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Construction Soil and Water Management Plan

Newcastle High School Redevelopment

Prepared for: Hansen Yunken

Document no:NA230761 R06

Revision no: 006

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Revisions

Revision	Description	Date	Prepared by	Approved by
01	CC1	26.03.2024	J Rhodes	U Knight
02	CC1 – updated plans	28.03.2024	J Rhodes	U Knight
03	Compliance table added	5.04.2024	J Rhodes	U Knight
04	Updated for DPHI Comments	7.05.2024	J Rhodes	U Knight
05	Updated for site conditions	20.06.2024	J Rhodes	U Knight
06	Correct Sed Basin Calcs	3.07.2024	J Rhodes	U Knight

Review Panel

Division/ office	Name
Newcastle	U.Knight

Table of Contents

1 SSD Compliance 4

2 Introduction 5

2.1 Project Description 5

3 Development 5

3.1 Proposed Development 5

3.2 Earthworks 5

4 Construction Soil and Water Management Plan 5

4.1 General 5

4.2 Pre-Construction 6

4.3 During Construction 6

4.4 Post Construction 7

4.5 Management of Small and Large Storm Events 7

4.6 Monitoring and Maintenance 7

5 Acid Sulfate Management 8

6 Conclusion 8

Appendices

Appendix A Erosion and Sediment Control Plans

Appendix B Sediment Basin Calculations

Appendix C Douglas Partners Acid Sulfate Soil Management Plan

Appendix D ACOR CVs

Appendix E Request for City of Newcastle Comment on CSWMP

Appendix F Construction Flood Emergency Management Plan

1 SSD Compliance

SSD Condition Number	Requirement	Report Reference
B18	The Applicant must prepare a Construction Soil and Water Management Sub-Plan (CSWMSP) and the plan must address, but not be limited to the following:	
	a) be prepared by a suitably qualified expert, in consultation with Council;	The plan was developed by Josh Rhodes and reviewed by Ulrika Knight who are both CPEng and NER Civil Engineers with over 20 years of experience developing sediment and erosion control plans for developments. CVs for Josh and Ulrika are attached in Appendix D. The plans have been developed generally in accordance with the plans provided for DA that were approved by the City of Newcastle. CoN provided acceptance of the plan on 22 May. The email to and from Council is shown in Appendix E.
	b) measures to ensure that sediment and other materials are not tracked onto the roadway	Refer to Section 4 of this report and the attached plans in Appendix A
	c) describe all erosion and sediment controls to be implemented during construction, including as a minimum, measures in accordance with the publication Managing Urban Stormwater: Soils & Construction (4th edition, Landcom 2004) commonly referred to as the 'Blue Book';	Refer to section 4 of this report and the attached plans in Appendix A
	d) include an Acid Sulfate Soils Management Plan, if required, including measures for the management, handling, treatment and disposal of acid sulfate soils, including monitoring of water quality at acid sulfate soils treatment areas	Refer to section 5 of this report and the attached plans in Appendix C
	e) provide a plan of how all construction works will be managed in a wet-weather event (i.e. storage of equipment, stabilisation of the site);	Refer to section 4 of this report and the attached plans in Appendix A

SSD Condition Number	Requirement	Report Reference
	f) detail all off-site flows from the site;	Refer to section 4 of this report and the attached plans in Appendix A
	g) describe the measures that must be implemented to manage stormwater and flood flows for small and large sized events, including, but not limited to 1 in 5-year ARI and 1 in 100-year ARI.	Refer to the Construction Flood Emergency Management Plan in Appendix F

2 Introduction

2.1 Project Description

Hansen Yunken engaged ACOR Consultants to undertake the civil design for the Newcastle High School Redevelopment Project located at 25A National Park Street, Newcastle West. Part of the scope of the civil scope is the preparation of a Construction Soil and Water Management Plan.

3 Development

3.1 Proposed Development

The redevelopment works consist of the demolition of several existing buildings on site, construction of a three storey Library/Learning Hub, a Multi-Purpose Facility, the relocation of a building as well as associated pathways and landscaping. Figure 1 shows the proposed redevelopment works.

3.2 Earthworks

The construction works on site will include significant site regrading. Figure 2 shows the extent of the earthworks cut and fill for the development.

4 Construction Soil and Water Management Plan

4.1 General

During the construction phase of the development, a Construction Soil and Water Management Plan (CSWMP) will be implemented to minimise water quality impacts. The CSWMP has been prepared in accordance with "Managing Urban Stormwater – Soils and Construction" by Landcom. This document is the industry standard for the management of stormwater runoff during construction in NSW. The control measures for the works include a sediment basin, sediment fences, cut-off drains for polluted stormwater, gully pit sediment barriers, field inlet sediment traps and temporary infiltration tank protection.

Details of the required construction phase control measures are provided on the detailed engineering drawings in accordance with the required standards. The contractor is responsible for the provision of the construction phase water quality infrastructure implementation and maintenance onsite. The erosion and sediment controls will continuously change throughout the construction phase. The contractor will minimise the amount of disturbed areas throughout the construction program. Where possible, catchments will be limited to below 2500m² to avoid the construction of unnecessarily large sediment basins. The erosion and sediment control plans, construction notes and details are shown in Appendix A.

The following information is provided to identify controls and procedures required to be incorporated into the Erosion and Sediment Control Program and responsible parties.

4.2 Pre-Construction

- Establish a single stabilised entry/exit point for each stage of construction. This point should also include a vehicle shakedown device to mitigate the transportation of dust and dirt.
- Sediment fences are to be placed along the low side of the site to slow flows, reduce scour and capture sediment runoff.
- Sediment fences are to be constructed at the base of fill embankments.
- Divert up-slope water around the work site and appropriately stabilise any drainage channels.
- Areas for plant and construction material storage are to be designated along with associated diversion drains and spillage holding ponds.
- Diversion banks are to be created at the upstream boundary of construction activities to ensure upstream runoff is diverted around any areas to be exposed. Catch drains are to be created at the downstream boundary of construction activities.
- A temporary sediment basin shall be constructed including dirty water channels to direct runoff from the disturbed areas to the basin for treatment prior to discharge to the downstream stormwater network. Sizing of the proposed sediment basin has been undertaken using the design spread in accordance with "Managing Urban Stormwater: Soils and Construction". The sediment basin was sized for a Type C soil which is consistent with the sand subgrade on site.

  The proposed location of the sediment basin will be the northeast corner of the site. The maximum disturbed area draining to this basin will be approximately 6,500m^2. All other disturbed areas onsite will be limited to below 2,500m^2. If greater areas are disturbed on site during construction, the requirements for the sediment basin size will need to be updated.

  Calculations showing the size of the sediment basin for a disturbed area of 6,500m^2 are shown in Appendix B.
- Site personnel are to be educated on the utilisation of the sediment and erosion control measures implemented on site and maintenance requirements.

4.3 During Construction

- Progressive stabilization of fill areas and fill batters.
- Construction activities are to be confined to the necessary construction areas.
- The provision of a construction entry/exit to prevent the tracking of debris from tyres of vehicles onto public roads and to limit the movement of construction equipment.
- The topsoil stockpile location will be nominated to coincide with areas previously disturbed. A sediment fence is to be constructed around the bottom of the stockpile to trap sediment. A diversion drain is to be installed upstream of the stockpile if required.
- Roof downpipes should be installed as soon as practicable after the roof is constructed.
- Transport loads that are subject to loss through wind or spillage shall be covered or sealed to prevent entry of pollutants to the stormwater system.
- Regular inspection and maintenance of sediment fences, sediment basin and other erosion control measures. Following rainfall events greater than 50mm, an inspection of erosion control measures and

removal of collected material should be undertaken. Replacement of any damaged equipment should be performed immediately.

- The weather forecast is monitored by Hansen Yuncken staff. If a wet-weather event is forecast than a Pre-Rainfall Inspection will be completed and logged in our safety management system 'Hammertech' to identify areas such as stockpiles that require stabilising, review sediment/erosion controls and store relevant equipment. A Post-Rainfall Inspection will be completed in Hammertech following the wet-weather event to review the site controls and rectify areas as needed.

4.4 Post Construction

- The Contractor/ Developer will be responsible for the maintenance of erosion and sediment control devices from the possession of the site until stabilisation has occurred to the satisfaction of the superintendent and Principal.
- The Erosion and Sediment Control Management Plans should be provided to all people involved with the site, including sub-contractors, private certifiers, body corporates and regulators.

4.5 Management of Small and Large Storm Events

- For smaller storm events, the runoff will be controlled by the proposed stormwater facilities including cut off drains, sediment fence, pit filters and the sediment basin.
- For large flood events, a Construction Flood Emergency Management Plan was prepared for the site by BMT dated March 2024. Refer to Appendix E for the report. In the event of a flood event, the recommendations of this plan will be adhered to on site.

4.6 Monitoring and Maintenance

Regular maintenance of the erosion and sediment control facilities is required through the construction phase of the project. Table 1 outlines the treatment measures and the frequency of maintenance for each.

Table 1: Frequency of maintenance for treatment measures

Treatment Measure	Maintenance Frequency	Description
Sediment Fence	Weekly inspections and following rainfall events to check for signs of sediment build up, erosion or weak points	Remove sediment build up. Reinforce weak points. Maintain alignment.
Pit Sediment Traps	Weekly inspections and following rainfall events to check for signs of sediment build up, broken filters and sediment in the pit.	Remove sediment and debris build up from around the pit or inside the pit. Repair or replace any damaged pit filters
Sediment Basins	Following significant rainfall events up to 50mm/day.	Review sediment buildup at the base as well as at the inlet and outlet structures. Maintain sediment storage zone volume from the design. Remove built up sediment.

Treatment Measure	Maintenance Frequency	Description
Diversion Drains	Weekly inspections and following rainfall events to check for signs of sediment build up, erosion or weak points	Remove sediment build up.
Vehicle Shakedown Device	Weekly inspections and following rainfall events to check for signs of sediment build up.	Remove sediment build up.

5 Acid Sulfate Management

An investigation into the presence of Acid Sulfate Soil (ASS) or Potential Acid Sulfate Soil (PASS) on site was undertaken as part of the original geotechnical investigation by Martins and reviewed in a further investigation by Douglas Partners. Testing of soils indicated that those above 8.3m depth (at approximate 4.3m AHD) were not ASS or PASS soils. As all proposed works are above this level, an Acid Sulfate Management Plan is not required for the site. Refer to Appendix C for the Douglas Partners report confirming the above.

6 Conclusion

The above report details the requirements of the Construction Soil and Water Management Plan for the Redevelopment of Newcastle High School project. The report covers the required erosion and sediment control infrastructure, the maintenance frequency, and requirements for the proposed development.

Yours faithfully,
ACOR Consultants Pty Ltd

Josh Rhodes
National Civil Leader, Principal Civil Engineer

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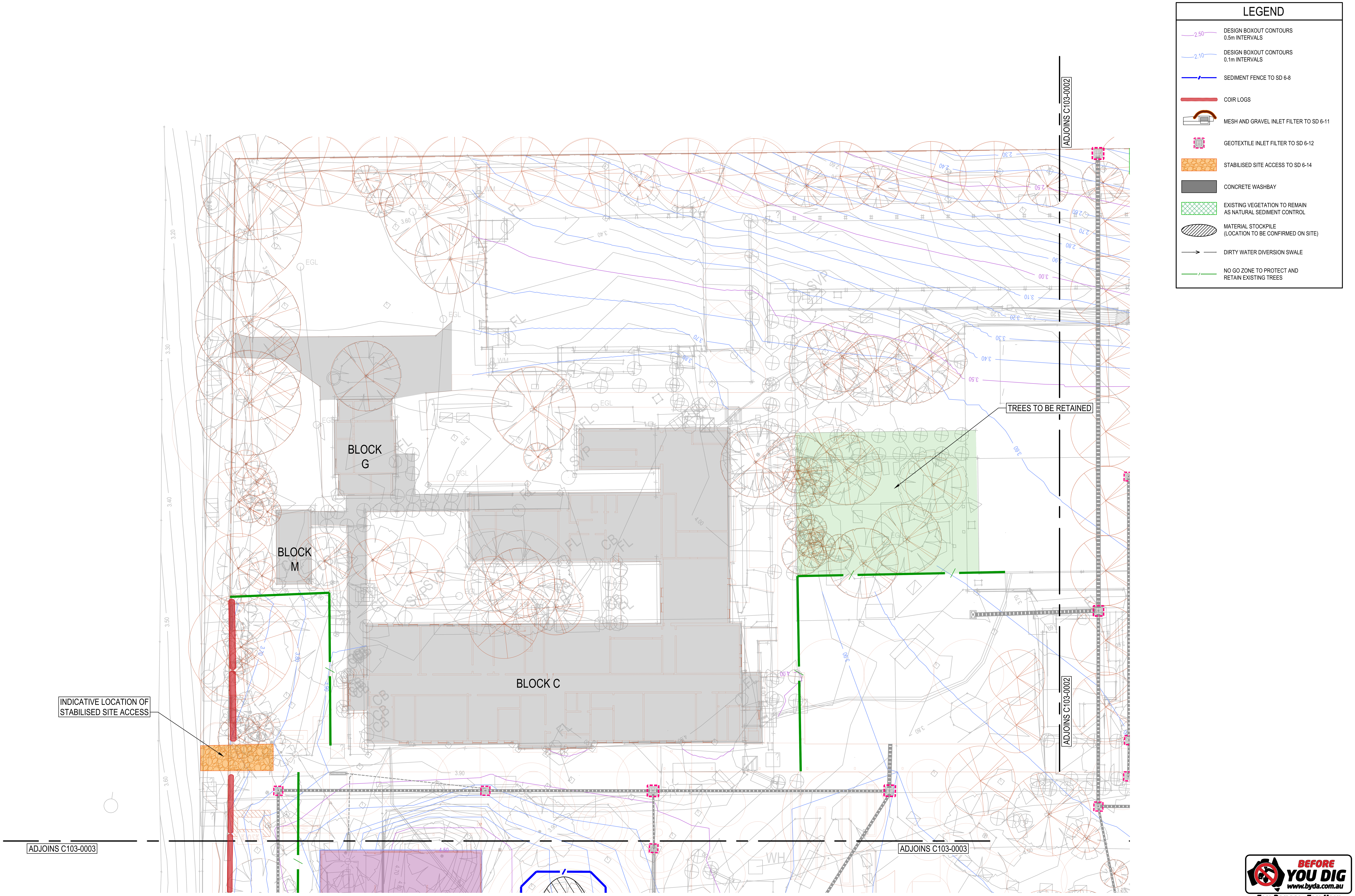
Appendix A Erosion and Sediment Control Plans



Issue.	Description	Date	Drawn	Approved
D	UPDATED FOR APPROVAL	21.06.24	MDM	JPR
C	UPDATED FOR APPROVAL	17.06.24	JPK	JPR
B	ISSUED FOR PRELIMINARY REVIEW	28.03.24	MDM	JPR
A	ISSUED FOR PRELIMINARY REVIEW	19.03.24	MDM	JPR

North

Scale

0 2.5 5 10 15m
SCALE BAR 1:250 @A1 1:500 @A3

PRINT IN COLOUR

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Project
NEWCASTLE HIGH SCHOOL REDEVELOPMENT
25A NATIONAL PARK STREET
NEWCASTLE WEST NSW 2302

Drawing Title
CIVIL SERVICES
EROSION AND SEDIMENT CONTROL PLAN
SHEET 1

Drawn	Designed	Q.A. Check	Date	Scale @ A1
MDM	JK	JPR	10.05.24	1:250

Project No.	Drawing No.	Issue
NS230761	C103-0001	D

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D	UPDATED FOR APPROVAL	21.06.24	MDM	JPR
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SHEET 2

Drawn	Designed	Q.A. Check	Date	Scale @ A1
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Project No.	Drawing No.	Issue
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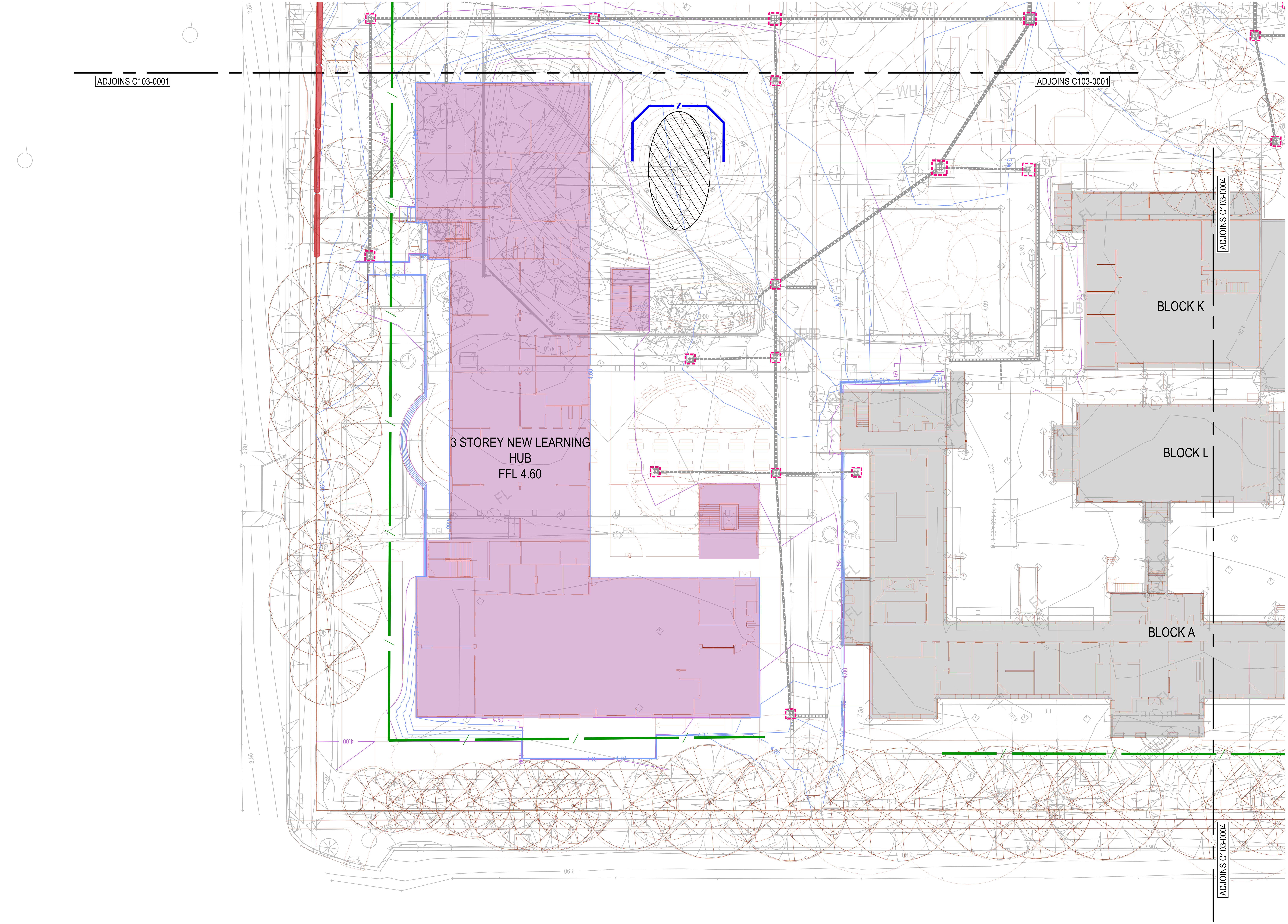
Jun 21, 2024 - 8:36am



LEGEND

- DESIGN BOXOUT CONTOURS 0.5m INTERVALS
- DESIGN BOXOUT CONTOURS 0.1m INTERVALS
- SEDIMENT FENCE TO SD 6-8
- COIR LOGS
- MESH AND GRAVEL INLET FILTER TO SD 6-11
- GEOTEXTILE INLET FILTER TO SD 6-12
- STABILISED SITE ACCESS TO SD 6-14
- CONCRETE WASHBAY
- EXISTING VEGETATION TO REMAIN AS NATURAL SEDIMENT CONTROL
- MATERIAL STOCKPILE (LOCATION TO BE CONFIRMED ON SITE)
- DIRTY WATER DIVERSION SWALE
- NO GO ZONE TO PROTECT AND RETAIN EXISTING TREES

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Scale
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Drawing Title
CIVIL SERVICES
EROSION AND SEDIMENT CONTROL PLAN
SHEET 3

Drawn	Designed	Q.A. Check	Date	Scale @ A1
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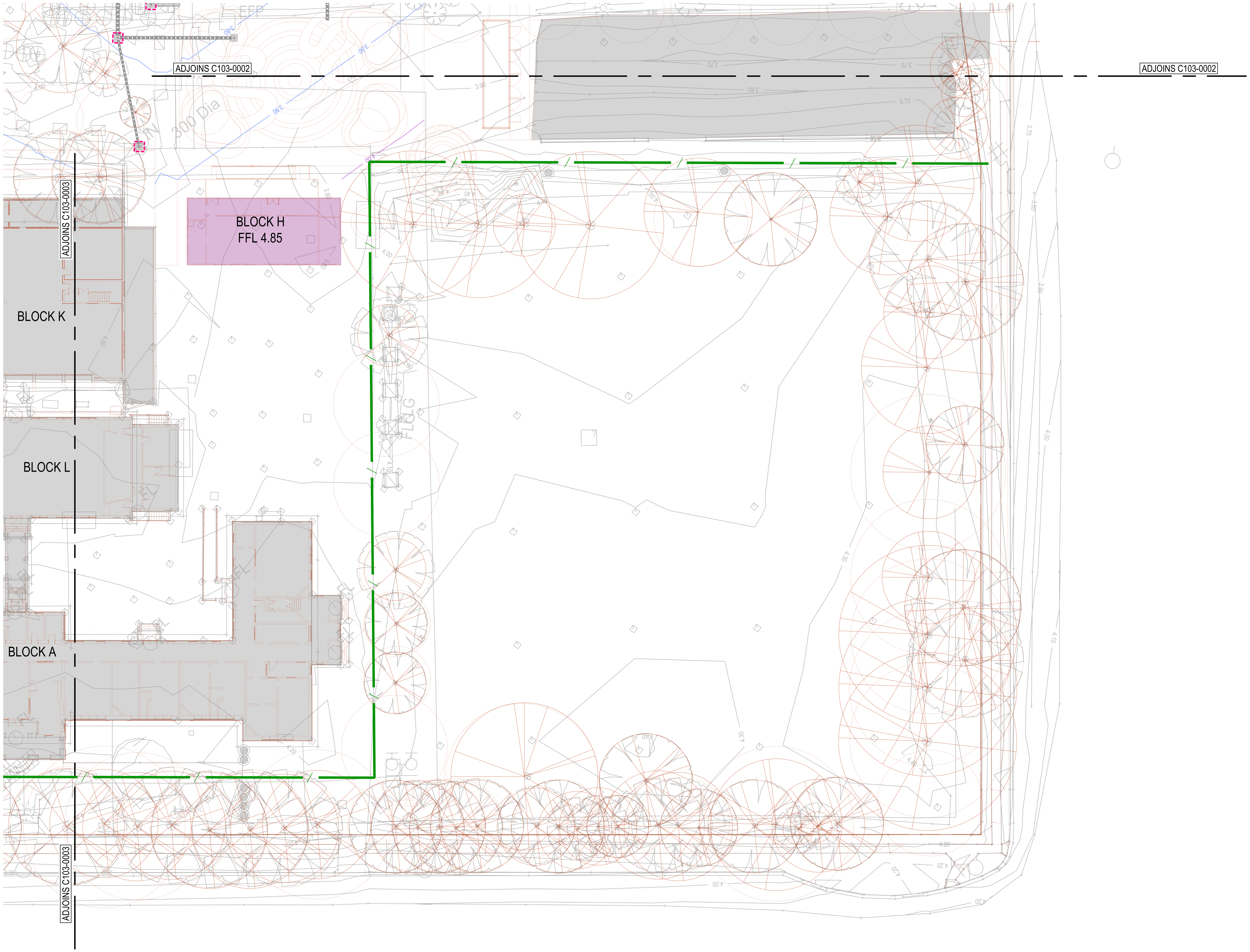

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2.10	DESIGN BOXOUT CONTOURS 0.1m INTERVALS
	SEDIMENT FENCE TO SD 6-8
	COIR LOGS
	MESH AND GRAVEL INLET FILTER TO SD 6-11
	GEOTEXTILE INLET FILTER TO SD 6-12
	STABILISED SITE ACCESS TO SD 6-14
	CONCRETE WASHBAY
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	MATERIAL STOCKPILE (LOCATION TO BE CONFIRMED ON SITE)
	DIRTY WATER DIVERSION SWALE
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A	ISSUED FOR PRELIMINARY REVIEW	19.03.24	MDM	JPR

1cm at full size

North

Scale
0 2.5 5 10 15m
SCALE BAR 1:250 @A1 1:500 @A3

PRINT IN COLOUR

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Drawing Title
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SHEET 4

Drawn	Designed	Q.A. Check	Date	Scale @ A1
MDM	JK	JPR	10.05.24	1:250

Project No.	Drawing No.	Issue
NS230761	C103-0004	D

Jun 21, 2024 - 8:36am

Appendix B Sediment Basin Calculations

Note: These "Standard Calculation" spreadsheets relate only to low erosion hazard lands as identified in figure 4.6 where the designer chooses to not use the RUSLE to size sediment basins. The more "Detailed Calculation" spreadsheets should be used on high erosion hazard lands as identified by figure 4.6 or where the designer chooses to run the RUSLE in calculations.

1. Site Data Sheet

Site name: Newcastle High School

Site location: Newcastle High School

Precinct: Newcastle High School

Description of site: School Redevelopment

Site area	Site						Remarks
	1	2	3	4	5	6	
Total catchment area (ha)	0.65						
Disturbed catchment area (ha)	0.65						

Soil analysis

Soil landscape							DIPNR mapping (if relevant)
Soil Texture Group	C						Sections 6.3.3(c), (d) and (e)

Rainfall data

Design rainfall depth (days)	5						See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	85						See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	38.9						See Section 6.3.4 (h)
Rainfall intensity: 2-year, 6-hour storm	9.84						See IFD chart for the site
Rainfall erosivity (R-factor)	2150						Automatic calculation from above data

Comments:

2. Storm Flow Calculations

Peak flow is given by the Rational Formula:

$$Qy = 0.00278 \times C_{10} \times F_Y \times I_{y,\,tc} \times A$$

where:

Q_y	is peak flow rate (m^3/sec) of average recurrence interval (ARI) of "Y" years
C_{10}	is the runoff coefficient (dimensionless) for ARI of 10 years. Rural runoff coefficients are given in Volume 2, figure 5 of Pilgrim (1998), while urban runoff coefficients are given in Volume 1, Book VIII, figure 1.13 of Pilgrim (1998) and construction runoff coefficients are given in Appendix F
F_y	is a frequency factor for "Y" years. Rural values are given in Volume 1, Book IV, Table 1.1 of Pilgrim (1998) while urban coefficients are given in Volume 1, Book VIII, Table 1.6 of Pilgrim (1998)
A	is the catchment area in hectares (ha)
$I_{y,\,tc}$	is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration (t_c) = $0.76 \times (A/100)^{0.38}$ hrs (Volume 1, Book IV of Pilgrim, 1998)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

Peak flow calculations, 1

Site	A (ha)	tc (mins)	Rainfall intensity, I, mm/hr						C_{10}
			$1_{yr,tc}$	$5_{yr,tc}$	$10_{yr,tc}$	$20_{yr,tc}$	$50_{yr,tc}$	$100_{yr,tc}$	
1	0.65	7	73.7	122	149	177	218	252	0.82
2									
3									
4									
5									
6									

Peak flow calculations, 2

ARI yrs	Frequency factor (F_y)	Peak flows						Comment
		1	2	3	4	5	6	
		(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m3/s)	
$1_{yr,\,tc}$	0.8	0.087						
$5_{yr,\,tc}$	0.95	0.172						
$10_{yr,\,tc}$	1	0.221						
$20_{yr,\,tc}$	1.05	0.275						
$50_{yr,\,tc}$	1.15	0.371						
$100_{yr,\,tc}$	1.2	0.448						

3. Volume of Sediment Basins: *Type C* Soils

Basin volume = settling zone volume + sediment storage volume

Settling Zone Volume

The settling zone volume for *Type C* soils is calculated to provide capacity to allow the design particle (e.g. 0.02 mm in diameter) to settle in the peak flow expected from the design storm (e.g. 0.25-year ARI). The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle. Peak flow/discharge for the 0.25-year, ARI storm is given by the Rational Formula:

$$Q_{tc,\,0.25} = 0.5 \times [0.00278 \times C_{10} \times F_y \times I_{1yr,\,tc} \times A\,]\ (m^3/sec)$$

where:

$Q_{tc,0.25}$ = flow rate (m^3/sec) for the 0.25 ARI storm event

C_{10} = runoff coefficient (dimensionless for ARI of 10 years)

F_y = frequency factor for 1 year ARI storm

$I_{1\,yr,tc}$ = average rainfall intensity (mm/hr) for the 1-year ARI storm

A = area of catchment in hectares (ha)

Basin surface area (A) = area factor x $Q_{tc,\,0.25}$ m^2

Particle settling velocities under ideal conditions (Section 6.3.5(e))

Particle Size	Area Factor
0.100	170
0.050	635
0.020	4100

Volume of settling zone = basin surface area x depth (Section 6.3.5(e)(ii))

Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 100 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE (Section 6.3.5(e)(iv)), in which case the "Detailed Calculation" spreadsheets should be used.

Total Basin Volume

Site	$Q_{tc,\,0.25}$ (m^3/s)	Area factor	Basin surface area (m^2)	Depth of settling zone (m)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)	Basin shape		
								L:W Ratio	Length (m)	Width (m)
1	0.044	635	28	0.6	17	17	33			
2		4100								
3		4100								
4		4100								
5		4100								
6		4100								

Appendix C Douglas Partners Acid Sulfate Soil Management Plan

Douglas Partners
Geotechnics | Environment | Groundwater

Acid Sulfate Soil Management Plan

Newcastle High School Upgrade
25a National Park Street, Newcastle West

Prepared for
School Infrastructure NSW

Project 213618.02
May 2023

Integrated Practical Solutions

Douglas Partners
Geotechnics | Environment | Groundwater

Document History

Document details

Project No.	213618.02	Document No.	R.004.Rev1
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File name	213618.02.R.004.Rev1.ASSMP.docx		

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Revision 1	1	0	Meaghan Bennett, School Infrastructure NSW Tessa Sharp, The APP Group Anthony Harrigan, The APP Group

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

	Signature	Date
Author		23 May 2023
Reviewer	M Blackert	23 May 2023

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Table of Contents

Page

1. Introduction.......1
2. Proposed Development.......2
3. Site Description.......2
4. Environmental Setting.......4
5. Previous Investigations.......5
   - 5.1 Overview.......5
   - 5.2 Martens (2021) – Geotechnical Investigation.......5
   - 5.3 DP (2022) – Geotechnical Investigation.......6
   - 5.4 DP (2023) – Draft Detailed Site Investigation (Contamination) (DSI).......6
6. Potential to Oxidise Soil.......7
7. Management Strategy.......8
   - 7.1 Soil Treatment.......8
   - 7.2 Liming and Monitoring Procedure.......9
   - 7.3 Neutralising Leachate.......10
   - 7.4 Dewatering.......11
   - 7.5 Monitoring Strategies.......12
     - 7.5.1 Soil Neutralisation / Management.......12
     - 7.5.2 Leachate Management.......13
     - 7.5.3 Dewatering.......13
     - 7.5.4 Reporting.......13
   - 7.6 Acceptance Criteria.......14
     - 7.6.1 Water.......14
     - 7.6.2 Soil.......14
8. ASS Contingency Plan.......15
9. References.......15
10. Limitations.......16

Appendix A: About This Report

Terminology, Symbols and Abbreviations

Soil Descriptions

Sampling, Testing and Excavation Methodology

Rock Descriptions

Cone Penetration Testing

Cone Penetration Tests (CPT 101 to 107) – DP (2022)

Borehole Logs (Bores 1a, 5a and 107a) – DP (2022)

Borehole Log (Bore 4) – DP (2022)

Borehole Logs (Bores 201A to 220 and 301 to 303) – DP (2023)

Test Pit Logs (304 to 316) – DP (2023)

Appendix B: Martens (2021) Borehole Logs and Explanatory Notes

Table B1 – Summary of Laboratory Results – Acid Sulfate Soils (Martens, 2021)

Envirolab Laboratory Reports (Martens, 2021)

Appendix C: Drawing 1 - Test Location Plan (DP, 2023)

Map 01 - Testing Plan (Martens, 2021)

Site Plan – Building Work Location - EJE Architecture (Ref 13331, C, 1A-0421-A)

Preliminary Bulk Earthworks Plan (Stantec Australasia Pty Ltd)

Acid Sulfate Soil Management Plan
Newcastle High School Upgrade
25a National Park Street, Newcastle West

1. Introduction

Douglas Partners Pty Ltd (DP) has prepared this acid sulfate soil management plan (ASSMP) for the proposed Newcastle High School (NHS) upgrade located at 25a National Park Street, Newcastle West (the 'site'). The proposed development comprises a new three storey learning hub, new multipurpose hall and the demolition of some existing structures.

It is understood that the ASSMP is required based on the potential for the disturbance of acid sulfate soils (ASS) during construction for the proposed development.

The ASSMP provides methods and strategies to minimise the potential for adverse impact associated with the disturbance of ASS during construction of the proposed development. This ASSMP provides the following:

- ASS management strategies;
- Monitoring program for soil and water quality; and
- Contingency procedures.

This ASSMP has been prepared based on the results of a previous geotechnical and preliminary ASS investigation conducted by Martens (2021) within the site). In lieu of ASS data for deeper soils extending to the full depth of proposed piling, this ASSMP has also been prepared based on DP's experience in the area with respect to ASS conditions.

