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Report on
Preliminary Geotechnical Investigation

Proposed Medical Research Centre
Campbelltown Hospital, Therry Road, Campbelltown

Prepared for
Western Sydney University
- Office of Estate and Commercial

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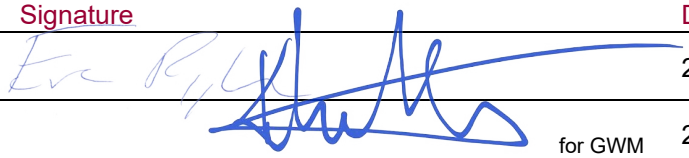
Author		2 July 2021
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Report on Preliminary Geotechnical Investigation
Proposed Medical Research Centre
Campbelltown Hospital, Therry Road, Campbelltown

1. Introduction

This report presents the results of a geotechnical investigation undertaken by Douglas Partners Pty Ltd (DP) for the proposed Macarthur Medical Research Centre (MMRC) on Parkside Crescent, Campbelltown. The work was commissioned by Ms Annalese Packer of Western Sydney University (WSU), and was carried out in accordance with the scope of work outlined in DP's proposal MAC200380 Rev2 dated 11 February 2021.

It is understood the design of the MMRC is still in development however preliminary plans indicate the proposed clinical school will include the construction of a three-storey building with two partial basement levels. The Centre will include research and teaching facilities, amenities and plant rooms. Floor plans indicate that the building will have a split-level design with level access to the lower first basement level from the west and level access to the ground floor from the east. Earthworks is expected to include up to 8 m of bulk excavation. The site is currently occupied by a concrete slab helipad and gabion retaining wall up to 4 m in height which will be demolished as part of the redevelopment.

Geotechnical investigation was undertaken to provide information on the subsurface conditions for design purposes and included the drilling of boreholes, laboratory testing and engineering assessment. Details of the field work and comments relevant to design and construction practice are given herein. The geotechnical investigation was carried out concurrently with a contamination investigation which has been reported separately (DP Project 34275.27 dated 22 June 2021).

Initial concept plans for the Centre were provided following completion of the field work.

2. Background

Several previous geotechnical and environmental investigations within the Campbelltown Hospital site have been undertaken by Douglas Partners Pty Ltd (DP) since August 1990 during separate stages of redevelopment. The relevant investigations to the subject development include the following:

- *"Report on Geotechnical and Environmental Investigation, UWS Campbelltown Clinical School, Parkside Crescent, Campbelltown"* (Project 84645) dated March 2015. This investigation was carried out for the building immediately to the south of the subject site.
- *"Report on Geotechnical Investigation, Proposed Campbelltown Hospital Redevelopment, Therry Road, Campbelltown"* (Project 34275.00) dated 10 May 2011. This investigation was carried out for numerous buildings across the hospital site including the building immediately to the north of the subject site.

The previous investigations comprised site inspections, borehole drilling, sampling, laboratory testing of selected samples, engineering analysis and reporting. Recommendations were provided for deep excavations, retention and foundation options for a range of founding conditions. The results of the previous investigations were generally consistent with the current investigation.

3. Site Description and Regional Geology

The site is an approximately rectangular shaped parcel of land of some 3000 m^2 located on the eastern side of Parkside Crescent, Campbelltown. The site has a frontage of approximately 65 m to Parkside Crescent and is bound by the Western Sydney University Clinical School Building to the south, Building D of the Campbelltown Hospital Complex to the north and the main hospital carpark to the east.

The site is currently occupied by the hospital helipad which comprises an on-grade concrete slab at RL83 m AHD. The helipad has been constructed on a fill platform which is approximately level with the carpark to the east. Surface levels fall away from the helipad to the north, south and west at grades in the range 5H:1V to 3H:1V. The battered slopes are then supported by gabion walls up to 4 m in height which are founded at RL74 – 75 m AHD along Parkside Crescent and the access driveways for the adjacent buildings.

The site layout and features are shown in Figures 1 and 2 below and Drawing 1 in Appendix B.

Figure 1: Looking south across the helipad toward WSU Clinical School

Figure 2: Looking west from Parkside Crescent (helipad is above gabion retaining wall and batter)

Reference to the Wollongong-Port Hacking 1:100 000 Geological Series Sheet indicates that the site is underlain by the Ashfield Shale Formation comprising laminite and dark-grey siltstone. The overburden residual soils associated within this formation typically comprise medium to high plasticity clays and silty clays. The results of the investigation were consistent with the geological mapping with siltstone encountered in all of the boreholes.

4. Proposed Development

The concept plans prepared by BVN Architects provided for the investigation indicate that the proposed MMRC will include the construction of a three-storey building with two partial basement levels (Lower Ground Levels 1 and 2). The building will contain clinical research facilities, seminar rooms, amenities and plant rooms. The floor plans indicate that the Lower Ground 02 floor level, which only occupies a small portion of the overall building footprint, will be at RL 75.1 m which is approximately level with Parkside Crescent but 8 m below the existing helipad surface level. The Level 00 floor level will be at RL 83.7 m which will provide level access with the existing surface levels in the carpark to the west. The building will include suspended pedestrian links which will provide internal access to the existing buildings to the north and south.

Demolition of the existing helipad and at least partial demolition of the existing gabion retaining wall will be undertaken as part of site preparation works.

5. Field Work

5.1 Field Work Methods

The field work for this investigation included the following:

- A walkover inspection by an engineering geologist.
- Drilling of nine boreholes across the proposed building area (Bores 201 – 209) using a track-mounted drilling rig fitted with solid flight augers and a tungsten carbide (TC) bit. The boreholes were initially drilled into the top of the underlying bedrock at depths in the range 6.0 – 9.2 m. Bores 202 – 204, 206 and 208 were extended into the bedrock using NMLC rock core drilling methods to depths of 12.8 – 14.3 m.
- Standard penetration tests (SPT) carried out at regular depth intervals within the overburden soil profiles during auger drilling to assess in situ strength and consistency.
- Sampling of soils to assist with the preparation of borehole log descriptions and laboratory testing.
- Standpipe piezometers installed in Bores 203, 204 and 208 to depths of 12.6 m, 13.5 m and 14.8 m respectively.

The test locations were determined in consultation with the client and set out on site by DP. The test locations were somewhat limited on site due to the topography of the site and presence of underground services. The surface levels (to Australian Height Datum, AHD) and co-ordinates were recorded using a differential GPS unit for which an accuracy of ±20 mm is typical (MGA94 Zone 56 coordinates). The borehole locations are shown on Drawing 1 in Appendix B.

5.2 Field Work Results

5.2.1 General

The subsurface conditions encountered in the boreholes are presented in the borehole logs in Appendix C together with notes defining classification methods and descriptive terms.

A summary of the sequence of subsurface conditions encountered at site is presented below:

Helipad Base	Encountered in Bores 202, 204, 206, 208 and 209. Concrete base 210 mm thick over gravel basecourse 200 – 300 mm thick.
Fill:	Encountered at all borehole locations to depths in the range 4.8 – 7.3 m. Comprising silty clay or gravelly clay (ripped siltstone gravel).
Natural Clay:	Encountered in all boreholes below the fill to depths in the range 5.5 – 8.9 m. Generally stiff and very stiff silty clay with some weathered shale bands and ironstone gravel. The moisture content of the natural clay was generally at or below the plastic limit.
Bedrock:	Siltstone (Ashfield Shale) was encountered beneath the natural clay in all boreholes from depths of 5.5 – 8.9 m. Generally very low strength initially and then progressing rapidly to medium strength (about 1 m into rock) and high strength (about 2 m into rock).

5.2.2 Rock Strengths

The resulting rock classifications for the cored boreholes (in accordance with Pells et al) as well as estimated classifications for the non-cored boreholes, including their corresponding Reduced Levels (RL – mAHD) are summarised in Table 1.

Table 1: Summary of Rock Class Levels

Bore No.	Surface RL (mAHD)	Rock Levels (Top of Layer)					
		Class IV Shale		Class III Shale		Class II Shale	
		Depth (m)	RL (m)	Depth (m)	RL (m)	Depth (m)	RL (m)
201	82.3	6.8	75.5	-	-	-	-
202	82.9	-	-	7.4	75.5	9.5	73.4
203	82.9	7.4	75.5	8.4	74.5	9.4	73.5
204	82.8	8.1	74.7	9.3	73.5	10.1	72.7
205	82.8	5.5	77.3	-	-	-	-
206	82.8	8.4	74.4	-	-	9.6	73.2
207	82.8	8.9	73.9	-	-	-	-
208	82.9	8.8	74.1	-	-	9.5	73.4
209	83.0	6.7	76.3	-	-	-	-

5.2.3 Groundwater

The groundwater observations made during the investigation are presented in Table 2.

Table 2: Summary of Groundwater Observations

Borehole No.	Groundwater Depth (m bgl)	Groundwater RL (m AHD)	Description
201	4.6	77.7	Perched groundwater at clay-fill interface encountered while augering 4 May 2021
203	6.4	76.5	Standing water level measured in standpipe 11 June 2021
204	7.8	75.1	Standing water level measured in standpipe 11 June 2021
208	6.2	76.6	Standing water level measured in standpipe 11 June 2021
209	5.5	77.6	Perched groundwater at clay-fill interface encountered while augering 4 May 2021

Where bgl = below ground level

Groundwater levels are transient and subject to seasonal variations, soil permeability and preceding climatic conditions.

6. Laboratory Testing

6.1 Mechanical Testing

Selected samples from the boreholes were tested in the laboratory for measurement of field moisture content, Atterberg limits, shrink-swell, California bearing ratio (CBR). The detailed test report sheets are given in Appendix D and summarised below.

Table 3: Summary of Laboratory Atterberg Limits Test Results

Borehole No.	Depth (m)	Soil Description	PL (%)	LL (%)	PI (%)	LS (%)	FMC (%)
201	1.9 – 2.0	Fill/Gravelly Clay	18	32	14	7.5	11.6
202	0.9 – 1.0	Fill/Gravelly Clay	21	44	23	11	21.3
203	5.5 – 5.95	Clay	21	44	23	9.0	11.1
205	4.0 – 4.45	Fill/Gravelly Clay	23	46	23	9.5	21.6
206	4.0 – 4.45	Fill/Gravelly Clay	19	39	20	10.0	12.9
207	7.0 – 7.45	Clay	23	53	30	13.0	21.3
208	6.5 – 6.95	Clay	22	52	30	13.0	20.6
209	5.5 – 5.95	Clay	25	58	33	14.5	28.6

Where: *PL = Plastic Limit* *LL = Liquid Limit* *PI = Plasticity Index*
LS = Linear Shrinkage *FMC = Field Moisture Content*

The results indicate that the natural clay and clayey fill samples tested are of intermediate and high plasticity and would be susceptible to shrinkage and swelling movements resulting from changes in soil moisture content.

