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Report on
Geotechnical Investigation

Proposed Sydney Olympic Park New High School
Burroway Road, Wentworth Point

Prepared for
School Infrastructure New South Wales (SINSW)

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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
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Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666

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1. Introduction

This report presents the results of a geotechnical investigation undertaken for a proposed new high school at Burroway Road, Wentworth Point. The work was commissioned by Schools Infrastructure New South Wales (SINSW) in consultation with Cadence Australia Pty Ltd (Cadence) who are project managers on behalf of SINSW. The work was undertaken in accordance with Douglas Partners (DP) proposal SYD200668.P.002.Rev0 dated 12 April 2021.

The proposed development covers an area of approximately 9,511 m^2 and includes a new high school. To the north of the site a playing field is proposed, however this is not part of the new high school development and will be owned and administered by others. The school is expected to comprise several multi-storey buildings with no basement levels around a central play area. The proposed site levels are to be raised to approximately 4.0 m AHD within the new high school area and will grade down towards the proposed playing field north of the school site.

DP has previously undertaken several investigations within the site and surrounds. Most notably, DP investigations on the 'Burroway Road Headland Park' site for Landcom which encapsulates the proposed high school site. DP previously prepared a desktop study for the school site based on the results of these previous investigations (Ref 202029.00.R.001 dated March 2021). Information from the previous investigations has also been used in this current report where relevant.

The purpose of this current geotechnical investigation was to obtain additional investigation data to refine the preliminary geotechnical model which was developed during the desktop study, and provide general comments on excavation conditions, shoring, groundwater and foundations, and to highlight potential geotechnical issues or constraints for the development. The additional investigations undertaken included:

- Piezocone penetration testing at seven locations;
- The drilling of cored boreholes at three locations;
- The drilling of one non cored borehole;
- Laboratory testing for a range of geotechnical and chemical parameters; and
- Analysis and interpretation of the results.

Details of both the field work and comments relevant to design and construction are given in this report.

This report supersedes the previous desktop report referenced above.

2. Proposed Development

The proposed development is for the construction of a school whereby the project is known as Sydney Olympic Park new high school. The school is to be developed in two stages. The SSD application will seek consent for both Stage One and Stage Two. While Stage Two is submitted as part of this proposal, construction is subject to approval of additional funding.

Stage One will provide for a Stream 5 high school, catering for up to 850 students. Stage Two will bring the school up to a stream 9 school capability catering up to 1,530 students.

The design features a six storey building. To the north of the site, a hall building (for sports and performance) is proposed.

The play space required to meet the need of students for Stage One can be generally accommodated onsite, within the 9,511 m^2 available. Additional play space may be required to accommodate the increased student numbers anticipated during Stage 2. The proposed adjoining play space comprises an area of around 8,800 m^2, and will be subject to a Joint Use Arrangement and available for public use outside school hours. The future Wentworth Point Peninsula Park will result in an open space area of approximately 4 ha.

The remainder of the peninsula (TfNSW land) is under review and will be subject to a separate approval process. Redevelopment of this land will include the new access road proposed off Burroway Road along the eastern boundary of the subject site and is proposed to include car parking, drop-off zones and delivery zones.

It is understood that no basement levels are proposed. Proposed site levels are about RL 4.0 m AHD within the new high school area and will grade down towards the proposed playing field to the north. This will require raising the existing ground levels by up to about 2 m in some areas and excavation of up to about 4 m in other areas.

3. Site Description

The proposed development is located within the peninsula of Wentworth Point at 7-11 Burroway Road, Wentworth Park across parts of three lots; Lot 202 DP1216628, Lot 203 DP1216628 and Lot 204 DP1216628. The site forms part of the Wentworth Point Planned Precinct, which was rezoned in 2014 for the purposes of high density residential, public recreation, school and business purposes.

The site is approximately 9,511 m^2 in area, with a frontage of approximately 91 m to Burroway Road. It currently contains vacant land, which is cleared of all past development, and almost entirely cleared of native vegetation.

The surrounding area is generally characterised by high rise residential and mixed-use developments. The site is directly adjacent to the Wentworth Point Peninsula Park and immediately east of Wentworth Point Public School.

Figure 1: Site Aerial Map. Source: Mecone

An embankment for the previously proposed 'Ridge Road' runs through the site and was constructed in 2019. With the exception of the area covered by the embankment, there is typically remnant concrete slabs present in the southern portion of the site, with grass and scattered trees elsewhere.

Prior to construction of the Ridge Road embankment the whole of the 'Burroway Road Headland Park' site was relatively flat with surface levels varying between about RL 2 m to RL 3 m AHD. The Wentworth Point peninsular is known to have been filled to raise general site levels in the late 1950s, and during subsequent land development activities, which accounts for the differences in levels across the site. Survey of the site was provided by Cadence Australia Pty Ltd (Plan of Detail and Levels Over Lot 204 and Part of Lots 202 & 203 in DP 1216628, Known as Sydney Olympic High School, Wentworth Point, by LTS, dated February 2021) and showed that the embankment is up to a level of RL 7.5 m AHD.

The location of the site is shown in Drawing 1 in Appendix B.

4. Regional Geology and Hydrogeology

The *Sydney 1:100 000 Geological Series Sheet* shows that the site is underlain by man-placed filling and alluvial/estuarine sediment. The sediment is likely to comprise silty to peaty sand, silt and clay. Shell layers are also expected to be present within the soil profile. The alluvial soils are expected to be underlain by Hawkesbury Sandstone which typically comprises medium to coarse-grained quartz sandstone with minor shale and laminite lenses.

The *Sydney 1:100 000 Soil Landscape Series Sheet* shows that the natural soils on the site are from the Birrong soil landscape. These soils are of alluvial origin and are characterised by localised flooding, a high erosion hazard, saline subsoil, seasonal waterlogging and very low soil fertility.

The *Prospect/Parramatta River 1:25 000 Acid Sulfate Soil Risk Map* shows the site as 'Disturbed Terrain' in which soil investigations are required to assess acid sulfate soil potential.

5. Previous Geotechnical Investigations

DP has previously undertaken the following geotechnical investigations on or close to the site:

- Report on Geotechnical Investigations, Wentworth Point Urban Activation Project, Hill Road and Burroway Road, Wentworth Point. Project number 84357.00 dated September 2014

  Geotechnical investigation for the Urban Activation Precinct for Urban Growth NSW which included numerous boreholes, piezocone penetration tests (CPTu) and dilatometer tests within and nearby the proposed high school site.

- Report on Geotechnical Investigation, Burroway Road Headland Park, Wentworth Point. Project number 84357.01 dated October 2018

  Geotechnical investigations for the 'Burroway Road Headland Park' site for Landcom which encapsulates the proposed high school site. The investigations included numerous boreholes and CPTu tests within and nearby the proposed high school site.

Investigations nearby the proposed high school site included six piezocone tests (CPTu 3, 8, 17,19, 125 and 126), one cored borehole (BHC3), one non cored borehole (BHA8), shear vane testing (SV3), dilatometer testing (DMT3 and DMT8) and dissipation tests. The previous investigations nearby to the high school site are discussed collectively with the current investigations in the following sections.

6. Field Work Methods

6.1 General

Both the previous field work carried out on or near the proposed high school site and the recent field work are discussed collectively within this report. All test locations are shown on Drawing 1 in Appendix B. The ground surface levels at the test locations were measured to AHD using an automatic level, relative to known benchmarks on or adjacent to the site, or a high-precision differential global positioning system (dGPS) receiver.

Some test locations involved more than one type of testing (e.g. cored boreholes, CPTu, dissipation tests, shear vane tests and dilatometer tests). In this case, the number associated with the test number describes the test location and the letters describe the type of test: CPTu refers to piezocone penetration test, BHC refers to cored borehole, BHA refers to non-cored borehole, SV refers to shear vane test and DMT refers to Dilatometer test.

6.2 Piezocone Penetration Tests

A total of thirteen piezocone penetration tests (CPTu) were undertaken on or nearby to the high school site to depths of between 10.0 m and 16.8 m using a specialist testing truck. The CPTu's included seven from the current field work (CPTu 203 to 206 and 208 to 210) and six from the previous investigations (CPTu 3, 8, 17,19, 125 and 126).

A CPTu involves pushing an instrumented cone and friction sleeve into the ground using hydraulic thrust from a ballasted truck-mounted testing rig. Measurements of cone resistance, sleeve friction and pore pressure are made at 20 mm depth intervals and are stored on a portable computer for subsequent interpretation.

6.3 Cored Boreholes

A total of four cored boreholes were drilled on or nearby to the high school site to depths of between 17.0 m to 23.0 m using a truck-mounted Explorer drilling rig. The boreholes included three from the recent investigations (BH204, BH207 and BH210) and one from the previous investigation (BHC3).

The bores were commenced using solid flight augers then continued using rotary wash-boring equipment inside top casing until weathered rock was encountered. Standard penetration tests were undertaken within the soil strata at regular depth intervals and an undisturbed soil sample was collected in a 50 mm diameter thin-walled steel tube from BHC3. NMLC and HQ-sized diamond core drilling equipment was used to obtain continuous core samples of the rock for identification and strength testing purposes.

6.4 Non cored boreholes

Two non-cored boreholes were drilled using a truck-mounted Explorer drilling rig. BH208 was drilled during the recent investigation to a depth of 2.1 m to collect a sample for acid sulfate soils testing. BHA8 was drilled during the previous investigation to a depth of 1.5 m nearby to the site during to allow Dilatometer testing to be carried out in the weaker alluvial soils below the filling.

6.5 Shear Vane Tests

A shear vane test (SV3) was undertaken within the proposed high school site during the previous investigations. The test was undertaken using a digital vane fitted to the cone penetration test truck. The vane is pushed into the ground to the required depth within solid casing using hydraulic thrust from the truck. The vane then extracts itself from within the casing to undertake the test procedure. The

undisturbed or peak shear strength was measured during 60° of slow rotation (i.e. 12° per minute) and the remoulded or residual shear strength was measured during 10 rotations of the vane at a slightly higher speed (i.e. 360° per minute). The data was stored on a portable computer for subsequent interpretation.

6.6 Dilatometer Tests

Dilatometer tests were undertaken at two locations (DMT3 and DMT8) on or nearby to the proposed high school site using a flat-blade Dilatometer and associated equipment. The equipment and an operator were supplied by Insitu Geotech Services Pty Ltd. The drilling rig and supervising engineer were supplied by Douglas Partners. Testing involved pushing the Dilatometer to the required depth below the base of a predrilled hole, and then undertaking a DMT at 200 mm intervals within the suitable soil horizon. The data was stored on a portable computer for subsequent interpretation.

6.7 Dissipation Tests

Dissipation tests were undertaken using the piezocone penetrometer. Each test involved stopping the piezocone at the required depth and measuring the rate of pore pressure dissipation to assess the compressibility / consolidation characteristics of the soils. The data is stored on a portable computer for subsequent interpretation, plotting and analysis.

7. Field Work Results

7.1 Soil and Rock Profile

The subsurface conditions inferred from the piezocone penetration tests are shown on the results sheets in Appendix C1 (recent) and Appendix C2 (previous). The materials encountered in the boreholes are presented on the borehole logs in Appendix D1 (recent cored boreholes), Appendix D2 (previous cored boreholes), Appendix E1 (recent non-cored boreholes) and Appendix E2 (previous non-cored boreholes). Notes defining descriptive terms and classification methods are included in Appendix A.

The soil and rock profile inferred/encountered can be described as follows:

- FILL (**Unit A**) – asphalt and concrete pavement in several locations. Clayey and sandy fill to depths of between 1.0 m and 3.5 m. The average depth of fill is 1.6 m. The boreholes also encountered gravel, silt, timber, shells, brick, cobbles, tile and concrete.
- WEAKER ALLUVIUM (**Unit B**) – typically very soft, soft and firm clays and peaty clays, and very loose and loose sands in all locations to depths of between 3.8 m and 12.5 m. The average depth to the base of the weaker alluvium is 6.1 m.
- STRONGER ALLUVIUM/RESIDUAL SOILS (**Unit C**) – typically firm to stiff, stiff, very stiff and hard clays, and medium dense sands in all locations apart from 210 to depths of between 10.8 m and 17.0 m. The average depth to the base of the stronger alluvium/residual soils is 13.2 m.
- BEDROCK (**Unit D**) – sandstone bedrock was encountered in the cored boreholes from depth of between 11.0 m to 17.0 m. The rock typically had a thin veneer of upto to 1.1 m of weathered

material, and became medium strength or stronger to the base of the bores from depths of between 11.8 m to 18.1 m. The presence of bedrock in the CPTs (excluding where cored borehole were drilled) was inferred from test refusal at depths of between 10.8 m and to 16.4 m; the average depth of refusal was 12.2 m.

Tables 1A and 1B summarise the levels at which the tops of different materials were encountered. Generally, the CPTs have been used to assess the soils strength and consistency and the boreholes used to assess the rock where applicable.

Table 1A: Summary of Material Strata Levels

Stratum	RL of Top of Stratum (m, AHD)						
	203	204	205	206	207	208	209
Ground Surface / Fill / Concrete	2.4	2.4	2.7	2.7	3.5	2.1	2.3
Weaker Alluvium	0.9	0.6	1.0	1.2	0.0	0.9	1.2
Stronger Alluvium / Residual	-2.3	-1.4	-3.0	-2.3	-4.5	-4.3	-4.0
Weathered Bedrock	-9.3	-8.6	-8.1	-9.7	-13.5	-9.7	-9.9
MS/HS Bedrock	NA	-9.4	NA	NA	-14.6	NA	NA
Base of Test	-9.3	-14.6	-8.1	-9.7	-19.5	-9.7	-9.9

Notes: NE = Not encountered; NA = not applicable; MS = Medium strength; HS = High strength

Table 1B: Summary of Material Strata Levels

Stratum	RL of Top of Stratum (m, AHD)						
	210	3	8	17	19	125	126
Ground Surface / Fill / Concrete	2.3	2.8	2.2	2.5	2.5	2.7	2.3
Weaker Alluvium	1.3	0.7	0.9	1.2	1.4	0.9	0.8
Stronger Alluvium / Residual	NE	-1.0	-3.6	-4.2	-2.4	-1.9	-4.2
Weathered Bedrock	NE	-10.2	-14.6	-13.9	-9.1	NE	NE
MS/HS Bedrock	-10.2	-10.6	NA	NA	NA	NA	NA
Base of Test	-14.7	-16.1	-14.6	-13.9	-9.1	-7.3	-7.7

Notes: NE = Not encountered; NA = not applicable; MS = Medium strength; HS = High strength

7.2 Groundwater

Groundwater was observed at depths of 1.1 m to 2.5 m in the boreholes and CPTs at the time of the field work. The average depth to groundwater was 1.7 m. These observed depths translate to levels of between RL -0.1 m and RL 1.5 m AHD. The average level of groundwater was RL 0.8 m AHD but is likely to vary over time with climatic conditions.

7.3 Shear Vane Tests

The results of the shear vane tests are provided in Appendix F. A summary of the results is provided in Table 2.

Table 2: Summary of Shear Vane Test Results

Test Location	Test Depth (m)	Material	Peak Shear Strength (kPa)	Residual Shear Strength (kPa)
SV3	3.7	Sandy silty clay	39	7

7.4 Dilatometer Tests

The results of the Dilatometer tests are provided in Appendix G. A summary of the results is provided in Table 3.

Table 3: Summary of Dilatometer Test Results

Test Location	Test Depth Range (m)	Typical Material	Dilatometer Modulus (MPa)			Undrained Shear Strength (kPa)		
			Max.	Min.	Ave.	Max.	Min.	Ave.
DMT3	2.2 to 6.0	Clay/Peaty clay	31.2	0.0	6.2	54	15	26
DMT8	2.4 to 6.0	Clay/Peaty clay	9.8	0.9	2.5	31	15	23

7.5 Dissipation Tests

The results of the dissipation tests are provided in Appendix H1 (recent) and H2 (previous). A summary of the results is provided in Table 4 and a graph of horizontal coefficient of consolidation (c_h) versus depth is shown in Figure 1 for various material types inferred from the CPTs.

Table 4: Summary of Dissipation Test Results for Various Materials

Material	No. of Tests	Horizontal Coefficient of Consolidation (c_h, m^2/year)		
		Maximum	Minimum	Average
s Clay	1	3	3	3
s Peaty clay	1	25	25	25
s to f Silty clay	4	141	11	49
f Sandy clay	1	23	23	23
f to st Peaty clay	4	231	14	74.5

Notes: s = soft; f = firm, st = stiff

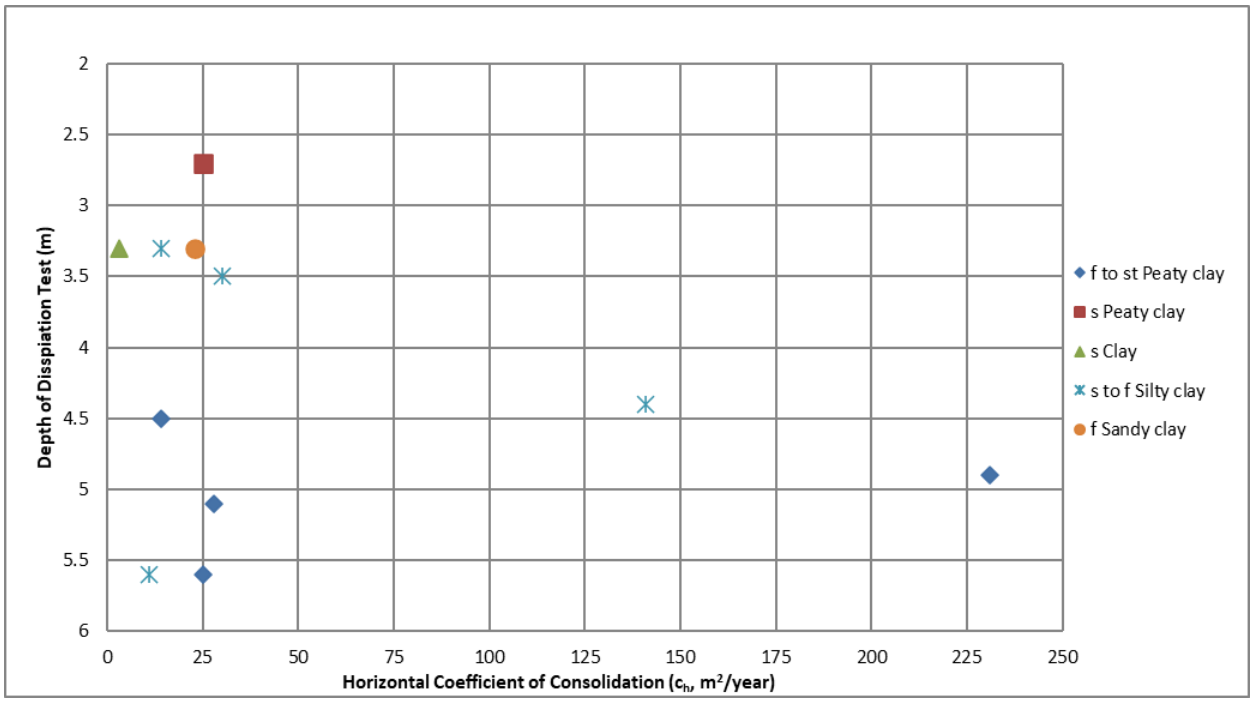

Figure 1: Graph of c_h vs. Depth for various material types

8. Laboratory Testing

Laboratory testing included point load testing, consolidation testing, aggressivity testing and acid sulfate soils testing. The point load testing is shown on the attached borehole logs in Appendix D1 (recent investigations) and Appendix D2 (previous investigation), other laboratory tests results are included in Appendix I1 (recent investigations) and Appendix I2 (previous investigations).

8.1 Rock Samples

Twenty-three samples selected from the rock core were tested for axial point load strength index (Is_{50}). The results ranged from 0.2 MPa to 3.5 MPa which correspond to very low strength and very high strength rock, respectively. These Is_{50} results suggest unconfined compressive strengths (UCS) in excess of 60 MPa for the very high strength rock encountered during the investigations.

8.2 Soil Samples

One soil sample was previously analysed to assess the consolidation characteristics of the soft clays recovered from the boreholes in the thin-walled steel tubes. A summary of the results is provided in Table 5. The laboratory test reports are included in Appendix I2.

Table 5: Summary of One Dimensional Consolidation Test Results

Sample/ Depth (m)	Description	No. of Load Cycles	Stress Range (kPa)	$c_{v,average}$ (m^2/year)	$m_{v,average}$ (m^2/MN)
BHC3/5.40-5.75	Silty clay	3	6 to 200	1.83	0.11

Notes: c_v = vertical coefficient of consolidation; m_v = coefficient of volume compressibility

One soil sample was analysed to assess the Atterberg Limits and California Bearing Ratio (CBR) of the fill towards Burroway Road on the east of the site at the request of the project Civil Engineers.

Table 6: Summary of Geotechnical Laboratory Test Results

BH ID	Depth (m)	Material	Atterberg Limits (%)			CBR (%)	MDD (t/m^3)	OMC (%)
			LL	PL	PI			
BH210	0 – 1.0	Fill / Sandy CLAY	32	17	15	8	1.88	14.0

Note: MC = Moisture Content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index, LS = Linear Shrinkage, CBR = California Bearing Ratio, MDD = Maximum Dry Density, OMC = Optimum Moisture Content

Seven soil samples were analysed to assess the aggressivity of the soil. A summary of the results is provided in Table 7. The laboratory test reports are included in Appendix I1 and Appendix I2.

Table 7: Summary of Soil Aggressivity Results

Sample/Depth (m)	Description	pH (pH units)	EC (µS/cm)	Chloride (mg/kg)	Sulphate (mg/kg)
BHC3/2.50-2.95	Silty Sand	8.0	1800	1300	1500
BH204 0.1-0.2	Fill / Gravelly Sand	8.8	290	150	260
BH204 0.9-1.0	Fill / Gravelly Sand	10.4	340	130	250
BH204 5-5.45	Silty Clay	8.0	1100	1400	230
BH204 8-845	Clay	5.0	1800	2400	360
BH207 14	Silty Clay	7.4	2200	3200	210
BH210 11.0-11.45	Sand	9.1	1400	1900	160

Notes: EC = electrical conductivity; All samples mixed at a ratio of 1(soil):5(water) prior to testing

Samples collected from the soil profile were screened to assess the presence of actual acid sulfate soil (AASS) and potential acid sulfate soil (PASS). AASS is described as soil that is producing acid in its natural state. PASS is described as soil that is not currently producing acid but will do if exposed to oxygen as a result of excavation from below the groundwater table or lowering of the groundwater table.

Screening involved testing the pH of a sub-sample of soil that had been mixed with distilled water (pH_F) and a sub-sample of soil that had been mixed with the oxidising agent, hydrogen peroxide (pH_{FOX}). Low values of pH_F and pH_{FOX} provide an indication AASS and PASS respectively. The results of the screening programme are provided in Appendix I1 and Appendix I2. Five soil samples were sent for quantitative analysis to confirm the presence of AASS and PASS in the soil profile.

One soil sample was analysed in a NATA accredited analytical laboratory using the Suspension Peroxide Oxidation and Combined Acidity and Sulphate (SPOCAS) and Chromium Reducible Sulphur test methods, and four soil samples were analysed using Chromium Reducible Sulphur test methods only. The results of the analyses are summarised in Table 8 together with the action criteria as outlined in the ASSMAC *Acid Sulfate Soil Manual*. The detailed laboratory results are included in Appendix I1 and I2.

Table 8: Results of Laboratory Testing for Acid Sulfate Soils

Bore/Sample Depth (m)	Description	pH_{kcl}	pH_{Ox}	S_{POS} (%w/w)	S_{Cr} (%w/w)	TAA (Mol H+/t)	TPA (Mol H+/t)	TSA (Mol H+/t)
BHC3/11.4-11.85	Silty clay	4.3	4.5	<0.005	<0.005	35	10	<5
BH204 2.5-2.95	Sandy	9.6	NT	NT	0.006	<5	NT	NT
BH207 4.0-4.1	Sandy	9.1	NT	NT	0.13	<5	NT	NT
BH207 5.0-5.45	Clayey	7.4	NT	NT	0.91	<5	NT	NT
BH208 2.0-2.1	Clayey	8.2	NT	NT	0.21	<5	NT	NT
Action Criteria for Sandy Soils*		<4	<3	>0.03	>0.03	>18	>18	>18
Action Criteria for Clayey Soils*		<4	<3	>0.1	>0.1	>62	>62	>62

Note: *Assuming <1000 t disturbed (e.g. during non-displacement piling)

The results shaded in yellow in Table 8 indicate that PASS does exist within the alluvial soil profile which confirms the results of the initial screening.

