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Austral Public School Upgrade

Geotechnical Interpretive Report

February 2025

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Austral Public School Upgrade
Geotechnical Interpretive Report

Department of Education

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Abbreviations & Glossary

ASS	Acid Sulphate Soil
BH	Borehole
B sample	Large, bulk disturbed sample taken from auger arisings which weigh 10 to 25kg
BYDA	Before You Dig Australia
CAT	Cable Avoidance Tool
CBR	California Bearing Ratio
D Sample	Small sample taken from auger arisings (a sample where the soil structure, water content and/or constituents have been changed during sampling)
DoE	Department of Education
kPa	Kilopascals
LL	Liquid Limit: the moisture content at which the soil passes from the plastic to the liquid state
LS	Linear Shrinkage
MPa	Megapascals
m AHD	Metres (above) Australian Height Datum
m bgl	Metres Below Ground Level
NSW	New South Wales
PI	Plasticity Index: numerical difference between the liquid limit and the plastic limit of a soil
PL	Plastic Limit: moisture content at which the soil becomes too dry to be in a plastic condition
RL	Reduced Level
SPT	Standard Penetration Test: determination of the resistance of soil at the base of a borehole to the dynamic penetration of a split barrel sampler and obtaining of disturbed samples for identification purposes
SPT N value	The number of blows to drive the split barrel sampler (split spoon sampler) to final 300mm out of the 450mm test depth
SPT Sample	A disturbed sample collected from the split spoon sampler after an SPT test has been performed
UCS	Uniaxial Compressive Strength
USCS	Unified Soil Classification System

1 Project background

1.1 Introduction

This Geotechnical Interpretive Report has been prepared to support a Review of Environmental Factors (REF) for the Department of Education (DoE) for the upgrade of Austral Public School (APS) (the activity). The purpose of the REF is to assess the potential environmental impacts of the activity prescribed by State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) as "development permitted without consent" on land carried out by or on behalf of a public authority under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Section 3.37 of the T&I SEPP.

The proposed activity is for the upgrades to the existing APS at 205 Edmondson Avenue, Austral, NSW, 2179 (the site).

The purpose of this report is to document the geotechnical investigation conducted at the site and to identify any potential geotechnical risks and constraints in the context of the proposed development. Information provided by the DoE included several development options, however, WSP was advised to use the final business case Option 3 architectural plan to inform the choice of borehole test locations.

A geotechnical desk top study (issued November 2022 [2]) was undertaken by WSP prior to the carrying out the site investigation. This report incorporates information from the desk study, as well as information derived from the geotechnical investigation and provides recommendations for geotechnical design parameters and foundation and pavement design.

1.2 Scope

The geotechnical site investigation addressed the following:

- Eight (8) boreholes drilled to target depth of 6.0m below ground level (bgl) or to termination criterion (SPT refusal) with a combination of hand auger, auger drilling with tc-bit, rock coring.
- Standard Penetration Tests (SPT) were undertaken at 1.0m to 1.5m intervals, in appropriate soil strata, to assess strength.
- Pocket penetrometer (PP) tests were completed on cohesive soil samples recovered from the SPT. Results are shown on the logs at the relevant depths.
- Point Load Testing (PLT) was carried out on rock core samples from two boreholes.
- An experienced geotechnical engineer from WSP supervised the field investigation and logged each borehole in accordance with AS 1726-2017 *Geotechnical Site Investigations* [1].
- Borehole co-ordinates were provided in MGA2020 format for each borehole using a hand-held GPS.
- Boreholes were backfilled with spoil recovered from the hole or grout where applicable, to achieve the same level as existing ground prior to intrusive works.

Borehole BH04 could not be carried out as the rig was unable to access its planned location due to space constraints fitting beneath the building canopies. As borehole BH04 was proposed to be a cored hole, borehole BH05 was instead cored to maintain a minimum of two cored holes in the drilling program.

2 Site description

APS is located at 205 Edmondson Avenue, Austral on the south-eastern corner of the intersection between Edmondson Avenue and Tenth Avenue. The site has an area of 2.986 ha and comprises of 6 allotments, legally described as:

- Lot 1 DP 398105
- Lot 1 DP 398106
- Lot 1 DP 509613
- Lot 1 DP 512119
- Lot 2 DP 509613
- Lot 865 DP2475

The site currently comprises an existing co-educational primary (K-6) public school with:

- 8 permanent buildings;
- 14 demountable structures;
- interconnected paths;
- covered walkways;
- play areas: and
- at-grade parking.

The Austral Community Pre-school is also located within the site.

The existing buildings are clustered in the northern part of the site, ranging between 1 to 2 storeys in height. There is a sports oval in the south-eastern portion of the site, and a densely vegetated informal play area located in the south-western portion of the site.

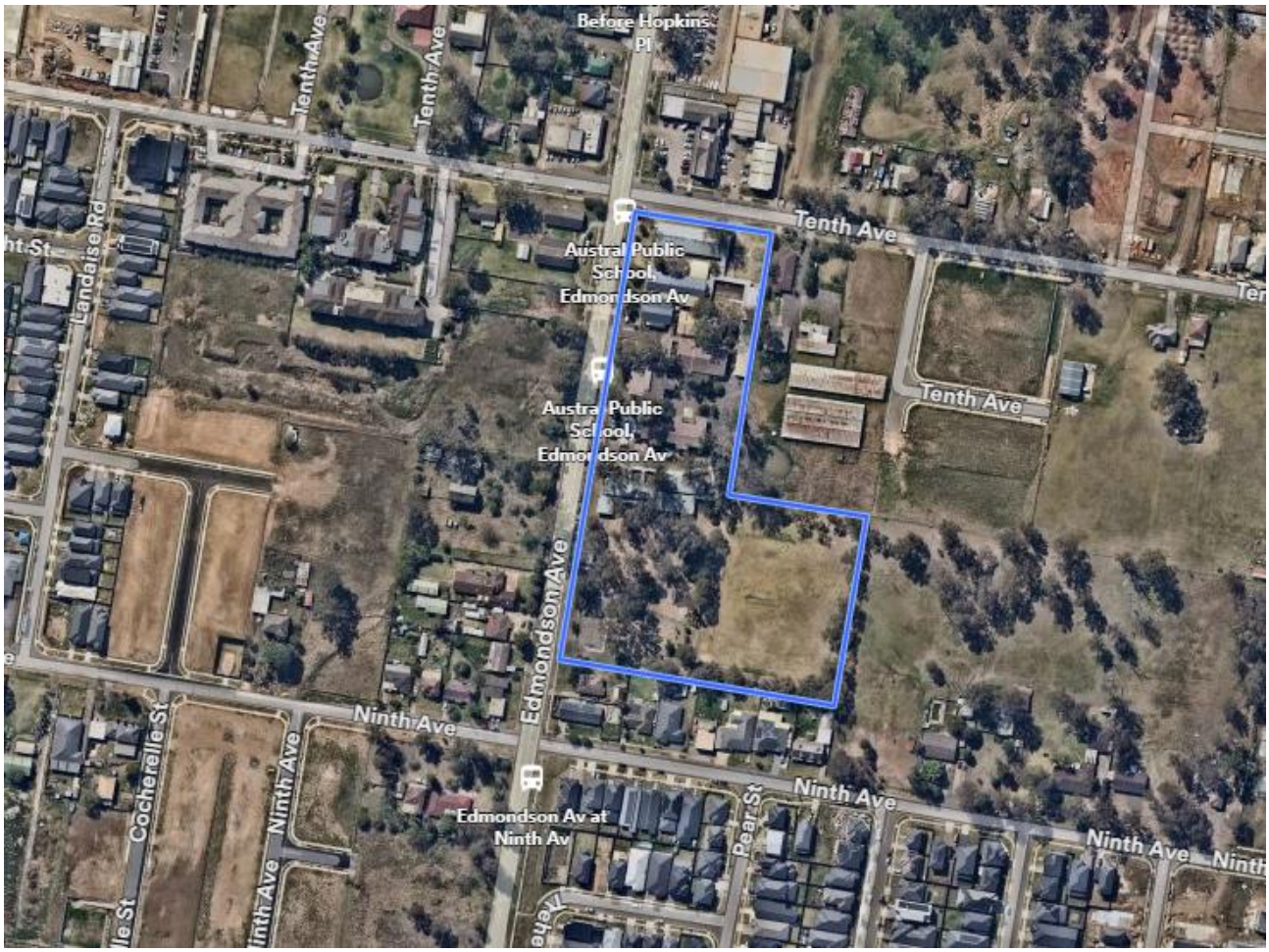

Figure 2.1 Aerial image of site (source: NearMap, taken 7 Sept 2023)

3 Proposed activities

The proposed activity involves alterations and additions to the existing APS, including the following:

- Demolition of existing structures and removal of trees, as well as other site preparation works;
- The erection of a new 3-storey building comprising teaching spaces that includes 20 permanent teaching spaces and 3 support teaching spaces;
- Refurbishment and change of school function of Building I from classrooms to a Library;
- At-grade parking (57 new spaces, including 1 accessible space);
- New driveway and access gate from Edmondson Road;
- Erection of a substation within the site on the northern boundary;
- Upgrade of the sports field;
- Internal pathways, fencing, utility upgrades and associated works; and
- Off-site public domain improvements including retention and upgrading of the Kiss & Drop area and a temporary pedestrian road crossing on Tenth Avenue.

The intent of the activity is to allow for upgrades to APS that will provide a CORE 35 primary school compliant with the EFSG. The works will increase the capacity of the school from 681 students and 40 FTE teachers to 734 students and 64 FTE teachers, respectively. Furthermore, provision within the expanded 734 student capacity will be made for the creation of 30 support class students places.

Figure 3.1 below shows the scope of works for the proposed activity.

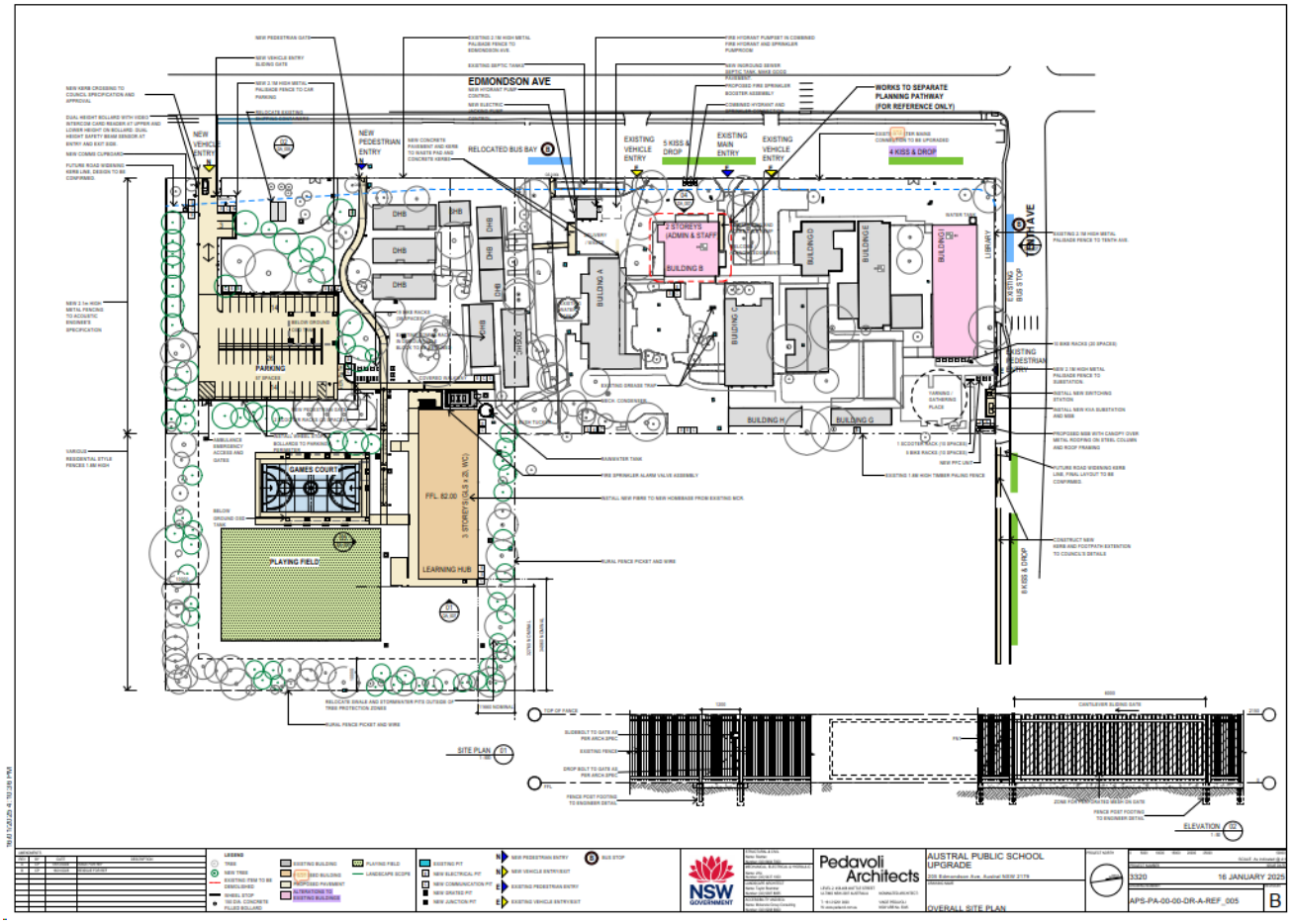

Figure 3.1 Proposed Site Plan (Source: Pedavoli Architects, Overall Site Plan (Rev B)

4 Geotechnical desktop study

A geotechnical desktop study was completed and issued to the DoE in November 2022 [2]. Refer to the report for background information.