The CBR samples were compacted to nominally 100% dry density ratio relative to Standard compaction at approximately optimum moisture content and then soaked for four days under surcharge loadings of 4.5 kg. The results of the field moisture content tests listed in Table 4 indicate the proposed subgrade soils at the time of the sampling were in the range 1.7% – 2.5% dry of standard optimum moisture content however it is noted that the field moisture contents were variable through the depth of the fill.

Table 4: Summary of Test Results – California Bearing Ratio (CBR)

Bore No	Depth (m)	FMC (%)	OMC (%)	MDD (t/m3)	Swell (%)	CBR (%)	Material
201	0.3 – 0.8	15.8	17.5	1.89	1.0	4.0	Fill/Gravelly Clay
205	0.3 – 0.7	16.0	18.5	1.85	0.5	3.0	Fill/Gravelly Clay

Where FMC = Field moisture content OMC = Optimum moisture content
MDD = Maximum dry density CBR = California bearing ratio

6.2 Aggressivity Testing

Selected samples from the boreholes were tested in the laboratory for measurement of pH, sulphates, chlorides and electrical conductivity. The detailed test report sheets and aggressivity table (Table D1) are given in Appendix D and summarised in Table 5.

Table 5: Results of Laboratory Testing—Chemical

Parameter		Units	Number of Tests	Range of Results
pH		pH units	10	7.1 – 9.4
Chlorides		(mg/kg)	10	<10 – 660
Sulphates		(mg/kg)	10	<10 – 340
Aggressivity (AS 2159: 2009)	to Concrete	-	10	Non-Aggressive
	to Steel	-	10	Non-Aggressive
EC1:5 [Lab.]		(mS/cm)	10	94 – 470
Resistivity		Ω.cm	10	2128 – 10638
ECe [M x EC1:5] [1]		(dS/m)	10	0.7 – 3.8
Salinity Class (Richards, 1954)		-	10	Non-Saline to Slightly Saline

Where: M = soil textural factor

The exposure classification for concrete and steel piles was determined in accordance with AS 2159 – 1996 (Ref 3) which indicates the soils tested would be classified as *"non-aggressive"* to concrete and *"non-aggressive"* to steel.

7. Comments

7.1 Geotechnical Model

The results of the investigation indicate that the site is underlain by fill to depths of 4.8 – 7.3 m (deepening to the west under the helipad). The fill was variably compacted. The fill is underlain by a natural residual clay profile, typically stiff to very stiff consistency to depths of 5.5 – 8.9 m (again, deepening to the west). The increasing depths of fill and clay to the west is consistent with historic aerial imagery which indicates that the original site graded to the west prior to the placement of fill.

Underlying the fill and residual clays is shale (Ashfield Shale) that is slightly weathered to fresh, initially very low strength but increases to medium strength within the upper 1 – 2 m, and then high strength generally from about 2 – 3 m below the rock surface.

Groundwater was measured at RL 75.1 – 76.6 (Bores 203, 204 and 208 as measured 11 June 2021) which appears to along the interface of the fill and natural clay.

The subsurface profiles can be seen in cross sections (Sections A-A', B-B' and C-C') which have been prepared from the borehole logs and are included in Appendix B.

7.2 Excavation

7.2.1 Excavation Conditions

It is understood that up to 8 m of excavation will be required to achieve the design Lower Ground 02 floor level of RL75.1 m AHD. Detailed excavation of services and lift pits may require 1 – 2 m of further localised excavation. The Lower Ground 02 floor footprint is mostly located within the western portion of the site where top of rock was encountered at RL 73.9 – 74.5 m. Accordingly, excavation will mostly be within existing fill and natural clays. Some localised excavation of very low strength shale should be expected due to minor variations in the level of top of rock. Detailed excavations for services and lifts pits may extend into the very low and then medium to high strength shale expected from around RL 72.5 – 73.5 m AHD.

Excavation of the upper soil layers (fill and natural) should be readily achieved using conventional earthmoving equipment, such as tracked excavators. Localised service and lift pit excavations will likely require some light to medium ripping assistance or the use of rock hammers (see vibration comments in following section) for the excavation of medium strength or stronger shale.

Assessment of excavation difficulties however, is best determined by intending contractors based on review of the borehole logs, inspection of core samples, consideration of the equipment they have at their disposal and the experience of the operators.

7.2.2 Vibration

The presence of the existing structures in the immediate vicinity of the excavation areas will need to be considered in assessing suitable excavation equipment, as the noise and ground vibration resulting from the excavation may cause damage to sensitive medical equipment, the underground services or other infrastructure. An assessment of vibration must be undertaken before work begins in selecting appropriate equipment. As the work will be undertaken within 20 m of what are likely vibration-sensitive structures, vibration trials must be undertaken prior to construction. If the monitoring indicates unacceptable levels of vibration, then the use of non-percussive (ie: rock sawing and ripping) excavation methods will be required. This requirement, however, will need to be determined once the details of the bulk earthworks and proposed excavation equipment are known. Notwithstanding the above, vibration monitoring may also be required during construction.

7.2.3 Excavation Support

The adjacent buildings to the north and south are founded at the approximate level of Parkside Crescent (approximate RL 75 – 76). As the Centre basement levels are proposed at RL 75, it is not expected that the excavation will encroach into the zone of influence of the adjacent building foundations. If design plans change and excavation does encroach into the zone of influence of the adjacent buildings or services, shoring will be required to avoid compromising the existing foundations.

7.2.4 Batter Slopes

During bulk excavation and earthworks, it is recommended that temporary batter slopes for Lower Ground 01 level (ie: above the groundwater table at RL 75.1 – 76.6 (Bores 203, 204 and 208 as measured 11 June 2021 do not exceed 1.5H:1V within the unsaturated fill and natural clay for batters up to 4 m high. Excavation for Lower Ground 02 is expected to be below the groundwater level and batters may require dewatering and specific geotechnical assessment for the design of safe batter slopes or shoring.

For permanent batters above the ground water, a maximum grade of 2H:1V is suggested, reducing to 3H:1V if maintenance access is required. Where batters greater than 4 m in height are required, the inclusion of a 3 m wide intermediate bench every 4 m in height is recommended to increase stability and reduce the effects of scour and erosion. Batter and excavation support within saturated fill and clay below the groundwater will require specific geotechnical assessment for the design of safe batter slopes or shoring.

7.2.5 Retaining walls

Earth pressures acting on retaining walls can be estimated on the basis of a trapezoidal pressure distribution (ie: triangular to 0.25 H, uniform from 0.25 H to 0.75 H and triangular decreasing to zero from 0.75 H to H) with depth using appropriate values of unit weight and active (K_a) or 'at rest' (K_0) earth pressure coefficients as set out in Table 6.

Table 6: Suggested Lateral Earth Pressure Design Parameters – Retaining Structures

Retained Material	Bulk Density (kN/m^3)	K_a(1)	K_0(1)	K_p(1)
Fill, clay and extremely weathered rock	20	0.3	0.6	2
Very low strength siltstone	22	0.25	0.4	400 kPa
Medium to high strength siltstone	22	10 kPa(2)	-	4,000 kPa

Notes: (1) Ultimate values with no reduction factor.
(2) A uniform pressure of 10 kPa should be adopted for the support of the medium to high strength siltstone to account for possible defects, but subject to inspection during the early stages of excavation to confirm bedding/jointing and revision of lateral restraint, if appropriate.

'At rest' pressure coefficients are appropriate where movement intolerant services or adjacent structures are present.

The pressure distribution given above does not include hydrostatic pressure due to groundwater behind retaining walls, which should be included in the design unless adequate drainage is provided to prevent the build-up of hydrostatic pressures.

The design of batter slopes and retaining walls should account for surcharge loads, including adjacent pavements, access roads, buildings or similar. Design should also consider the effects of plant operating above the excavation and/or retaining walls during construction.

7.3 Groundwater Inflow into Excavation

There is potential for groundwater inflow into the excavation along the interface of the fill and natural clay as indicated by standing water levels at around RL 75.1 – 76.6 (Bores 203, 204 and 208 as measured 11 June 2021). It is noted that groundwater levels can fluctuate with seasonal climatic changes and variability in the permeability of the subsurface strata.

Whilst the extent of groundwater inflow would be dependent on prior weather conditions, short-term inflow rates would be expected to be controlled from sumps within the excavation. In the longer-term, however, given the depth of the basement, the requirements for drainage behind perimeter walls (including any shotcrete walls) and under-floor drainage will need to be included.

7.4 Disposal of Excavated Materials

Under the Protection of the Environment Operation Act (1997), the burden of proof that materials received by a landfill or fill site meet the environmental criteria for proposed land use rests on the waste/fill receiving site. This includes Virgin Excavated Natural Materials (VENM), such as will be removed below the filling from this site. Accordingly, environmental testing may need to be carried out to classify the spoil. The type and extent of testing undertaken would depend on final use or destination of the spoil and requirements of the receiving site. As a minimum, allowance should be made during bulk excavation to stockpile topsoil, fill and underlying residual soils separately, to enable the best possible waste classification of the natural soils/rock to be achieved. Reference must be made to DP's Detailed Site Investigation (Project 34275.27) for further details relating to disposal of excavated materials.

7.5 Foundations

Based on the conditions encountered in the boreholes and the expected magnitude of the building loads, the existing fill and residual clays are considered appropriate for structural support. Excavation of the deepest portion of the building, namely the Lower Ground 02 02 at RL 75.1 m AHD, is expected to variably expose residual clay and Class IV Shale. In order to achieve uniform founding conditions, the building foundation system is recommended to comprise piers extended into the underlying bedrock.

Based on the results of the field investigation and laboratory testing, building footings and retaining wall footings could be proportioned using the maximum design parameters presented in Table 7. The footing recommendations and design parameters for any given strata will need to be confirmed following the completion of design stage when the final excavation and founding depths and design loads are known.

Table 7: Estimated Design Parameters

Material	Ultimate Base Bearing Pressures (kPa) (1)	Ultimate Shaft Adhesion Pressures (kPa) (2)	Allowable Base Bearing Pressures (kPa) (3)	Allowable Shaft Adhesion Pressures (kPa)	Allowable Lateral Resistance (kPa)
Class IV Shale	6,000	150	1,000	100	300
Class III Shale	20,000	750	3,500	350	1,000
Class II Shale	70,000(4)	1,000(4)	6,000(4)	600(4)	1,500(4)

Notes (1) The values are in accordance with Pells et al- 1998 (Ref 3);
(2) Ultimate values occur at large settlements (generally >5% of the minimum footing width);
(3) Assumes adequately cleaned and roughened pile sockets;
(4) Values for Class II Shale only to be adopted after additional investigation (coring footings or spoon testing).

Ultimate base bearing and shaft adhesion values have also been provided for Limit State design. A geotechnical strength reduction factor (Φg) of 0.45 must be applied in accordance with AS 2159 – 2009, Table 4.3.2 based on the available information. Pile testing will be required in accordance with AS 2159 – 2009 if adopting values of Φg>0.45.

