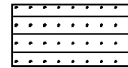
Conglomeratic sandstone



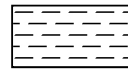
Sandstone



Siltstone



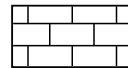
Laminite



Mudstone, claystone, shale

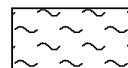


Coal

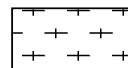


Limestone

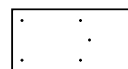
Metamorphic Rocks



Slate, phyllite, schist

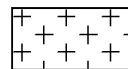


Gneiss

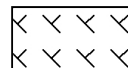


Quartzite

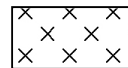
Igneous Rocks



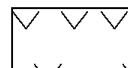
Granite



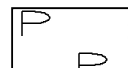
Dolerite, basalt, andesite



Dacite, epidote



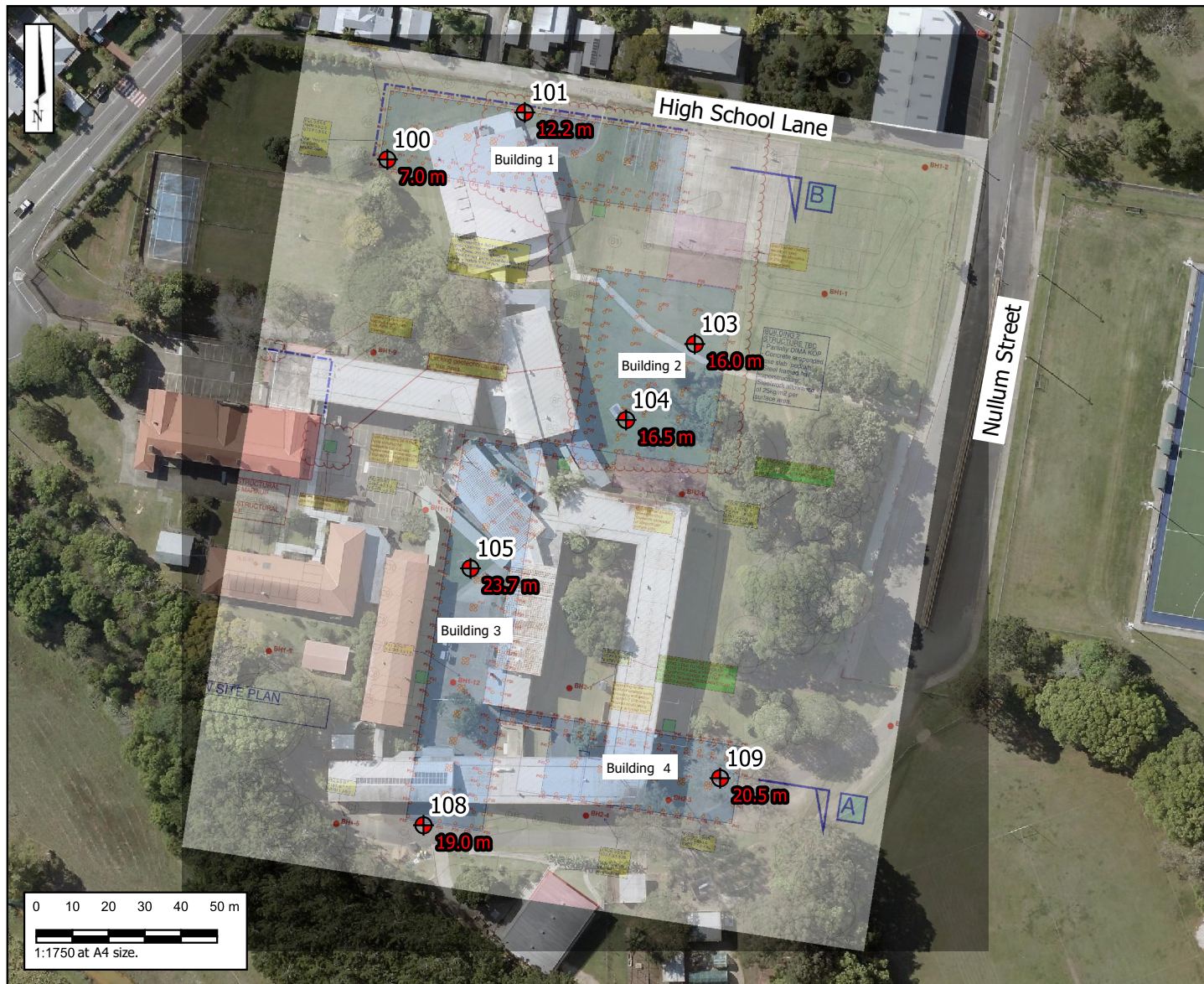
Tuff, breccia



Porphyry

Appendix B

Drawing 1 – Site and Test Location Plan
Drawing 2 – Previous Investigation Borehole Locations



Site Locality

Legend:

- Approximate borehole location and number and depth to rock

Client supplied proposed building footprints overlaid in blue.

Image obtained from Metromap dated 11 September 2021.



Site Locality

Legend:

- DP (2021) approximate borehole location and number
- DP (2020) approximate borehole location and number

Client supplied proposed building footprints overlayed in blue.

Image obtained from Metromap dated 11 September 2021.

Appendix C

Borehole Logs and Rock Core Photographs

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 9.0 AHD
EASTING: 538282
NORTHING: 6865751
DIP/AZIMUTH: 90°/--

BORE No: 100
PROJECT No: 203033.02
DATE: 28-9-2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	B - Bedding	J - Joint	S - Shear	F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
9	0.15	TOPSOIL Silty CLAY CL: low plasticity, pale brown, trace sand, moist, w<PL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.4 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 10.6 m; NMLC core to 14 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50)) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50)) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 9.0 AHD
EASTING: 538282
NORTHING: 6865751
DIP/AZIMUTH: 90°/-

BORE No: 100
PROJECT No: 203033.02
DATE: 28-9-2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)			Discontinuities		Sampling & In Situ Testing								
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
	9	METASILTSTONE: brown, very low strength, highly weathered, Neranleigh-Fernvale beds (continued)																									
	9.5	- estimated low strength																				S					30/100mm
	10																										
	10.5	- medium strength																				S					30/20mm
	10.6	- brown with grey/blue, moderately weathered, slightly fractured																									PL(A) = 0.55 PL(D) = 0.13 PL(A) = 0.15 PL(D) = 0.33 PL(A) = 0.4
	10.9	- slightly weathered																				C	100	90			PL(A) = 0.38 PL(A) = 0.28 PL(D) = 0.16 PL(A) = 0.31 PL(A) = 0.57
	12	- medium to high																									PL(A) = 0.96
	12.0																					C	100	78			PL(A) = 1.17 PL(D) = 0.23
	13																										PL(A) = 1.08 PL(D) = 0.77
	14																					C	100	75			PL(A) = 3.28 PL(D) = 0.89 PL(A) = 1.55 PL(D) = 0.59
	14.0	Bore discontinued at 14.0m depth. Limit of investigation.																									
	15																										

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.4 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 10.6 m; NMLC core to 14 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

Project Name: Proposed Murwillumbah Education Campus
 Location: 86 Riverview Street, Murwillumbah
 Project No: 203033.02
 Client: Built (NSW) Pty Ltd
 Date: 29 September 2021



Bore: 100
 Box: 1 of 1
 Depth: 10.6 m to 14.0 m



CLIENT: Built (NSW) Pty Ltd
 OFFICE: Gold Coast
 DATE: October 2021

Core Photograph – Bore 100
Proposed Murwillumbah Education Campus
86 Riverview Street, Murwillumbah

PROJECT No: 203033.02
 Box No: 1 of 1
 REVISION: 0

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 8.0 AHD
EASTING: 538320
NORTHING: 6865764
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 203033.02
DATE: 29-9-2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
8	0.3	TOPSOIL CLAY CL-CI: low to medium plasticity, brown, moist, w=PL CLAY CI: medium plasticity, brown-red, trace sand, moist, w=PL, stiff, residual																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.4 m; NW 15 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 15.0 m; NMLC to 18.86 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50)) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50)) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 8.0 AHD
EASTING: 538320
NORTHING: 6865764
DIP/AZIMUTH: 90°/-

BORE No: 101
PROJECT No: 203033.02
DATE: 29-9-2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
0		- pale brown with white, very stiff <i>(continued)</i>																								
8.5		- mottled dark brown and pale brown, very stiff, extremely weathered rock																								
9	9.0	- hard																				S				23, 30/140mm
10																										
11																										
12																						S				30/120mm
12.2		METASILTSTONE: brown, very low strength, highly weathered, Neranleigh-Fernvale beds																								
13																										
14																										
14.1		- pale grey/blue and brown																								
15	15.0	- low strength, highly weathered to moderately weathered, fractured																				S				30/50mm PL(A) = 0.28
15.4		- pale grey-blue, medium, slightly weathered																				C	100	25		PL(A) = 0.28
15.8		- fragmented																				C	100	13		
16.0																										

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.4 m; NW 15 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 15.0 m; NMLC to 18.86 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 8.0 AHD
EASTING: 538320
NORTHING: 6865764
DIP/AZIMUTH: 90°/-

BORE No: 101
PROJECT No: 203033.02
DATE: 29-9-2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		Ex Low	Very Low	Low	Medium	High	Very High		B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
		- highly fractured to fractured																			
	16.6	- fractured to slightly fractured																C	100	13	PL(A) = 0.37
	17																				
	18.0	- grey-blue																C	100	89	PL(A) = 0.44
	18.86	Bore discontinued at 18.86m depth. Limit of investigation.																C	100	64	PL(A) = 0.31
	19																				
	20																				
	21																				
	22																				
	23																				

RIG: P160 - Rig 5 **DRILLER:** BB-NCDW **LOGGED:** BMc **CASING:** HW 1.4 m; NW 15 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 15.0 m; NMLC to 18.86 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	G Gas sample	PID Photo ionisation detector (ppm)
B Bulk sample	P Piston sample	PL(A) Point load axial test (50) (MPa)
BLK Block sample	U Tube sample (x mm dia.)	PL(D) Point load diametral test (50) (MPa)
C Core drilling	W Water sample	pp Pocket penetrometer (kPa)
D Disturbed sample	W Water seep	S Standard penetration test
E Environmental sample	W Water level	V Shear vane (kPa)

Project Name: Proposed Murwillumbah Education Campus
 Location: 86 Riverview Street, Murwillumbah
 Project No: 203033.02
 Client: Built (NSW) Pty Ltd
 Date: 29 September 2021



Bore: 101
 Box: 1 of 1
 Depth: 15.0 m to 18.86 m



CLIENT: Built (NSW) Pty Ltd
 OFFICE: Gold Coast
 DATE: October 2021

Core Photograph – Bore 101
Proposed Murwillumbah Education Campus
86 Riverview Street, Murwillumbah

PROJECT No: 203033.02
 Box No: 1 of 1
 REVISION: 0

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 4.5 AHD
EASTING: 538367
NORTHING: 6865700
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 203033.02
DATE: 1-10-2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High		Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
	0.2	TOPSOIL Silty CLAY CI: medium plasticity, brown, moist, w>PL																								
		CLAY CI-CH: medium to high plasticity, red-brown, trace sand, moist, w=PL, stiff, residual																								
	1.1	- brown and red-brown mottled, trace gravel																				S				3,4,5 N = 9
	1.5	Silty CLAY CI: medium plasticity, pale brown, moist, w=PL, stiff, residual																								
	2.0	- pale red-brown																								
	2.5	stiff to very stiff, trace weathered rock fragments																				S				4,7,11 N = 18
	4.0	- pale brown-red and pale brown, w>PL																				S				5,7,12 N = 19
	5.5	- very stiff																				S				7,10,12 N = 22
	6.2	- with weathered rock fragments																								
																									</	

RIG: P160 - Rig 2

DRILLER: DB-NCDW

LOGGED: BMc

CASING: HW 1m

TYPE OF BORING: Auger to 4 m; mud rotary to 19.38 m.