9. Geotechnical Model

A geotechnical model for the site is presented in Geotechnical Cross-Sections A-A and B-B in Drawings 3 and 4 in Appendix B. Drawing 2 is also included which shows the contours to the top of bedrock across the site inferred from the boreholes and CPTs.

A summary of the geotechnical model is shown in Table 9. Refer to discussions in Section 7.1 for more detailed discussion of the encountered subsurface conditions and geological units.

Table 9: Summary of Geotechnical Model

Geological Unit	Average Unit Thickness	Description
Unit A	1.6 m	Fill, asphalt and concrete pavement. Clayey and sandy fill with variable amounts of gravel, silt, timber, shells, brick, cobbles, tile and concrete.
Unit B	4.5 m	Alluvium comprising very soft, soft and firm clays and peaty clays, and very loose and loose sands.
Unit C	7.1 m	Alluvium/residual soils comprising firm to stiff, stiff, very stiff and hard clays with some sands.
Unit D	Not applicable	Sandstone and laminite bedrock which typically has a thin veneer of weathered material overlying medium and/or high strength rock.
Groundwater	Not applicable	Measured at depths of 1.1 m to 2.5 m (average 1.7 m) which correlate to levels of RL -0.1 m to RL 1.5 m with an average of RL 0.8 m (AHD).

10. Comments

10.1 Site Preparation

It is understood that earthworks will be required to level the site to achieve the proposed site levels. Based on our current understanding of a proposed site level of about RL 4 m AHD, there would be a large amount of cut from the embankment and fill in other areas of the site.

The placement of fill over the weaker alluvium that has not already been adequately preloaded will cause consolidation of the very soft and soft clays which has the potential to cause significant settlement if not planned for. Where surcharging for the embankment has already been carried out further settlement once the fill has been removed is less likely, however some ongoing creep type settlement may still occur.

Some form of soft soil improvement will probably be required to reduce both total and differential settlement across the site. This could be undertaken by pre-loading or surcharging the areas which are yet to have been preloaded to allow the consolidation settlement to occur in a controlled manner, usually with the aid of wick drains to hasten the process. The time taken to achieve adequate consolidation is dependent on the thickness of soft soil, the consolidation characteristics of the soil and the proposed load to be applied. The required period of pre-loading or surcharging is likely to vary across the site. Alternatively, non-time dependent ground improvement such as the installation of controlled-modulus columns would also be technically feasible although may not be as economical. Detailed analysis of the proposed fill depths and consolidation characteristics of the weaker alluvium will be required in order to determine the best technical solution.

A suitable methodology for bulk filling works on the site is as follows:

- Proof-roll the prepared subgrade areas using a large roller (e.g. 12 tonne deadweight) to check for the presence of any soft zones which may need to be rectified prior to the placement of filling. A bridging layer may be required where there is insufficient filling above the soft clays;
- Place approved filling material in maximum 250 mm thick layers and compact to a dry density ratio of at least 98% relative to Standard compaction;
- Ensure the moisture content of the filling is within 2% of optimum if it exhibits clay-like properties; and
- Undertake density testing in accordance with the recommendations provided in Australian Standard AS 3798 – 2007 *Guidelines on earthworks for commercial and residential developments* or other suitable specification.

Piling rigs and other large machinery will require a suitable working platform on the site for safety and operational reasons. An assessment of the required platform capacity should be made once piling equipment has been selected. Experience on sites with similar subsurface profiles suggests that some form of working platform improvement will be required.

The existing concrete slabs and pavements could be removed and crushed for re-use on site as filling, bridging material or as roadbase for temporary access roads/working platforms. If the slabs are to remain in place, then they should be broken-up to ensure that they do not act as a drainage barrier across the site. Slabs within proposed building footprints should be demolished or broken up enough to avoid impact to piling further down the track. Slabs may also need to be demolished to allow installation of ground improvement works, for example wick drains or continuous modulus columns.

10.2 Excavation

Excavation is expected to be limited to works for levelling the embankment, pile caps, slab thickenings and services and will therefore be required within fill and soils. Excavation in these materials should be readily achievable using conventional earthmoving equipment such as a hydraulic excavator with bucket attachment. A hydraulic rock hammer will probably be required to remove existing concrete slabs and pavements.

It should be noted that any off-site disposal of spoil will generally require assessment for re-use or classification in accordance with current *Waste Classification Guidelines* (NSW EPA, 2014).

10.3 Excavation Support

10.3.1 General

Vertical excavations in fill and soil are not expected to be self-supporting for any extended period of time. Temporary batters should be feasible for minor excavations on the site and should be cut no steeper than 1.5(H):1(V) for depths of up to 2 m. Flatter batters may be required if groundwater is encountered. Permanent or semi-permanent batters for embankments should be no steeper than 2(H):1(V) and may need to be flatter or incorporate intermediate benches if greater than 3 m in height.

It is understood that no large excavations are proposed for the development, however, it is noted that shoring support will be required in areas where batters are considered impractical. Suitable shoring systems for minor excavations include driven steel-sheet piles or proprietary shoring boxes.

10.3.2 Earth Pressures

Excavation/embankment faces retained either temporarily or permanently will be subjected to earth pressures from the ground surface down to the base of the excavation/embankment. Table 10 outlines material and strength parameters that could be used for the design of excavation support structures. A triangular lateral earth pressure distribution could be assumed for cantilevered shoring systems and systems with one row of support. A rectangular lateral earth pressure distribution could be assumed for retaining walls fully propped by the building floor slabs.

Table 10: Material and Strength Parameters for Excavation Support Structures

Material	Bulk Unit Weight (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Coefficient of Earth Pressure at Rest (K_o)	Coefficient of Passive Earth Pressure[1] (K_p)
Fill	20	0.35	0.6	2.5
Weaker Alluvium	20	0.5	0.75	2.0
Stronger Alluvium	20	0.3	0.5	3.0

Notes: [1] Only below bulk excavation level/embankment toe level

Lateral pressures due to surcharge loads from construction machinery and traffic should be included where relevant. Hydrostatic pressure should also be included in the design where adequate drainage is not provided behind the full height of the walls.

10.4 Groundwater

The groundwater level has been measured within about 1 m of the existing ground surface and may fluctuate over time. It is understood that bulk excavation is not required and excavation will probably be limited to works for pile caps, slab thickenings and services. Excavation below the groundwater table is expected to prove problematic and should be avoided where possible.

Seepage of water into excavations should be able to be managed using a sump to collect water in the base of the excavation and a pump to remove the water. Seepage through sandy layers may require

the excavation of additional pits or the use of dewatering spears to allow dewatering to be undertaken in the area of interest.

10.5 Foundations

10.5.1 General

Spread footings (e.g. pad and strip footings) will not be appropriate for the site due to the weak alluvium encountered during the investigation. All significant column loads will therefore need to be supported on piles founded in bedrock. Lightly loaded structures may be able to be founded in the 'Unit C' stronger alluvium / residual soil described in the geotechnical model if differential settlements can be managed.

Further, analysis of the CPT results suggests that the weaker alluvium has an over-consolidation ratio of less than unity. Consolidation of the alluvium is therefore ongoing. The lowest floor slabs in the buildings will need to be designed to accommodate movements and can be expected to settle and crack overtime. This also applies to any road corridors. If such movements cannot be tolerated then the slabs should also be fully suspended on piles.

Suitable pile types for heavily loaded columns include continuous flight auger (CFA) piles, concrete screw-type piles (e.g. Atlas and Omega piles), driven precast concrete piles and driven steel piles. Lightly loaded structures could also be supported using these piles types, and possibly steel screw piles in areas of the site where the stronger alluvium is shallow and where corrosion protection measures are provided.

We understand that an underground storage tank (UST) may be present on or nearby to the site. We understand that further investigation of the UST is being undertaken by others. If the UST is within the building footprint then it may cause an obstruction to piling and may need to be removed. Other obstructions such as concrete may be encountered in the fill. As such, some allowance for dealing with these during construction should be made.

10.5.2 Drilled Piles

CFA piles are constructed by drilling a hollow-stem auger into the ground to a nominated depth. Concrete or grout is injected through the stem of the auger as the auger is withdrawn. A column of concrete or grout is then formed upon complete auger withdrawal and a steel reinforcing cage is lowered into the column to complete the pile.

Concrete screw-type piles are constructed using a similar process to a CFA pile except that the auger is inserted and withdrawn at the pitch of the auger so that pile spoil is not produced. This forms a full-displacement pile which allows for increased shaft capacities in soils. The downside of this piling technique is that refusal occurs on the top of rock and therefore lower end-bearing pressures usually result. However, this is unlikely to be a major concern on the school site because strong rock was encountered at or close to the bedrock surface and practical refusal of a CFA piling rig would probably occur at a similar depth in any case.

CFA and concrete screw-type piles could be designed using the parameters provided in Table 11. Parameters for both the working stress and limit-state design approaches have been provided. Steel

screw piles for lightly loaded structures could be designed using the end-bearing parameters for the Unit C alluvium shown in Table 11.

Table 11: Design Parameters for CFA Piles and Concrete Screw-type Piles

Material Description	Allowable End-Bearing Pressure (kPa)	Allowable Shaft Adhesion (kPa)[1]	Ultimate End-Bearing Pressure (kPa)	Ultimate Shaft Adhesion (kPa)[1]	Elastic Modulus (MPa)
Unit C Alluvium	150	0	450	0	20
ELS to VLS Rock	1000	50	3000	150	100
MS Rock	3500	350	30000	700	500
HS Rock	6000	600	60000	1500	1000

Notes: [1]Reduce by 50% for uplift loads and ensure cone-pullout criteria are met; ELS = extremely low strength; VLS = very low strength; MS = medium strength; HS = high strength

It should be noted that the serviceability limit-state is likely to govern the design of the drilled piles and the ultimate bearing pressures provided in Table 11 are unlikely to be achieved within the limits of serviceability. An appropriate geotechnical strength reduction factor should be applied when using the limit-state approach as outlined in AS 2159 – 2009 *Piling – Design and installation*.

Settlement of a pile is dependent on the loads applied to the pile and the foundation conditions in the socket zone and below the pile toe. The total settlement of a CFA or concrete screw-type pile designed using the 'allowable' parameters provided in Table 11 should be less than 10 mm upon application of the design load.

Soil decompression can occur during CFA piling when a strong stratum is encountered. In this case, the augers continue to rotate but the rate of auger progression decreases and soil from around the auger is displaced upwards towards the surface. Decompression can cause weakening and settlement of the soils adjacent to the pile and should be avoided by monitoring auger speed and progression closely.

10.5.3 Driven Piles

Driven precast concrete or steel-tube piles could also be used to support the proposed building loads and have an advantage in that they are also full-displacement piles (i.e. no pile spoil produced) and can usually support higher loads than piles cast in place. The capacity of a pile driven to rock is likely to be governed by the structural capacity of the pile and the efficiency of the driving equipment. Driven piles could initially be designed on the basis of the 'ultimate' design parameters provided in Table 11 although are usually governed by the structural capacity of the pile rather than the geotechnical capacity. The installation of test piles and pile load testing should then be undertaken to confirm driving conditions, pile set, pile capacity and an appropriate geotechnical strength reduction factor.

Settlement of a driven pile should be estimated using load test data obtained during the design confirmation stage of the piling process.

10.5.4 Negative Skin Friction

Negative skin friction describes the additional load applied to a pile as a result of consolidation or settlement of a compressible soil in contact with the pile shaft. The structural capacity of the pile should be designed to include a negative skin friction allowance of 20 kPa in the weaker alluvium (i.e. Unit B in the Geotechnical Model presented for the site) and overlying filling.

10.6 Acid Sulfate Soils

The laboratory testing indicates that potential acid sulfate soils (PASS) are present within the soil profile. It is currently understood that large-scale lowering of the groundwater table should not be required during construction. However, if non-displacement piles are used on the site (e.g. CFA piles) then acid production may occur as a result of pile spoil being brought to the surface.

The pile spoil will need to be managed on site prior to disposal or reuse in an appropriate manner. Management generally involves mixing the PASS with lime in a controlled manner. An *Acid Sulfate Soil Management Plan* will need to be developed prior to the commencement of construction if acid sulfate soils are to be disturbed as part of the development.

10.7 Soil Salinity and Aggressivity to Concrete and Steel

The salinity hazard map indicates that the moderate salinity potential category is relevant for the site. Soil salinity is assessed with respect to electrical conductivity after conversion of the result to EC_e (electrical conductivity of a saturated extract) by multiplication with a factor dependent on soil texture. Once converted, the EC_e value is compared to the guideline ranges listed within Table 12. The purpose of this investigation was not to undertake a detailed salinity assessment; regardless eight samples were tested for EC as part of the aggressivity testing and showed classifications varying from Non-Saline to Highly Saline.

Table 12: Soil Salinity Classification

Class	EC_e (dS/m)	Implication
Non-Saline	<2	Salinity effects mostly negligible
Slightly Saline	2 – 4	Yields of sensitive crops effected
Moderately Saline	4 – 8	Yields of many crops effected
Very Saline	8 – 16	Only tolerant crops yield satisfactorily
Highly Saline	>16	Only a few very tolerant crops yield satisfactorily

It is currently understood that large-scale lowering of the groundwater table should not be required during construction and that the site will be filled. Assuming standard good building practices are employed, including cover to reinforcement within concrete and correct installation of a brick damp course (where used), so that it cannot be bridged to allow moisture to move into brick work and up the wall, and appropriate non saline fill and capping is used at the site, it is likely that impacts from saline soils will be limited to the design of piles and inground structures. The design of all piles and inground structures should consider the recommendations of relevant standard (for example AS 2159 – 2009

Piling – Design and installation and AS 3600 – 2018 Concrete Structures) with respect to saline and aggressive soils. Comments on aggressivity to steel and concrete piles are provided below.

Aggressivity to steel and concrete piles was assessed using the laboratory test results. The exposure classification for steel piles is assessed as being Severe in accordance with Australian Standard AS 2159 – 2009 Piling – Design and installation. An appropriate allowance for section loss or cathodic protection will be required if steel piles are proposed. The exposure classification for concrete piles is assessed as being Moderate in accordance with Australian Standard AS 2159 – 2009 Piling – Design and installation.

10.8 Seismicity

A Hazard Factor (*Z*) of 0.08 would be appropriate for the development site in accordance with Australian Standard AS 1170.4 – 2007 *Structural design actions – Part 4: Earthquake actions in Australia*. The site sub-soil class would be Class D_e due to the very low soil strengths encountered on the site.

11. Limitations

Douglas Partners (DP) has prepared this report for this project at Burroway Road, Wentworth Point in accordance with DP's proposal SYD200668.P.002.Rev0 dated 12 April 2021. This report is provided for the exclusive use of School Infrastructure New South Wales (SINSW) for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

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

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Appendix A

About This Report

About this Report

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Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Sampling Methods

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Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

Description and Classification Methods

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

Soil Types

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

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

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

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

Definitions of grading terms used are:

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

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

In fine grained soils (>35% fines)

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

In coarse grained soils (>65% coarse)
- with clays or silts

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

In coarse grained soils (>65% coarse)
- with coarser fraction

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

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

Soil Descriptions

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Origin

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

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

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

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

Moisture Condition – Fine Grained Soils

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

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

Rock Strength

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

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Rock Descriptions

Degree of Fracturing

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

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

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

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Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

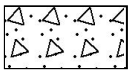
Symbols & Abbreviations

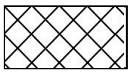
Graphic Symbols for Soil and Rock

General

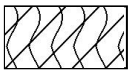

Asphalt

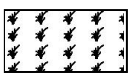

Road base

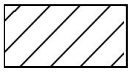

Concrete

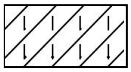

Filling

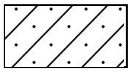
Soils


Topsoil

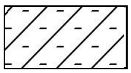

Peat

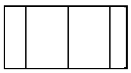

Clay

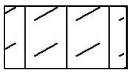

Silty clay

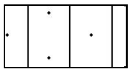

Sandy clay

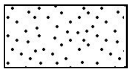

Gravelly clay

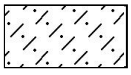

Shaly clay

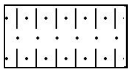

Silt


Clayey silt


Sandy silt

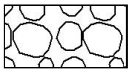

Sand

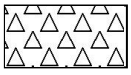

Clayey sand


Silty sand


Gravel

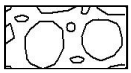

Sandy gravel


Cobbles, boulders

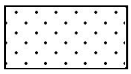

Talus

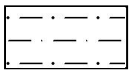
Sedimentary Rocks

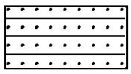

Boulder conglomerate

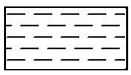

Conglomerate


Conglomeratic sandstone

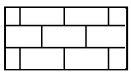

Sandstone


Siltstone

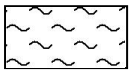

Laminite

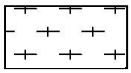

Mudstone, claystone, shale

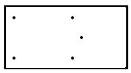

Coal


Limestone

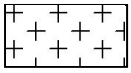
Metamorphic Rocks

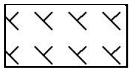

Slate, phyllite, schist

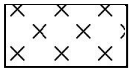

Gneiss

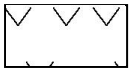

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Cone Penetration Tests

Douglas Partners

Introduction

The Cone Penetration Test (CPT) is a sophisticated soil profiling test carried out in-situ. A special cone shaped probe is used which is connected to a digital data acquisition system. The cone and adjoining sleeve section contain a series of strain gauges and other transducers which continuously monitor and record various soil parameters as the cone penetrates the soils.

The soil parameters measured depend on the type of cone being used, however they always include the following basic measurements

- Cone tip resistance q_c
- Sleeve friction f_s
- Inclination (from vertical) i
- Depth below ground z

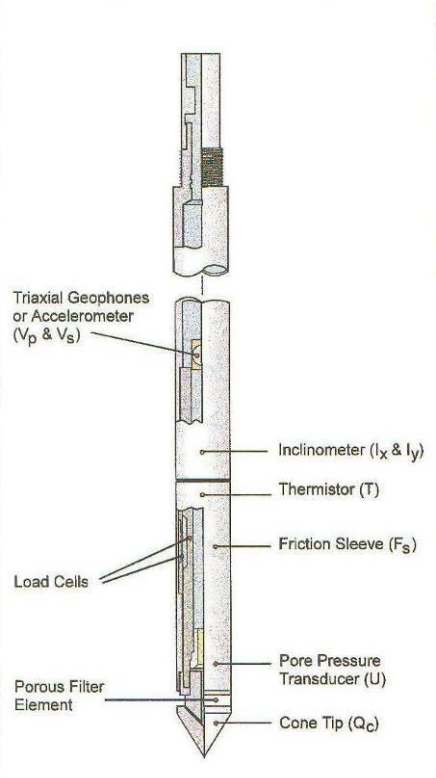


Figure 1: Cone Diagram

The inclinometer in the cone enables the verticality of the test to be confirmed and, if required, the vertical depth can be corrected.

The cone is thrust into the ground at a steady rate of about 20 mm/sec, usually using the hydraulic rams of a purpose built CPT rig, or a drilling rig. The testing is carried out in accordance with the Australian Standard AS1289 Test 6.5.1.

Figure 2: Purpose built CPT rig

The CPT can penetrate most soil types and is particularly suited to alluvial soils, being able to detect fine layering and strength variations. With sufficient thrust the cone can often penetrate a short distance into weathered rock. The cone will usually reach refusal in coarse filling, medium to coarse gravel and on very low strength or better rock. Tests have been successfully completed to more than 60 m.

Types of CPTs

Douglas Partners (and its subsidiary GroundTest) owns and operates the following types of CPT cones:

Type	Measures
Standard	Basic parameters (q_c, f_s, i & z)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (σ) plus basic parameters
Seismic	Shear wave velocity (V_s), compression wave velocity (V_p), plus basic parameters

Strata Interpretation

The CPT parameters can be used to infer the Soil Behaviour Type (SBT), based on normalised values of cone resistance (Qt) and friction ratio (Fr). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

Cone Penetration Tests

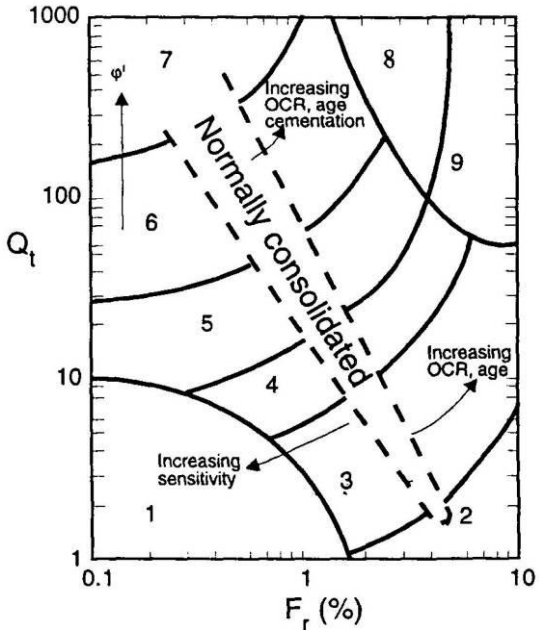


Figure 3: Soil Classification Chart

DP's in-house CPT software provides computer aided interpretation of soil strata, generating soil descriptions and strengths for each layer. The software can also produce plots of estimated soil parameters, including modulus, friction angle, relative density, shear strength and over consolidation ratio.

DP's CPT software helps our engineers quickly evaluate the critical soil layers and then focus on developing practical solutions for the client's project.

Engineering Applications

There are many uses for CPT data. The main applications are briefly introduced below:

Settlement

CPT provides a continuous profile of soil type and strength, providing an excellent basis for settlement analysis. Soil compressibility can be estimated from cone derived moduli, or known consolidation parameters for the critical layers (eg. from laboratory testing). Further, if pore pressure dissipation tests are undertaken using a piezocone, in-situ consolidation coefficients can be estimated to aid analysis.

Pile Capacity

The cone is, in effect, a small scale pile and, therefore, ideal for direct estimation of pile capacity. DP's in-house program ConePile can analyse most pile types and produces pile capacity versus depth plots. The analysis methods are based on proven static theory and empirical studies, taking account of scale effects, pile materials and method of installation. The results are expressed in limit state format, consistent with the Piling Code AS2159.

Dynamic or Earthquake Analysis

CPT and, in particular, Seismic CPT are suitable for dynamic foundation studies and earthquake response analyses, by profiling the low strain shear modulus G_0. Techniques have also been developed relating CPT results to the risk of soil liquefaction.

Other Applications

Other applications of CPT include ground improvement monitoring (testing before and after works), salinity and contaminant plume mapping (conductivity cone), preloading studies and verification of strength gain.