If the design values for Class II or Class III Shale are proposed, daily site inspections will be required (as a minimum) for Class III rock, whilst coring or spoon testing will be required in the base of 50% of footings should parameters for Class II rock be required.

Settlements of up to 1% of the footing width can be expected for shallow footings designed on the basis of the parameters listed in Table 7.

Reference should be made to Table 1 with respect to the depths and reduced levels of the various grades of rock in the individual boreholes. It is noted that higher bearing pressures may be available within high strength shale, however, based on the presence of fractured bands within high strength rock core sample obtained from borehole BH1 some slight downgrading has been applied in arriving at the suggested parameters listed in Table 7.

As an example, for typical column loads of 1000 – 1500 kN, a 600 mm diameter pile would require a 1 m socket into Class III Shale (ie: a pier founding levels at approximately RL72). This would result in pile depths of approximately 11 m at the eastern side of the site and approximately 3 m following excavation to design Lower Ground 02 Levels in the western portion of the site. It is noted that the topography of the site precluded the drilling of boreholes along the western edge of the site and the rock levels should be confirmed prior to construction.

Local variations in rock strength and depth may occur across the site. All pile excavations should be inspected by a geotechnical engineer or engineering geologist and approved prior to concreting to confirm reduced pressures are not warranted due to extensively weathered or jointed zones.

It is understood that bored piers were utilised for the construction of the new clinical building to the west of site, however there are significant differences in fill depths and groundwater levels when compared to that site. The use of bored piers may be feasible for this site depending on groundwater inflow rates. Alternatively, auger grouted piles are considered suitable for the site provided installation is undertaken by an experienced contractor.

7.5.1 General

It is noted that in order to achieve sockets into medium to high strength rock, it would be necessary to employ a high torque boring rig for pier construction or alternatively, install pile groups at closely spaced centres with pile caps. The choice between the alternative pile systems will be dependent on relative costs and on suitability in relation to proposed construction.

Where footing systems are proposed adjacent to services, batters or located near retaining walls, local deepening of the footings or alternatively the inclusion of piles will most likely be required. Founding levels are to be below the zone of influence of the service trenches, batters and any retaining walls, with the zone of influence defined as an imaginary line extending from the base of the trench to the ground surface inclined at 45° (ie: 1 horizontal:1 vertical).

7.6 Pavements and Ground Slabs

The existing fill is uncontrolled and not considered appropriate for support of floor slabs. The Lower Ground 02 level floor slab (expected to be variably founded on natural clay and shale) could be designed for a CBR of 3% provided allowance is made for minor differential movement between the slab-on-grade and walls. The remaining floor slabs are expected to be a suspended design.

Subfloor drainage must be provided for at least the Lower Ground 02 level and possibly connected to a pump system. Allowance will need to be made for water-proofing the basement and uplift due to water pressure with design on a fully tanked basement if drainage cannot be provided.

A preliminary design CBR value of 3% could be adopted for on grade access pavements on Parkside Crescent. To maintain this design value, or any other amended/alternate design CBR value, it will be necessary to prepare the subgrade soils into a well compacted condition that is free of significant adverse long-term or differential settlements and/or deflection under service loading.

7.7 Seismic Design

In accordance with Part 4 of the Structural design actions Standard, AS1170.4 – 2007, the site is assessed to have a Site Sub-Soil Class of “C_e”.

8. Additional Geotechnical Requirements

Geotechnical inputs that are discussed in this report and will require input prior to and during construction are summarised as follows:

- Further geotechnical review as design progresses.
- Additional monitoring of groundwater levels.
- Vibration monitoring of field trials and during excavation including foundation construction.
- Inspection and environmental testing of excavated materials (ie: waste classification) prior to disposal.
- Inspection during foundation construction by a geotechnical consultant to provide validation of the bearing pressures and site conditions encountered are consistent with the foundation design.
- Working platform assessments for mobile cranes and piling rigs.

Notwithstanding the above mentioned items, the client and the building contractor should also be aware of any conditions in the development consent that require professional input during design and construction.

9. References

Geology of 1:100 000 Wollongong - Port Hacking Geological Series Sheet No 9029 - 9129, Dept. of Mines, (1985).

Foundations on Shales and Sandstones in the Sydney Region, Pells *et al*, Australian Geomechanics Journal (1998).

Australian Standard AS 2159 - 2009 "*Piling - Design and Installation"*.

AS 1170.4 - 2007, "Structural Design Actions - Part 4: Earthquake Actions in Australia".

10. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Campbelltown Hospital, Therry Road, Campbelltown in accordance with DP's proposal MAC200380 dated 11 February 2021 and acceptance received from Ms Annalese Packer of WSU. The work was carried out under WSU contract, dated 6 April 2021). This report is provided for the exclusive use of Western Sydney University - Office of Estate and Commercial 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 subsurface 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. Subsurface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

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

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.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

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

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.

Symbols & Abbreviations

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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

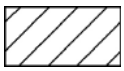

Concrete


Filling

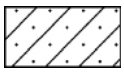
Soils

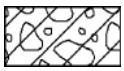

Topsoil

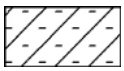

Peat


Clay


Silty clay


Sandy clay

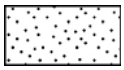

Gravelly clay


Shaly clay

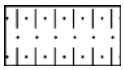

Silt


Clayey silt


Sandy silt

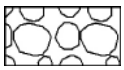

Sand

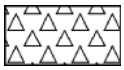

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

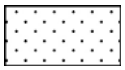

Talus

Sedimentary Rocks

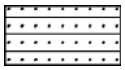

Boulder conglomerate

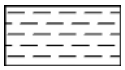

Conglomerate


Conglomeratic sandstone

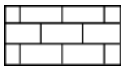

Sandstone


Siltstone

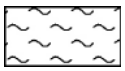

Laminite

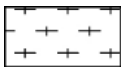

Mudstone, claystone, shale

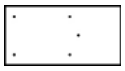

Coal


Limestone

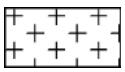
Metamorphic Rocks

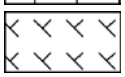

Slate, phyllite, schist

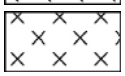

Gneiss

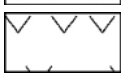

Quartzite

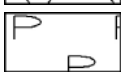
Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Soil Descriptions

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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).

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.
Note: If HW and MW cannot be differentiated use DW (see below)		
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:

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

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.