This ASSMP was prepared with reference to the following:

- *Acid Sulfate Soil Manual*, Acid Sulfate Soil Management Advisory Committee [ASSMAC] (Stone, Ahern, & Blunden, 1998);
- *Acid Sulfate Soils Laboratory Methods Guidelines. In Queensland Acid Sulfate Soils Manual 2004* [QASSIT] (Ahern, McElnea, & Sullivan, 2004);
- *Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines* (Dear, et al., 2014); and
- *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual* (Sullivan, et al., 2018).

2. Proposed Development

It is understood that the development at the Newcastle High School (Newcastle Education Campus) will include the following scope:

- Demolition of eight (8) existing buildings;
- Construction of a new three (3) storey learning hub located on the southwestern corner of the campus, including a new library, canteen, covered outdoor learning area (COLA), support learning unit, general learning spaces, hospitality teaching spaces, and science labs;
- Construction of a new multi-purpose facility (MPF) located in the north-eastern corner of the campus including a gymnasium, stage, fitness lab, flexible learning spaces, outdoor courts, and end-of-trip (EOT) facilities;
- Internal refurbishment works within the existing administration building on Parkway Ave to form a new student hub;
- New student entry from Parkway Avenue;
- Relocation of Block H approximately 50m South;
- Ancillary works to enable the proposed upgrades and include new civil infrastructure and a comprehensive landscaping strategy.

Plans of the proposed development are shown in Appendix C.

Preliminary earthworks plans provided in Appendix C indicate generally minor cuts (260 m^3) and more substantial fill (8,964 m^3) for an overall balance of fill at 8,664 m^3. It is understood that the north-eastern part of the site will remain at similar levels for flooding requirements. Furthermore, stormwater infiltration beds are proposed around the school area.

It is understood, however, that continuous flight auger (CFA) piles are proposed for some structures, notably the MPF building in the north-eastern corner of the campus. Piles may be founded to depths of 8 m to 10.5 m below ground level (down to approx. RL -8.5 AHD) to target the medium dense to dense sand layer reported in DP (2022).

3. Site Description

Site Address	25a National Park Street, Newcastle West, NSW.
Legal Description	Part Lot 1 Deposited Plan (D.P) 150725; Part Lot 1 D.P. 575171; Part Lot 1 D.P. 794827.
Area	Site investigation area approximately 21,700 m^2 (2.17 ha) – red in Figure 1; Total area of above lots (overall school) approximately 46,000 m^2 (4.6 ha) – yellow in Figure 1.
Zoning	Zone R2 Low density residential.

Local Council Area	Newcastle City Council.
Current Use	Secondary (high) school.
Surrounding Uses	North / North-east: • Fearnley Dawes Athletic Centre (private recreational field); • Merewether Scout Hall. North-east / east: • Public netball courts and playing fields (National Park No 5 and 6 Sportsground); • Private recreation (Wanderers Rugby Club and National Park No 2 Sportsground. South-east, south, west and north-west: • Residential.

The site is shown on Figure 1.

Figure 1: School Boundary (yellow) and site investigation boundary 'the site' (red)

4. Environmental Setting

Site Topography	Reference to the NSW Contours Hunter and Central Coast LiDAR indicates ground levels range from about RL 4 / 4.5 (AHD) on the southern and western parts to about RL 2.5 on the eastern site of the lot. The land falls gently to the north-east for most of the site, which terraces down to the lowest areas in the north-east near the northern lot boundary.
Regional Topography	The surrounding area is located at RLs 5-6 with locally lower areas, typically in drainage canals. More regionally, the topography varied greatly near the coastal and Newcastle Harbour areas.
Soil Landscape	Reference to the Newcastle 1:100,000 Soil Landscapes Sheet indicates the site is located within the Hamilton soil landscape comprising quaternary deposits in the Hunter Plain region. This group comprises 'deep' soils (>15cm), well-drained weak Podzols with some 'deep' (>100cm) well-drained Brown Podzolic Soils on fans. Limitations include wind erosion hazard, groundwater pollution hazard, strong acidity, non-cohesive soils.
Geology	Reference to the Newcastle Coalfields Surface Geology Sheet, published by BHP, indicates that the site is underlain by alluvial soils which overlie rock strata of the Newcastle Coal Measures. The rock strata are of Permian age and typically comprise sandstone, siltstone, claystone and multiple coal seams. Reference to the NSW Seamless Geology mapping indicates the site is underlain by the following: • Clastic sediment (QP_u) in the southern and central portion of the school site which typically comprises clay, silt and marine sand; • Anthropogenic deposits (Q_h) in the northern portion of the school site which typically comprises anthropogenic fill; and • Alluvial floodplain deposits (QH_af) in the north western portion of the site which typically comprises silt, sand and clay. The boundary line for the mapped anthropogenic deposits is shown on DP (2023) test location plan provided in Appendix C.
Acid Sulfate Soils (ASS)	Published ASS risk mapping indicates that the site is mapped as a low probability occurrence of ASS greater than 3 m below the ground surface. It is noted that ASS typically occur at levels of approximately RL 5 AHD or below, but typically at elevations less than 1 AHD in coastal environments. Previous ASS testing has been undertaken at the site my Martens (2021) which is discussed further in Section 5.2.

5. Previous Investigations

5.1 Overview

Several investigations have been undertaken for the proposed development including geotechnical, contamination and ASS assessments. A summary of the previous investigations where relevant to this ASSMP has been provided below.

5.2 Martens (2021) – Geotechnical Investigation

Martens Consulting Engineers (Martens) has undertaken a geotechnical investigation at the site. The investigation included drilling of 11 bores to depths up to 9.0 m, collection of soil samples for ASS and geotechnical testing purposes and laboratory analysis.

Pertinent results from this investigation include:

- Subsurface conditions at the site consist of:
  - Fill (mainly sand) to depths ranging between 0.2 m and 2.5 m; underlain by
  - Alluvial soils initially comprising sand which transitioned into clayey sand from depths of 5 m to 7.5 m and further into sandy clay from below about 8.0 m to 8.5 m depth.
- Deepest fill was observed in the north-eastern portion of the site;
- Groundwater was encountered at depths ranging between 2.4 m and 5.6 m;
- Laboratory analysis indicated that the samples tested were predominately sand sized with some minor proportions of sand, silt and gravel. The percentage of clay and silt was greater in the samples collected below about 7 m to 8 m depth.
- Limited ASS chromium suite testing for natural alluvial soils was undertaken for samples ranging from 1.1 m to 8.3 m bgl (approximate RL 2.9 AHD to -4.3 AHD). The results below indicated:
  - Chromium reducible sulfur (Scr – potential acidity) or total actual acidity (TAA) was not detected above the limit of reporting (LOR) for tested upper soils to about 5.5 m bgl (approximate RL 2.9 to RL-2.1);
  - Potential acidity (Scr) was identified in three samples which were at depths of 5.6 m, 5.7 m and 8.3 m bgl (approximate RL -1.7 to -4.3), with results below the adopted action criteria (0.03% S). It was reported by Martens that the soils tested were not considered to be actual or potential ASS. It is noted that the clayey soils typically had higher potential acidity (Scr) results, with the deeper sandy clay materials tested at 8.3 m depth (approximate RL -4.3) having the highest potential acidity result only marginally below the action criteria.
- Martens indicated that excavations for the proposed development were unlikely to exceed 2 m depth. Based on the results of the preliminary testing conducted by Martens and the proposed excavation depth Martens considered an ASSMP and/or further ASS testing was not required.

Envirolab laboratory reports and a results summary from the Martens (2021) investigation including groundwater depths noted by Martens at each relevant bore have been summarised in Appendix B which also includes the borehole logs from the investigation.

It is noted that Martens (2021) did not conduct ASS screening tests that are normally undertaken at regular depth intervals to profile ASS conditions and inform detailed laboratory testing requirements with reference to current guidelines (Sullivan, et al., 2018). On this basis, the ASS results in in Martens (2021) report may be considered preliminary and, therefore, variable ASS conditions may exist at the site.

5.3 DP (2022) – Geotechnical Investigation

DP has undertaken a geotechnical investigation at the site. The investigation included seven cone penetration tests (CPTs) to depths ranging between 12.34 m and 32.10 m and three bores to depths ranging between 1.1 m and 2.2 m.

Pertinent findings include the following:

- Subsurface conditions at the site consists of mainly sandy fill up to 1.2 m depth overlying alluvial soils to approximately 30 m depth. The alluvial soils consisted of predominately sand with a clay layer at about 6 m to 8 m depth. The sand layer continued to depths of 12.3 m to 14.4 m and was underlain by a layer of clay to the top of weathered rock at depths of approximately 29 m to 35 m;
- Bores confirmed the presence of abandoned mining within the Borehole Seam at a depth of approximately 55 m;
- Deepest fill was observed in the north-eastern portion of the site.

Groundwater was encountered at depths ranging between 0.5 m and 1.7 m (approximate RL 1.8 to RL 2.5). It should be noted that several measurements were undertaken following cone penetration testing and these results may be artificially higher because there may not have been sufficient time for the groundwater levels to stabilise before the measurement was taken. The water levels in the drilled bores (DP, 2023) were in the range of approximate RL 0.5 AHD to RL 2.0 AHD (discussed below).

Borehole logs for the geotechnical investigation have been provided in Appendix A.

5.4 DP (2023) – Draft Detailed Site Investigation (Contamination) (DSI)

Douglas Partners Pty Ltd (DP) has undertaken a detailed site investigation (DSI) for the proposed upgrade. The objectives of the DSI were to assess the suitability of the site for the proposed development and whether further investigation and/or management is required regarding the proposed development.

The investigation included a brief desktop / site history review, site inspection, subsurface investigation via test pits and bores, laboratory testing for contamination purposes and preparation of a draft report.

Pertinent findings from the investigation relevant to this ASSMP are presented below:

Fill:	Found in all test locations. Generally comprising sand, silty sand, clayey sand, gravelly sand, sandy gravel, silt, clay, silty clay with trace anthropogenic inclusions such as metal, glass, ceramic, plastic, brick, fibro, wire, rubber, terracotta, concrete, coal / coal chitter, ash, slag, asphalt to depths of between 0.1 m and 3.15 m bgl (refer to logs for details).
Sand / Silty Sand:	Found in most test locations beneath fill except at Bores 201A, 202A, 204, 205, 212 to 218, 301 and 303 and Pits 305 and 306. The remaining test locations terminated in this material between depths of 0.6 m to 2.7 m.

Free groundwater was observed in Pits 225, 305 and 306 at depths of 1.1 m to 2.8 m bgl (approximate RL 1.8 to RL -0.5). It should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

No testing for ASS was undertaken as part of the geotechnical or contamination assessments conducted by DP.

Test pit and borehole logs from the DSI have been provided in Appendix A.

6. Potential to Oxidise Soil

Preliminary ASS testing conducted to date by Martens (2021) was limited to testing to depths up to 8.3 m depth (approximate RL -4.3). While the soils tested were found to have existing and potential acidity results below the adopted action criteria, soils at depth (in particular clayey soils) were found to have some potential for acid generation upon oxidation suggesting deeper soils or soils with higher clay contents may have higher existing and potential acidity results.

In the absence of site-specific testing at depths below 8.3 m depth (approximate RL-4.3), it is recommended that alluvial soils below this depth are considered as ASS as a precaution.

Based on available information and our understanding of the proposed development, the following activities may therefore expose ASS to oxidising conditions during construction:

- Installation of CFA piles (understood to reach depths of 8 m to 10.5 m below ground level (approximate RL -4.0 to RL -8.5)) that disturb ASS and bring spoil/cuttings to the surface;
- Excavation/dewatering of ASS for service installations or other underground infrastructure (understood to be < 2 m bgl).

The recommended management option for excavated ASS is neutralisation by full lime treatment and oxidation.

To confirm the presence and extent of ASS at depths greater than 8.3 m (~RL-4.3), site-specific investigation should be conducted to determine soil and groundwater conditions prior to the commencement of construction.

7. Management Strategy

7.1 Soil Treatment

Neutralisation of ASS may be required for natural sandy clays/clayey sands below 8.3 m (~RL -4.3). Treatment should be undertaken with reference to Dear et al (2014) and Stone, Ahern & Blunden (1998) as discussed below. It is noted that limited guidance on management of ASS is provided in the *National Acid Sulfate Soils Guidance* (Sullivan, et al., 2018).

ASS should be segregated from overlying soils including potentially contaminated fill and natural soils which are not ASS. Segregation should also be undertaken with reference to the subsurface conditions provided in the RAP, with due consideration of the contamination status of overlying soils/fill. In the case of CFA pile installation, particular procedures and equipment will be required to facilitate appropriate segregation in consultation with the piling contractor.

Excavated and segregated ASS should be treated within a suitable contained and bunded area prior to off-site disposal and/or re-use on-site.

The location of the bunded area should be selected to minimise the potential for impact on nearby sensitive receptors, including nearby water bodies (i.e., Cottage Creek and Hunter River downstream). Any leachate produced in the bunded area should be contained for monitoring and treatment as discussed below.

If a suitable located bunded area is not available on-site, consideration could be given to progressive treatment of soils immediately adjacent to the excavation as the material is excavated (i.e., treated within 4 hours of excavation).

Suitable neutralising agents for ASS include Grade 1 agricultural lime ($CaCO_3$), calcined magnesia (MgO or $Mg(OH)_2$) and dolomite ($MgCO_3.CaCO_3$), although Grade 1 agricultural lime is recommended due to the potential for dolomite and calcined magnesia to degrade water quality as a result of the soluble product magnesium sulfate produces in the process of neutralising acids.

An assessment of the dosing rate for lime treatment can be calculated from the results of detailed laboratory testing, using the following equation, which includes a factor of safety.

Alkali Material Required (kg)

$$\textit{per unit volume of soil } (m^3) = \left(\frac{\%\text{S x } 623.7}{19.98}\right) \times \frac{100}{\text{ENV}(\%)} \times D \times FOS$$

Where: *%S = existing and potential acidity (% S units);*
623.7 = % S to mol H^+ / t;
19.98 = mol H^+ / t to kg $CaCO_3$ / t;
D = Bulk density of soil (t/m^3);
FOS = safety factor (usually 1.5);
ENV = Effective Neutralising Value (e.g., 80% for Grade 1 Agricultural lime).

Note: *The ENV is calculated based on the molecular weight, particle size and purity of the neutralising agent and should be assessed for proposed materials in accordance with Dear SE et al (2014).*

It is recommended that Grade 1 agricultural lime is used for the neutralisation of ASS excavated during the construction.

Martens (2021) previously conducted ASS testing to a maximum depth of 8.3 m (~RL-4.3) at the site and concluded that ASS conditions were not present to the depth of testing. It is understood, however, that piling may extend deeper than the previous assessment (approximately 10.5 m (~RL-8.5)). In lieu of available ASS data for deeper soils (i.e. >8.3 m / ~RL-4.3) and based on DP's previous experience in the area, an initial liming rate of **5 to 10 kg lime/tonne (~8 to 16kg lime/m^3)** should be adopted for pile spoil generated from depths greater than 8.3 m / ~RL-4.3.

The above liming rates are based on the use of Grade 1 agricultural lime with an effective neutralising value (ENV) of 80% and an estimated bulk density of 1.8 tonne/m^3 for sands and 1.4 tonne/m^3 for excavated clays (Note: A bulk density of 1.6- tonne/m^3 has been utilised in the above estimates given the clayey sand/sandy clays encountered at depth).

Site specific testing will be required to confirm ASS conditions at depths greater than 8.3 m / ~RL-4.3, to confirm ASS conditions and where present calculate site-specific initial liming rates to minimise the risk of over-liming or unnecessary treatment. Given the preliminary nature of previous ASS testing by Martens (2021) it is also recommended that the additional sampling and testing of deeper soils also include systematic sampling and testing comprising screening testing and detailed ASS (Scr suite) testing of upper natural soils for confirmation purposes.

7.2 Liming and Monitoring Procedure

The initial liming rates should be trialled to minimise the risk of over-liming. Lime rates should be confirmed and modified as required during the works through validation testing.

The following liming / monitoring procedures for the treatment of ASS are recommended:

- The surface of the bunded soil treatment area/stockpile area adjacent to the excavation should be dosed with approximately 1 kg/m^2 of agricultural lime as a precautionary measure. If ASS are to be treated over existing concrete / asphalt pavements, treatment areas should be appropriately bunded with fill/treated ASS or hay bales etc and lined with black plastic;
- All excavated ASS should be contained within the suitably bunded area(s) and kept moist to minimise oxidation, prior to treatment with lime. Progressive neutralisation will minimise the area required for bunding;
- The neutralising agent and ASS should be thoroughly mixed and aerated using, for example, an agricultural lime spreader and excavator or rotary hoe. The soil should be treated in layers up to 300 mm thick to encourage aeration;
- Stockpiled ASS soil should be limed as soon as practicable following excavation initially at the estimated lime application rate (refer to Section 7.1). Application rates at the site may vary depending on soil conditions encountered at depths greater than 8.3 m (~RL 4.3);
- The actual lime rate required will also depend on the results of monitoring during neutralisation. Additional lime will be required if monitoring results indicate that appropriate neutralisation has not been achieved. Conversely the liming rate may decrease if monitoring suggests over-liming has occurred;

- Sampling and testing should be undertaken in accordance with Section 7.5 to verify the neutralisation treatment. The acceptance criteria are discussed in Section 7.6. Depending on the results of testing, reapplication of lime may be necessary to gain adequate neutralisation. Care should be taken to avoid over-liming of soils;
- Upon verification of treatment, the neutralised ASS could be re-used on site or disposed to a licensed landfill following confirmation of the waste classification by an appropriately qualified consultant. It is noted that ASS must be appropriately neutralised prior to off-site landfill disposal in accordance with NSW EPA *Waste Classification Guidelines - Part 4: Acid Sulfate Soils* (NSW EPA, 2014). Alternatively, the NSW EPA may assess an application for reuse of the treated soils on another site, via classification with a specific exemption. The requirements for the exemption should be confirmed prior to construction;
- The geotechnical and contamination suitability of the treated soils should be confirmed if proposed for re-use.

It is noted that there is a potential for piling spoil brought to the surface to be intermixed with concrete materials that will generally raise the soil pH and potentially neutralise ASS conditions to some degree. It is recommended that initial screening / testing of pile spoil is conducted prior to lime application to confirm liming requirements and avoid over application.

7.3 Neutralising Leachate

Leachate water collected from the bunded area(s) should be neutralised as necessary before disposal. Calcined magnesia (magnesium hydroxide, burnt magnesite, or magnesia) is the recommended neutralising agent as it produces a two-step reaction, which proceeds rapidly at acidic pH and slows down as higher pH is approached, and hence reduces the potential for over-neutralisation to occur.

The amount of neutraliser required to be added to the leachate can be calculated from the following equation:

$$\textit{Alkali Material Required (kg)} = \frac{M_{Alkali} \times 10^{-pH\ initial}}{2 \times 10^{3}} \times V$$

where: pH initial = initial pH of leachate

V = volume of leachate (litres)

M_{Alkali} = molecular weight of alkali material (g/mole)

Note: molecular weight of calcined magnesia (M_{MgO}) = 40 g/mole.

The alkali should be added to the leachate as slurry. Mixing of the slurry is best achieved using an agitator.

Any discharge / disposal of water (if required) should be conducted in accordance with statutory and regulatory requirements and site-specific approvals from Water NSW (if required).

Regular monitoring of leachate should be conducted as discussed in Section 7.5.

7.4 Dewatering

Groundwater at the site has previously been intercepted during field investigations at a depth range of 0.5 to 5.6 m bgl (DP, 2022; Martens, 2021). For the more recent DSI (DP, 2023), free groundwater was observed in Pits 225, 305 and 306 at depths of 1.1 m to 2.8 m bgl (approximate RL 1.8 to RL -0.5) which is considered more representative of typical groundwater levels.

No information has been provided regarding the potential for dewatering for the proposed development. Dewatering, if required, is expected to be localised for service trenches and shallow excavations. If dewatering activities are required for the project they should be conducted according to appropriate licencing and regulatory requirements (i.e., Hunter Water Corporation, Newcastle City Council etc) as well as the strategies provided below where dewatering is likely to disturb ASS.

Potential options for the management / disposal of extracted groundwater during dewatering include the following:

- Re-injection of groundwater at a location away from the dewatered excavation;
- Overland discharge and infiltration, or infiltration within a temporary pond/basin;
- Disposal to sewer subject to a Trade Waste agreement;
- Stormwater disposal subject to regulatory approval and appropriate water quality treatment and monitoring requirements.

The following procedure is recommended to minimise potential adverse impacts resulting from excavation and dewatering of ASS during construction:

- Minimise the dewatering depth required for installation (i.e., as close as practicable to the invert level of the excavation);
- Minimise the time and volume of exposed ASS (i.e., staged excavations and dewatering);
- If re-injection is proposed, periodic monitoring of reinjected water should be conducted to assess potential impacts from the dewatering process;
- For discharge / infiltration methods, extracted groundwater should be collected in a suitably sized multi-stage sedimentation tank or on-site detention structures and neutralised as necessary prior to disposal;
- The extracted groundwater could then be discharged to a bunded area or constructed pond/basin away from the dewatering site (i.e., reinjected or evaporation/infiltration) or discharged overland or to sewer/stormwater, subject to regulatory requirements and licences;
- Background groundwater pH was measured at 7.0 in December 2022 (DP, 2023), however, pH of the extracted water should be monitored prior to dewatering and discharge. Neutralisation should be undertaken, as discussed below, if discharge water pH falls below natural background levels for re-injection / evaporation / infiltration or outside regulatory requirements (sewer/stormwater disposal);
- Dose the base of temporary excavations (i.e., service trenches, stormwater retention etc.) at a rate of approximately 1 kg/m^2 of agricultural lime prior to construction and cessation of dewatering to counteract the generation of acidic leachate following groundwater recovery;

- Segregate and treat the ASS excavated during construction as discussed in Section 7.1 and 7.2; and
- Undertake monitoring as recommended in Section 7.5.

The following procedure is recommended for neutralising groundwater if required:

- The neutralising agent (e.g., agricultural lime or calcined magnesia) should be added as a slurry at the first stage of a multi-stage sedimentation tank or detention structure to allow the lime to mix with the extracted groundwater prior to discharge;
- The neutralising agent should be added at a constant rate during dewatering. The rate of dosing should be minimal initially and be monitored and adjusted based on the results of regular monitoring of the treated extracted groundwater.

It is noted that the above procedures should be reviewed following completion of the detailed site investigation (DSI) and preparation of a site-specific remediation action plan (RAP) to ensure the procedures are commensurate with contaminated land requirements.

7.5 Monitoring Strategies

7.5.1 Soil Neutralisation / Management

It is recommended that the following inspections and monitoring be undertaken when excavating ASS materials, based on guidelines presented in the ASSMAC (Stone, Ahern, & Blunden, 1998) and QASSIT (Ahern, McElnea, & Sullivan, 2004) manuals:

- Daily inspection of liming operations during initial excavation, to be reviewed following establishment of liming procedures;
- Sampling and testing after lime treatment (i.e., measurements of soil pH in distilled water and pH following oxidation with peroxide) should initially be undertaken at a frequency of at least one sample per 20 m^3 excavated soil to verify the neutralisation treatment. The frequency of testing could be reviewed as treatment progresses. A lower frequency of testing could be considered, subject to consistent results, soil conditions and treatment procedures;
- Analysis of soil samples for chromium suite analysis by a NATA accredited laboratory to confirm appropriate neutralisation, with sampling density in stockpiles as follows:
    - <250 m^3: two samples;
    - 250-500 m^3: three samples;
    - 500-1000 m^3: four samples.
- The frequency of testing could be reduced depending on the results of monitoring and consistency of excavated ASS.

Note: The frequency of testing would also need to comply with NSW EPA requirements in the event that a specific exemption was sought for off-site re-use of treated ASS materials.

7.5.2 Leachate Management

Leachate collected within the bunded area should be temporarily stored and neutralised as necessary. The pH of the leachate should be monitored daily, and prior to any discharge to the environment. The neutralised leachate could be discharged overland within the site (e.g., controlled evaporation/infiltration), or discharged to sewer / stormwater, subject to regulatory requirements and licences/approvals.

Neutralisation/treatment should be undertaken if discharge water pH falls below background levels if overland evaporation/infiltration is proposed, or to within regulatory requirements if discharge is proposed.

A contingency procedure should be in place to allow lime dosing and monitoring to confirm neutralisation prior to discharge.

7.5.3 Dewatering

Extracted groundwater should be temporarily stored and neutralised as necessary. The pH of extracted water associated with areas of ASS should be monitored twice daily (AM, PM) prior to discharge. The groundwater could be reinjected, discharged overland (i.e., evaporation / infiltration) as discussed in Section 7.4, or discharged to sewer or stormwater subject to regulatory requirements and licences.

Neutralisation should be undertaken if discharge water pH falls below natural background groundwater levels (re-injection / evaporation / infiltration) or outside regulatory requirements (stormwater/sewer discharge). Background groundwater pH was recorded at 7.0 from an irrigation bore in the eastern part of the site in December 2022 (DP, 2023). Construction details and depth for the irrigation bore were not known at the time of the DSI and may not to have been representative of groundwater conditions in the area (it was considered that the bore potentially contained tap/town water). Therefore, pH should be retested at the commencement of dewatering.

A contingency procedure should be in place to allow for lime dosing and monitoring confirming that neutralisation has been achieved prior to discharge.

7.5.4 Reporting

A record of treatment of ASS and leachate should be maintained by the contractor and should include the following details:

- Date;
- Location and source of material (e.g., excavation of pile spoil generation);
- Time stockpile has been exposed prior to treatment (i.e., time of excavation and backfilling);
- Neutralisation process undertaken;
- Lime rate utilised;
- Results of soil, leachate and groundwater monitoring;
- Records of ASS disposal to landfill or alternative site under a specific exemption (if applicable);
- Record of location and level placement where treated ASS has been re-used on-site (if any).

A record should also be maintained confirming contingency measures and additional treatment if undertaken. Monitoring should be commensurate with licencing and regulatory requirements.

A final report should be issued upon completion of the works presenting the monitoring regime and results to confirm that no adverse environmental impact has occurred during the works. The report shall include (where required) details of the total volume of ASS excavated, detailed analytical results confirming that acceptable ASS treatment has occurred, water monitoring results of extracted groundwater (where required), site records from contractors and records of the final disposal destination of the materials removed from site (if required).

A report will be prepared by the environmental consultant with reference to the ASSMAC (Stone, Ahern, & Blunden, 1998) and QASSIT (Ahern, McElnea, & Sullivan, 2004) guidelines as well as other appropriate guidance documentation detailing the results of ASS management during construction.

7.6 Acceptance Criteria

7.6.1 Water

Discharge of waters should be conducted in accordance with relevant statutory and regulatory requirements including ANZECC (2000) and ANZG (2018).

Measurement of pH and EC of groundwater at the commencement of construction should be conducted. These measurements in conjunction with those measured during the previous investigation summarised in Table B1 in Appendix B will be used to confirm baseline conditions at the site prior to evaporation / infiltration / re-injection at the site.

Groundwater quality should be assessed in accordance with regulatory requirements if discharge to sewer/stormwater is required.

It is noted that the ANZECC (2000) trigger value range of pH 7.0 to pH 8.5 for estuarine environments is considered to be appropriate for surface water / stormwater discharge, rather than the marine or freshwater criteria as the Hunter River is the closest surface water body receptor. pH adjustment may therefore be required for this option.

7.6.2 Soil

Further treatment of soils may be required if monitoring of the material reveals any of the following properties:

- pH_F is less than background values. Applicable background values are those present within the area proposed for re-use of treated ASS (i.e., background pH of soils within re-use areas). At the commencement of ASS construction activities, the background soil pH should be determined within the nominated re-use areas (where required);
- pH_F minus pH_{FOX} is greater than 1 and pH_F is less than background values;
- Net Acidity results are greater than zero OR the lime associated acid neutralisation capacity (ANC) <1.5 times the Existing and Potential Acidity.

Depending on the results of testing, reapplication of lime may be necessary to gain adequate neutralisation. Care should be taken to ensure over-liming does not occur.

Note: The validation testing would also need to comply with NSW EPA (2014) requirements if a specific exemption was sought for off-site re-use of treated ASS materials.

8. ASS Contingency Plan

Remedial action will be required if the standards or acceptance criteria outlined above are not being achieved. Remedial action could include but not be limited to the following:

- Mixing of additional lime through the excavated material if neutralisation does not satisfy the criteria as provided in Section 7.1;
- Additional neutralisation of leachate if under liming has occurred;
- If monitoring indicates that over-liming has occurred, additional untreated ASS or leachate should be mixed through over-limed soils to reduce pH to acceptable levels. The required mixing rate to remediate the soil or leachate should be confirmed by monitoring tests;
- Cessation of dewatering discharge if monitoring indicates groundwater conditions are outside background values and regulatory requirements (dependent upon the discharge option). Should dewatering discharge be restricted, contingency would include collection, treatment and/or disposal of extracted groundwater to a licensed facility.

During periods of heavy or prolonged rainfall, stockpiled soils should be appropriately contained/covered or temporarily backfilled to minimise leachate generation and runoff.

Sufficient lime should be stored on site during construction for the neutralisation of ASS and contingency measures.

The development should be conducted with due regard to erosion and sediment controls to minimise potential impacts to nearby sensitive receptors, including stormwater drains.

Management of ASS during construction should be conducted by an experienced contractor in accordance with regulatory and statutory requirements. Validation of ASS management should be conducted by an experienced and qualified environmental consultant.

9. References

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10. Limitations

Douglas Partners (DP) has prepared this report for this project at 25a National Park Street, Newcastle West with reference to DP's proposal 213618.02.P.001.Rev0 dated 15 June 2022 and approved variation and acceptance received from School Infrastructure. The work was carried out under Part D – Standard Form Agreement (SINSW03434/22) dated 21 July 2022. This report is provided for the exclusive use of School Infrastructure NSW for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

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

Douglas Partners Pty Ltd

Appendix A

About This Report
Terminology, Symbols and Abbreviations
Soil Descriptions
Sampling, Testing and Excavation Methodology
Rock Descriptions
Cone Penetration Testing
Cone Penetration Tests (CPT 101 to 107) – DP (2022)
Borehole Logs (Bores 1a, 5a and 107a) – DP (2022)
Borehole Log (Bore 4) – DP (2022)
Borehole Logs (Bores 201A to 220 and 301 to 303) – DP (2023)
Test Pit Logs (304 to 316) – DP (2023)

About this Report

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

continued next page

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

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Terminology, Symbols and Abbreviations

August 2020

Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style `XW`. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	`KL`
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	`UK`
No data	Information required to allow classification of the property was not available. For example if drilling is commenced from the base of a hole predrilled by others	`ND`
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example providing a description of the strength of a concrete pavement	`NA`

Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

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Introduction

All materials which are not considered to be “in-situ rock” are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:

classification
name
detailed description

(SW) Clayey SAND, trace silt; grey, fine to medium grained

The “classification” comprises a two character “group symbol” providing a general summary of dominant soil characteristics. The “name” summarises the particle sizes within the soil which most influence it’s behaviour. The detailed description presents more information about the soil’s composition, condition, structure, and origin.

Classification, naming and description of soils requires the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either “fine grained” (also known as “cohesive” behaviour) or “coarse grained” (“non cohesive” behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Fraction	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as “oversize”	
Cobble	63 - 200		
Gravel[1]	2.36 - 63	Coarse	>65%
Sand[1]	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

1 – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer “component proportions” below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a “Sandy CLAY”, this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a “primary”, “secondary”, or “minor” component of the soil mixture, depending on it’s influence over the soils behaviour.

Component Proportion Designation	Definition[1]	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor[2]	Present in the soil, but not significant to it’s engineering properties	All other components	All other components

1 – As defined in AS1726-2017 6.1.4.4

2 – in the detailed material description, minor components are split into two further sub categories. Refer “identification of minor components” below

Composite Materials

In certain situations a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example “INTERBEDDED Silty CLAY AND SAND”.

Classification

The soil classification comprises a two character group symbol. The first symbol identifies the primary component. The second symbol identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component[1]	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

[1] – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	clay/silt: 0-5% sand/gravel: 0-15%

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type		Particle size (mm)
Gravel	Coarse	19 - 63
	Medium	6.7 - 19
	Fine	2.36 – 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular particle size with the range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

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Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	<PL
	Near plastic limit	Can be moulded	≈PL
	Wet of plastic limit	Water residue remains on hands when handling	>PL
	Near liquid limit	“oozes” when agitated	≈LL
	Wet of liquid limit	“oozes”	>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code NDF, meaning “not-assessable due to drilling fluid use” may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Rock

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the “consistency” describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented “strength” is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered rock origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description

Quantitative engineering performance of these materials may be determined by laboratory testing, or estimated by correlated field tests (for example penetration or shear vane testing), or by tactile methods, as appropriate.

<u>Consistency (fine grained soils)</u>

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	ST
Very stiff	Indented by thumbnail	>100 - ≤200	VST
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	FR

<u>Relative Density (coarse grained soils)</u>

Tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15-≤35	L
Medium dense	>35-≤65	MD
Dense	>65-≤85	D
Very dense	>85	VD

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MCE
Weakly cemented	WKCE
Cemented	CE
Strongly bound	SB
Weakly bound	WB
Unbound	UB

Extremely Weathered Rock

AS1726-2017 considers weathered rock material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. very low strength rock). These materials may be identified as “extremely weathered rock” in reports and by the abbreviation code XWR on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RES
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than ‘very low’ as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LCS
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or sea shore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be “oversize” may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with “MIXTURE OF”.