5 Geotechnical investigation

5.1 Sitework overview

The geotechnical investigation was carried out on Monday and Tuesday 16 and 17 January 2022 and comprised the following:

- Eight (8) boreholes to a maximum depth of 6.4m bgl with associated SPT, PP tests and PLTs.

A summary of the completed geotechnical investigation locations is presented in Table 5.1. Investigation locations are further summarised on the site plan provided in Appendix A. Engineering logs, including SPT and PLT results are presented in Appendix B.

Table 5.1 Summary of geotechnical investigation

Borehole ID	Easting[1]	Northing[1]	Reduced Levels (m AHD)[1]	Termination Depth (m bgl)	Remarks
BH01	297781.8	6243068.4	82.7	2.60	Termination criterion reached
BH02	297844.3	6243058.4	84.3	3.08	Termination criterion reached
BH03	297795.9	6243024.9	82.8	2.62	Termination criterion reached
BH05	297779.8	6242951.1	80.2	6.00	Target depth reached
BH06	297840.0	6242904.0	81.0	4.16	Termination criterion reached
BH07	297867.6	6242902.4	81.3	6.14	Target depth reached
BH08	297897.0	6242907.8	81.9	4.10	Termination criterion reached
BH09	297792.8	6242845.3	81.3	3.10	Termination criterion reached

[1] Approximate MGA2020 co-ordinates and RLs obtained from GIS plan (correct to within +/- 1m)

5.2 Investigation methodology

5.2.1 Preliminaries

The geotechnical investigation was undertaken in accordance with the approved Health Environment and Safety Plan (HESP) and WSP Ground Penetration Permits. Relevant Safe Work Method Statements (SWMS) were adhered to during the site works.

5.2.2 Service location

Prior to attending site, a before-you-dig Australia (BYDA) service search was completed and service plans for potential services collated. To determine the presence of underground services, ground penetrating radar (GPR) and cable avoidance tool (CAT) scanning was undertaken.

The proposed borehole investigation locations were identified to be clear of underground utilities prior to the commencement of breaking ground.

5.2.3 Fieldwork

All field work was managed by an experienced WSP geotechnical engineer who was responsible for supervising drilling activities, soil and rock logging, collecting samples, directing in-situ testing and preparing engineering logs. All augered and cored boreholes were drilled using a track mounted Comacchio Geo305 drilling rig. A solid flight auger fitted with a tungsten carbide (TC) bit was used to drill through solid strata. Boreholes were subsequently advanced to target depth by diamond-bit HQ rock coring.

To assess the soil strength and consistency or density of the subsurface strata, and to obtain further soil samples, SPTs were carried out in accordance with AS 1289.6.3.1.-2004 [3], at 1.0m or 1.5m intervals, with start depths varying between 0.50 to 1.50m bgl.

PLTs were carried out on recovered rock core samples at approximately 1m intervals. The results of PLTs can be used to provide an indication of the unconfined compressive strength (UCS) of the rock based on correlations with published data. Boreholes were backfilled with excess drilling soil and grouted where applicable.

All geotechnical investigation work was carried out in accordance with AS 1726-2017 *Geotechnical site investigations* [1].

6 Geotechnical assessment

6.1 Subsurface conditions and ground model

Based on the results of the geotechnical investigation, the geology identified across the site is consistent with the regional geology indicated by the 1:100,000 Penrith Geological Map. The ground profile across the site extent can be generally summarised as follows:

- Topsoil, typically comprising low to medium plasticity sandy Clay, overlying,
- Fill, typically low to medium plasticity sandy gravelly Clay, overlying,
- Residual soil, typically comprising medium plasticity silty Clay with sand, overlying,
- Weathered rock (inferred Bringelly Shale) ranging from very low to high strength.

For geotechnical characterisation of the ground conditions and to inform engineering design, the soil and rock types encountered across the site have been generalised into the Geotechnical Units presented in Table 6.1.

Table 6.1 Summary of ground conditions and inferred geotechnical ground model

Geotechnical Unit	Generalised Description	Depth to Top of Unit (m bgl)	Thickness (m)
1. Topsoil	sandy Clay Low to medium plasticity Dark brown, brown With rootlets	0.0	0.1
2. Fill (Encountered in BH01, BH02 and BH03)	sandy Clay with gravel Low plasticity Dark brown, brown With rootlets	0.1	0.4
3. Residual Soil	silty sandy Clay Stiff to hard Medium plasticity Grey, mottled red, red-brown With rootlets and organic matter	Where fill is present: 0.5 – 0.8	Where fill is present: 1.3 – 2.5
		Where no fill is present: 0.0 – 0.1	Where no fill is present: 2.0 – 3.0
4a. Weathered Rock	Bringelly Shale: Extremely weathered Siltstone Hard Brown, grey mottled red Recovered as Silty Clay with sand	0.8 – 3.1	1.2 – 1.6 [1] 0.10m in BH07 (Base proven in BH05 & 07)

Geotechnical Unit	Generalised Description	Depth to Top of Unit (m bgl)	Thickness (m)
4b. Weathered Rock (BH05 & BH07 only)	Bringelly Shale: Highly to extremely weathered Siltstone Very low to low strength Fine grained, trace quartz Grey, black, brown	2.0 – 3.2	1.8 – 2.0
4c. Weathered Rock (BH05 & BH07 only)	Bringelly Shale: Highly to slightly weathered Laminite Interbedded Shale, claystone and Sandstone Increasing sandstone with depth Very low to high strength	4.0 – 5.0	1.40 – 2.0

[1] Base of unit 4a Weathered Rock proven in BH05, therefore thickness is proven to 1.20. Base of unit not proven in BH06, however 1.60m thickness is recorded.

The borehole logs are included within Appendix B, along with a cross section of boreholes BH06, BH07 and BH08 within Appendix D.

6.2 Field test results

6.2.1 Standard Penetration Test

The SPT procedure is described in the Explanatory Notes in Appendix B. SPTs were undertaken at 1.0m intervals until refusal. The SPTs were done within Geotechnical Unit 3, Residual Soil, and Geotechnical Unit 4a, Extremely Weathered Rock. The SPTs generally all refused on the top of Geotechnical Unit 4b, Weathered Rock. The SPT N values for residual soil range between 8 – 45, with the majority of the results between 20 – 42. The majority of the SPTs within extremely weathered rock refused, apart from two which had N values of 28 and 56. The SPT results can be viewed on the borehole logs within Appendix B.

6.2.2 Point load tests

PLTs were undertaken on rock core samples from boreholes BH05 and BH07 at approximately 1.0m intervals. The results are presented in Table 6.2 below. The point load strength index, $Is_{(50)}$, has been correlated to a strength classification using Table 19 *Rock material strength classification* within AS 1726-2017 [1].

Table 6.2 Point load test results

Borehole	Sample Depth (m bgl)	Test Type (Axial / Diametral)	Specimen length (W) (mm)	Specimen Diameter (D) (mm)	Applied Load (kN)	Point Load Strength Index, $Is_{(50)}$ (MPa)[1]	Strength Classification[1]
BH05	2.47	D	220.0	63.5	0.1	0.03	VL
	2.66	D	120.0	63.5	0.1	0.01	VL

Borehole	Sample Depth (m bgl)	Test Type (Axial / Diametral)	Specimen length (W) (mm)	Specimen Diameter (D) (mm)	Applied Load (kN)	Point Load Strength Index, $Is_{(50)}$ (MPa)[1]	Strength Classification[1]
	2.66	A	63.5	29.0	0.1	0.02	VL
	3.66	D	250.0	63.5	0.0	0.01	VL
	3.66	A	63.5	30.0	0.1	0.02	VL
	4.75	D	150.0	63.5	0.2	0.05	VL
	4.75	A	63.5	30.0	1.1	0.43	M
	5.71	D	180.0	63.5	0.2	0.05	VL
	5.71	A	63.5	29.0	1.1	0.45	M
BH07	3.54	D	120.0	63.5	0.6	0.16	L
	3.54	A	63.5	58.0	0.5	0.13	L
	4.55	D	150.0	63.5	0.1	0.02	VL
	4.55	A	63.5	39.0	0.4	0.14	L
	5.49	D	130.0	63.5	0.8	0.22	L
	5.49	A	63.5	27.0	1.0	0.44	M
	6.20	D	200.0	63.5	0.1	0.03	VL
	6.20	A	63.5	32.0	0.1	0.04	VL

[1] Refer to borehole logs within Appendix B for graphical representation.

6.2.3 *Pocket penetrometer*

Pocket Penetrometer tests were undertaken on residual soil samples. The results are presented in Table 6.3 below.

Table 6.3 Pocket penetrometer test results

Borehole	Depth Range (m bgl)	Number of Tests	Unconfined Compressive Strength Range (kPa)[1]	Strength Classification[1]
BH01	1.60 – 1.80	3	320 – 430	VSt – H
BH02	0.60 – 0.80	3	>600	VSt – H
	1.60 – 1.95	4	400 – 530	VSt – H
BH03	0.80 – 0.90	2	200 – 210	VSt
	1.60 – 1.70	2	590	H

Borehole	Depth Range (m bgl)	Number of Tests	Unconfined Compressive Strength Range (kPa)[1]	Strength Classification[1]
BH05	0.60	1	>600	H
BH06	0.70 – 0.90	2	550 - >600	H
BH07	0.60 – 0.90	3	550 - >600	H
	1.60 – 1.80	3	210 – 260	VSt
BH08	0.60 – 0.80	2	>600	H
	1.60 – 1.80	3	>600	H
	3.20	1	>600	H
BH09	0.60 – 0.90	3	>600	H
	1.60 – 1.90	3	>600	H

[1] Refer to borehole logs within Appendix B to view all test results.

6.3 Groundwater

Groundwater was not encountered in any boreholes during the fieldwork. It should be noted, however, that groundwater levels are subject to seasonal and climatic variations. Periods of heavy rainfall may result in a perched water table.

6.4 Laboratory testing

Selected disturbed soil samples were collected from the auger arisings and sent to Resource Laboratories Pty. Ltd (Resource Labs), a NATA-accredited soil laboratory. Scheduled lab tests are listed in Table 6.4. Test results are summarised in Section 6.4.1 and 6.4.2 and certificates are provided in Appendix C. These tests help to classify the soil for engineering purposes.