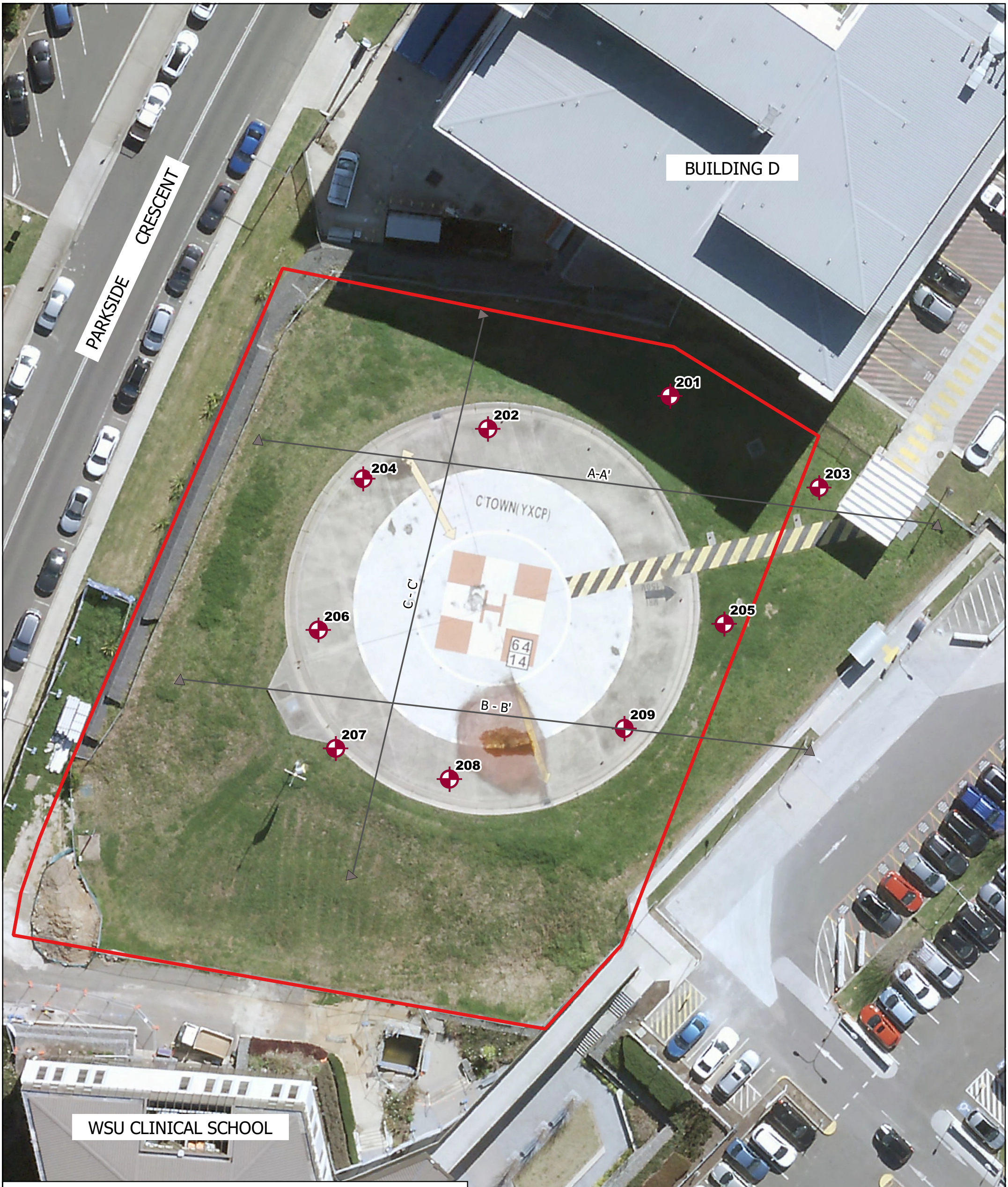
Stratification Spacing

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

Appendix B

Drawing 1
Sections A – C



Douglas Partners
Geotechnics / Environment / Groundwater

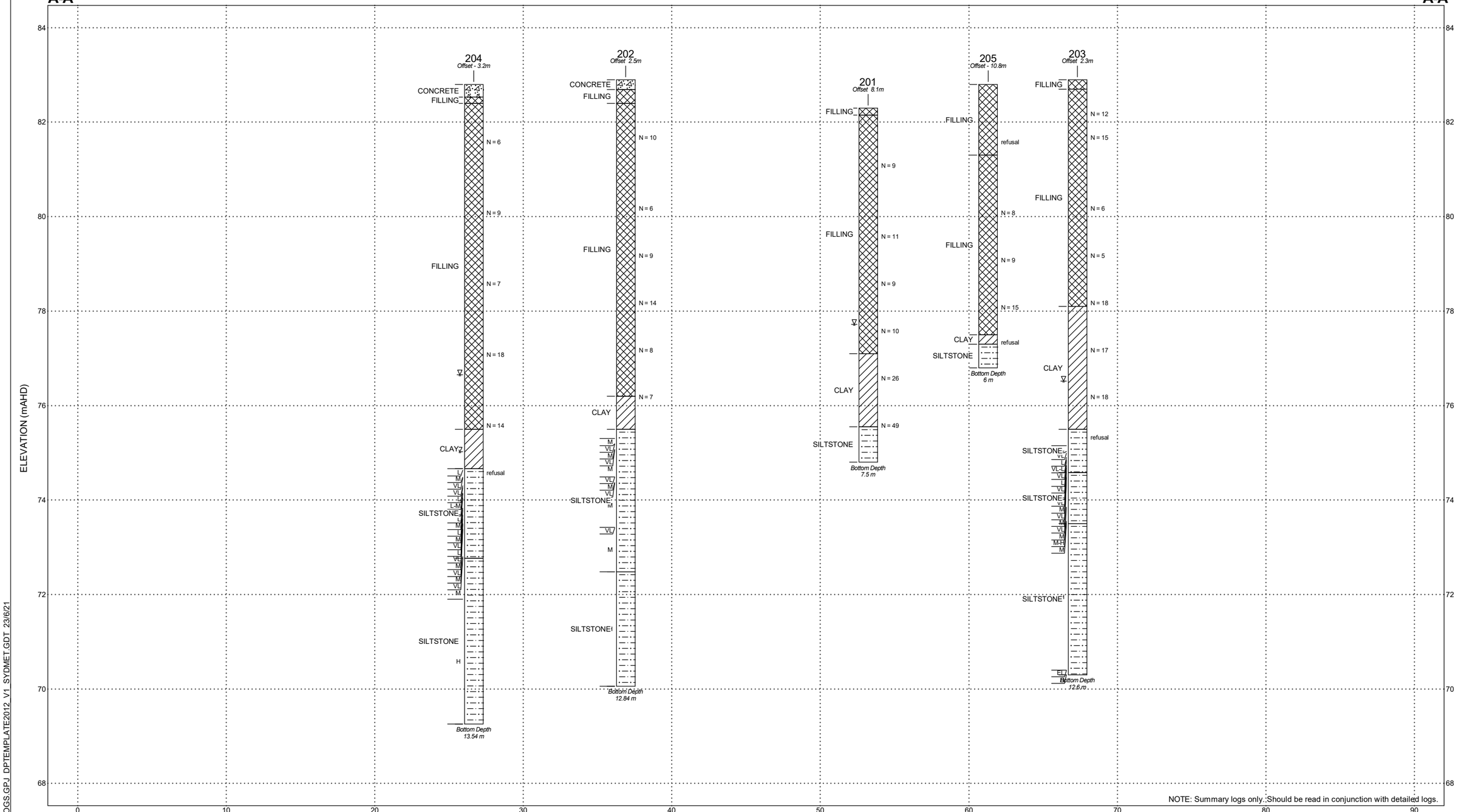
TITLE: **Borehole Location Plan**
Proposed Medical Research Facility
Campbelltown Hospital, Therry Road

MGA

OFFICE: Macarthur
DRAWN BY: ECR
DATE: 26 May 2021

CLIENT: Western Sydney University
PROJ. #: 34275.31
DRAWING No: 1
REVISION: 0
SCALE: As Shown

A-A'



DISTANCE ALONG PROFILE (m)

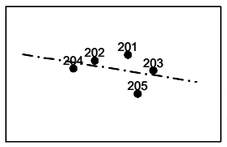
LEGEND

- Filling
- Clay
- Siltstone
- Concrete

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

TESTS / OTHER
N - Standard penetration test value
▽ - Water level
PP - Pocket penetrometer test value

SITE MAP



0 5
Horizontal Scale (metres)
Vertical Exaggeration = 3.2

STANDARD CROSS-SECTION 34275.31.L.001.REV0 LOGS.GPJ DPTEMPLATE2012 V1 SYDMET.GDT 23/6/21

Douglas Partners
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CLIENT: Western Sydney University		TITLE: **Cross-section A - A'**	PROJECT No: 34275.31
OFFICE: Macarthur	DRAWN BY: DS	**Proposed Medical Research Centre**	DRAWING No: A-1
SCALE: 1:251 (H) 1:79 (V) @ A3	DATE: 23.06.2021	**Therry Road, Campbelltown, NSW**	REVISION: 0

B

B-B'

ELEVATION (mAHD)

84
82
80
78
76
74
72
70
68

0
10
20
30
40
50
60
70
80
90

DISTANCE ALONG PROFILE (m)

206 Offset 5.5m
207 Offset -4.3m
208 Offset - 6.5m
209 Offset - 0.1m
205 Offset 9.6m

CONCRETE
FILLING
N = 6
N = 14
N = 12
N = 6
FILLING
FILLING
N = 17
N = 26
N = 19
N = 16
N = 22
N = 24
CLAY
CLAY
N = 15
refusal
SILTSTONE
refusal
Bottom Depth 9.2 m
SILTSTONE
M
H
SILTSTONE
M
H
Bottom Depth 14.28 m

CONCRETE
FILLING
N = 8
N = 8
FILLING
N = 14
N = 8
N = 17
N = 16
CLAY
N = 23
refusal
SILTSTONE
M
SILTSTONE
H
Bottom Depth 14.28 m

CONCRETE
FILLING
N = 14
N = 6
FILLING
N = 7
N = 18
CLAY
SILTSTONE
refusal
Bottom Depth 7.1 m

FILLING
refusal
N = 8
FILLING
N = 9
N = 15
CLAY
refusal
SILTSTONE
Bottom Depth 6 m

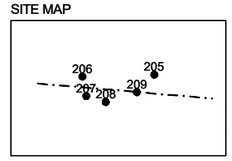
NOTE: Summary logs only. Should be read in conjunction with detailed logs.

LEGEND
- Filling
- Clay
- Siltstone
- Concrete

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

TESTS / OTHER
N - Standard penetration test value
WL - Water level
PP - Pocket penetrometer test value

SITE MAP



0 5
Horizontal Scale (metres)
Vertical Exaggeration = 3.2

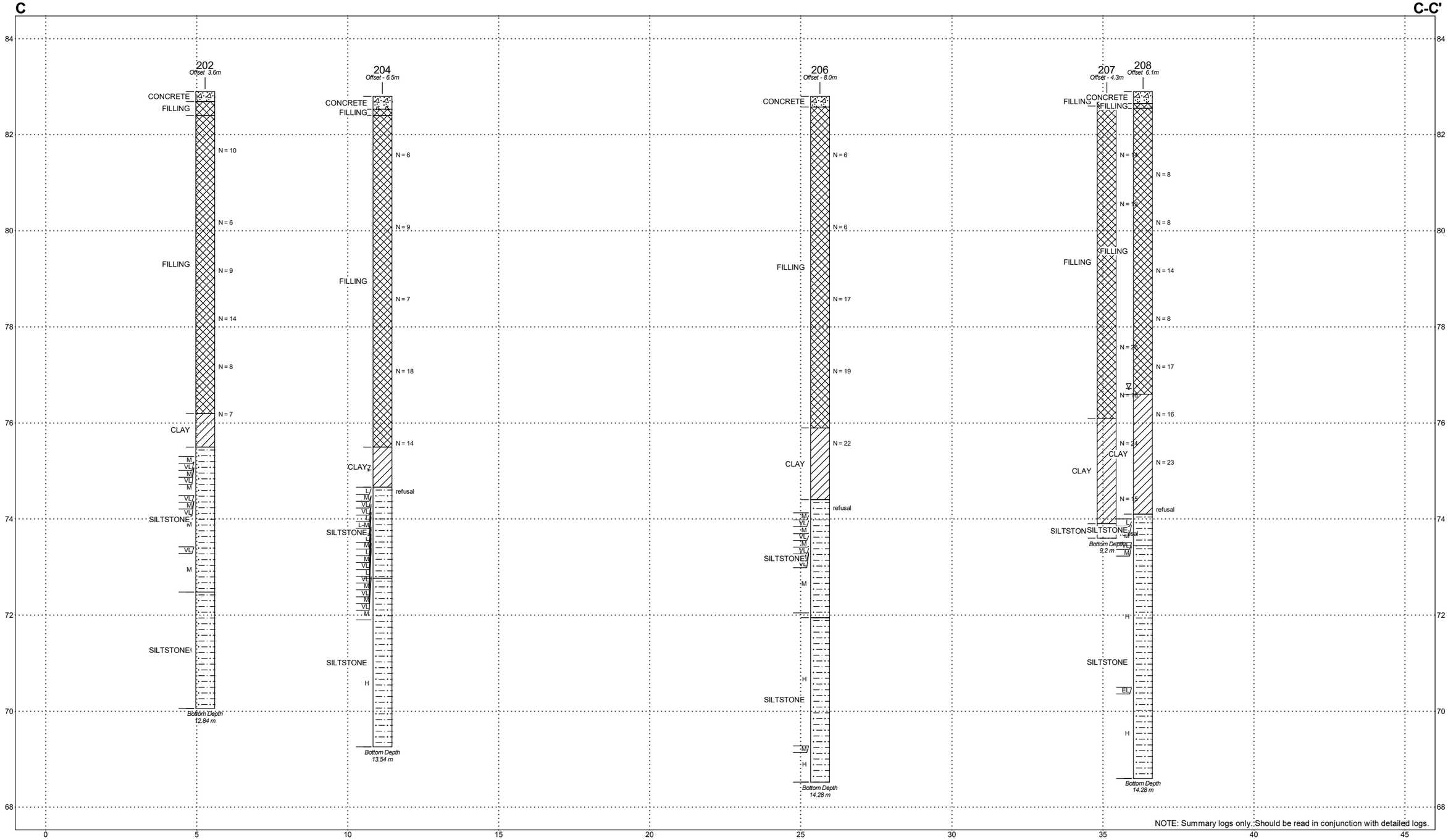
Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Western Sydney University		TITLE: **Cross-section B - B'**	PROJECT No: 34275.31
OFFICE: Macarthur	DRAWN BY: DS	**Proposed Medical Research Centre**	DRAWING No: A-2
SCALE: 1:251 (H) 1:79 (V) @ A3	DATE: 23.06.2021	**Therry Road, Campbelltown, NSW**	REVISION: 0

STANDARD CROSS-SECTION 34275.31.L.001.REV0 LOGS.GPJ DPTEMPLATE2012 V1 SYDMET.GDT 23/6/21

C

C-C'



NOTE: Summary logs only. Should be read in conjunction with detailed logs.