WATER OBSERVATIONS: Groundwater measured at 3.8 m depth.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	≡	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test ts(50) (MPa)
		PL(D)	Point load diametral test ts(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 4.5 AHD
EASTING: 538367
NORTHING: 6865700
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 203033.02
DATE: 1-10-2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing						
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
	-4	- with weathered rock fragments <i>(continued)</i>																								
	8.9	- hard																				S				11,14,17 N = 31
	9																									
	-5																									
	9.8	- pale red-brown with white																				S				13,14,18 N = 32
	10																									
	-6																									
	11																									
	-7																									
	11.5	- extremely weathered rock																				S				11,21,29 N = 50
	12																									
	-8																									
	13																					S				11, 19, 30/120mm
	-9																									
	14																									
	-10																									
	15																					S				12, 29, 30/100mm
	-11																									
	16.0																									

RIG: P160 - Rig 2

DRILLER: DB-NCDW

LOGGED: BMc

CASING: HW 1m

TYPE OF BORING: Auger to 4 m; mud rotary to 19.38 m.

WATER OBSERVATIONS: Groundwater measured at 3.8 m depth.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 4.5 AHD
EASTING: 538367
NORTHING: 6865700
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 203033.02
DATE: 1-10-2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing								
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
-12		METASILTSTONE: pale brown and white, very low strength, extremely weathered, Neranleigh-Fernvale beds																									30/130mm	
-17																							S					
-13																												
-18																							S					27, 30/120mm
-14																												
-19																												
19.38		Bore discontinued at 19.38m depth. Limit of investigation.																				S					23, 23, 30/80mm	
-15																												
-20																												
-16																												
-21																												
-17																												
-22																												
-18																												
-23																												
-19																												

RIG: P160 - Rig 2

DRILLER: DB-NCDW

LOGGED: BMc

CASING: HW 1m

TYPE OF BORING: Auger to 4 m; mud rotary to 19.38 m.

WATER OBSERVATIONS: Groundwater measured at 3.8 m depth.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rlverveiw Street, Murwillumbah

SURFACE LEVEL: 8.3 AHD
EASTING: 538348
NORTHING: 6865679
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 203033.02
DATE: 29-9-2021
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FR		Ex Low	Very Low	Low	Medium	High		Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
	0.1	TOPSOIL Silty CLAY CL-CI: low to medium plasticity, brown, moist, w<PL CLAY CI-CH: medium to high plasticity, red-brown, trace sand, moist, w=PL, stiff, residual																								4,6,6 N = 12
	2.3	Silty CLAY CI: medium plasticity, pale red-brown, moist, w=PL, stiff, residual																								6,10,14 N = 24
	3.0	- pale red-brown and yellow, very stiff, trace weathered rock fragments, tending to extremely weathered rock																								4,11,12 N = 23

RIG: P160 - Riq 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.3 m; NW 22 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 18 m; NMLC core to 22.4 m; mud rotary from 22.4 m to 26 m; NMLC core from 26 m to 27.7 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test ls(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test ls(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 8.3 AHD
EASTING: 538348
NORTHING: 6865679
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 203033.02
DATE: 29-9-2021
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low			Medium	High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
0		- pale red-brown and yellow, very stiff, trace weathered rock fragments, tending to extremely weathered rock <i>(continued)</i>																			
9	9.0	- hard, with weathered rock fragments																S			11,16,15 N = 31
-1																					
10																					
-2																					
11																					
-3																					
12																		S			17,25,28 N = 53
-4																					
13																					
-5																					
14																					
-6																					
15																		S			26, 30/130mm
-7																					

RIG: P160 - Rig 5 **DRILLER:** BB-NCDW **LOGGED:** BMc **CASING:** HW 1.3 m; NW 22 m
TYPE OF BORING: Auger to 4.5 m; mud rotary to 18 m; NMLC core to 22.4 m; mud rotary from 22.4 m to 26 m; NMLC core from 26 m to 27.7 m.
WATER OBSERVATIONS: No free groundwater encountered while auger drilling.
REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test (s(50) (MPa)
		PL(D)	Point load diametral test (s(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rlverveiw Street, Murwillumbah

SURFACE LEVEL: 8.3 AHD
EASTING: 538348
NORTHING: 6865679
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 203033.02
DATE: 29-9-2021
SHEET 3 OF 4

[illegible]

RIG: P160 - Riq 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.3 m; NW 22 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 18 m; NMLC core to 22.4 m; mud rotary from 22.4 m to 26 m; NMLC core from 26 m to 27.7 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 8.3 AHD
EASTING: 538348
NORTHING: 6865679
DIP/AZIMUTH: 90°/-

BORE No: 104
PROJECT No: 203033.02
DATE: 29-9-2021
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing						
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
-16	24.5	Silty CLAY Cl: medium plasticity, pale brown, moist, w=PL, hard, residual, extremely weathered rock (continued)																									30/115mm
-25		METASILTSTONE: brown with pale grey-blue, very low strength, highly weathered, Neranleigh-Fernvale beds																				S					
-26	26.0	- medium strength, moderately weathered																				S					30/30mm PL(A) = 0.14 PL(D) = 0.1 PL(A) = 0.66 PL(A) = 0.65 PL(D) = 0.38
-27	27.0	- medium to high strength, slightly weathered																				C	100	54			PL(A) = 1.02 PL(D) = 0.46
-27.7	27.7	Bore discontinued at 27.7m depth. Limit of investigation.																				C	100	53			PL(A) = 1.24 PL(D) = 0.44 PL(A) = 2.11 PL(D) = 1.38
-28																											
-29																											
-30																											
-31																											
-32																											
-33																											

RIG: P160 - Rig 5 **DRILLER:** BB-NCDW **LOGGED:** BMc **CASING:** HW 1.3 m; NW 22 m
TYPE OF BORING: Auger to 4.5 m; mud rotary to 18 m; NMLC core to 22.4 m; mud rotary from 22.4 m to 26 m; NMLC core from 26 m to 27.7 m.
WATER OBSERVATIONS: No free groundwater encountered while auger drilling.
REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test (50) (MPa)
		PL(D)	Point load diametral test (50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

Project Name: Proposed Murwillumbah Education Campus
 Location: 86 Riverview Street, Murwillumbah
 Project No: 203033.02
 Client: Built (NSW) Pty Ltd
 Date: 29 September 2021



Bore: 104
 Box: 1 of 2
 Depth: 18.0 m to 22.0 m



CLIENT: Built (NSW) Pty Ltd
 OFFICE: Gold Coast
 DATE: October 2021

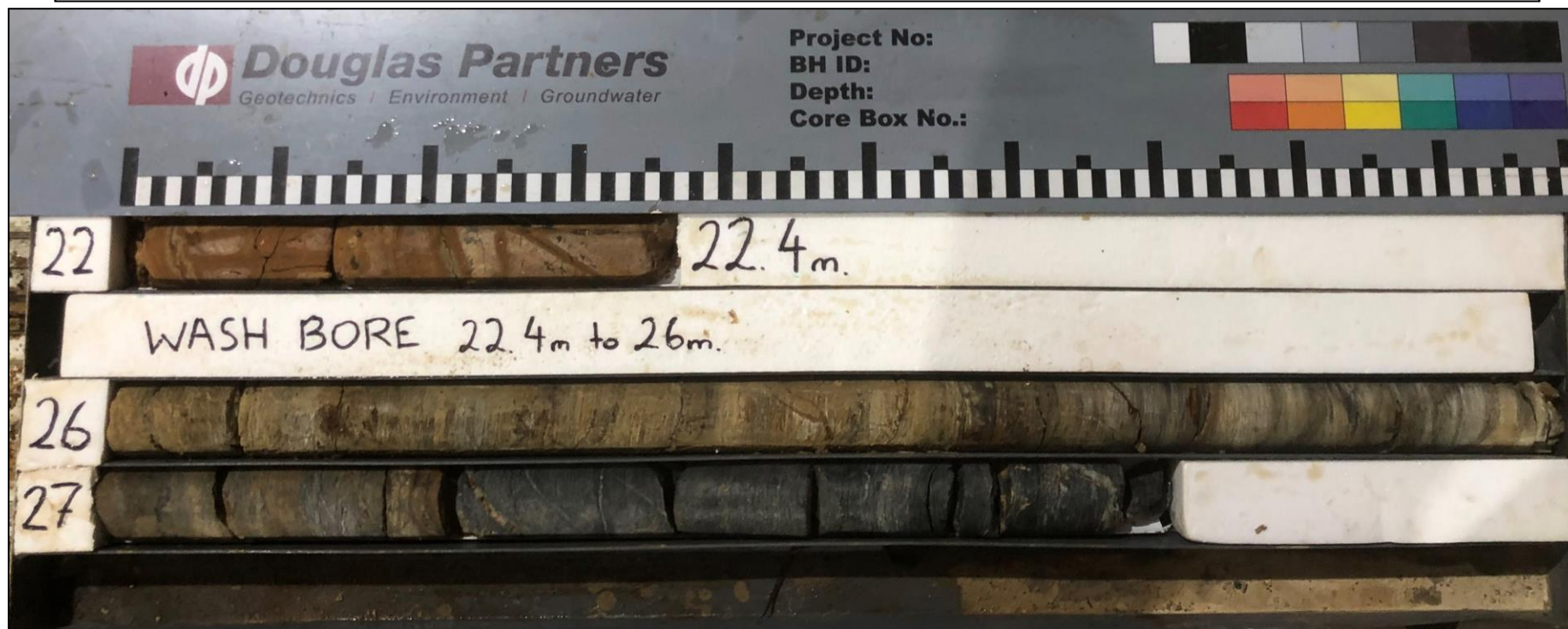
Core Photograph – Bore 104
Proposed Murwillumbah Education Campus
86 Riverview Street, Murwillumbah

PROJECT No: 203033.02
 Box No: 1 of 2
 REVISION: 0

Project Name: Proposed Murwillumbah Education Campus
 Location: 86 Riverview Street, Murwillumbah
 Project No: 203033.02
 Client: Built (NSW) Pty Ltd
 Date: 29 September 2021



Bore: 104
 Box: 2 of 2
 Depth: 22.0 m to 27.7 m



 Douglas Partners Geotechnics Environment Groundwater	CLIENT: Built (NSW) Pty Ltd	Core Photograph – Bore 104 Proposed Murwillumbah Education Campus 86 Riverview Street, Murwillumbah	PROJECT No: 203033.02
	OFFICE: Gold Coast		Box No: 2 of 2
	DATE: October 2021		REVISION: 0

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 16.0 AHD
EASTING: 538305
NORTHING: 6865638
DIP/AZIMUTH: 90°/-