Table 6.4 Geotechnical laboratory testing schedule

Laboratory Test	Borehole ID	Sample Type	Sample Depth (m bgl)	Date Sampled
Moisture Content (AS1289.2.1.1)	BH02	SPT	1.50 – 1.95	16/01/2023
	BH05	SPT	0.50 – 0.95	17/01/2023
	BH06	SPT	1.50 – 1.95	16/01/2023
	BH07	SPT	0.50 – 0.95	16/01/2023
	BH09	SPT	0.50 – 0.95	16/01/2023
Atterberg Limits & Linear Shrinkage (LL, PL, PI and LS) (AS1289.3.1.1, 3.2.1, 3.3.1, 3.4.1)	BH02	SPT	1.50 – 1.95	16/01/2023
	BH03	D	0.50 – 0.70	17/01/2023
	BH05	SPT	0.50 – 0.95	17/01/2023
	BH06	SPT	1.50 – 1.95	16/01/2023
	BH07	SPT	0.50 – 0.95	16/01/2023

Laboratory Test	Borehole ID	Sample Type	Sample Depth (m bgl)	Date Sampled
	BH08	SPT	0.50 – 0.95	16/01/2023
	BH09	B	1.00 – 1.50	16/01/2023
Soil Aggressivity Test (pH, Chloride, Sulphate, Resistivity)	BH01	SPT	1.50 – 1.95	17/01/2023
	BH02	SPT	0.50 – 0.95	16/01/2023
	BH03	SPT	1.50 – 1.95	17/01/2023
	BH05	SPT	1.50 – 1.70	17/01/2023
	BH06	SPT	3.00 – 3.45	16/01/2023
	BH07	SPT	1.50 – 1.95	16/01/2023
	BH08	SPT	0.50 – 0.95	16/01/2023
	BH09	B	1.00 – 1.50	16/01/2023
CBR (AS1289.6.1) 4-day soak, 4.5kg surcharge, remoulded ratio @98%	BH09	B	1.00 – 1.50	16/01/2023

LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index, LS = Linear Shrinkage, CBR = California Bearing Ratio

6.4.1 Geotechnical test results

Geotechnical laboratory test results are provided in Table 6.5 and Table 6.6.

Table 6.5 Atterberg Limits Test Results

Borehole ID	Sample Depth (m bgl)	Material	USUC Symbol	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
BH02	1.50 – 1.95	silty Clay	CH	18.8	66	17	49	14.5
BH03	0.50 – 0.70	silty Clay	CH	-	75	19	56	17
BH05	0.50 – 0.95	silty sandy Clay	CL	9.0	37	13	24	10.5
BH06	1.50 – 1.95	silty Clay	CL	12.6	47	15	32	13
BH07	0.50 – 0.95	silty Clay	CH	16.5	52	16	36	12
BH08	0.50 – 0.95	silty Clay	CH	-	62	17	45	14
BH09	0.50 – 0.95	silty Clay	-	9.9	-	-	-	-
BH09	1.00 – 1.50	silty Clay	CH	-	62	18	44	15.5

USCS = Unified Soil Classification System
CH = inorganic clays of high plasticity (LL ≥ 50%)
CL = inorganic clays of low to medium plasticity, gravelly / sandy clays (LL ≤ 50%)

Table 6.6 CBR Test Results

Borehole ID	Sample Depth (m bgl)	Material	CBR (%)
BH09	1.00 – 1.50	silty Clay	0.5

6.4.2 *Chemical test results*

Soil chemical laboratory test results are provided in Table 6.7. These tests are used to assess the exposure class for buried concrete and steel.

Table 6.7 Chemical Laboratory Test Results

Borehole ID	Sample Depth (m bgl)	pH	Sulphate ($SO4^{2-}$) (mg/kg)	Chloride (mg/kg)
BH01	1.50 – 1.95	5.2	420	380
BH02	0.50 – 0.95	5.4	290	140
BH03	1.50 – 1.95	5.2	320	180
BH05	1.50 – 1.70	8.7	40	650
BH06	3.00 – 3.45	5.9	100	190
BH07	1.50 – 1.95	5.4	410	490
BH08	0.50 – 0.95	5.5	120	210
BH09	1.00 – 1.50	5.4	230	960

6.5 Preliminary geotechnical design parameters

Preliminary geotechnical design parameters have been development for the adopted Geotechnical Units across the site extent. These properties are representative values typical of the geotechnical conditions encountered at the site. The design parameters have been developed based on interpretation of all geotechnical investigation results, consideration of published correlations and engineering judgement.

During the construction phases, all materials encountered should be inspected, compared, and verified with the parameters adopted during the design process by an experienced geotechnical engineer or engineering geologist.

The soil design parameters presented in Table 6.8 are intended for use with Ultimate Limit State (ULS) and Serviceability Limit State (SLS) design approaches, using appropriate design standards with associated strength reduction and load factors applied accordingly.

Table 6.8 Summary of geotechnical design parameters for adopted geotechnical units

Geotechnical Unit	Consistency Strength	Bulk Unit Weight, γ (kN/m^3) [1]	Undrained Shear Strength, C_u (kPA) [2]	Effective Cohesion, C' (kPa) [2]	Effective Friction Angle, Ø' (°) [2]	Drained Poisson Ratio, v' [2]	Elastic Modulus, E' (MPa) [2]
1 (Topsoil) [3]	-	15	-	-	-	-	-
2 (Fill)	-	16	-	-	-	-	-
3 (RS)	Stiff to Hard	19	100	4	28	0.3	20
4a (RS/WR)	Hard	20	200	8	30	0.3	40
4b (Siltstone)	Very low to low	23	-	150	32	0.25	250
4c (Laminate)	Very low to high	24	-	100	32	0.25	300

[1] Bulk unit weight inferred from Table D1, Appendix D of AS 4678: 2002 *Earth retaining structures* [4].

[2] Values based on published literature and engineering judgement with similar materials.

[3] Topsoil and fill material is inherently unsuitable and would typically be removed and replaced as per Section 7.1.1. of this report.

6.6 Site classification

Site classification in accordance with AS 2870-2011 *Residential slabs and footings* [5] is based on the expected ground surface movements as a result of soil volumetric changes due to moisture content variations. Sites where ground movement is predominantly due to soil reactivity under normal conditions are classified from lowest to highest reactivity (Classes A, S, M, H1, H2 and E). Although not fully applicable to the design of commercial development, an assessment in accordance with AS 2870-2011 [5] provides an indicative framework for foundation design.

Based on the subsurface profile encountered and with reference to Table 2.1 of AS 2870-2011 [5], the site could reasonably be taken to have a soil reactivity classification of M (moderate) based on a clayey residual soil profile overlying weathered rock. This means that the site soil could experience moderate ground movement from moisture changes. Ground surface movements are expected to be in the range of 20mm to 40mm for a class M site.

6.7 Durability assessment

Using Tables 6.4.2(C) and 6.5.2(C) within AS 2159-2009 [7] the soils can generally be classified as Exposure non-aggressive for concrete piles and steel piles. One sample, BH09 1.00-1.50m bgl, is classified as Mild for steel piles. Using Table 2.8.1 in AS 3600-2018 [8] the soils can be classified as Exposure Classification A1.

Salinity was assessed against the rankings presented in NSW DLWC (2002) [15], Site Investigations for Urban Salinity. Analysis for salinity parameters (electric conductivity) indicates that the residual clay soils were found to be non-saline to slightly saline.

6.8 Earthquake site classification

AS/NZS 1170.4-2007 *Earthquake actions in Australia* [10] requires designers to consider the effects of earthquakes. The design is influenced by a hazard factor (based on the probability of an earthquake occurring) and the classification of the site (based on the subsoil strength and thickness).

The hazard factor (Z) for this site should be taken as 0.09 as per Table 3.2 and Figure 3.2(A) of AS/ANZ 1170.4 [10]. The hazard factor quotes in the standard is based on a 1 in 500-year probability of exceedance.

The site sub-soil classification recommended for this site is Class C_e (shallow soil) as per Section 4 of the AS/NZS 1170.4. Although rock is generally present within a depth of 3.0m, the rock has a compressive strength less than 1 MPa and therefore does not qualify for Class B_e (rock).

7 Discussion and recommendations

7.1 Earthworks and constructability

All excavation work should be carried out in accordance with the SafeWork NSW publications, Excavation Work Code of Practice, January 2020 [11] **and Construction Work Code of Practice, August 2019** [12]**.** If the publications have been revised before construction commences, the most recently published version should be used.

7.1.1 Site preparation

Geotechnical Units 1 and 2, topsoil and fill, are inherently unsuitable materials due to their variable nature and should therefore be removed off site and/or stripped and stockpiled for reuse as landscaping (non-engineered) material, as appropriate. Additional unsuitable material, potentially not identified during the geotechnical investigation, may include man-made waste, perishable materials, other organics and any materials with a CBR value less than 1% (CBR<1). Such materials should be excavated, further stockpiled and/or disposed off-site in general accordance with NSW Environmental Protection Authority (EPA) Waste Classification Guidelines.

As part of construction, the site should be suitably cleared and grubbed, with temporary drainage provided to manage surface run-off and potential inflow. Where exposed, temporary protection should be provided for exposed soil slopes to prevent erosion and loss of topsoil

During construction, inspection by a suitable qualified geotechnical engineer or engineering geologist should be sought to verify the geotechnical conditions across the site, to identify any localised zones of poor or unsuitable material.

7.1.2 Excavatability of site material

Excavation of topsoil (Geotechnical Unit 1), fill (Geotechnical Unit 2), residual soil (Geotechnical Unit 3) and extremely weathered rock (Geotechnical Unit 4a) will be readily achieved using conventional earthmoving plant such as dozers, excavators with straight-blade or toothed buckets.

Geotechnical Unit 4b and 4c are expected to range from moderate to hard ripping using a dozer. The use of large, tracked excavators with hydraulic rock breakers may be required for smaller excavations in these units. Large excavations could be advanced using dozers with ripping tynes. Low productivity during excavation should be expected within such materials. However, it is not expected that the proposed development (Final Business Case Option 3) will require deep excavations.

It is recommended that the engaged contractors examine the engineering logs to make their own assessment of the required excavation plant and production rates prior to breaking ground.

Off-site disposal of waste spoil will typically require classification in accordance with the NSW EPA Classification Guidelines [13].

7.1.3 Cut and fill works

Suitability of cut material to be used as fill

Material derived from excavation will consist of a mixture of sandy clay fill material and residual clay soils, with the potential for excavation of weathered siltstone. Residual soil and poor quality rock (Geotechnical Units 1, 3 and 4a) should not be used beneath structures or pavements/ hardstand as it would likely show characteristics of high shrink/swell potential from changes in moisture content and is prone to ‘creep’ settlement over time which is greater as the depth of fill increases. This creep settlement is in addition to any immediate elastic settlement or consolidation settlement under imposed structural loads. Creep settlement can occur under the self-weight of the soil and continue for many years after placement.

These characteristics can be improved by treatments such as adding hydrated lime (typically 2%-5% by volume) or mixing with crushed sandstone (which may be readily available as spoil from other projects around Sydney). Testing would be required to determine the optimum mix proportions.

Alternatively, the poor quality clay soils and very weak rock from near the surface could be stockpiled separately for use in landscape areas or removed from site.

The better quality excavated rock (Geotechnical Units 4b and 4c in Table 6.1) could be crushed and reused as general fill. This material could potentially be placed under building footprints provided imported sandstone or similar material is placed above to provide protection from decomposition. The depth of imported sandstone would have to be assessed depending on the nature of the building, required bearing capacity and tolerance to settlement.

Engineered fill used as replacement material or to support shallow building footings should be placed, compacted, and testing under Level 1 supervision in general accordance with AS 3798 *Guidelines on earthworks for commercial and residential developments* [14].

7.1.4 Batters and benching

Based on the proposed site development, it is expected that excavations will be associated with the demolition of existing building as well as excavations for foundations of the proposed buildings. These excavations may encounter Geotechnical Units 1 to 4b. Due to its inherent unsuitability and heterogeneous nature, topsoil (Geotechnical Unit 1) and fill (Geotechnical Unit 2) materials should not be incorporated into batter slopes and should be treated in accordance with the recommendations in Section 5.1.1 of this report.

Residual soils (Geotechnical Unit 3) are expected to remain stable at long-term batters of up to 1V:2H for heights up to 3m. Geotechnical Unit 4a is expected to be stable at an unsupported batter of up to 1V:1.5H and for slope heights up to 3m. Surface protection would be required for slopes as Bringelly Shale including residual soil is particularly susceptible to deterioration and erosion. Short term protection during construction would include polythene sheeting. Permanent forms of protection could include vegetation or sprayed concrete. Preliminary design recommendations for unsupported (short term) or permeant (long term) cut slopes are presented in Table 7.1. Cut slopes would require appropriate stability analysis and designed to achieve a factor of safety of 1.3 and 1.5 for short- and long-term stability respectively.

If groundwater inflows are encountered during construction, a sump should be formed at the base of the excavation and the water pumped out. Adequate drainage measures should be incorporated into long term design solutions.

Table 7.1 Temporary and permanent batter slopes

Geotechnical Unit	Consistency / Strength	Cut Slope Batters	
		Permanent	Temporary
3 (Residual soil)	Stiff to Hard	1V: 2H	1V: 1.5H
4a (Extremely Weathered Rock)	Hard	1V: 2H	1V: 1.5H
4b (Weathered Rock)	Very low to low	1V: 1.5H	1V: 0.75H
4c (Weathered Rock)	Very low to high	1V: 1H	1V: 0.75H

A minimum 0.5m wide bench should be incorporated at a maximum every 1.5m of excavation.