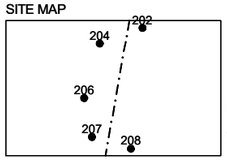
LEGEND

- Concrete
- Filling
- Clay
- Siltstone

ROCK STRENGTH
EL - Extremely Low
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High

TESTS / OTHER
N - Standard penetration test value
▽ - Water level
PP - Pocket penetrometer test value

SITE MAP



0 3
Horizontal Scale (metres)
Vertical Exaggeration = 1.6

STANDARD CROSS-SECTION 34275.31.L.001.REV0 LOGS.GPJ DPTEMPLATE2012 V1 SYDMET.GDT 23/6/21

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Western Sydney University		TITLE: **Cross-section C - C'**	PROJECT No: 34275.31
OFFICE: Macarthur	DRAWN BY: DS	**Proposed Medical Research Centre**	DRAWING No: A-3
SCALE: 1:125 (H) 1:79 (V) @ A3	DATE: 23.06.2021	**Therry Road, Campbelltown, NSW**	REVISION: 0

Appendix C

Borehole Logs (Bores 201 – 209)

BOREHOLE LOG

CLIENT: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.3 mAHD
EASTING: 297391
NORTHING: 6227038
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 34275.31
DATE: 4/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
82	0.15	FILL/TOPSOIL: Gravelly CLAY CL-CI, low to medium plasticity, dark brown, shale gravel, trace rootlets, w<<PL,		A/E	0.0 – 0.15				
		FILL/Silty CLAY CI: medium plasticity, dark brown then grey, with siltstone gravel, w<PL, variably compacted		A/E	0.4 – 0.5				
				A/E	0.9 – 1.0				
81	1			S/E	1.45		4,3,6 N = 9		
				A/E	1.9 – 2.0				
80	2			S/E	2.5 – 2.95		3,4,7 N = 11		
79	3			S/E	3.5 – 3.95		3,4,5 N = 9		
78	4			S/E	4.5 – 4.95		3,4,6 N = 10	▼ 04-05-21	
77	5			S/E	5.5 – 5.95		5,13,13 N = 26		
	5.2	CLAY CI-CH: medium to high plasticity, brown, with ironstone gravel, trace rootlets, w<PL, very stiff, residual							
76	6			S	6.5 – 6.95		5,15,34 N = 49		
	6.75	SILTSTONE: grey, very low strength, moderately weathered, Bringelly Shale							
75	7								
	7.5	Bore discontinued at 7.5m - limit of investigation							
74	8								
73	9								

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** Uncased
TYPE OF BORING: SFA to 7.5m
WATER OBSERVATIONS: Perched groundwater observed whilst augering at 4.6m
REMARKS: Location coordinates are in MGA94 Zone 56.

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_x	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)

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BOREHOLE LOG

CLIENT: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.9 mAHD
EASTING: 297374
NORTHING: 6227035
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 34275.31
DATE: 5 - 7/5/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
82	0.21	CONCRETE: 210mm thick, 8mm reo at 100mm depth, up to 20mm aggregate										
	0.5	FILL/Gravelly CLAY CI-CH: medium to high plasticity, dark brown, igneous gravel, with sand							A/E			
82	1	FILL/Gravelly CLAY CI-CH: medium to high plasticity, dark brown and grey, siltstone gravel, w<PL, variably compacted							A/E			
									S/E			3,5,5 N = 10
81	2								A/E			
									S/E			3,3,3 N = 6
80	3	- trace sandstone gravel below 3.4m										
									S/E			2,4,5 N = 9
79	4											
									S/E			5,7,7 N = 14
78	5											
									S/E			3,4,4 N = 8
77	6											
	6.7	CLAY CI:CH: medium to high plasticity, brown mottled pale grey, trace ironstone gravel, w<PL, apparently stiff, residual							S E			3,3,4 N = 7
76	7											
	7.4	(possibly disturbed)										
75	8	SILTSTONE: grey, with 1-2% fine sandstone lamination, medium strength with very low strength bands, fresh stained then fresh, fractured, Ashfield Shale						7.6-7.64: Jx2, 60°, pl 7.71-7.83: Csx2, 10mm 7.91m: J, 60°, pl 8m: J, 20°, pl, fe 8.22-8.29m: Jx3, 60-90°, pl 8.31m: B, 15°, pl, clay 5mm 8.41-8.53m: Csx2 10mm, fe 8.76-9.41m: Bx7, 0-10°, pl, clay up to 7mm 8.85-9.41m: Jx3, 40-70°, pl, clay vn 9.48m: Cs 10mm, fe 9.88m: B, 5°, pl, clay vn	C	100	51	PL(A) = 0.63 PL(A) = 0.45 PL(A) = 0.81
74	9											
73												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 7.5m

TYPE OF BORING: Diacore to 0.21m, SFA to 7.5m, rotary to 7.0m, NMLC coring to 12.84m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

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_x	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: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.9 mAHD
EASTING: 297374
NORTHING: 6227035
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 34275.31
DATE: 5 - 7/5/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
72	10	SILTSTONE: (continued)						10.05-10.37m: Bx5, 0-10°, pl, fe				PL(A) = 0.84
	10.42	SILTSTONE: grey, with 10-15% fine sandstone lamination, high strength, unbroken, Ashfield Shale										
71	11											PL(A) = 1.31
	12								C	100	100	PL(A) = 1.34
70	12.84	Bore discontinued at 12.84m - limit of investigation										PL(A) = 1.45
69	13											
	14											
68	15											
67	16											
66	17											
65	18											
64	19											
63												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 7.5m

TYPE OF BORING: Diacore to 0.21m, SFA to 7.5m, rotary to 7.0m, NMLC coring to 12.84m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

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_x	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: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.9 mAHD
EASTING: 297404
NORTHING: 6227030
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 34275.31
DATE: 4/5/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
82	0.2	FILL/Silty SAND: fine to medium grained, dark brown, with siltstone gravel and clay, dry							A/E*			
		FILL/Silty CLAY CI-CH: medium to high plasticity, dark brown to brown, with siltstone gravel, w<PL, variably compacted							A/E			
	1								S/E			4,6,6 N = 12
									S/E			3,6,9 N = 15
81	2								E/A			
									S/E			4,4,2 N = 6
80	3											
									S/E			2,3,2 N = 5
79	4											
	4.8	CLAY CI-CH: medium to high plasticity, brown mottled pale grey, trace ironstone gravel, w<PL, very stiff, residual							S E			3,8,10 N = 18
78	5											
									S			6,8,9 N = 17
77	6											
						06-11-21			S			4,7,11 N = 18
76	7											
	7.4	SILTSTONE: grey, with up to 5% fine sandstone lamination, low strength with very low strength bands, slightly weathered, fractured, Ashfield Shale							S			11,25/10mm,- refusal
75	8							7.8m: J, 45°, cu, clay vn 7.87m: J, 70-80°, ir, clay vn 7.93m: J, 60°, cu 8.05m: Cs 30mm, fe 8.17m: Cs 10mm 8.22m: Cs 10mm 8.28m: Ds 40mm, fe 8.42m: Cs 10mm 8.47m: B, 0-20°, ir 8.52m: B, 10°, pl, clay 7mm	C	100	36	PL(A) = 0.21
	8.32	SILTSTONE: grey, with up to 5% fine sandstone lamination, medium strength, slightly weathered, fractured, Ashfield Shale										
74	9											PL(A) = 0.51
	9.4	SILTSTONE: grey, with up to 10% fine sandstone lamination, high strength, fresh, slightly fractured, Ashfield Shale						8.88-9.36m: Jx5, 30-60°, pl, fe 9.39m: B, 0°, pl, clay 2mm	C	100	97	PL(A) = 1.24
73												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 7.7m
TYPE OF BORING: SFA to 7.5m, rotary to 7.75m, NMLC coring to 12.6m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56. * Replicate sample BD1/040521 collected

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_x	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)

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BOREHOLE LOG

CLIENT: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.9 mAHD
EASTING: 297404
NORTHING: 6227030
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 34275.31
DATE: 4/5/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
72	11	SILTSTONE: grey, with up to 10% fine sandstone lamination, high strength, fresh, slightly fractured, Ashfield Shale *(continued)*										PL(A) = 1.37
									C	100	97	
71	12							J, 30°, pl				PL(A) = 1.41
	12.6							12.4-12.44: Jx2, 45°. [; 12.5m: Cs 10mm				PL(A) = 1.12
70	13	Bore discontinued at 12.6m - limit of investigation										
69	14											
68	15											
67	16											
66	17											
65	18											
64	19											
63												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 7.7m

TYPE OF BORING: SFA to 7.5m, rotary to 7.75m, NMLC coring to 12.6m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. * Replicate sample BD1/040521 collected

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_x	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: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.8 mAHD
EASTING: 297363
NORTHING: 6227031
DIP/AZIMUTH: 90°/--

BORE No: 204
PROJECT No: 34275.31
DATE: 10/5/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
82	0.27	CONCRETE: 270mm thick, 8mm reo at 120mm depth, up to 20mm aggregate										
	0.4	FILL/Sandy GRAVEL: fine to coarse grained, dark brown, igneous gravel, moist							A/E			
	1	FILL/Gravelly CLAY CI-CH: medium to high plasticity, brown and pale grey, siltstone gravel, trace sandstone and igneous gravel, w~PL, variably compacted							A/E			
									S/E			2,3,3 N = 6
81	2											
									E*			
									S/E			3,3,6 N = 9
80	3											
									S/E			3,3,4 N = 7
79	4											
	5	- becoming w<PL below 5.0m										
78									S/E			6,7,11 N = 18
	6											
77									S/E			5,7,7 N = 14
	7											
	7.3	CLAY CI-CH: medium to high plasticity brown and grey, trace rootlets, w<PL, stiff, residual (possibly disturbed between 7.3 - 7.45m)										
76	8					06-11-21						
	8.14	SILTSTONE: grey, with 3-5% fine sandstone lamination, medium strength with low to very low strength bands, slightly weathered, fractured, Ashfield Shale						8.16m: B, 0°, pl, clay 7mm 8.22-10.03m: Bx13, 0-10°, clay 0-9mm, fe 8.32-8.34m: Cs 20mm, fe 8.35-9.94m: Jx10, 30-60°, pl & ir, clay 0-5mm, fe 8.66-8.67m: Cs 10mm 9.12-9.20m: Ds 80mm 9.3-9.32m: Cs 20mm, fe	S			~~15,50,-~~ refusal PL(A) = 0.43
75	9								C	100		PL(A) = 0.64
74												
73												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 8.0m

TYPE OF BORING: Diacore to 0.27m, SFA to 8.0m, rotary to 8.14m, NMLC coring to 13.54m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. * Replicate sample BD4/100521 collected

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_x	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: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.8 mAHD
EASTING: 297363
NORTHING: 6227031
DIP/AZIMUTH: 90°/--