BORE No: 105
PROJECT No: 203033.02
DATE: 21-9-2031
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
16	0.1	TOPSOIL Silty CLAY Cl: medium plasticity, brown, moist, w>PL																					
		CLAY Cl: medium plasticity, red-brown, trace sand, moist, w=PL, stiff, residual																					
15	1																						
	1.5	Silty CLAY Cl: medium plasticity, pale brown and white, moist, w=PL, very stiff, residual																S				4,6,9 N = 15	
14	2																						
13	3																	S				6,12,13 N = 25	
12	4																						
11	5																	S				5,9,14 N = 23	
10	6																						
																		S				7,12,15 N = 27	
9	7																						
	7.5	- brown, trace weathered rock fragments, hard																S				11,12,27 N = 39	

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.4 m; NW to 24 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 24 m; NMLC core to 28 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50)) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50)) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 16.0 AHD
EASTING: 538305
NORTHING: 6865638
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 203033.02
DATE: 21-9-2031
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
		- brown, trace weathered rock fragments, hard (continued)																								
	9.0	- pale brown and white-blue silty clay																				S				26, 30/130mm
	10																									
	11																				S					8,23,27 N = 50
	12																									
																					S					3,7,9 N = 16
	12.5	- pale grey-blue and brown, stiff to very stiff																								
	13																									

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.4 m; NW to 24 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 24 m; NMLC core to 28 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 16.0 AHD
EASTING: 538305
NORTHING: 6865638
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 203033.02
DATE: 21-9-2031
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		- stiff <i>(continued)</i>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	</

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.4 m; NW to 24 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 24 m; NMLC core to 28 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 16.0 AHD
EASTING: 538305
NORTHING: 6865638
DIP/AZIMUTH: 90°/-

BORE No: 105
PROJECT No: 203033.02
DATE: 21-9-2031
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
-8																				
	24.3	highly weathered, Neranleigh-Fernvale beds																		30/30mm PL(A) = 0.2 PL(D) = 0.14
	24.7	- low to medium, moderately weathered, fractured - 200 mm hard clay band - medium strength															C S	100	22	PL(A) = 0.36 PL(D) = 0.12 PL(A) = 0.37
-9	25																C	100	45	PL(A) = 0.38 PL(D) = 0.24
	25.8	- grey-blue, slightly weathered, slightly fractured															C	100	92	PL(A) = 1.12 PL(D) = 0.08 PL(A) = 0.9 PL(A) = 1.46 PL(A) = 0.84 PL(D) = 0.29
-10	26																			
	27																C	100	91	PL(A) = 1.6 PL(A) = 1.68 PL(A) = 1.95 PL(D) = 0.55 PL(A) = 2.93 PL(D) = 0.41
-11	28.0	Bore discontinued at 28.0m depth. Limit of investigation.																		
-12	29																			
-13	30																			
-14	31																			
-15																				

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.4 m; NW to 24 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 24 m; NMLC core to 28 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

Project Name: Proposed Murwillumbah Education Campus
 Location: 86 Riverview Street, Murwillumbah
 Project No: 203033.02
 Client: Built (NSW) Pty Ltd
 Date: 1 October 2021



Bore: 105
 Box: 1 of 1
 Depth: 24.0 m to 28.0 m



CLIENT: Built (NSW) Pty Ltd
 OFFICE: Gold Coast
 DATE: October 2021

Core Photograph – Bore 105

Proposed Murwillumbah Education Campus

86 Riverview Street, Murwillumbah

PROJECT No: 203033.02

Box No: 1 of 1

REVISION: 0

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 15.8 AHD
EASTING: 538292
NORTHING: 6865567
DIP/AZIMUTH: 90°/--

BORE No: 108
PROJECT No: 203033.02
DATE: 27 - 28/9/2021
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)			Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	B - Bedding	J - Joint	S - Shear	F - Fault	Type	Core Rec. %	RQD %
15 1 14 2 13 3 12 4 11 5 10 6 9 7 8	0.1	ASPHALTIC CONCRETE																						
	0.35	FILL Sandy GRAVEL GP: fine to medium grained, brown, fine to coarse grained sand, moist, appeared well compacted																						
		CLAY CI: medium plasticity, red-brown, moist, w>PL, stiff, residual																	S				3,4,7 N = 11	
	1.5	- very stiff																						
	1.8	Silty CLAY CL-CI: low to medium plasticity, white and brown, moist, w>PL, very stiff, residual, tending to extremely weathered rock																	S				4,9,14 N = 23	
	3.5	- brown with grey																	S				3,6,7 N = 13	
	4.5	- white with brown, w=PL, trace weathered rock fragments																	S				7,12,15 N = 27	
	6.2	- hard																	S				13, 23, 30/140mm	
	7.5	- brown with white																	S				14,20,30 N = 50	

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.3 m; NW 22.5 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 22.5 m; NMLC core to 25.8 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50)) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50)) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 15.8 AHD
EASTING: 538292
NORTHING: 6865567
DIP/AZIMUTH: 90°/--

BORE No: 108
PROJECT No: 203033.02
DATE: 27 - 28/9/2021
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing				
			EW	HV	MW	SW	FR		Ex Low	Very Low	Low	Medium	High		Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
		- brown with white <i>(continued)</i>																							
	9.0	- tending to very low strength weathered rock																			S				24, 30/120mm
	10																								
	11																				S				25, 30/150mm
	12																				S				25, 23, 30/130mm
	13.0	- with weathered rock fragments, tending to extremely weathered rock																				S			30/140mm
	14																								
	15																				S				26, 30/130mm

RIG: P160 - Rig 5 **DRILLER:** BB-NCDW **LOGGED:** BMc **CASING:** HW 1.3 m; NW 22.5 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 22.5 m; NMLC core to 25.8 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 15.8 AHD
EASTING: 538292
NORTHING: 6865567
DIP/AZIMUTH: 90°/-

BORE No: 108
PROJECT No: 203033.02
DATE: 27 - 28/9/2021
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)			Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		- with weathered rock fragments, tending to extremely weathered rock <i>(continued)</i>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.3 m; NW 22.5 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 22.5 m; NMLC core to 25.8 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 15.8 AHD
EASTING: 538292
NORTHING: 6865567
DIP/AZIMUTH: 90°/-

BORE No: 108
PROJECT No: 203033.02
DATE: 27 - 28/9/2021
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
		- slightly fractured																		PL(A) = 0.58 PL(A) = 0.06 PL(D) = 0.3 PL(A) = 0.32
	24.9	- highly fractured															C	100	91	PL(A) = 0.13 PL(D) = 0.5 PL(A) = 1.85 PL(A) = 0.64
	25.1	- slightly fractured															C	100	88	
	25.8	Bore discontinued at 25.8m depth. Limit of investigation.																		
	26																			
	27																			
	28																			
	29																			
	30																			
	31																			

RIG: P160 - Rig 5

DRILLER: BB-NCDW

LOGGED: BMc

CASING: HW 1.3 m; NW 22.5 m

TYPE OF BORING: Auger to 4.5 m; mud rotary to 22.5 m; NMLC core to 25.8 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50)) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50)) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

Project Name: Proposed Murwillumbah Education Campus
 Location: 86 Riverview Street, Murwillumbah
 Project No: 203033.02
 Client: Built (NSW) Pty Ltd
 Date: 28 September 2021



Bore: 108
 Box: 1 of 1
 Depth: 23.0 m to 25.8 m



CLIENT: Built (NSW) Pty Ltd
 OFFICE: Gold Coast
 DATE: October 2021

Core Photograph – Bore 108
 Proposed Murwillumbah Education Campus
 86 Riverview Street, Murwillumbah

PROJECT No: 203033.02
 Box No: 1 of 1
 REVISION: 0

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 7.5 AHD
EASTING: 538374
NORTHING: 6865580
DIP/AZIMUTH: 90°/--

BORE No: 109
PROJECT No: 203033.02
DATE: 30/9 - 1/10/2021
SHEET 1 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)			Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
	0.1	FILL GRAVEL GP: fine to coarse gravel, pale brown and white, moist																				
7																						
1																		S			0,1,4 N = 5	
6																						
2	2.0	- stiff																				
5																		S			5,7,11 N = 18	
3																						
4	3.2	- trace weathered rock fragments																				
4																						
4																						
3	4.2	Silty CLAY CI: medium plasticity, pale brown and grey, moist, w=PL, stiff, residual																				
5																						
2																						
5																						
2	5.5	- very stiff to hard, tending to extremely weathered rock																S			10,15,22 N = 37	
6																						
1																						
7																						
0																						

RIG: P160 - Rig 2

DRILLER: DB-NDW

LOGGED: BMc

CASING: HW 1.2 m; NW 26.5 m.

TYPE OF BORING: Auger to 1.5 m; mud rotary to 26.5 m; NMLC core to 30.35 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 7.5 AHD
EASTING: 538374
NORTHING: 6865580
DIP/AZIMUTH: 90°/--

BORE No: 109
PROJECT No: 203033.02
DATE: 30/9 - 1/10/2021
SHEET 2 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing						
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
		- very stiff to hard, tending to extremely weathered rock <i>(continued)</i>																								
-1	8.5	- pale grey and brown																				S				11,15,19 N = 34
9																										
-2																										
10																										
-3																										
11																										
-4																						S				17,12,11 N = 23
12																										
-5																										
13																										
-6																										
14																										
-7	14.5	- hard, extremely weathered rock																				S				10,15,22 N = 37
15																										
-8																										

RIG: P160 - Rig 2 **DRILLER:** DB-NDW **LOGGED:** BMc **CASING:** HW 1.2 m; NW 26.5 m.

TYPE OF BORING: Auger to 1.5 m; mud rotary to 26.5 m; NMLC core to 30.35 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Rilvervew Street, Murwillumbah

SURFACE LEVEL: 7.5 AHD
EASTING: 538374
NORTHING: 6865580
DIP/AZIMUTH: 90°/--

BORE No: 109
PROJECT No: 203033.02
DATE: 30/9 - 1/10/2021
SHEET 3 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing							
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
	-9	- hard, extremely weathered rock (continued)																									
	17																										
	-10																										
	18																					S				17, 22, 30/120mm	
	-11																										
	19	- pale grey-pink and brown																									
	19.0																					S				16, 27, 30/130mm	
	-12																										
	20																										
	-13	20.5	METASILTSTONE: pale grey-pink and brown, very low strength, extremely weathered, Neranleigh-Fernvale beds																				S				19, 30/140mm
	21																										
	-14																										
	22																						S				30/110mm
	-15																										
	23																										
	-16																						S				26, 30/100mm

RIG: P160 - Rig 2

DRILLER: DB-NDW

LOGGED: BMc

CASING: HW 1.2 m; NW 26.5 m.

TYPE OF BORING: Auger to 1.5 m; mud rotary to 26.5 m; NMLC core to 30.35 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50)) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50)) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed Murwillumbah Education Campus
LOCATION: 86 Riverveiw Street, Murwillumbah

SURFACE LEVEL: 7.5 AHD
EASTING: 538374
NORTHING: 6865580
DIP/AZIMUTH: 90°/-

BORE No: 109
PROJECT No: 203033.02
DATE: 30/9 - 1/10/2021
SHEET 4 OF 4

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing						
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
-17		METASILTSTONE: pale grey-pink and brown, very low strength, extremely weathered, Neranleigh-Fernvale beds <i>(continued)</i>																								
-25																										
-18																										
-26																										
26.2		- brown with pale grey-blue, very low strength, highly weathered																								
-19	26.5	- medium strength, fractured																								
26.9	27	- grey-blue, medium to high strength, slightly weathered, fractured to slightly fractured																				C	100	75	PL(A) = 1.21 PL(D) = 0.37 PL(A) = 0.4 PL(D) = 0.36 PL(A) = 2.18 PL(D) = 1.56	
-20																										
28																						C	100	78	PL(A) = 5.92 PL(D) = 3	
-21																										
28.9	29	- slightly fractured																								
-22																						C	100	100	PL(A) = 5.64 PL(D) = 2.61	
30																										
-23	30.35	Bore discontinued at 30.35m depth. Limit of investigation.																								
31																										
-24																										

RIG: P160 - Rig 2 **DRILLER:** DB-NDW **LOGGED:** BMc **CASING:** HW 1.2 m; NW 26.5 m.