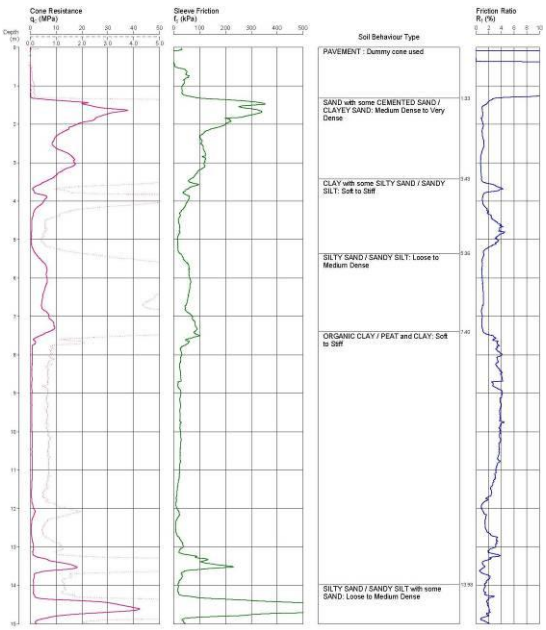
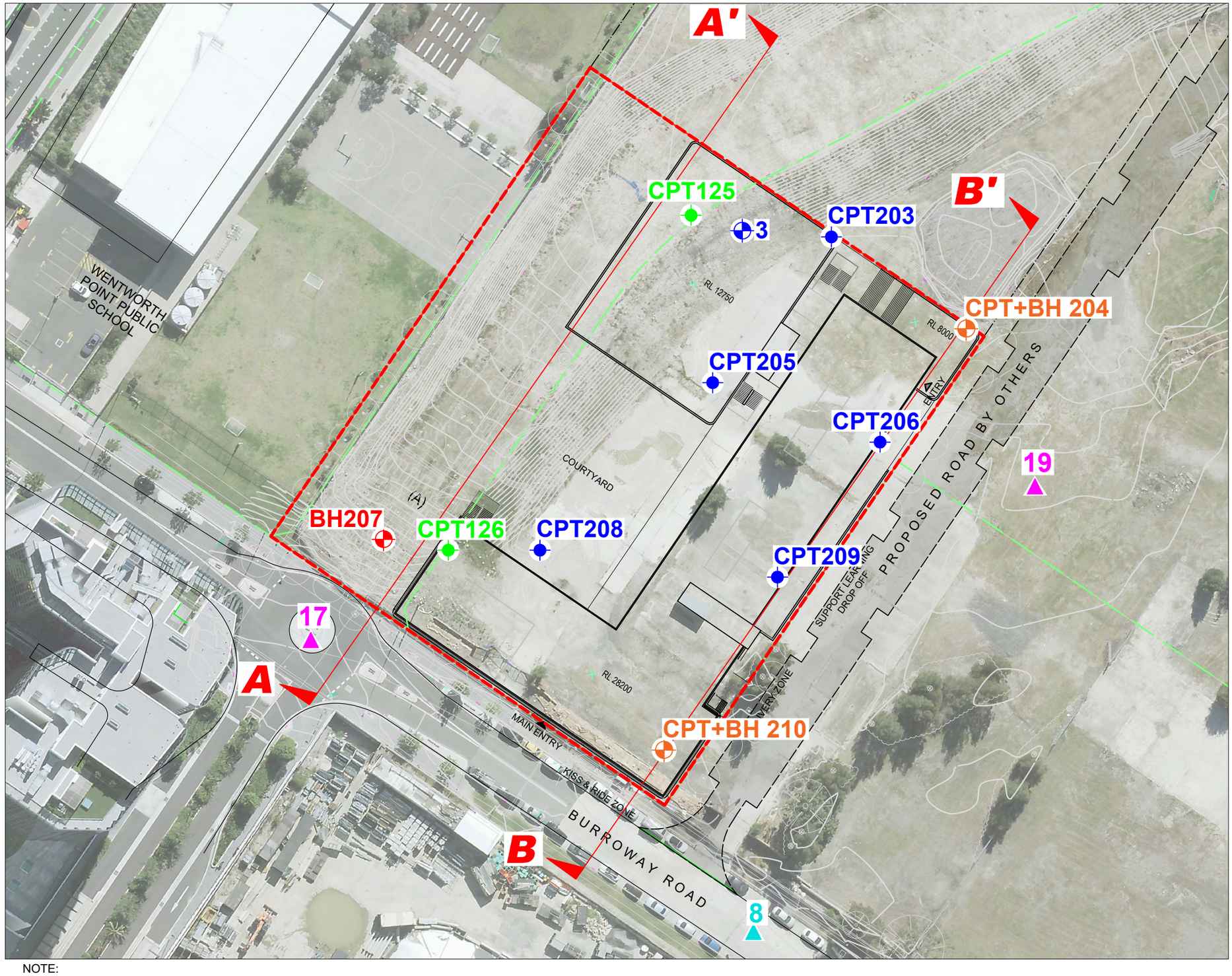
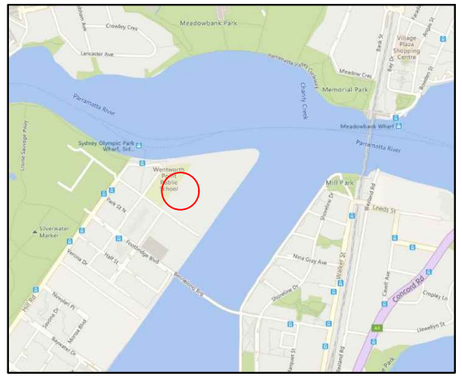


Figure 4: Sample Cone Plot

Appendix B

Drawings





Locality Plan

LEGEND

- Approximate Proposed High School Site Boundary

84357.00, July 2014

- CPTu, Cored borehole & Dilatometer testing
- CPTu, Dilatometer testing
- CPTu

84357.01, August 2018

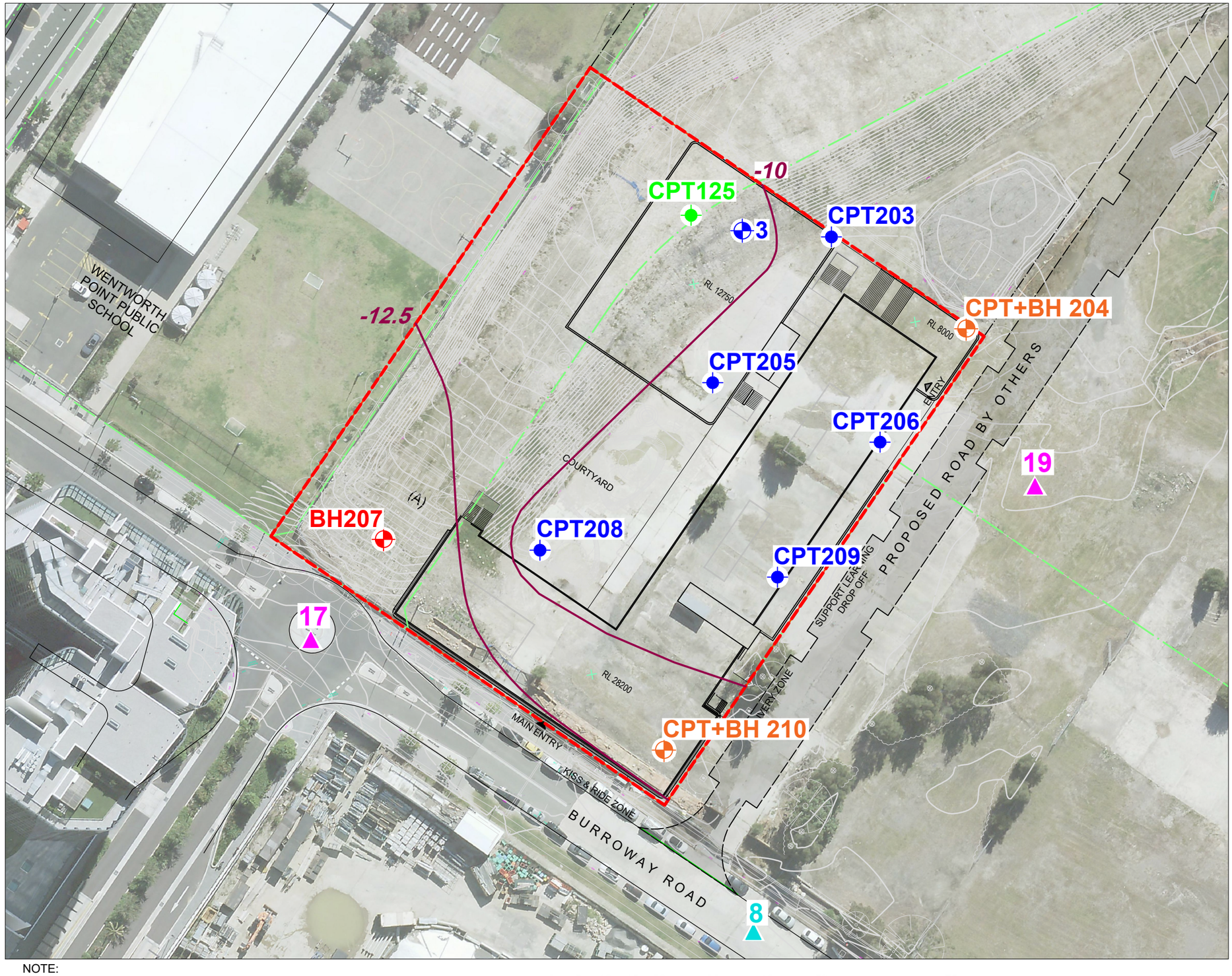
- CPTu
- Borehole Location
- CPT and Borehole Locations
- CPT Locations

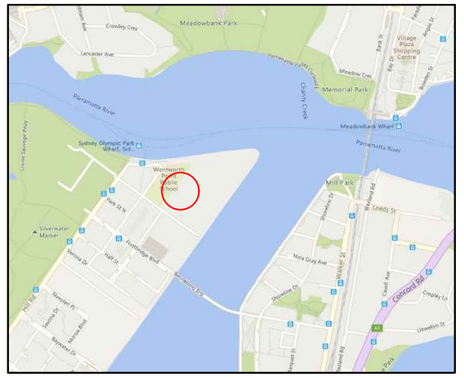
NOTE:
1: Base image from MetroMap (Dated 15.04.2021)
2: Site Plan Proposed' (DWG: SOPHS-WB-AR-DA1102, Rev A, Dated 16 August 2021) is overlain with reference to existing site features and is approximate only.

0 5 10 15 20 30 40 50 75m
1:750 @ A3

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: SINSW		TITLE: **Locations of Tests**	PROJECT No: 202029.00
OFFICE: Sydney	DRAWN BY: MG	**Proposed Sydney Olympic Park High School**	DRAWING No: 1
SCALE: 1:750 @ A3	DATE: 17.08.2021	**Burroway Road, WENTWORTH POINT**	REVISION: 0





Locality Plan

LEGEND

- Approximate Proposed High School Site Boundary

84357.00, July 2014

- CPTu, Cored borehole & Dilatometer testing
- CPTu, Dilatometer testing
- CPTu

84357.01, August 2018

- CPTu
- Top of Rock Contour (RL, m to AHD)
- Borehole Location
- CPT and Borehole Locations
- CPT Locations

NOTE:
1: Base image from MetroMap (Dated 15.04.2021)
2: Site Plan Proposed' (DWG: SOPHS-WB-AR-DA1102, Rev A, Dated 16 August 2021) is overlain with reference to existing site features and is approximate only.

0 5 10 15 20 30 40 50 75m
1:750 @ A3

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: SINSW		TITLE: **Top of Rock Contour Plan**	PROJECT No: 202029.00
OFFICE: Sydney	DRAWN BY: MG	**Proposed Sydney Olympic Park High School**	DRAWING No: 2
SCALE: 1:750 @ A3	DATE: 17.08.2021	**Burroway Road, WENTWORTH POINT**	REVISION: 0

A

A'

ELEVATION (AHD)

APPROXIMATE HIGH SCHOOL SITE BOUNDARY

APPROXIMATE HIGH SCHOOL SITE BOUNDARY

CPT17
Offset 6.7m
Qc 0 5 50
l-md
s&vl
f
st-vst
md
st
md-d
Bottom Depth 16.44 m

BH207
Offset 6.3m
vl
N = 0
s
N = 5
f-st
N = 15
vst
L
H
Bottom Depth 23 m

CPT126
Offset - 4.7m
Qc 0 5 50
vl/vs-s
s-f
st
st-vst
vst-h
N = 13
Bottom Depth 10m

C3
Offset - 13.9m
N = 24
s
vs-s
N = 2
vl/vs-s
s
st-vst
st
N = 36
h
N = 32
EL
M-H,M
VH-H
Bottom Depth 18.9 m

CPT125
Offset - 5.9m
Qc 0 5 50
st-vst
h
Bottom Depth 10.08 m

UNIT A

UNIT B

UNIT C

UNIT D

UNIT DESCRIPTION
Unit A - Fill
Unit B - Very Soft to Firm Clays/Very Loose to Loose Sands
Unit C - Stiff to Hard Clays/Medium Dense to Dense Sands
Unit D - Bedrock

DISTANCE ALONG PROFILE (m)

LEGEND
- Core Loss
- Clay
- Clayey Silt
- Concrete
- Filling
- Gravelly Sand
- Peaty Clay
- Sand
- Sandstone
- Sandy Clay
- Shale
- Silty Clay
- Silty Sand

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

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

SOIL CONSISTENCY
vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

SOIL DENSITY
vl - Very Loose
l - Loose
md - Medium Dense
d - Dense
vd - Very Dense

TESTS / OTHER
N - Standard penetration test value
- Interpreted geotechnical boundary
- Water level

0 16
Horizontal Scale (metres)
Vertical Exaggeration = 4.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: SINSW		TITLE: **Cross-section A-A'**	PROJECT No: 202029.00
OFFICE: Sydney	DRAWN BY: MG	**Proposed Sydney Olympic Park High School**	DRAWING No: 3
SCALE: 1:800 (H) 1:200 (V) @ A3	DATE: 17.08.2021	**Burroway Road, WENTWORTH POINT**	REVISION: 0

B

B'

APPROXIMATE HIGH SCHOOL SITE BOUNDARY

APPROXIMATE HIGH SCHOOL SITE BOUNDARY

CPT/BH210
Offset 0.3m
Bottom Depth 12.44 m

CPT209
Offset 1.5m
Bottom Depth 12.16 m

CPT206
Offset 0.3m
Bottom Depth 12.4 m

CPT/BH204
Offset - 0.8m
Bottom Depth 11 m

Bottom Depth 17 m

Bottom Depth 17 m

UNIT A

UNIT B

UNIT C

UNIT D

ELEVATION (AHD)

DISTANCE ALONG PROFILE (m)

UNIT DESCRIPTION
Unit A - Fill
Unit B - Very Soft to Firm Clays/Very Loose to Loose Sands
Unit C - Stiff to Hard Clays/Medium Dense to Dense Sands
Unit D - Bedrock

LEGEND
- Concrete
- Filling
- Silty Sand
- Clay
- Sand
- Silty Clay
- Sandy Clay
- Sandstone
- Clayey Sand
- Laminite

NOTES:
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

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

SOIL CONSISTENCY
vs - Very Soft
s - Soft
f - Firm
st - Stiff
vst - Very Stiff
h - Hard

SOIL DENSITY
vl - Very Loose
l - Loose
md - Medium Dense
d - Dense
vd - Very Dense

TESTS / OTHER
N - Standard penetration test value
— ? — — - Interpreted geotechnical boundary
- Water level

Horizontal Scale (metres)
Vertical Exaggeration = 4.0

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: SINSW		TITLE: **Cross-section B-B'**	PROJECT No: 202029.00
OFFICE: Sydney	DRAWN BY: MG	**Proposed Sydney Olympic Park High School**	DRAWING No: 4
SCALE: 1:800 (H) 1:200 (V) @ A3	DATE: 17.08.2021	**Burroway Road, WENTWORTH POINT**	REVISION: 0

Appendix C1

Recent Piezocone Penetration Test Results

CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

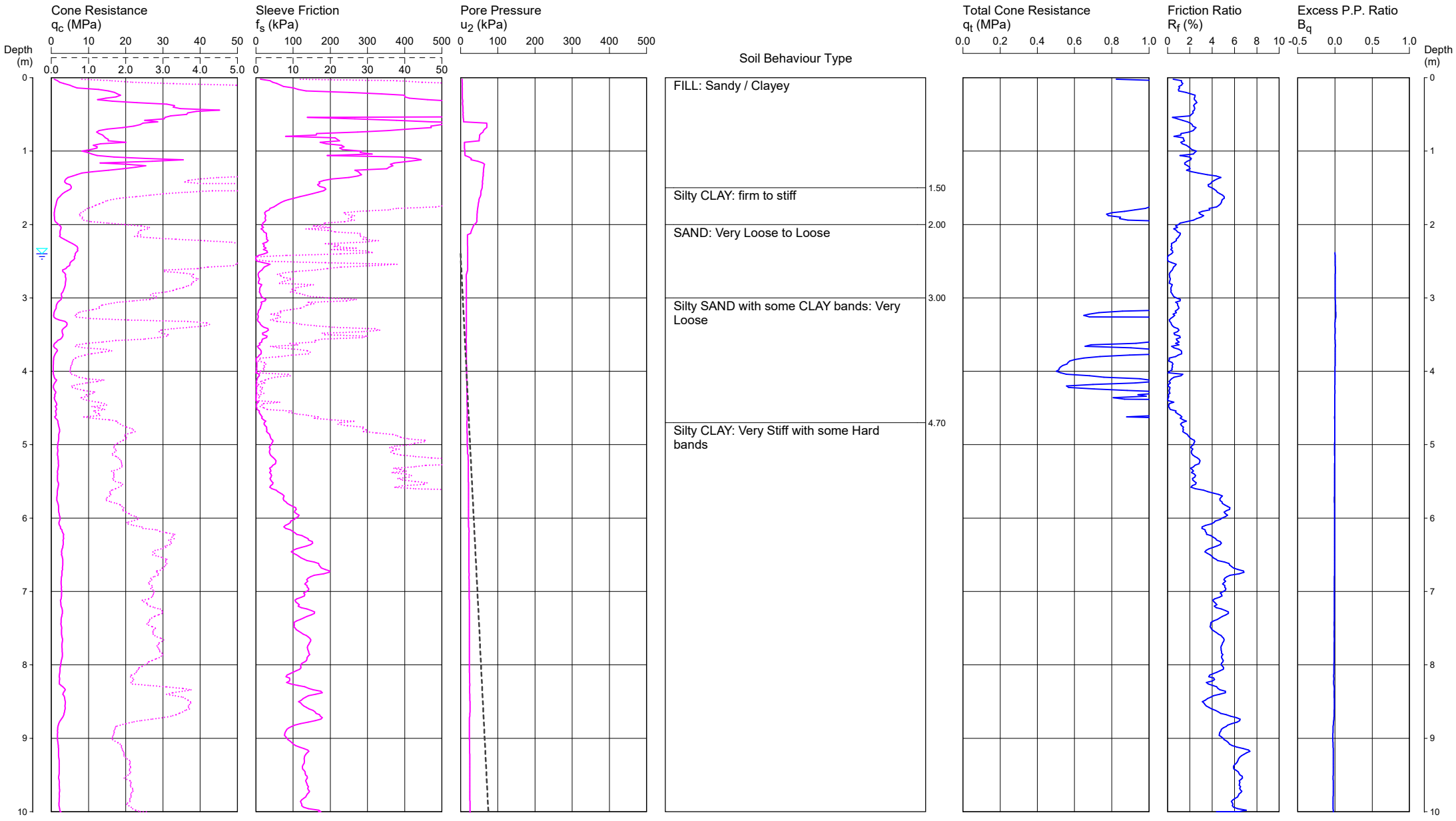
REDUCED LEVEL: 2.4

COORDINATES: 322398E 6255738N

CPT203

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 2.4m AFTER WITHDRAWAL OF RODS.

Water depth after test: 2.40m depth (assumed)

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT203.CP5
Cone ID: 200309T **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

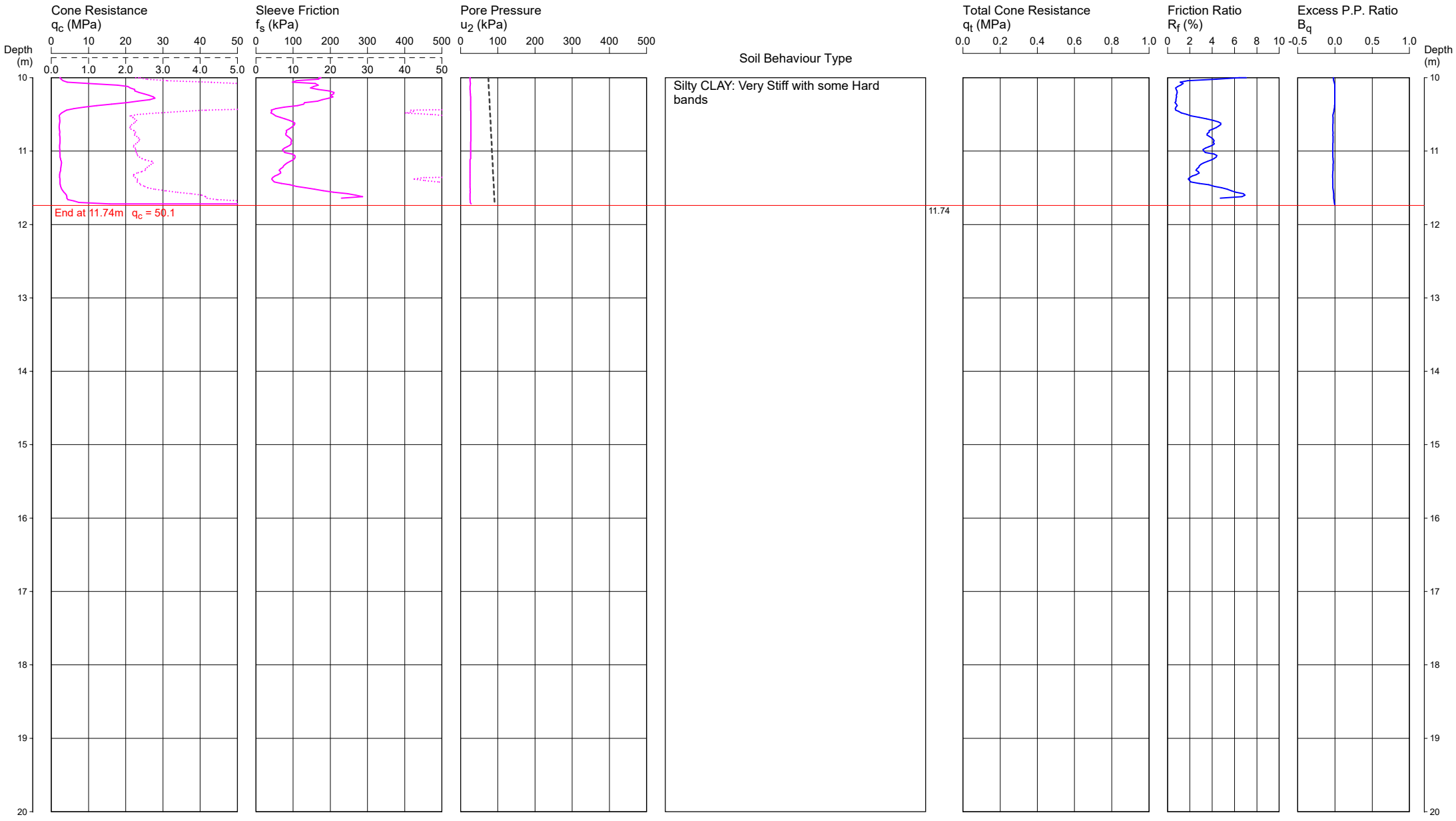
REDUCED LEVEL: 2.4

COORDINATES: 322398E 6255738N

CPT203

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 2.4m AFTER WITHDRAWAL OF RODS.

Water depth after test: 2.40m depth (assumed)

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT203.CP5

Cone ID: 200309T **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

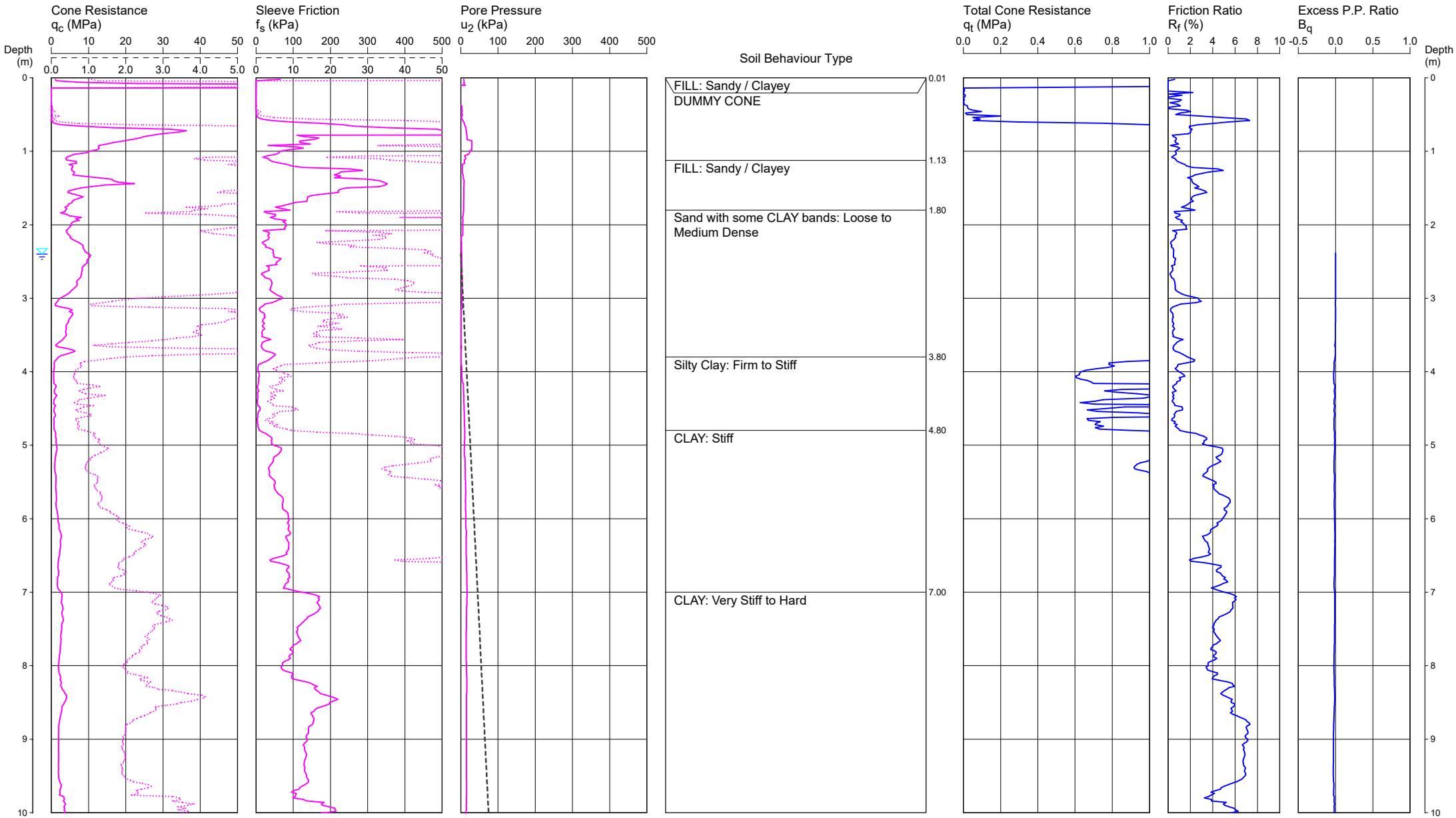
REDUCED LEVEL: 2.4

COORDINATES: 322423E 6255721N

CPT204

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: DUMMY CONE FROM 0.12 TO 0.7m DEPTH TO PENETRATE FILLING. TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 2.5m AFTER WITHDRAWAL OF RODS.