BORE No: 204
PROJECT No: 34275.31
DATE: 10/5/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
72	10.03	SILTSTONE: grey, with 5-7% fine sandstone lamination, medium strength then high strength, fresh stained then fresh, slightly fractured, Ashfield Shale						10.0-10.03m: Ds 30mm				PL(A) = 0.46 PL(A) = 0.56
	11							10.51m: B, 0°, pl, clay 2mm 10.53m: B, 0°, pl, fe 10.72m: B, 10°, pl, clay 2mm	C	100		
71	12							11.29-11.8m: Jx4, 45-70°, pl, ir & cu, clay vn	C	100		PL(A) = 2.34
70	13							12.58m: J, 80°, ir				PL(A) = 1.43 PL(A) = 1.44
	13.54	Bore discontinued at 13.54m - limit of investigation										
69	14											
68	15											
67	16											
66	17											
65	18											
64	19											
63												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 8.0m

TYPE OF BORING: Diacore to 0.27m, SFA to 8.0m, rotary to 8.14m, NMLC coring to 13.54m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. * Replicate sample BD4/100521 collected

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_x	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: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.8 mAHD
EASTING: 297396
NORTHING: 6227018
DIP/AZIMUTH: 90°/--

BORE No: 205
PROJECT No: 34275.31
DATE: 5/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
82	0.0	FILL/Gravelly CLAY CI-CH: medium to high plasticity, brown to dark brown, siltstone gravel, with silt, trace brick fragments, sandstone gravel and rootlets, w~PL, variably compacted, first 100mm topsoil		A/E	0.0 - 0.1				
		- becoming w<PL below 0.4m		A/E	0.4 - 0.5				
1				A/E	0.9 - 1.0				
				S/E					
	1.5	- asphaltic concrete at 1.3m			1.45				
81		FILL/Gravelly CLAY CI-CH: medium to high plasticity, grey, siltstone gravel, with silt, w<PL, variably compacted		A/E	1.9 - 2.0		2,3,4 N = 7		
2					2.5				
				S/E			3,4,4 N = 8		
80					2.95				
3					3.5				
		- becoming dark brown, PVC fragments below 3.6m		S/E			2,4,5 N = 9		
79					3.95				
4					4.5				
		- igneous gravel below 4.7m		S/E			6,8,7 N = 15		
78					4.95				
5	5.3								
	5.5	CLAY CI-CH: medium to high plasticity, brown, trace ironstone gravel, apparently stiff, residual			5.45		21/150mm,-,- refusal		
77		SILTSTONE: grey, low strength, slightly weathered		S	5.5				
6	6.0	Bore discontinued at 6.0m - limit of investigation							
76									
7									
75									
8									
74									
9									
73									

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** Uncased
TYPE OF BORING: SFA to 6.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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_x	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: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.8 mAHD
EASTING: 297359
NORTHING: 6227017
DIP/AZIMUTH: 90°/--

BORE No: 206
PROJECT No: 34275.31
DATE: 10/5/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
82	0.22	CONCRETE: 220mm thick, 3 x 8mm reinforcement at 120mm depth, up to ~20mm aggregate										
		FILL/Gravelly CLAY CI-CH: medium to high plasticity, brown and gey, siltstone gravel, trace igneous and sandstone gravel, w<PL, variably compacted							E/A*			
	1								A/E			
									S/E			2,2,4 N = 6
81	2											
80	3								S/E			2,2,4 N = 6
79	4								S/E			3,9,8 N = 17
		- asphaltic concrete at 4.3m										
78	5											
77	6	- concrete fragments at 5.9m							S/E			6,6,13 N = 19
76	6.9	CLAY CI-CH: medium to high plasticity, brown mottled pale grey, w<PL, very stiff, residual							S/E			6,9,13 N = 22
75	7 8											
	8.4	SILTSTONE: grey, with 3-5% fine sandstone lamination, medium strength, with very low strength bands, fresh stained, fractured, Ashfield Shale							S			24/140mm,-,- refusal
74	9							8.67m: J, 45°, pl, clay vn 8.7m: B, 0°, pl, clay 3mm 8.73-8.84: Ds 110mm 8.87m: Cs 10mm 8.90-9.12m: B, 0-10°, pl, clay 3-5mm 9.10-9.15m: Ds 50mm 9.16-9.42m: Jx6,	C	100	21	PL(A) = 0.55 PL(A) = 0.46
73												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 8.5m

TYPE OF BORING: Diacore to 0.22m, SFA to 8.5m, rotary to 8.67m, NMLC coring to 14.28m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. * Replicate sample BD3/100521 collected

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_x	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: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.8 mAHD
EASTING: 297359
NORTHING: 6227017
DIP/AZIMUTH: 90°/--

BORE No: 206
PROJECT No: 34275.31
DATE: 10/5/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
72		SILTSTONE: grey, with 3-5% fine sandstone lamination, medium strength, with very low strength bands, fresh stained, fractured, Ashfield Shale *(continued)*						20-60°, pl, clay vn 9.37-9.41m: Ds 40mm 9.47m: B, 0-10°, pl, fe 9.48m: B, 0-10°, pl, fe 9.5-9.53m: Ds 30mm 9.54-10.58m: Bx12, 0-10°, clay 0-5mm, fe 9.87-10.74m: Jx4, 0-45°, fe, clay vn 10.85m: B, 0-5°, pl, fe	C	100	21	PL(A) = 0.59 PL(A) = 1.14
	10.85											
71	11	SILTSTONE: grey, with 5-10% fine sandstone lamination, high strength, fresh, unbroken then fractured to slightly fractured, Ashfield Shale										PL(A) = 1.41
	12							12.17m: J, 45°, cu, fe				PL(A) = 1.74
70	13							12.87m: J, 45°, pl 13.0-13.1m: Jx3, 45°, pl 13.2-13.3m: Jx6, 30-45°, pl, cu, st 13.49-13.52m: Jx2, 30-45°, pl 13.72-13.85m: Jx2, pl, 30-45°	C	100	92	PL(A) = 2.08
69	14											
	14.28	Bore discontinued at 14.28m - limit of investigation										PL(A) = 1.25
68	15											
67	16											
66	17											
65	18											
64	19											
63												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 8.5m

TYPE OF BORING: Diacore to 0.22m, SFA to 8.5m, rotary to 8.67m, NMLC coring to 14.28m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. * Replicate sample BD3/100521 collected

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_x	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)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.8 mAHD
EASTING: 297361
NORTHING: 6227007
DIP/AZIMUTH: 90°/--

BORE No: 207
PROJECT No: 34275.31
DATE: 5/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
82	0.2	FILL/TOPSOIL: Silty SAND, fine to medium grained, dark brown, with siltstone gravel and rootlets, moist		A/E	0.0–0.1				
		FILL/Silty CLAY CI: medium plasticity, dark brown, with siltstone gravel, trace sandstone gravel, w<PL, variably compacted		A/E	0.4–0.5				
	1			A/E	0.9–1.0				
				S/E			4,6,8 N = 14		
		- bitumen fragment at 1.3m			1.45				
81	2			A/E	1.9–2.0				
					2.15		2,5,7 N = 12		
				S/E	2.5				
80	3								
79	4								
78	5			S/E	5.0		7,11,15 N = 26		
		- brick fragment at 5.45m			5.45				
77	6			S/E	6.0		3,5,11 N = 16		
					6.45				
76	6.7	CLAY CI-CH: medium to high plasticity, brown mottled pale grey, w<PL, stiff to very stiff, residual							
	7			S/E	7.0		4,8,16 N = 24		
75					7.45				
	8			S	8.0		4,7,8 N = 15		
74					8.75				
	8.9								
	9	SILTSTONE: grey, very low strength, slightly weathered, Ashfield Shale		S	9.0		11,20/50mm,- refusal bouncing		
	9.2	Bore discontinued at 9.2m - limit of investigation			9.2				
73									

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** Uncased
TYPE OF BORING: SFA to 9.2m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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_x	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
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BOREHOLE LOG

CLIENT: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.9 mAHD
EASTING: 297371
NORTHING: 6227004
DIP/AZIMUTH: 90°/--

BORE No: 208
PROJECT No: 34275.31
DATE: 7/5/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.25	CONCRETE: 250mm thick, 8mm reo at 110mm depth, up to 20mm aggregate										
	0.35	FILL/Sandy GRAVEL: fine to coarse grained, dark brown, igneous gravel, with clay							A/E			
82	1	FILL/Gravelly CLAY CI-CH: medium to high plasticity, dark brown and grey, siltstone gravel, trace igneous and sandstone gravel, w<PL, variably compacted							A/E			
									S/E			2,3,5 N = 8
81	2											
									S/E			4,4,4 N = 8
80	3											
									S/E			3,7,7 N = 14
79	4											
									S/E			4,4,4 N = 8
78	5											
		- grey sandy gravel band between 5.65-5.75m							S/E			4,10,7 N = 17
77	6											
	6.3	CLAY CI-CH: medium to high plasticity, brown mottled pale grey, trace ironstone and rootlets, w<PL, stiff to very stiff, residual				06-11-21			S/E			3,7,9 N = 16
76	7											
									S			8,11,12 N = 23
75	8											
	8.8								S			10,12,20/100mm refusal
74	9	SILTSTONE: grey, with 15-20% fine sandstone lamination, medium strength, with very low strength bands, slightly weathered then fresh stained, fractured, Ashfield Shale						8.9m: J, 60°, pl, ti 8.96-9.03m: Cs 70mm, fe 9.09m: J, 60°, pl, fe 9.3m: B, 10°, pl, fe 9.34m: J, 55°, pl, he 9.39-9.40m: Cs 10mm, fe	C	100	71	PL(A) = 0.67 PL(A) = 1.58
	9.46											
73												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 8.8m

TYPE OF BORING: Diacore to 0.25m, Hand auger to 1.5m, SFA to 8.5m, rotary to 8.8m, NMLC coring to 14.3m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

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_x	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: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 82.9 mAHD
EASTING: 297371
NORTHING: 6227004
DIP/AZIMUTH: 90°/--

BORE No: 208
PROJECT No: 34275.31
DATE: 7/5/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
72	11	SILTSTONE: grey, with 2-10% fine sandstone lamination, high strength, fresh stained then fresh, slightly fractured, Ashfield Shale *(continued)*						9.44m: B, 0-10°, pl, clay 7mm 9.45m: J, 10°, pl, clay vn 9.64-10.38m: Bx5, 0-5°, pl, fe 10.72m: B, 0°, pl, fe	C	100	71	PL(A) = 1.42
71	12							12.05m: J, 30°, cu, cln 12.38m: J, 60°, pl, cln 12.40-12.42: Cs 20mm 12.55-12.72m: Jx2, 45°, pl, cln	C	100	99	PL(A) = 1.55 PL(A) = 1.81 PL(A) = 1.18
70	13							13.66m: J, 70-80°, pl				
69	14											PL(A) = 1.24
	14.3	Bore discontinued at 14.28m - limit of investigation										
68	15											
67	16											
66	17											
65	18											
64	19											
63												

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** HQ to 8.8m

TYPE OF BORING: Diacore to 0.25m, Hand auger to 1.5m, SFA to 8.5m, rotary to 8.8m, NMLC coring to 14.3m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