TYPE OF BORING: Auger to 1.5 m; mud rotary to 26.5 m; NMLC core to 30.35 m.

WATER OBSERVATIONS: No free groundwater encountered while auger drilling.

REMARKS: Location coordinates are in MGA94 Zone 56J. Surface level interpolated from client provided survey; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

Project Name: Proposed Murwillumbah Education Campus
 Location: 86 Riverview Street, Murwillumbah
 Project No: 203033.02
 Client: Built (NSW) Pty Ltd
 Date: 1 October 2021



Bore: 109
 Box: 1 of 1
 Depth: 26.5 m to 30.35 m



CLIENT: Built (NSW) Pty Ltd
 OFFICE: Gold Coast
 DATE: October 2021

Core Photograph – Bore 109
Proposed Murwillumbah Education Campus
86 Riverview Street, Murwillumbah

PROJECT No: 203033.02
 Box No: 1 of 1
 REVISION: 0

Appendix D

Previous Borehole Logs

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 3.8 Approx
EASTING: 538388
NORTHING: 6865693
DIP/AZIMUTH: 90°/-

BORE No: 1
PROJECT No: 98119.00
DATE: 16-4-2020
SHEET 1 OF 1

Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)
			Type	Depth	Sample	Results & Comments		
0.1	TOPSOIL Clayey SAND (SC): fine to medium grained sand, brown, moist							
	Silty CLAY (CI): medium plasticity, brown with pale brown, with fine to medium grained sand, stiff		D	0.2				
			D	0.5				
0.8	(CI-CH) - medium to high plasticity, red with pale brown			0.8				
1.5	Sandy CLAY (CI): medium plasticity, red with pale brown and grey, fine to coarse grained sand, stiff		D	1.5				
1.7			S	1.7		3,5,5 N = 10		
1.8	Silty CLAY (CI-CH): medium to high plasticity, red with pale grey and brown, moist, stiff		D	1.8				
1.95				1.95				
2.0				2.0				
2.3	- red with pale grey and orange, traces fine to medium gravel							
3.0			S	3.0		5,7,11 N = 18		
3.45				3.45				
4.5			S	4.5		4,8,7 N = 15		
4.95				4.95				
5.0	Bore discontinued at 5.0m . Limit of Investigation.							

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 3.5 Approx
EASTING: 538428
NORTHING: 6865737
DIP/AZIMUTH: 90°/-

BORE No: 2
PROJECT No: 98119.00
DATE: 16-4-2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
3 1 2 3 4 5 6 7		FILL Silty CLAY (CL): low plasticity, pale brown with red, trace fine to coarse grained sand, moist, poorly compacted		D	0.1							
					0.3							
				B	0.5							
				D	0.6							
					0.8							
	1.0	Silty CLAY (CH): high plasticity, pale grey, moist, soft to firm		D	1.1							
	1.3	- grey with red, firm			1.2							
					1.5		1,1,3 N = 4					
				S	1.95							
	2.2	- grey with red and orange										
3 4 5 6 7					3.0		2,3,4 N = 7					
				S	3.45							
	3.4	- trace fine to medium gravel										
					3.8							
		Sandy CLAY (CI): medium plasticity, pale grey with red and orange, fine to coarse grained sand with fine to medium gravel (quartz), moist, firm			4.5		2,2,4 N = 6					
				S	4.95							
	6.0	- stiff			6.0		4,4,4 N = 8					
				S	6.45							
	6.5	Bore discontinued at 6.5m . Limit of Investigation.										

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: Seepage observed at 0.9 m depth.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PLD	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 8.9 Approx
EASTING: 538288
NORTHING: 6865733
DIP/AZIMUTH: 90°/-

BORE No: 3
PROJECT No: 98119.00
DATE: 16-4-2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)
				Type	Depth	Sample	Results & Comments		
		FILL Sandy CLAY (CL): low plasticity, brown with orange, fine to coarse grained sand, with fine to coarse gravel, moist, apparently well compacted		D	0.1				
					0.3				
	0.5	Silty CLAY (CL): low plasticity, orange-brown, trace sand, moist, firm		D	0.5				
	0.7	- trace fine to coarse gravel		B	0.8				
					1.0				
	1				1.5				
				S	1.95		3,3,4 N = 7		
	2								
	2.3	- stiff							
					3.0				
				S	3.45		3,4,5 N = 9		
	4								
	4.4	- pale grey with orange							
				S	4.5		4,6,10 N = 16		
					4.95				
	5	Bore discontinued at 5.0m . Limit of Investigation.							
	6								

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	sp	Standard penetration test
E	Environmental sample	W	Water level	S	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 12.4 Approx
EASTING: 538243
NORTHING: 6865769
DIP/AZIMUTH: 90°/-

BORE No: 4
PROJECT No: 98119.00
DATE: 16-4-2020
SHEET 1 OF 1

Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)			
			Type	Depth	Sample	Results & Comments		5	10	15	20
0.2	Silty SAND (SM): fine to medium grained sand, brown, moist, loose										
0.5	Sandy CLAY (CL): low plasticity, brown, fine to medium grained sand, moist, firm		D	0.4							
				0.5							
	Silty CLAY (CI): medium plasticity, brown-red, trace fine to coarse grained sand, moist, firm		D	0.6							
1.0				1.0							
1.5			S	1.5		2,2,2 N = 4					
1.95				1.95							
2.5	- stiff, pale brown										
2.8	- with fine to coarse grained sand and fine to medium gravel										
3.0			S	3.0		4,10,8 N = 18					
3.45				3.45							
4.5			S	4.5		5,5,7 N = 12					
4.95				4.95							
5.0	Bore discontinued at 5.0m . Limit of Investigation.										

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	sp	Standard penetration test
E	Environmental sample	W	Water level	S	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 16.0 Approx
EASTING: 538275
NORTHING: 6865570
DIP/AZIMUTH: 90°/-

BORE No: 5
PROJECT No: 98119.00
DATE: 16-4-2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
16	0.1	FILL Sandy CLAY (CL): low plasticity, dark brown, fine to coarse grained sand, trace fine gravel, moist, poorly compacted										
	0.3	Silty CLAY (CL): low plasticity, dark brown, with fine to medium grained sand, moist, stiff										
		(Cl): medium plasticity, red, trace fine to medium grained sand, stiff										
				D	0.5							
					0.8							
15	1											
	1.3	- orange-pale grey-red, very stiff										
	1.5	- hard			1.5		8,15,24 N = 39					
	1.8	- tending to extremely weathered metasilstone		S	1.95							
14	2											
					3.0		10,18,24 N = 42					
13	3			S	3.45							
12	4											
					4.5		16,14,18 N = 32					
11	5	Bore discontinued at 5.0m . Limit of Investigation.			4.95							
10	6											

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 19.7 Approx
EASTING: 538256
NORTHING: 6865608
DIP/AZIMUTH: 90°/-

BORE No: 6
PROJECT No: 98119.00
DATE: 16-4-2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)
				Type	Depth	Sample	Results & Comments		
	0.1	FILL Sandy GRAVEL (GP): fine to coarse gravel, grey, fine to coarse grained sand, moist, apparently well compacted		D	0.1				
	0.3	FILL Sandy CLAY (CL): low plasticity, brown, fine to coarse grained sand, with fine to coarse gravel, poorly compacted			0.3				
	1.3	Silty CLAY (CI): medium plasticity, orange with pale grey, trace fine to coarse grained sand, moist, very stiff			1.5				
	1.8	- hard, tending to extremely weathered metasiltstone		S	1.95		5,8,16 N = 24		
	2.2	- with very low strength metasiltstone layers							
	2.4	METASILTSTONE: pale grey with orange, very low strength							
	2.9	Bore discontinued at 2.9m . TC bit refusal on inferred low strength or stronger metasiltstone. Limit of Investigation.		S	2.9 2.91		30/10mm		

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 3.7 Approx
EASTING: 538450
NORTHING: 6865582
DIP/AZIMUTH: 90°/-

BORE No: 7
PROJECT No: 98119.00
DATE: 17-4-2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.1	FILL Sandy CLAY (CL): low plasticity, dark brown, fine to medium grained sand, moist, poorly compacted		D	0.0							
		FILL Silty CLAY (CI): medium plasticity, brown with orange, with fine to medium grained sand, moist, poorly compacted		D	0.1							
				D	0.2							
				D	0.6							
	0.9	Silty CLAY (CH): high plasticity, pale grey with orange and red, trace fine gravel, moist, firm		D	1.0							
				D	1.2							
				S	1.5		2,3,3 N = 6					
					1.95							
	2.5	- with fine to medium grained sand										
	2.9	Sandy CLAY (CH): high plasticity, grey with orange and brown, fine to medium grained sand, moist, firm		S	3.0		2,3,3 N = 6					
					3.45							
	3.7	- wet										
	4.0	Silty CLAY (CI-CH): medium to high plasticity, red with grey, trace fine gravel, moist, very stiff, residual		S	4.5		4,10,18 N = 28					
					4.95							
	5.0	Bore discontinued at 5.0m . Limit of Investigation.										