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Rock Strength

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

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

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

[1] Assumes a ratio of 20:1 for UCS to $I_{s(50)}$. It should be noted that the UCS to $I_{s(50)}$ ratio varies significantly for different rock types and specific ratios may be required for each site.

On investigation logs only, the following data contiguity codes may be in rock strength tables for layers or seams of material "within rock", but for which the equivalent UCS strength is less than 0.6 MPa.

Scenario	Abbreviation Code
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The properties of the material encountered over this interval are described in the "Description of Strata" and soil properties columns.	SOIL
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The prominence of the material is such that it can be considered to be a seam (as defined in Table 22 of AS1726-2017) and the properties of the material are described in the defect column.	SEAM

Degree of Weathering

The degree of weathering of rock is classified as follows:

Weathering Term	Description	Abbreviation Code
Residual Soil[1,2]	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.	RS
Extremely weathered[1,2]	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	XW
Highly weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.	HW
Moderately weathered	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.	MW
Slightly weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.	SW
Fresh	No signs of decomposition or staining.	FR
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.	DW

[1] – AS1726-2017 6.1.9 provides similar definitions for "residual soil" and "extremely weathered material" as soil origins. Generally, the soil origin terms would be used above the depth at which very low strength or stronger rock material is first encountered, while both soil origin and weathering should may be stated for soil encountered below the first contact with rock material, where appropriate.

[2] –The parent rock type, of which the residual/extremely weathered material is a derivative, will be stated in the description (where discernible).

Degree of Alteration

The degree of alteration of the rock material (physical or chemical changes caused by hot gasses or liquids at depth) is classified as follows:

Term	Description	Abbreviation Code
Extremely altered	Material is altered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.	XA
Highly altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be increased by leaching, or may be decreased due to precipitation of secondary materials in pores.	HA
Moderately altered	The whole of the rock material is discoloured, usually by 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.	MA
Slightly altered	Rock is slightly discoloured but shows little or no change of strength from fresh rock	SA
Note: If HA and MA cannot be differentiated use DA (see below)		
Distinctly altered	Rock strength usually changed by alteration. The rock may be highly discoloured, usually by staining or bleaching. Porosity may be increased by leaching, or may be decreased due to precipitation of secondary minerals in pores.	DA

Degree of Fracturing

The following descriptive classification apply to the spacing of natural occurring fractures in the rock mass. It includes bedding plane partings, joints and other defects, but excludes drilling breaks. These terms are generally not required on investigation logs where fracture spacing is presented as a histogram, and where used are presented in an unabbreviated format.

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

Rock Quality Designation

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

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

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

Stratification Spacing

These terms may be used to describe the spacing of bedding partings in sedimentary rocks. Where used, these terms are generally presented in an unabbreviated format

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

Defect Descriptions

Defect Type

Term	Abbreviation Code
Bedding plane	B
Clay seam	CS
Cleavage	CV
Crushed zone	CZ
Decomposed seam	DS
Fault	F
Joint	J
Lamination	LAM
Parting	PT
Sheared zone	SZ
Vein	VN
Drilling/handling break	DB , HB
Fracture	FCT

Rock Defect Orientation

Term	Abbreviation Code
Horizontal	H
Vertical	V
Sub-horizontal	SH
Sub-vertical	SV

Rock Defect Coating

Term	Abbreviation Code
Clean	CLN
Coating	CO
Healed	HE
Infilled	INF
Stained	STN
Tight	TI
Veneer	VEN

Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLY
Iron oxide	FE
Manganese	MN
Silty	SLT

intentionally blank

Rock Defect Shape/Planarity

Term	Abbreviation Code
Curved	CU
Irregular	IR
Planar	PL
Stepped	ST
Undulating	UN

Rock Defect Roughness

Term	Abbreviation Code
Polished	PO
Rough	RO
Slickensided	SL
Smooth	SM
Very rough	VR

Other Rock Defect Attributes

Term	Abbreviation Code
Fragmented	FG
Band	BND
Quartz	QTZ

Defect Orientation

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

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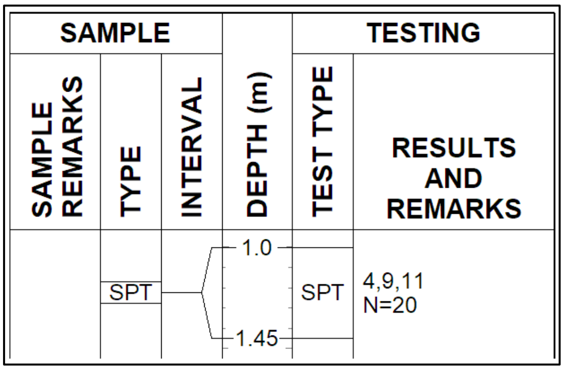
Sampling, Testing and Excavation Methodology

Terminology
Symbols
Abbreviations

August 2020

Sampling and Testing

A record of samples retained and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:



Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Acid sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Sample from SPT test	SPT
Environmental sample	E
Gas sample	G
Jar sample	J
Undisturbed tube sample	U[1]
Water sample	W
Piston sample	P
Core sample for unconfined compressive strength testing	UCS

1 – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kpa)	PP
Photo ionisation detector	PID
Standard Penetration Test	SPT
Shear vane (kpa)	V
Unconfined compressive strength, (MPa)	UCS
Point load test, axial (A), diametric (D), irregular (I)	PLT(_)

Field and laboratory testing (continued)

Test Type	Code
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	Observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Excavator/backhoe bucket	B[1]
Toothed bucket	TB[1]
Mud/blade bucket	MB[1]
Ripping tyne/ripper	RT
Rock breaker/hydraulic hammer	RB
Hand auger	HA[1]
NMLC series coring	NMLC
HMLC series coring	HMLC
NQ coring	NQ
HQ coring	HQ
PQ coring	PQ
Push tube	PT [1]
Rock roller	RR[1]
Solid flight auger. Suffixes (TC) and (V) indicate tungsten carbide or v-shaped tip respectively	SFA[1]
Sonic drilling	SON[1]
Vibrocore	VC[1]
Wash bore (unspecified bit type)	WB[1]
Existing exposure	X
Hand tools (unspecified)	HT
Predrilled	PD
Specialised bit (refer report)	SPEC[1]
Diatube	DT[1]
Hollow flight auger	HFA[1]
Vacuum excavation	VE

1 – numeric suffixes indicate tool diameter/width in mm

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGH SCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

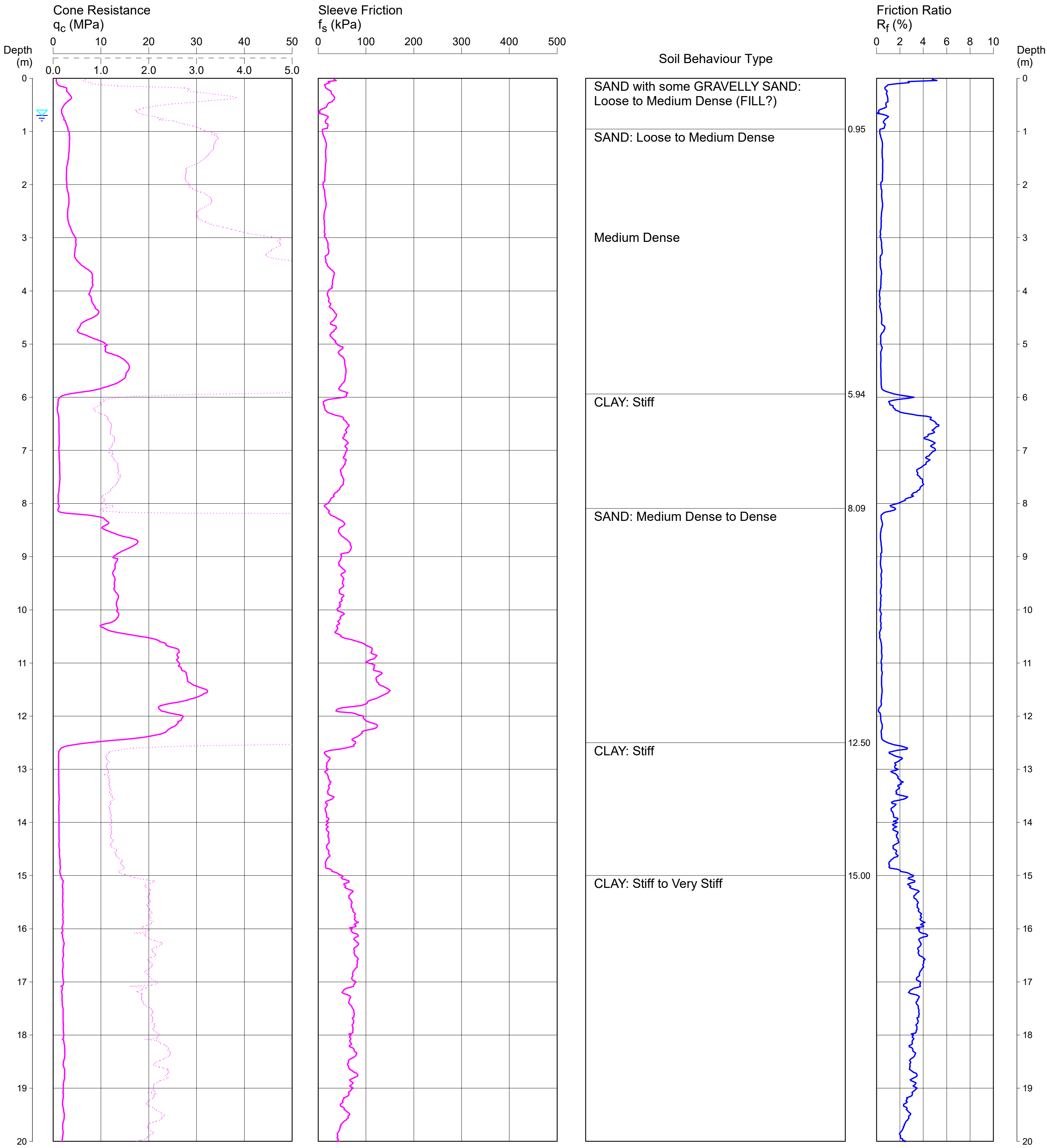
REDUCED LEVEL: 2.6

COORDINATES: 384035.8E 6355583.4N AHD

CPT101

DATE 13/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO SUDDEN BEND ON HARD MATERIAL
GROUNDWATER LEVEL OBSERVED AT 0.7M AFTER WITHDRAWAL OF RODS

Water depth after test: 0.70m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT101.CP5
Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGH SCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

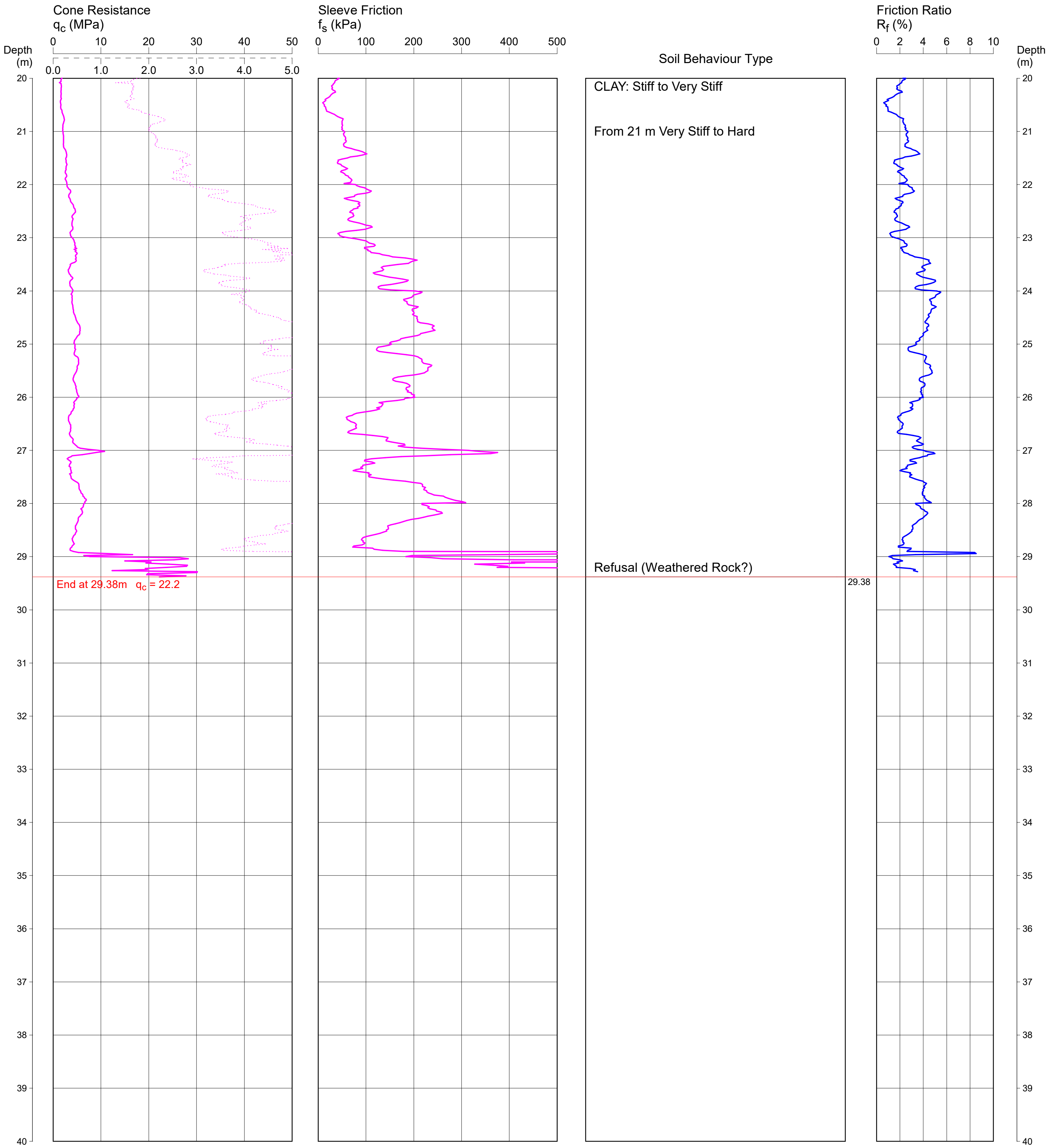
REDUCED LEVEL: 2.6

COORDINATES: 384035.8E 6355583.4N AHD

CPT101

DATE 13/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO SUDDEN BEND ON HARD MATERIAL
GROUNDWATER LEVEL OBSERVED AT 0.7M AFTER WITHDRAWAL OF RODS

Water depth after test: 0.70m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT101.CP5
Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGHSCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

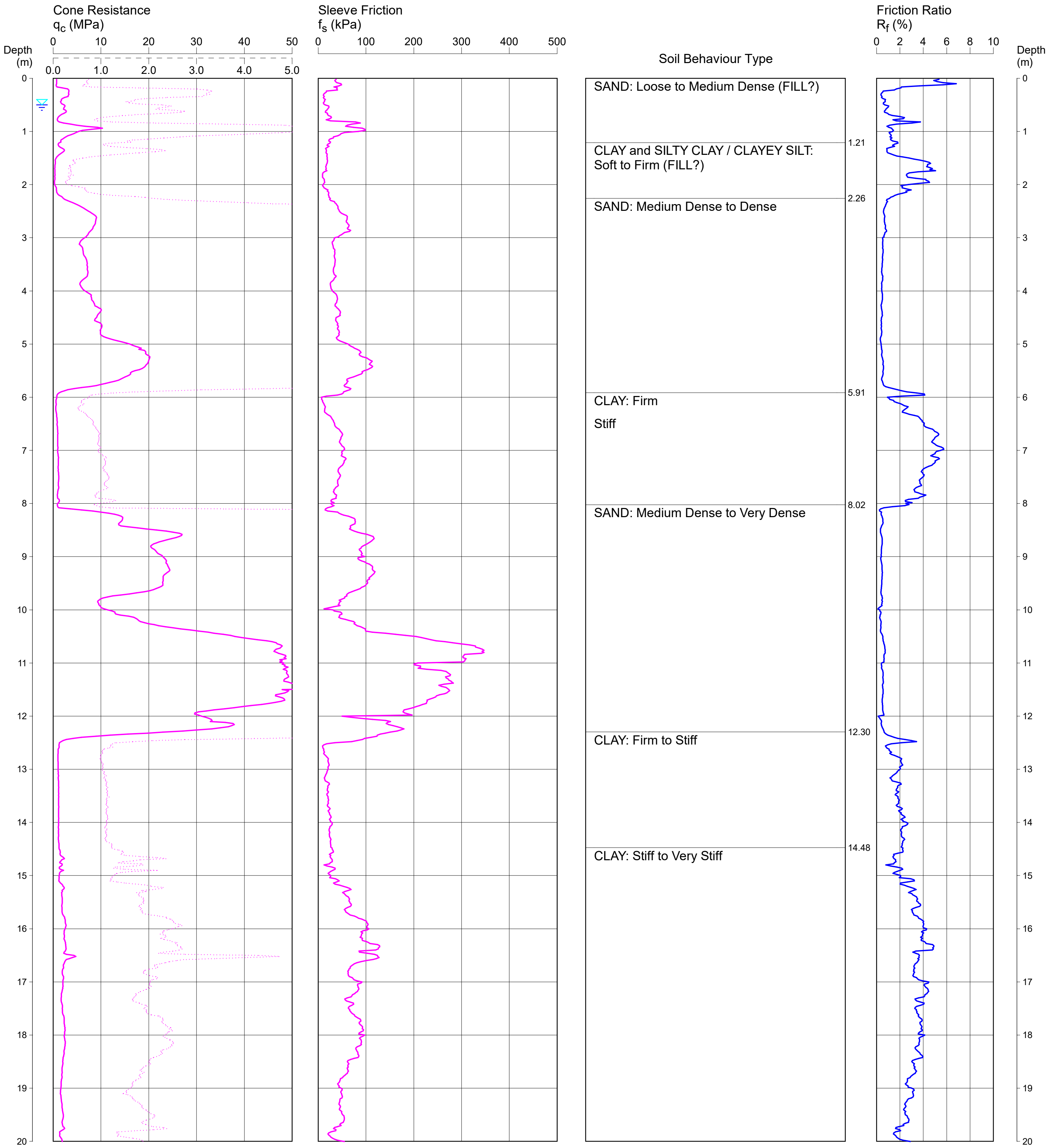
REDUCED LEVEL: 2.3

COORDINATES: 384014.1E 6355610.4N AHD

CPT102

DATE 14/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING IN INFERRED WEATHERED ROCK
GROUNDWATER LEVEL OBSERVED AT 0.5M AFTER WITHDRAWAL OF RODS

Water depth after test: 0.50m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT102.CP5

Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGHSCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

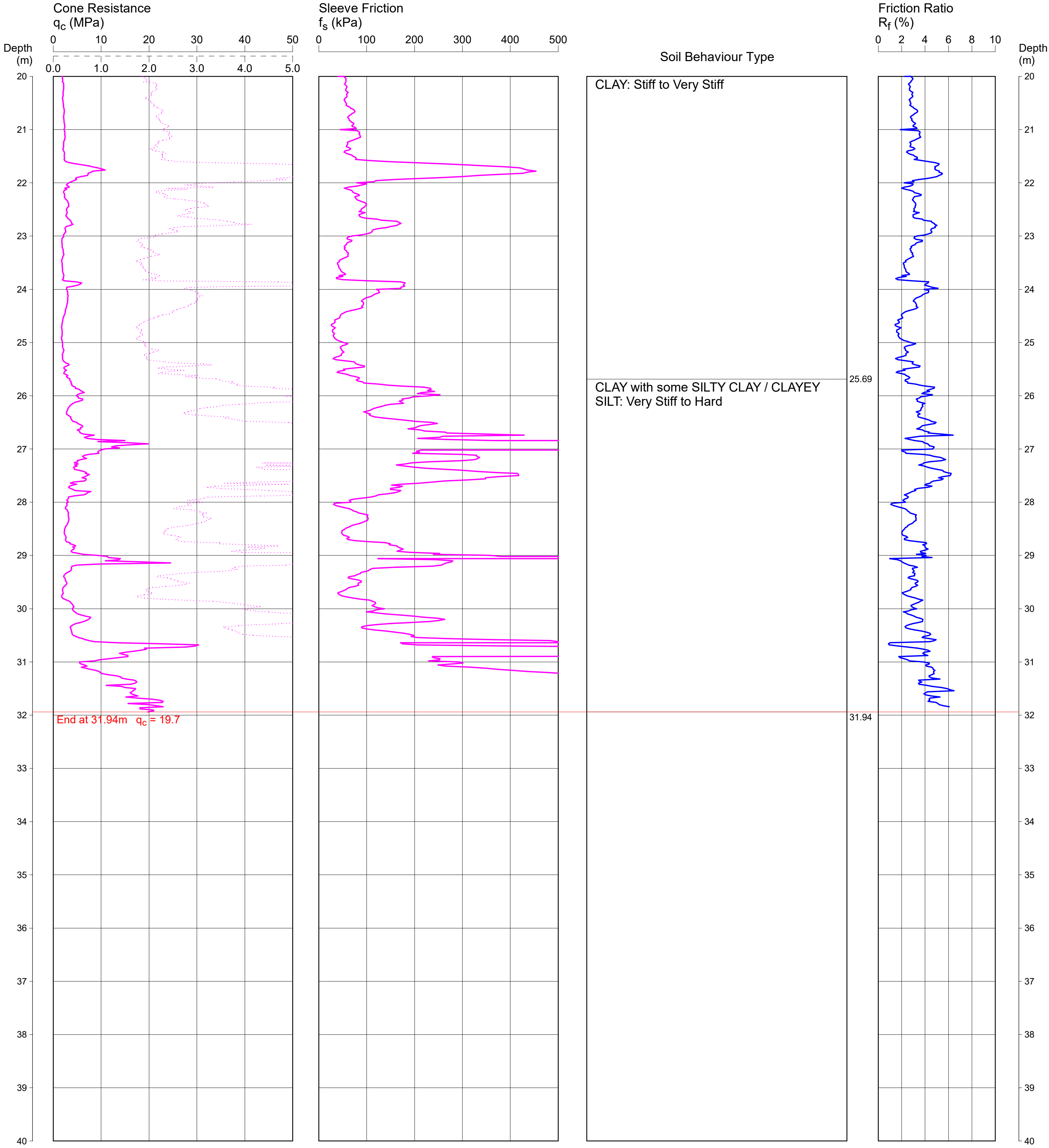
REDUCED LEVEL: 2.3

COORDINATES: 384014.1E 6355610.4N AHD

CPT102

DATE 14/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING IN INFERRED WEATHERED ROCK
GROUNDWATER LEVEL OBSERVED AT 0.5M AFTER WITHDRAWAL OF RODS

Water depth after test: 0.50m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT102.CP5
Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGHSCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

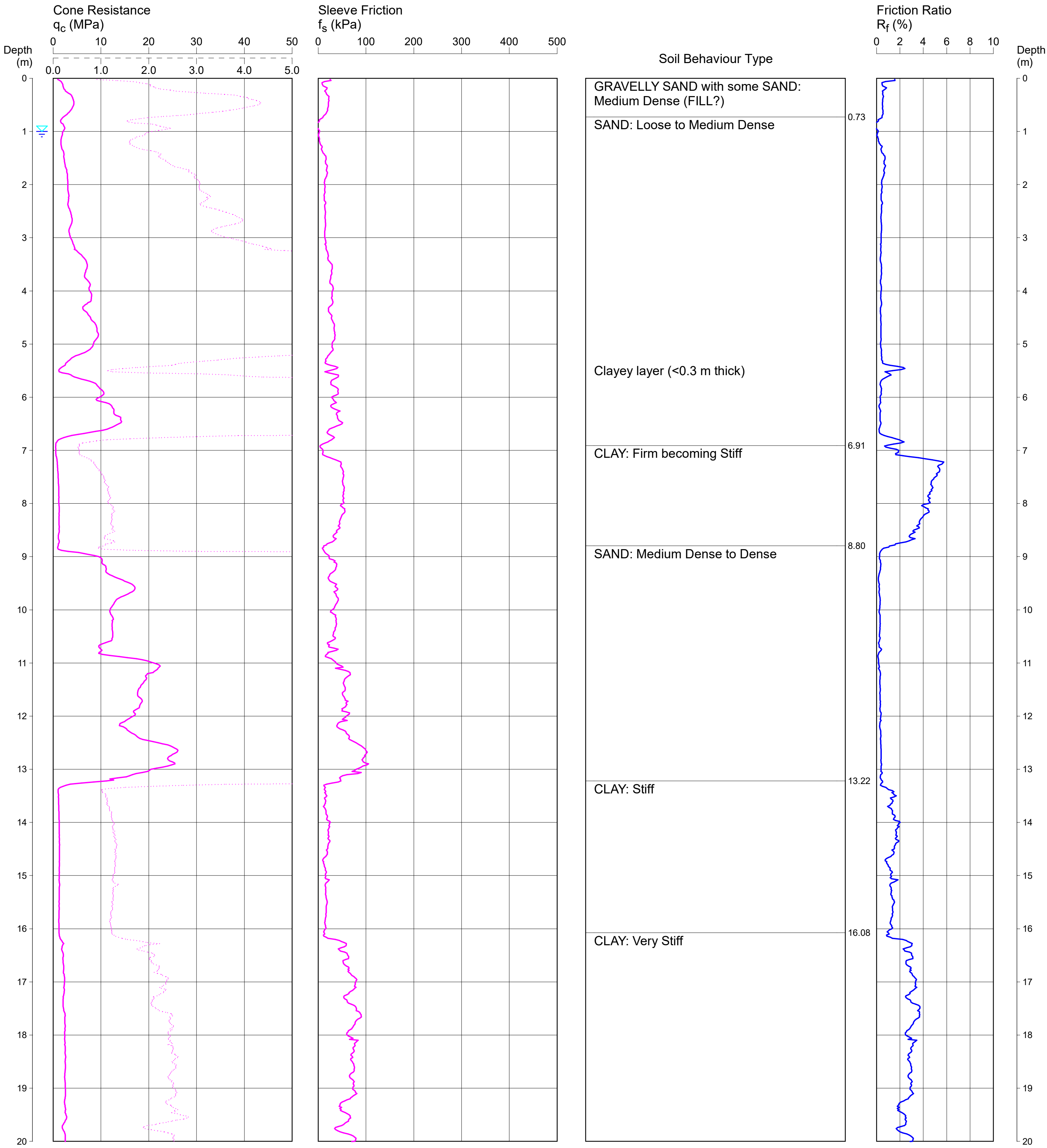
REDUCED LEVEL: 3.3

COORDINATES: 383991.2E 6355578.0N AHD

CPT103

DATE 13/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO SUDDEN BEND ON HARD MATERIAL
GROUNDWATER LEVEL OBSERVED AT 1.0M AFTER WITHDRAWAL OF RODS

Water depth after test: 1.00m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT103.CP5
Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGHSCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

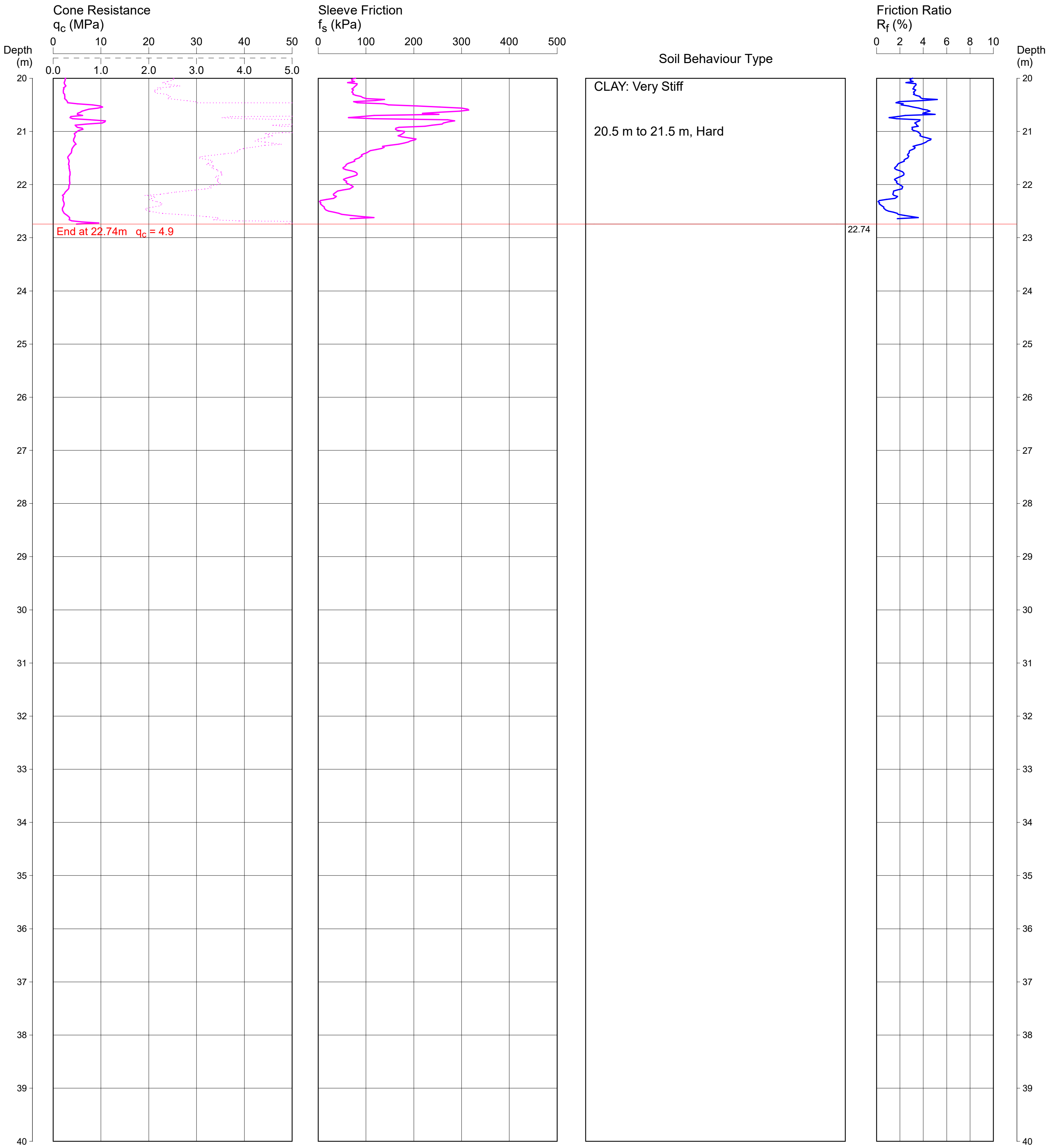
REDUCED LEVEL: 3.3

COORDINATES: 383991.2E 6355578.0N AHD

CPT103

DATE 13/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO SUDDEN BEND ON HARD MATERIAL
GROUNDWATER LEVEL OBSERVED AT 1.0M AFTER WITHDRAWAL OF RODS

Water depth after test: 1.00m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT103.CP5
Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGH SCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

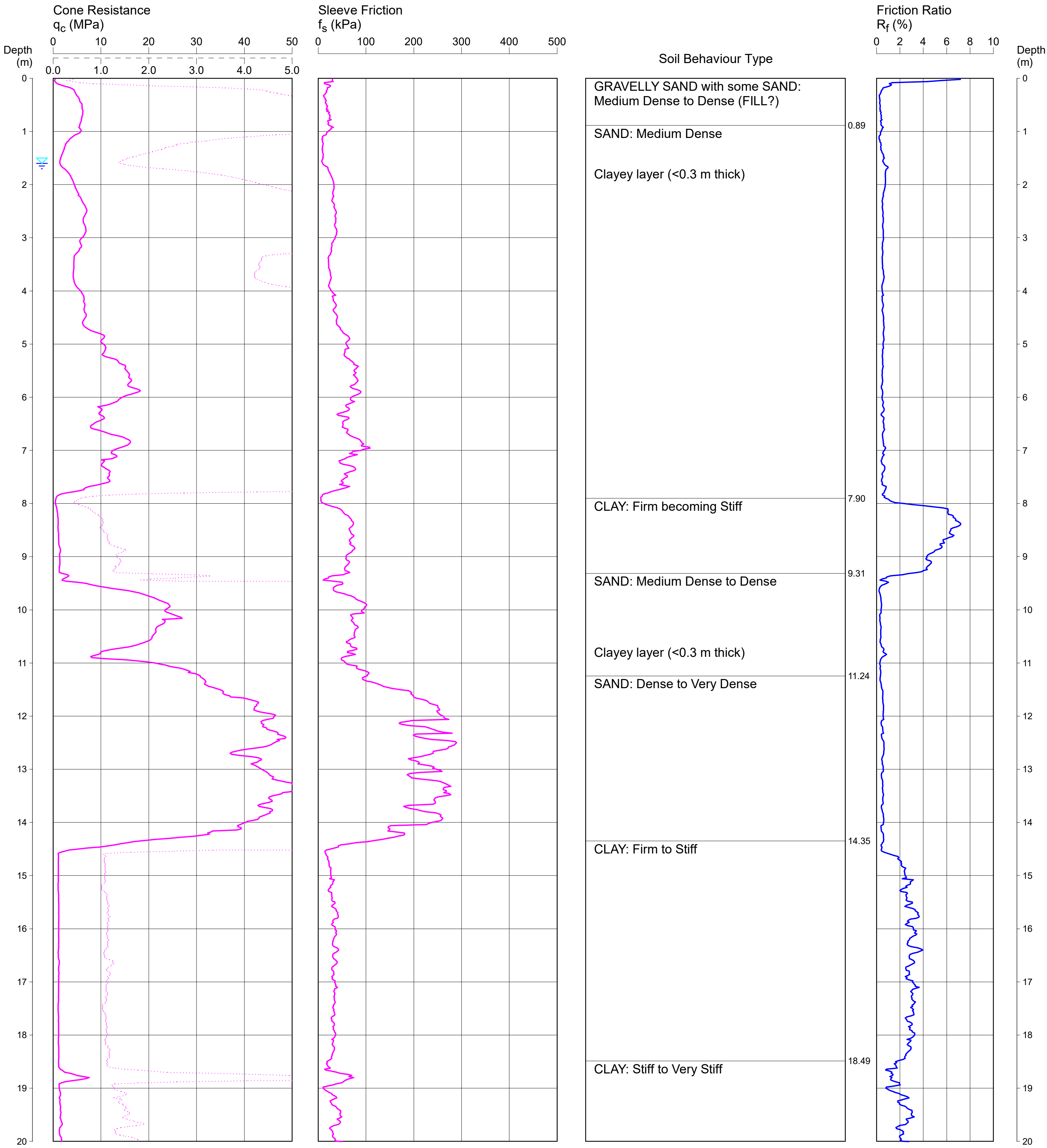
REDUCED LEVEL: 4.1

COORDINATES: 383825.6E 6355634.9N AHD

CPT104

DATE 13/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING IN INFERRED WEATHERED ROCK
GROUNDWATER LEVEL OBSERVED AT 1.6M AFTER WITHDRAWAL OF RODS