If the site boundaries / constraints prevent application of the above recommended safe batter slopes, consideration should be given to:

- Use of a 1:1 batter slope incorporating a minimum 0.5m wide bench at a depth of 1m and every 1.5m of excavation thereafter.
- Retaining structures, if required would typically include concrete solider piles or post and panel walls with timber/steel/concrete walers, or sheet piles to support temporary excavations.

All excavations (deeper than 1.5m) should be observed by a geotechnical engineer or engineering geologist, who shall assess safe batter angles appropriate for the conditions encountered. Where access is required for a worker the need (or otherwise) for support of the temporary excavation should be assessed on-site by a geotechnical engineer or engineering geologist.

Supports could include retaining structures (shoring) and/or use of trench shields to protect workers within the excavation.

If a period of heavy rainfall occurs during construction, the stability of the excavation should also be reassessed prior to recommencement of work. If the exposed soils have softened significantly due to an increase in moisture content, then temporary shoring or other approaches may be required to support excavations.

7.2 Footings and pavement design

7.2.1 Foundations

Foundation options will depend on the structural loading and the ability of the structure to accommodate movement. For example, steel framed shed type buildings can typically accommodate greater movement compared with a concrete framed or brick walled structures. It is anticipated, from the proposed development plan, that the majority of the constructed buildings will be brick walled.

Options to be considered include:

- Pad footings – founded on the stiff to hard residual soils, where bearing pressures to 150kPa can be supported with settlements of around 1% of the footing width.
- Pad footings on engineered fill – allowable bearing pressures would be dependent on the depth and type of fill and advice sought at a later design stage.
- Piled foundations – extending into the weathered siltstone/laminate bedrock where bearing pressures over 1MPa are required and settlements of 1% of the pile diameter can be accommodated. However, bearing pressures over 1MPa are not expected.
- Combination of individual footings and slab on ground – this option would consist of using pad footings as discussed above with a floating concrete slab. The slab would need to be constructed above a capping layer of granular imported material.

The estimated allowable bearing capacities outlined above are dependent on the foundation subgrade being inspected by a suitably qualified geotechnical engineer or engineering geologist to verify that ground conditions are consistent with design assumptions, founding surfaces are clean from spoil and other soft / loose materials, and free from water to allow concrete placement. Proof rolling of the foundation subgrade (soils only) should be conducted and if visible deformation is observed or unsuitable material is encountered at foundation level, the affected material / area should be over-excavated and replaced with suitable material.

Engineered fill used as replacement material or to support high level building footings should be placed, compacted, and tested under level 1 supervision in general accordance with AS 3798 – 2007 *Guidelines for earthworks for commercial and residential developments* [14].

7.2.2 Pavement

Based on the proposed development drawing (Final Business Case Option 3), pavement is required only for vehicle parking.

The laboratory CBR test reported that the sample (Unit 3 – Residual Soil) has a CBR value of 0.5%. This is a relatively low value, therefore it is expected that subgrade treatment will be required to improve its strength. Subgrade treatment will depend on the proposed use and vehicle design assumptions. Treatments could include either in situ stabilisation

using a cementous binder mixed into the subgrade surface, or alternatively use deeper layers of pavement based on a CBR of 0.5%. This should be assessed during the detailed design phase once the proposed development has been confirmed.

It is recommended that the subgrade is inspected by a geotechnical engineer or engineering geologist and proof rolled to identify any soft spots prior to the placement of any pavement materials. There may be a requirement to excavate soft material or uncontrolled fill and replace with imported granular engineered fill at some locations.

Particular attention should be given to site drainage to avoid accumulation or ponding of water as this will compromise the bearing capacity of the pavement if it penetrates cracks, leading to further damage.

8 Conclusions and mitigation measures

It is important to note that there are no geotechnical risks identified that would constrain future development of the proposed site, although design measures and ground treatments necessary to accommodate the site conditions may have a cost implication. Based on the relatively lightly loaded structures anticipated, foundations are likely to consist of shallow pad and strip footings founded on stiff clay or better. Engineered fill is expected to be required beneath slabs and areas of hardstand / pavement and this could consist of hydrated lime treated in-situ soil or imported quality material.

Mitigation measures which would be implemented for the project are listed in Table 8-1.

Table 8-1 Geotechnical related mitigation measures

Mitigation Number/Name	Aspect/Section	Mitigation Measure	Reason for Mitigation Measure
Poor quality ground	Construction	Consider hierarchy of controls: Remove from site, keep on site within landscaping areas; treat with hydrated lime to improve engineering properties and use within the works, replace with imported better quality material	To avoid cost of removal from site; to achieve the required engineering properties to allow use within the works
Surplus soil material	Design stage	Consider reducing cut volume by supporting the building on piers or create a split level	Avoid or reduce volume of soil for disposal off site.
Expansive soils	Design and construction	Treat residual soil and extremely weak rock with hydrated lime to improve engineering properties and to reduce or remove shrink/swell movement from drying and wetting.	To reduce or remove the risk of cracking of hardstand areas, pavements and structures
Salinity	Construction	Prior to ground disturbance, a visual inspection would be undertaken to identify areas that potentially contain saline soils. Areas where evidence of salting is observed or recorded will be subject to further testing as required. If salinity is confirmed, excavated soils will be managed in accordance with Book 4 Dryland Salinity: Productive use of Saline Land and Water (NSW DECC 2008) to prevent impacts from salinity.	To reduce the risk of salt mobilisation

9 References

[1] Standards Asutralia Limited, “AS 1726:2017 Geotechnical Site Investigations,” SAI Global Limited , Sydney , 2017.

[2] WSP Australian Pty Ltd, “Schools Infrastructure NSW: Austral Public School Redevelopment - Geotechnical Desktop Study (Ref. PS134724-SYD-GEO-REP-001),” WSP, November 2022.

[3] Standards Australia , “AS 1289.6.3.1 - 2004 Methods of testing soils for engineering purposes,” SAI Global , Sydney, 2004.

[4] Standards Australia , “AS 4678-2002 Earth-retaining Structures,” SAI Global Limited , Sydney, 2002.

[5] Australian Standard, “AS 2870-2011 Residential slabs and footings,” Standards Australia Limited , Sydney, 2011.

[6] Standards Australia , “AS 2159-2009 Piling - Design and installation,” SAI Global Limited , Sydney, 2009.

[7] Standards Australia , AS 2159 Piling - design and installation, Sydney: SAI Global , 2009.

[8] Standards Australia, AS 3600 Concrete Structures, SYdney: SAI Global , 2018.

[9] Standards Australia, “AS 3600:2018 Concrete structures,” SAI Global Limited, Sydney, 2018.

[10] Standards Australia, “AS 1170.4-2007 Structural Design Actions - Part 4 Earthquake actions in Australia,” SAI Global Limited, Sydney, 2018.

[11] SafeWork NSW, “Code of Practice: Excavation Work,” NSW Government , January 2020.

[12] SafeWork NSW, “Code of Practice: Construction Work,” NSW Government , August 2019.

[13] State of NSW, Environment Protection Authority , “Waste Classificaion Guidelines, Part 1: Classifying Waste,” NSW Environmental Protection Authority (EPA) , Sydney, November 2014.

[14] Standards Australia , “AS 3798-2007 Guidelines on earthworks for commercial and residential developments,” SAI Global Limited `, Sydney, 2007.

[15] NSW Department of land and Water Conservation 2002 (DLWC 2002), *Site Investigations for Urban Salinity*

10 Limitations

SCOPE OF SERVICES

This geotechnical site assessment report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances, the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

RELIANCE ON DATA

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

GEOTECHNICAL INVESTIGATION

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared to meet the specific needs of individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor or even some other consulting civil engineer. This report was prepared expressly for the client and expressly for purposes indicated by the client or his/her representative. Use by any other persons for any purpose, or by the client for a different purpose, might result in problems. The client should not use this report for other than its intended purpose without seeking additional geotechnical advice.

THIS GEOTECHNICAL REPORT IS BASED ON PROJECT-SPECIFIC FACTORS

This geotechnical engineering report is based on a subsurface investigation, which was designed for project-specification factors, including the nature of any development, its size and configuration, the location of any development on the site and its orientation, and the location of access roads and parking areas. Unless further geotechnical advice is obtained, this geotechnical engineering report cannot be used:

- When the nature of any proposed development is changed.
- When the size, configuration location or orientation of any proposed development is modified.

This geotechnical engineering report cannot be applied to an adjacent site.

THE LIMITATIONS OF SITE INVESTIGATION

When assessing a site from a limited number of boreholes or test pits there is the possibility that variations may occur between test locations. Site exploration identifies specific subsurface conditions only at those points from which samples have been taken. The risk that variations will not be detected can be reduced by increasing the frequency of test locations; however, this often does not result in any overall cost savings for the project. The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regards to the proposed development. Despite investigation the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The borehole logs are the subjective interpretation of subsurface conditions at a particular location, made by trained personnel. The interpretation may be limited by the method of investigation and cannot always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than

borehole investigation, however, such methods are limited by depth and site disturbance restrictions. In borehole investigation, the actual interface between materials may be more gradual or abrupt than a report indicates.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions may be modified by changing natural forces or man-made influences. A geotechnical engineering report is based on conditions which existed at the time of subsurface exploration.

Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept appraised of any such events and should be consulted to determine if additional tests are necessary.

AVOID MISINTERPRETATION

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

BORE/PROFILE LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. To minimise the likelihood of bore/profile log misinterpretation, contractors should be given access to the complete geotechnical engineering report prepared or authorised for their use. Providing the best available information to contractors helps prevent costly construction problems. For further information on this matter reference should be made to ‘Guidelines for the Provision of Geotechnical Information in Construction Contracts’ published by the Institution of Engineers Australia, National Headquarters, Canberra 1987.

GEOTECHNICAL INVOLVEMENT DURING CONSTRUCTION

During construction, excavation is frequently undertaken which exposes the actual subsurface conditions. For this reason, geotechnical consultancy should be retained through the construction stage to identify variations if they are exposed, and to conduct additional tests, which may be required and to deal quickly with geotechnical problems if they arise.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the client and no other party. WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

OTHER LIMITATIONS

WSP will not be liable to update or revise the report to consider any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

Appendix A

Ground Investigation Plan

PS134724
Austral Public School

Figure 1
Approximate Borehole Location Plan

TENTH AVENUE
NINTH AVENUE
EDMONDSON AVENUE
PEAR STREET
NSW
BH01
BH02
BH03
BH05
BH06
BH07
BH08
BH09

Legend

- Cored Boreholes
- Non-cored Boreholes
- Site Boundary

Coordinate system: GDA2020 MGA Zone 56

Scale ratio correct when printed at A3

1:1,500 Date: 24/01/2023

Data sources: - NSWSS, Metromap, ABS, Geoscience Australia

Appendix B

Borehole Logs, Core Photographs and Explanatory Notes

Explanatory Notes – Engineering Logs

Engineering logs have been prepared in general accordance with AS1726:2017 “Geotechnical Site Investigations”, AGS 4.1AU data format and as defined below.

DRILLING/EXCAVATION METHODS

Symbol	Term
AD/T	Auger drilling with TC-bit
AD/V	Auger drilling with V-bit
AS	Auger screwing
AT	Air track / rotary air blast
DP	Direct push
DT	Diatube
E	Excavator
HA	Hand auger
HAND	Hand excavation
HSA	Hollow stem auger
NMLC/HMLC	Diamond core – triple tube
NQ3/HQ3/PQ3	Diamond core – wireline
RC	Reverse circulation
RR	Rock roller
S	Sonic drill
VB	Vibrocoring
VE	Vacuum extraction
WB	Washbore with blade or drag bit

WATER

Complete water loss — Outflow

Partial water loss — Inflow

Water level at date shown

NOT OBSERVED – not possible to assess groundwater conditions e.g. due to drilling water, surface seepage or cave-in
NOT ENCOUNTERED – the hole was dry soon after excavation, however, groundwater could be present in less permeable strata. Inflow may have been observed had the hole been left open for a longer period

FIELD TEST (Soil borehole and test pit logs)

DCP Dynamic Cone Penetrometer
HB Hammer bounce
HW/RW SPT penetration under rod/hammer weight only
OT Other test (e.g., plate load test)
PID Photoionisation detector
PKT Permeability test (various methods)
PRM Pressuremeter test
PP Pocket penetrometer
PSP Perth sand penetrometer
SPT Standard penetration test, with ‘N’ value
VST Shear vane test

SAMPLE

B Bulk disturbed sample
C Core sample
CBR CBR mould sample
D Small disturbed sample
ES Soil sample for environmental testing
EW Water sample for environmental testing
G Gas sample
P Piston sample
U63 Push tube sample (with diameter in mm)
W Water sample

TOTAL CORE RECOVERY (Rock logs only)

$$TCR\ (\%) = \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100$$

ROCK QUALITY DESIGNATION (Rock logs only)

$$RQD\ (\%) = \frac{\sum \text{Length of sound core pieces} > 100\text{mm}}{\text{Length of core run}} \times 100$$

GROUP SYMBOL (Soil borehole and test pit logs)

Soils are classified to reflect their primary and significant secondary component/characteristic using the classification symbols described in AS1726-2017, summarised as follows.