Water depth after test: 2.40m depth (assumed)

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT204.CP5

Cone ID: 120522T **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

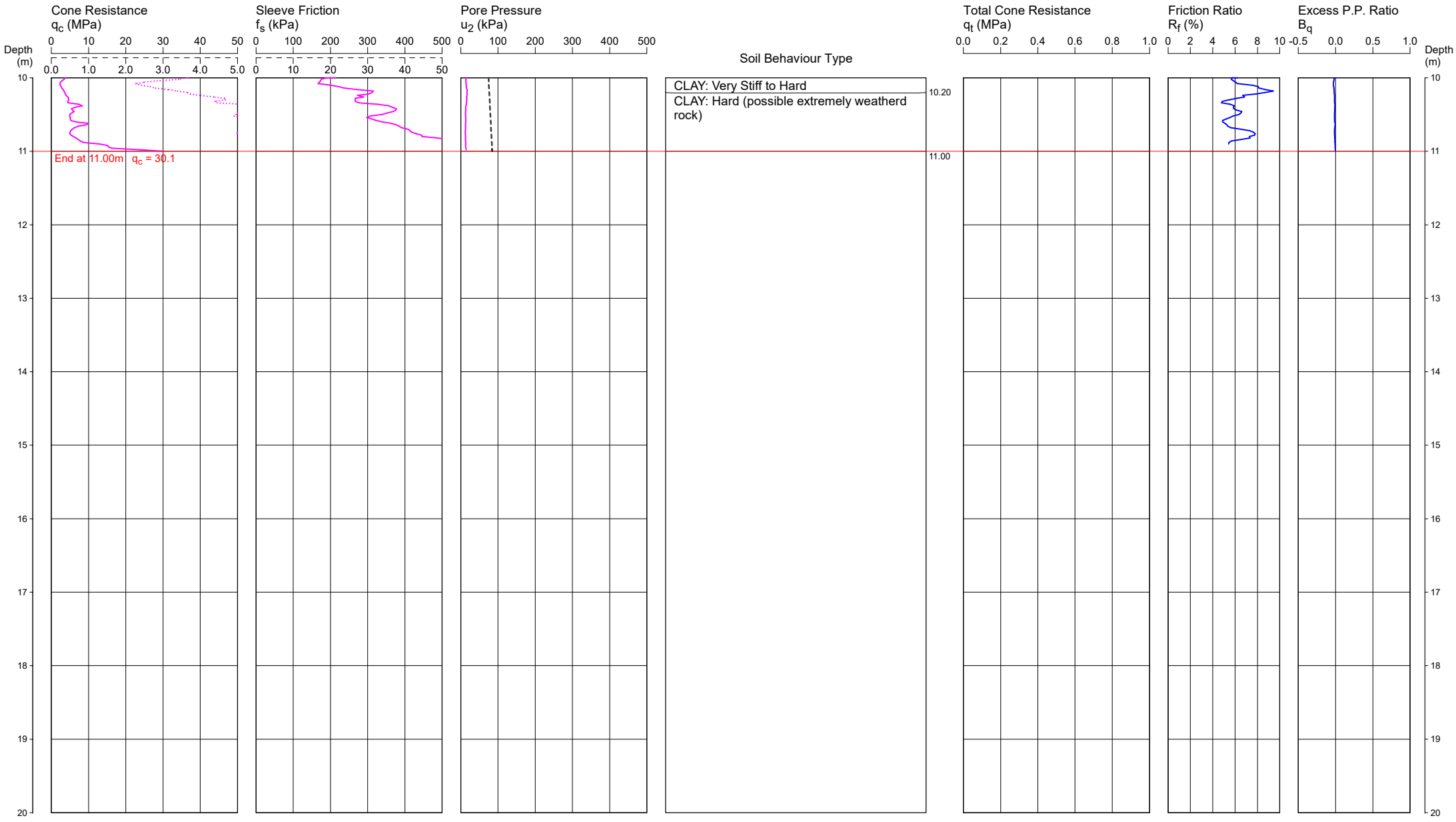
REDUCED LEVEL: 2.4

COORDINATES: 322423E 6255721N

CPT204

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: DUMMY CONE FROM 0.12 TO 0.7m DEPTH TO PENETRATE FILLING. TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK. GROUNDWATER OBSERVED AT 2.5m AFTER WITHDRAWAL OF RODS.

Water depth after test: 2.40m depth (assumed)

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT204.CP5

Cone ID: 120522T **Type:** I-CFXYP20-10

Douglas Partners
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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

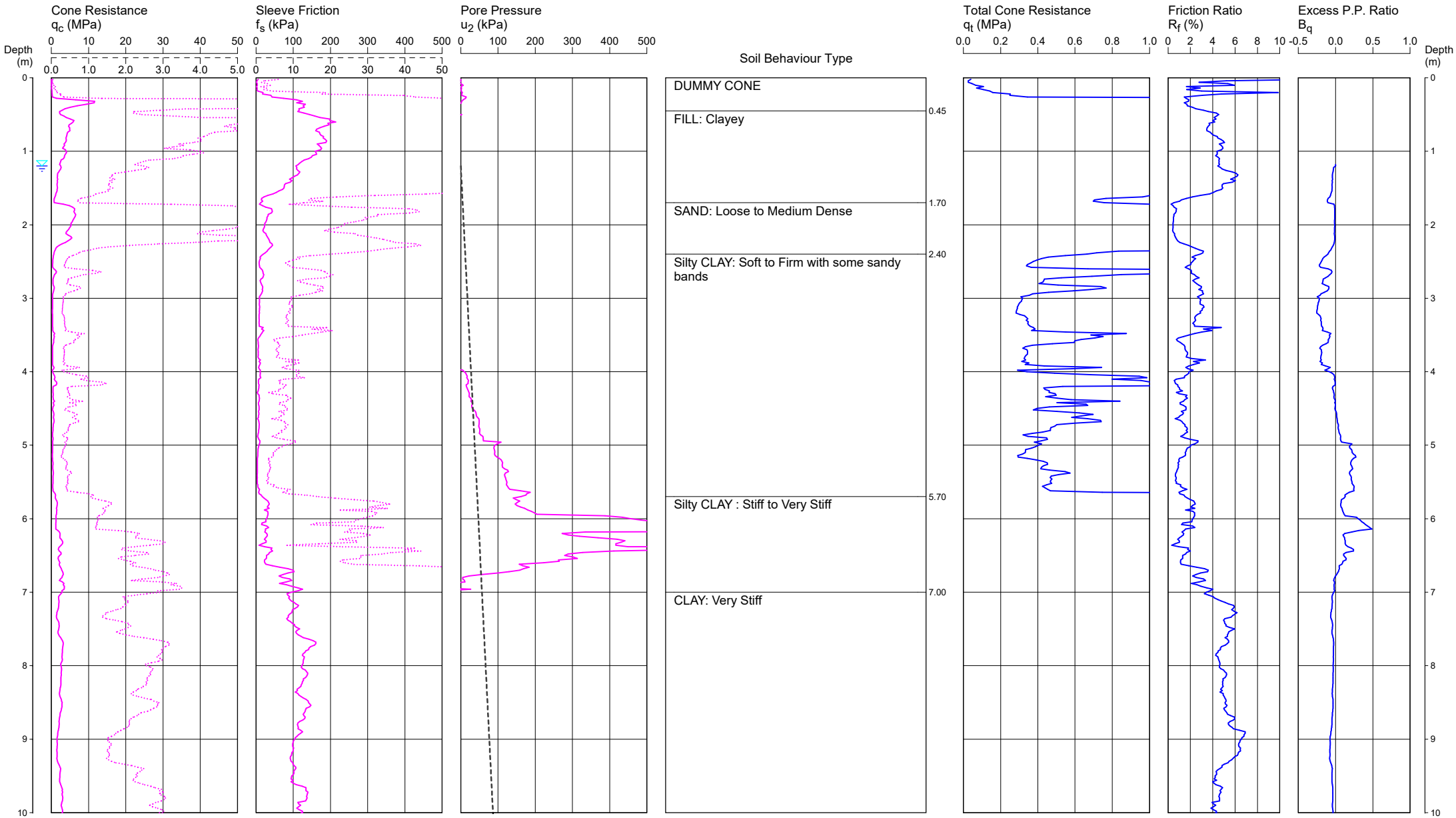
REDUCED LEVEL: 2.7

COORDINATES: 322376E 6255711N

CPT205

DATE 13/05/2021

PROJECT No: 202029.00



REMARKS: DUMMY CONE FROM 0.0 TO 0.45m TO PENETRATE FILLING. TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK. GROUNDWATER OBSERVED AT 1.2m AFTER WITHDRAWAL OF RODS.

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT205.CP5

Cone ID: 120522T **Type:** I-CFXYP20-10

Water depth after test: 1.20m depth (assumed)

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

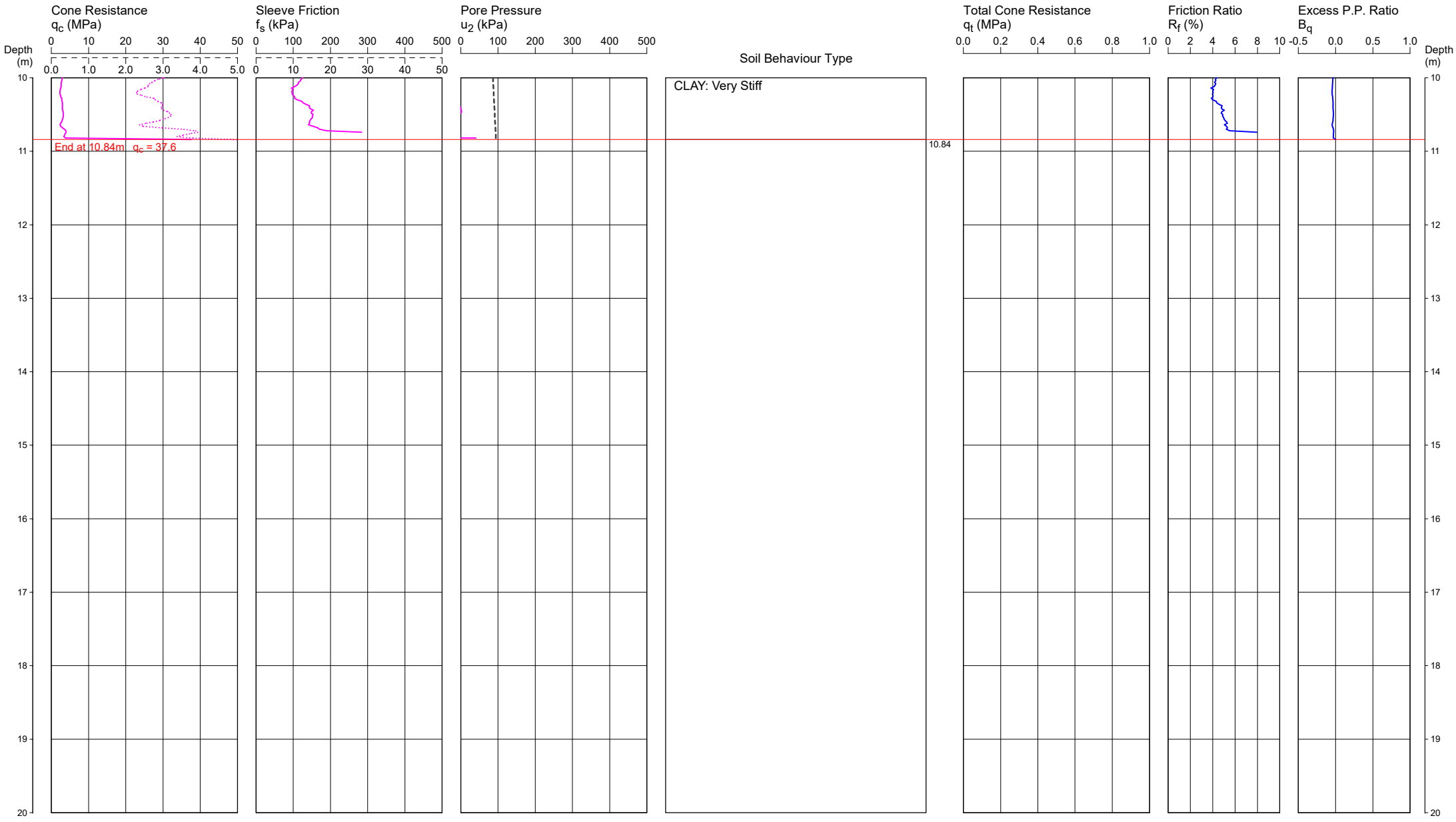
REDUCED LEVEL: 2.7

COORDINATES: 322376E 6255711N

CPT205

DATE 13/05/2021

PROJECT No: 202029.00



REMARKS: DUMMY CONE FROM 0.0 TO 0.45m TO PENETRATE FILLING. TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK. GROUNDWATER OBSERVED AT 1.2m AFTER WITHDRAWAL OF RODS.

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT205.CP5

Cone ID: 120522T **Type:** I-CFXYP20-10

Water depth after test: 1.20m depth (assumed)

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

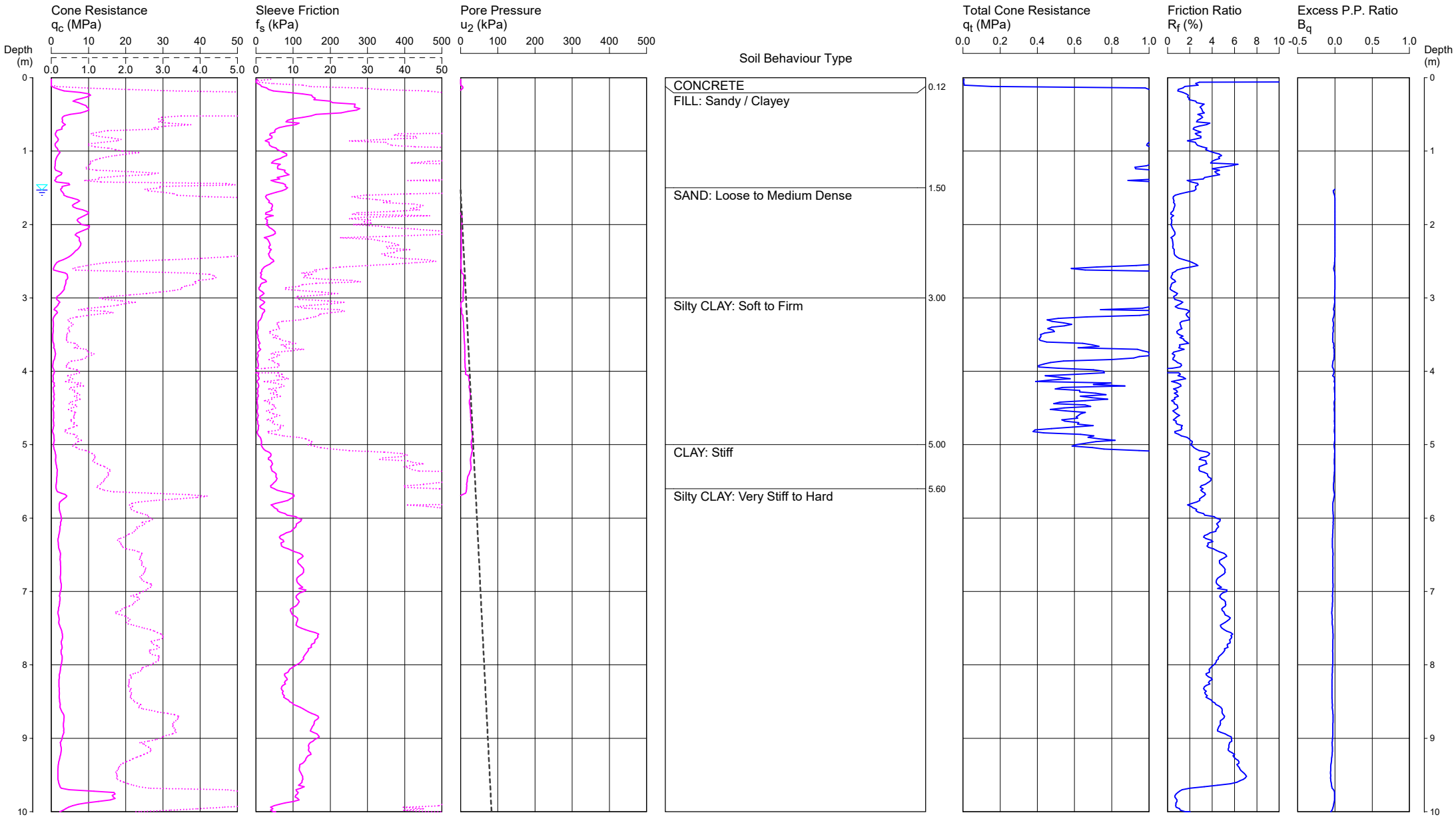
REDUCED LEVEL: 2.7

COORDINATES: 322407E 6255700N

CPT206

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: CONCRETE CORE TO 0.12m DEPTH. TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 1.53m AFTER WITHDRAWAL OF RODS.

Water depth after test: 1.53m depth (assumed)

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT206.CP5
Cone ID: 200309T **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

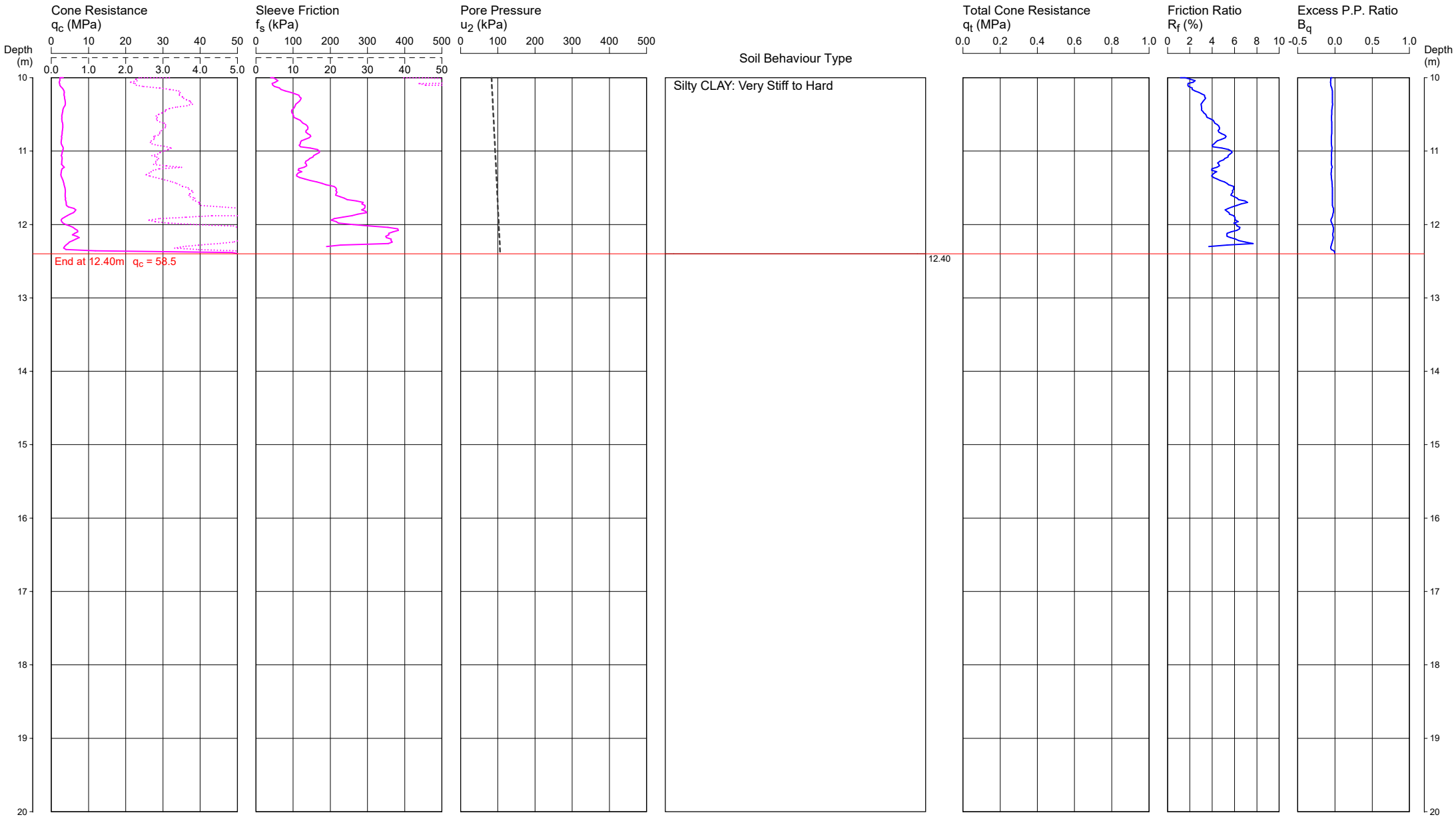
REDUCED LEVEL: 2.7

COORDINATES: 322407E 6255700N

CPT206

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: CONCRETE CORE TO 0.12m DEPTH. TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 1.53m AFTER WITHDRAWAL OF RODS.