Water depth after test: 1.60m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT104.CP5
Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGH SCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

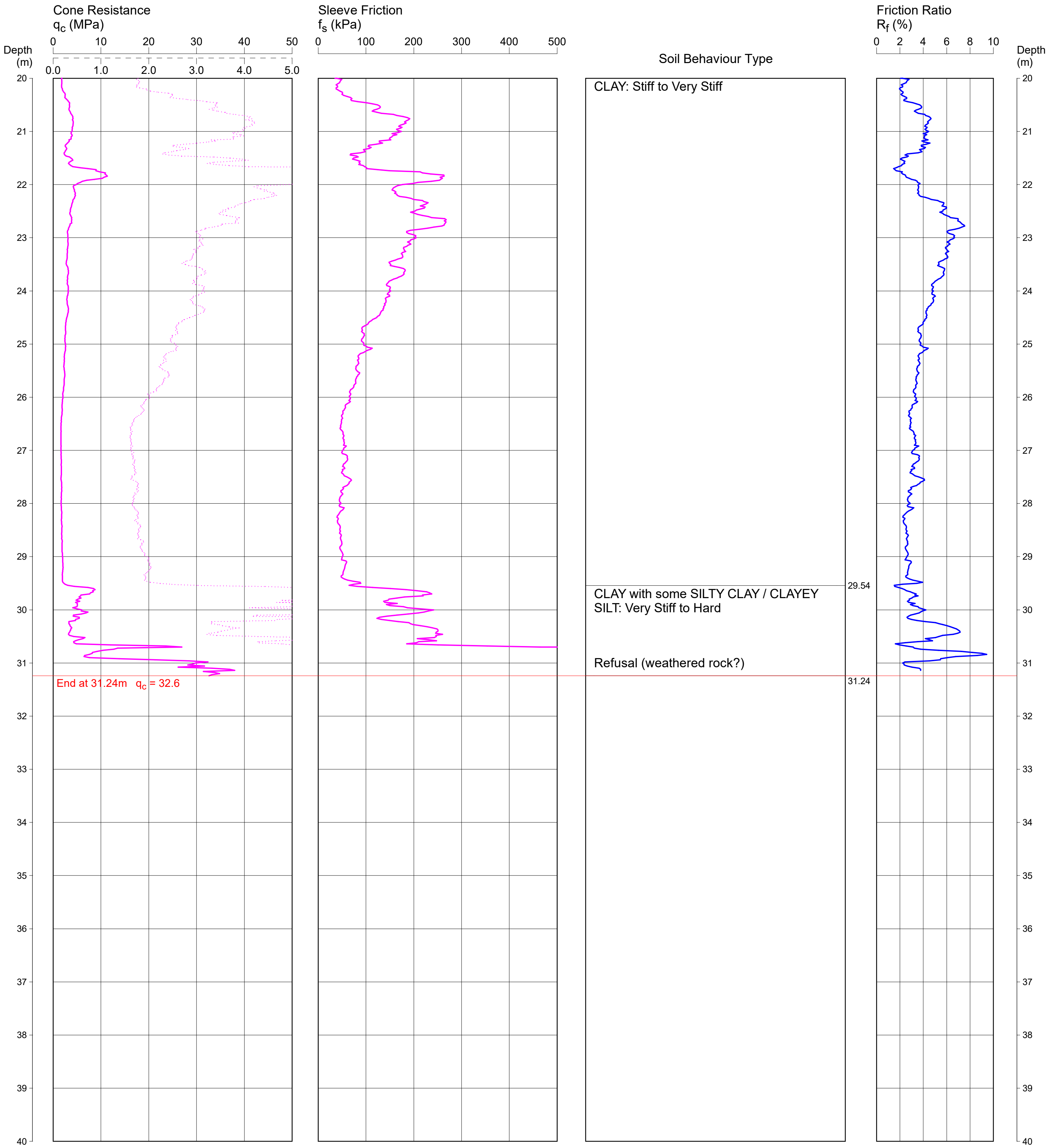
REDUCED LEVEL: 4.1

COORDINATES: 383825.6E 6355634.9N AHD

CPT104

DATE 13/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING IN INFERRED WEATHERED ROCK
GROUNDWATER LEVEL OBSERVED AT 1.6M AFTER WITHDRAWAL OF RODS

Water depth after test: 1.60m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT104.CP5
Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGH SCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

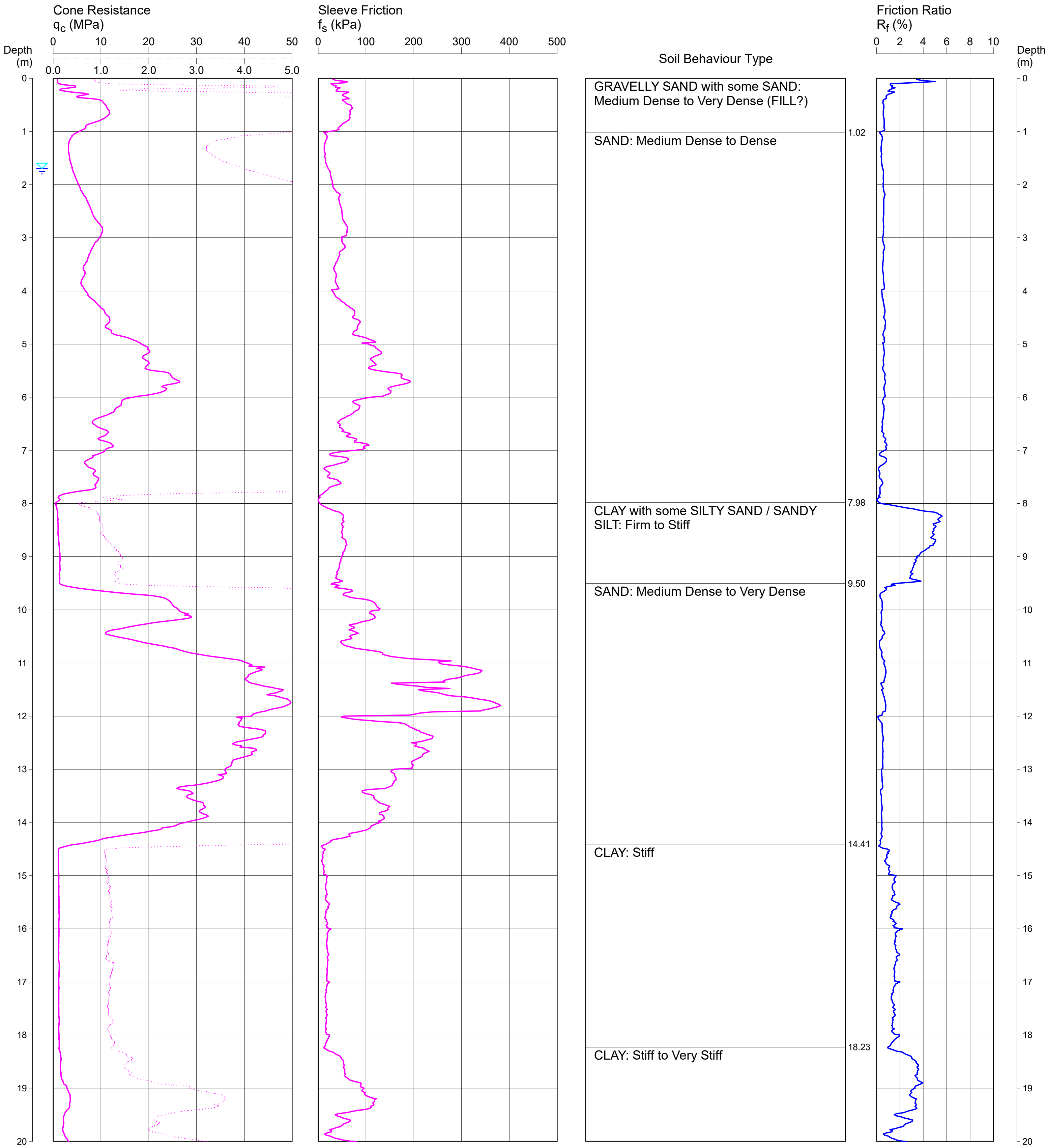
REDUCED LEVEL: 4.1

COORDINATES: 383849.0E 6355627.1N AHD

CPT105

DATE 14/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING IN INFERRED WEATHERED ROCK
GROUNDWATER LEVEL OBSERVED AT 1.7M AFTER WITHDRAWAL OF RODS

Water depth after test: 1.70m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT105.CP5
Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGH SCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

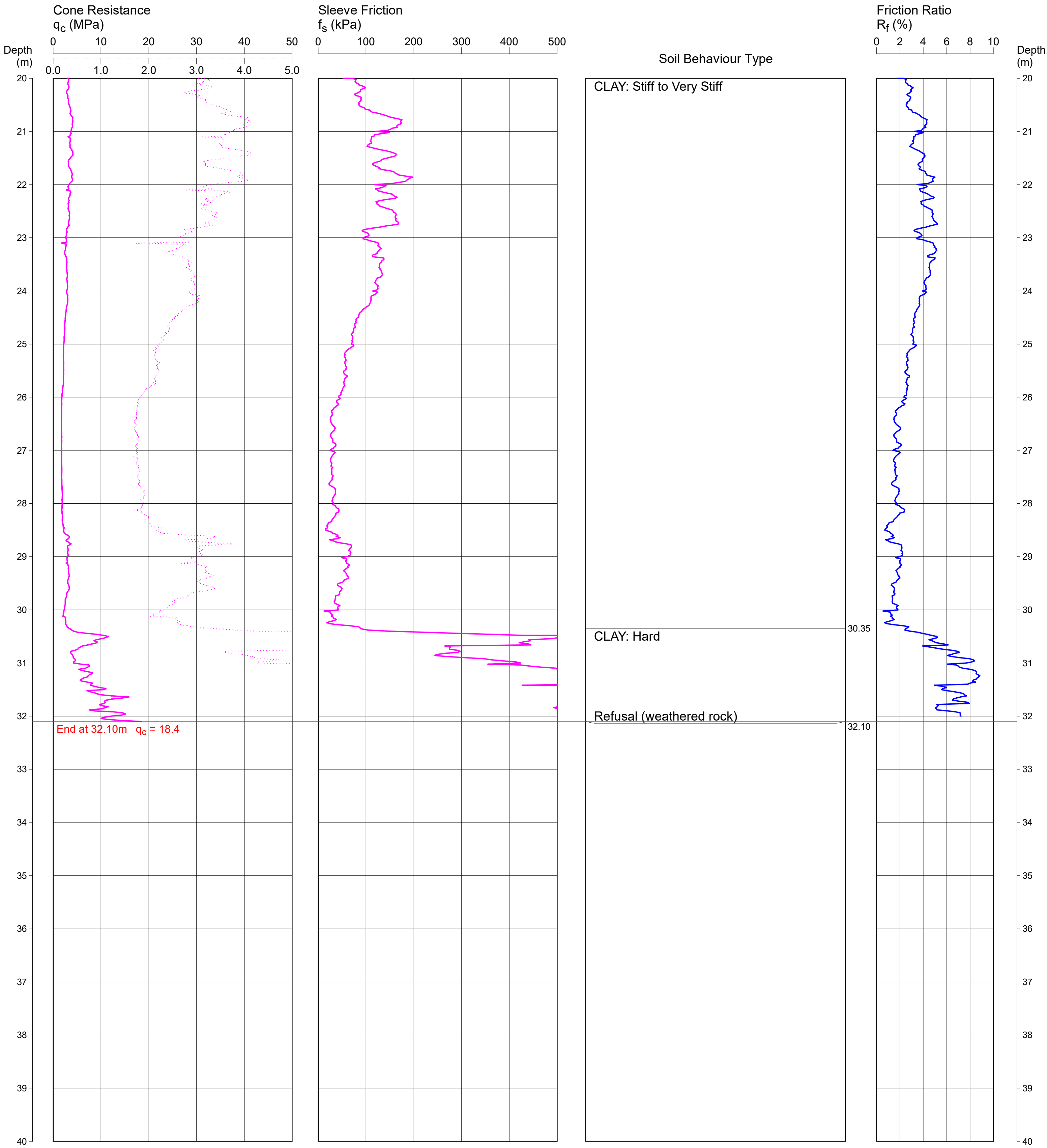
REDUCED LEVEL: 4.1

COORDINATES: 383849.0E 6355627.1N AHD

CPT105

DATE 14/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE ROD BOWING IN INFERRED WEATHERED ROCK
GROUNDWATER LEVEL OBSERVED AT 1.7M AFTER WITHDRAWAL OF RODS

Water depth after test: 1.70m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT105.CP5

Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGHSCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

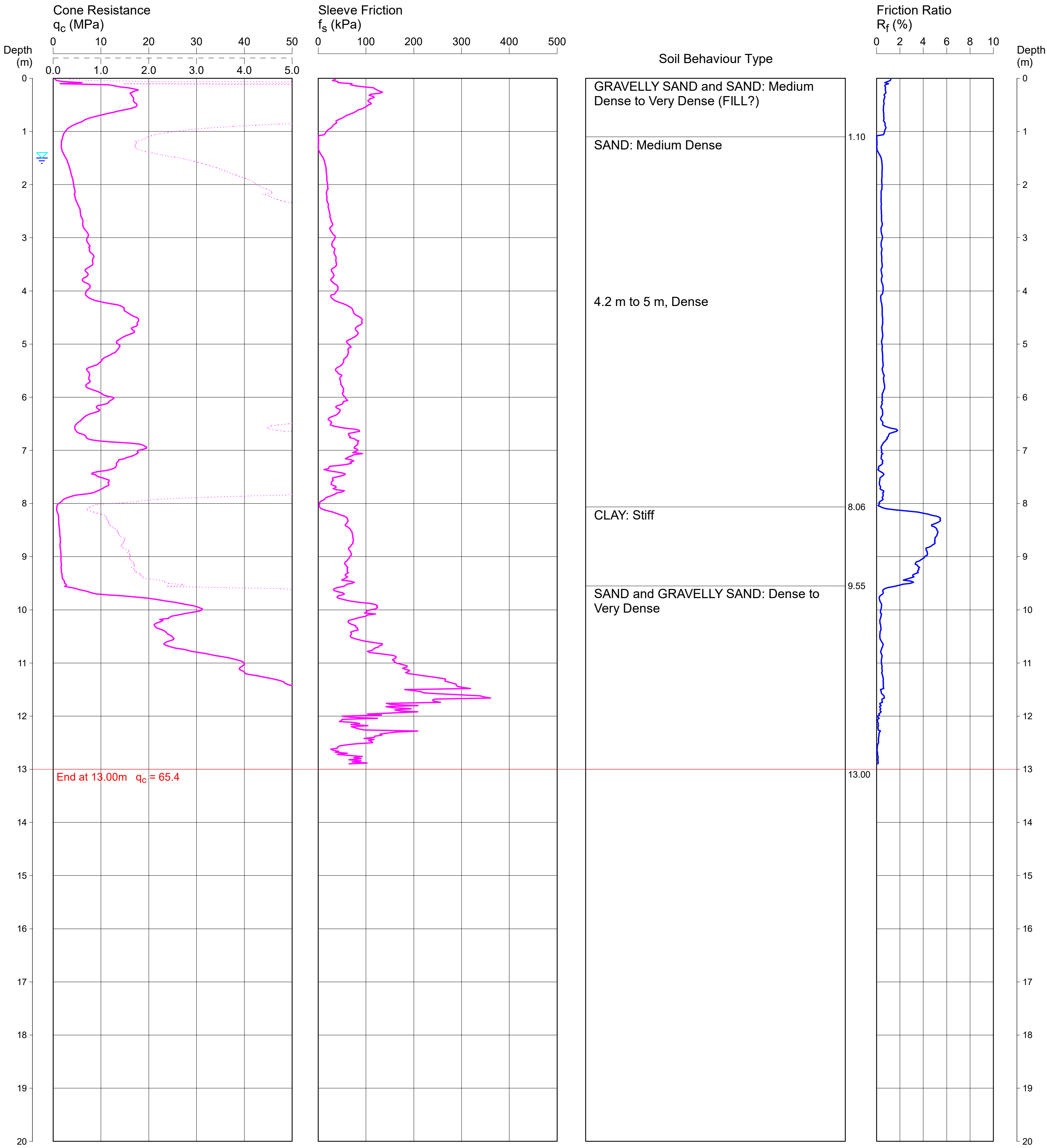
REDUCED LEVEL: 4.0

COORDINATES: 383803.1E 6355604.1N AHD

CPT106

DATE 13/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE BENDING IN VERY DENSE SANDS. ASPHALT 30MM THICK. GROUNDWATER LEVEL OBSERVED AT 1.5M AFTER WITHDRAWAL OF RODS

Water depth after test: 1.50m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT106.CP5

Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NSW

PROJECT: NEWCASTLE HIGH SCHOOL UPGRADE

LOCATION: 160-200 PARKWAY AVENUE, HAMILTON SOUTH

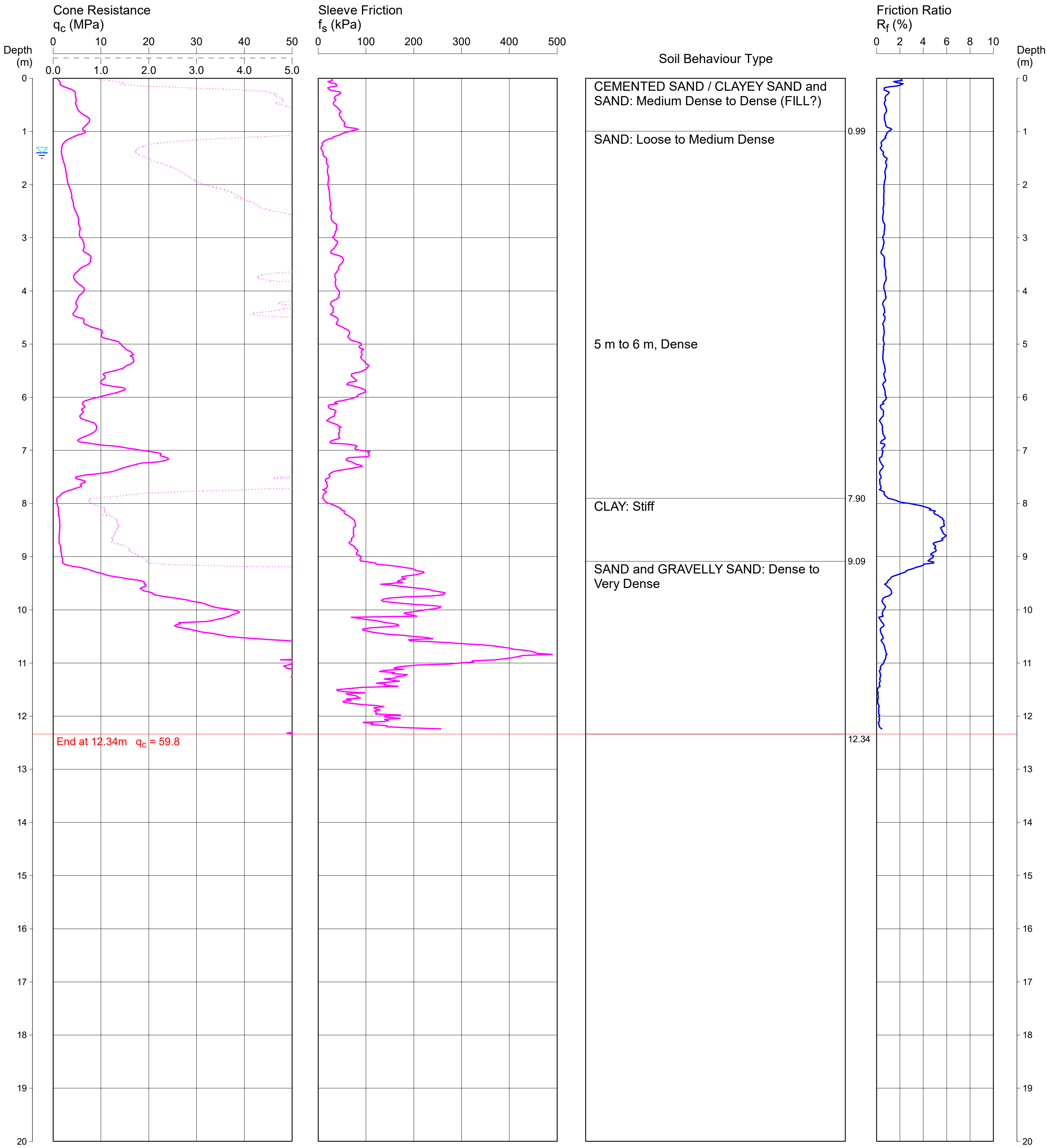
REDUCED LEVEL: 3.9

COORDINATES: 383822.5E 6355565.9N AHD

CPT107

DATE 13/07/2022

PROJECT No: 213618.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE BENDING IN VERY DENSE SANDS
GROUNDWATER LEVEL OBSERVED AT 1.4M AFTER WITHDRAWAL OF RODS

Water depth after test: 1.40m depth (measured)

File: P:\213618.01 - HAMILTON SOUTH, Newcastle High Drilling\4.0 Field Work\CPT Logs\CPT107.CP5

Cone ID: 170705 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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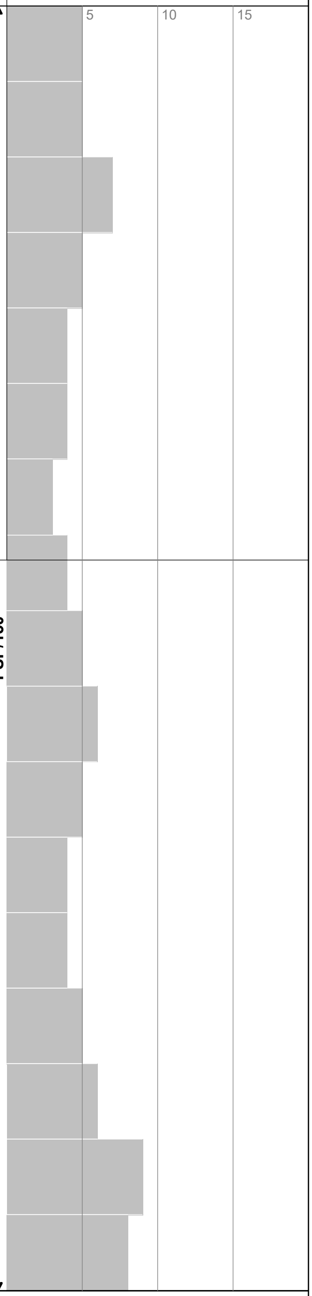
BOREHOLE LOG

CLIENT: School Infrastructure NSW		**SURFACE LEVEL:** 3.2 AHD	**LOCATION ID:** 1a
PROJECT: Newcastle High School Upgrade		**COORDINATE E:**383998 **N:** 6355595.5	**PROJECT No:** 213618.01
LOCATION: 160-200 Parkway Avenue, Hamilton South		**DATUM/GRID:** MGA94 Zone 56	**DATE:** 08/07/22
		DIP/AZIMUTH: 90°/---	**SHEET:** 1 of 1

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING AND REMARKS**

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL (DEPTH (m))	TEST TYPE	RESULTS AND REMARKS
		0.0	FILL/ (ML) Sandy SILT; dark brown; silt fraction fine; sand fraction fine to medium; trace rootlets and organics		FILL	NA	<PL		D	0.0–0.1	PSP/150	
	3	0.15	FILL/ (GP) Sandy GRAVEL; dark brown black; gravel fraction fine to medium; sand fraction fine to coarse; with white inclusions, slag with coal		FILL	NA	M		D	0.15–0.25		
		0.25	(SP) SAND, with silt; grey brown		ALV	MD	M		D	0.3–0.4		
		0.5	(SP) SAND; pale grey		ALV	MD	M to W		D	0.6–0.8		
		0.85	(SP) SAND, with silt, trace gravel; pale brown; gravel fraction fine to medium, sub-rounded 0.95-1.1m: brown		ALV	MD	M to W		D	0.9–1.1		
	2	1.1	Borehole discontinued at 1.10m depth partial bore collapse from 0.7m									



NOTES: (#)Soil origin is "probable" unless stated otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Push Tube Rig	**OPERATOR:** Chaplin	**LOGGED:** Chaplin
METHOD: PT to 1.1m	**CASING:**	

REMARKS: Groundwater likely between 0.5m and 0.8m depth

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: 160-200 Parkway Avenue, Hamilton South

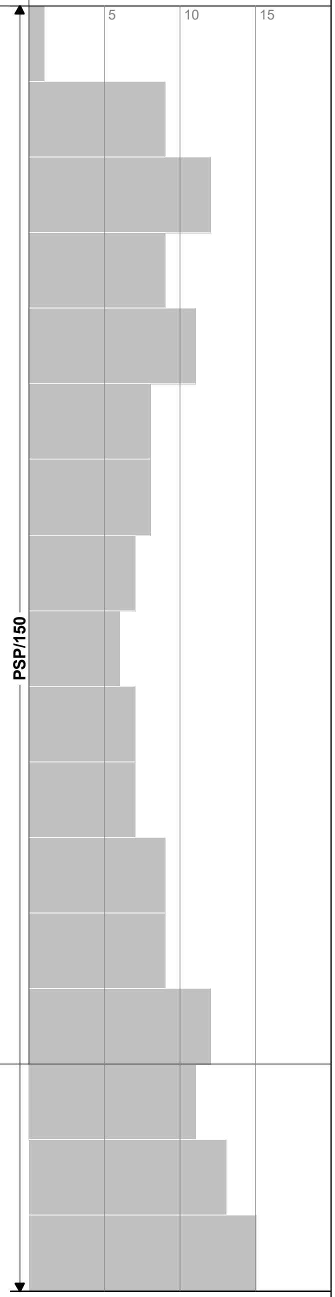
SURFACE LEVEL: 4.1 AHD
COORDINATE E:383845 **N:** 6355630
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 5a
PROJECT No: 213618.01
DATE: 08/07/22
SHEET: 1 of 1

DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	SAMPLE TYPE	SAMPLE DEPTH (m)
0.0	FILL/ (ML) Sandy SILT; dark brown; low plasticity; trace rootlets and organics	FILL	NA	<PL		
0.1	FILL/ (ML) Sandy SILT; dark brown; silt fraction low plasticity; sand fraction fine to medium 0.2-0.3m: with concrete rubble	FILL	NA	<PL to =PL		
0.3	(SP) SAND, with silt; grey; fine to medium 0.35-0.4m: with fine gravel (SR)	ALV	D	M	D	0.5–0.6
0.7	(SP) SAND; pale grey; fine to medium	ALV	MD	M		
0.9	(SP) SAND, with silt; brown; fine to medium	ALV	MD	M	D	0.9–1.0
1.0	(SP) SAND; grey; fine to medium 1.2-1.3m: with fine to medium gravel (SR)	ALV	MD	M	D	1.2–1.3
1.3	(SP) SAND, with clay; brown dark brown; sand fraction fine to medium; clay fraction fine to medium, sub-rounded	ALV	MD	M		
1.5	(SP) SAND; pale grey yellow; fine to medium	ALV	MD	M to W	D	1.9–2.1
2.1	Borehole discontinued at 2.10m depth Virtual refusal due to hole collapse at 2.1m					

RL (m): 4, 3, 2

TESTING AND REMARKS — TEST TYPE: PSP/150



NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: PTR
METHOD: PT to 2.1m
REMARKS:

OPERATOR: Chaplin
CASING:

LOGGED: Chaplin

EXPORTED 27/07/22 11:32. TEMPLATE ID: DP_101.02.00_SOILLOG

Refer to explanatory notes for symbol and abbreviation definitions

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: 160-200 Parkway Avenue, Hamilton South

SURFACE LEVEL: 4 AHD
COORDINATE **E:**383821.8 **N:** 6355566.4
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 107a
PROJECT No: 213618.01
DATE: 08/07/22
SHEET: 1 of 1

CONDITIONS ENCOUNTERED

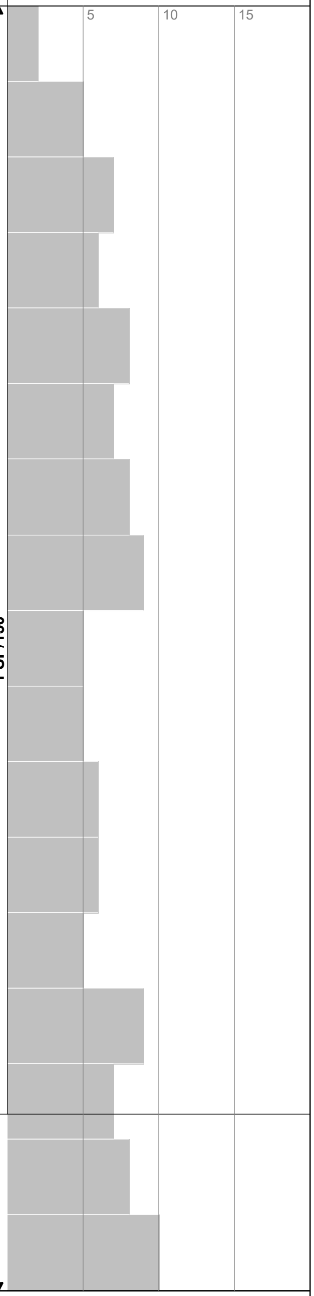
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE
No free groundwater observed		0.0	FILL/ (ML) Sandy SILT; dark brown; silt fraction fine; sand fraction fine to medium; with trace rootlets and organics		FILL	NA	<PL
		0.15	(SP) SAND, with silt; grey; fine to medium		ALV	MD	M
		0.5	(SP) SAND; pale grey; fine to medium		ALV	MD	M
	3	0.8	(SP) SAND, with silt, trace gravel; dark brown; sand fraction fine to medium; gravel fraction fine to medium, sub-rounded		ALV	MD	M
		1.1	(SP) SAND; pale grey; fine to medium		ALV	MD	M
		1.2	(SP) SAND, with silt, trace gravel; grey; sand fraction fine to medium; gravel fraction fine to medium, sub-rounded		ALV	MD	M to W
	2	1.4	(SP) SAND; pale grey yellow; fine to medium 1.8-2.2m: pale grey		ALV	MD	M to W
		2.2	Borehole discontinued at 2.20m depth Virtual refusal due to hole collapse at 1.2m				

SAMPLE

REMARKS	TYPE	INTERVAL / DEPTH (m)
	D	0.0–0.1
	D	0.3–0.4
	D	0.6–0.7
	D	0.9–1.0
	D	1.3–1.4
	D	1.5–1.6
	D	2.0–2.2

TESTING AND REMARKS

TEST TYPE	RESULTS AND REMARKS
PSP/150 (0.0–2.7)	



NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: PTR
METHOD: PT to 2.2m
REMARKS: Groundwater likely between 1.2m and 1.4m depth

OPERATOR: Butcher
CASING:

LOGGED: Chaplin

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Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: 160-200 Parkway Avenue, Hamilton South

SURFACE LEVEL: 4 AHD
COORDINATE E:383791 **N:** 6355598
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 4
PROJECT No: 213618.01
DATE: 06/07/22
SHEET: 2 of 7

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
1.5			Silty CLAY; medium plasticity *(continued)*														
	-7	11													11		
	-8	12													12		
	-9	13													13		
		13.5	Clayey SAND; fine to medium														
	-10	14													14		
		14.75	Silty CLAY; dark grey														
	-11	15													15		
	-12	16													16		
	-13	17													17		
	-14	18													18		
	-15	19													19		

NOTES: [#]Soil origin is "probable" unless otherwise stated.

PLANT: Hanjin 114
OPERATOR: Total Drilling
LOGGED: Millard
METHOD: SFA to 2.5m, then PD to 33.3m, then HQ core to 62.0m
CASING: PQ to 2.5m, HWT to 36.2m
REMARKS: Soil description and depths are based on drillers logs. Information on soil should be obtained fron nearby Cone Penetration Tests (CPT)

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: 160-200 Parkway Avenue, Hamilton South

SURFACE LEVEL: 4 AHD
COORDINATE E:383791 **N:** 6355598
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 4
PROJECT No: 213618.01
DATE: 06/07/22
SHEET: 3 of 7

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	SOIL STRENGTH (where encountered) / SOIL MOISTURE	GRAPHIC	WEATH. (RS XW HW MW DW SW FS FR)	DEPTH (m)	STRENGTH (VL L M H VH EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m) (0.01 0.05 0.10 0.50 1.00 5.00)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
1.5			Silty CLAY; dark grey *(continued)*															
	-17	21														21		
	-18	22														22		
	-19	23														23		
	-20	24														24		
	-21	25														25		
	-22	26														26		
	-23	27														27		
	-24	28														28		
	-25	29														29		

NOTES: [#]Soil origin is "probable" unless otherwise stated.