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_x	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: Western Sydney University
PROJECT: Proposed Medical Research Centre
LOCATION: Therry Road, Campbelltown, NSW

SURFACE LEVEL: 83.0 mAHD
EASTING: 297387
NORTHING: 6227009
DIP/AZIMUTH: 90°/--

BORE No: 209
PROJECT No: 34275.31
DATE: 10/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
83	0.23	CONCRETE: 230mm thick, 8mm reo at 100mm depth, up to 20mm aggregate							
	0.4	FILL/Sandy GRAVEL: fine to coarse grained, dark brown, igneous gravel, moist		E	0.3				
				A	0.4				
		FILL/Gravelly CLAY CI-CH: medium to high plasticity, brown and grey, siltstone gravel, trace sandstone gravel, w>PL, variably compacted			0.5				
82	1			A/E*	0.9				1
					1.0				
		- becoming w<PL below 1.0m		S			4,6,8 N = 14		
					1.45				
81	2								2
				S	2.5		2,2,4 N = 6		
80	3				2.95				3
79	4			S/E	4.0		4,3,4 N = 7		4
					4.45				
78	5								5
	5.3	CLAY CI-CH: medium to high plasticity, brown mottled grey, trace ironstone gravel, w<PL, very stiff, residual							
				S/E	5.5		4,7,11 N = 18	10-05-21	
77	6				5.95				6
	6.7	SILTSTONE: grey, very low to low strength, slightly weathered, Ashfield Shale							
76	7	7.0		S	7.0		25,-,- refusal bouncing		7
		Bore discontinued at 7.1m - limit of investigation			7.15				
75	8								8
74	9								9

RIG: Hanjin 8D drill rig **DRILLER:** Rockwell **LOGGED:** RB **CASING:** Uncased

TYPE OF BORING: Diacore to 0.23m, SFA to 7.0m

WATER OBSERVATIONS: Free groundwater observed whilst augering at 5.5m

REMARKS: Location coordinates are in MGA94 Zone 56. * Replicate sample BD2/100521 collected

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_x	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)

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Appendix D

Results of Laboratory Testing

Material Test Report

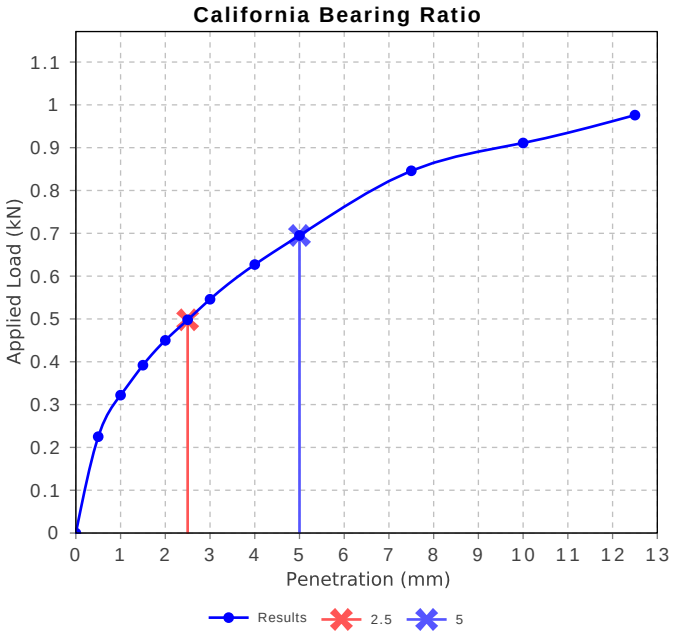
Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Fax: (02) 4646 1886
Email: ramon.arancibia@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Ramon Arancibia
Assistant Laboratory Manager
Laboratory Accreditation Number: 828

Report Number: **34275.31-2**
Issue Number: 1
Date Issued: 03/06/2021
Client: Western Sydney University - Office of Estate and Commercial
Locked Bag 1797, Penrith NSW 2751
Contact: Annalese Packer
Project Number: 34275.31
Project Name: Proposed Medical Research Centre
Project Location: Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request: 5579
Sample Number: MA-5579A
Date Sampled: 19/05/2021
Dates Tested: 19/05/2021 - 31/05/2021
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH201 (0.3 - 0.8m)**
Material: Gravelly CLAY

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**4.0**		
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)	1.89		
Optimum Moisture Content (%)	17.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.5		
Dry Density after Soaking (t/m^3)	1.87		
Field Moisture Content (%)	15.8		
Moisture Content at Placement (%)	17.6		
Moisture Content Top 30mm (%)	17.9		
Moisture Content Rest of Sample (%)	17.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48.9		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
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Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
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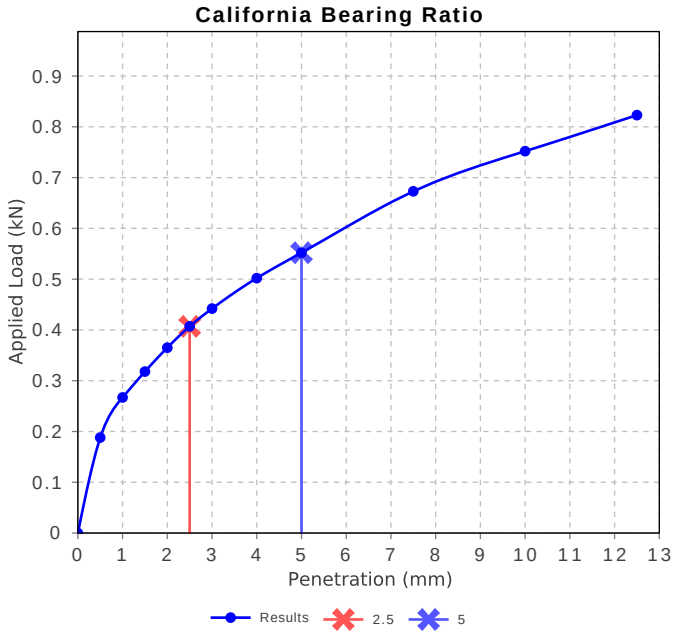
Fax: (02) 4646 1886
Email: ramon.arancibia@douglaspartners.com.au

Report Number:	**34275.31-2**
Issue Number:	1
Date Issued:	03/06/2021
Client:	Western Sydney University - Office of Estate and Commercial
	Locked Bag 1797, Penrith NSW 2751
Contact:	Annalese Packer
Project Number:	34275.31
Project Name:	Proposed Medical Research Centre
Project Location:	Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request:	5579
Sample Number:	MA-5579B
Date Sampled:	19/05/2021
Dates Tested:	19/05/2021 - 31/05/2021
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH205 (0.3 - 0.7m)**
Material:	Gravelly CLAY

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Ramon Arancibia
Assistant Laboratory Manager
Laboratory Accreditation Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**3.0**		
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)	1.85		
Optimum Moisture Content (%)	18.5		
Laboratory Density Ratio (%)	99.5		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.84		
Field Moisture Content (%)	16.0		
Moisture Content at Placement (%)	18.4		
Moisture Content Top 30mm (%)	20.0		
Moisture Content Rest of Sample (%)	19.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	49.2		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

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Report Number:	**34275.31-1**
Issue Number:	1
Date Issued:	02/06/2021
Client:	Western Sydney University - Office of Estate and Commercial
	Locked Bag 1797, Penrith NSW 2751
Contact:	Annalese Packer
Project Number:	34275.31
Project Name:	Proposed Medical Research Centre
Project Location:	Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request:	5597
Sample Number:	MA-5597S
Date Sampled:	20/05/2021
Dates Tested:	20/05/2021 - 01/06/2021
Sample Location:	**BH201 (1.9 - 2.0 m)**
Material:	FILL/Gravelly CLAY

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
clean lab
Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	32		
Plastic Limit (%)	18		
Plasticity Index (%)	**14**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	7.5		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	11.6

Material Test Report

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Email: meregal.henakaa@douglaspartners.com.au

Report Number:	**34275.31-1**
Issue Number:	1
Date Issued:	02/06/2021
Client:	Western Sydney University - Office of Estate and Commercial
	Locked Bag 1797, Penrith NSW 2751
Contact:	Annalese Packer
Project Number:	34275.31
Project Name:	Proposed Medical Research Centre
Project Location:	Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request:	5597
Sample Number:	MA-5597T
Date Sampled:	20/05/2021
Dates Tested:	20/05/2021 - 31/05/2021
Sample Location:	**BH202 (0.9 - 1.0 m)**
Material:	FILL/Gravelly CLAY

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
clean lab
Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	44		
Plastic Limit (%)	21		
Plasticity Index (%)	**23**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	11.0		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	21.3

Material Test Report

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Report Number:	**34275.31-1**
Issue Number:	1
Date Issued:	02/06/2021
Client:	Western Sydney University - Office of Estate and Commercial
	Locked Bag 1797, Penrith NSW 2751
Contact:	Annalese Packer
Project Number:	34275.31
Project Name:	Proposed Medical Research Centre
Project Location:	Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request:	5597
Sample Number:	MA-5597U
Date Sampled:	20/05/2021
Dates Tested:	20/05/2021 - 01/06/2021
Sample Location:	**BH203 (5.5 - 5.95 m)**
Material:	CLAY - brown mottled

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
clean lab
Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	44		
Plastic Limit (%)	21		
Plasticity Index (%)	**23**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	9.0		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	11.1

Material Test Report

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Report Number:	**34275.31-1**
Issue Number:	1
Date Issued:	02/06/2021
Client:	Western Sydney University - Office of Estate and Commercial
	Locked Bag 1797, Penrith NSW 2751
Contact:	Annalese Packer
Project Number:	34275.31
Project Name:	Proposed Medical Research Centre
Project Location:	Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request:	5597
Sample Number:	MA-5597V
Date Sampled:	20/05/2021
Dates Tested:	20/05/2021 - 31/05/2021
Sample Location:	**BH205 (4.0 - 4.45 m)**
Material:	FILL/ Gravelly CLAY

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
clean lab
Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	46		
Plastic Limit (%)	23		
Plasticity Index (%)	**23**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	9.5		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	21.6

Material Test Report

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Report Number:	**34275.31-1**
Issue Number:	1
Date Issued:	02/06/2021
Client:	Western Sydney University - Office of Estate and Commercial
	Locked Bag 1797, Penrith NSW 2751
Contact:	Annalese Packer
Project Number:	34275.31
Project Name:	Proposed Medical Research Centre
Project Location:	Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request:	5597
Sample Number:	MA-5597W
Date Sampled:	20/05/2021
Dates Tested:	20/05/2021 - 31/05/2021
Sample Location:	**BH206 (4.0 - 4.45 m)**
Material:	FILL/Gravelly CLAY

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
clean lab
Laboratory Accreditation Number: 828

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	12.9

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	39		
Plastic Limit (%)	19		
Plasticity Index (%)	**20**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	10.0		
Cracking Crumbling Curling	None		