Symbol	Major division	Typical names
GW, GP	GRAVEL	Gravel & gravel-sand mixtures, little/no fines
GM		Gravel-silt & gravel-sand-silt mixtures
GC		Gravel-clay & gravel-sand-clay mixtures
SW, SP	SAND	Sand & gravel-sand mixtures, little/no fines
SM		Sand-silt mixtures
SC		Sand-clay mixtures
ML	SILT & CLAY (low & medium plasticity)	Inorganic silt/clayey fine sand or silt
CL, CI		Inorganic clay, gravelly clay, sandy clay
OL		Organic silt
MH	SILT & CLAY (high plasticity)	Inorganic silt
CH		Inorganic clay, high plasticity
OH		Organic clay, med-high plasticity, organic silt
Pt	Highly organic soil	Peat, highly organic soil

FIELD DESCRIPTION

Soil and rock materials described in general accordance with AS1726-2017. The description of percentage of cobbles and boulders in a soil may be limited by sample size.

MOISTURE CONDITION

Coarse grained soils and rocks
Dry (D), Moist (M) or Wet (W).
Estimated based on appearance and feel.

Cohesive soils (estimated based on judgement)

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

COHESIVE SOILS – CONSISTENCY

The consistency of a cohesive soil is assessed by tactile means or field measurement of undrained shear strength.
A Hand Penetrometer may be used in the field or the laboratory to provide approximate assessment of unconfined compressive strength of cohesive soils (kPa) as follows:

Strength	Symbol	Indicative undrained shear strength (kPa)	Hand Penetrometer Reading (kPa)
Very Soft	VS	≤ 12	< 25
Soft	S	>12 and ≤ 25	25 to 50
Firm	F	> 25 and ≤ 50	50 to 100
Stiff	St	>50 and ≤ 100	100 to 200
Very Stiff	VSt	> 100 and ≤ 200	200 to 400
Hard	H	>200	> 400
Friable	Fr	-	-

COHESIONLESS SOILS – RELATIVE DENSITY

Relative density terms are used to describe silty and sandy material, and these are usually based on resistance to drilling penetration or the Standard Penetration Test (SPT) ‘N’ values.

The Standard Penetration Test (SPT) is carried out in accordance with AS 1289, 6.3.1. For completed tests the number of blows required to drive the split spoon sampler 300 mm is recorded as the N value. For incomplete tests the number of blows and the penetration beyond the seating

depth of 150 mm are recorded. If the 150 mm seating penetration is not achieved the number of blows to achieve the measured penetration is recorded. SPT correlations may be subject to corrections for overburden pressure and equipment type.

Term	Symbol	Density Index	N Value (blows /0.3 m)	DCP (blows/100 mm)
Very Loose	VL	0 to 15	0 to 4	0 to 1
Loose	L	15 to 35	4 to 10	1 to 2
Medium Dense	MD	35 to 65	10 to 30	2 to 3
Dense	D	65 to 85	30 to 50	4 to 8
Very Dense	VD	>85	>50	>8

SOIL STRUCTURE

Soil structure is described to AS 1726-2017 if visible and present.

SOIL / ROCK ORIGIN

The geological origin of the soil or rock is presented as an interpretation of the geological and geomorphological setting. Origin cannot be deduced on the basis of material appearance and properties alone and is therefore limited by the availability of supporting geological information

ROCK MATERIAL WEATHERING

Rock weathering is described mainly using the following abbreviations and definitions used in AS1726.

Term	Symbol	Definition
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.
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 recognizable. 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	Rock shows no sign of decomposition of individual minerals or colour changes.

If differentiation between highly and moderately weathered rock is not practicable, then Distinctly Weathered (DW) is used as defined in AS1726:2017.

INFERRED ROCK STRENGTH

Rock strength is inferred based on field assessment, Point Load Index (AS4133.4.1) or Uniaxial Compressive Strength (AS 4133.4.2.1) as follows:

Term	Symbol	UCS (MPa)	Point Load Index $Is_{(50)}$ (MPa)*
Very Low	VL	0.6 to 2	0.03 to 0.1
Low	L	2 to 6	0.1 to 0.3
Medium	M	6 to 20	0.3 to 1
High	H	20 to 60	1 to 3
Very High	VH	60 to 200	3 to 10
Extremely High	EH	>200	>10

*example based on UCS = 20 x $Is_{(50)}$, actual correlation factor varies across rock types and weathering grades

●○ Axial\Diametral Point Load Index test

■ Uniaxial Compressive Strength test

DEFECT SPACING/BEDDING SPACING (Rock)

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

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

DEFECT TYPE (Rock)

Symbol	Term	Symbol	Term
CS	crushed seam	J	joint
DB	drilling break	MB	mechanical break
DL	drill lift	P	parting
EW	extremely weathered seam	S	sheared surface
HB	handling break	SS	shear seam
IS	infilled seam	SZ	shear zone

DEFECT ORIENTATION (Rock)

Dip measured relative to the horizontal plane in vertical boreholes and relative to core axis in inclined boreholes.

DEFECT ROUGHNESS AND SHAPE (Rock)

Roughness	Description	Roughness	Description
SM	Smooth	PO	Polished
RF	Rough	SL	Slickensided
VR	Very Rough		

Shape	Description	Shape	Description
PR	Planar	CU	Curved
UN	Undulating	ST	Stepped
IR	Irregular		

DEFECT APERTURE OBSERVATION (Rock)

Symbol	Term
CN	Clean
CT	Coating (<=1 mm)
SN	Stained
VN	Veneer

Aperture infill is denoted through presence of a value in the aperture thickness measurement and an infill material code or name in the infill material cell.

DEFECT INFILLING (Rock)

Where defects are infilled, the infilling material is either coded with a soil\mineral name (e.g. CLAY), a group symbol code (e.g. SC), or one of the material codes in the table below.

Term	Description	Term	Description
Ca	Calcite	Mn	Manganese
Ch	Chlorite	Py	Pyrite
Co	Coal/carbonaceous	Gp	Gypsum
CR	Crushed rock	Qz	Quartz
Fe	Limonite/ironstone	Ud	Unidentified
Fs	Feldspar		

OTHER OBSERVATIONS

Ranking of visually observable contamination and odour (applies on specific soil contamination projects only)

Symbol	Term
R = 0	No visible evidence of contamination
R = 1	Slight evidence of contamination
R = 2	Visible evidence of contamination
R = 3	Significant visible evidence of contamination
R = A	No non-natural odours identified
R = B	Slight non-natural odours identified
R = C	Moderate non-natural odours identified
R = D	Strong non-natural odours identified

Graphic Log Colour Scheme – Soils and Rocks

The soil and rock colour schemes presented on the logs and fences have been derived from those below.
The rock colour scheme is taken from Geoscience Australia's predecessor, the Bureau of Mineral Resources (BMR).

	Clay dominated soils	Soils
	Silt dominated soils, topsoil, undifferentiated fine grained soil	
	Sand dominated soils	
	Gravel or cobble dominated soils	
	Peat soils	
	Lithic sedimentary breccia and conglomerate	Sedimentary rocks
	Sandstone, arenite	
	Arkose	
	Pelitic rocks, shale, mudstone	
	Greywacke, siltstone, siltstone-sandstone mixtures	
	Coal, lignite, undifferentiated carbonaceous rock	
	Limestone, chert, undifferentiated calcareous soils, and rocks	
	Undifferentiated metamorphic rocks of any grade	Metamorphic rocks
	Schist, gneiss, and other high grade metamorphic rocks	
	Greenschist, phyllite, hornfels and lower grade metamorphic rocks	
	Undifferentiated igneous rock, tuff, volcanics	Igneous rocks
	Extrusive acid igneous rock, rhyolite	
	Extrusive basic igneous rock, basalt, spilite	
	Extrusive intermediate igneous rock, dacite	
	Extrusive ultrabasic igneous	
	Intrusive acid igneous rock, all granitoid rock	
	Intrusive basic igneous rock, gabbro, dolerite	
	Intrusive intermediate igneous rock, andesite, diorite	
	Intrusive ultrabasic igneous rock, peridotite	
	Fill, concrete, pavement	Secondary rock, man-made and other materials
	Water	
	Undifferentiated evaporite unit	
	Calcrete	
	Ironstone, ferricrete, ferruginous rock	

Graphic Symbols – Soils and Rocks

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

SOIL SYMBOLS

Main components


CLAY


SILT


SAND


GRAVEL


BOULDERS / COBBLES


TOPSOIL


PEAT

Minor components


CLAYEY


SILTY


SANDY


GRAVELLY

OTHER MATERIAL SYMBOLS


FILL


BITUMEN


CONCRETE

ROCK SYMBOLS

Sedimentary Rocks


SANDSTONE


SILTSTONE


CLAYSTONE, MUDSTONE


SHALE


COAL


LIMESTONE


CONGLOMERATE

Igneous rocks


GRANITE


BASALT


UNDIFFERENTIATED IGNEOUS

Metamorphic rocks


SLATE, PHYLLITE, SCHIST


GNEISS


QUARTZITE

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH01

FILE / JOB NO : PS134724
SHEET : 1 OF 1

CLIENT : Department of Education NSW
PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

POSITION : E: 297781.8, N: 6243068.4 (MGA2020-56) SURFACE ELEVATION : 82.70 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 17/1/2023 DATE COMPLETED : 17/1/2023 DATE LOGGED : 17/1/2023 LOGGED BY : CTJ CHECKED BY : PH

DRILLING					MATERIAL						
PROGRESS: DRILLING & CASING	PROGRESS: WATER	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T	(-)	E	NFGWE	0.50m D 0.70m	0.0 82.7			0.10m TOPSOIL Sandy CLAY: low plasticity, dark brown, sand is fine to coarse grained; with fine to coarse grained, sub-angular gravel; with rootlets. FILL Sandy CLAY: low plasticity, dark brown, sand is fine to coarse grained; with fine to coarse grained, sub-angular gravel; with rootlets.		St	TOPSOIL Grass at surface 0.01-1.50: slow augering due to possible nearby services. NO SPT FILL
					0.50m			Silty CLAY: medium plasticity, red-brown, orange-brown, with fine to coarse grained sand; trace rootlets.			RESIDUAL SOIL 0.50: inferred stiff
					1.0 81.7		CI		w<PL	St	
				SPT 4,7,11 N=18 1.95m				1.5m: becoming grey mottled red and orange-brown, with organic material		VSt - H	1.60: PP =320 kPa 1.70: PP =400 kPa 1.80: PP =430 kPa
					2.00m 2.0 80.7			1.9m: becoming red mottled grey, trace siltstone pieces SILTSTONE; RECOVERED AS SILTY CLAY: medium plasticity, pale grey, brown, orange brown, trace fine to coarse grained sand.			RESIDUAL SOIL / EXTREMELY WEATHERED MATERIAL
		F-H								H	
		H		SPT 7/20mm HB N=R 2.52m	2.60m			2.5m: becoming pale grey-brown Hole Terminated at 2.60 m Refusal			2.50: significant increase in drill resistance, SPT to confirm refusal 2.50: Hammer triple bouncing
					3.0 79.7						
					4.0 78.7						
					5.0 77.7						
					6.0 76.7						
					7.0 75.7						
					8.0 74.7						

See Explanatory Notes for details of abbreviations & basis of descriptions.