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PLANT: Hanjin 114
OPERATOR: Total Drilling
LOGGED: Millard
METHOD: SFA to 2.5m, then PD to 33.3m, then HQ core to 62.0m
CASING: PQ to 2.5m, HWT to 36.2m
REMARKS: Soil description and depths are based on drillers logs. Information on soil should be obtained fron nearby Cone Penetration Tests (CPT)

Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: 160-200 Parkway Avenue, Hamilton South

SURFACE LEVEL: 4 AHD
COORDINATE E:383791 **N:** 6355598
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 4
PROJECT No: 213618.01
DATE: 06/07/22
SHEET: 4 of 7

RL (m)	Depth (m)	Description of Strata	Weathering	Strength	Recovery (%)	RQD	Defects & Remarks
		Silty CLAY; dark grey *(continued)*					
-29.3	33.3	CST SST; pale brown grey	MW-HW	M-H	13	5	33.3-33.45m: fragmented
-29.45	33.45	CORE LOSS 33.45-35.92m: possible pebbly sandstone/conglomerate					
-31.92	35.92	SILTSTONE; grey	HW (35.92-36.15); FR (36.15-37.41); SW (37.41-38.8); FR (38.8-)	VL-L (35.92-36.15); L (36.15-36.52); M (36.52-37.16); L (37.16-37.22); M (37.22-)	100 / 100 / 100	0 / 51 / 71	36.15-36.23m: fragmented 36.62-36.7m: DB 37.16-37.22m: fragmented 37.41-37.51m: PT SH PL, SM 37.63-37.69m: fragmented 37.94-37.97m: fragmented 38.64m: J 45° PL, SM 38.8-38.84m: fragmented 39.0-39.37m: J SV PL, RO, <1mm, trace calcite 39.2-39.32m: PT x6 SH PL, RO 39.8-39.82m: fragmented

Groundwater: 1.5

NOTES: [#]Soil origin is "probable" unless otherwise stated.

PLANT: Hanjin 114
OPERATOR: Total Drilling
LOGGED: Millard
METHOD: SFA to 2.5m, then PD to 33.3m, then HQ core to 62.0m
CASING: PQ to 2.5m, HWT to 36.2m
REMARKS: Soil description and depths are based on drillers logs. Information on soil should be obtained fron nearby Cone Penetration Tests (CPT)

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: 160-200 Parkway Avenue, Hamilton South

SURFACE LEVEL: 4 AHD
COORDINATE E:383791 **N:** 6355598
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 4
PROJECT No: 213618.01
DATE: 06/07/22

CONDITIONS ENCOUNTERED											SAMPLE				TESTING	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH. (RS XW HW MW SW FS FR; DW)	DEPTH (m)	STRENGTH (VL L M H VH EH)	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE / RESULTS AND REMARKS
1.5			SILTSTONE; grey *(continued)*		FR		M									
	-37	41						100	71						41	
											41.6-41.64m: J x3 60° PL, SM					
											41.84-41.85m: fragmented					
	-38	42													42	
			42.36-42.45m: lenticular bedding 42.36-42.68m: pale grey			42.36	H									
	-39	43			FR			100	92						43	
	-40	44													44	
	-41	45													45	
	-42	46				46.15	H				46.09-46.12m: fragmented 46.15m: J 60° PL, FE				46	
20% water loss from 46.5m to 55.58m depth					FS			100	89							
	-43	47				47.09					47.09m: J 20° IR, RO, FE				47	
	-44	48			FR										48	
	-45	49						100	79						49	

NOTES: [(#)]Soil origin is "probable" unless otherwise stated.

PLANT: Hanjin 114
OPERATOR: Total Drilling
LOGGED: Millard
METHOD: SFA to 2.5m, then PD to 33.3m, then HQ core to 62.0m
CASING: PQ to 2.5m, HWT to 36.2m
REMARKS: Soil description and depths are based on drillers logs. Information on soil should be obtained fron nearby Cone Penetration Tests (CPT)

Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: 160-200 Parkway Avenue, Hamilton South

SURFACE LEVEL: 4 AHD
COORDINATE E:383791 **N:** 6355598
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 4
PROJECT No: 213618.01
DATE: 06/07/22
SHEET: 6 of 7

CONDITIONS ENCOUNTERED | **SAMPLE** | **TESTING**

RL (m)	Depth (m)	Description of Strata	Graphic	Weath.	Depth (m)	Strength	Recovery (%)	RQD
		SILTSTONE; grey *(continued)*	Siltstone	FR		H	100 / 100	79 / 72
-49	52.89–53.16			FS	52.89, 53.16	H	100	69
				FR		H	100	54
-51	54.92–55.22			FS	54.92, 55.22	H		
	55.58	COAL; black; (borehole seam)	Coal	FR	55.58	L	100	47
					56.16	M		
					56.47	L		
					56.75	M		
					57.13	L		
	57.55	CORE LOSS; (weak coal - possible crush zone)			57.55		52	0
	58.15	COAL; black	Coal	FR	58.15	L		
					58.39	M		
					58.65	L		
					58.85	M		
					59.0	L		
					59.25	M	100	81

RL/Depth scale: -47 / 51; -48 / 52; -49 / 53; -50 / 54; -51 / 55; -52 / 56; -53 / 57; -54 / 58; -55 / 59

Groundwater: 1.5; ▶ 55.58 — intermittent water loss 50-100% los from 55.58m to 60.25m depth

Defects & Remarks:
- 50.34-50.56m: J 60°-70° UN, RO
- 50.71-50.77m: clay seam
- **46.5-55.58: 20% water loss**
- 52.4-52.74m: J 80° PL, SM
- 52.74-52.89m: fragmented
- 52.89-53.16m: J SV IR, SM, FE
- 53.38-53.52m: J 80° PL, SM
- 53.62-53.68m: J 80° PL, SM
- 54.92-55.22m: J SV IR, SM, FE
- 55.43-55.58m: fragmented
- 55.58-56.16m: fragmented
- 56.47-56.75m: fragmented
- 59.75-54.92m: J SV PL, SM
- 57.13-57.55m: fragmented
- **55.58-60.25: intermittent water loss, 50-100% loss**
- 58.15-58.39m: fragmented
- 58.65-58.85m: fragmented
- 59.0-59.25m: fragmented
- 59.4-59.9m: J/2 SV PL, RO

NOTES: [(#)]Soil origin is "probable" unless otherwise stated.

PLANT: Hanjin 114
OPERATOR: Total Drilling
LOGGED: Millard
METHOD: SFA to 2.5m, then PD to 33.3m, then HQ core to 62.0m
CASING: PQ to 2.5m, HWT to 36.2m
REMARKS: Soil description and depths are based on drillers logs. Information on soil should be obtained fron nearby Cone Penetration Tests (CPT)

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: 160-200 Parkway Avenue, Hamilton South

SURFACE LEVEL: 4 AHD
COORDINATE E:383791 **N:** 6355598
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 4
PROJECT No: 213618.01
DATE: 06/07/22
SHEET: 7 of 7

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
1.5			COAL; black *(continued)*			60.0	L			60.0-60.25m: fragmented						
		60.25	SILTSTONE; grey			60.25	L			60.25-60.55m: J SV PL, SM 60.55-60.58m: fragmented						
	-57	60.63	SANDSTONE; pale grey; fine to medium		FR	60.63	H	100	81					61		
	-58	62.0	Borehole discontinued at 62.00m depth			62.0								62		

NOTES: [#]Soil origin is "probable" unless otherwise stated.

PLANT: Hanjin 114
OPERATOR: Total Drilling
LOGGED: Millard
METHOD: SFA to 2.5m, then PD to 33.3m, then HQ core to 62.0m
CASING: PQ to 2.5m, HWT to 36.2m
REMARKS: Soil description and depths are based on drillers logs. Information on soil should be obtained fron nearby Cone Penetration Tests (CPT)

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.1 AHD
COORDINATE E:384063.3 **N:** 6355617.1
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 201A
PROJECT No: 213618.02
DATE: 30/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	2	0.0	FILL/ (SP) Silty SAND, with gravels; grey brown grey; sand fraction fine to medium; gravels fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace rootlets, glass, tape, ceramic, plastic, slag, coal 0.4m: brown		FILL	NA	D		D E		0.0 0.05	PID	<1
									D E		0.25	PID	<1
									D E		0.5	PID	<1
		0.6	FILL/ (SP) SAND, trace gravel; intermixed brown grey pale grey; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded; trace coal, shells, slag 0.9m: fine to coarse sub-angular to sub-rounded gravels		FILL		M						
		1							D E		1.0	PID	<1
	1	1.1	Test pit discontinued at 1.10m depth Hand refusal on gravels										
	0	2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel to 0.3m Hand auger to 1.1m
METHOD:
REMARKS: D1/30.11.22 at 0.5m

OPERATOR: Kramer
LOGGED: Kramer

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Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.3 AHD
COORDINATE E:383968.0 **N:** 6355688.9
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 202A
PROJECT No: 213618.02
DATE: 30/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) SAND; brown; fine to medium; trace rootlets, fine sub-angular to sub-rounded gravels (crushed natural rock)		FILL	NA	D		D E		0.0 0.05	PID	<1
	2	0.2	FILL/ (SP) Silty SAND; dark grey; fine to medium; trace glass, ceramic, coal, brick fragments, slag		FILL		M		D E		0.25	PID	<1
									D E		0.5	PID	<1
		0.7	FILL/ (SP) SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded		FILL		M		D E		0.72	PID	<1
		0.75	Test pit discontinued at 0.75m depth Hand refusal on gravels										
	1	1									1		
	0	2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel to 0.3m Hand auger to 0.75m
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

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Refer to explanatory notes for symbol and abbreviation definitions

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.1 AHD
COORDINATE E:383922.4 **N:** 6355610.1
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 203A
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	2	0.0	FILL/ (SP) Silty SAND; brown; fine to medium; trace roots / rootlets, plastic		FILL	NA	D to M		D E		0.0 0.05	PID	<1
		0.2	FILL/ (SP) Gravelly SAND; brown pale brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to subrounded (crushed natural rock)		FILL		D		D E		0.25	PID	<1
		0.3	(SP) SAND; pale grey; fine to medium		ALV		D to M		D E		0.5	PID	<1
		0.8	Borehole discontinued at 0.80m depth Limit of investigation										
	1	1									1		
	0	2									2		

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD:
REMARKS:

OPERATOR: Kramer
CASING:

LOGGED: Kramer

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Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.0 AHD
COORDINATE E:383944.9 **N:** 6355699.7
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 204
PROJECT No: 213618.02
DATE: 11/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) SAND; brown grey; fine to medium; trace fine to medium grained, subangular to subrounded gravel (crushed natural rock), glass, dry 0.4m: fine to medium subangular to subrounded gravels (crushed natural rock)		FILL	NA	D to M		D, E		0.05	PID	<1
									D, E		0.25	PID	<1
									D, E		0.5	PID	<1
		0.7	FILL/ (SP) Silty SAND; dark brown; fine to medium; trace fine to medium subangular to subrounded gravels (crushed natural rock), ceramic, slag, coal reject, brick fragments, dry		FILL				D, E		0.8	PID	<1
	2	0.95	Borehole discontinued at 0.95m depth Hand refusal on cobbles										

RL (m) scale: 2, 1, 0. Depth (m) scale: 1, 2.

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Hand Auger to 0.95m
REMARKS: Co-ordinates by hand held GPS. Approximate surface level based on interpolation from survey plan

OPERATOR: Kramer
CASING: Uncased
LOGGED: Kramer

Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.2 AHD
COORDINATE E:383930.1 **N:** 6355710.6
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 205
PROJECT No: 213618.02
DATE: 11/11/22
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	3	0.0	FILL/ (SP) SAND; brown; fine to medium; with silt, trace fine to medium subangular to subrounded gravels (crushed natural rock), glass, slag, ash, brick fragments, dry 0.3m: fine to medium subangular to subrounded gravels (crushed natural rock)		FILL	NA	D to M		D E		0.05	PID	<1
									D E		0.25	PID	<1
									D E		0.5	PID	<1
		0.6	Borehole discontinued at 0.60m depth Hand refusal on gravels										
	2	1									1		
	1	2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Hand Auger to 0.6m
REMARKS: Co-ordinates by hand held GPS. Approximate surface level based on interpolation from survey plan

OPERATOR: Kramer
CASING: Uncased

LOGGED: Kramer

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.6 AHD
COORDINATE E:383907.7 **N:** 6355729.6
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 206
PROJECT No: 213618.02
DATE: 11/11/22
SHEET: 1 of 1

GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	0.0	FILL/ (SP) SAND; grey brown; fine to medium; trace fine to medium subangular to subrounded gravels (crushed natural rock), ash, rootlets, dry	FILL	NA	D		D, E	0.05	PID	<1
	0.3	(SP) SAND; grey; fine to medium; trace rootlets, dry	ALV				D, E	0.5	PID	<1
	0.65	(SP) Silty SAND; brown to dark brown; fine to medium; dry (possible indurated sand)	ALV				D, E	0.7	PID	<1
	0.95	(SP) SAND; pale brown; fine to medium; dry	ALV				D, E	1.0	PID	<1
	1.0	Borehole discontinued at 1.00m depth Limit of investigation								

RL (m): 3, 2, 1; DEPTH (m): 2

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Hand Auger to 1.0m
OPERATOR: Kramer
CASING: Uncased
LOGGED: Kramer
REMARKS: Co-ordinates by hand held GPS. Approximate surface level based on interpolation from survey plan

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.6 AHD
COORDINATE E:383907.4 **N:** 6355729.8
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 206A
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) SAND, trace gravel; grey brown; sand fraction fine to medium; gravel fraction fine to medium; ash, rootlets, dry to moist		FILL	NA	D to M		D E		0.0 0.05	PID	<1
	3	0.4	(SP) SAND; grey; fine to medium; trace rootlets		ALV		D		D E		0.5	PID	<1
		0.7	(SP) SAND; brown; fine to medium		ALV		D		D E		0.7	PID	<1
		0.9	Test pit discontinued at 0.90m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless stated otherwise. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.4 AHD
COORDINATE E:383855.8 **N:** 6355704.8
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 207
PROJECT No: 213618.02
DATE: 11/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) SAND; brown to grey; fine to medium; trace fine to coarse subangular to subrounded gravels (crushed natural rock), rootlets, coal reject, roots, dry		FILL	NA	D		D, E		0.05	PID	<1
	3								D, E		0.25	PID	<1
									D, E		0.5	PID	<1
		1							D, E		1.0	PID	<1
		1.05	(SP) SAND; brown; fine to medium; dry		ALV				D, E		1.3	PID	<1
	2	1.45	Borehole discontinued at 1.45m depth Limit of investigation										
	1	2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Hand Auger to 1.45m
REMARKS: Co-ordinates by hand held GPS. Approximate surface level based on interpolation from survey plan

OPERATOR: Kramer
CASING: Uncased
LOGGED: Kramer

Refer to explanatory notes for symbol and abbreviation definitions

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.7 AHD
COORDINATE E: 383885.2 **N:** 6355697.1
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 208
PROJECT No: 213618.02
DATE: 11/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) SAND; brown; fine to medium; with silt, trace fine to medium subangular to subrounded gravels (crushed natural rock), plastic, ash, dry		FILL	NA	D		D, E		0.05	PID	<1
									D, E		0.2	PID	<1
		0.25	(SP) SAND; pale grey; fine to medium; dry to moist		ALV	NA	M		D, E		0.5	PID	<1
	3	0.75	Borehole discontinued at 0.75m depth Limit of investigation										
		1									1		
	2												
		2									2		
	1												

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Hand Auger to 0.75m
REMARKS: Co-ordinates by hand held GPS. Approximate surface level based on interpolation from survey plan

OPERATOR: Kramer
CASING: Uncased

LOGGED: Kramer

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Refer to explanatory notes for symbol and abbreviation definitions

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 4.0 AHD
COORDINATE E:383812.0 **N:** 6355647.1
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 209
PROJECT No: 213618.02
DATE: 11/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) SAND; grey; fine to medium; with fine to coarse subangular to subrounded gravel (crushed natural rock), trace glass, sandstone cobbles, coal reject, dry 0.2-0.3m: fibro fragment observed		FILL	NA	M		D E		0.05	PID	<1
									D E		0.25	PID	<1
		0.3	FILL/ (SP) Gravelly SAND, with gravel; grey brown; sand fraction fine to medium; gravel fraction fine to medium, subangular to subrounded; crushed natural rock, dry		FILL				D E		0.35	PID	<1
		0.4			FILL				D E		0.45	PID	<1
		0.5	FILL/ (SP) SAND; brown; fine to medium; trace fine to medium subangular to subrounded gravels (crushed natural rock), dry										
			(SP) SAND; pale grey; fine to medium; dry to moist		ALV				D E		0.7	PID	<1
		0.85	(SP) SAND; dark brown; fine to medium; dry to moist (indurated sand)		ALV								
	3	1.0	Borehole discontinued at 1.00m depth Limit of investigation						D E		1.0	PID	<1
	2	2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Hand Auger to 1.0m
OPERATOR: Kramer
CASING:
LOGGED: Kramer
REMARKS: Co-ordinates by hand held GPS. Approximate surface level based on interpolation from survey plan

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Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 4.0 AHD
COORDINATE E:383810.8 **N:** 6355648.0
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 209A
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	
No free groundwater observed	4 / 0.0	FILL/ (SP) SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace rootlets, ash		FILL	NA	D		D, E, B, D, E		0.0, 0.05, 0.25	PID, PID	<1, <1	
	0.35	FILL/ (SP) Gravelly SAND; brown pale brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock)		FILL		D		D, E		0.35, 0.4	PID, PID	<1, <1	
	0.45	(SP) SAND; pale grey; fine to medium		ALV		D to M							
	0.65	Test pit discontinued at 0.65m depth Limit of investigation											
	3 / 1									1			
	2 / 2									2			

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel
OPERATOR:
LOGGED: Kramer
METHOD:
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 4.1 AHD
COORDINATE E:383813.1 **N:** 6355646.8
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 209B
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	4	0.0	FILL/ (SP) SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets, brick, plastic		FILL	NA	D		D, E, B	0.0, 0.05	PID	<1
									D, E	0.2	PID	<1
		0.25	FILL/ (SP) SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace brick, slag		FILL		D			0.25	PID	<1
									B, D, E	0.5	PID	<1
		0.6	(SP) SAND; pale grey; fine to medium; trace rootlets		ALV		D			0.6	PID	<1
		0.7	Test pit discontinued at 0.70m depth Limit of investigation									
	3	1								1		
	2	2								2		

NOTES: (#)Soil origin is "probable" unless stated otherwise. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS: D1/20.12.22 @ 0.2m

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.9 AHD
COORDINATE E:383810.1 **N:** 6355646.7
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 209C
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets		FILL	NA	D		D, E	0.0, 0.05	PID	<1
		0.1	FILL/ (SP) SAND, with silt; brown; fine to medium; trace metal, glass, plastic, fine to medium sub-angular to sub-rounded gravels (crushed natural rock)		FILL		D		B, D, E	0.2, 0.25	PID, PID	<1, <1
		0.25	FILL/ (SP) SAND, trace gravel; brown dark brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock)		FILL		D		D, E	0.5	PID	<1
		0.65	(SP) SAND; pale grey; fine to medium		ALV		D to M		D	0.7	PID	<1
		0.8	(SP) SAND; dark brown; fine to medium		ALV		D to M					
		0.85	Test pit discontinued at 0.85m depth Limit of investigation									

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

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Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 4.0 AHD
COORDINATE E:383809.5 **N:** 6355649.2
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 209D
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND, trace gravel; brown grey; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); rootlets		FILL	NA	D to M		D, E, B, D, E		0.0, 0.05, 0.25, 0.3	PID, PID, PID	<1, <1, <1
		0.3	(SP) SAND; brown; fine to medium; trace rootlets 0.5m: pale grey		ALV		D		D, E		0.5	PID	<1
		0.6	Test pit discontinued at 0.60m depth Limit of investigation										
	3	1									1		
	2	2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.9 AHD
COORDINATE E:383812.4 **N:** 6355649.9
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 209E
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN	CONSIS./DENSITY	MOISTURE	SAMPLE TYPE	SAMPLE DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	0.0	FILL/ (SP) Silty SAND, trace gravel; brown grey; sand fraction fine to medium; gravel fraction fine to coarse sub-angular, sub-rounded, angular (crushed natural rock); rootlets, asphalt, brick fragments	FILL	NA	D	D, E	0.0–0.05	PID	<1
						D, E, B	0.2	PID	<1
	0.25	FILL/ (SP) SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace slag and ash	FILL		M	D, E	0.5	PID	<1
	0.55	(SP) SAND; pale brown; fine to medium	ALV		D	D	0.7	PID	<1
	0.75	Test pit discontinued at 0.75m depth Limit of investigation							

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

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Refer to explanatory notes for symbol and abbreviation definitions

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 4.0 AHD
COORDINATE E:383909.5 **N:** 6355620.0
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 210
PROJECT No: 213618.02
DATE: 11/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (GP) Sandy GRAVEL; fine, sub-angular to sub-rounded; with fine to medium grained sand, dry (crusher dust)		FILL	NA	D		D E		0.05	PID	<1
		0.07	0.07m: black hessian dividing layer										
			FILL/ (SP) Silty SAND; brown grey; fine to medium; trace fine to medium subangular to subrounded gravels (crushed natural rock), ash, dry		FILL				D E		0.25	PID	<1
		0.3	(SP) SAND; grey; fine to medium; trace rootlets, dry		ALV								
			0.5m: pale grey, dry to moist						D E		0.5	PID	<1
		0.75	Borehole discontinued at 0.75m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Hand Auger to 0.75m
REMARKS: Co-ordinates by hand held GPS. Approximate surface level based on interpolation from survey plan

OPERATOR: Kramer
CASING: Uncased
LOGGED: Kramer

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.7 AHD
COORDINATE E:383929.6 **N:** 6355659.2
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 211
PROJECT No: 213618.02
DATE: 11/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] DENSITY.[*]	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) SAND; brown grey; fine to medium; with silt, trace slag, ash, brick fragments, fine to medium subangular to subrounded gravels (crushed natural rock), sandstone cobble, dry		FILL	NA	D		D, E		0.05	PID	<1
									D, E		0.25	PID	<1
		0.4	(SP) SAND; grey; fine to medium; trace rootlets, dry 0.6m: pale grey		ALV				D, E		0.5	PID	<1
	3	0.9	Borehole discontinued at 0.90m depth Limit of investigation										
		1									1		
	2	2									2		
	1												

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Hand Auger to 0.9m
OPERATOR: Kramer
CASING: Uncased
LOGGED: Kramer
REMARKS: Co-ordinates by hand held GPS. Approximate surface level based on interpolation from survey plan

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 8.2 AHD
COORDINATE E:383936.9 **N:** 6355670.8
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 212
PROJECT No: 213618.02
DATE: 11/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	8	0.0	FILL/ (SP) SAND; brown; fine to medium; with fine to coarse subangular to subrounded gravel (crushed natural rock), trace plastic, rootlets, cobbles, roots, dry		FILL	NA	D		D, E		0.05	PID	<1
									D, E		0.25	PID	<1
									D, E		0.5	PID	<1
	7, 6	0.6	Borehole discontinued at 0.60m depth Limit of investigation								1, 2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Hand Auger to 0.6m
OPERATOR: Kramer
CASING: Uncased
LOGGED: Kramer
REMARKS: Co-ordinates by hand held GPS. Approximate surface level based on interpolation from survey plan

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.7 AHD
COORDINATE E:383864.8 **N:** 6355643.5
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 213
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) SAND, with silt, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock)		FILL	NA	D		D / E		0.0 / 0.05	PID	<1
		0.1	FILL/ (SP) Gravelly SAND, with silt; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace brick		FILL		D		D / E		0.25	PID	<1
									D / E		0.5	PID	<1
	3	0.6	Borehole discontinued at 0.60m depth Hand refusal										
		1									1		
	2												
		2									2		
	1												

NOTES: (#)Soil origin is "probable" unless stated otherwise. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD:
REMARKS:

OPERATOR: Kramer
CASING:

LOGGED: Kramer

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Refer to explanatory notes for symbol and abbreviation definitions

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 4.0 AHD
COORDINATE E:383863.7 **N:** 6355620.9
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 214
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); abundant rootlets 0.1m: possible pavement		FILL	NA	D		D E		0.0 0.05	PID	<1
		0.1	Borehole discontinued at 0.10m depth Hand refusal										
	3	1									1		
	2	2									2		
	1												

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD:
REMARKS: Bore through garden bed

OPERATOR: Kramer
CASING:

LOGGED: Kramer

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.9 AHD
COORDINATE E:383864.6 **N:** 6355623.4
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 214A
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium, sub-angular to sub-rounded (crushed natural rock); abundant rootlets		FILL		M		D E		0.0 0.05	 PID	 <1
		0.1	Test pit discontinued at 0.10m depth Limit of investigation										
	3												

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD:
REMARKS:

OPERATOR: Kramer

LOGGED: Kramer

Refer to explanatory notes for symbol and abbreviation definitions

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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 4.0 AHD
COORDINATE E:383866.0 **N:** 6355621.3
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 214B
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	4	0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium, sub-angular to sub-rounded (crushed natural rock); abundant rootlets		FILL		M		D E		0.0 0.05	PID	<1
		0.1	Test pit discontinued at 0.10m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless stated otherwise. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.3 AHD
COORDINATE E:383989.8 **N:** 6355656.7
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 215
PROJECT No: 213618.02
DATE: 30/11/22
SHEET: 1 of 1

GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	SAMPLE TYPE	SAMPLE DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	0.0	FILL/ (SP) Silty SAND, with gravel; brown grey; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets, asphalt, glass, ceramic, metal	FILL	NA	D	D, E	0.0 - 0.05	PID	<1
						D, E	0.25	PID	<1
						D, E	0.5	PID	<1
	0.55	FILL/ (SP) SAND, trace gravel; pale grey pale brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock)	FILL		D	D, E	0.7	PID	<1
	0.8	FILL/ (SP) SAND, with silt; intermixed brown pale brown orange; fine to medium 1.1m: with fine to coarse sub-angular to sub-rounded gravels 1.2m: wet	FILL		M	D, E	1.0	PID	<1
	1.3	Test pit discontinued at 1.30m depth Hand refusal on gravels							

RL (m) scale: 2, 1, 0

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel to 0.3m Hand auger to 1.3m
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

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Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL:
COORDINATE E: N:
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 216
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.0 – 0.1	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium subangular to subrounded (crushed natural rock); (crushed natural rock), dry to moist		FILL				D E		0.0 0.05	PID	<1
			Test pit discontinued at 0.10m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
OPERATOR: Kennedy
LOGGED: Kramer
METHOD:
REMARKS:

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL:
COORDINATE E: N:
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 216A
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium, sub-angular to sub-rounded (crushed natural rock)		FILL		D to M		D E		0.0		
											0.05	PID	<1
		0.1	Test pit discontinued at 0.10m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL:
COORDINATE E: N:
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 217
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.0 – 0.1	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium subangular to subrounded; (crushed natural rock), dry to moist		FILL	NA	D to M		D E		0.0 0.05	PID	<1
			Test pit discontinued at 0.10m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
OPERATOR: Kennedy
LOGGED: Kramer
METHOD:
REMARKS:

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Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL:
COORDINATE E: N:
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 217A
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium, sub-angular to sub-rounded (crushed natural rock)		FILL		D to M		D E		0.0 0.05	PID	<1
		0.1	Test pit discontinued at 0.10m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL:
COORDINATE E: N:
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 218
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium subangular to subrounded; (crushed natural rock), dry to moist		FILL	NA	D to M		D		0.0		
									E		0.05	PID	<1
		0.15	Test pit discontinued at 0.15m depth Limit of investigation										
		1									1		
		2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
OPERATOR: Kennedy
LOGGED: Kramer
METHOD:
REMARKS:

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL:
COORDINATE E: N:
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 219
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium, sub-angular to sub-rounded (crushed natural rock)		FILL		D to M		D E		0.0		
		0.05	Test pit discontinued at 0.05m depth Limit of investigation								0.05	PID	<1

NOTES: (#)Soil origin is "probable" unless stated otherwise. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD:
REMARKS:

OPERATOR: Kramer
LOGGED: Kramer

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL:
COORDINATE E: N:
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 220
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium, sub-angular to sub-rounded (crushed natural rock)		FILL		D to M		D E		0.0		
		0.05	Test pit discontinued at 0.05m depth Limit of investigation								0.05	PID	<1

NOTES: (#)Soil origin is "probable" unless stated otherwise. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
OPERATOR: Kramer
LOGGED: Kramer
METHOD:
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.0 AHD
COORDINATE E:383938.6 **N:** 6355703.5
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 221
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	3	0.0	FILL/ (SP) Silty SAND; brown; fine to medium; with rootlets		FILL	NA	M		D	0.0		
									E	0.05	PID	<1
		0.06	FILL/ (GP) Sandy GRAVEL, with silt, with slag; brown; medium to coarse, angular to sub-angular, (crushed natural rock); trace brick fragments, glass shards, ceramic shards		FILL		M		D	0.1	PID	<1
		0.11	FILL/ (SP) Silty SAND, with gravel; brown dark brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace coal reject, slag (possibly coal tar asphalt), brick fragments		FILL		M		D, E	0.3	PID	<1
										0.5	PID	<1
								coal tar sample	D, E	0.6	PID	<1
										0.7	PID	<1
		0.75	Test pit discontinued at 0.75m depth Refusal on brick									
	2	1								1		
	1	2								2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Auger
OPERATOR: Kramer/Helbig
LOGGED: Kramer
METHOD:
REMARKS:

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.8 AHD
COORDINATE E:383951.7 **N:** 6355696.3
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 222
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); with rootlets		FILL	NA	M		D, E		0.0–0.1	PID	<1
		0.3	FILL/ (SP) SAND, with silt, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular (crushed natural rock); trace slag, concrete pieces, brick (half bricks and fragments), possible coal tar asphalt fragments		FILL		M		D, E		0.4	PID	<1
	2								D, E		0.8	PID	<1
		0.9	(SP) SAND; brown pale brown; fine to medium		ALV		M		D		1.0	PID	<1
		1.1	Test pit discontinued at 1.10m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel to 0.5m then hand auger to 1.1m
OPERATOR: Kramer/Helbig
LOGGED: Kramer
METHOD:
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 1.1 AHD
COORDINATE E:384002.6 **N:** 6355660.0
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 223
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	1	0.0	FILL/ (SP) Silty SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets		FILL	NA	M		D, E	0.0–0.05	PID	<1
		0.1	FILL/ (SP) SAND; brown; fine to medium; trace rootlets		FILL		M		D, E	0.15–0.2	PID	<1
		0.2	FILL/ (SP) Silty SAND; brown to dark brown; fine to medium; trace glass shards, brick fragments, ceramic shards, ash, slag, bolts, copper coil, plastic (hard)		FILL		M		D, E	0.2	PID	<1
									B	0.3	PID	<1
								D2/LAH	D, E	0.5	PID	<1
		0.6	Test pit discontinued at 0.60m depth Limit of investigation							0.6	PID	<1
	0	1								1		
	-1	2								2		

NOTES: (#)Soil origin is "probable" unless stated otherwise. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel to 0.6m
OPERATOR: Kramer/Helbig
LOGGED: Kramer
METHOD:
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 1.8 AHD
COORDINATE E:384022.4 **N:** 6355645.2
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 224
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE
No free groundwater observed		0.0	FILL/ (SP) Silty SAND; brown; fine to medium; trace rootlets, ceramic shards, slag, metal shards, glass shards, coal reject		FILL	NA	M
		0.65	FILL/ (SP) SAND; pale brown; fine to medium; trace rootlets		FILL		M
	1	1.0	FILL/ (SP) SAND, with clay, with gravel; dark brown dark grey; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock) 1.1m: From 1.1m, trace ceramic and ash		FILL		M / W
		1.2	Test pit discontinued at 1.20m depth Limit of investigation				
	0	2					
	-1						

SAMPLE TYPE	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
D, E, B	0.0–0.7		
D, E	0.05	PID	<1
D, E	0.5	PID	<1
	0.7	PID	<1
D, E	0.8	PID	<1
D, E	1.1	PID	<1

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Shovel to 0.65m then hand auger to 1.2m
OPERATOR: Kramer/Helbig
LOGGED: Kramer
METHOD:
REMARKS:

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.9 AHD
COORDINATE E:384047.2 **N:** 6355627.6
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 225
PROJECT No: 213618.02
DATE: 20/12/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN[#]	CONSIS.[*] / DENSITY.[*]	MOISTURE	REMARKS	TYPE	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
		0.0	FILL/ (SP) Silty SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace rootlets, slag, ash, ceramic shards, glass shards		FILL	NA	M		D, E	0.0–0.05	PID	<1
									B	0.0–0.6		
									D, E	0.5	PID	<1
										0.6	PID	<1
		0.6	FILL/ (SP) SAND; pale brown; fine to medium; trace rootlets, ash, ceramic shards		FILL		M		D, E	0.8	PID	<1
Free groundwater observed	2	1.0	FILL/ (SP) SAND, with clay, trace gravel; dark brown dark grey; sand fraction fine to medium; gravel fraction fine to medium sub-rounded (crushed natural rock); pockets of red brown low plasticity sandy clay 1.1m: trace glass		FILL		M / W	D3/LAH	D, E	1.05	PID	<1
		1.2	Test pit discontinued at 1.20m depth Limit of investigation									
	1	2								2		
	0											

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hand Tools
METHOD: Shovel to 0.6m then hand auger to 1.2m
REMARKS:

OPERATOR: Kramer/Helbig
LOGGED: Kramer

Refer to explanatory notes for symbol and abbreviation definitions

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.1 AHD
COORDINATE E:384041.4 **N:** 6355631.2
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 301
PROJECT No: 213618.02
DATE: 04/10/22
SHEET: 1 of 1

GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN	CONSIS./DENSITY	MOISTURE	SAMPLE TYPE	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	0.0	FILL/ (ML) SILT, trace sand; brown; silt fraction low plasticity; sand fraction fine to medium; trace rootlets, glass, slag, ash, ceramic, fine to coarse sub-angular to sub-rounded gravel	FILL	NA	W to <PL	D E	0.05	PID	<1
						D E	0.3	PID	<1
						D E	0.5	PID	<1
	0.6	FILL/ (SP) SAND, with silt, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium, sub-angular to sub-rounded; trace ceramic	FILL	NA	M	D E	0.7	PID	<1
	0.8	(SP) SAND; pale brown; fine to medium	ALV		W	D E	1.0	PID	<1
	1.3	Borehole discontinued at 1.30m depth Limit of investigation							

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 300mm Auger
METHOD: 300mm auger to 1.3m
REMARKS:

OPERATOR: Kramer
CASING:

LOGGED: Kramer

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Refer to explanatory notes for symbol and abbreviation definitions

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BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.1 AHD
COORDINATE E:384012.6 **N:** 6355654.8
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 302
PROJECT No: 213618.02
DATE: 04/10/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN	CONSIS./DENSITY	MOISTURE	SAMPLE TYPE	SAMPLE DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	2	0.0	FILL/ (ML) SILT, trace sand; brown; silt fraction low plasticity; sand fraction fine to medium grain; trace rootlets, glass, slag, ash, ceramic, fine to coarse sub-angular to sub-rounded gravel	FILL	NA	W to <PL	D, E	0.05	PID	<1
							D, E	0.3	PID	<1
		0.4	FILL/ (SP) Silty SAND; brown; fine to medium; with fine to medium sub-angular to sub-rounded gravels (Cnr), slag gravels, trace ceramic, coal reject, and rootlets	FILL		D to M	D, E	0.5	PID	<1
		0.8	FILL/ (SP) SAND, with silt; grey; fine to medium; fine to medium sub-angular to sub-rounded gravels, trace ceramic, metal, wire and organics	FILL		M	D, E	1.0	PID	<1
	1	1.1	FILL/ (CL) Silty CLAY, with sand; grey; clay fraction low plasticity; sand fraction fine to medium grain; trace brick, rootlets	FILL		W to <PL	D, E	1.15	PID	<1
		1.2	FILL/ (SP) Silty SAND; grey, dark grey; fine to medium; with fine to medium ash gravels, fine to medium sub-angular to sub-rounded gravels (crushed natural rock), trace organics and coal rejects	FILL		M to W	D, E	1.3	PID	<1
		1.4	FILL/ (SP) SAND; grey; fine to medium; trace fine to medium sub-angular to sub-rounded gravels (crushed natural rock)	FILL		W	D, E	1.5	PID	<1
		1.6	FILL/ (ML) SILT; grey brown; low plasticity; trace rootlets	FILL		W to <PL	D	1.65	PID	<1
		1.7	FILL/ (SP) SAND, with silt; grey; fine to medium; organics, fine to medium sub-angular to sub-rounded gravels (crushed natural rock)), brick, rubber	FILL		W	D, E	1.8	PID	<1
	0	1.9	FILL/ (ML) Clayey SILT, trace gravel; grey; silt fraction low plasticity; gravel fraction fine to medium, sub-angular to sub-rounded; with organics 2.0m: several bones up to 100mm length	FILL		W to <PL	D, E	2.0	PID	<1
		2.1	Borehole discontinued at 2.10m depth Limit of machine							

NOTES: [#]Soil origin is "probable" unless stated otherwise. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 300mm Auger
METHOD: 300mm auger to 2.1m
REMARKS:

OPERATOR: Kramer
CASING:

LOGGED: Kramer

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Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.5 AHD
COORDINATE E:383964.9 **N:** 6355622.3
DATUM/GRID: MGA94 Zone 56
DIP/AZIMUTH: 90°/---

LOCATION ID: 303
PROJECT No: 213618.02
DATE: 04/10/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND; brown; fine to medium; trace rootlets, bricks, fine to medium sub-angular to sub-rounded gravels (crushed natural rock)		FILL	NA	M		D E		0.05	PID	<1
									D E		0.3	PID	<1
	3	0.5	FILL(?)/ (SP) SAND, with silt; grey; fine to medium; trace rootlets		possibly FILL		M to W		D E		0.5	PID	<1
									D E		0.6		
		0.65	FILL(?)/ (CH) CLAY; pale brown mottled grey; high plasticity; trace rootlets, fine rounded gravels (crushed natural rock)		possibly FILL		W to <PL		D E		1.0	PID	<1
		1.1	(SP) SAND, with silt; grey; fine to medium; trace rootlets		ALV		M		D E		1.2	PID	<1
	2	1.3	(SP) SAND; pale grey; fine to medium		ALV		M		D E		1.5	PID	<1
		1.7	Borehole discontinued at 1.70m depth Limit of investigation										
	1	2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

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PLANT: 5.5T Excavator with 300mm Auger
METHOD: 300mm auger to 1.7m
REMARKS:

OPERATOR: Kramer
CASING:

LOGGED: Kramer

Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.4 AHD
COORDINATE E:384044.3 **N:** 6355587.7
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 304
PROJECT No: 213618.02
DATE: 28/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND; brown; fine to medium; trace rootlets, roots, ceramic, glass		FILL	NA	D		D E		0.0 0.05	PID	<1
									D E		0.25	PID	<1
		0.3	FILL/ (CH) CLAY; grey mottled brown; high plasticity; trace rootlets, fine to medium sub-angular to sub-rounded gravels (crushed natural rock)		FILL		W <PL		D E		0.4	PID	<1
	2	0.5	(SP) SAND, with silt; grey; fine to medium 0.85m: pale grey		ALV		M		D E		0.7	PID	<1
		1.0	Test pit discontinued at 1.00m depth Limit of investigation								1		
	1												
		2									2		
	0												

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs
METHOD: 450mm bucket to 1.0m
REMARKS:

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.3 AHD
COORDINATE E:384023.0 **N:** 6355612.5
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 305
PROJECT No: 213618.02
DATE: 28/11/22
SHEET: 1 of 1

Groundwater	RL (m)	Depth (m)	Description of Strata	Origin	Consis./Density	Moisture	Sample Type	Sample Depth (m)	Test Type	Results and Remarks
Seepage at 1.2m, free groundwater observed at 2.8m		0.0	FILL/ (SP) Silty SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets, roots	FILL	NA	D	D E	0.0–0.05	PID	<1
	2	0.25	FILL/ (SP) Silty Gravelly SAND; dark grey brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets, fine to coarse slag gravels, ceramic, glass, ash	FILL		M	D E	0.3	PID	<1
		0.5	FILL/ (SP) Silty SAND; brown; fine to medium; trace brick, glass, metal, ceramic 0.6m: fibro fragment observed (305F)	FILL		M	D E	0.6	PID	<1
		0.65	FILL/ SAND; fine to medium	FILL			D E	1.0	PID	<1
	1	1.2	FILL/ SAND; intermixed pale brown grey; fine to medium; trace metal sheets / rods, trace glass, plastic	FILL		W	D E	1.5	PID	<1
		1.8	FILL/ SILT; dark grey; low plasticity; with organics	FILL		W >PL	D E	2.0	PID	<1
	0	2.1	FILL/ (SP) Silty SAND; grey; fine to medium	FILL		M to W	D E	2.5	PID	<1
							D E	3.0	PID	<1
	-1	3.15	Test pit discontinued at 3.15m depth Limit of machine							

NOTES: (#)Soil origin is "probable" unless stated otherwise. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs
METHOD: 450mm bucket to 3.15m
REMARKS: D1/28.11.22

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.3 AHD
COORDINATE E:384000.5 **N:** 6355629.8
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 306
PROJECT No: 213618.02
DATE: 28/11/22
SHEET: 1 of 1

Groundwater	RL (m)	Depth (m)	Description of Strata	Origin	Consis./Density	Moisture	Sample Type	Sample Depth (m)	Test Type	Results and Remarks
		0.0	FILL/ (SP) Silty SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets, roots, ceramic	FILL	NA	D	D E	0.0 – 0.05	PID	<1
	2	0.3	FILL/ (SP) Silty Gravelly SAND; dark grey brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets, fine to coarse slag gravels, ceramic, glass, ash	FILL		M	D E	0.4	PID	<1
		0.5	SAND; pale brown; fine to medium			M	D E	0.6	PID	<1
		0.7	SAND, trace gravel; intermixed pale brown grey; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); with rusted metal, trace glass, sandstone cobbles			M	D E	1.0	PID	<1
		1.1	FILL/ Clayey SAND; dark grey; trace metal / gravels, fine to medium sub-angular to sub-rounded (crushed natural rock)	FILL		M	D E	1.2	PID	<1
Free groundwater observed	1	1.3	FILL/ Sandy Clayey GRAVEL; dark grey; gravel fraction fine to medium, sub-angular to sub-rounded, (crushed natural rock); sand fraction fine to medium	FILL		W	D E	1.4	PID	<1
		1.5	FILL/ Clayey SAND; grey; fine to medium; trace rootlets	FILL		W	D E	1.6	PID	<1
							D E	2.0	PID	<1
	0	2.1	FILL/ (CL) Silty CLAY; dark grey; low plasticity; trace rootlets	FILL		W >PL	D E	2.2	PID	<1
		2.3	Test pit discontinued at 2.30m depth Pit collapse							

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
METHOD: 450mm bucket to 2.3m
REMARKS:

OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 2.5 AHD
COORDINATE E:383985.5 **N:** 6355642.7
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 307
PROJECT No: 213618.02
DATE: 28/11/22
SHEET: 1 of 1

Groundwater	RL (m)	Depth (m)	Description of Strata	Origin	Consis./Density	Moisture	Sample Type	Sample Depth (m)	Test Type	Results and Remarks
		0.0	FILL/ (SP) Silty SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets, gravel	FILL	NA	D	D / E	0.0–0.05	PID	<1
	2	0.25	FILL/ Silty SAND, with gravel; grey brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace glass, brick, terracotta, slag, ceramic, coal 0.3-0.5m: abundant fibro fragments (307F) present	FILL			D / E D / E	0.3 0.5	PID PID	<1 <1
		0.7	FILL/ (SP) SAND; pale brown; fine to medium 0.8m: pale brown grey	FILL		D to M	D / E	0.8	PID	<1
	1	0.9	FILL/ (SP) Clayey SAND, trace gravel; intermixed brown grey; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace ceramic, brick, glass, rusted metal	FILL			D / E	1.0	PID	<1
		1.4	FILL/ SAND, with silt; grey; fine to medium; trace organics	FILL			D / E	1.5	PID	<1
		1.6	FILL/ (CL) Silty CLAY; dark grey; low plasticity; trace rootlets	FILL		W >PL	D / E	1.8	PID	<1
		2.0	FILL/ Clayey SAND; brown grey; fine to medium; with abundant organics 2.0-2.3m: strong decaying organic odor	FILL		W	D / E	2.2	PID	<1
Seepage	0	2.3	(SP) SAND; grey pale grey; fine to medium	ALV		W	D / E	2.5	PID	<1
		2.7	Test pit discontinued at 2.70m depth Limit of investigation							

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
METHOD: 450mm bucket to 2.7m
REMARKS: D2/28.11.22 at 0.3m

OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.5 AHD
COORDINATE E:383956.6 **N:** 6355601.0
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 308
PROJECT No: 213618.02
DATE: 28/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND; brown; fine to medium; trace rootlets		FILL	NA	D		D E		0.0 0.05	PID	<1
		0.2	FILL/ (GP) Sandy GRAVEL; grey; fine to medium, sub-angular to sub-rounded, (crushed natural rock); with slag, coal, ash		FILL		D		D E		0.25	PID	<1
	3	0.35	(SP) SAND; pale grey; fine to medium; trace rootlets		ALV		M		D E		0.5	PID	<1
		0.7	Test pit discontinued at 0.70m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
METHOD: 450mm bucket to 0.7m
REMARKS:

OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.4 AHD
COORDINATE E:383971.8 **N:** 6355591.2
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 309
PROJECT No: 213618.02
DATE: 28/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND; brown; fine to medium; trace rootlets		FILL	NA	D		D, E		0.0–0.05	PID	<1
		0.2	FILL/ (GP) Sandy GRAVEL; grey; fine to medium, sub-angular to sub-rounded, (crushed natural rock); with slag, coal, ash		FILL		D		D, E		0.25	PID	<1
	3	0.3	(SP) SAND; pale grey; fine to medium; trace rootlets		ALV		M		D, E		0.5	PID	<1
		0.7	Test pit discontinued at 0.70m depth Limit of investigation										
	2	1									1		
	1	2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs
METHOD: 450mm bucket to 0.7m
REMARKS:

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.3 AHD
COORDINATE E:383991.5 **N:** 6355574.4
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 310
PROJECT No: 213618.02
DATE: 28/11/22
SHEET: 1 of 1

CONDITIONS ENCOUNTERED								SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND; brown; fine to medium; trace rootlets		FILL	NA	D		D E		0.0 0.05	PID	<1
	3	0.2	(SP) SAND; pale grey; fine to medium; trace rootlets		ALV		M		D E		0.25	PID	<1
									D E		0.5	PID	<1
		0.6	Test pit discontinued at 0.60m depth Limit of investigation										
	2	1									1		
	1	2									2		

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NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs
METHOD: 450mm bucket to 0.6m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.1 AHD
COORDINATE E:384002.8 **N:** 6355589.4
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 311
PROJECT No: 213618.02
DATE: 28/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	3	0.0	(SP) Silty SAND; brown; fine to medium; trace glass		ALV	NA			D, E		0.0–0.05	PID	<1
									D, E		0.25	PID	<1
		0.4	(SP) SAND; pale grey; fine to medium; trace rootlets		ALV		M		D, E		0.5	PID	<1
		0.8	Test pit discontinued at 0.80m depth Limit of investigation										
	2	1									1		
	1	2									2		

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
METHOD: 450mm bucket to 0.8m
REMARKS: D3/28.11.22 at 0.25m

OPERATOR: Kramer/Krebs

LOGGED: Kramer/Krebs

Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.8 AHD
COORDINATE E:383891.4 **N:** 6355717.2
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 312
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	SAMPLE REMARKS	SAMPLE TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ (SP) Silty SAND; brown; fine to medium; trace rootlets		FILL	NA	M		D, E		0.0 – 0.05	PID	<1
		0.05	FILL/ (SP) SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace brick, terracotta, rootlets, concrete, plastic		FILL		D		D, E		0.25	PID	<1
		0.35	(SP) SAND; pale brown; fine to medium		ALV		M		D, E		0.5	PID	<1
									D, E		1.0	PID	<1
		1.1	Test pit discontinued at 1.10m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
METHOD: 450mm bucket to 1.1m
REMARKS:

OPERATOR: Kramer
LOGGED: Kramer

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Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 4.9 AHD
COORDINATE E:383843.2 **N:** 6355654.9
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 313
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	SAMPLE TYPE	SAMPLE DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	0.0	FILL/ (SP) SAND, with silt, with gravel; brown; sand fraction fine to medium; gravel fraction fine sub-angular to sub-rounded (crushed natural rock); trace plastic, roots	FILL	NA	D	D, E	0.0 – 0.05	PID	<1
	0.1	FILL/ (SP) SAND, trace gravel; pale brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); cobbles	FILL		D	D, E	0.25	PID	<1
	0.3	FILL/ (SP) Gravelly SAND; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace rootlets, (possible pavement gravels)	FILL		M	D, E	0.5	PID	<1
	0.6	FILL/ (SP) Gravelly SAND; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace brick, concrete, terracotta, cobbles, plastic, slate, metal	FILL		D	D, E	1.0	PID	<1
	1.3	ASPHALTIC CONCRETE;				D, E	1.35	PID	<1
	1.37	FILL/ (SP) Gravelly SAND; pale brown; sand fraction fine to medium; gravel fraction fine to medium sub- angular to sub-rounded; (pavement gravels)	FILL		M	D, E	1.5	PID	<1
	1.65	ASPHALTIC CONCRETE;				D	1.67	PID	<1
	1.7	(SP) SAND; pale brown; fine to medium	ALV		M	D, E	2.0	PID	<1
	2.2	Test pit discontinued at 2.20m depth Limit of investigation							

RL (m): 4, 3, 2

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
OPERATOR: Kramer
LOGGED: Kramer
METHOD: 450mm bucket to 2.2m
REMARKS: D1/29.11.22 at 1.0m

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Refer to explanatory notes for symbol and abbreviation definitions

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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 3.9 AHD
COORDINATE E:383857.4 **N:** 6355649.0
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 314
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	SAMPLE TYPE	SAMPLE DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	0.0	FILL/ (SP) SAND, with silt; brown; fine to medium; trace rootlets	FILL	NA	D	D, E	0.0–0.05	PID	<1
	0.1	FILL/ (SP) Gravelly SAND, with silt; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace rootlets, brick	FILL			D, E	0.15	PID	<1
	0.2	ASPHALTIC CONCRETE;				D, E	0.23	PID	<1
	0.25	FILL/ (SP) Gravelly SAND; pale brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded; (pavement gravels)	FILL		M	D, E	0.4	PID	<1
	0.5	FILL/ (SP) Gravelly SAND; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock); trace brick fragments	FILL		M	D, E	0.55	PID	<1
	0.7	(SP) SAND; pale brown; fine to medium	ALV		M	D, E	1.0	PID	<1
	1.1	Test pit discontinued at 1.10m depth Limit of investigation							

NOTES: (#)Soil origin is "probable" unless stated otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs
METHOD: 450mm bucket to 1.1m
REMARKS:

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Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 4.9 AHD
COORDINATE E:383836.2 **N:** 6355627.1
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 315
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed		0.0	FILL/ Silty SAND; brown; fine to medium		FILL	NA	D		D, E		0.0–0.05	PID	<1
		0.1	FILL/ (SP) SAND, trace gravel; pale brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace sandstone cobbles / boulder		FILL				D, E		0.25	PID	<1
									D, E		0.5	PID	<1
	4	0.6	FILL/ (SP) SAND, with gravel; brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); trace metal, plastic, brick, asphalt, ceramic, terracotta		FILL				D, E		1.0	PID	<1
		1.15	FILL/ Gravelly SAND; pale red; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock)		FILL		D to M		D, E		1.2	PID	<1
		1.25	FILL/ SAND, with gravel; dark brown; sand fraction fine to medium; gravel fraction fine to medium (crushed natural rock); trace concrete		FILL				D, E		1.5	PID	<1
	3	1.85	SAND; grey pale grey; fine to medium 2.1m: brown, moist				M		D, E		2.0	PID	<1
	2	2.4	Test pit discontinued at 2.40m depth Limit of investigation										

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs
METHOD: 450mm bucket to 2.4m
REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions

Douglas Partners
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TEST PIT LOG

CLIENT: School Infrastructure NSW
PROJECT: Newcastle High School Upgrade
LOCATION: Parkway Avenue, Hamilton South

SURFACE LEVEL: 5.1 AHD
COORDINATE E:383848.7 **N:** 6355618.3
DATUM/GRID: MGA94 Zone 56

LOCATION ID: 316
PROJECT No: 213618.02
DATE: 29/11/22
SHEET: 1 of 1

GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN	CONSIS./DENSITY	MOISTURE	SAMPLE TYPE	SAMPLE DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
No free groundwater observed	0.0	FILL/ Silty SAND; brown; fine to medium	FILL	NA	D	D, E	0.0–0.05	PID	<1
	0.1	FILL/ (SP) SAND, trace gravel; pale brown; sand fraction fine to medium; gravel fraction fine to coarse sub-angular to sub-rounded (crushed natural rock); sandstone cobbles / boulder	FILL			D, E	0.25	PID	<1
						D, E	0.5	PID	<1
	0.75	FILL/ (SP) SAND, with silt; dark brown; fine to medium; trace concrete, brick	FILL		D	D, E	1.0	PID	<1
	1.35	FILL/ Gravelly SAND; pale red; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock)	FILL		D to M	D, E	1.4	PID	<1
	1.45	FILL/ (SP) SAND, trace gravel; brown; sand fraction fine to medium; gravel fraction fine to medium sub-angular to sub-rounded (crushed natural rock)	FILL		D to M	D, E	1.5	PID	<1
	1.7	(SP) SAND; pale grey; fine to medium	ALV		M	D, E	2.0	PID	<1
	2.2	Test pit discontinued at 2.20m depth Limit of investigation							

RL (m): 5, 4, 3

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: 5.5T Excavator with 450mm bucket
OPERATOR: Kramer/Krebs
LOGGED: Kramer/Krebs
METHOD: 450mm bucket to 2.2m
REMARKS: D2/29.11.22

Refer to explanatory notes for symbol and abbreviation definitions

Appendix B

Martens (2021) Borehole Logs and Explanatory Notes
Table B1 – Summary of Laboratory Results – Acid Sulfate Soils (Martens, 2021)
Envirolab Laboratory Reports (Martens, 2021)

CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	REF BH101
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7594	RL SURFACE	3 m	DATUM: AHD
EXCAVATION DIMENSIONS	9.00 m depth	NORTHING	-32.9313	ASPECT		SLOPE

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L		0	3.00	1 ES 0.10 m 1 D 0.20-0.40 m			SP	FILL: Gravelly SAND; fine to medium grained; dark grey; with silt; trace clay; medium grained gravels.	M		FILL
	H		2	2.00 1.00					Coarse grained gravels/boulders encountered.			
	L	19/01/21	2.5	2.50 0.50	1 ES 2.60 m 1 D 3.00-3.20 m			SP	SAND; find to medium grained; dark grey; with silt; trace clay and gravel; sandy clay seams encountered at irregular intervals.	W		ALLUVIUM
			9	9.00					Hole Terminated at 9.00 m (Target depth reached)			

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P2007929 BH101 - 111.GPJ <<DrawingFile>> 25/02/2021 11:18 10.02.00.04 Datgel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Prj: Martens 2.00 2016-11-13

CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	**REF BH102**	
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1	
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929	
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7581	RL SURFACE	3 m	DATUM	AHD
EXCAVATION DIMENSIONS	9.00 m depth	NORTHING	-32.9306	ASPECT		SLOPE	

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH / RL	SAMPLE OR FIELD TEST	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L			3.00 / 0.20	1 ES 0.10 m	SP	FILL: Sandy CLAY; low to medium plasticity; dark brown; with fine to medium grained gravels.	M		FILL
				0.20 / 2.80	1 B 0.20-0.60 m 1 ES 0.30 m 1 D 0.40-0.60 m	SP	SAND; fine to medium grained; brown; trace silt; trace fine gravels.		MD - D	ALLUVIUM
			1	1.00 / 2.00			Becoming pale brown/grey.			
			2		1 D 2.00-2.20 m					
			3		1 D 3.00-3.20 m					
			4							
			5		1 D 5.00-5.20 m					
		19/01/21	6					W		
	M		7	7.00 / -4.00	1 D 7.00-7.20 m		Clayey SAND; fine to medium grained; grey; with silt.			
			8							
			9	9.00			Hole Terminated at 9.00 m (Target depth reached)			

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PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1	
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929	
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7576	RL SURFACE	4 m	DATUM	AHD
EXCAVATION DIMENSIONS	9.00 m depth	NORTHING	-32.9313	ASPECT		SLOPE	

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	M			4.00	1 ES 0.10 m 1 B 0.20-0.60 m 1 D 0.30-0.50 m 1 ES 0.60 m			SP	FILL: SAND; fine to medium grained; brown; with medium grained gravels; with silt; trace clay.			FILL
	L			1.50 2.50	1 ES 1.60 m			SP	SAND; fine to medium grained; pale brown/yellow; trace clay; trace silt.	M		ALLUVIUM
				2.00 2.00	1 D 2.10-2.30 m				Becoming pale brown.			
		19/01/21			1 D 4.00-4.20 m							
				5.50 -1.50	1 D 6.00-6.20 m				Becoming brown/grey.	W		
				6.50 -2.50	1 D 7.00-7.20 m				Becoming grey; increasing clay content.			
				7.50 -3.50				SC	Clayey SAND; fine to medium grained; grey.			
				8.50 -4.50	1 D 8.70-8.90 m			CI	Sandy CLAY; medium plasticity; grey; with silt.			
			9	9.00					Hole Terminated at 9.00 m (Target depth reached)			

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CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	**REF BH104**
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7588	RL SURFACE	4 m	DATUM AHD
EXCAVATION DIMENSIONS	9.00 m depth	NORTHING	-32.9317	ASPECT		SLOPE

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L		0	4.00	1 B 0.10-0.50 m 2 ES 0.10 m 1 D 0.30-0.50 m			SP	SAND; fine to medium grained; pale brown; with silt; trace gravel.	M	MD - D	ALLUVIUM
			1	1.00 3.00	1 ES 1.10 m 1 D 2.00-2.20 m 1 D 3.00-3.20 m 1 D 4.10-4.30 m			SC	SAND; fine to medium grained; brown/pale brown; trace silt and gravel.			
		19/01/21 (at 4.0 m)								W		
			8	8.00 -4.00				CL-CI	Sandy CLAY; low to medium plasticity; grey.			
			9	9.00					Hole Terminated at 9.00 m (Target depth reached)			

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	**REF BH105**
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7591	RL SURFACE	3 m	DATUM: AHD
EXCAVATION DIMENSIONS	6.00 m depth	NORTHING	-32.9315	ASPECT		SLOPE

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH / RL	SAMPLE OR FIELD TEST	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L		0.00	3.00	2 ES 0.10 m 1 D 0.30-0.50 m	SC	FILL: Clayey SAND; fine grained; brown/dark brown; trace fine to medium grained gravels.	M		FILL
		19/01/21 (water level at approx. 2.3 m)	1.50	1.50	1 ES 1.80 m 1 D 1.90-2.10 m 1 D 4.50-4.70 m	SC	Clayey SAND; find to medium grained; brown/dark grey; trace silt, clay and gravel.	M / W	L / MD - D	ALLUVIUM
			5.00	-2.00	1 D 5.50-5.70 m	SC	Clayey SAND; medium to coarse grained; pale brown.	W		
			6.00				Hole Terminated at 6.00 m (Target depth reached)			

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CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	REF BH106		
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1		
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929		
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7592	RL SURFACE	4 m	DATUM	AHD	
EXCAVATION DIMENSIONS	6.00 m depth	NORTHING	-32.9319	ASPECT		SLOPE		

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L			4.00	1 ES 0.10 m 1 D 0.20-0.40 m			SP	SAND; fine grained; grey/pale grey.	M	MD	ALLUVIUM
			1	0.80 3.20	1 ES 0.90 m 1 D 1.00-1.20 m			SM	Silty SAND; fine grained; brown/dark brown.			
		19/01/21	2	1.90 2.10	1 D 2.00-2.20 m			SP	SAND; fine to medium grained; pale brown.	W		
			3									
			4		1 D 4.00-4.20 m						MD - D	
			5	5.40 -1.40	1 D 5.60-5.80 m				Becoming grey/yellowish brown.			
			6	6.00					Hole Terminated at 6.00 m (Target depth reached)			
			7									
			8									
			9									

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CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	REF BH107
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7578	RL SURFACE	4 m	DATUM AHD
EXCAVATION DIMENSIONS	6.00 m depth	NORTHING	-32.9313	ASPECT		SLOPE

Drilling | **Sampling** | **Field Material Description**

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L			4.00	1 ES 0.10 m			SP	FILL: SAND; fine to medium grained; brown; with clay and fine to medium grained gravels.	M		FILL
	H		1	0.50 3.50	1 ES 0.80 m			SP	FILL: Gravelly SAND; medium grained; brown; with clay; medium to coarse grained gravels.			ALLUVIUM
			2	1.50 2.50	1 ES 1.60 m 1 D 1.70-1.90 m			SP	SAND; fine to medium grained; pale brown/brown, trace clay.			
		19/01/21	3	2.50 1.50					Becoming pale brown.	W		
			4		1 D 3.80-4.00 m							
			5	5.50 -1.50	1 D 5.70-5.90 m				Becoming dark grey.			
			6	6.00					Hole Terminated at 6.00 m (Target depth reached)			
			7									
			8									
			9									

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CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	**REF BH108**	
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1	
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929	
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7574	RL SURFACE	4 m	DATUM	AHD
EXCAVATION DIMENSIONS	6.00 m depth	NORTHING	-32.9321	ASPECT		SLOPE	

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH / RL	SAMPLE OR FIELD TEST	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L			4.00	2 ES 0.10 m	SP	FILL: SAND; fine to medium grained; brown/dark brown; with pebbles and gravels; trace clay.			FILL
				0.20 / 3.80	1 B 0.20-0.60 m 1 ES 0.30 m 1 D 0.40-0.60 m	SP	SAND; fine to medium grained; brown, dark brown/pale brown; with silt.	M	MD	ALLUVIUM
			1	0.80 / 3.20	1 ES 0.90 m 1 D 1.00-1.20 m		Becoming grey/dark grey.			
			2		1 D 2.00-2.20 m					
		19/01/21	3					W	MD - D	
				3.50 / 0.50			Pale brown.			
			4		1 D 4.00-4.20 m					
			5		1 D 5.60-5.80 m					
			6	6.00			Hole Terminated at 6.00 m (Target depth reached)			
			7							
			8							
			9							

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CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	REF BH109
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7596	RL SURFACE	3 m	DATUM AHD
EXCAVATION DIMENSIONS	2.00 m depth	NORTHING	-32.9319	ASPECT		SLOPE

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L	Not Encountered		3.00	1 ES 0.10 m			SP	SAND; fine to medium grained; grey/brown; trace clay.			ALLUVIUM
					1 ES 0.80 m							
			1	1.00 / 2.00					Pale grey/pale brown.	M	MD	
					1 ES 1.50 m							
			2	2.00					Hole Terminated at 2.00 m (Target depth reached)			
			3									
			4									
			5									
			6									
			7									
			8									
			9									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS & ASSOCIATES PTY LTD
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Engineering Log - BOREHOLE

CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	REF BH110
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7591	RL SURFACE	3 m	DATUM: AHD
EXCAVATION DIMENSIONS	2.00 m depth	NORTHING	-32.9317	ASPECT		SLOPE

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	RL / DEPTH	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L	Not Encountered		3.00 / *0.30*	1 ES 0.10 m			SP	FILL: SAND; fine grained; grey/pale brown; trace clay fragments.	M		FILL
				2.70	1 ES 0.40 m			SP	SAND; fine grained; grey/pale brown.		MD	ALLUVIUM
			1	*1.10* / 1.90	1 ES 1.20 m				Grey/brown.			
				1.50 / 1.50	1 ES 1.60 m				Brown.			
			2	*2.00*					Hole Terminated at 2.00 m (Target depth reached)			

Depth scale: 3, 4, 5, 6, 7, 8, 9

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CLIENT	NSW Department of Education	COMMENCED	19/01/2021	COMPLETED	20/01/2021	REF BH111
PROJECT	Geotechnical and Land Contamination Assessment	LOGGED	DS	CHECKED	JF	Sheet 1 OF 1
SITE	Newcastle High School	GEOLOGY	Quaternary Deposits	VEGETATION	Grass	PROJECT NO. 2007929
EQUIPMENT	4WD ute-mounted hydraulic drill rig	EASTING	151.7576	RL SURFACE	4 m	DATUM AHD
EXCAVATION DIMENSIONS	2.00 m depth	NORTHING	-32.9315	ASPECT		SLOPE

METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	L	Not Encountered		4.00	1 ES 0.10 m			SP	FILL: SAND; fine to medium grained; brown/dark brown; with fine to medium grained gravels; trace clay.	M		FILL
				0.40 / 3.60	1 ES 0.60 m			SP	SAND; fine to medium grained; grey/brown; trace clay.		MD - D	ALLUVIUM
			1	1.00 / 3.00	1 ES 1.10 m				Orange/brown.			
				1.50 / 2.50					Becoming pale brown.			
			2	2.00					Hole Terminated at 2.00 m (Target depth reached)			
			3									
			4									
			5									
			6									
			7									
			8									
			9									

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Engineering Log - BOREHOLE

MARTENS 2.00 LIB.GLB Log MARTENS BOREHOLE P2007929 BH101 - 111.GPJ <<DrawingFile>> 25/02/2021 11:19 10.02.00.04 Datgel Lab and In Situ Tool - DGD | Lib: Martens 2.00 2016-11-13 Prj: Martens 2.00 2016-11-13

Important Information About Your Report (1 of 2)

These notes have been prepared by Martens to help you interpret and understand the limitations of your report. Not all are necessarily relevant to all reports but are included as general reference.

Engineering Reports - Limitations

The recommendations presented in this report are based on limited investigations and include specific issues to be addressed during various phases of the project. If the recommendations presented in this report are not implemented in full, the general recommendations may become inapplicable and Martens & Associates accept no responsibility whatsoever for the performance of the works undertaken.

Occasionally, sub-surface conditions between and below the completed boreholes or other tests may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact Martens & Associates.

Relative ground surface levels at borehole locations may not be accurate and should be verified by on-site survey.

Engineering Reports – Project Specific Criteria

Engineering reports are prepared by qualified personnel. They are based on information obtained, on current engineering standards of interpretation and analysis, and on the basis of your unique project specific requirements as understood by Martens. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the Client.

Where the report has been prepared for a specific design proposal (e.g. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (e.g. to a twenty storey building). Your report should not be relied upon, if there are changes to the project, without first asking Martens to assess how factors, which changed subsequent to the date of the report, affect the report's recommendations. Martens will not accept responsibility for problems that may occur due to design changes, if not consulted.