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: Groundwater encountered at 3.7 m depth.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 14.6 Approx
EASTING: 538243
NORTHING: 6865709
DIP/AZIMUTH: 90°/-

BORE No: 8
PROJECT No: 98119.00
DATE: 17-4-2020
SHEET 1 OF 1

Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)
			Type	Depth	Sample	Results & Comments		
0.0	FILL Gravelly SAND (SP): fine to coarse grained sand, dark brown, fine to coarse gravel, with silt, moist		D	0.0				
0.2				0.2				
0.3	FILL Silty SAND (SM): fine to medium grained sand, brown, moist, poorly compacted		D	0.3				
0.4				0.4				
0.9	Silty SAND (SM): fine to medium grained sand, dark brown, moist, loose							
1.1								
1.3	Silty CLAY (CI): medium plasticity, brown with, fine to medium grained sand, soft to firm							
1.5	- pale brown, with fine to medium gravel, stiff							
1.5	- pale brown with grey		S	1.5		5.5,6 N = 11		
1.95				1.95				
2.4	- very stiff							
2.8	Bore discontinued at 2.8m . TC bit refusal on inferred low strength or stronger metasiltstone. Limit of Investigation.		S	2.8		20/30mm		
2.83				2.83				

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 14.5 Approx
EASTING: 538287
NORTHING: 6865701
DIP/AZIMUTH: 90°/-

BORE No: 9
PROJECT No: 98119.00
DATE: 17-4-2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.5	FILL Silty SAND (SM): fine to medium grained sand, brown, trace fine to medium gravel, moist, apparently well compacted										
	1.0	Fill Sandy CLAY (CL): low plasticity, brown with pale brown, fine to coarse grained sand, with fine gravel, moist, apparently poorly compacted		D	0.5							
	1.5				1.0							
	1.8				1.5							
	2.0	Silty CLAY (CL): low plasticity, dark brown, trace fine to medium grained sand, moist, firm		S	1.95		2,4,3 N = 7					
	2.2	(CI): medium plasticity										
	2.6	- pale brown-orange, stiff										
	3.0	- pale brown-orange with grey		S	3.0		5,5,6 N = 11					
	3.6	- stiff to very stiff			3.45							
	4.1	- hard, pale grey and orange and pale red, tending to extremely weathered metasiltstone		S	4.5		8,18,30/140mm					
	5.0	Bore discontinued at 5.0m . Limit of Investigation.			4.95							

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 21.9 Approx
EASTING: 538210
NORTHING: 6865658
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 98119.00
DATE: 17-4-2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)
				Type	Depth	Sample	Results & Comments		
		Fill Sandy CLAY (CL): low plasticity, brown, fine to coarse grained sand, with fine gravel, moist, apparently well compacted							
21	0.8	Silty CLAY (CL): low plasticity, orange with pale grey, with weathered rock fragments, moist, hard			1.0				
1	1.0	METASILTSTONE: orange with pale grey, very low strength		D					
	1.2	- pale grey with orange			1.5				
2									
									
19	2.8			S	2.8		30/130mm		
3	2.93	Bore discontinued at 2.93m . Refusal on inferred low strength or stronger metasiltstone. Limit of Investigation.			2.93				
18	4								
17	5								
16	6								
15									

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test ls(50) (MPa)
		PL(D)	Point load diametral test ls(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 16.4 Approx
EASTING: 538296
NORTHING: 6865653
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 98119.00
DATE: 17-4-2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)
				Type	Depth	Sample	Results & Comments		
		FILL Sandy CLAY (CL): low plasticity, dark brown with brown, fine to coarse grained sand, trace fine to coarse gravel, moist, poorly compacted		D	0.2				
				D	0.5				
	0.7	Silty CLAY (CH): high plasticity, pale brown with red, moist, stiff		D	0.8				
	0.8			D	1.0				
	1.0	- red with pale brown - very stiff							
	1.8	Bore discontinued at 1.8m . Limit of Investigation.							
	2								
	3								
	4								
	5								
	6								

RIG: Hang Auger

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Hand Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



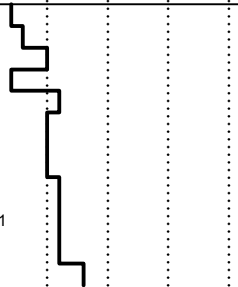
Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW/DoE
PROJECT: Proposed School Works
LOCATION: Murwillumbah High School, Murwillumbah

SURFACE LEVEL: 16.4 Approx
EASTING: 538294
NORTHING: 6865612
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 98119.00
DATE: 17-4-2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)
				Type	Depth	Sample	Results & Comments		
	0.4	FILL Silty CLAY (CL): low plasticity, dark brown, with fine to medium grained sand, trace fine gravel, moist, poorly compacted							
	1.9	Silty CLAY (CI-CH): medium to high plasticity, red with pale brown, moist, very stiff							
	2	Bore discontinued at 1.9m . Limit of Investigation.							

RIG: Hang Auger

DRILLER: Geoserve

LOGGED: BM

CASING: N/A

TYPE OF BORING: Hand Auger

WATER OBSERVATIONS: No free groundwater was encountered during the investigation.

REMARKS: Surface level interpolated from Intergovernmental Committee on Surveying and Mapping (ICSM) data dated 2019.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed School Structures
LOCATION: MHS, 86 Riverview Street, Murwillumbah

SURFACE LEVEL: ESL
EASTING: 538333
NORTHING: 6865601
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 203033.00
DATE: 14-4-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)
				Type	Depth	Sample	Results & Comments		
	0.05	TOPSOIL Silty CLAY CL: low plasticity, dark brown, with fine to medium grained sand, moist, w>PL		D	0.1				
	0.5	Silty CLAY CL: medium plasticity, red, moist, w=PL, stiff, residual - red with brown, very stiff		D	0.5				
1	1.0	Bore discontinued at 1.0m . Push tube refusal, limit of investigation.							
2									
3									
4									
5									
6									

RIG: Push Tube

DRILLER: Geoserve

LOGGED: MM/BMc

CASING: N/A

TYPE OF BORING: Push Tube

WATER OBSERVATIONS: No free groundwater encountered during investigation.

REMARKS: ESL=existing site level; w=moisture content; PL=plastic limit; LL=liquid limit.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed School Structures
LOCATION: MHS, 86 Riverview Street, Murwillumbah

SURFACE LEVEL: ESL
EASTING: 538230
NORTHING: 6865704
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 203033.00
DATE: 14-4-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.2	FILL Gravelly SAND SP: fine to coarse grained, dark brown, fine to coarse grained gravel, with silt, moist, appeared poorly to moderately compacted		D	0.1							
		Silty CLAY CL-CL: low to medium plasticity, brown, moist, w>PL, firm to stiff, residual		D	0.5							
				D	0.7							
1					1.0							
	1.3	- w=PL, stiff		S			2.2.5 N = 7					
					1.45							
	1.7	- orange with pale grey, hard, tending to extremely weathered siltstone										
2					2.5							
				S			13, 30/140mm					
	2.8	- with weathered rock fragments, extremely weathered siltstone			2.79							
3												
	3.6	METASILTSTONE: very low strength, grey with brown										
4					4.0							
	4.14	Bore discontinued at 4.14m . Limit of investigation.		S	4.14		30/140mm					
5												
6												

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: MM/BMc

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater encountered during investigation.

REMARKS: ESL=existing site level; w=moisture content; PL=plastic limit; LL=liquid limit.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test ls(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test ls(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed School Structures
LOCATION: MHS, 86 Riverview Street, Murwillumbah

SURFACE LEVEL: ESL
EASTING: 538360
NORTHING: 6865578
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 203033.00
DATE: 14-4-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing			Water	Dynamic Penetrometer Test (blows per 100mm)
				Type	Depth	Sample	Results & Comments	
	0.05	TOPSOIL Silty CLAY CL: low plasticity, dark brown, with fine to medium grained sand, moist, w>PL			0.1			
		Silty CLAY CI: medium plasticity, red, trace fine to coarse grained sand, moist, w>PL, stiff, residual		B	0.7			
	1				1.0		4,6,8 N = 14	
				S	1.45			
	1.8	- red with brown/orange, trace fine to coarse gravel (weathered rock fragments), w=PL, very stiff			2.5		6,7,11 N = 18	
	2			S	2.95			
	2.6	- red with orange and grey			4.0		5,9,14 N = 23	
	3			S	4.45			
	4							
	4.45	Bore discontinued at 4.45m . Limit of investigation.						
	5							
	6							

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: MM/BMc

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater encountered during investigation.

REMARKS: ESL=existing site level; w=moisture content; PL=plastic limit; LL=liquid limit.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



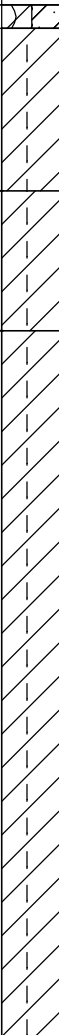
Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed School Structures
LOCATION: MHS, 86 Riverview Street, Murwillumbah

SURFACE LEVEL: ESL
EASTING: 538338
NORTHING: 6865566
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 203033.00
DATE: 14-4-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.1	FILL TOPSOIL Sandy CLAY CL: low plasticity, dark brown, fine to coarse grained sand, moist, w>PL		D	0.1					
		Silty CLAY CI: medium plasticity, red with pale grey, trace fine to coarse grained sand and fine to medium gravel, moist, w>PL, stiff, residual		D	0.4					
	0.8	- red with orange and grey								
1				S	1.0		4,5,9 N = 14		1	
	1.4	- w=PL			1.45					
2				S	2.5		4,7,8 N = 15		2	
3					2.95				3	
4				S	4.0		3,5,6 N = 11		4	
	4.45	Bore discontinued at 4.45m . Limit of investigation.			4.45					
5									5	
6									6	

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: MM/BMc

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater encountered during investigation.

REMARKS: ESL=existing site level; w=moisture content; PL=plastic limit; LL=liquid limit.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed School Structures
LOCATION: MHS, 86 Riverview Street, Murwillumbah

SURFACE LEVEL: ESL
EASTING: 538203
NORTHING: 6865721
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 203033.00
DATE: 14-4-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.1	TOPSOIL Silty CLAY CL: low plasticity, dark brown, moist, w>PL		D	0.1							
	0.3	Silty CLAY CL-CI: low to medium plasticity, dark brown, moist, w>PL, firm to stiff, residual										
	0.5	- brown		D	0.6							
		- brown with red, trace fine to medium gravel		D	0.8							
1												
	1.6	- stiff										
2	2.0	Bore discontinued at 2.0m . Push tube limit, limit of investigation.										
3												
4												
5												
6												

RIG: Push Tube

DRILLER: Geoserve

LOGGED: MM/BMc

CASING: N/A

TYPE OF BORING: Push Tube

WATER OBSERVATIONS: No free groundwater encountered during investigation.

REMARKS: ESL=existing site level; w=moisture content; PL=plastic limit; LL=liquid limit.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test $ls(50)$ (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test $ls(50)$ (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed School Structures
LOCATION: MHS, 86 Riverview Street, Murwillumbah

SURFACE LEVEL: ESL
EASTING: 538366
NORTHING: 6865663
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 203033.00
DATE: 14-4-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)
				Type	Depth	Sample	Results & Comments		
	0.1	FILL TOPSOIL Silty CLAY CL: low plasticity, dark brown, with fine to coarse grained sand, moist, w>PL		D	0.1				
		FILL Silty CLAY CL: medium plasticity, red with brown and orange, trace fine to coarse grained sand, moist, w=PL, appeared well compacted		D	0.3				
	0.5	- appeared moderately compacted		D	0.4				
				B					
					0.8				
	1			D	1.0		1.2,2 N = 4		
				S	1.45				
	1.9			D	1.9				
	2.0	Silty CLAY CL: low plasticity, dark brown, moist, w>PL, firm, residual							
	2.2	- red		D	2.4		3.5,7 N = 12		
		- w=PL, stiff, trace fine to medium gravel (weathered rock fragments)			2.5				
				S					
	2.9	- red with brown/orange			2.95				
	3								
	3.5	- orange with red and grey, w<PL, very stiff							
	4			S	4.0		6,9,12 N = 21		
					4.45				
	5			S	5.5		4,8,14 N = 22		
	5.95	Bore discontinued at 5.95m . Limit of investigation.			5.95				
	6								

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: MM/BMc

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater encountered during investigation.