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH02

CLIENT : Department of Education NSW
PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

FILE / JOB NO : PS134724
SHEET : 1 OF 1

POSITION : E: 297844.3, N: 6243058.4 (MGA2020-56) SURFACE ELEVATION : 84.30 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 16/1/2023 DATE COMPLETED : 16/1/2023 DATE LOGGED : 16/1/2023 LOGGED BY : CTJ CHECKED BY : PH

DRILLING					MATERIAL						
PROGRESS: DRILLING & CASING	PROGRESS: WATER	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
					0.0 84.3			0.10m TOPSOIL Sandy CLAY: low plasticity, dark brown, sand is fine to coarse grained; with fine to coarse grained, sub-angular gravel; with rootlets.			TOPSOIL Grass at surface
								FILL Clayey SAND: fine to coarse grained, dark brown, brown, clay is low to medium plasticity; trace fine to coarse grained, sub-angular gravel.		St	FILL
				SPT 5,7,7 N=14				0.50m Silty CLAY: medium plasticity, red-brown, grey, orange-brown, with rootlets; trace fine to coarse grained sand.			RESIDUAL SOIL 0.60: PP >600 kPa 0.70: PP >600 kPa 0.80: PP >600 kPa
				0.95m	1.0 83.3			0.9m: becoming grey mottled red			
		E									
				SPT 4,6,9 N=15			CI		w<PL	VSt - H	1.60: PP =450 kPa 1.70: siltstone piece, 20mm diameter 1.70: PP =400 kPa 1.85: PP =530 kPa 1.95: PP =360 kPa
				1.95m				1.65m: with orange-brown mottling			
					2.0 82.3			1.9m: with siltstone pieces			
		F-H									2.60: increase in drill resistance
								2.80m 2.8m: becoming pale grey-brown		H	RESIDUAL SOIL / EXTREMELY WEATHERED MATERIAL
				SPT 19 HB N=R 3.08m	3.0 81.3			3.08m SILTSTONE; RECOVERED AS SILTY CLAY: medium plasticity, pale grey-brown, brown.			
								Hole Terminated at 3.08 m Termination criterion reached			
AD/T	(-)		NFGWE		4.0 80.3						
					5.0 79.3						
					6.0 78.3						
					7.0 77.3						
					8.0 76.3						

See Explanatory Notes for details of abbreviations & basis of descriptions.

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH03

FILE / JOB NO : PS134724
SHEET : 1 OF 1

CLIENT : Department of Education NSW
PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

POSITION : E: 297795.9, N: 6243024.9 (MGA2020-56) SURFACE ELEVATION : 82.80 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 17/1/2023 DATE COMPLETED : 17/1/2023 DATE LOGGED : 17/1/2023 LOGGED BY : CTJ CHECKED BY : PH

DRILLING					MATERIAL					
PROGRESS: DRILLING & CASING	PROGRESS: WATER	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T		H			0.0 82.8			0.15m CONCRETE.			ROAD SURFACE
		E		0.50m				FILL Gravelly Sandy CLAY: medium plasticity, dark brown, sand is fine to coarse grained; gravel is fine to coarse grained, sub-angular; asphalt gravel.		F - St	FILL
HA		D 0.70m					CI	0.50m Sandy Silty CLAY: medium plasticity, dark brown, grey, red-brown, sand is fine to coarse grained; with fine to coarse grained, sub-angular gravel.		St	RESIDUAL SOIL 0.50: inferred stiff based on HA resistance
		F						0.80m 0.7m: with rootlets, organic matter			
					1.0 81.8		CI	Silty CLAY: medium plasticity, grey mottled red, trace fine to coarse grained sand; trace rootlets.		VSt	0.80: PP =210 kPa 0.90: PP =200 kPa
AD/T	(-)	E	NFGWE	SPT 10,16,25 N=41 1.95m				1.5m: becoming grey only, no rootlets 1.80m	w<PL		1.60: PP =560 kPa 1.70: PP =590 kPa
					2.0 80.8			SILTSTONE; RECOVERED AS SILTY CLAY: medium plasticity, red, brown, siltstone pieces, with fine to coarse grained sand. 1.9m: becoming grey mottled red		H	RESIDUAL SOIL / EXTREMELY WEATHERED MATERIAL 1.90: PP >600 kPa
		H						2.62m			
		F-H		SPT 6/20mm HB N=R 2.62m				Hole Terminated at 2.62 m Termination criterion reached			2.60: TC-auger refusal, SPT conducted to confirm 2.60: hammer triple bouncing
					3.0 79.8						
					4.0 78.8						
					5.0 77.8						
					6.0 76.8						
					7.0 75.8						
					8.0 74.8						

See Explanatory Notes for details of abbreviations & basis of descriptions.

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH05

FILE / JOB NO : PS134724
SHEET : 1 OF 2

CLIENT : Department of Education NSW
PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

POSITION : E: 297779.8, N: 6242951.1 (MGA2020-56) SURFACE ELEVATION : 80.20 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 17/1/2023 DATE COMPLETED : 17/1/2023 DATE LOGGED : 17/1/2023 LOGGED BY : CTJ CHECKED BY : PH

DRILLING						MATERIAL					
PROGRESS: DRILLING & CASING	PROGRESS: WATER	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T	(-)	E	NFGWE		0.0 80.2		CL-CI	Sandy CLAY: low to medium plasticity, orange-brown, sand is fine to coarse grained; with fine to coarse grained, sub-angular to sub-rounded gravel.		VSt	RESIDUAL SOIL Grass at surface 0.10: inferred very stiff
				SPT 7,21,21 N=42						H	0.60: PP >600 kPa
		F-H		0.95m	1.0 79.2			SILTSTONE: recovered as Silty CLAY, medium plasticity, grey, black, with fine to coarse grained sand.	w<PL		RESIDUAL SOIL / EXTREMELY WEATHERED MATERIAL
				SPT 27,25 HB N=R 1.76m				1.5m: becoming pale grey-brown		H	
		VH			2.0 78.2			Continued as Cored Drill Hole			1.80: significant increase in drill resistance
					3.0 77.2						
					4.0 76.2						
					5.0 75.2						
					6.0 74.2						
					7.0 73.2						
					8.0 72.2						

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

HOLE NO : BH05

FILE / JOB NO : PS134724
SHEET : 2 OF 2

CLIENT : Department of Education NSW PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

POSITION : E: 297779.8, N: 6242951.1 (MGA2020-56) SURFACE ELEVATION : 80.20 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 17/1/2023 DATE COMPLETED : 17/1/2023 DATE LOGGED : 17/1/2023 LOGGED BY : CTJ CHECKED BY : PH

CASING DIAMETER : BARREL (Length) : 3.00 m BIT : Diamond BIT CONDITION : Good

DRILLING					MATERIAL				FRACTURES		
PROGRESS: DRILLING & CASING	PROGRESS: WATER	(CORE LOSS RUN %) / DRILL DEPTH	RQD (%)	SAMPLES & FIELD TESTS	DEPTH (m) / RL (m AHD)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	WEATHERING	ESTIMATED STRENGTH UCS=20·$I_{a(50)}$ ● - Axial ○ - Diametral ■ - UCS VL -2 L -6 M -20 H -60 VH -200 EH	NATURAL FRACTURE (mm) 20 40 100 300 1000	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
					0.0 80.2							
					1.0 79.2							
					2.00m 2.0 78.2		START CORING AT 2.00m					
HQ3	0% LOSS	0% LOSS 3.00	67				SILTSTONE: fine grained, grey-brown, orange-brown, trace quartz inclusions.	XW - HW				CS J, 86°, CN, IR, SM CS
							2.32m: becoming grey 2.4m: with carbonaceous- and iron-rich veins	HW				
							2.7m: becoming dark grey, black					
	0% LOSS	0% LOSS 4.00	76		3.0 77.2			XW				
							3.56m: claystone pieces (40mm)					
					4.00m 4.0 76.2		LAMINITE: SHALE: 80% & SANDSTONE: 20%: fine to medium grained, grey-brown, orange-brown, with claystone pieces.	HW				
							4.55m: increase in claystone/mudstone content	HW - MW				J, 5 - 10°, CN, IR, SM
	0% LOSS	0% LOSS 6.00	76		5.0 75.2			MW				J, 90°, CN, IR, RF
							5.68: increase in sandstone content	SW				J, 10°, Pl, SM, Fe EW, clay
					6.00m 6.0 74.2		Hole Terminated at 6.00 m Termination criterion reached					
					7.0 73.2							
					8.0 72.2							

See Explanatory Notes for details of abbreviations & basis of descriptions.

REPORT OF CORE PHOTOGRAPHS: BH05

CLIENT: Department of Education NSW
PROJECT: Austral Public School Redevelopment
LOCATION: Edmondson Avenue, Austral NSW 2179
JOB NO: PS134724

POSITION:
COORDS: 297779.8 m 6242951.1 m MGA2020-56
SURFACE RL: 80.20 m DATUM: AHD
COORDS:
SURFACE RL: DATUM:
INCLINATION: -90°
HOLE DEPTH: 6.00 m

SHEET: 1 OF 1
DRILL RIG: Geo 305
CONTRACTOR: Matrix Drilling
LOGGED: CTJ DATE: 17/1/23
CHECKED: PH DATE: 24/1/23

PointID : BH05 Depth Range: 2.00 - 6.00 m

This report of core photographs must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F31
RL1

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH06

FILE / JOB NO : PS134724
SHEET : 1 OF 1

CLIENT : Department of Education NSW
PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

POSITION : E: 297840.0, N: 6242904.0 (MGA2020-56) SURFACE ELEVATION : 81.00 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 16/1/2023 DATE COMPLETED : 16/1/2023 DATE LOGGED : 16/1/2023 LOGGED BY : CTJ CHECKED BY : PH

DRILLING					MATERIAL					
PROGRESS: DRILLING & CASING	PROGRESS: WATER	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T	(-)	E	NFGWE	SPT 7,7,8 N=15 0.95m	0.0 81.0			0.10m TOPSOIL Sandy CLAY: medium plasticity, brown, sand is fine to coarse grained; with rootlets.			TOPSOIL Grass at surface
							CI	Silty CLAY: medium plasticity, brown mottled grey, orange-brown, with fine to coarse grained sand; trace siltstone pieces.		St - VSt	RESIDUAL SOIL
											0.70: PP =550 kPa
					1.0 80.0			1.00m 0.9m: with siltstone pieces Silty CLAY: medium plasticity, brown, orange-brown with grey, with fine to coarse grained sand; with siltstone pieces.			0.90: PP >600 kPa
		E-F		SPT 9,10,11 N=21 1.95m			CI	1.6m: becoming dark brown mottled grey 1.8m: with fine to coarse, sub-angular to sub-rounded gravel, decrease in silt fines	w<PL		1.75: root ~3mm diameter
		F			2.0 79.0			2.50m		H	2.30: increase in drill resistance
								SILTSTONE: RECOVERED AS SILTY CLAY: as above but orange brown, brown, trace fine to coarse grained sand.			RESIDUAL SOIL / EXTREMELY WEATHERED MATERIAL
		F-H		SPT 6,14,14 N=28 3.45m	3.0 78.0			3.1m: with red, grey siltstone pieces			3.00: friable, crumbled sample, no PP tests
		H		SPT 15,7/10mm HB N=R 4.16m	4.0 77.0			4.16m 4.0m: becoming dark grey, orange-brown			
								Hole Terminated at 4.16 m Termination criterion reached			
					5.0 76.0						
					6.0 75.0						
					7.0 74.0						
					8.0 73.0						

See Explanatory Notes for details of abbreviations & basis of descriptions.

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH07

FILE / JOB NO : PS134724
SHEET : 1 OF 2

CLIENT : Department of Education NSW
PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

POSITION : E: 297867.6, N: 6242902.4 (MGA2020-56) SURFACE ELEVATION : 81.40 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 16/1/2023 DATE COMPLETED : 16/1/2023 DATE LOGGED : 16/1/2023 LOGGED BY : CTJ CHECKED BY : PH

DRILLING					MATERIAL					
PROGRESS: DRILLING & CASING	PROGRESS: WATER	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T	(-)	E	NFGWE	SPT 5,6,6 N=12	0.0 81.4			0.10m TOPSOIL Sandy CLAY: medium plasticity, brown, sand is fine to coarse grained; with rootlets.			TOPSOIL Grass at surface
							CI	Sandy Silty CLAY: medium plasticity, pale orange-brown, brown, sand is fine to coarse grained; with fine to coarse grained, sub-angular gravel; trace rootlets.		VSt	RESIDUAL SOIL
								0.50m			
				SPT 5,6,6 N=12			CI	Sandy Silty CLAY: medium plasticity, brown, grey, sand is fine to coarse grained; with fine to coarse grained gravel; with rootlets.		H	0.60: PP >600 kPa possible reworked residual 0.80: PP =550 kPa
				0.95m				0.90m			
					1.0 80.4			Silty CLAY: medium to high plasticity, red-brown, grey, with fine to coarse grained sand; trace rootlets.			0.90: PP >600 kPa
								1.5m: becoming grey mottled red-brown		H	
				SPT 3,3,5 N=8			CI-CH		w<PL		1.60: PP =210 kPa 1.70: PP =260 kPa 1.80: PP =250 kPa
				1.95m	2.0 79.4					VSt	
								2.50m			
		F						Silty CLAY: medium plasticity, grey, brown, with fine to coarse grained sand; trace siltstone pieces.			
							CI			H	
		H		SPT 16,25,15/50mm HB N=R	3.0 78.4			3.10m			
								3.20m SILTSTONE; RECOVERED AS SILTY CLAY: medium plasticity, grey, brown, trace fine to coarse grained sand.		H	RESIDUAL SOIL EXTREMELY WEATHERED MATERIAL 3.10: PP >600 kPa
								Continued as Cored Drill Hole			
					4.0 77.4						
					5.0 76.4						
					6.0 75.4						
					7.0 74.4						
					8.0 73.4						

See Explanatory Notes for details of abbreviations & basis of descriptions.