Engineering Reports – Recommendations

Your report is based on the assumption that site conditions, as may be revealed through selective point sampling, are indicative of actual conditions throughout an area. This assumption often cannot be substantiated until project implementation has commenced. Therefore your site investigation report recommendations should only be regarded as preliminary.

Only Martens, who prepared the report, are fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report, there is a risk that the report will be misinterpreted and Martens cannot be held responsible for such misinterpretation.

Engineering Reports – Use for Tendering Purposes

Where information obtained from investigations is provided for tendering purposes, Martens recommend that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document.

Martens would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Engineering Reports – Data

The report as a whole presents the findings of a site assessment and should not be copied in part or altered in any way.

Logs, figures, drawings *etc* are customarily included in a Martens report and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), desktop studies and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Engineering Reports – Other Projects

To avoid misuse of the information contained in your report it is recommended that you confer with Martens before passing your report on to another party who may not be familiar with the background and purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Subsurface Conditions - General

Every care is taken with the report in relation to interpretation of subsurface conditions, discussion of geotechnical aspects, relevant standards and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions - the potential will depend partly on test point (eg. excavation or borehole) spacing and sampling frequency, which are often limited by project imposed budgetary constraints.

- Changes in guidelines, standards and policy or interpretation of guidelines, standards and policy by statutory authorities.
- The actions of contractors responding to commercial pressures.
- Actual conditions differing somewhat from those inferred to exist, because no professional, no matter how qualified, can reveal precisely what is hidden by earth, rock and time.

  The actual interface between logged materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

If these conditions occur, Martens will be pleased to assist with investigation or providing advice to resolve the matter.

Subsurface Conditions - Changes

Natural processes and the activity of man create subsurface conditions. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Reports are based on conditions which existed at the time of the subsurface exploration / assessment.

Decisions should not be based on a report whose adequacy may have been affected by time. If an extended period of time has elapsed since the report was prepared, consult Martens to be advised how time may have impacted on the project.

Subsurface Conditions - Site Anomalies

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

Report Use by Other Design Professionals

To avoid potentially costly misinterpretations when other design professionals develop their plans based on a Martens report, retain Martens to work with other project professionals affected by the report. This may involve Martens explaining the report design implications and then reviewing plans and specifications produced to see how they have incorporated the report findings.

Subsurface Conditions – Geo-environmental Issues

Your report generally does not relate to any findings, conclusions, or recommendations about the potential for hazardous or contaminated materials existing at the site unless specifically required to do so as part of Martens' proposal for works.

Specific sampling guidelines and specialist equipment, techniques and personnel are typically used to perform geo-environmental or site contamination assessments. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Martens for information relating to such matters.

Responsibility

Geo-environmental reporting relies on interpretation of factual information based on professional judgment and opinion and has an inherent level of uncertainty attached to it and is typically far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded.

To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Martens to other parties but are included to identify where Martens' responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Martens closely and do not hesitate to ask any questions you may have.

Site Inspections

Martens will always be pleased to provide engineering inspection services for aspects of work to which this report relates. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site. Martens is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction.

Definitions

In engineering terms, soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material does not exhibit any visible rock properties and can be remoulded or disintegrated by hand in its field condition or in water, it is described as a soil. Other materials are described using rock description terms.

The methods of description and classification of soils and rocks used in this report are typically based on Australian Standard 1726 and the Unified Soil Classification System (USCS) – refer Soil Data Explanation of Terms (2 of 3). In general, descriptions cover the following properties: strength or density, colour, moisture, structure, soil or rock type and inclusions.

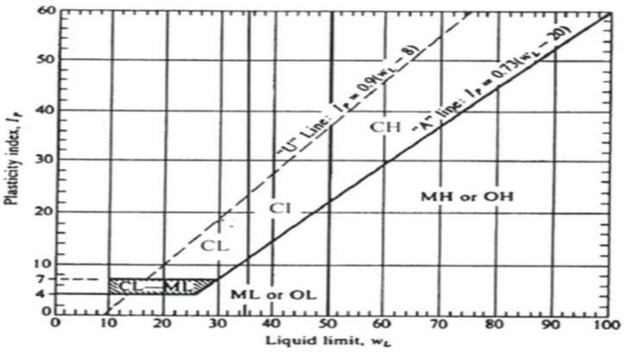
Particle Size

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (e.g. sandy CLAY). Unless otherwise stated, particle size is described in accordance with the following table.

Division	Subdivision		Particle Size (mm)
Oversized	BOULDERS		>200
	COBBLES		63 to 200
Coarse Grained Soil	GRAVEL	Coarse	19 to 63
		Medium	6.7 to 19
		Fine	2.36 to 6.7
	SAND	Coarse	0.6 to 2.36
		Medium	0.21 to 0.6
		Fine	0.075 to 0.21
Fine Grained Soil	SILT		0.002 to 0.075
	CLAY		< 0.002

Plasticity Properties

Plasticity properties of cohesive soils can be assessed in the field by tactile properties or by laboratory procedures.



Soil Moisture Condition

Coarse Grained (Granular) Soil:

Dry (D):	Looks and feels dry. Cemented soils are hard, friable or powdery. Uncemented soils run freely through fingers.
Moist (M):	Feels cool and damp and is darkened in colour. Particles tend to cohere.
Wet (W):	As for moist but with free water forming on hands when handled.

Fine Grained (Cohesive) Soil:

Moist, dry of plastic limit[1] (w < PL):	Looks and feels dry. Hard, friable or powdery.
Moist, near plastic limit (w ≈ PL):	Can be moulded, feels cool and damp, is darkened in colour, at a moisture content approximately equal to the PL.
Moist, wet of plastic limit (w > PL):	Usually weakened and free water forms on hands when handled.
Wet, near liquid limit[2] (w ≈ LL)	
Wet, wet of liquid limit (w > LL)	

[1] Plastic Limit (PL): Moisture content at which soil becomes too dry to be in a plastic condition.

[2] Liquid Limit (LL): Moisture content at which soil passes from plastic to liquid state.

Consistency of Cohesive Soils

Cohesive soils refer to predominantly clay materials.
(Note: consistency is affected by soil moisture condition at time of measurement)

Term	C_u (kPa)	Field Guide
Very Soft (VS)	≤12	A finger can be pushed well into the soil with little effort. Sample exudes between fingers when squeezed in fist.
Soft (S)	>12 and ≤25	A finger can be pushed into the soil to about 25mm depth. Easily moulded by light finger pressures.
Firm (F)	>25 and ≤50	The soil can be indented about 5mm with the thumb, but not penetrated. Can be moulded by strong figure pressure.
Stiff (St)	>50 and ≤100	The surface of the soil can be indented with the thumb, but not penetrated. Cannot be moulded by fingers.
Very Stiff (VSt)	>100 and ≤200	The surface of the soil can be marked, but not indented with thumb pressure. Difficult to cut with a knife. Thumbnail can readily indent.
Hard (H)	> 200	The surface of the soil can only be marked with the thumbnail. Brittle. Tends to break into fragments.
Friable (Fr)	-	Crumbles or powders when scraped by thumbnail. Can easily be crumbled or broken into small pieces by hand.

Density of Granular Soils

Non-cohesive soils are classified on the basis of relative density, generally from standard penetration test (SPT) or Dutch cone penetrometer test (CPT) results as below:

Relative Density	%	SPT 'N' Value* (blows/300mm)	CPT Cone Value (q_c MPa)
Very loose	≤15	< 5	< 2
Loose	>15 and ≤35	5 - 10	2 - 5
Medium dense	>35 and ≤65	10 - 30	5 - 15
Dense	>65 and ≤85	30 - 50	15 - 25
Very dense	> 85	> 50	> 25

* Values may be subject to corrections for overburden pressures and equipment type and influenced by soil moisture condition at time of measurement.

Minor Components

Minor components in soils may be present and readily detectable, but have little bearing on general geotechnical classification. Terms include:

Description of components	Proportion of component in:					
	coarse grained soil				fine grained soil	
	% Fines	Terminology	% Accessory coarse fraction	Terminology	% Sand/ gravel	Terminology
Minor	≤5	Trace clay / silt, as applicable	≤15	Trace sand / gravel, as applicable	≤15	Trace sand / gravel, as applicable
	>5,≤12	With clay / silt, as applicable	>15,≤30	With sand / gravel, as applicable	>5,≤30	With sand / gravel, as applicable
Secondary	>12	Prefix soil name as 'silty' or 'clayey', as applicable	>30	Prefix soil name as 'sandy' or 'gravelly', as applicable	>30	Prefix soil name as 'sandy' or 'gravelly', as applicable

Symbols for Soils and Other

SOILS

- COBBLES/BOULDERS
- GRAVEL (GP or GW)
- Silty GRAVEL (GM)
- Clayey GRAVEL (GC)
- SAND (SP or SW)
- Silty SAND (SM)
- Clayey SAND (SC)
- SILT (ML or MH)
- ORGANIC SILT or CLAY (OH or OL)
- CLAY (CL, CI or CH)
- Silty CLAY
- Sandy CLAY
- PEAT (Pt)
- Gravelly CLAY

OTHER

- FILL
- TALUS
- ASPHALT
- CONCRETE
- TOPSOIL

Unified Soil Classification Scheme (USCS)

FIELD IDENTIFICATION PROCEDURES
(Excluding particles larger than 63 mm and basing fractions on estimated mass)

Soil group		Fraction	Subgroup	Description	USCS	Primary Name
COARSE GRAINED SOILS More than 65 % of material less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.36 mm.	GRAVEL and GRAVEL-SAND Mixtures (≤ 5% fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes; not enough fines to bind coarse grains; no dry strength	GW	GRAVEL
				Predominantly one size or a range of sizes with some intermediate sizes missing; not enough fines to bind coarse grains; no dry strength	GP	GRAVEL
			GRAVEL-SILT and GRAVEL-SAND-SILT mixtures (≥12% fines) [1]	With excess non-plastic fines (for identification procedures see ML below); zero to medium dry strength; may also contain sand	GM	Silty GRAVEL
				With excess plastic fines (for identification procedures see CL below); medium to high dry strength; may also contain sand	GC	Clayey GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.36 mm	SAND and GRAVEL-SAND mixtures (≤5% fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes; not enough fines to bind coarse grains; no dry strength.	SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing; not enough fines to bind coarse grains; no dry strength	SP	SAND
			SAND-SILT and SAND-CLAY mixtures (≥12% fines) [1]	With excess non-plastic fines (for identification procedures see ML below); zero to medium dry strength;	SM	Silty SAND
				With excess plastic fines (for identification procedures see CL below); medium to high dry strength	SC	Clayey SAND

IDENTIFICATION PROCEDURES ON FRACTIONS < 0.2 MM

Soil group		DRY STRENGTH (Crushing Characteristics)	DILATANCY	TOUGHNESS	DESCRIPTION	USCS	Primary Name
FINE GRAINED SOILS More than 35 % of material less than 63 mm is smaller than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	None to Low	Quick to Slow	Low	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or silt with low plasticity [2]	ML	SILT [3]
		Medium to High	None to Slow	Medium	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays	CL (or CI[4])	CLAY
		Low to Medium	Slow	Low	Organic slits and organic silty clays of low plasticity	OL	Organic SILT or CLAY
		Low to Medium	None to Slow	Low to Medium	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	MH	SILT [3]
		High to Very High	None	High	Inorganic clays of high plasticity, fat clays	CH	CLAY
		Medium to High	None to Very Slow	Low to Medium	Organic clays of medium to high plasticity, organic silt of high plasticity	OH	Organic SILT or CLAY
HIGHLY ORGANIC SOILS		Readily identified by colour, odour, spongy feel and frequently by fibrous texture				Pt	PEAT

Notes:

1. Between 5% and 12% - dual classification, e.g. GP-GM.
2. Low Plasticity Clay – Liquid Limit $W_L \leq 35\%$; Medium Plasticity Clay – Liquid limit $W_L > 35\%$, $\leq 50\%$; High Plasticity Clay - Liquid limit $W_L > 50\%$.
3. Low Plasticity Silt – Liquid Limit $W_L \leq 50\%$; High Plasticity Silt - Liquid limit $W_L > 50\%$.
4. CI may be adopted for clay of medium plasticity to distinguish from clay of low plasticity.

Soil Data

martens consulting engineers

Soil Agricultural Classification Scheme

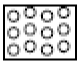
In some situations, such as where soils are to be used for effluent disposal purposes, soils are often more appropriately classified in terms of traditional agricultural classification schemes. Where a Martens report provides agricultural classifications, these are undertaken in accordance with descriptions by Northcote, K.H. (1979) *The factual key for the recognition of Australian Soils*, Rellim Technical Publications, NSW, p 26 - 28.

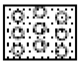
Symbol	Field Texture Grade	Behaviour of moist bolus	Ribbon length	Clay content (%)
S	Sand	Coherence nil to very slight; cannot be moulded; single grains adhere to fingers	0 mm	< 5
LS	Loamy sand	Slight coherence; discolours fingers with dark organic stain	6.35 mm	5
CLS	Clayey sand	Slight coherence; sticky when wet; many sand grains stick to fingers; discolours fingers with clay stain	6.35mm - 1.3cm	5 - 10
SL	Sandy loam	Bolus just coherent but very sandy to touch; dominant sand grains are of medium size and are readily visible	1.3 - 2.5	10 - 15
FSL	Fine sandy loam	Bolus coherent; fine sand can be felt and heard	1.3 - 2.5	10 - 20
SCL^-	Light sandy clay loam	Bolus strongly coherent but sandy to touch, sand grains dominantly medium size and easily visible	2.0	15 - 20
L	Loam	Bolus coherent and rather spongy; smooth feel when manipulated but no obvious sandiness or silkiness; may be somewhat greasy to the touch if much organic matter present	2.5	25
Lfsy	Loam, fine sandy	Bolus coherent and slightly spongy; fine sand can be felt and heard when manipulated	2.5	25
SiL	Silt loam	Coherent bolus, very smooth to silky when manipulated	2.5	25 + > 25 silt
SCL	Sandy clay loam	Strongly coherent bolus sandy to touch; medium size sand grains visible in a finer matrix	2.5 - 3.8	20 - 30
CL	Clay loam	Coherent plastic bolus; smooth to manipulate	3.8 - 5.0	30 - 35
SiCL	Silty clay loam	Coherent smooth bolus; plastic and silky to touch	3.8 - 5.0	30- 35 + > 25 silt
FSCL	Fine sandy clay loam	Coherent bolus; fine sand can be felt and heard	3.8 - 5.0	30 - 35
SC	Sandy clay	Plastic bolus; fine to medium sized sands can be seen, felt or heard in a clayey matrix	5.0 - 7.5	35 - 40
SiC	Silty clay	Plastic bolus; smooth and silky	5.0 - 7.5	35 - 40 + > 25 silt
LC	Light clay	Plastic bolus; smooth to touch; slight resistance to shearing	5.0 - 7.5	35 - 40
LMC	Light medium clay	Plastic bolus; smooth to touch, slightly greater resistance to shearing than LC	7.5	40 - 45
MC	Medium clay	Smooth plastic bolus, handles like plasticine and can be moulded into rods without fracture, some resistance to shearing	> 7.5	45 - 55
HC	Heavy clay	Smooth plastic bolus; handles like stiff plasticine; can be moulded into rods without fracture; firm resistance to shearing	> 7.5	> 50

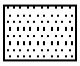
Symbols for Rock

SEDIMENTARY ROCK

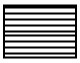
 BRECCIA

 CONGLOMERATE

 CONGLOMERATIC SANDSTONE

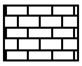
 SANDSTONE/QUARTZITE

 SILTSTONE

 MUDSTONE/CLAYSTONE

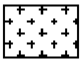
 SHALE

 COAL

 LIMESTONE

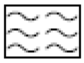
 LITHIC TUFF

IGNEOUS ROCK

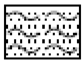
 GRANITE

 DOLERITE/BASALT

METAMORPHIC ROCK

 SLATE, PHYLLITE, SCHIST

 GNEISS

 METASANDSTONE

 METASILTSTONE

 METAMUDSTONE

Definitions

Descriptive terms used for Rock by Martens are based on AS1726 and encompass rock substance, defects and mass.

Rock Material	The intact rock that is bounded by defects.
Rock Defect	Discontinuity, fracture, break or void in the material or minerals across which there is little or no tensile strength.
Rock Structure	The nature and configuration of the different defects within the rock mass and their relationship to each other.
Rock Mass	The entirety of the system formed by all of the rock material and all of the defects that are present.

Degree of Weathering

Rock weathering is defined as the degree of decline in rock structure and grain property and can be determined in the field.

Term	Symbol	Definition
Residual soil[1]	RS	Material is weathered to such an extent that it has soil properties. Mass structure, material texture, and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered[1]	XW	Material is weathered to such an extent that it has soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System. Mass structure and material texture and fabric of original rock are still visible.
Highly weathered[2]	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the original colour of the rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered[2]	MW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the rock is not recognisable. Rock strength shows little or no change 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 substance unaffected by weathering. No sign of decomposition of individual materials or colour changes.

Notes:
1 RS and EW material is described using soil descriptive terms.
2. The term "Distinctly Weathered" (DW) may be used to cover the range of substance weathering between EW and SW

Rock Strength

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the loading. The test procedure is described by the International Society of Rock Mechanics.

Term (Strength)	I_s (50) MPa	Uniaxial Compressive Strength MPa	Field Guide	Symbol
Very low	>0.03 ≤0.1	0.6 – 2	May be crumbled in the hand. Sandstone is 'sugary' and friable.	VL
Low	>0.1 ≤0.3	2 – 6	Core 150mm long x 50mm diameter may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	L
Medium	>0.3 ≤1.0	6 – 20	Core 150mm long x 50mm diameter can be broken by hand with considerable difficulty. Readily scored with a knife.	M
High	>1 ≤3	20 – 60	Core 150mm long x 50mm diameter cannot be broken by unaided hands, can be slightly scratched or scored with a knife. Breaks with single blow from pick.	H
Very high	>3 ≤10	60 – 200	Core 150mm long x 50mm diameter, broken readily with hand held hammer. Cannot be scratched with knife. Breaks after more than one pick strike.	VH
Extremely high	>10	>200	A piece of core 150mm long x 50mm diameter is difficult to break with hand held hammer. Rings when struck with a hammer.	EH

Degree of Fracturing

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude fractures such as drilling breaks (DB) or handling breaks (HB).

Term	Description
Fragmented	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than core diameter.
Highly fractured	Core lengths are generally less than 20 mm to 40 mm with occasional fragments.
Fractured	Core lengths are mainly 30 mm to 100 mm with occasional shorter and longer sections.
Slightly fractured	Core lengths are generally 300 mm to 1000 mm, with occasional longer sections and sections of 100 mm to 300 mm.
Unbroken	The core does not contain any fractures.

Rock Core Recovery

TCR = Total Core Recovery

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100\,\%$$

SCR = Solid Core Recovery

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100\,\%$$

RQD = Rock Quality Designation

$$= \frac{\sum \text{Axial lengths of core} > 100 \text{ mm long}}{\text{Length of core run}} \times 100\,\%$$

Rock Strength Tests

▼ Point load strength Index (Is50) - axial test (MPa)

▶ Point load strength Index (Is50) - diametral test (MPa)

● Uniaxial compressive strength (UCS) (MPa)

Defect Type Abbreviations and Descriptions

Defect Type (with inclination given)

BP	Bedding plane parting
FL	Foliation
CL	Cleavage
JT	Joint
FC	Fracture
SZ/SS	Sheared zone/ seam (Fault)
CZ/CS	Crushed zone/ seam
DZ/DS	Decomposed zone/ seam
FZ	Fractured Zone
IS	Infilled seam
VN	Vein
CO	Contact
HB	Handling break
DB	Drilling break

Planarity

Pl	Planar
Cu	Curved
Un	Undulating
St	Stepped
Ir	Irregular
Dis	Discontinuous

Roughness

Pol	Polished
Sl	Slickensided
Sm	Smooth
Ro	Rough
VR	Very rough

Thickness

Zone	> 100 mm
Seam	> 2 mm < 100 mm
Plane	< 2 mm

Coating or Filling

Cn	Clean
Sn	Stain
Ct	Coating
Vnr	Veneer
Fe	Iron Oxide
X	Carbonaceous
Qz	Quartzite
MU	Unidentified mineral

Inclination

Inclination of defect is measured from perpendicular to and down the core axis.

Direction of defect is measured clockwise (looking down core) from magnetic north.

Sampling

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

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

Undisturbed samples may be taken by pushing a thin-walled sampling tube, e.g. U_{50} (50 mm internal diameter thin walled tube), into soils and withdrawing a soil sample in a relatively undisturbed state. Such samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Other sampling methods may be used. Details of the type and method of sampling are given in the report.

Drilling / Excavation Methods

The following is a brief summary of drilling and excavation methods currently adopted by the Company and some comments on their use and application.

Hand Excavation - in some situations, excavation using hand tools, such as mattock and spade, may be required due to limited site access or shallow soil profiles.

Hand Auger - the hole is advanced by pushing and rotating either a sand or clay auger, generally 75-100 mm in diameter, into the ground. The penetration depth is usually limited to the length of the auger pole; however extender pieces can be added to lengthen this.

Test Pits - these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils and, if it is safe to descend into the pit, collection of bulk disturbed samples. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (e.g. Pengo) - the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling (Push Tube) - the hole is advanced by pushing a 50 - 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength *etc.* is only marginally affected.

Continuous Spiral Flight Augers - the hole is advanced using 90 - 115 mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface or, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling - the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling - similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling - a continuous core sample is obtained using a diamond tipped core barrel of usually 50 mm internal diameter. Provided full core recovery is achieved (not always possible in very weak or fractured rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

In-situ Testing and Interpretation

Cone Penetrometer Testing (CPT)
Cone penetrometer testing (sometimes referred to as Dutch Cone) described in this report has been carried out using an electrical friction cone penetrometer.

The test is described in AS 1289.6.5.1-1999 (R2013). In the test, a 35 mm diameter rod with a cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system.

Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the push rod centre to an amplifier and recorder unit mounted on the control truck. As penetration occurs (at a rate of approximately 20 mm per second) the information is output on continuous chart recorders. The plotted results given in this report have been traced from the original records. The information provided on the charts comprises:

(i) Cone resistance (q_c) - the actual end bearing force divided by the cross sectional area of the cone, expressed in MPa.

(ii) Sleeve friction (q_f) - the frictional force of the sleeve divided by the surface area, expressed in kPa.

(iii) Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower (A) scale (0 - 5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main (B) scale (0 - 50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1 % - 2 % are commonly encountered in sands and very soft clays rising to 4 % - 10 % in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

$$q_c \text{ (MPa)} = (0.4 \text{ to } 0.6) \text{ N (blows/300 mm)}$$

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:

$$q_c = (12 \text{ to } 18)\ C_u$$

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes *etc.* This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Standard Penetration Testing (SPT)
Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample.

The test procedure is described in AS 1289.6.3.1-2004. The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm penetration depth increments and the 'N' value is taken as the number of blows for the last two 150 mm depth increments (300 mm total penetration). In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued. The test results are reported in the following form:

(i) Where full 450 mm penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7 blows:

as 4, 6, 7
N = 13

(ii) Where the test is discontinued, short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm

as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

Dynamic Cone (Hand) Penetrometers
Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150mm increments of penetration. Normally, there is a depth limitation of 1.2m but this may be extended in certain conditions by the use of extension rods. Two relatively similar tests are used.

Perth sand penetrometer (PSP) - a 16 mm diameter flat ended rod is driven with a 9 kg hammer, dropping 600 mm. The test, described in AS 1289.6.3.3-1997 (R2013), was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.

Cone penetrometer (DCP) - sometimes known as the Scala Penetrometer, a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm. The test, described in AS 1289.6.3.2-1997 (R2013), was developed initially for pavement sub-grade investigations, with correlations of the test results with California Bearing Ratio published by various Road Authorities.

Pocket Penetrometers
The pocket (hand) penetrometer (PP) is typically a light weight spring hand operated device with a stainless steel loading piston, used to estimate unconfined compressive strength, q_u, (UCS in kPa) of a fine grained soil in field conditions. In use, the free end of the piston is pressed into the soil at a uniform penetration rate until a line, engraved near the piston tip, reaches the soil surface level. The reading is taken from a gradation scale, which is attached to the piston via a built-in spring mechanism and calibrated to kilograms per square centimetre (kPa) UCS. The UCS measurements are used to evaluate consistency of the soil in the field moisture condition. The results may be used to assess the undrained shear strength, C_u, of fine grained soil using the approximate relationship:

$q_u = 2 \times C_u$.

It should be noted that accuracy of the results may be influenced by condition variations at selected test surfaces. Also, the readings obtained from the PP test are based on a small area of penetration and could give misleading results. They should not replace laboratory test results. The use of the results from this test is typically limited to an assessment of consistency of the soil in the field and not used directly for design of foundations.

Test Pit / Borehole Logs

Test pit / borehole log(s) presented herein are an engineering and / or geological interpretation of the subsurface conditions. Their reliability will depend to some extent on frequency of sampling and methods of excavation / drilling. Ideally, continuous undisturbed sampling or excavation / core drilling will provide the most reliable assessment but this is not always practicable, or possible to justify on economic grounds. In any case, the test pit / borehole logs represent only a very small sample of the total subsurface profile.

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

Laboratory Testing

Laboratory testing is carried out in accordance with AS 1289 Methods of Testing Soil for Engineering Purposes. Details of the test procedure used are given on the individual report forms.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems:

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

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

Test, Drill and Excavation Methods

Explanation of Terms (3 of 3)

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DRILLING / EXCAVATION METHOD

HA	Hand Auger	RD	Rotary Blade or Drag Bit	NQ	Diamond Core - 47 mm
AD/V	Auger Drilling with V-bit	RT	Rotary Tricone bit	NMLC	Diamond Core – 51.9 mm
AD/T	Auger Drilling with TC-Bit	RAB	Rotary Air Blast	HQ	Diamond Core – 63.5 mm
AS	Auger Screwing	RC	Reverse Circulation	HMLC	Diamond Core – 63.5 mm
HSA	Hollow Stem Auger	CT	Cable Tool Rig	DT	Diatube Coring
S	Excavated by Hand Spade	PT	Push Tube	NDD	Non-destructive digging
BH	Tractor Mounted Backhoe	PC	Percussion	PQ	Diamond Core - 83 mm
JET	Jetting	E	Tracked Hydraulic Excavator	X	Existing Excavation

SUPPORT

Nil	No support	S	Shotcrete	RB	Rock Bolt
C	Casing	Sh	Shoring	SN	Soil Nail
WB	Wash bore with Blade or Bailer	WR	Wash bore with Roller	T	Timbering

WATER

▽ Water level at date shown	◁ Partial water loss
▷ Water inflow	◀ Complete water loss

GROUNDWATER NOT OBSERVED (NO)	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUNDWATER NOT ENCOUNTERED (NX)	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

PENETRATION / EXCAVATION RESISTANCE

L	Low resistance: Rapid penetration possible with little effort from the equipment used.
M	Medium resistance: Excavation possible at an acceptable rate with moderate effort from the equipment used.
H	High resistance: Further penetration possible at slow rate & requires significant effort equipment.
R	Refusal/ Practical Refusal. No further progress possible without risk of damage/ unacceptable wear to digging implement / machine.

These assessments are subjective and dependent on many factors, including equipment power, weight, condition of excavation or drilling tools, and operator experience.

SAMPLING

D	Small disturbed sample	W	Water Sample	C	Core sample
B	Bulk disturbed sample	G	Gas Sample	CONC	Concrete Core

U63 Thin walled tube sample - number indicates nominal undisturbed sample diameter in millimetres

TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-2004
4,7,11	4,7,11 = Blows per 150mm.
N=18	'N' = Recorded blows per 300mm penetration following 150mm seating
DCP	Dynamic Cone Penetration test to AS1289.6.3.2-1997. 'n' = Recorded blows per 150mm penetration

Notes:

RW	Penetration occurred under rod weight only
HW	Penetration occurred under hammer and rod weight only
20/100mm	Where practical refusal or hammer double bouncing occurred, blows and penetration for that interval are reported (e.g. 20 blows for 100 mm penetration)

CPT	Static cone penetration test
CPTu	CPT with pore pressure (u) measurement
PP	Pocket penetrometer test expressed as instrument reading (kPa)
FP	Field permeability test over section noted
VS	Field vane shear test expressed as uncorrected shear strength (sv = peak value, sr = residual value)
PM	Pressuremeter test over section noted
PID	Photoionisation Detector reading in ppm
WPT	Water pressure tests

SOIL DESCRIPTION

Density		**Consistency**		**Moisture**	
VL	Very loose	VS	Very soft	D	Dry
L	Loose	S	Soft	M	Moist
MD	Medium dense	F	Firm	W	Wet
D	Dense	St	Stiff	Wp	Plastic limit
VD	Very dense	VSt	Very stiff	Wl	Liquid limit
		H	Hard		

ROCK DESCRIPTION

Strength		**Weathering**	
VL	Very low	EW	Extremely weathered
L	Low	HW	Highly weathered
M	Medium	MW	Moderately weathered
H	High	SW	Slightly weathered
VH	Very high	FR	Fresh
EH	Extremely high		

Table B1: Summary of Laboratory Results - Acid Sulfate Soils (Martens, 2021)

Bore ID	Sample Depth (m)	Approximate Surface Ground Level (mAHD)	Approximate Sample RL (m AHD)	Depth to Groundwater (m bgl)	Sample Description	Screening Test Results				Laboratory Results							
						pH			Strength of Reaction[b]								
						pH_F	pH_{FOX}	pH_F - pH_{FOX}		pH_{KCl}	S_{KCl}	Scr %S	s-TAA %S	S_{NAS} %S	s-ANC_{BT} %S	Net Acidity[c] %S	Existing and Potential Acidity %S
102	3.1	3.0	-0.1	4.6	Sand	NT	NT	NT	NT	5.8	<0.005	<0.005	<0.01	NT	NT	<0.005	<0.005
	5.1		-2.1		Sand	NT	NT	NT	NT	5.6	<0.005	<0.005	<0.01	NT	NT	<0.005	<0.005
104	3.1	4.0	0.9	4.0	Sand	NT	NT	NT	NT	5.5	<0.005	<0.005	<0.01	NT	NT	<0.005	<0.005
	8.3		-4.3		Sandy Clay	NT	NT	NT	NT	5.3	<0.005	0.02	<0.01	NT	NT	0.025	0.025
105	5.6	3.0	-2.6	2.4	Clayey Sand	NT	NT	NT	NT	5.4	<0.005	0.01	<0.01	NT	NT	0.011	0.011
108	1.1	4.0	2.9	2.5	Sand	NT	NT	NT	NT	5.3	0.006	<0.005	<0.01	NT	NT	<0.005	<0.005
	2.1		1.9		Sand	NT	NT	NT	NT	5.6	<0.005	<0.005	<0.01	NT	NT	<0.005	<0.005
	5.7		-1.7		Sand	NT	NT	NT	NT	5.4	<0.005	0.005	<0.01	NT	NT	0.009	0.009
Guideline		Coarse sands, poorly buffered				<4[d]	<3.5[e]	≥1[e]	-	Coarse sands, poorly buffered							0.01
		Coarse sands to loamy sands and peats								Coarse sands to loamy sands and peats							0.03
		Medium sandy loams to light clays								Medium sandy loams to light clays							0.06[f]/0.03[g]
		Fine medium to heavy clays & silty clays								Fine medium to heavy clays & silty clays							0.1[f]/0.03[g]

Notes to Table B1:

a Depth below ground surface

b Strength of Reaction

1 denotes no or slight reaction

2 denotes moderate reaction

3 denotes high reaction

4 denotes very vigorous reaction

F denotes bubbling/frothy reaction indicative of organics

V denotes vapours generated

B denotes bubbles generated

H denotes heat generated

c Calculated by the laboratory based on the ABA equation in ASS Laboratory Methods Guidelines

d For actual acid sulphate soils (ASS)

e Indicative value only for Potential Acid Sulphate Soils (PASS)

f QASSIT Action Criteria for disturbance of 1-1000 tonnes of material

g QASSIT Action Criteria for disturbance of more than 1000 tonnes of material

Bold results indicative of ASS

Shaded results indicate an exceedence of QASSIT action criteria

pH_F - Soil pH Test (1:5 soil:distilled water)

pH_{FOX} - Soil Peroxide pH Test (1:4 soil:distilled water following oxidation of soil with 30% hydrogen peroxide (H_20_2))

NT Not tested

*Laboratory methods used to quantify ANC are likely to overestimate environmental effectiveness

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SOIL ANALYSIS CHAIN OF CUSTODY FORM

Project								
Name	P2007929 – Newcastle High School							
Martens Contact Officer	Dean Shi			**Contact Email**	dshi@martens.com.au			
Sampling and Shipping	**Sample Date**	19 - 20 January 2021	**Dispatch Date**	29 January 2021	**Turnaround Time**	Standard		
	Our Reference	P2007929COC02V01		**Shipping Method**	**Hand**	**Post**	**Courier**	X
	On Ice (X)	X	**No Ice (X)**		**Other (X)**			

Laboratory									
Name	EnviroLab								
Sample Delivery Address	12 Ashley Street, Chatswood								
Delivery Contact	**Name**	Aileen	**Phone**	9910 6200	**Fax**		**Email**	samplereceipt@envirolabservices.com.au	
Please Send Report By (X)	**Post**		**Fax**		**Email**	X	**Reporting Email Address**	jfulton@martens.com.au dshi@martens.com.au	

	Sample ID	SCr Suite
1	BH102/3.0-3.2	X
2	BH102/5.0-5.2	X
3	BH104/3.0-3.2	X
4	BH104/8.2-4.8	X
5	BH105/5.5-5.7	X
6	BH108/1.0-1.2	X
7	BH108/2.0-2.2	X
8	BH108/5.6-5.8	X