Water depth after test: 1.53m depth (assumed)

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT206.CP5
Cone ID: 200309T **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

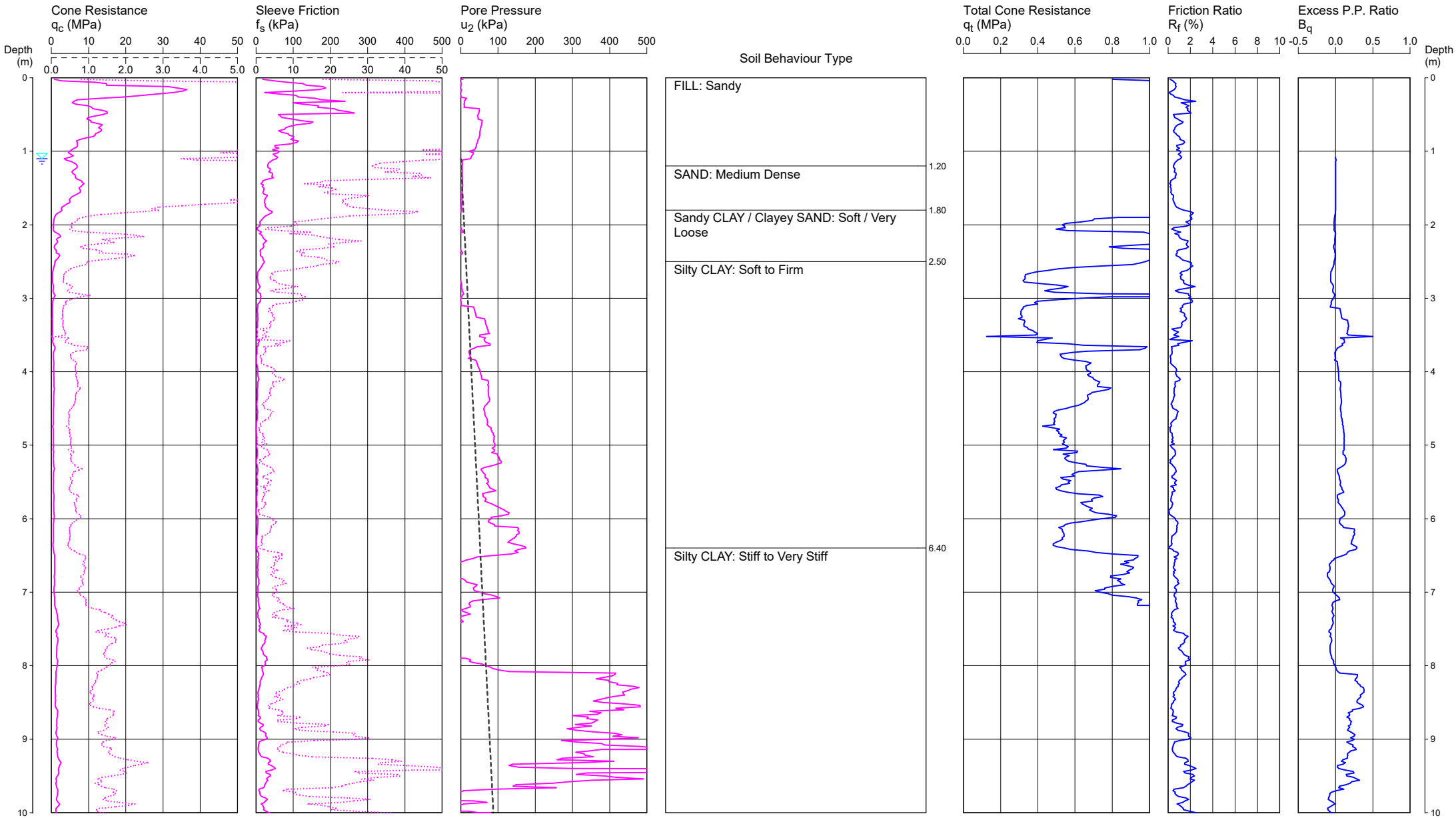
REDUCED LEVEL: 2.1

COORDINATES: 322344E 6255680N

CPT208

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK.GROUNDWATER OBSERVED AT 1.1m AFTER WITHDRAWAL OF RODS

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT208.CP5

Code ID: 120522T **Type:** I-CFXYP20-10

Water depth after test: 1.10m depth (assumed)

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

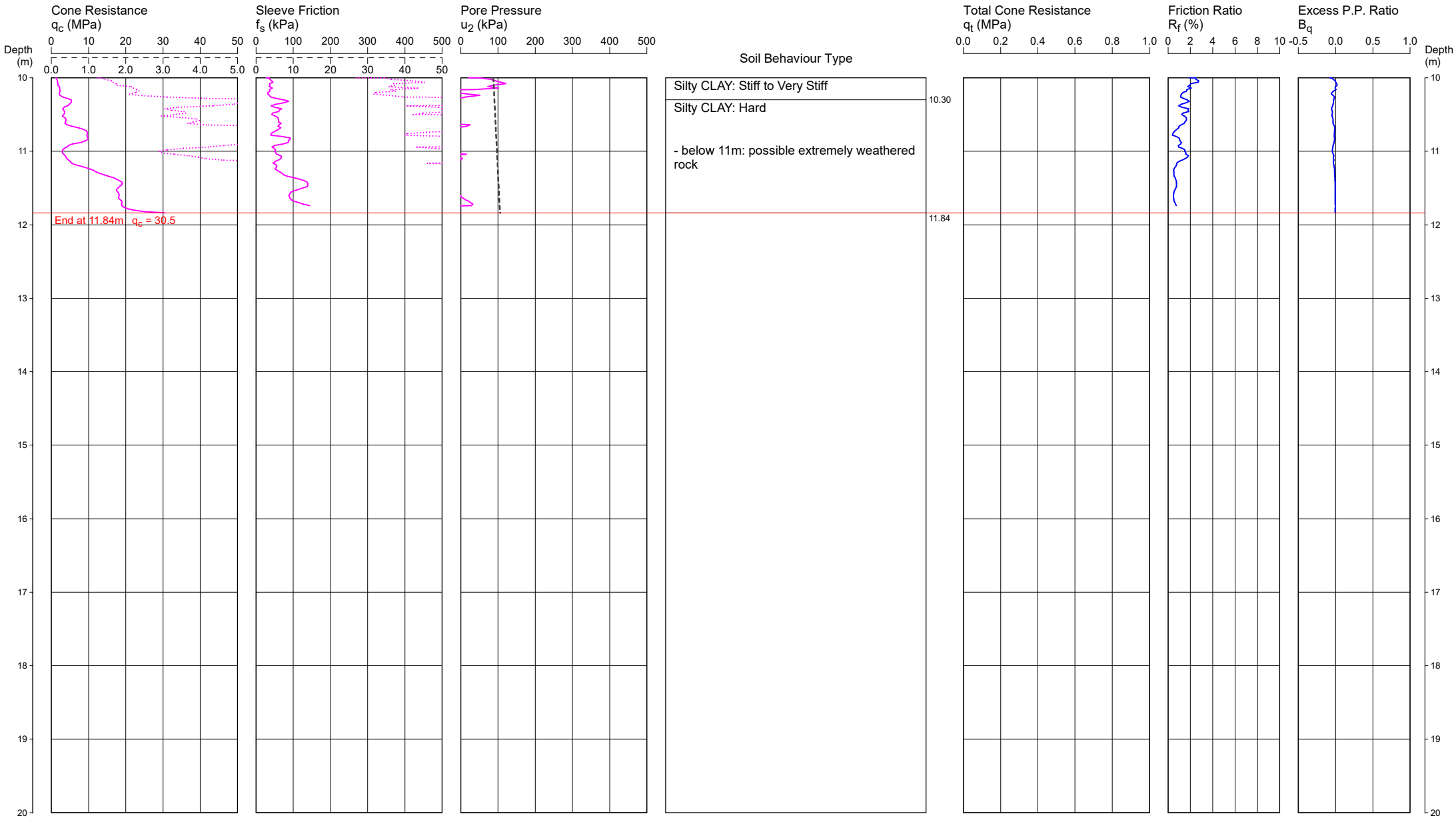
REDUCED LEVEL: 2.1

COORDINATES: 322344E 6255680N

CPT208

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 1.1m AFTER WITHDRAWAL OF RODS.

Water depth after test: 1.10m depth (assumed)

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT208.CP5
Cone ID: 120522T **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

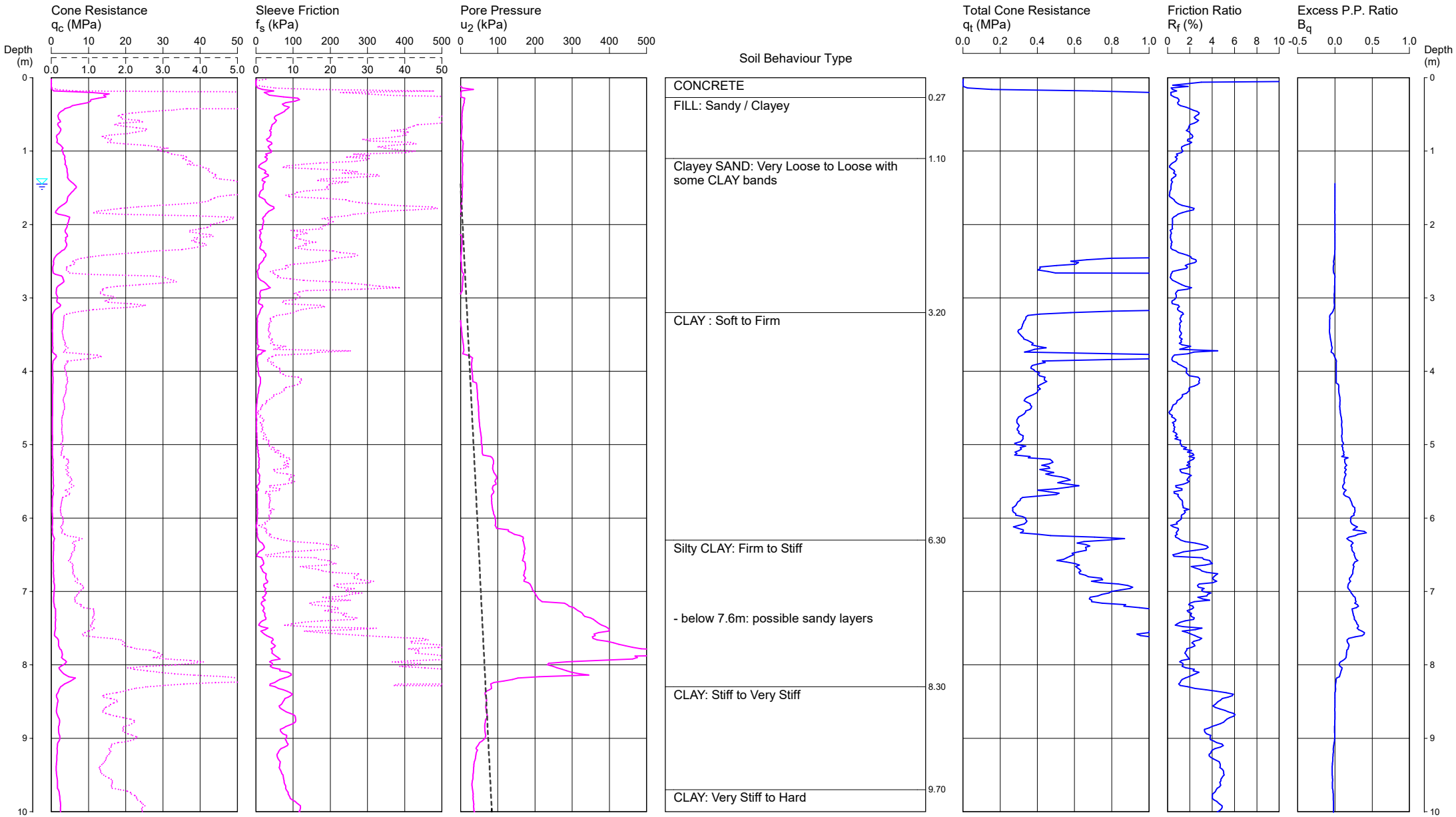
REDUCED LEVEL: 2.3

COORDINATES: 322388E 6255675N

CPT209

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: CONCRETE CORE TO 0.27m DEPTH. TEST DISCONTINUED DUE TO BENDING ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 1.45m AFTER WITHDRAWAL OF RODS.

Water depth after test: 1.45m depth (assumed)

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT209.CP5

Cone ID: 120522T **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

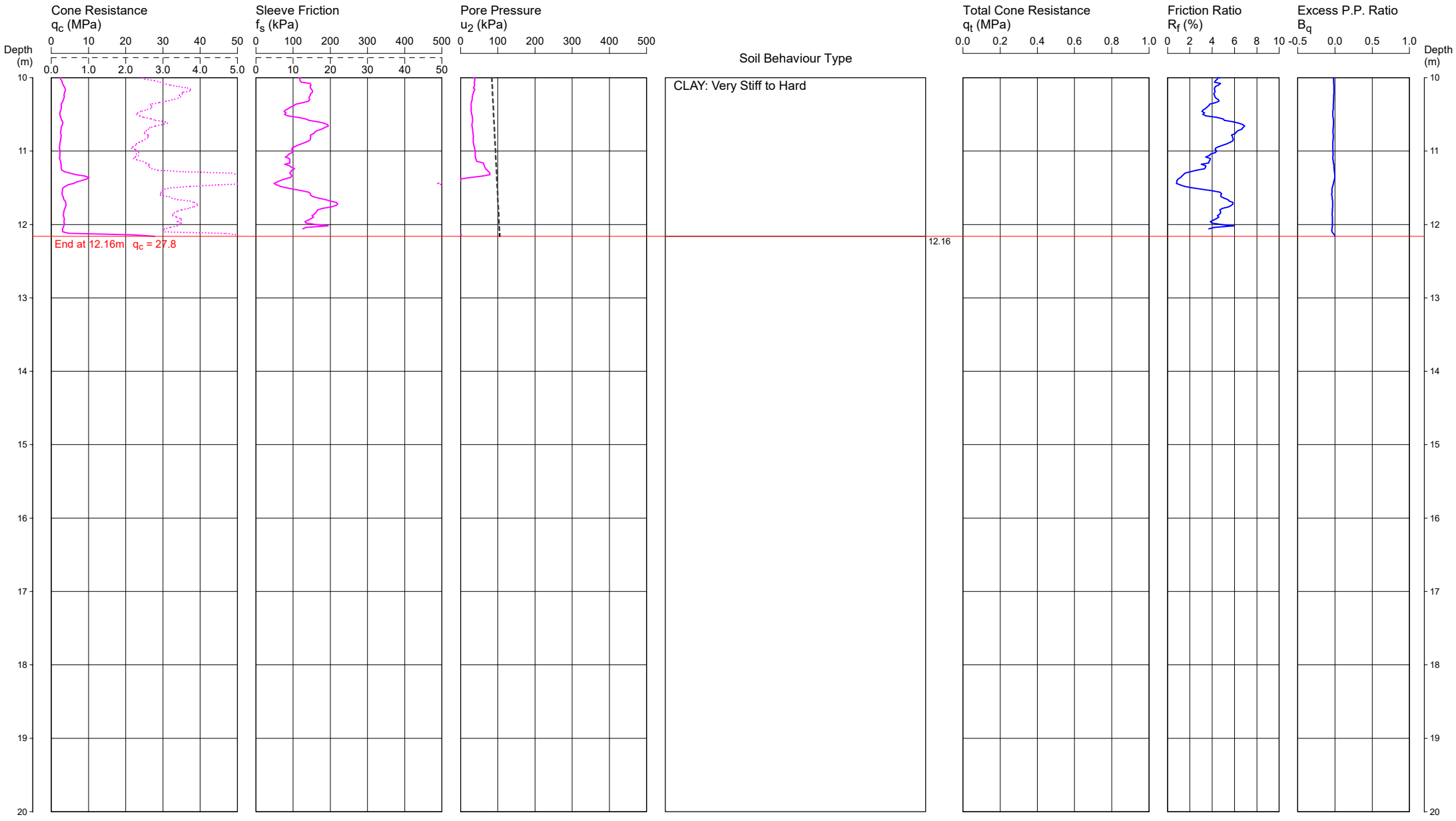
REDUCED LEVEL: 2.3

COORDINATES: 322388E 6255675N

CPT209

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: CONCRETE CORE TO 0.27m DEPTH. TEST DISCONTINUED DUE TO BENDING ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 1.45m AFTER WITHDRAWAL OF RODS.

Water depth after test: 1.45m depth (assumed)

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT209.CP5
Cone ID: 120522T **Type:** I-CFXYP20-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

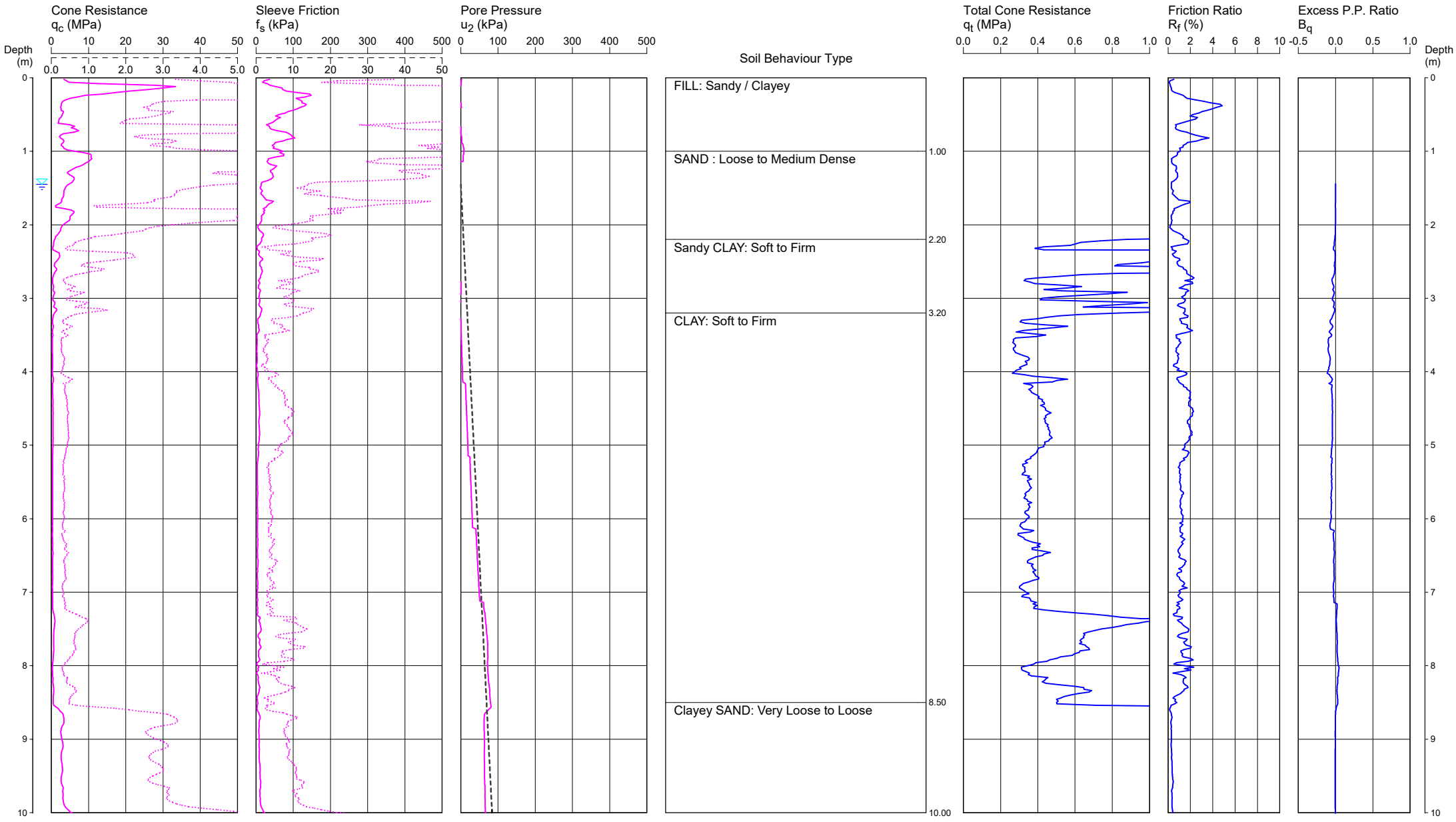
REDUCED LEVEL: 2.3

COORDINATES: 322367E 6255643N

CPT210

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 1.45m AFTER WITHDRAWAL OF RODS.

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT210.CP5
Cone ID: 200309T **Type:** I-CFXYP20-10

Water depth after test: 1.45m depth (assumed)

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: SCHOOL INFRASTRUCTURE NEW SOUTH WALES (SINSW)

PROJECT: PROPOSED HIGH SCHOOL

LOCATION: BURROWAY RD, WENTWORTH POINT

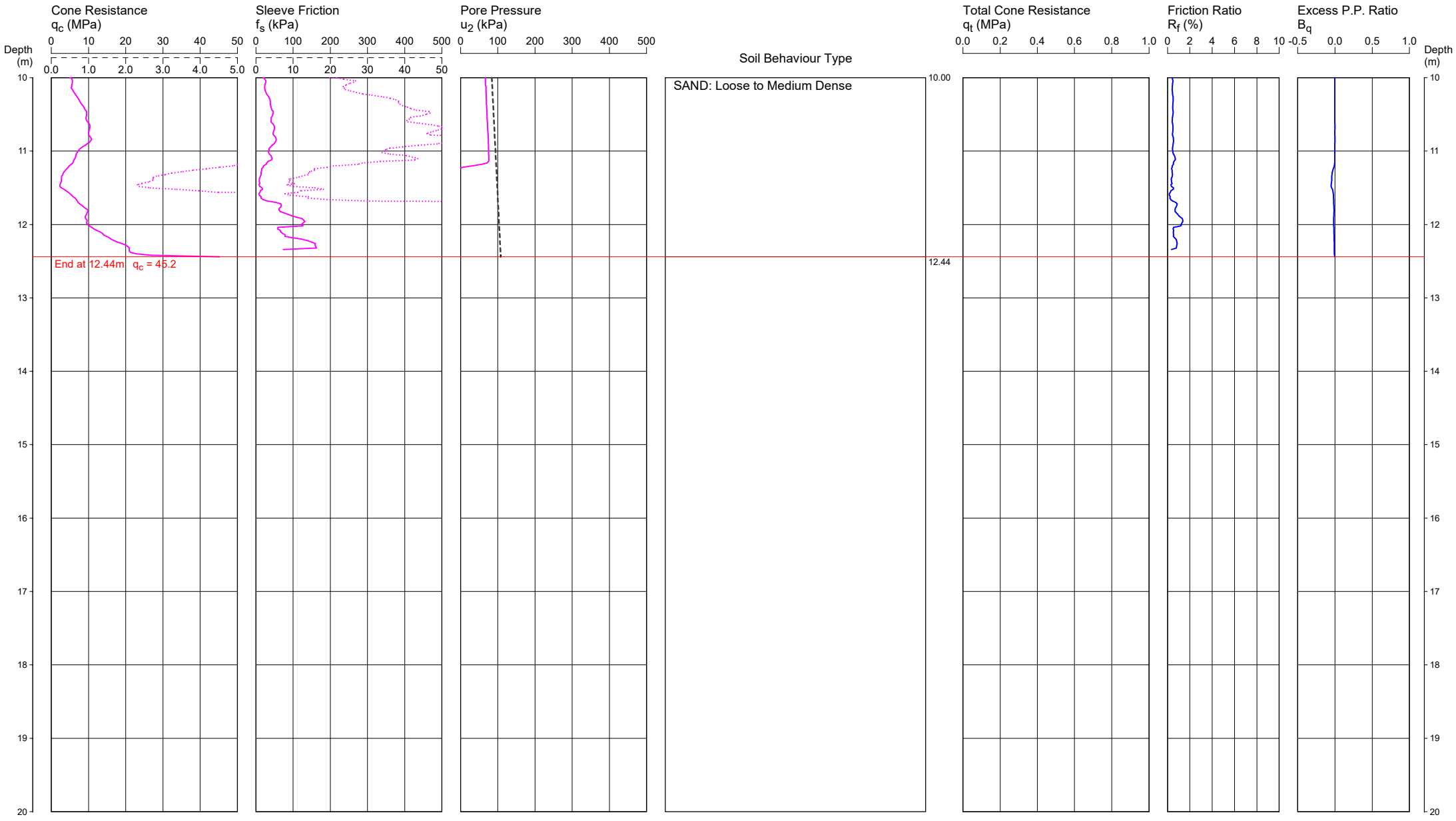
REDUCED LEVEL: 2.3

COORDINATES: 322367E 6255643N

CPT210

DATE 05/05/2021

PROJECT No: 202029.00



REMARKS: TEST DISCONTINUED DUE TO REFUSAL ON INFERRED WEATHERED ROCK.
GROUNDWATER OBSERVED AT 1.45m AFTER WITHDRAWAL OF RODS.

File: P:\202029.00 - WENTWORTH POINT, Proposed High School\4.0 Field Work\4.2 Testing\CPT Interpreted Logs\CPT210.CP5
Cone ID: 200309T **Type:** I-CFXYP20-10

Water depth after test: 1.45m depth (assumed)

ConePlot Version 5.9.2

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Appendix C2

Previous Piezocone Penetration Test Results

CONE PENETRATION TEST

CLIENT: URBAN GROWTH NSW

PROJECT: WENTWORTH POINT URBAN ACTIVATION PRECINCT

LOCATION: HILL RD & BURROWAY RD, WENTWORTH POINT

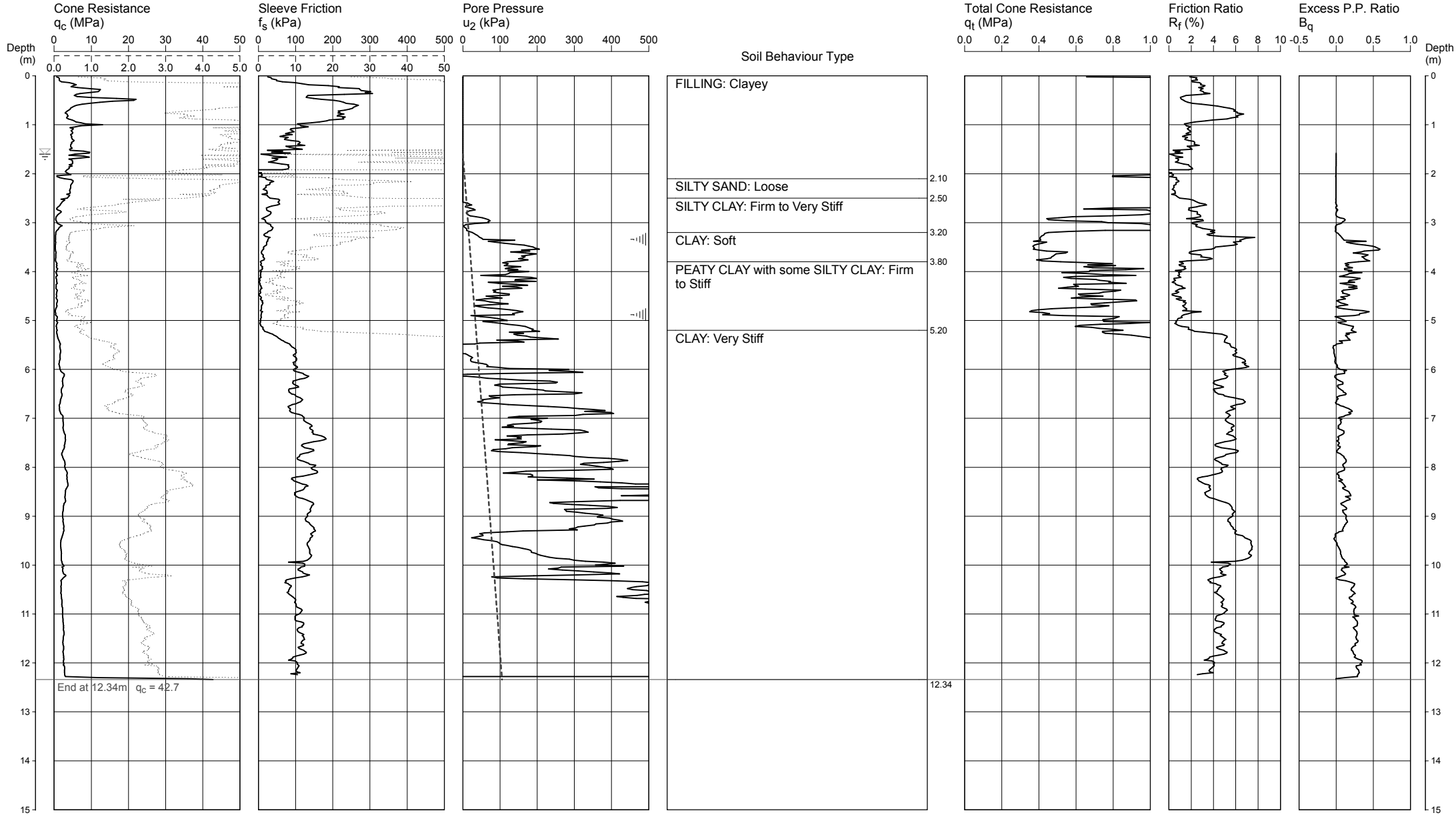
REDUCED LEVEL: 2.8

COORDINATES: 322367E 6255728N

CPT3

DATE 9/7/2014

PROJECT No: 84357



REMARKS: GROUNDWATER OBSERVED AT 1.6 m DEPTH.