CORED DRILL HOLE LOG

HOLE NO : BH07

FILE / JOB NO : PS134724
SHEET : 2 OF 2

CLIENT : Department of Education NSW PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

POSITION : E: 297867.6, N: 6242902.4 (MGA2020-56) SURFACE ELEVATION : 81.40 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 16/1/2023 DATE COMPLETED : 16/1/2023 DATE LOGGED : 16/1/2023 LOGGED BY : CTJ CHECKED BY : PH

CASING DIAMETER : BARREL (Length) : 3.00 m BIT : Diamond BIT CONDITION : Good

DRILLING					MATERIAL				FRACTURES		
PROGRESS: DRILLING & CASING	PROGRESS: WATER	CORE LOSS (CORE LOSS RUN %) / DRILL DEPTH	RQD (%)	SAMPLES & FIELD TESTS	DEPTH (m) / RL (m AHD)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Colour, Grain size, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	WEATHERING	ESTIMATED STRENGTH UCS=20·$I_{a(50)}$ ● - Axial ○ - Diametral ■ - UCS VL -2 L -6 M -20 H -60 VH -200 EH	NATURAL FRACTURE (mm) 20 40 100 300 1000	VISUAL	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, orientation, infilling or coating, shape, roughness, thickness, other
					0.0 81.4							
					1.0 80.4							
					2.0 79.4							
					3.0 78.4							
							3.20m START CORING AT 3.20m					
HQ3	0% LOSS	0% LOSS 4.50	0	SPT 16,25,15/50mm HB N=R 3.35m	4.0 77.4		SILTSTONE: grey, brown, black, resembling residual soil.	XW				J, 20°, CN, Pl, SM CS
	0% LOSS	0% LOSS 6.41	71		5.0 76.4		5.00m LAMINITE: CLAYSTONE: 40% & SANDSTONE: 60%: fine to medium grained, red-grey, brown, grey.	XW - HW HW				J, 10 - 15°, CN, Pl, SM J, 30°, CN, Pl, SM
					6.0 75.4		5.89m SILTSTONE: grey, orange-brown, iron-rich veins.	XW				
							6.41m Hole Terminated at 6.41 m Target depth					
					7.0 74.4							
					8.0 73.4							

See Explanatory Notes for details of abbreviations & basis of descriptions.

REPORT OF CORE PHOTOGRAPHS: BH07

CLIENT: Department of Education NSW
PROJECT: Austral Public School Redevelopment
LOCATION: Edmondson Avenue, Austral NSW 2179
JOB NO: PS134724

POSITION:
COORDS: 297867.6 m 6242902.4 m MGA2020-56
SURFACE RL: 81.40 m DATUM: AHD
COORDS:
SURFACE RL: DATUM:
INCLINATION: -90°
HOLE DEPTH: 6.41 m

SHEET: 1 OF 1
DRILL RIG: Geo 305
CONTRACTOR: Matrix Drilling
LOGGED: CTJ DATE: 16/1/23
CHECKED: PH DATE: 24/1/23

PointID : BH07 Depth Range: 3.20 - 6.41 m

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GAP gINT FN. F31
RL1

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH08

FILE / JOB NO : PS134724
SHEET : 1 OF 1

CLIENT : Department of Education NSW
PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

POSITION : E: 297897.0, N: 6242907.8 (MGA2020-56) SURFACE ELEVATION : 81.90 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 16/1/2023 DATE COMPLETED : 16/1/2023 DATE LOGGED : 16/1/2023 LOGGED BY : CTJ CHECKED BY : PH

DRILLING						MATERIAL					
PROGRESS: DRILLING & CASING	PROGRESS: WATER	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T	(-)	E	NFGWE	SPT 6,9,11 N=20 0.95m	0.0 81.9		CL-Cl	Silty Sandy CLAY: low to medium plasticity, pale brown, sand is fine to coarse grained; trace fine to coarse grained, sub-angular gravel; trace rootlets.		VSt	RESIDUAL SOIL Grass at surface
								0.50m			
					1.0 80.9		Cl	Silty CLAY: medium plasticity, red-brown mottled grey, with fine to coarse grained sand; trace rootlets.		H	0.60: PP >600 kPa 0.80: PP >600 kPa
								0.9m: with fine to coarse, sub-angular to sub-rounded gravel, trace siltstone pieces			
		E-F		SPT 8,16,29 N=45 1.95m				1.5m: becoming pale grey, resembling extremely weathered siltstone, no gravel			1.60: PP >600 kPa 1.70: PP >600 kPa 1.80: PP >600 kPa
					2.0 79.9			2.00m SILTSTONE; RECOVERED AS SILTY CLAY: medium plasticity, dark grey, grey-brown, trace fine to coarse grained sand.	w<PL		RESIDUAL SOIL / EXTREMELY WEATHERED MATERIAL
											2.70: increase in drill resistance
		H		SPT 12,26,30 N=56 3.45m	3.0 78.9			3.0m: becoming dark grey, black		H	3.20: PP >600 kPa
				SPT 17 HB N=R 4.10m	4.0 77.9			4.10m Hole Terminated at 4.10 m Termination criterion reached			
					5.0 76.9						
					6.0 75.9						
					7.0 74.9						
					8.0 73.9						

See Explanatory Notes for details of abbreviations & basis of descriptions.

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH09

FILE / JOB NO : PS134724
SHEET : 1 OF 1

CLIENT : Department of Education NSW
PROJECT : Austral Public School Redevelopment
LOCATION : Edmondson Avenue, Austral NSW 2179

POSITION : E: 297792.8, N: 6242845.3 (MGA2020-56) SURFACE ELEVATION : 81.30 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Geo 305 MOUNTING : Track CONTRACTOR : Matrix Drilling DRILLER : JY

DATE STARTED : 16/1/2023 DATE COMPLETED : 16/1/2023 DATE LOGGED : 16/1/2023 LOGGED BY : CTJ CHECKED BY : PH

DRILLING					MATERIAL					
PROGRESS: DRILLING & CASING	PROGRESS: WATER	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	GROUP SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T	(-)	E	NFGWE	SPT 8,14,12 N=26	0.0 81.3		CI	Sandy CLAY: medium plasticity, brown, dark brown, sand is fine to coarse grained; trace fine to coarse grained, sub-angular gravel; trace rootlets.		Fr	RESIDUAL SOIL Grass at surface
				0.95m 1.00m B	0.50m			Silty CLAY: medium plasticity, brown mottled grey, orange-brown, with fine to coarse grained sand; trace siltstone pieces.			0.60: PP >600 kPa 0.70: PP >600 kPa
					1.0 80.3				w<PL		0.90: PP >600 kPa
							CI			H	
		E-F		1.50m SPT 7,8,20 N=28				1.5m: becoming red-brown mottled grey			1.60: PP >600 kPa 1.70: PP >600 kPa
				1.95m				1.8m: becoming pale grey only			1.90: PP >600 kPa
					2.00m 2.0 79.3			1.95m: becoming weathered rock, recovered as Silty CLAY SILTSTONE; RECOVERED AS SILTY CLAY: medium plasticity, grey, red-brown, orange-brown.			RESIDUAL SOIL / EXTREMELY WEATHERED MATERIAL
		F-H								H	2.50: increase in drill resistance
								2.8m: becoming pale grey-brown			
				SPT 20 HB N=R 3.10m	3.0 78.3 3.10m			Hole Terminated at 3.10 m Termination criterion reached			
					4.0 77.3						
					5.0 76.3						
					6.0 75.3						
					7.0 74.3						
					8.0 73.3						

See Explanatory Notes for details of abbreviations & basis of descriptions.

Appendix C

Laboratory Certificates

resource laboratories
AGGREGATE, ROCK, AND SOIL TESTING
ABN: 25 131 532 020
Sydney: 12/1 Boden Road Seven Hills NSW 2147 | PO Box 45 Pendle Hill NSW 2145
Ph: (02) 9674 7711 **| Fax:** (02) 9674 7755 **| Email:** info@resourcelab.com.au

Test Report

Customer: WSP Australia Pty Limited
Project: PS134724 - Austral Public School GI
Location: Austral, NSW

Job number: 23-0026
Report number: 1
Page: 1 of 1

Moisture Content

Sampling method: Tested as received

Test method(s): AS 1289.1.1, 2.1.1

	Results				
Laboratory sample no.	29663	29666	29668	29670	29673
Customer sample no.	BH02-GEO-002-SPT-1.50_1.95	BH05-GEO-001-SPT-0.50_0.95	BH06-GEO-002-SPT-1.50_1.95	BH07-GEO-001-SPT-0.50_0.95	BH09-GEO-001-SPT-0.50_0.95
Date sampled	16/01/2023	17/01/2023	16/01/2023	16/01/2023	16/01/2023
Material description	silty CLAY, trace of gravel, pale grey/red/yellow-brown	silty sandy CLAY, trace of gravel, brown/ red	silty CLAY, with sand, trace of gravel, brown/ dark brown/red	silty CLAY, trace of sand and gravel, brown/ red	silty CLAY, with sand, trace of gravel, brown/ pale grey/red
Moisture content (%)	18.8	9.0	12.6	16.5	9.9

Laboratory sample no.					
Customer sample no.					
Date sampled					
Material description					
Moisture content (%)					

Approved Signatory: L. Coleman **Date:** 06/02/2023

resource laboratories
AGGREGATE, ROCK, AND SOIL TESTING
ABN: 25 131 532 020
Sydney: 12/1 Boden Road Seven Hills NSW 2147 | PO Box 45 Pendle Hill NSW 2145
Ph: (02) 9674 7711 **| Fax:** (02) 9674 7755 **| Email:** info@resourcelab.com.au

Test Report

Customer: WSP Australia Pty Limited
Project: PS134724 - Austral Public School GI
Location: Austral, NSW

Job number: 23-0026
Report number: 2

Soil Index Properties

Sampling method: Tested as received

Test method(s): AS 1289.1.1, 2.1.1, 3.1.1, 3.2.1, 3.3.1, .3.4.1

	Results				
Laboratory sample no.	29663	29664	29666	29668	29670
Customer sample no.	BH02-GEO-002-SPT-1.50_1.95	BH03-GEO-001-D-0.50_0.70	BH05-GEO-001-SPT-0.50_0.95	BH06-GEO-002-SPT-1.50_1.95	BH07-GEO-001-SPT-0.50_0.95
Date sampled	16/01/2023	17/01/2023	17/01/2023	16/01/2023	16/01/2023
Material description	silty CLAY, trace of gravel, pale grey/red/yellow-brown	silty CLAY, trace of sand and gravel, red/grey	silty sandy CLAY, trace of gravel, brown/red	silty CLAY, with sand, trace of gravel, brown/ dark brown/red	silty CLAY, trace of sand and gravel, brown/ red
Liquid limit (%)	66	75	37	47	52
Plastic limit (%)	17	19	13	15	16
Plasticity index (%)	49	56	24	32	36
Linear shrinkage (%)	14.5	17.0	10.5	13.0	12.0
Cracking / Curling / Crumbling	-	-	-	-	-
Sample history	Air dried	Air dried	Air dried	Air dried	Air dried
Preparation	Dry sieved	Dry sieved	Dry sieved	Dry sieved	Dry sieved

Approved Signatory: L. Coleman **Date:** 06/02/2023

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

resource laboratories
AGGREGATE, ROCK, AND SOIL TESTING
ABN: 25 131 532 020
Sydney: 12/1 Boden Road Seven Hills NSW 2147 | PO Box 45 Pendle Hill NSW 2145
Ph: (02) 9674 7711 **| Fax:** (02) 9674 7755 **| Email:** info@resourcelab.com.au