REMARKS: ESL=existing site level; w=moisture content; PL=plastic limit; LL=liquid limit.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test (s(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test (s(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Built (NSW) Pty Ltd
PROJECT: Proposed School Structures
LOCATION: MHS, 86 Riverview Street, Murwillumbah

SURFACE LEVEL: ESL
EASTING: 538211
NORTHING: 6865707
DIP/AZIMUTH: 90°/-

BORE No: 7
PROJECT No: 203033.00
DATE: 14-4-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 100mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.15	FILL TOPSOIL Sandy CLAY CL: low plasticity, dark brown, fine to coarse grained sand, trace fine to medium gravel, moist, w>PL		D	0.1							
		Silty CLAY CL-CL: low plasticity, dark brown, moist, w>PL, soft, residual		D	0.5							
1	0.9	- pale brown			1.0							
	1.2	- firm		S			0.3,5 N = 8					
	1.5	- orange with pale grey, w=PL, stiff			1.45							
	1.7	- w<PL, very stiff										
2	1.9	- with weathered rock fragments										
					2.5							
	2.8	- hard, extremely weathered siltstone		S			8,12,17 N = 29					
3					2.95							
4					4.0		26, 30/130mm					
	4.28	Bore discontinued at 4.28m . Limit of investigation.		S	4.28							
5												
6												

RIG: Christie Soil Rig

DRILLER: Geoserve

LOGGED: MM/BMc

CASING: N/A

TYPE OF BORING: Auger

WATER OBSERVATIONS: No free groundwater encountered during investigation.

REMARKS: ESL=existing site level; w=moisture content; PL=plastic limit; LL=liquid limit.

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	sp	Standard penetration test
E	Environmental sample	≡	Water level	S	Shear vane (kPa)

Appendix E

Laboratory Test Results

Material Test Report



Joel Alford

Approved Signatory: Joel Alford

Senior Technician

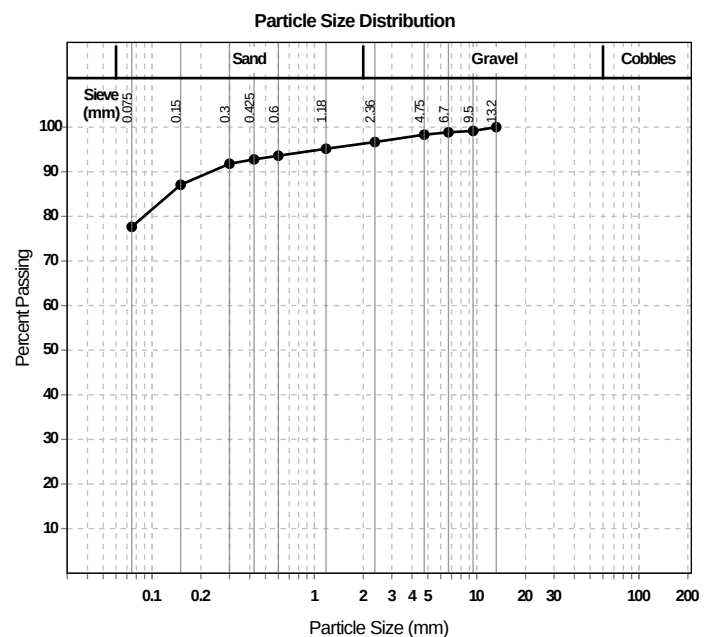
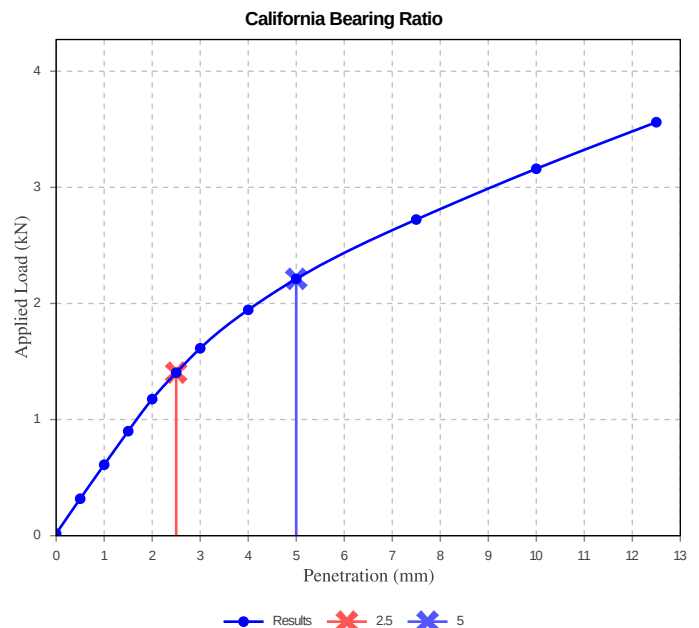
NATA Accredited Laboratory Number: 828

Report Number: 98119.00-1
Issue Number: 1
Date Issued: 08/05/2020
Client: School Infrastructure NSW/ Department of Education
10 Coral Crescent, Gateshead NSW 2325
Contact: Claudia Nolte
Project Number: 98119.00
Project Name: Murwillumbah Proposed School Works
Project Location: Murwillumbah High School, Murwillumbah
Client Reference: Quality
Work Request: 6092
Sample Number: GL-6092A
Date Sampled: 24/04/2020
Dates Tested: 24/04/2020 - 01/05/2020
Sample Location: BH 2, Depth: 0.1 - 0.8m

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	11		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.69		
Optimum Moisture Content (%)	18.0		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	96.0		
Dry Density after Soaking (t/m ³)	1.69		
Field Moisture Content (%)	17.7		
Moisture Content at Placement (%)	17.1		
Moisture Content Top 30mm (%)	21.5		
Moisture Content Rest of Sample (%)	19.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	163.2		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
13.2 mm	100		0	
9.5 mm	99		1	
6.7 mm	99		0	
4.75 mm	98		1	
2.36 mm	97		2	
1.18 mm	95		2	
0.6 mm	94		2	
0.425 mm	93		1	
0.3 mm	92		1	
0.15 mm	87		5	
0.075 mm	78		9	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	31		
Plastic Limit (%)	18		
Plasticity Index (%)	13		



Material Test Report

Report Number: 98119.00-1
Issue Number: 1
Date Issued: 08/05/2020
Client: School Infrastructure NSW/ Department of Education
10 Coral Crescent, Gateshead NSW 2325
Contact: Claudia Nolte
Project Number: 98119.00
Project Name: Murwillumbah Proposed School Works
Project Location: Murwillumbah High School, Murwillumbah
Client Reference: Quality
Work Request: 6092
Sample Number: GL-6092A
Date Sampled: 24/04/2020
Dates Tested: 24/04/2020 - 01/05/2020
Sample Location: BH 2, Depth: 0.1 - 0.8m

Linear Shrinkage (AS1289 3.4.1)	Min	Max
Linear Shrinkage (%)	7.5	
Cracking Crumbling Curling	None	



Approved Signatory: Joel Alford

Senior Technician

NATA Accredited Laboratory Number: 828

Material Test Report



Joel Alford

Approved Signatory: Joel Alford

Senior Technician

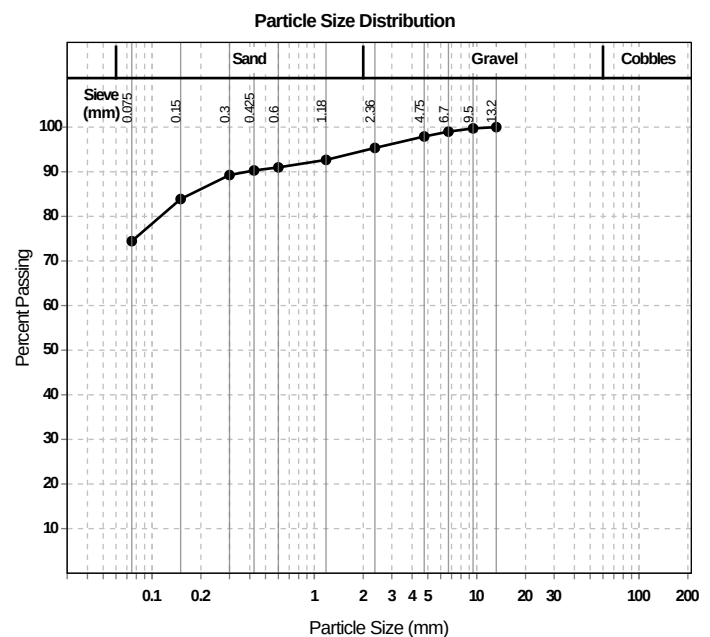
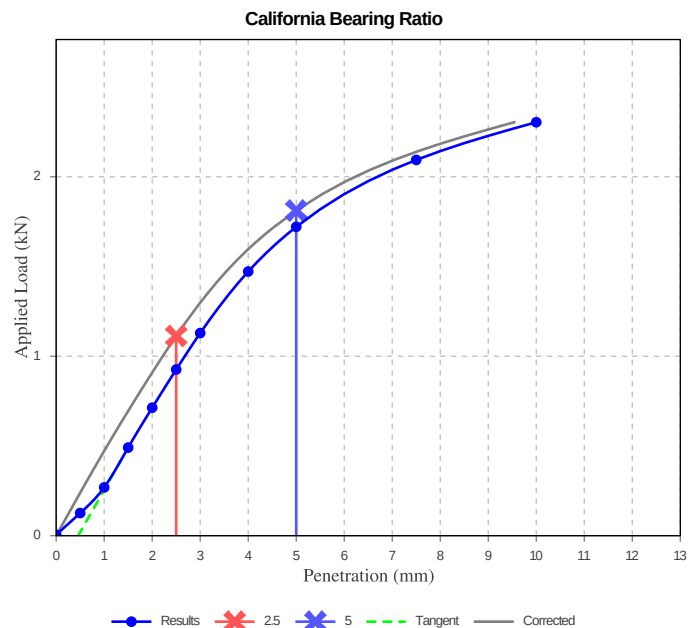
NATA Accredited Laboratory Number: 828

Report Number: 98119.00-1
Issue Number: 1
Date Issued: 08/05/2020
Client: School Infrastructure NSW/ Department of Education
10 Coral Crescent, Gateshead NSW 2325
Contact: Claudia Nolte
Project Number: 98119.00
Project Name: Murwillumbah Proposed School Works
Project Location: Murwillumbah High School, Murwillumbah
Client Reference: Quality
Work Request: 6092
Sample Number: GL-6092B
Date Sampled: 24/04/2020
Dates Tested: 24/04/2020 - 06/05/2020
Sample Location: BH 3, Depth: 0.5 - 1.0m

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	9		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.88		
Optimum Moisture Content (%)	12.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	97.0		
Dry Density after Soaking (t/m ³)	1.88		
Field Moisture Content (%)	10.5		
Moisture Content at Placement (%)	12.2		
Moisture Content Top 30mm (%)	15.1		
Moisture Content Rest of Sample (%)	14.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	162.8		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	99		1	
4.75 mm	98		1	
2.36 mm	95		3	
1.18 mm	93		3	
0.6 mm	91		2	
0.425 mm	90		1	
0.3 mm	89		1	
0.15 mm	84		5	
0.075 mm	74		9	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	22		
Plastic Limit (%)	17		
Plasticity Index (%)	5		



Material Test Report

Report Number: 98119.00-1
Issue Number: 1
Date Issued: 08/05/2020
Client: School Infrastructure NSW/ Department of Education
10 Coral Crescent, Gateshead NSW 2325
Contact: Claudia Nolte
Project Number: 98119.00
Project Name: Murwillumbah Proposed School Works
Project Location: Murwillumbah High School, Murwillumbah
Client Reference: Quality
Work Request: 6092
Sample Number: GL-6092B
Date Sampled: 24/04/2020
Dates Tested: 24/04/2020 - 06/05/2020
Sample Location: BH 3, Depth: 0.5 - 1.0m