Material Test Report

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Report Number:	**34275.31-1**
Issue Number:	1
Date Issued:	02/06/2021
Client:	Western Sydney University - Office of Estate and Commercial
	Locked Bag 1797, Penrith NSW 2751
Contact:	Annalese Packer
Project Number:	34275.31
Project Name:	Proposed Medical Research Centre
Project Location:	Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request:	5597
Sample Number:	MA-5597X
Date Sampled:	20/05/2021
Dates Tested:	20/05/2021 - 31/05/2021
Sample Location:	**BH207 (7.0 - 7.45 m)**
Material:	CLAY - brown mottled, pale grey

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
clean lab
Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	53		
Plastic Limit (%)	23		
Plasticity Index (%)	**30**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	13.0		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	21.3

Material Test Report

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Report Number:	**34275.31-1**
Issue Number:	1
Date Issued:	02/06/2021
Client:	Western Sydney University - Office of Estate and Commercial
	Locked Bag 1797, Penrith NSW 2751
Contact:	Annalese Packer
Project Number:	34275.31
Project Name:	Proposed Medical Research Centre
Project Location:	Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request:	5597
Sample Number:	MA-5597Y
Date Sampled:	20/05/2021
Dates Tested:	20/05/2021 - 31/05/2021
Sample Location:	**BH208 (6.5 - 6.95 m)**
Material:	CLAY - brown mottled, pale grey

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
clean lab
Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	52		
Plastic Limit (%)	22		
Plasticity Index (%)	**30**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	13.0		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	20.6

Material Test Report

Douglas Partners
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Macarthur Laboratory
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Phone: (02) 4647 0075
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Email: meregal.henakaa@douglaspartners.com.au

Report Number:	**34275.31-1**
Issue Number:	1
Date Issued:	02/06/2021
Client:	Western Sydney University - Office of Estate and Commercial
	Locked Bag 1797, Penrith NSW 2751
Contact:	Annalese Packer
Project Number:	34275.31
Project Name:	Proposed Medical Research Centre
Project Location:	Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request:	5597
Sample Number:	MA-5597Z
Date Sampled:	20/05/2021
Dates Tested:	20/05/2021 - 31/05/2021
Sample Location:	**BH209 (5.5 - 5.95 m)**
Material:	CLAY - brown mottled, grey

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
clean lab
Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	58		
Plastic Limit (%)	25		
Plasticity Index (%)	**33**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	14.5		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	28.6

Material Test Report

Report Number: **34275.31-1**
Issue Number: 1
Date Issued: 02/06/2021
Client: Western Sydney University - Office of Estate and Commercial
Locked Bag 1797, Penrith NSW 2751
Contact: Annalese Packer
Project Number: 34275.31
Project Name: Proposed Medical Research Centre
Project Location: Campbelltown Hospital, Therry Road, Campbelltown NSW
Work Request: 5597
Dates Tested: 20/05/2021 - 24/05/2021
Location: Campbelltown Hospital, Therry Road

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Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
clean lab
Laboratory Accreditation Number: 828

Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content (%)	Material
MA-5597A	BH201 (0.4 - 0.5 m)	11.9 %	Fill/Gravelly CLAY
MA-5597B	BH201 (4.0 - 4.45 m)	22.9 %	CLAY - brown gravelly clay
MA-5597C	BH202 (4.5 - 4.95 m)	18.0 %	FILL/Gravelly CLAY
MA-5597D	BH202 (6.5 - 6.95 m)	28.0 %	CLAY - brown and pale grey
MA-5597E	BH203 (3.5 - 3.95 m)	14.8 %	FILL/Silty CLAY
MA-5597F	BH203 (6.5 - 6.95 m)	15.8 %	CLAY - brown mottled, pale grey
MA-5597G	BH204 (0.4 - 0.5 m)	26.0 %	FILL/Gravelly CLAY
MA-5597H	BH204 (5.5 - 5.95 m)	14.5 %	CLAY - brown mottled, pale grey
MA-5597I	BH205 (0.9 - 1.0 m)	15.8 %	FILL/Silty CLAY
MA-5597J	BH205 (2.5 - 2.95 m)	11.4 %	FILL/Silty CLAY
MA-5597K	BH206 (0.4 - 0.6 m)	24.5 %	FILL/Gravelly CLAY
MA-5597L	BH206 (1.0 - 1.45 m)	25.3 %	FILL/Gravelly CLAY
MA-5597M	BH207 (1.9 - 2.0 m)	15.8 %	FILL/Silty CLAY
MA-5597N	BH207 (6.0 - 6.45 m)	12.7 %	CLAY - brown mottled, pale grey
MA-5597O	BH208 (0.9 - 1.0 m)	30.1 %	FILL/ Gravelly CLAY
MA-5597P	BH208 (3.5 - 3.95 m)	19.0 %	FILL/Gravelly CLAY
MA-5597Q	BH209 (1.0 - 1.45 m)	0.0 %	FILL/Gravelly CLAY
MA-5597R	BH209 (2.5 - 2.95 m)	41.1 %	FILL/Gravelly CLAY
MA-5597S	BH201 (1.9 - 2.0 m)	11.6 %	FILL/Gravelly CLAY
MA-5597T	BH202 (0.9 - 1.0 m)	21.3 %	FILL/Gravelly CLAY
MA-5597U	BH203 (5.5 - 5.95 m)	11.1 %	CLAY - brown mottled
MA-5597V	BH205 (4.0 - 4.45 m)	21.6 %	FILL/ Gravelly CLAY
MA-5597W	BH206 (4.0 - 4.45 m)	12.9 %	FILL/Gravelly CLAY
MA-5597X	BH207 (7.0 - 7.45 m)	21.3 %	CLAY - brown mottled, pale grey
MA-5597Y	BH208 (6.5 - 6.95 m)	20.6 %	CLAY - brown mottled, pale grey
MA-5597Z	BH209 (5.5 - 5.95 m)	28.6 %	CLAY - brown mottled, grey

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12 Ashley St Chatswood NSW 2067
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CERTIFICATE OF ANALYSIS 269443

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Eric Riggle
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**34275.31, Campbelltown Hospital**
Number of Samples	8 Soil, 2 Rock
Date samples received	19/05/2021
Date completed instructions received	19/05/2021

Analysis Details

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

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

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

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

Report Details

Date results requested by	26/05/2021
Date of Issue	26/05/2021

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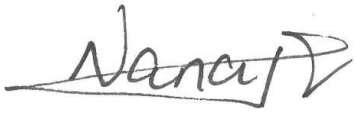
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Team Leader, Inorganics

Authorised By



Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		269443-1	269443-2	269443-3	269443-4	269443-5
Your Reference	UNITS	BH201	BH202	BH203	BH204	BH205
Depth		6.5-6.95m	0.4-0.5m	1.9-2.0m	0.9-1.0m	3.5-3.95m
Date Sampled		4/05/2021	6/05/2021	4/05/2021	10/05/2021	5/05/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	24/05/2021	24/05/2021	24/05/2021	24/05/2021	24/05/2021
Date analysed	-	24/05/2021	24/05/2021	24/05/2021	24/05/2021	24/05/2021
pH 1:5 soil:water	pH Units	7.1	8.8	7.6	8.6	8.7
Electrical Conductivity 1:5 soil:water	µS/cm	350	220	160	170	180
Chloride, Cl 1:5 soil:water	mg/kg	430	28	51	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	26	200	170	130	88

Misc Inorg - Soil						
Our Reference		269443-6	269443-7	269443-8	269443-9	269443-10
Your Reference	UNITS	BH203	BH206	BH208	BH209	BH206
Depth		8.5-8.7m	5.5-5.95m	7.5-7.95m	0.9-1.0m	9.5-m9.7
Date Sampled		4/05/2021	10/05/2021	7/05/2021	10/05/2021	4/05/2021
Type of sample		Rock	Soil	Soil	Soil	Rock
Date prepared	-	24/05/2021	24/05/2021	24/05/2021	24/05/2021	24/05/2021
Date analysed	-	24/05/2021	24/05/2021	24/05/2021	24/05/2021	24/05/2021
pH 1:5 soil:water	pH Units	9.3	8.2	7.1	7.8	9.4
Electrical Conductivity 1:5 soil:water	µS/cm	94	180	470	290	160
Chloride, Cl 1:5 soil:water	mg/kg	24	59	660	48	140
Sulphate, SO4 1:5 soil:water	mg/kg	<10	56	20	340	<10

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

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	269443-2
Date prepared	-			24/05/2021	1	24/05/2021	24/05/2021		24/05/2021	24/05/2021
Date analysed	-			24/05/2021	1	24/05/2021	24/05/2021		24/05/2021	24/05/2021
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	7.1	7.2	1	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	350	310	12	99	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	430	370	15	91	#
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	26	20	26	92	#

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

MISC_INORG_DRY
Percent recovery is not possible to report due to the high concentration of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.
Samples were out of the recommended holding time for this analysis pH/EC in soil.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	34275.31	**Suburb:**	Campbelltown Hospital	**To:**	Lab name: Enviro Lab Services
Project Name:	Campbelltown Hospital	**Order Number**			
Project Manager:	Eric Riggle	**Sampler:**	RB	**Attn:**	
Emails:	Eric.Riggle@douglaspartners.com.au			**Phone:**	0499 070 933
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐			**Email:**	
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐	No ☐	(If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
						pH	EC	SO4	Cl					
BH201(6.5-6.95m)	1	05/04/21	S	P		x	x	x	x					1:5 soil:water ratio
BH202(0.4-0.5m)	2	05/06/21	S	P		x	x	x	x					1:5 soil:water ratio
BH203(1.9-2.0m)	3	05/04/21	S	P		x	x	x	x					1:5 soil:water ratio
BH204(0.9-1.0m)	4	05/10/21	S	P		x	x	x	x					1:5 soil:water ratio
BH205(3.5-3.95m)	5	05/05/21	S	G,P		x	x	x	x					1:5 soil:water ratio
BH203(8.5-8.7m)	6	05/04/21	Rock	G		x	x	x	x					1:5 soil:water ratio
BH206(5.5-5.95m)	7	05/10/21	S	G,P		x	x	x	x					1:5 soil:water ratio
BH208(7.5-7.95m)	8	05/07/21	S	G,P		x	x	x	x					1:5 soil:water ratio
BH209(0.9-1.0m)	9	05/10/21	S	P		x	x	x	x					1:5 soil:water ratio
BH206(9.5-9.7m)	10	05/04/21	Rock	G		x	x	x	x					1:5 soil:water ratio
PQL (S) mg/kg														**ANZECC PQLs req'd for all water analytes** ☐

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

JROLRB
Lab No: 269443
Date Received:
Time Received: 1350
Received By: TSHAW
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: 8HM unless specified here:

Lab Report/Reference No:

Total number of samples in container: | **Relinquished by:** | **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd | **Address:** 18 Waler Crescent, Smeaton Grange, NSW | **Phone:** | **Fax:**

Signed: | **Received by:** T SHAW | **Date & Time:** 19-05-2021 1350