Water depth after test: 1.60m depth (measured)

File: P:\84357 WENTWORTH POINT, Urban Activation Precinct PMO\Field\CPT Plots\CPT3.CP5

Cone ID: 120539 **Type:** I-CFXYP20-10

Dissipation Test

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CONE PENETRATION TEST

CLIENT: URBAN GROWTH NSW

PROJECT: WENTWORTH POINT URBAN ACTIVATION PRECINCT

LOCATION: HILL RD & BURROWAY RD, WENTWORTH POINT

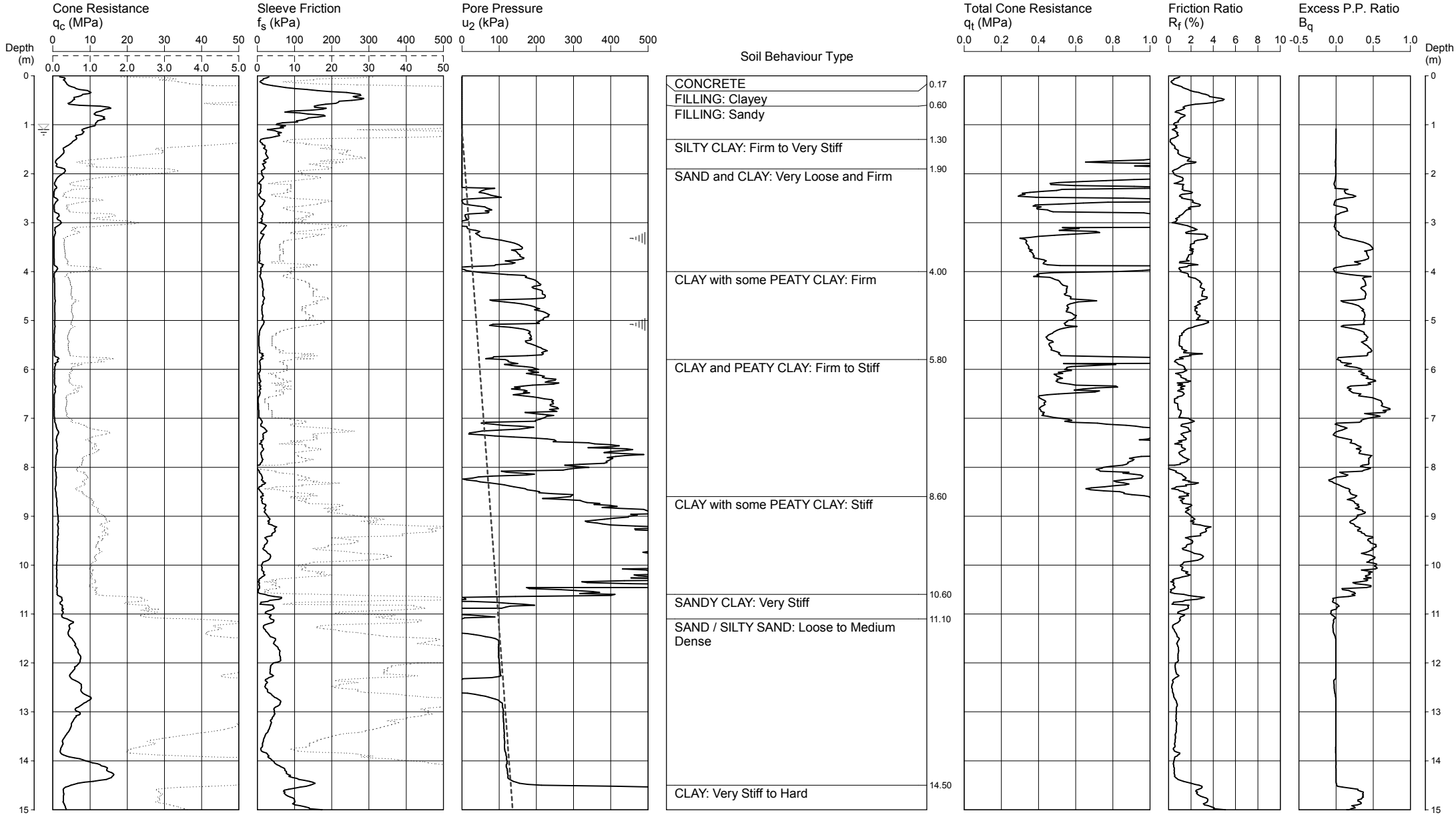
REDUCED LEVEL: 2.2

COORDINATES: 322373E 6255618N

CPT8

DATE 3/7/2014

PROJECT No: 84357



REMARKS: HOLE COLLAPSE AT 1.1 m DEPTH AFTER WITHDRAWAL OF RODS.

File: P:\84357 WENTWORTH POINT, Urban Activation Precinct PMO\Field\CPT Plots\CPT8.CP5

Cone ID: 120509 **Type:** I-CFXYP20-10

Water depth after test: 1.10m depth (assumed)

Dissipation Test

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CONE PENETRATION TEST

CLIENT: URBAN GROWTH NSW

PROJECT: WENTWORTH POINT URBAN ACTIVATION PRECINCT

LOCATION: HILL RD & BURROWAY RD, WENTWORTH POINT

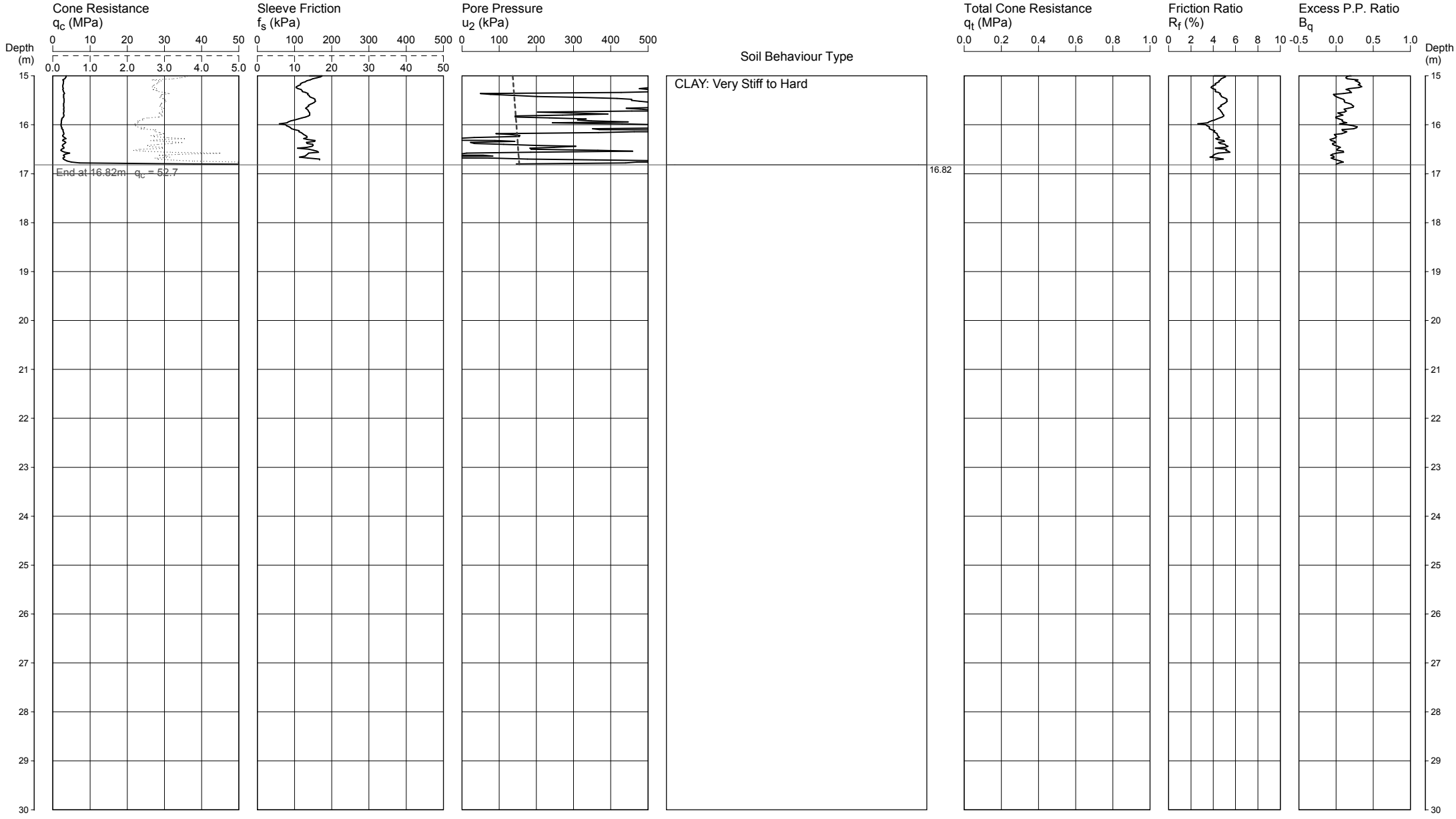
REDUCED LEVEL: 2.2

COORDINATES: 322373E 6255618N

CPT8

DATE 3/7/2014

PROJECT No: 84357



REMARKS: HOLE COLLAPSE AT 1.1 m DEPTH AFTER WITHDRAWAL OF RODS.

File: P:\84357 WENTWORTH POINT, Urban Activation Precinct PMO\Field\CPT Plots\CPT8.CP5

Cone ID: 120509 **Type:** I-CFXYP20-10

Water depth after test: 1.10m depth (assumed)

Dissipation Test

Douglas Partners
Geotechnics / Environment / Groundwater

CONE PENETRATION TEST

CLIENT: URBAN GROWTH NSW

PROJECT: WENTWORTH POINT URBAN ACTIVATION PRECINCT

LOCATION: HILL RD & BURROWAY RD, WENTWORTH POINT

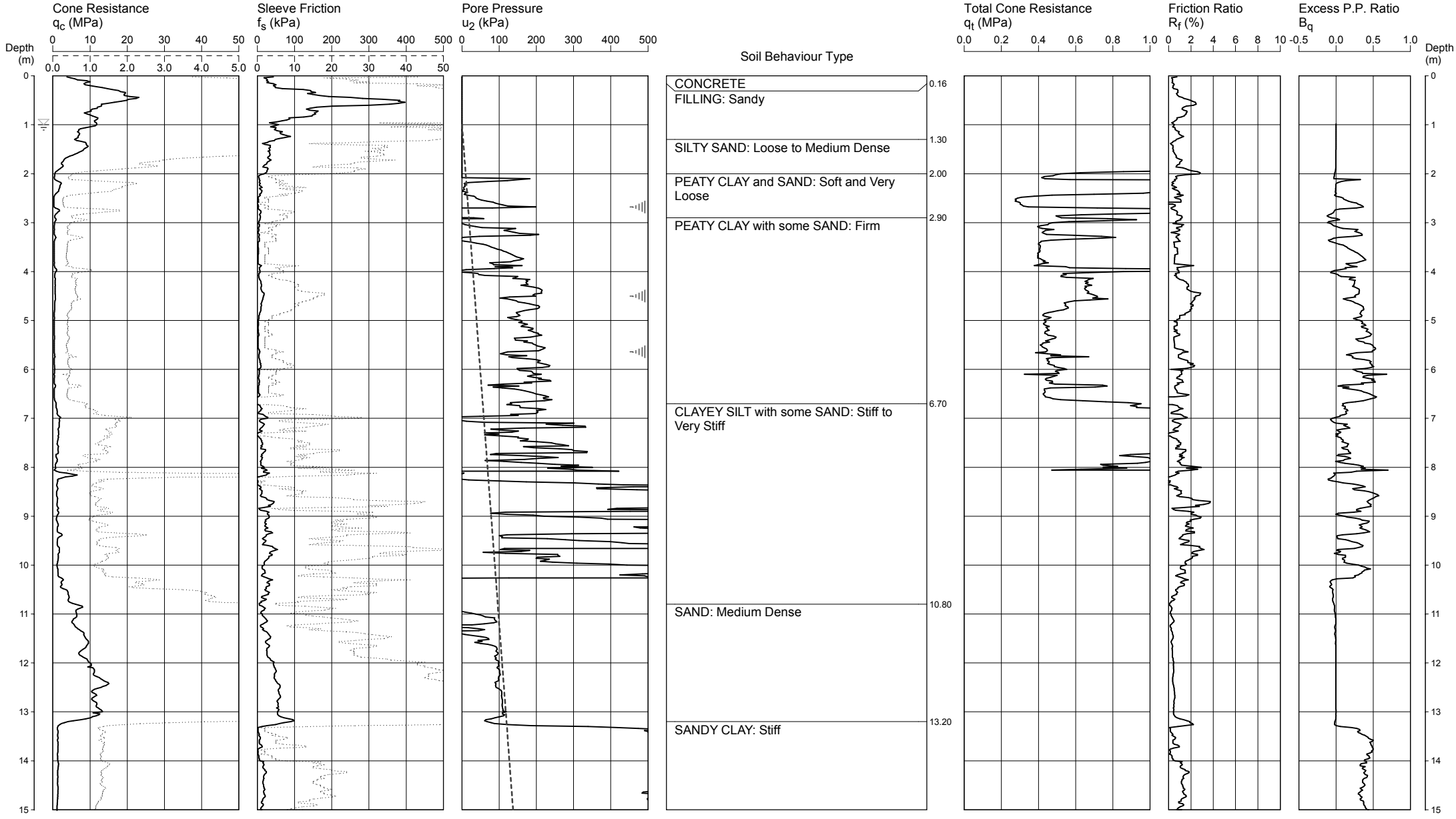
REDUCED LEVEL: 2.5

COORDINATES: 322304E 6255667N

CPT17

DATE 2/7/2014

PROJECT No: 84357



REMARKS: HOLE COLLAPSE AT 0.5 m DEPTH AFTER WITHDRAWAL OF RODS.

File: P:\84357 WENTWORTH POINT, Urban Activation Precinct PMO\Field\CPT Plots\CPT17.CP5

Cone ID: 120522 **Type:** I-CFXYP20-10

Water depth after test: 1.00m depth (assumed)

Dissipation Test

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CONE PENETRATION TEST

CLIENT: URBAN GROWTH NSW

PROJECT: WENTWORTH POINT URBAN ACTIVATION PRECINCT

LOCATION: HILL RD & BURROWAY RD, WENTWORTH POINT

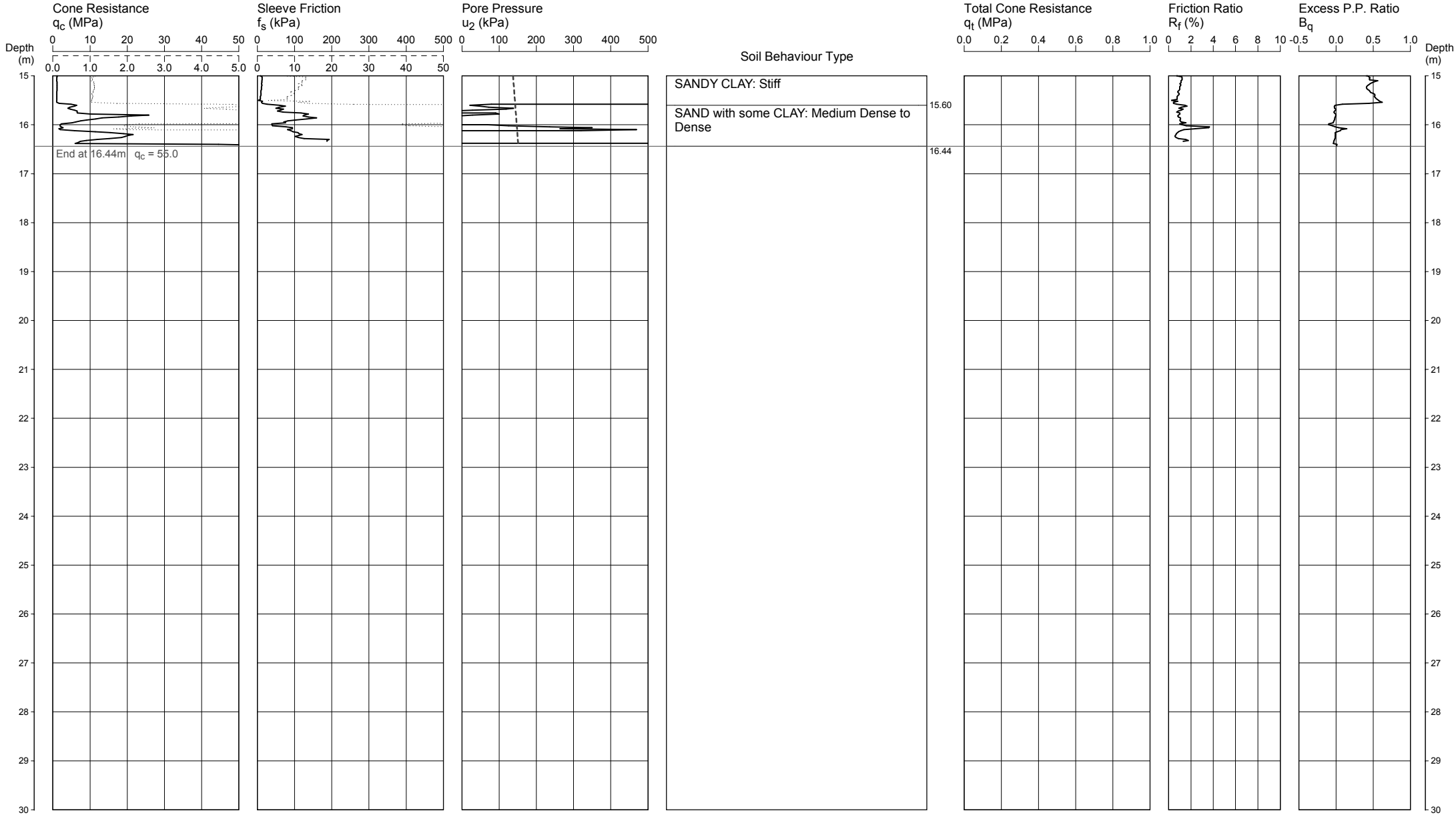
REDUCED LEVEL: 2.5

COORDINATES: 322304E 6255667N

CPT17

DATE 2/7/2014

PROJECT No: 84357



REMARKS: HOLE COLLAPSE AT 0.5 m DEPTH AFTER WITHDRAWAL OF RODS.

File: P:\84357 WENTWORTH POINT, Urban Activation Precinct PMO\Field\CPT Plots\CPT17.CP5

Cone ID: 120522 **Type:** I-CFXYP20-10

Water depth after test: 1.00m depth (assumed)

Dissipation Test

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Geotechnics | Environment | Groundwater

CONE PENETRATION TEST

CLIENT: URBAN GROWTH NSW

PROJECT: WENTWORTH POINT URBAN ACTIVATION PRECINCT

LOCATION: HILL RD & BURROWAY RD, WENTWORTH POINT

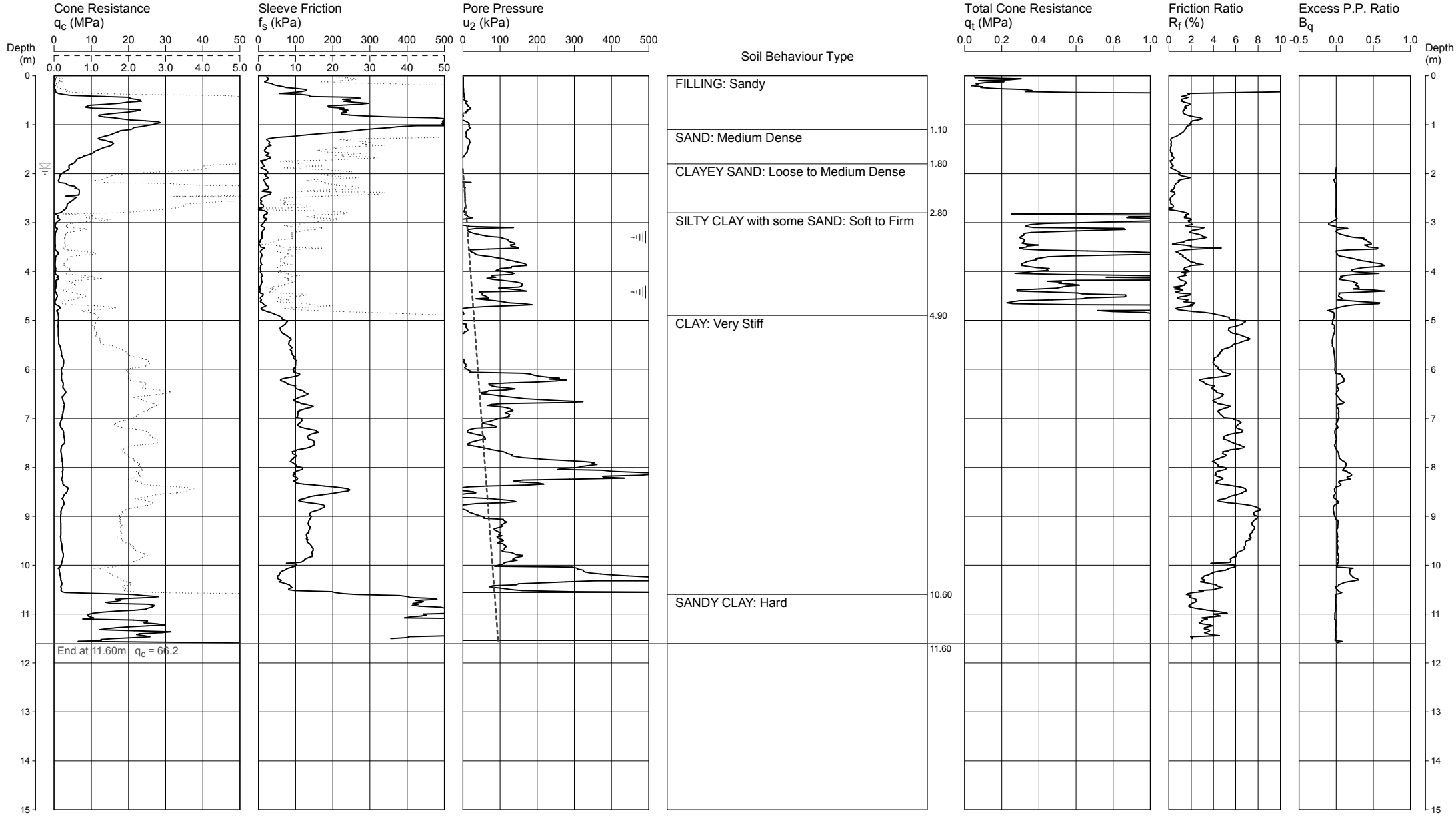
REDUCED LEVEL: 2.5

COORDINATES: 322421E 6255693N

CPT19

DATE 7/7/2014

PROJECT No: 84357



REMARKS: GROUNDWATER OBSERVED AT 1.9 m DEPTH.