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 260511
Date Received: 29/1/21
Time Received: 13:22
Received By: A
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 260511

Client Details

Client	Martens & Associates Pty Ltd
Attention	Dean Shi
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**P2007929 - Newcastle High School**
Number of Samples	8 SOIL
Date samples received	29/01/2021
Date completed instructions received	29/01/2021

Analysis Details

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

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

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

Report Details

Date results requested by	05/02/2021
Date of Issue	05/02/2021

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Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Chromium Suite						
Our Reference		260511-1	260511-2	260511-3	260511-4	260511-5
Your Reference	UNITS	BH102/3.0-3.2	BH102/5.0-5.2	BH104/3.0-3.2	BH104/8.2-4.8	BH105/5.5-5.7
Date Sampled		19-20/01/2021	19-20/01/2021	19-20/01/2021	19-20/01/2021	19-20/01/2021
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	02/02/2021	02/02/2021	02/02/2021	02/02/2021	02/02/2021
Date analysed	-	02/02/2021	02/02/2021	02/02/2021	02/02/2021	02/02/2021
pH_{kcl}	pH units	5.8	5.6	5.5	5.3	5.4
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+/t	<5	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	<0.005	0.02	0.01
a-Chromium Reducible Sulfur	moles H^+/t	<3	<3	<3	14	6
S_{HCl}	%w/w S	NT	NT	NT	NT	NT
S_{KCl}	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
S_{NAS}	%w/w S	NT	NT	NT	NT	NT
ANC_{BT}	% $CaCO_3$	NT	NT	NT	NT	NT
s-ANC_{BT}	%w/w S	NT	NT	NT	NT	NT
s-Net Acidity	%w/w S	<0.005	<0.005	<0.005	0.025	0.011
a-Net Acidity	moles H^+/t	<5	<5	<5	16	6.7
Liming rate	kg $CaCO_3$/t	<0.75	<0.75	<0.75	1	<0.75
a-Net Acidity without ANCE	moles H^+/t	<5	<5	<5	16	6.7
Liming rate without ANCE	kg $CaCO_3$/t	<0.75	<0.75	<0.75	1.2	<0.75
s-Net Acidity without ANCE	%w/w S	<0.005	<0.005	<0.005	0.025	0.011

Chromium Suite				
Our Reference		260511-6	260511-7	260511-8
Your Reference	UNITS	BH108/1.0-1.2	BH108/2.0-2.2	BH108/5.6-5.8
Date Sampled		19-20/01/2021	19-20/01/2021	19-20/01/2021
Type of sample		SOIL	SOIL	SOIL
Date prepared	-	02/02/2021	02/02/2021	02/02/2021
Date analysed	-	02/02/2021	02/02/2021	02/02/2021
pH $_{kcl}$	pH units	5.3	5.6	5.4
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+ /t	<5	<5	<5
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	0.005
a-Chromium Reducible Sulfur	moles H^+ /t	<3	<3	<3
S_{HCl}	%w/w S	NT	NT	NT
S_{KCl}	%w/w S	0.006	<0.005	<0.005
S_{NAS}	%w/w S	NT	NT	NT
ANC_{BT}	% $CaCO_3$	NT	NT	NT
s-ANC_{BT}	%w/w S	NT	NT	NT
s-Net Acidity	%w/w S	<0.005	<0.005	0.0090
a-Net Acidity	moles H^+ /t	<5	<5	5.5
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+ /t	<5	<5	5.5
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	<0.75	<0.75
s-Net Acidity without ANCE	%w/w S	<0.005	<0.005	0.0090

Method ID	Methodology Summary
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			02/02/2021	1	02/02/2021	02/02/2021		02/02/2021	[NT]
Date analysed	-			02/02/2021	1	02/02/2021	02/02/2021		02/02/2021	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	1	5.8	5.8	0	99	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	1	<0.01	<0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+/t	5	Inorg-068	<5	1	<5	<5	0	98	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+/t	3	Inorg-068	<3	1	<3	<3	0	109	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	1	NT	NT		[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	1	NT	NT		[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	1	NT	NT		[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	1	NT	NT		[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
a-Net Acidity	moles H^+/t	5	Inorg-068	<5	1	<5	<5	0	[NT]	[NT]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-068	<0.75	1	<0.75	<0.75	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+/t	5	Inorg-068	<5	1	<5	<5	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-068	<0.75	1	<0.75	<0.75	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

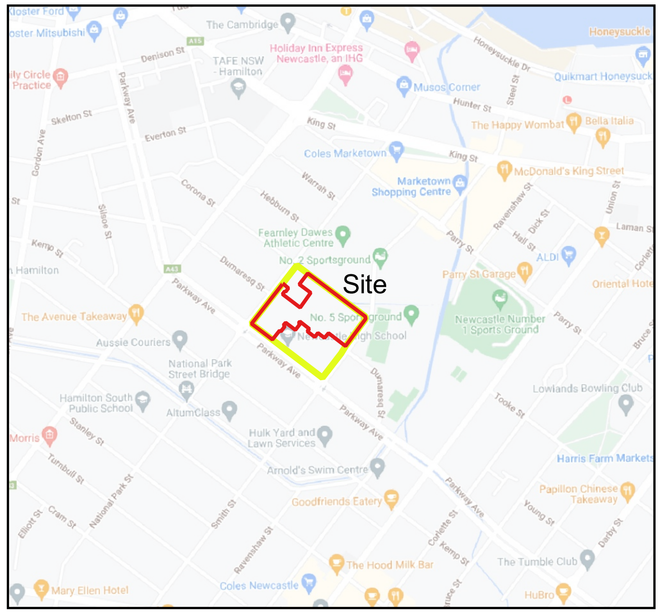
Measurement Uncertainty estimates are available for most tests upon request.

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

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

Appendix C

Test Location Plan (DP, 2023)
Map 01 - Testing Plan (Martens, 2021)
Site Plan – Building Work Location - EJE Architecture
(Ref 13331, C, 1A-0421-A)
Preliminary Bulk Earthworks Plan (Stantec Australasia Pty Ltd)



Site Location

0 10 20 30 40 m

Drawing adapted from Metromap image dated 11.06.2022.
Test locations are approximate only and were located using Differential GPS.

Legend

Current Investigation Test Locations

- ACM Sample
- Surface Water Sample
- Test Pit
- Hand Auger
- Groundwater Monitoring Well
- Hand Auger
- Test Pit
- Hand Augers / Hand Pits
- Surface Samples

Previous Test Locations

- Geotechnical Bore (DP, 2022b)
- Geotechnical CPT (DP, 2022b)
- Geotechnical Marten (2021)
- Investigation Area
- Site Boundary
- Lot Boundary
- Appoximate Boundary of Mapped Anthropogenic Deposits

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: School Infrastructure NSW		TITLE:	**Test Location Plan and Site Features**
OFFICE: Newcastle	DRAWN BY: PLH		**Newcastle High School Upgrade**
SCALE: 1:1,500 @ A3	DATE: 23.May.2023		**25a National Park Street, Newcastle West**

N

PROJECT No:	213618.02
DRAWING No:	1
REVISION:	2

0 10 20 30 40 50 m

1:1500 @ A3

Aerial: Nearmap (2020)

martens
Environment | Water | Geotechnics | Civil | Projects

Map Title / Figure:
Testing Plan

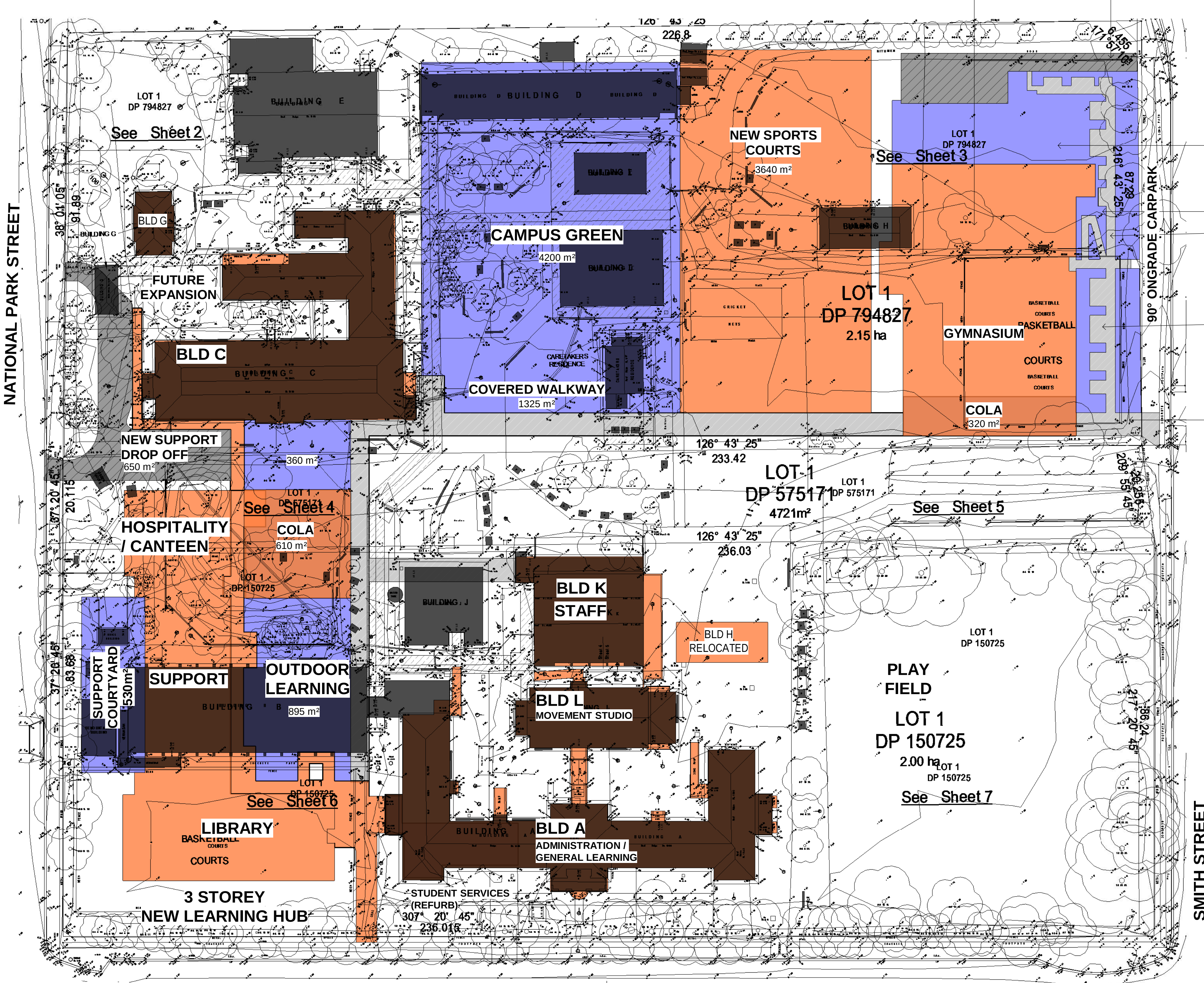
Map 01	Map
160 - 200 Parkway Avenue, Hamilton South, NSW	Site
Newcastle Education Precinct Development	Project
Geotechnical Investigation	Sub-Project
NSW Department of Education C/- SINSW	Client
25/02/2021	Date

Project No: P2007929 Map Set: MS04-R01 EPSG: 28356

SITE PLAN - BUILDING WORK LOCATION

TO REFERENCE WHEN PLACING DEMOUNTABLES

LEGEND : NEW AND EXISTING WORKS	
NEW WORK TO OCCUR FOR BUILDINGS	
NEW WORK TO OCCUR FOR LANDSCAPING	
NEW AND EXITING PATHWAYS	
NEW AND EXISTING ROADS	
EXISTING BUILDINGS	



1 OVERALL SITE PLAN - GROUND FLOOR - WORKS TO OCCUR

1 : 500

EJE ARCHITECTURE
ACN 002 912 843 | ABN 82 644 649 849
Nominated Architect - Bernard Collins | NSW Architects Registration No: 4438
P +61 2 4929 2353 | F +61 2 4926 3069 | E mail@eje.com.au | W www.eje.com.au
A 412 KING STREET, NEWCASTLE, NSW 2300

NSW GOVERNMENT Education School Infrastructure

REV	DATE	COMMENTS
A	10/05/2022	ISSUE FOR INFORMATION

DRN	CHKD	VRFD
MG	KG	

PROJECT: NEWCASTLE EDUCATION CAMPUS

SITE: 25A NATIONAL PARK STREET NEWCASTLE WEST 2302

CLIENT: DEPARTMENT OF EDUCATION NSW

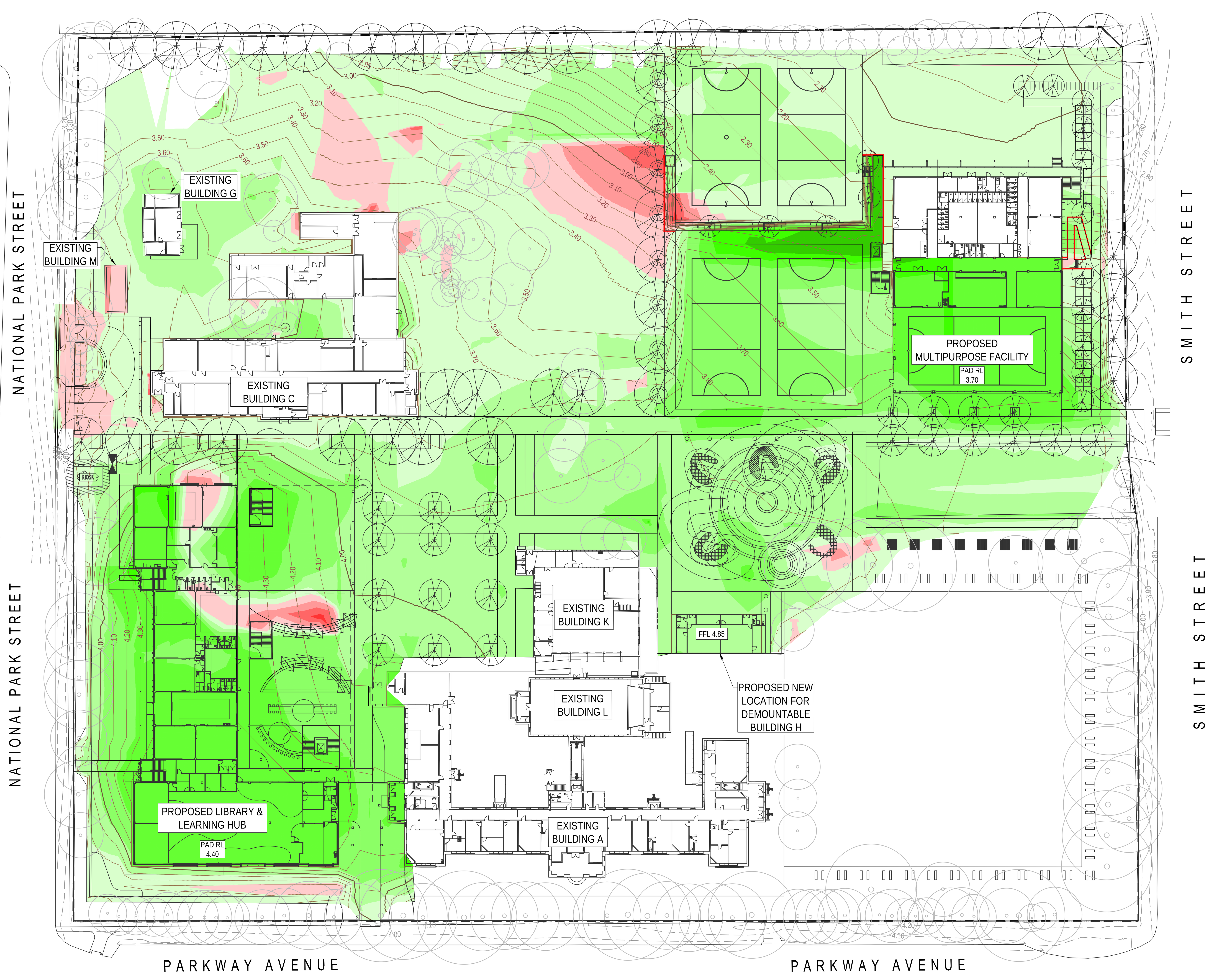
DRAWING: SITE PLAN - WORKS TO BE UNDERTAKEN

WORK IN FIGURED DIMENSIONS IN PREFERENCE TO SCALE. CHECK DIMENSIONS AND LEVELS ON SITE PRIOR TO THE ORDERING OF MATERIALS OR THE COMPLETION OF WORKSHOP DRAWINGS. IF IN DOUBT ASK. REPORT ALL ERRORS AND OMISSIONS.

DRAWN	DATE	SCALES
MG	10/05/22	As indicated@ A1 1:1000@ A3

PROJECT No	PHASE	DRAWING No	REV
13331	C	1A-042	A

EJE architecture



LEGEND

	SITE BOUNDARY
14.0	BULK EARTHWORKS CONTOUR
18.0	EXISTING CONTOURS
PAD RL	BULK EARTHWORKS LEVEL

NOTES

1. VOLUMES ARE INDICATIVE ONLY AND ARE BASED ON A COMPARISON BETWEEN THE DESIGN SURFACE AND THE SURVEYED SURFACE.
2. NOTE THAT ALL VOLUMES DEPICTED ARE SOLID VOLUMES ONLY AND MAY NOT REFLECT DETAILED EARTHWORKS.
3. NO ALLOWANCE HAS BEEN MADE FOR BULKING FACTORS.
4. NO ALLOWANCE HAS BEEN MADE FOR DETAILED EARTHWORKS; ie INFILTRATION TANKS, RAINWATER TANK, SERVICE TRENCHING, DETAILED EXCAVATION, FOOTINGS, RETAINING WALLS, PAVEMENT BOXING, BUILDING SLABS AND THE LIKE.
5. THE CONTRACTOR SHALL USE FINAL SURFACE LEVELS AND TYPICAL PAVEMENT DETAILS FOR ACTUAL EARTHWORKS LEVELS.
6. BULK EARTHWORKS CUT/FILL VOLUME CONSIDERATIONS:
   - 300mm TOPSOIL HAS BEEN CONSIDERED TO BE REMOVED.
   - 400mm STRUCTURAL SLAB UNDER BUILDING PADS.
   - 200mm THICKNESS FOR PAVEMENTS.
   - 200mm FOR LANDSCAPE AREAS BUILD-UPS.

5. THE SURVEY SURFACE AS PROVIDED HAS BEEN UTILISED FOR COMPARISON PURPOSES.

6. STANTEC DOES NOT TAKE RESPONSIBILITY FOR ACCURACY OF EXISTING SURVEY.

CUT AND FILL VOLUME:

CUT: 260 m^3
FILL: 8,924 m^3
NET: 8,664 m^3 (FILL)

CUT/FILL DEPTH RANGES

COLOUR	LOWER	UPPER
	-2.2	-2.0
	-2.0	-1.8
	-1.8	-1.6
	-1.6	-1.4
	-1.4	-1.2
	-1.2	-1.0
	-1.0	-0.8
	-0.8	-0.6
	-0.6	-0.4
	-0.4	-0.2
	-0.2	0.0
	0.0	0.2
	0.2	0.4
	0.4	0.6
	0.6	0.8
	0.8	1.0
	1.0	1.2
	1.2	1.4

1:500 A1
1:1000 A3

Key Plan: (NTS)

		By	Appd	YYYY.MM.DD
D	100% SCHEMATIC DESIGN RE-ISSUE	CPO	JMB	2022.10.10
C	100% SCHEMATIC DESIGN ISSUE	LPT	JMB	2022.09.23
B	90% SCHEMATIC DESIGN ISSUE	MDR	JMB	2022.08.23
A	75% SCHEMATIC DESIGN ISSUE	MDR	JMB	2022.08.02

Issued/Revision

Issue Status

PRELIMINARY

NOT FOR CONSTRUCTION

This document is suitable only for the purpose noted above.
Use of this document for any other purpose is not permitted.

Colour Disclaimer
This drawing has been documented in colour. This drawing is required to be printed in colour. Failure to do so may result inloss of information. Black and white printing may be used if specific black and white documents have been obtained from Stantec.

Notes

Stantec

Stantec Australia Pty. Ltd.
Level 6, Building B
207 Pacific Highway
St Leonards, NSW 2065
Tel: +61 2 8484 7000

Client/Project Logo

Client/Project
SINSW

NEWCASTLE EDUCATION CAMPUS

25A NATIONAL PARK STREET, NEWCASTLE WEST 2302

File Name: NEC-STNC-XX-XX-DR-C-100001.DWG	-	-	-	2022.08.02
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

Title
BULK EARTHWORKS PLAN

Project No. 301350909
Scale 1:500
Revision D
Drawing No. **NEC-STNC-XX-XX-DR-C-100001**

Appendix D ACOR CVs

Joshua Rhodes

BE (Hons) Civil MIEAust CPEng NER

CIVIL LEADER | NEWCASTLE GENERAL MANAGER

Qualifications

Bachelor of Engineering (Honours) (Civil), University of Newcastle

Hunter Water WSAA Accredited Water and Sewer Reticulation Designer

Affiliations

Member, Institution of Engineers Australia (MIEAust)

Chartered Professional Engineer. (CPEng)

National Engineers Register (NER-Civil)

ACOR CONSULTANTS

ENGINEERS

MANAGERS

INFRASTRUCTURE PLANNERS

DEVELOPMENT CONSULTANTS

Experience

Joshua is an Associate Principal of ACOR and a Senior Civil Engineer with experience in a wide variety of projects, in particular urban, rural and industrial Land Development, Defence, Local Government, Rail and Electrical Substation design.

His experience includes stormwater quantity and quality management, including Water Sensitive Urban Design, road and earthworks design, project management, contract administration, design, specification reviews and site supervision/inspections.

Residential & Industrial Subdivisions

Design and documentation for site works, roads and stormwater drainage at:

- Clifteigh Meadows Residential Development Cliffleigh Stages 7,8, 9a,12, 13 and 15
- Garawon Place subdivision, Fletcher
- Bower Residential Estate stages 1-5
- Sanctuary Residential Development, Fletcher (Stages 14 to 17) 152 residential lots
- Minmi Urban Release Area
  Earthworks, roads and stormwater management for land development rezoning and DA for 3,300 residential lots
- Morisset Park Residential Development
  62 residential lots
- Brush Creek Residential Development, Edgeworth (Stages 1-5 & 7 Precinct 2) 200+ residential lots
- Industrial Estate, Gunnedah
  19 Industrial lots
- Mornington Heights Estate, Gunnedah
  344 residential lots
- Oxley Highway, Gunnedah
  28 industrial lots

Defence Projects

- Defence Logistics Transformation Project ($350M)
  New major base entries and main road works as well as design of internal site works, roads and stormwater drainage at Moorebank NSW and Bandiana VIC
- RAAF Base Williamtown NSW – Stage 2 Redevelopment ($275M) - New major base entries & RMS main road works

Local Government

Design & documentation for site works, roads & stormwater drainage at:

- Cooranbong Cycleway, design of over 12km of cycleway from the Watagan Park development, Cooranbong to Morisset Town Centre
- Camden Valley Way, Elderslie
  1.2km dual lane road, signalised intersection and roundabout design
  - RMS road intersections and roundabouts design at:
  - Oxley Highway Gunnedah and Industrial Subdivision
- Dora Street and Ourimbah Street, Morisset (RMS review)
- Design of road works for Hunter Councils:
  - Clarence Town Road, Glen Oak for Port Stephens Council - Design of 2.2km of rural road and associated stormwater culverts
  - Clarence Town Road, Clarence Town for Dungog Council - Design of 2km of rural road and associated stormwater drains
  - East Seaham Road, Seaham 2.2km rural road and associated drainage for Port Stephens Council
- Peppertree Road, Medowie
  Road extension and intersection design and associated stormwater drainage for Port Stephens Council
- Saleyards and Fairydale Lane, Mudgee
  3 km of urban and rural road design and stormwater drainage for Mid-Western Regional Council
- Wollar Road, Wollar
  1.5 km rural road design
- Sanctuary Development stages 1 to 5B swale improvements for New Castle City Council
- North Sydney Education precinct
  Napier and Charles Street and Wheeler Lane upgrades for North Sydney council
- Stormwater Management Croudace Road, Elemovale for New Castle City council

Joshua Rhodes

- James L Boyd Reserve carpark, Swansea for Lake Macquarie City Council
- Balmoral Reserve carpark, Balmoral for Lake Macquarie City Council
- Cooranbong Cycleway approximately 10km of Cycleway from Cooranbong to Morisset

Industrial

- Civil and structural design including earthworks, compound levels, roads, stormwater drainage, secondary separation/oil containment, erosion/sediment controls, yard structures / foundations, blast walls and switch buildings at:
  - Wallerawang 132/66kV substation
  - Tomaree 33/11kV substation
  - Boggabri East switching station
  - Wollar 500/330kV substation
  - Bannaby 500/330kV substation
- Williamsdale 330/132kV substation
  Earthworks, temporary sediment basin and secondary containment basin design
- Daracon Headquarters and Concrete Batching Plant, Cameron Park
- Pacific National LPC Inspection and Scoping Program:
  - Hunter Bulk Terminal
  - Inner Harbour
  - Outer Harbour
- Newcastle Airport outer Harbour East Apron Expansions Concept Design
- Newcastle Airport Short stay carpark

Mining Materials Handling

- Mine pit top civil infrastructure design including stockpiles, conveyor formations, site works, earthworks, roads and stormwater management at:
  - Ashton Coal, Camberwell
  - Blakefield South Portal Hardstand
  - Drayton Coal Mine Extension, Muswellbrook

Specialist Skills

- Project Management
- Design of Stormwater Management Systems
- Design of Stormwater Quality Systems
- Road and Siteworks Design
- Design of Erosion and Sediment Controls

Ulrika Knight

BE (Hons) MIEAust

ASSOCIATE

SENIOR CIVIL ENGINEER

Qualifications

Bachelor of Engineering (Hons), University of Newcastle

Certificate of Registration under the NSW Design and Building Practitioners Regulations 2021

- Professional Engineering Registration (Civil)
- Design Practitioner Registration (Drainage, Civil Engineering)

Affiliations

Member, Institution of Engineers Australia (MIEAust)
Chartered Professional Engineer (CPEng) National Engineering Register (NER)
APEC Engineer IntPE (Aus)

ACOR CONSULTANTS

ENGINEERS

MANAGERS

INFRASTRUCTURE PLANNERS

DEVELOPMENT CONSULTANTS

Expertise

Ulrika is a Senior Civil Engineer with experience in a wide variety of infrastructure and land development projects, in particular urban, rural and industrial land development; commercial, educational and healthcare infrastructure; local government roads and stormwater drainage facilities; service stations and fuel terminals; defence projects.

Ulrika has expertise in civil design, project management, contract administration and site supervision of major works. She has developed particular skills in the management of design projects and performing quality assurance reviews of design documentation including drawings, design calculations and reports.

Key Projects

Road and Drainage Infrastructure

- RMS road intersections and roundabouts design at:
  - Masters, Pacific Highway Heatherbrae
  - Masters, Manning River Drive Taree
  - Metroll, Awaba Road Toronto
- Various detention and trunk drainage design solutions for Maitland City Council at:
  - Norm Chapman Oval, Rutherford
  - East Maitland Park
  - Hague Street, Rutherford
- Various stormwater drainage design solutions for Muswellbrook Shire Council at
  - Drainage study at Bell Street, Muswellbrook
  - Drainage study at Mill Street, Muswellbrook
  - Stormwater drainage design at Sowerby/Flanders Street, Muswellbrook
  - Stormwater drainage design at Lorne Street, Muswellbrook
  - Ogilvie Street, Denman
- Roads, car parking and stormwater drainage design various developments:
  - Seniors Living Development, Port Macquarie
  - East Maitland Dental Surgery
  - Tuncurry Caravan Park
  - Big 4 Caravan Park, Cessnock
  - Bargo RFS Station
  - Blaxland RFS Station
  - Service Station, Forbes
  - Park Avenue, Kotara - residential unit developments
  - Paterson Road, Bolwarra - residential unit developments
  - Masters Plumbers, Warners Bay - commercial development
  - Kinda Kapers, Mount Hutton - commercial development

Park and Urban Infrastructure Upgrades

- Richley Reserve Stages 1 and 2 Blackbutt Reserve, New Lambton

Residential and Industrial Subdivisions

- Coordination of planning, design and documentation for site works, roads and stormwater drainage including trunk drainage design, stormwater detention and water quality design at:
  - Warnervale – 51 residential lots
  - .Cliftleigh Stage 9A - 48 residential lots
  - Morisset Park - 62 residential lots
  - Links Road, Gunnedah - 50 residential lots
  - Radford Park, Branxton - 165 rural residential lots
  - Mornington Heights Estate, Gunnedah - 344 residential lots
  - Stonebridge Estate, Cessnock - 146 residential lots
  - Nikkinba Ridge Estate, Fletcher - 250 residential lots
  - Bennetts Green - 27 industrial lots
  - Cameron Park Estate, Cameron Park - 35 industrial lots
  - Greenleaf, Fullerton Cove - 234 lot retirement village
  - The Lake Retiremnet Resort, Wyee - 110 lot retirement village
  - Greenleaf, Belmont North - retirement village – 24 units
  - Northlakes Estate Stage 52 – 15 residential lots
  - The Sanctuary, Aberglasslyn – 250 residential lots
  - Kingfisher Grove Estate, Shortland - 45 residential units

Substations and Electrical Infrastructure

- Civil and structural design including earthworks, compound levels, roads, stormwater drainage, secondary separation/oil containment, erosion/sediment controls, yard structures/foundations, blast walls and switch buildings at:
  - Wallerawang 132/66kV for Transgrid with John Holland Group
  - Tomaree 33/11kV substation for Ausgrid
  - Wollar 500/330kV substation for Transgrid with UGL
  - Bannaby 500/330kV substation for Transgrid with UGL
  - Upper Tumut switching station with Transgrid

Ulrika Knight

Key Projects (continued)

Education Infrastructure

- St Bede's Catholic College, Chisholm Stage 1 - Civil design services for DA and CC, and construction inspections
- St Aloysius Primary School, Chisholm Stage 2 - Civil design services for CC, and construction inspections
- Gorokan Public School - Civil design services for redesign and expansion of existing carpark
- Kurri Kurri High School – Civil design services for a new carpark and associated stormwater drainage works
- Eleebana Public School - Civil design for a new disabled access ramp, concrete stairs and drainage works
- Bishop Tyrrell Anglican College - Flood study and civil design for playing fields and courts
- BER NSW Primary Schools Program - Design Phase for Hunter Region - Design manager for the civil and structural design teams. Project included the design of new halls, homebases, administration blocks, canteens, libraries, COLAs etc. at 16 schools.
- BER NSW Primary Schools Program - Construction Phase for Hunter Region - Civil and structural Inspections at various schools.
- All Saints College - St. Mary's Campus Maitland - Civil design for roads, carparking and stormwater drainage.
- St Catherine's High School Singleton - Civil design
- St Joseph's Primary School Bulahdelah - Civil design.

Mining, Industrial and Materials Handling

- PUMA Bitumen Loading Depot, Kwinana - Project design manager; civil and structural design services including earthworks, roads, stormwater drainage, detention, water quality, buildings, concrete bund walls, steel pipe supports, steel access stairs
- PUMA Diesel Depot, Kalgoorlie – Project design manager; civil and structural design services including roads, stormwater drainage, detention, buildings, concrete bunds, pipe supports
- AGC Industries Melville Island Bulk Fuel Facility – Civil design engineer: civil design services including earthworks, roads, stormwater drainage, buildings concrete bund walls and bund floor, steel access stairs
- Mine pit top civil infrastructure design including stockpiles, conveyor formations, roads and stormwater management at:
  - Ashton Coal
  - Blakefield
- Design of earthworks, site works and stormwater management for Daracon at:
  - Martins Creek Quarry
  - Ardglen Quarry
  - Cameron Park Headquarters
  - Cameron Park concrete batching plant

Defence Projects

- HMAS Harman
  This project involved the design of new Living in Accommodation (LIA) at Training 1 Standard to support the current and long-term capability needs at Harman. The civil design included site grading, earthworks, retaining walls, stormwater drainage including detention and water quality, carparking, DDA complaints and coordination of services.
- RAAF Pearce Sewer Infrastructure Works
  This project involved the assessment of the existing sewer assets located at RAAF Base Pearce and detailing and design of refurbishment works of the sewer pump stations, manholes, maintenance shafts, and replacement of existing asbestos cement rising mains. The objective of the project was to repair and replace the assets to extend the life of the sewer network on site.
- RAAF Pearce GM Facility – Source Area D Capping
  This project involved civil design and documentation for the installation of surface capping over PFAS impacted soils located within the ground's maintenance area. The civil works included site grading, earthworks including capping layer, kerbs and stormwater drainage.
- Defence Logistics Transformation Project ($350M) – project elements included new major base entries and main road works at:
  - Moorebank NSW
  - Bandiana VIC

Other Civil Engineering Projects

- The Sanctuary, Aberglasslyn - Site management and construction administration
- Ringwood Raceway, Seaham - review of earthworks and stormwater management report for DA
- Design of roads, footpaths, stormwater drainage. Retaining walls and bus stops for disabled access for Hunter Councils
- Review of design documents including drawings, design calculations and reports for numerous civil and structural projects in accordance with company's quality systems and procedures.

Specialist Skills

- Project Management of multidiscipline projects
- Management of land development and infrastructure projects
- Quality Assurance reviews of design documents
- Design and documentation of roads and site works
- Design of stormwater management systems
- Design of stormwater quality systems
- Design of erosion and sediment controls