Linear Shrinkage (AS1289 3.4.1)	Min	Max
Linear Shrinkage (%)	5.0	
Cracking Crumbling Curling	Curling	



Douglas Partners Pty Ltd
Gold Coast Laboratory

Unit 2/3 Distribution Avenue Molendinar QLD 4214

Phone: (07) 5568 8900

Email: Joel.alford@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing



Approved Signatory: Joel Alford
Senior Technician

NATA Accredited Laboratory Number: 828

Material Test Report

Report Number: 98119.00-1
Issue Number: 1
Date Issued: 08/05/2020
Client: School Infrastructure NSW/ Department of Education
 10 Coral Crescent, Gateshead NSW 2325
Contact: Claudia Nolte
Project Number: 98119.00
Project Name: Murwillumbah Proposed School Works
Project Location: Murwillumbah High School, Murwillumbah
Client Reference: Quality
Work Request: 6092
Sample Number: GL-6092C
Date Sampled: 24/04/2020
Dates Tested: 24/04/2020 - 06/05/2020
Sample Location: BH 7, Depth: 1.0 - 1.2m

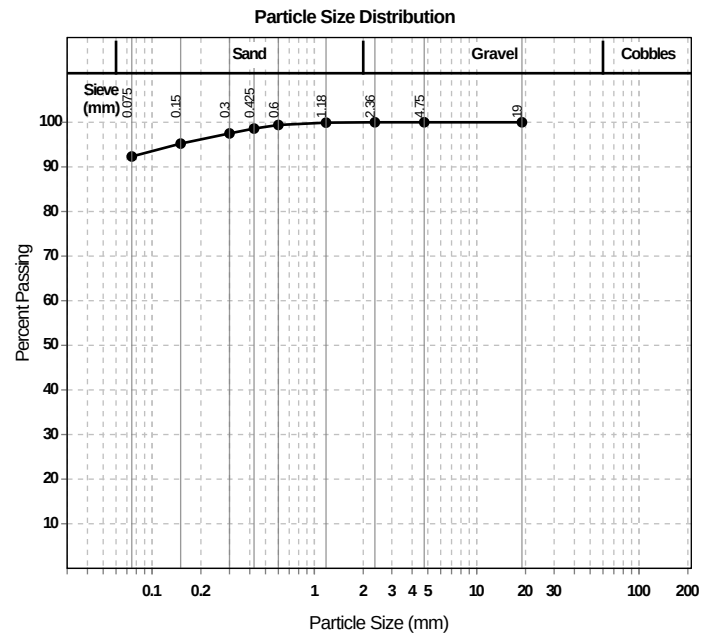


Approved Signatory: Joel Alford
 Senior Technician
 NATA Accredited Laboratory Number: 828

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
19 mm	100		0	
4.75 mm	100		0	
2.36 mm	100		0	
1.18 mm	100		0	
0.6 mm	99		1	
0.425 mm	99		1	
0.3 mm	98		1	
0.15 mm	95		2	
0.075 mm	92		3	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)			Min	Max
Sample History	Oven Dried			
Preparation Method	Dry Sieve			
Liquid Limit (%)	79			
Plastic Limit (%)	24			
Plasticity Index (%)	55			

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	21.5		
Cracking Crumbling Curling	None		



Material Test Report



Joel Alford

Approved Signatory: Joel Alford

Senior Technician

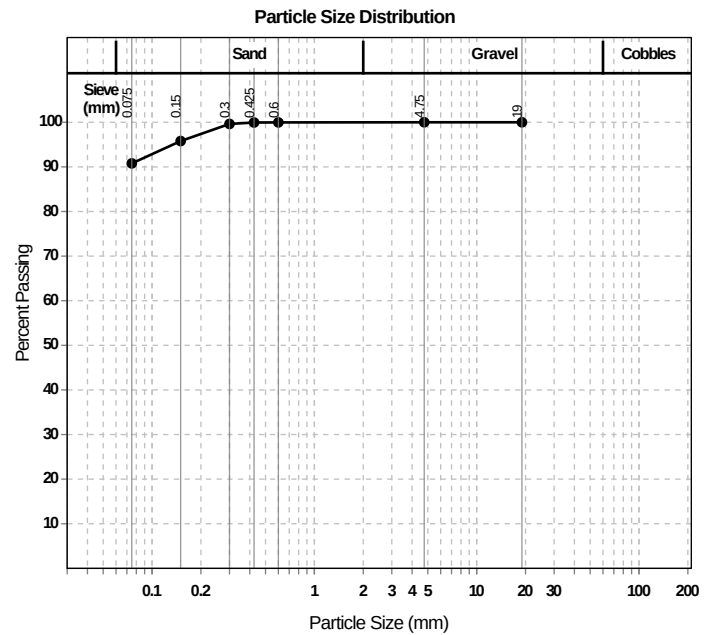
NATA Accredited Laboratory Number: 828

Report Number: 98119.00-1
Issue Number: 1
Date Issued: 08/05/2020
Client: School Infrastructure NSW/ Department of Education
10 Coral Crescent, Gateshead NSW 2325
Contact: Claudia Nolte
Project Number: 98119.00
Project Name: Murwillumbah Proposed School Works
Project Location: Murwillumbah High School, Murwillumbah
Client Reference: Quality
Work Request: 6092
Sample Number: GL-6092D
Date Sampled: 24/04/2020
Dates Tested: 24/04/2020 - 06/05/2020
Sample Location: BH 11, Depth: 0.8 - 1.0m

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
19 mm	100		0	
4.75 mm	100		0	
0.6 mm	100		0	
0.425 mm	100		0	
0.3 mm	100		0	
0.15 mm	96		4	
0.075 mm	91		5	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)				Min	Max
Sample History	Oven Dried				
Preparation Method	Dry Sieve				
Liquid Limit (%)	63				
Plastic Limit (%)	26				
Plasticity Index (%)	37				

Linear Shrinkage (AS1289 3.4.1)				Min	Max
Linear Shrinkage (%)	14.5				
Cracking Crumbling Curling	Curling				



CERTIFICATE OF ANALYSIS

Work Order : **EB2011271**
Client : **DOUGLAS PARTNERS PTY LTD**
Contact : **BEAU McDONALD**
Address : **2/3 DISTRIBUTION AVENUE**
MOLENDINAR 4214
Telephone : **----**
Project : **Proposed School Works**
Order number : **98119**
C-O-C number : **----**
Sampler : **BEAU McDONALD**
Site : **----**
Quote number : **EN/222**
No. of samples received : **4**
No. of samples analysed : **4**

Page : 1 of 2
Laboratory : Environmental Division Brisbane
Contact : John Pickering
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61 7 3552 8634
Date Samples Received : 24-Apr-2020 15:00
Date Analysis Commenced : 27-Apr-2020
Issue Date : 29-Apr-2020 09:59



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Santusha Pandra	Senior Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Santusha Pandra	Senior Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting
 Ø = ALS is not NATA accredited for these tests.
 ~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				Bore 1 1.8m-2.0m	Bore 2 0.1m-0.3m	Bore 8 0.3-0.4	Bore 2 1.1m-1.2m	----
Client sampling date / time				16-Apr-2020 00:00	16-Apr-2020 00:00	16-Apr-2020 00:00	16-Apr-2020 00:00	----
Compound	CAS Number	LOR	Unit	EB2011271-001	EB2011271-002	EB2011271-003	EB2011271-004	-----
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	4.9	5.2	6.9	5.4	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	16	19	13	11	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	24.4	21.3	7.7	24.0	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	20	30	<10	20	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	10	10	<10	<10	----

Material Test Report

Report Number: 203033.00-1
Issue Number: 1
Date Issued: 06/05/2021
Client: Built (NSW) Pty Ltd
 Level 7/343 George Street, Sydney NSW 2000
Contact: Alain Pavelic
Project Number: 203033.00
Project Name: Proposed School Structures
Project Location: 86 Rlvview Street, Murwillumbah
Work Request: 8323
Sample Number: GL-8323A
Date Sampled: 28/04/2021
Dates Tested: 28/04/2021 - 05/05/2021
Sample Location: Bore 3, Depth: 0.1 - 0.7m



Accredited for compliance with ISO/IEC 17025 - Testing

Joel Alford

Approved Signatory: Joel Alford

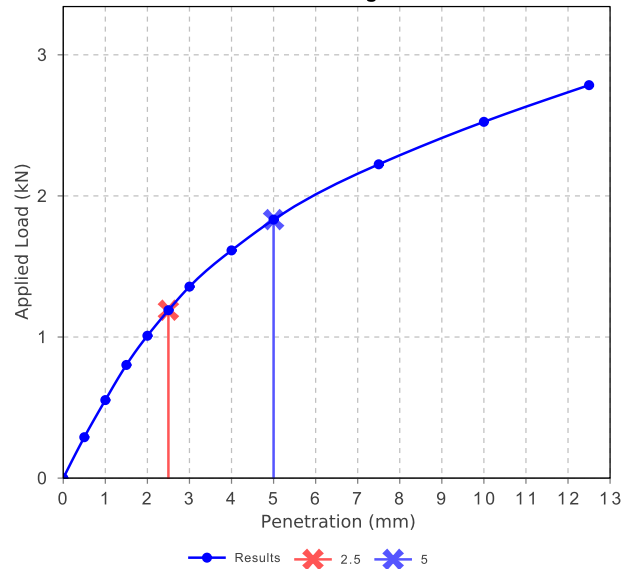
Assistant Manager

Laboratory Accreditation Number: 828

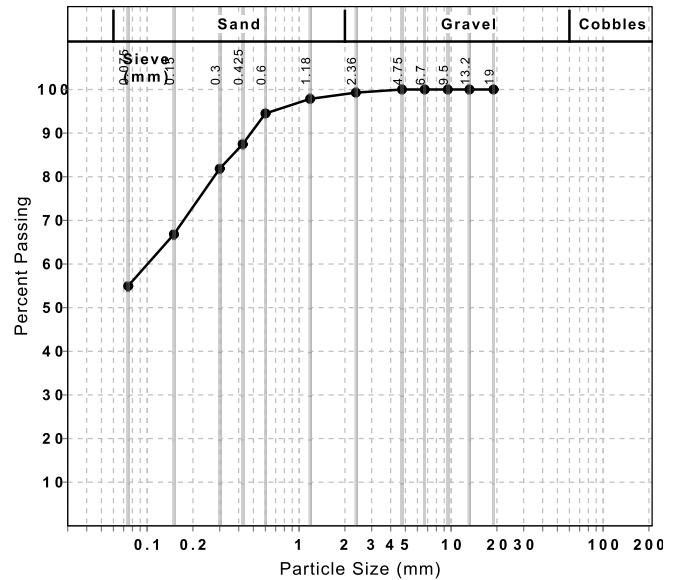
California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	9.0		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.61		
Optimum Moisture Content (%)	22.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	101.5		
Dry Density after Soaking (t/m ³)	1.61		
Field Moisture Content (%)	20.3		
Moisture Content at Placement (%)	22.5		
Moisture Content Top 30mm (%)	24.1		
Moisture Content Rest of Sample (%)	23.4		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	25.1		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
19 mm	100		0	
13.2 mm	100		0	
9.5 mm	100		0	
6.7 mm	100		0	
4.75 mm	100		0	
2.36 mm	99		1	
1.18 mm	98		1	
0.6 mm	95		3	
0.425 mm	87		7	
0.3 mm	82		6	
0.15 mm	67		15	
0.075 mm	55		12	