File: P:\84357 WENTWORTH POINT, Urban Activation Precinct PMO\Field\CPT Plots\CPT19.CP5

Cone ID: 120522 **Type:** I-CFXYP20-10

Water depth after test: 1.90m depth (measured)

Dissipation Test

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CONE PENETRATION TEST

CLIENT: LANDCOM

PROJECT: BURROWAY ROAD HEADLAND PARK

LOCATION: BURROWAY ROAD, WENTWORTH POINT

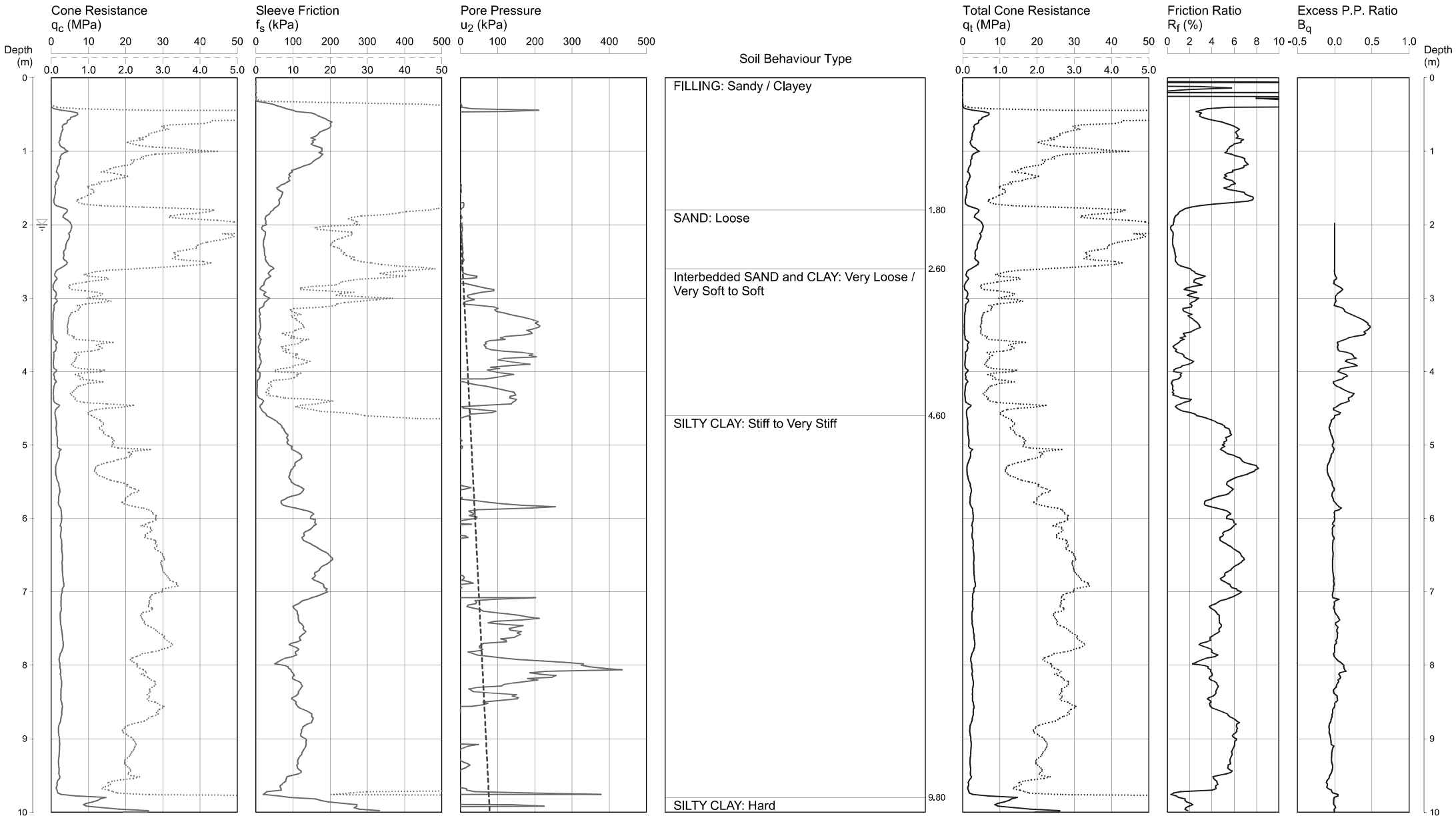
REDUCED LEVEL: 2.7 AHD

COORDINATES: 322372E 6255742N

CPT125

DATE 14/08/2018

PROJECT No: 84357.01



REMARKS: HAND AUGER TO 0.4 m. TEST DISCONTINUED AT TARGET DEPTH. HOLE COLLAPSE AT 1.75 m AFTER WITHDRAWAL OF RODS.

File: P:\84357.01 - WENTWORTH POINT Headland Park\4.0 Field Work\4.2 Testing\CPTu Test Results\2018.08.14\CPT125.CP5

Cone ID: 120539 **Type:** I-CFXYP20-10

Water depth after test: 2.00m depth (assumed)

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CONE PENETRATION TEST

CLIENT: LANDCOM

PROJECT: BURROWAY ROAD HEADLAND PARK

LOCATION: BURROWAY ROAD, WENTWORTH POINT

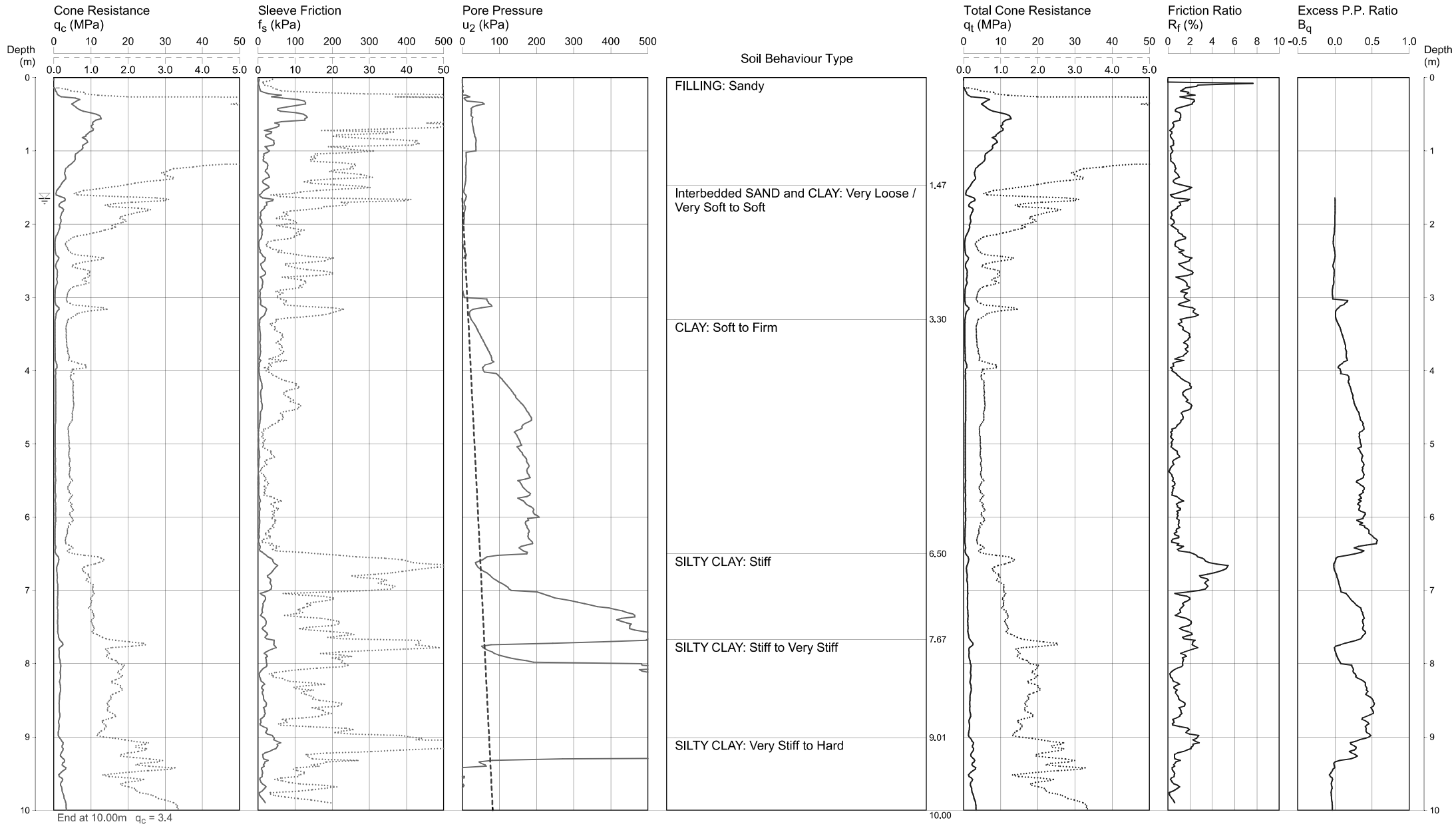
REDUCED LEVEL: 2.3 AHD

COORDINATES: 322327E 6255680N

CPT126

DATE 14/08/2018

PROJECT No: 84357.01



REMARKS: HAND AUGER TO 0.3 m. TEST DISCONTINUED AT TARGET DEPTH. GROUNDWATER OBSERVED AT 1.65 m AFTER WITHDRAWAL OF RODS.

Water depth after test: 1.65m depth (assumed)

File: P:\84357.01 - WENTWORTH POINT Headland Park\4.0 Field Work\4.2 Testing\CPTu Test Results\2018.08.14\CPT126.CP5

Cone ID: 120509 **Type:** I-CFXYP20-10

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Appendix D1

Recent Cored Borehole Log and Core Photographs

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed High School
LOCATION: Burroway Road, Wentworth Point

SURFACE LEVEL: 2.4 AHD
EASTING: 322423
NORTHING: 6255721
DIP/AZIMUTH: 90°/--

BORE No: BH204
PROJECT No: 202029.00
DATE: 3 - 4/5/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		Fill/ Gravelly SAND: fine to coarse, pale brown and grey, fine to coarse igneous and sandstone gravel, trace concrete, moist							A			
	1	Below 0.3: brown, fine to coarse igneous, sandstone and stilstone gravel, with clay and trace silt							S			7,13,13 N = 26
	1.8	SAND SP: fine to medium, pale grey-brown, trace silt and shell fragments, moist then wet, loose to medium dense, estuarine							S			4,5,5 N = 10
		Below 2.8m: wet				▼						
	4.0	Silty CLAY CI-CH: medium to high plasticity, dark grey, trace fine sand, w<PL, stiff, estuarine							A			
	4.8	Sandy CLAY CI: medium plasticity, pale grey and dark grey, fine sand, organic odour, w<PL, soft, estuarine							S			3,3,6 N = 9
	5.0	Silty CLAY CI: medium plasticity, orange brown and pale-grey, with fine to medium sand, w<PL, stiff, residual										
	7.0	CLAY CI-CH: medium to high plasticity, grey, orange and yellow-grey, with silt, trace ironstone gravel, w<PL, very stiff to hard, residual							S			5,7,14 N = 21

RIG: Explorer **DRILLER:** SS **LOGGED:** NB **CASING:** HW to 5.5m, HQ to 11.0m

TYPE OF BORING: Solid Flight Auger (TC bit) to 5 m, wash bore to 11.05m, NMLC coring to 17.0m

WATER OBSERVATIONS: Free groundwater observed whilst augering at 2.5

REMARKS: Coordinates and surface levels obtained via differential GPS

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed High School
LOCATION: Burroway Road, Wentworth Point

SURFACE LEVEL: 2.4 AHD
EASTING: 322423
NORTHING: 6255721
DIP/AZIMUTH: 90°/--

BORE No: BH204
PROJECT No: 202029.00
DATE: 3 - 4/5/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8		CLAY CI-CH: medium to high plasticity, grey, orange and yellow-grey, with silt, trace ironstone gravel, w<PL, very stiff to hard, residual *(continued)*										
-9	11 11.05	Silty CLAY CI: medium plasticity, orange brown and pale-grey, with fine to medium sand, w<PL, hard, residual						11.35m: Ds 30mm 11.5m: Ds 40mm 11.57m: Ds 30mm 11.73m: Ds 30mm				PL(A) = 0.2
-10	11.25 11.76	SANDSTONE: fine grained, pale orange and white, low strength with bands of very low strength, highly weathered, fractured, Mittagong Formation										
-11	12 13	SANDSTONE: fine to coarse grained, pale brown-grey, thickly bedded at 10-20 degrees, high strength, moderately weathered, slightly fractured to unbroken, Hawkesbury Sandstone						12.58m: Ds 20mm 13m: B5°, pl, ro, cly co 13.05m: B2°, pl, ro, cly co 13.55m: B2°, pl, ro, cly co	C	100	80	PL(A) = 1.4 PL(A) = 1.6
-12	14											PL(A) = 1.3
-13	15 15.24	SANDSTONE: fine to coarse grained, pale grey, high strength, slightly weathered, unbroken, Hawkesbury Sandstone						14.94m: Cs 2mm >>	C	100	100	PL(A) = 1.5
-14	16							16.17m: Ds 2mm				PL(A) = 1.2
-15	17 17.0	Bore discontinued at 17.0m Termination at target depth										
-16	18											
-17	19											

RIG: Explorer **DRILLER:** SS **LOGGED:** NB **CASING:** HW to 5.5m, HQ to 11.0m

TYPE OF BORING: Solid Flight Auger (TC bit) to 5 m, wash bore to 11.05m, NMLC coring to 17.0m

WATER OBSERVATIONS: Free groundwater observed whilst augering at 2.5

REMARKS: Coordinates and surface levels obtained via differential GPS

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: 204 PROJECT: WENTWORTH POINT MAY 2021

11.05 – 15.00m

BORE: 204 PROJECT: WENTWORTH POINT MAY 2021

15.00 – 17.00m

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed High School
LOCATION: Burroway Road, Wentworth Point

SURFACE LEVEL: 3.5 AHD
EASTING: 322315
NORTHING: 6255682
DIP/AZIMUTH: 90°/--

BORE No: BH207
PROJECT No: 202029.00
DATE: 5 - 6/5/2021
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		Fill/ Clayey SAND: fine to coarse, pale orange-brown, with fine to coarse igneous and sandstone gravel, trace concrete fragments, moist							A			
									A			
									A			
									S			15,17,16 N = 33
									A			
		Below 1.8m: concrete cobbles or slab										
	2.0								A			
		Fill/ Gravelly SAND: fine to coarse sand, dark grey, fine to coarse siltstone and sandstone gravel, trace concrete fragments, moist							A			
		Below 2.4m: grades to pale brown, with clay, trace tile, wet				▼						
	3.5	SAND SP: fine to coarse, dark grey, with clay, trace silt and shell fragments, wet, very loose, estuarine							A			
									S			0,0,0 N = 0
	5.3	CLAY CH: high plasticity, dark grey, trace fine to medium sand, fine gravel and shell fragments, soft, estuarine										
	8.0	Silty CLAY CI-CH: medium to high plasticity, grey and orange and yellow-grey, trace ironstone gravel, w<PL, firm to stiff, residual							S			0,1,4 N = 5

RIG: Explorer **DRILLER:** SS **LOGGED:** NB **CASING:** HW to 5.5m, HQ to 17.0m

TYPE OF BORING: Solid Flight Auger (TC bit) to 2.5 m, wash bore to 17.0m, NMLC coring to 23.0m

WATER OBSERVATIONS: Free groundwater observed whilst augering at 2.5m

REMARKS: Coordinates and surface levels obtained via differential GPS, no SPT completed at 2.5m due to bore-hole collapse

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed High School
LOCATION: Burroway Road, Wentworth Point

SURFACE LEVEL: 3.5 AHD
EASTING: 322315
NORTHING: 6255682
DIP/AZIMUTH: 90°/--

BORE No: BH207
PROJECT No: 202029.00
DATE: 5 - 6/5/2021
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-7		Silty CLAY CI-CH: medium to high plasticity, grey and orange and yellow-grey, trace ironstone gravel, w<PL, firm to stiff, residual *(continued)*										
-8	11	Below 11m: grading to very stiff							S			6,6,7 N = 13
-9	12											
-10	13											
-11	14 14.0	Sandy CLAY CI: medium plasticity, grey and orange and yellow-grey, trace ironstone gravel, w<PL, very stiff, residual							S			7,7,8 N = 15
-12	15											
-13	16											
-14	17 17.0	Core Loss (possible very low strength to low strength sandstone)						17m: CORE LOSS: 530mm	C	82	75	
	17.53	SANDSTONE: fine to coarse grained, pale brown-grey, low strength then very low strength, moderately weathered with band of highly weathered, fractured, Hawkesbury Sandstone						17.67m: B2°, pl, ro, fe stn 17.73m: B2°, pl, ro, fe stn 17.84m: B2°, pl, ro, fe stn 17.85m: J90°, un, fe he 17.95m: Ds 152mm				PL(A) = 0.3
-15	18 18.12	SANDSTONE: fine to coarse grained, pale brown grey and pale-grey, high strength, slightly weathered then fresh, slightly fractured then unbroken, Hawkesbury Sandstone						18.16m: Cs 2mm 18.26m: Cs 2mm 18.31m: B4°, pl, ro, cly co 18.85m: J45°, pl, he 19.37m: B2°, un, ro, fe stn 19.45m: Ds 2mm 19.82m: J40°, pl, he				PL(A) = 1 PL(A) = 1.5
-16	19											

RIG: Explorer **DRILLER:** SS **LOGGED:** NB **CASING:** HW to 5.5m, HQ to 17.0m

TYPE OF BORING: Solid Flight Auger (TC bit) to 2.5 m, wash bore to 17.0m, NMLC coring to 23.0m

WATER OBSERVATIONS: Free groundwater observed whilst augering at 2.5m

REMARKS: Coordinates and surface levels obtained via differential GPS, no SPT completed at 2.5m due to bore-hole collapse

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed High School
LOCATION: Burroway Road, Wentworth Point

SURFACE LEVEL: 3.5 AHD
EASTING: 322315
NORTHING: 6255682
DIP/AZIMUTH: 90°/--

BORE No: BH207
PROJECT No: 202029.00
DATE: 5 - 6/5/2021
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-17	21	SANDSTONE: fine to coarse grained, pale brown grey and pale-grey, high strength, slightly weathered then fresh, slightly fractured then unbroken, Hawkesbury Sandstone *(continued)*										PL(A) = 1.5
-18									C	100	100	
								21.71m: Ds 5mm				
-19	22											PL(A) = 1.6
	23 23.0											PL(A) = 1.2
-20		Bore discontinued at 23.0m Termination at target depth										
	24											
-21												
	25											
-22												
	26											
-23												
	27											
-24												
	28											
-25												
	29											
-26												

RIG: Explorer **DRILLER:** SS **LOGGED:** NB **CASING:** HW to 5.5m, HQ to 17.0m

TYPE OF BORING: Solid Flight Auger (TC bit) to 2.5 m, wash bore to 17.0m, NMLC coring to 23.0m

WATER OBSERVATIONS: Free groundwater observed whilst augering at 2.5m

REMARKS: Coordinates and surface levels obtained via differential GPS, no SPT completed at 2.5m due to bore-hole collapse

SAMPLING & IN SITU TESTING LEGEND

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

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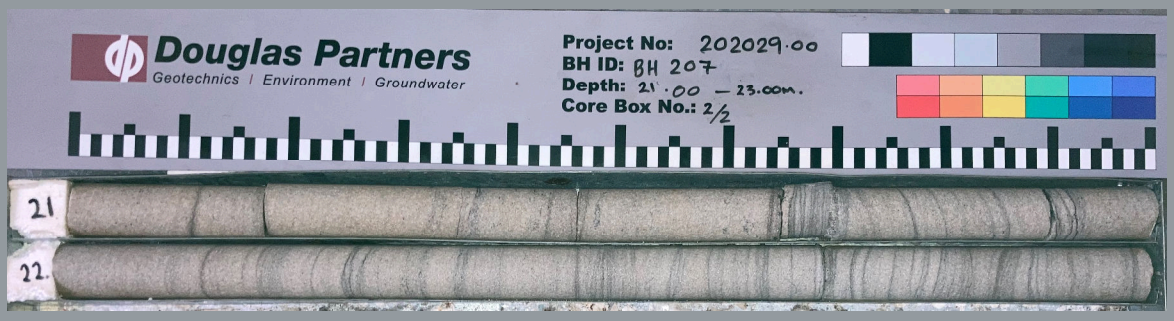
BORE: 207 PROJECT: WENTWORTH POINT MAY 2021

17.00 – 20.00m

BORE: 207 PROJECT: WENTWORTH POINT MAY 2021



21.00 – 22.00m

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed High School
LOCATION: Burroway Road, Wentworth Point

SURFACE LEVEL: 2.3 AHD
EASTING: 322367
NORTHING: 6255643
DIP/AZIMUTH: 90°/--

BORE No: BH210
PROJECT No: 202029.00
DATE: 3/5/2021
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
2	0.0	Fill/ Gravelly SAND: fine to medium sand, dark grey, fine to coarse igneous gravel, moist, generally in a medium dense condition							A			
	0.3								A			
1		Fill/ CLAY: medium plasticity, brown and red-brown, trace fine sand and tile fragments, w<PL, generally in a stiff condition							A			
	1.1								S			6,5,6 N = 11
		SAND SP: fine to medium, yellow-brown, with clay, trace shell fragments, wet, medium dense, estuarine							A			
0	2.2					▼			A			
		Sandy CLAY CI: medium plasticity, dark grey, fine to medium sand, trace shell fragments, w>PL, soft to firm, estuarine							A			
-1									S			0,0,0 N = 0
-2												
-3	5.0	CLAY CH: high plasticity, dark grey, trace fine to medium sand, fine gravel and shell fragments, w<PL, soft to firm, estuarine							S			0,0,0 N = 0
-4												
-5												
-6									S			0,0,2 N = 2
-7	8.5	Clayey SAND: fine to medium, dark grey, trace shell fragments, wet, very loose, estuarine										
-8												
-9												

RIG: Explorer **DRILLER:** SS **LOGGED:** NB **CASING:** HW to 5.5m, HQ to 12.53m

TYPE OF BORING: Solid Flight Auger (TC bit) to 2.5 m, wash bore to 12.53m, NMLC coring to 17.0m

WATER OBSERVATIONS: Free groundwater observed whilst augering at 1.5m

REMARKS: Coordinates and surface levels obtained via differential GPS

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed High School
LOCATION: Burroway Road, Wentworth Point

SURFACE LEVEL: 2.3 AHD
EASTING: 322367
NORTHING: 6255643
DIP/AZIMUTH: 90°/--

BORE No: BH210
PROJECT No: 202029.00
DATE: 3/5/2021
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
-8		Clayey SAND: fine to medium, dark grey, trace shell fragments, wet, very loose, estuarine *(continued)*										
-9	11 11.0	SAND SP: fine to medium, yellow-brown, trace shell fragments, wet, loose, estuarine							S			6,5,4 N = 9
-10	12											
-11	12.53 13	SANDSTONE: fine to coarse grained, pale orange and pale grey, medium bedded at 5-20 degrees, high strength with a band of medium strength, highly weathered then moderately weathered, slightly weathered then fresh, slightly fractured , Hawkesbury Sandstone						13.12m: B5°, pl, ro, fe stn 13.16m-13.25m: B5°(5x), pl, ro, cly co 13.55m: Cs 4mm 13.81m: Cs 1mm 13.91m: B5°, pl, ro, fe stn	C	100	95	PL(A) = 1.1 PL(A) = 0.8
-12	14											PL(A) = 1.2
-13	15	Below 15.08m: unbroken Below 15.58m: thinly bedded at 0-10 degrees						14.8m: B5°, pl, ro, fe stn 15.08m: Ds 2mm	C	100	100	PL(A) = 1.8
-14	16							15.93m-15.94m: B2°(2x), pl, ro, cly co 16.24m: Ds 4mm				PL(A) = 1.1
-15	17 17.0	Bore discontinued at 17.0m Termination at target depth										
-16	18											
-17	19											

RIG: Explorer **DRILLER:** SS **LOGGED:** NB **CASING:** HW to 5.5m, HQ to 12.53m

TYPE OF BORING: Solid Flight Auger (TC bit) to 2.5 m, wash bore to 12.53m, NMLC coring to 17.0m