Test Report

Customer: WSP Australia Pty Limited
Project: PS134724 - Austral Public School GI
Location: Austral, NSW

Job number: 23-0026
Report number: 2

Soil Index Properties

Sampling method: Tested as received

Test method(s): AS 1289.1.1, 2.1.1, 3.1.1, 3.2.1, 3.3.1, .3.4.1

	Results				
Laboratory sample no.	29672	29674			
Customer sample no.	BH08-GEO-001-SPT-0.50_0.95	BH09-GEO-002-B-1.00_1.50			
Date sampled	16/01/2023	16/01/2023			
Material description	silty CLAY, with sand, trace of gravel, brown/ red/grey	silty CLAY, trace of sand and gravel, brown/ red/pale grey			
Liquid limit (%)	62	62			
Plastic limit (%)	17	18			
Plasticity index (%)	45	44			
Linear shrinkage (%)	14.0	15.5			
Cracking / Curling / Crumbling	-	-			
Sample history	Air dried	Air dried			
Preparation	Dry sieved	Dry sieved			

Approved Signatory:  L. Coleman **Date:** 06/02/2023

resource laboratories
AGGREGATE, ROCK, AND SOIL TESTING
ABN: 25 131 532 020
Sydney: 12/1 Boden Road Seven Hills NSW 2147 | PO Box 45 Pendle Hill NSW 2145
Ph: (02) 9674 7711 | **Fax:** (02) 9674 7755 | **Email:** info@resourcelab.com.au

Test Report

Customer: WSP Australia Pty Limited
Project: PS134724 - Austral Public School GI
Location: Austral, NSW

Job number: 23-0026
Report number: 3

California Bearing Ratio

Sampling method: Tested as received
Test method(s): AS 1289.1.1, 2.1.1, 5.1.1, 6.1.1

	Results			
Laboratory sample no.	29674			
Customer sample no.	BH09-GEO-002-B-1.00_1.50			
Date sampled	16/01/2023			
Material description	silty CLAY, trace of sand and gravel, brown/ red/pale grey			
Maximum dry density (t/m^3)	1.74			
Optimum moisture content (%)	17.2			
Field moisture content (%)	n/a			
Oversize retained on 19.0mm sieve (%)	0			
Minimum curing time (hours)	168			
Dry density before soak (t/m^3)	1.70			
Dry density after soak (t/m^3)	1.58			
Moisture content before soak (%)	17.0			
Moisture content after soak (%)	23.9			
Moisture content after test - top 30mm (%)	36.4			
Moisture content after test - remaining depth (%)	21.1			
Density ratio before soaking (%)	98.0			
Moisture ratio before soaking (%)	98.5			
Period of soaking (days)	4			
Compactive effort	Standard			
Mass of surcharge applied (kg)	4.5			
Swell after soaking (%)	8.0			
Penetration (mm)	5.0			
CBR Value (%)	**0.5**			

Notes: Specified LDR: 98 ±1%

Method of establishing plasticity level - Visual / tactile

Approved Signatory: L. Coleman **Date:** 14/02/2023

NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025 - Testing.

NATA Accredited Laboratory Number: **17062**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2302715**	Page	: 1 of 4
Client	: **RESOURCE LABORATORIES PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR CHRIS GREELY	Contact	: Sarah Mathew
Address	: PO BOX 45 PENDLE HILL NSW 2145	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: 02 9674 7711	Telephone	: +61-2-8784 8555
Project	: PS134724	Date Samples Received	: 27-Jan-2023 15:20
Order number	: 23-0061	Date Analysis Commenced	: 30-Jan-2023
C-O-C number	: ----	Issue Date	: 03-Feb-2023 11:46
Sampler	: ----		
Site	: Austral Public School GI, Austral, NSW		
Quote number	: EN/222		
No. of samples received	: 8		
No. of samples analysed	: 8		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

- Corrosion assessment for Concrete and Steel piles in soil per Australian Standard AS2159-2009 uses a combination of soil and groundwater data (Tables 6.4.2 C & 6.5.2 C). In the absence of groundwater data, assessment has been made against soil criteria only. Refer to AS2159-2009 section 6.4 for further interpretation of corrosion assessment. ALS is not NATA accredited for Corrosion Assessment comments
- EA167: Soil Condition A – High permeability soils (e.g. sands and gravels) which are in groundwater
- EA167: Soil Condition B – Low permeability soils (e.g. silts and clays) or all soils above groundwater

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

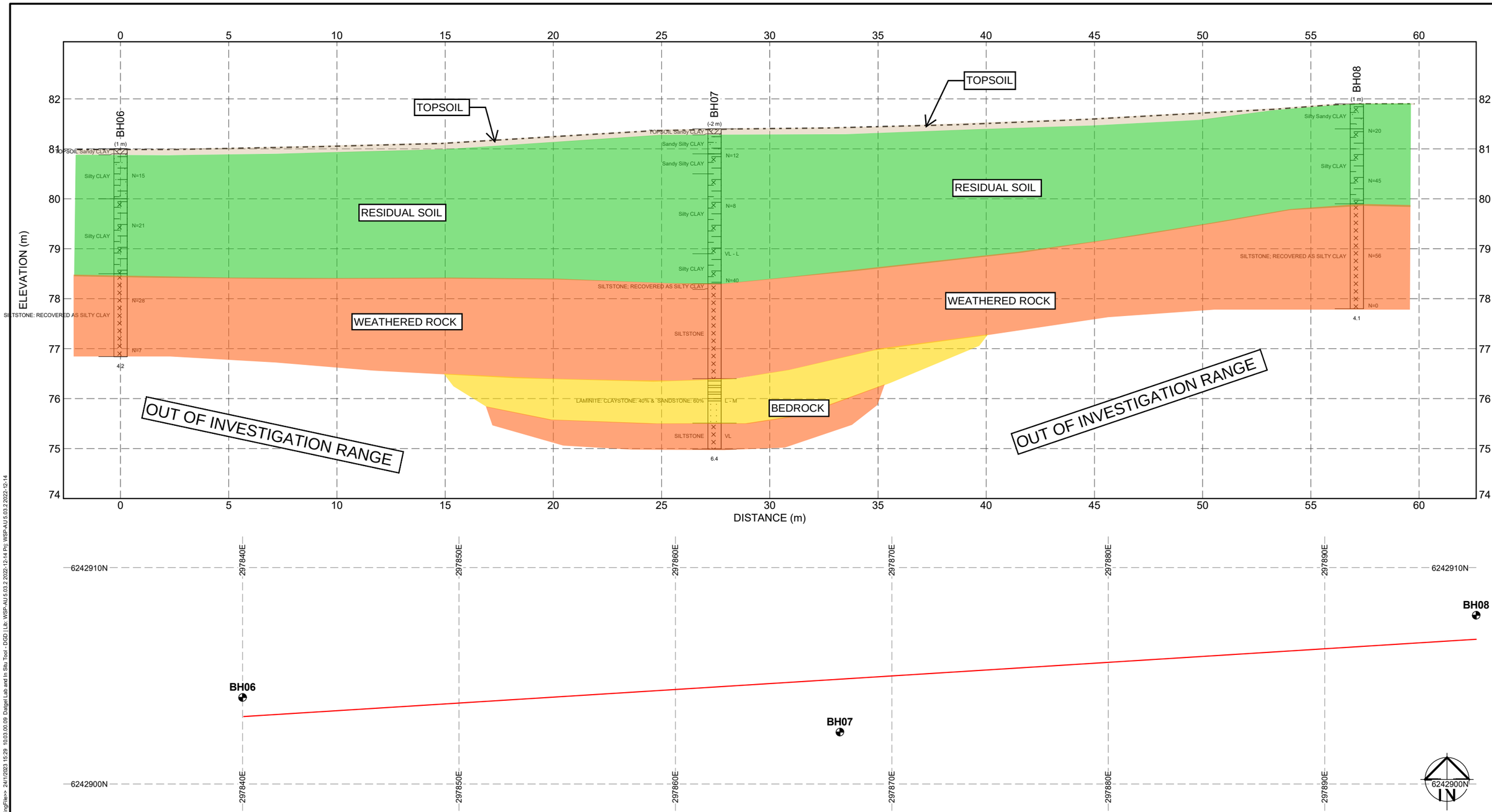
Compound	CAS Number	LOR	Unit	Sample ID	29661 BH01-GEO-002-SPT-1.50_1.95	29662 BH02-GEO-001-SPT-0.50_0.95	29665 BH03-GEO-002-SPT-1.50_1.95	29667 BH05-GEO-002-SPT-1.50_1.70	29669 BH06-GEO-003-SPT-3.00_3.45
				Sampling date / time	17-Jan-2023 00:00	16-Jan-2023 00:00	17-Jan-2023 00:00	17-Jan-2023 00:00	16-Jan-2023 00:00
					ES2302715-001	ES2302715-002	ES2302715-003	ES2302715-004	ES2302715-005
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**5.2**	**5.4**	**5.2**	**8.7**	**5.9**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**384**	**215**	**259**	**453**	**189**
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**14.9**	**12.8**	**11.9**	**7.3**	**9.3**
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		**2600**	**4650**	**3860**	**2210**	**5290**
EA167: Corrosion Classification (per AS2159-2009)									
Ø **Exposure Classification - Concrete Piles Soil Condition A**	----	-	-		**Mild**	**Mild**	**Mild**	**Moderate**	**Moderate**
Ø **Exposure Classification - Concrete Piles Soil Condition B**	----	-	-		**Non Aggressive**	**Non Aggressive**	**Non Aggressive**	**Mild**	**Mild**
Ø **Exposure Classification - Steel Piles Soil Condition A**	----	-	-		**Non Aggressive**	**Non Aggressive**	**Non Aggressive**	**Non Aggressive**	**Non Aggressive**
Ø **Exposure Classification - Steel Piles Soil Condition B**	----	-	-		**Non Aggressive**	**Non Aggressive**	**Non Aggressive**	**Non Aggressive**	**Non Aggressive**
ED040S: Soluble Major Anions									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		**420**	**290**	**320**	**40**	**100**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		**380**	**140**	**180**	**650**	**190**

Analytical Results

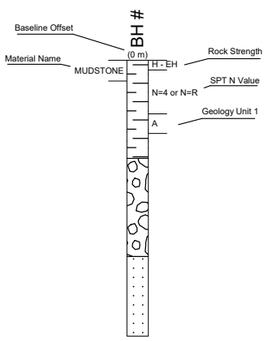
Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	29671 BH07-GEO-002-SPT-1.50_1.95	29672 BH08-GEO-001-SPT-0.5_0.95	29674 BH09-GEO-002-B-1.00_1.50	----	----
			Sampling date / time	16-Jan-2023 00:00	16-Jan-2023 00:00	16-Jan-2023 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2302715-006	ES2302715-007	ES2302715-008	--------	--------
				Result	Result	Result	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	5.4	5.5	5.4	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	427	182	578	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	18.0	13.4	12.9	----	----
EA080: Resistivity								
Resistivity at 25°C	----	1	ohm cm	2340	5490	1730	----	----
EA167: Corrosion Classification (per AS2159-2009)								
Ø Exposure Classification - Concrete Piles Soil Condition A	----	-	-	Mild	Mild	Mild	----	----
Ø Exposure Classification - Concrete Piles Soil Condition B	----	-	-	Non Aggressive	Non Aggressive	Non Aggressive	----	----
Ø Exposure Classification - Steel Piles Soil Condition A	----	-	-	Non Aggressive	Non Aggressive	Non Aggressive	----	----
Ø Exposure Classification - Steel Piles Soil Condition B	----	-	-	Non Aggressive	Non Aggressive	Non Aggressive	----	----
ED040S: Soluble Major Anions								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	410	120	230	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	490	210	960	----	----

Appendix D

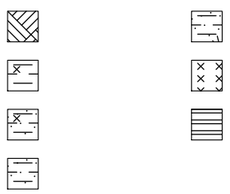
Geotechnical Cross Section



POST LEGEND



MATERIAL GRAPHIC



MAP KEY

H 1:176
0 2 4 6 8 10m
V 1:176
0 0.5 1 1.5 2 2.5m
Coord.System: Height Datum:

	TITLE: Subsurface Section	DRAWN: CTJ	DATE: 24/01/2023
		CHECKED: PH	DATE: 24/01/2023
		SCALE: H 1:176 V 1:76	A3
		PROJECT No	FIGURE No: 01