California Bearing Ratio



Particle Size Distribution



Material Test Report

Report Number: 203033.00-1
Issue Number: 1
Date Issued: 06/05/2021
Client: Built (NSW) Pty Ltd
Level 7/343 George Street, Sydney NSW 2000
Contact: Alain Pavelic
Project Number: 203033.00
Project Name: Proposed School Structures
Project Location: 86 Rlvview Street, Murwillumbah
Work Request: 8323
Sample Number: GL-8323A
Date Sampled: 28/04/2021
Dates Tested: 28/04/2021 - 05/05/2021
Sample Location: Bore 3, Depth: 0.1 - 0.7m

Douglas Partners Pty Ltd

Gold Coast Laboratory

Unit 2/3 Distribution Avenue Molendinar QLD 4214

Phone: (07) 5568 8900

Email: Joel.alford@douglaspartners.com.au



Accredited for compliance with ISO/IEC 17025 - Testing



Approved Signatory: Joel Alford

Assistant Manager

Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	45		
Plastic Limit (%)	26		
Plasticity Index (%)	19		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	13.5		
Cracking Crumbling Curling	None		

Material Test Report

Report Number: 203033.00-1
Issue Number: 1
Date Issued: 06/05/2021
Client: Built (NSW) Pty Ltd
 Level 7/343 George Street, Sydney NSW 2000
Contact: Alain Pavelic
Project Number: 203033.00
Project Name: Proposed School Structures
Project Location: 86 Rlvview Street, Murwillumbah
Work Request: 8323
Sample Number: GL-8323B
Date Sampled: 28/04/2021
Dates Tested: 28/04/2021 - 05/05/2021
Sample Location: Bore 6, Depth: 0.1 - 0.8m

Douglas Partners Pty Ltd

Gold Coast Laboratory

Unit 2/3 Distribution Avenue Molendinar QLD 4214

Phone: (07) 5568 8900

Email: Joel.alford@douglaspartners.com.au



Accredited for compliance with ISO/IEC 17025 - Testing

Joel Alford

Approved Signatory: Joel Alford

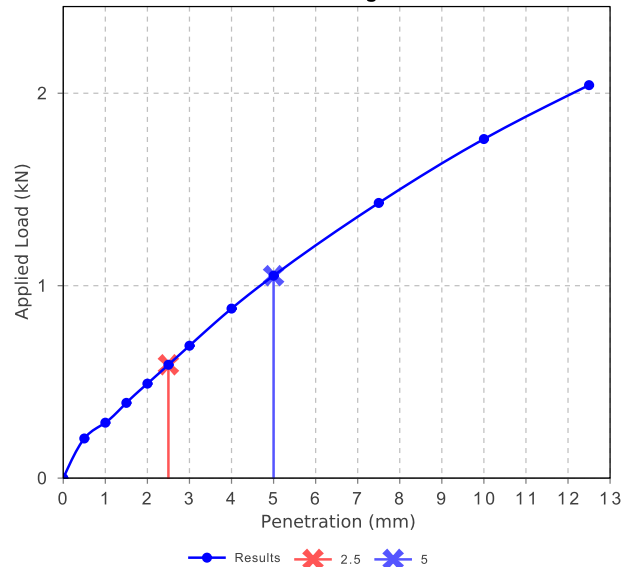
Assistant Manager

Laboratory Accreditation Number: 828

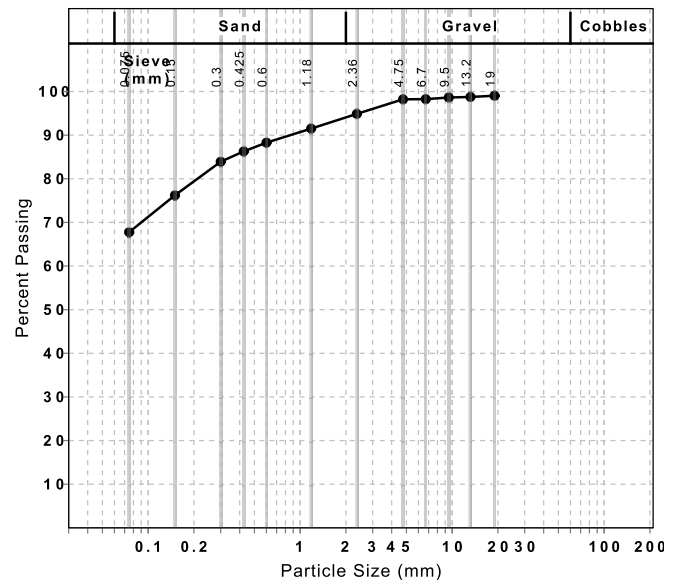
California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	5.0		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.63		
Optimum Moisture Content (%)	22.0		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	97.5		
Dry Density after Soaking (t/m ³)	1.62		
Field Moisture Content (%)	17.7		
Moisture Content at Placement (%)	21.4		
Moisture Content Top 30mm (%)	25.0		
Moisture Content Rest of Sample (%)	23.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours			
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0.9		

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
19 mm	99		1	
13.2 mm	99		0	
9.5 mm	99		0	
6.7 mm	98		0	
4.75 mm	98		0	
2.36 mm	95		3	
1.18 mm	91		3	
0.6 mm	88		3	
0.425 mm	86		2	
0.3 mm	84		2	
0.15 mm	76		8	
0.075 mm	68		8	

California Bearing Ratio



Particle Size Distribution



Material Test Report

Report Number: 203033.00-1
Issue Number: 1
Date Issued: 06/05/2021
Client: Built (NSW) Pty Ltd
Level 7/343 George Street, Sydney NSW 2000
Contact: Alain Pavelic
Project Number: 203033.00
Project Name: Proposed School Structures
Project Location: 86 Rlvview Street, Murwillumbah
Work Request: 8323
Sample Number: GL-8323B
Date Sampled: 28/04/2021
Dates Tested: 28/04/2021 - 05/05/2021
Sample Location: Bore 6, Depth: 0.1 - 0.8m

Douglas Partners Pty Ltd

Gold Coast Laboratory

Unit 2/3 Distribution Avenue Molendinar QLD 4214

Phone: (07) 5568 8900

Email: Joel.alford@douglaspartners.com.au



Accredited for compliance with ISO/IEC 17025 - Testing



Approved Signatory: Joel Alford

Assistant Manager

Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	41		
Plastic Limit (%)	23		
Plasticity Index (%)	18		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	10.5		
Cracking Crumbling Curling	None		



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH1/0.5	BH2/0.1	BH3/0.1	BH4/0.1	BH4/0.2
Sampling date / time					14-Apr-2021 00:00	14-Apr-2021 00:00	14-Apr-2021 00:00	14-Apr-2021 00:00	14-Apr-2021 00:00
Compound	CAS Number	LOR	Unit		EB2110706-030	EB2110706-031	EB2110706-033	EB2110706-035	EB2110706-036
				Result	Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		5.2	----	----	----	4.7
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		38.5	30.2	34.9	43.6	31.2
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		50000	----	----	----	55600
EA200: AS 4964 - 2004 Identification of Asbestos in Soils									
Asbestos Detected	1332-21-4	0.1	g/kg		----	No	No	No	----
Asbestos (Trace)	1332-21-4	5	Fibres		----	No	No	No	----
Asbestos Type	1332-21-4	-	--		----	-	-	-	----
Synthetic Mineral Fibre	----	0.1	g/kg		----	No	No	No	----
Organic Fibre	----	0.1	g/kg		----	Yes	Yes	Yes	----
Sample weight (dry)	----	0.01	g		----	210	148	135	----
APPROVED IDENTIFIER:	----	-	--		----	V.PHUNG	V.PHUNG	V.PHUNG	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		50	----	----	----	30
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		<10	----	----	----	<10
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		----	8	<5	<5	----
Cadmium	7440-43-9	1	mg/kg		----	<1	<1	<1	----
Chromium	7440-47-3	2	mg/kg		----	11	39	43	----
Copper	7440-50-8	5	mg/kg		----	21	11	17	----
Lead	7439-92-1	5	mg/kg		----	52	18	29	----
Nickel	7440-02-0	2	mg/kg		----	6	9	19	----
Zinc	7440-66-6	5	mg/kg		----	118	89	64	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		----	0.1	<0.1	<0.1	----
EP066: Polychlorinated Biphenyls (PCB)									
Total Polychlorinated biphenyls	----	0.1	mg/kg		----	----	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		----	----	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		----	----	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg		----	----	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg		----	----	<0.05	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH4/1.3	BH5/0.1	BH5/0.6	BH6/0.1	BH6/0.3
Sampling date / time					14-Apr-2021 00:00	14-Apr-2021 00:00	14-Apr-2021 00:00	14-Apr-2021 00:00	14-Apr-2021 00:00
Compound	CAS Number	LOR	Unit		EB2110706-037	EB2110706-038	EB2110706-039	EB2110706-040	EB2110706-041
				Result	Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		4.8	----	----	----	5.2
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		35.4	----	27.0	26.9	36.3
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		41700	----	----	----	58800
EA200: AS 4964 - 2004 Identification of Asbestos in Soils									
Asbestos Detected	1332-21-4	0.1	g/kg		----	No	----	No	----
Asbestos (Trace)	1332-21-4	5	Fibres		----	No	----	No	----
Asbestos Type	1332-21-4	-	--		----	-	----	-	----
Synthetic Mineral Fibre	----	0.1	g/kg		----	No	----	No	----
Organic Fibre	----	0.1	g/kg		----	Yes	----	Yes	----
Sample weight (dry)	----	0.01	g		----	86.5	----	115	----
APPROVED IDENTIFIER:	----	-	--		----	V.PHUNG	----	V.PHUNG	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		50	----	----	----	40
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		10	----	----	----	<10
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		----	----	6	<5	----
Cadmium	7440-43-9	1	mg/kg		----	----	<1	<1	----
Chromium	7440-47-3	2	mg/kg		----	----	10	25	----
Copper	7440-50-8	5	mg/kg		----	----	<5	10	----
Lead	7439-92-1	5	mg/kg		----	----	8	19	----
Nickel	7440-02-0	2	mg/kg		----	----	<2	5	----
Zinc	7440-66-6	5	mg/kg		----	----	<5	48	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		----	----	<0.1	0.2	----
EP066: Polychlorinated Biphenyls (PCB)									
Total Polychlorinated biphenyls	----	0.1	mg/kg		----	----	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.05	mg/kg		----	----	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg		----	----	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg		----	----	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg		----	----	<0.05	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH6/1.9	BH7/0.1	BH7/0.5	30/0.25	30/0.5
Sampling date / time					14-Apr-2021 00:00	14-Apr-2021 00:00	14-Apr-2021 00:00	14-Apr-2021 00:00	14-Apr-2021 00:00
Compound	CAS Number	LOR	Unit		EB2110706-043	EB2110706-045	EB2110706-046	EB2110706-047	EB2110706-048
				Result	Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		5.4	7.1	7.1	----	----
EA037: Ass Field Screening Analysis									
ø pH (F)	----	0.1	pH Unit		----	----	----	5.2	5.3
ø pH (Fox)	----	0.1	pH Unit		----	----	----	4.0	4.0
ø Reaction Rate	----	1	-		----	----	----	2	1
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		39.2	34.5	29.5	----	----
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		66700	43500	40000	----	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		30	<10	<10	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		<10	<10	<10	----	----