WATER OBSERVATIONS: Free groundwater observed whilst augering at 1.5m

REMARKS: Coordinates and surface levels obtained via differential GPS

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: 210 PROJECT: WENTWORTH POINT MAY 2019

12.53 – 17.00m

Appendix D2

Previous Cored Borehole Log and Core Photographs

BOREHOLE LOG

CLIENT: Urban Growth NSW
PROJECT: Wentworth Point Urban Activation Precinct
LOCATION: Hill Rd & Burroway Rd, Wentworth Point

SURFACE LEVEL: 2.8 AHD
EASTING: 322367
NORTHING: 6255728
DIP/AZIMUTH: 90°/--

BORE No: BHC3
PROJECT No: 84357
DATE: 26/6/2014
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.0	CONCRETE										
	0.2	FILLING - brown, gravelly sandy clay filling with some brick and a trace of cobbles, moist							A			
	1.0								A			
		1.2m: increasing sand content							S			8,12,12 N = 24
	1.6	CLAYEY SILT (possible filling) - soft, dark grey, slightly sandy, clayey silt with a trace of timber, moist							A			
	1.8	SILTY CLAY - very soft to soft, dark grey, silty clay with some sand and shells				▼						
	2.6	SILTY SAND - loose, grey, fine grained clayey silty sand filling with a trace of shells and organic material							S			3,1,1 N = 2
	3.1	SILTY CLAY - soft, dark grey, slightly sandy, silty clay 3.65m: trace of timber then significant shells										
	5.25	SANDY CLAY - firm, yellow-brown, sandy clay with some shells										
	5.5	SILTY CLAY - stiff to very stiff, light grey with some red-brown mottling, silty clay							U_{50}			pp = 200
	6.5	SANDY CLAY - stiff, yellow-brown, sandy clay with some shells 7.0m: trace of timber										
	8.4	SILTY CLAY - hard, grey and orange-brown mottled, silty clay							S			9,15,21 N = 36

RIG: Explorer 1 **DRILLER:** JS **LOGGED:** KM/SI **CASING:** HW to 2.7m; HQ to 13.4m

TYPE OF BORING: Solid flight auger (TC-bit) to 2.5m; Rotary to 13.4m; NMLC-Coring to 18.9m

WATER OBSERVATIONS: Free groundwater observed at 2.05m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Urban Growth NSW
PROJECT: Wentworth Point Urban Activation Precinct
LOCATION: Hill Rd & Burroway Rd, Wentworth Point

SURFACE LEVEL: 2.8 AHD
EASTING: 322367
NORTHING: 6255728
DIP/AZIMUTH: 90°/--

BORE No: BHC3
PROJECT No: 84357
DATE: 26/6/2014
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SILTY CLAY - hard, grey and orange-brown mottled, silty clay *(continued)*										
		10.0m: some fine grained sand										
		11.4m: grey and orange-brown mottled							S			8,13,19 N = 32
		12.0m: some sand										
	13.0	SANDSTONE - extremely low strength, yellow-brown sandstone						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0°- 10°				
	13.4	SANDSTONE - medium to high then medium strength, moderately and highly to moderately weathered, fractured and slightly fractured, brown, medium grained sandstone with some clay bands						13.72m: J25°, pl, ro, fe 13.9m: B0°, cly co, 3mm 14.31-14.6m: B (x5) 0°-5°, cly co, 3-10mm	C	100	85	PL(A) = 1 PL(A) = 0.8 PL(A) = 3.5
	14.6	SANDSTONE - very high then high strength, slightly weathered and fresh, slightly fractured, light grey-brown and light grey, medium to coarse grained sandstone						15.14m: B10°, fe 15.47m: B0°, fe, cly 15.61m: J45°, pl, ro, fe, cly >>	C	100	100	PL(A) = 1.4 PL(A) = 2.1 PL(A) = 2.3
	18.9	Bore discontinued at 18.9m										

RIG: Explorer 1 **DRILLER:** JS **LOGGED:** KM/SI **CASING:** HW to 2.7m; HQ to 13.4m

TYPE OF BORING: Solid flight auger (TC-bit) to 2.5m; Rotary to 13.4m; NMLC-Coring to 18.9m

WATER OBSERVATIONS: Free groundwater observed at 2.05m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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DOUGLAS PARTNERS PTY LTD

URBAN ACTIVATION PRECINCT – WENTWORTH POINT

BORE C3 PROJECT 84357 JUL 2014

13.42 – 17.0

DOUGLAS PARTNERS PTY LTD

URBAN ACTIVATION PRECINCT – WENTWORTH POINT

BORE C3 PROJECT 84357 JUL 2014

17.0 – 18.9m

Appendix E1

Recent Non-Cored Borehole Log

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed High School
LOCATION: Burroway Road, Wentworth Point

SURFACE LEVEL: 2.1 AHD
EASTING: 322344
NORTHING: 3255680
DIP/AZIMUTH: 90°/--

BORE No: BH208
PROJECT No: 202029.00
DATE: 3/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	VWP Construction Details
2	0	FILL							
1	1								
	1.2	SAND							
	1.8	Sandy CLAY		A	2.0				
0	2				2.1				
	2.1	Bore discontinued at 2.1m							
-1	3								
-2	4								
-3	5								
-4	6								
-5	7								
-6	8								
-7	9								

RIG: Explorer **DRILLER:** SS **LOGGED:** **CASING:** Nil

TYPE OF BORING: Solid Flight Auger (TC bit) to 2.1 m

WATER OBSERVATIONS: Free groundwater observed at 1.1m

REMARKS: Borehole drilled for collection of acid sulfate soil sample, refer to CPT log for description of strata

SAMPLING & IN SITU TESTING LEGEND

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

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Appendix E2

Previous Non-Cored Borehole Log

BOREHOLE LOG

CLIENT: Urban Growth NSW
PROJECT: Wentworth Point Urban Activation Precinct
LOCATION: Hill Rd & Burroway Rd, Wentworth Point

SURFACE LEVEL: 2.2 AHD
EASTING: 322374
NORTHING: 6255617
DIP/AZIMUTH: 90°/--

BORE No: BHA8
PROJECT No: 84357
DATE: 2/7/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.22	CONCRETE							
	0.4	FILLING - grey-brown, clayey gravelly sand filling, humid							
		FILLING - brown, fine to coarse grained slightly clayey, shelly sand filling with a trace of fine to medium gravel, moist		A	1.0			▼	
	1.25	SILTY SAND - grey, silty sand with some shells, saturated		A	1.4				
	1.5	1.4m: some clay							
		NOT DRILLED. DMT TESTING ONLY							
	6.0	Bore discontinued at 6.0m							

RIG: Explorer 1 **DRILLER:** JS **LOGGED:** KM **CASING:** HW to 1.5m

TYPE OF BORING: Solid flight auger (TC-bit) to 1.5m; DMT testing to 6.0m

WATER OBSERVATIONS: Free groundwater observed at 1.3m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Appendix F

Previous Shear Vane Test Results

SHEAR VANE TEST

CLIENT:	Urban Growth NSW	**PROJECT NO:**	84357	**LOCATION:**	SV3
PROJECT:	Wentworth Point Urban Activation Precinct	**DATE:**	14-Jul-14	**RL:**	2.8
LOCATION:	Hill Rd & Burroway Rd, Wentworth Point			**COORDINATES:**	E322367, N6255728

SHEAR VANE:

LENGTH (mm): 150

DIAMETER (mm): 75

THICKNESS (mm): 2

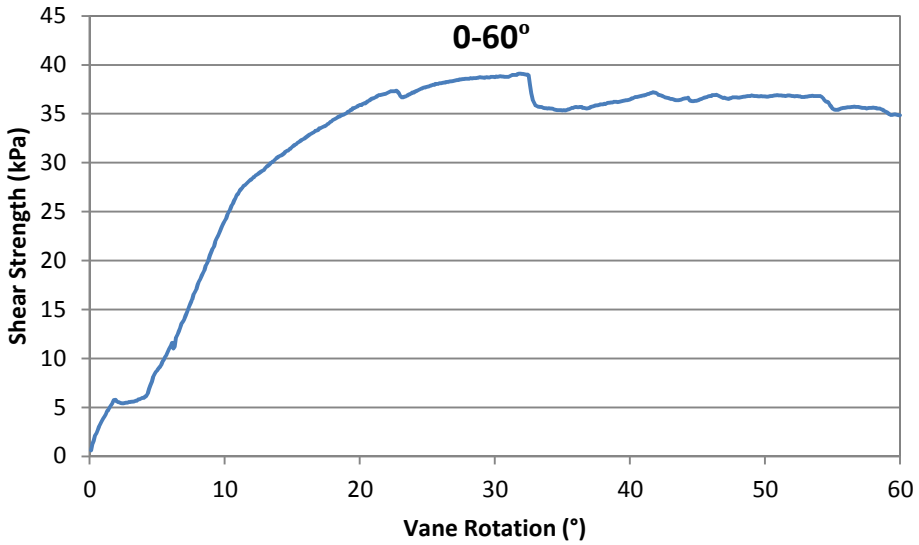
EQUIPMENT: Icone Vane Tester

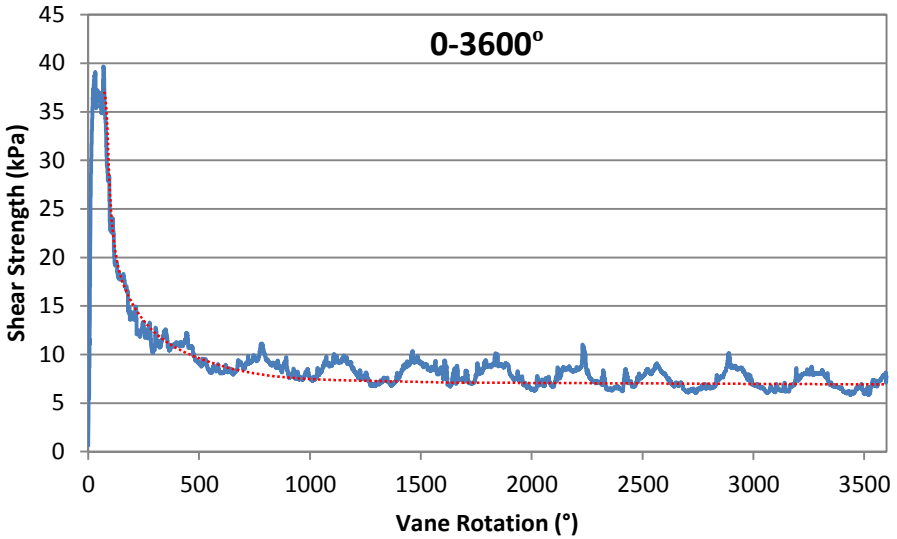
CALIBRATION DATE: Nov-12

RATE OF VANE ROTATION: 12º/min for 60º; 360º/min thereafter

DEPTH TESTED (m):	**UNDISTURBED SHEAR STRENGTH (kPa):**	**REMOULDED SHEAR STRENGTH (kPa):**
3.66	39	7

SOIL DESCRIPTION: Slightly sandy silty clay with shells and a trace of timber





Test procedure undertaken as per AS 1289.6.2.1

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Appendix G

Previous Dilatometer Results

DILATOMETER TEST

CLIENT:	Urban Growth NSW	**PROJECT NO:**	84357	**TEST LOCATION:**	DMT3
PROJECT:	Wentworth Point Urban Activation Precinct	**DATE:**	1-Jul-14	**RL:**	2.8
LOCATION:	Hill Rd & Burroway Rd, Wentworth Point	**TESTER:**	Insitu Geotech Services	**COORDINATES:**	E322367, N6255728

Z (m)	A (kPa)	B (kPa)	Po (kPa)	P1 (kPa)	Gamma (kN/m^3)	Sigma' (kPa)	Uo (kPa)	Id	Ed (MPa)	Cu (kPa)
2.2	300	1200	279	1145	18.6	35	2	3.13	30.1	-
2.4	370	1300	347	1245	18.6	37	4	2.61	31.2	-
2.6	270	850	265	795	18.6	39	6	2.05	18.4	-
2.8	185	340	201	285	15.7	41	8	0.43	2.9	26
3	190	310	208	255	15.7	42	10	0.24	1.6	27
3.2	190	320	207	265	15.7	43	12	0.3	2	26
3.4	200	290	219	235	13.7	44	14	0.08	0.5	28
3.6	170	260	189	205	13.7	45	16	0.09	0.5	22
3.8	170	260	189	205	13.7	46	18	0.09	0.5	22
4	150	225	170	170	13.7	47	20	-	0	19
4.2	180	290	198	235	15.7	47	22	0.21	1.3	23
4.4	185	285	204	230	14.7	49	24	0.15	0.9	23
4.6	180	400	193	345	16.7	50	26	0.91	5.3	21
4.8	150	230	170	175	13.7	51	27	0.04	0.2	17
5	140	220	160	165	13.7	52	29	0.04	0.2	15
5.2	140	240	159	185	14.7	53	31	0.21	0.9	15
5.4	170	270	189	215	14.7	53	33	0.17	0.9	19
5.6	270	450	285	395	16.7	54	35	0.44	3.8	34
5.8	350	750	354	695	17.7	56	37	1.08	11.8	45
6	400	800	404	745	17.7	57	39	0.94	11.8	54

LEGEND:

Z = Depth below ground surface
Po, P1 = Corrected A & B readings
Id = Material Index
Ed = Dilatometer Modulus
Ud = Pore Pressure Index

Gamma = Bulk Unit Weight
Sigma' = Effective Overburden Stress
Uo = Pore Pressure
Cu = Undrained Shear Strength

GENERAL PARAMETERS:

DeltaA = 20 kPa
DeltaB = 55 kPa
GammaTop = 17.0 kN/m^3
FactorEd = 34.7
Zm=0kPa, Zabs=0m, Zw=2.0m

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DILATOMETER TEST

CLIENT:	Urban Growth NSW	**PROJECT NO:**	84357	**TEST LOCATION:**	DMT8
PROJECT:	Wentworth Point Urban Activation Precinct	**DATE:**	2-Jul-14	**RL:**	2.2
LOCATION:	Hill Rd & Burroway Rd, Wentworth Point	**TESTER:**	Insitu Geotech Services	**COORDINATES:**	E322373, N6255618

Z (m)	A (kPa)	B (kPa)	Po (kPa)	P1 (kPa)	Gamma (kN/m^3)	Sigma' (kPa)	Uo (kPa)	Id	Ed (MPa)	Cu (kPa)
2.4	120	220	129	160	14.7	30	11	0.27	1.1	15
2.6	140	260	148	200	15.7	31	13	0.39	1.8	18
2.8	110	450	107	390	16.7	32	15	3.09	9.8	-
3	110	380	110	320	16.7	34	17	2.25	7.3	-
3.2	180	335	186	275	15.7	35	19	0.53	3.1	23
3.4	165	260	174	200	14.7	36	21	0.17	0.9	20
3.6	160	270	168	210	15.7	37	23	0.29	1.5	19
3.8	135	230	144	170	14.7	38	25	0.22	0.9	15
4	200	340	207	280	15.7	39	26	0.41	2.6	24
4.2	215	350	222	290	15.7	40	28	0.35	2.4	26
4.4	230	360	237	300	15.7	42	30	0.3	2.2	29
4.6	230	360	237	300	15.7	43	32	0.31	2.2	28
4.8	250	380	257	320	15.7	44	34	0.28	2.2	31
5	220	345	227	285	15.7	45	36	0.3	2	25
5.2	200	310	208	250	15.7	46	38	0.25	1.5	22
5.4	200	305	208	245	15.7	47	40	0.22	1.3	21
5.6	210	320	218	260	15.7	49	42	0.24	1.5	22
5.8	210	320	218	260	15.7	50	44	0.24	1.5	22
6	210	320	218	260	15.7	51	46	0.24	1.5	22

LEGEND:

Z = Depth below ground surface
Po, P1 = Corrected A & B readings
Id = Material Index
Ed = Dilatometer Modulus
Ud = Pore Pressure Index

Gamma = Bulk Unit Weight
Sigma' = Effective Overburden Stress
Uo = Pore Pressure
Cu = Undrained Shear Strength

GENERAL PARAMETERS:

DeltaA = 10 kPa
DeltaB = 60 kPa
GammaTop = 17.0 kN/m^3
FactorEd = 34.7
Zm=0kPa, Zabs=0m, Zw=1.3m

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Appendix H1

Recent Dissipation Test Results

DISSIPATION TEST

CLIENT SCHOOL INFRASTRUCTURE NSW

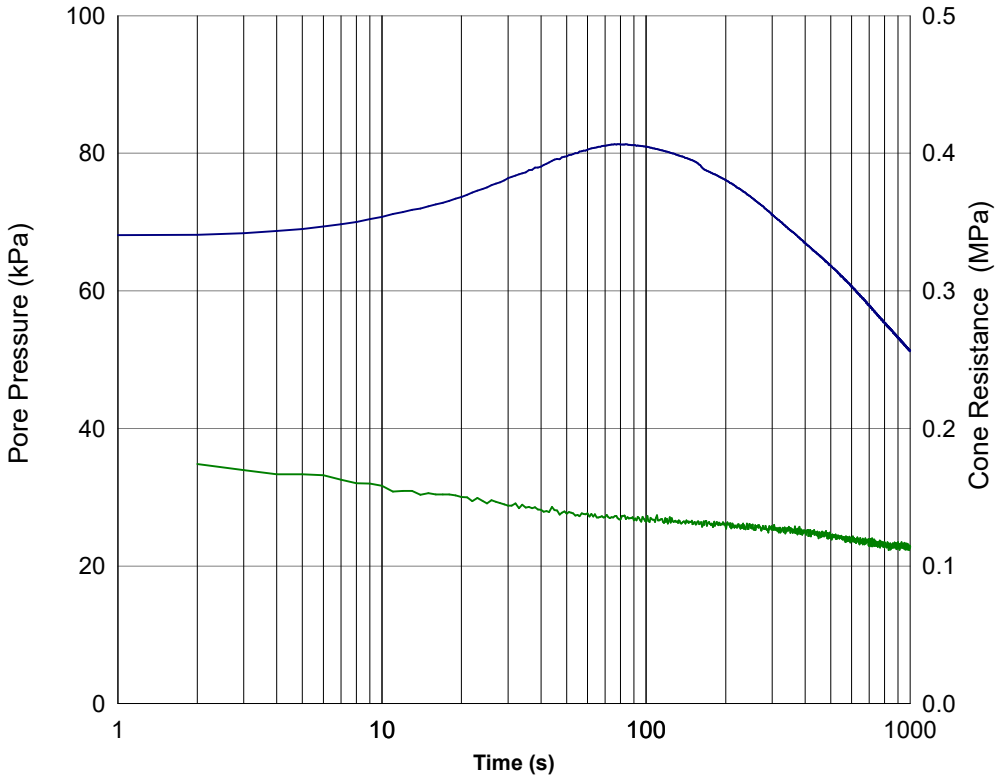
PROJECT	PROPOSED HIGHSHCOOL
LOCATION	BURROWAY RD, WENTWORTH POINT
PROJECT No	202029

CPT208

DEPTH 3.5m

DATE 05/05/2021

PORE PRESSURE / CONE RESISTANCE



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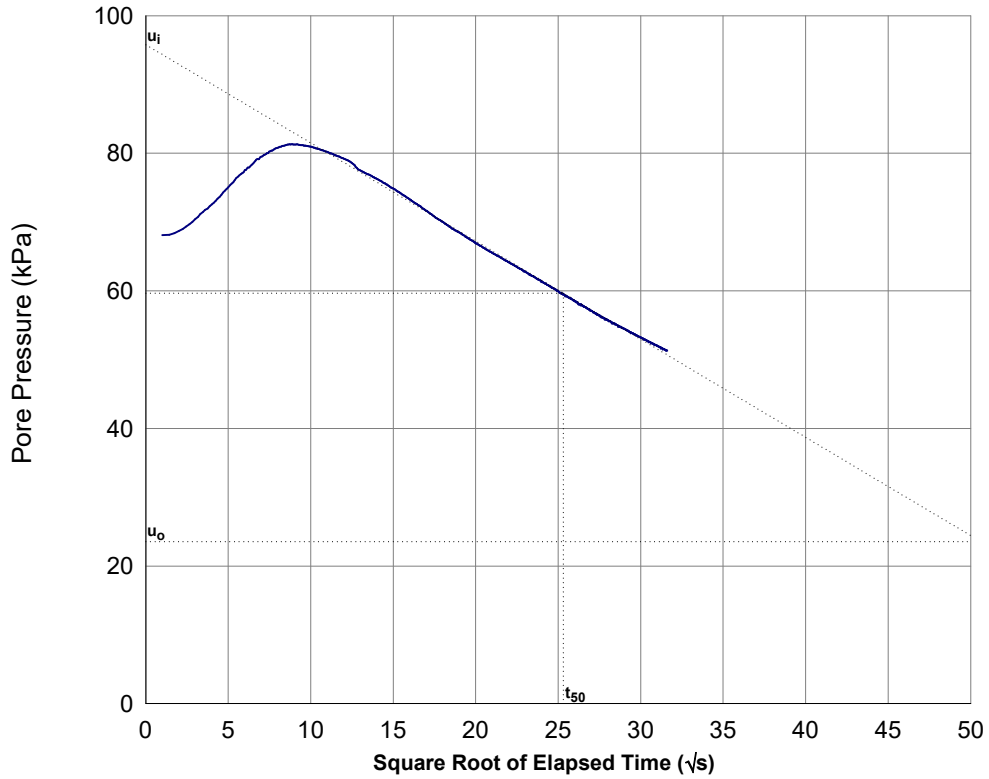


Water Level after test:	1.1	
Estimated hydrostatic pore pressure (u_0):	23.5	**kPa**
Estimated Initial Pore Pressure (u_i):	95.8	**kPa**
Final Measured Pore Pressure:	51.3	**kPa**
Time for 50% pore pressure reduction (t_{50}):	641	**seconds**
	10.7	**minutes**

c_h:	30	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

REMARKS:

File: CPT208.T01
Cone ID: 120522T **Type:** I-CFXYP20-10

Date
Plotted
Checked

DISSIPATION TEST

CLIENT SCHOOL INFRASTRUCTURE NSW

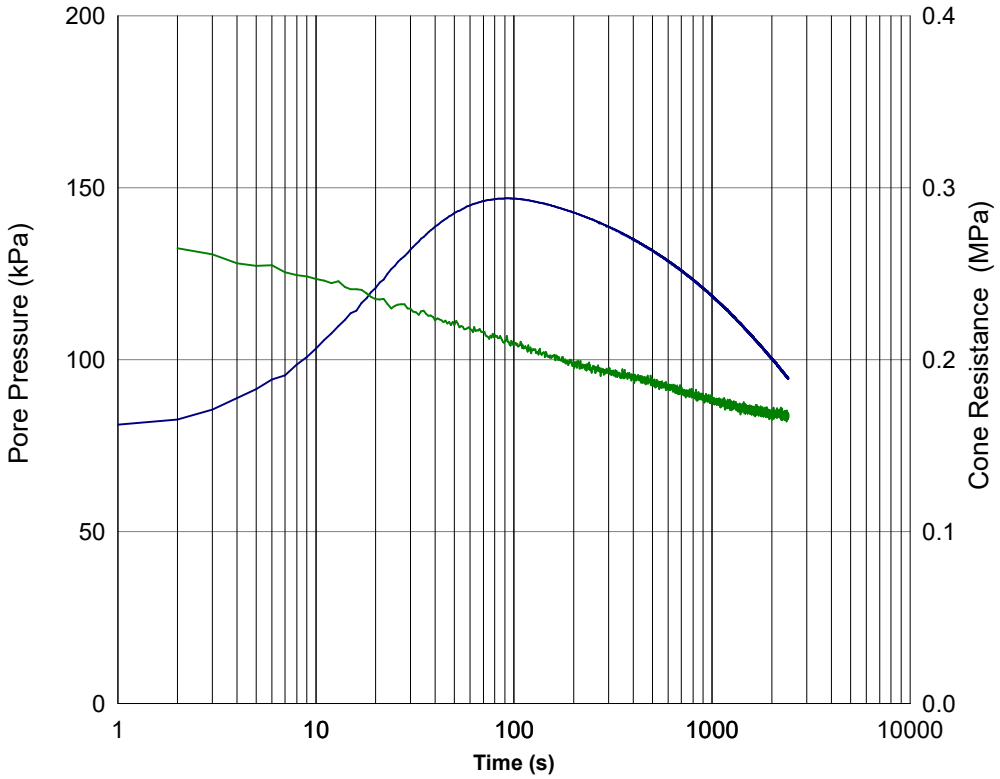
PROJECT	PROPOSED HIGHSHCOOL
LOCATION	BURROWAY RD, WENTWORTH POINT
PROJECT No	202029

CPT208

DEPTH 5.64m

DATE 05/05/2021

PORE PRESSURE / CONE RESISTANCE



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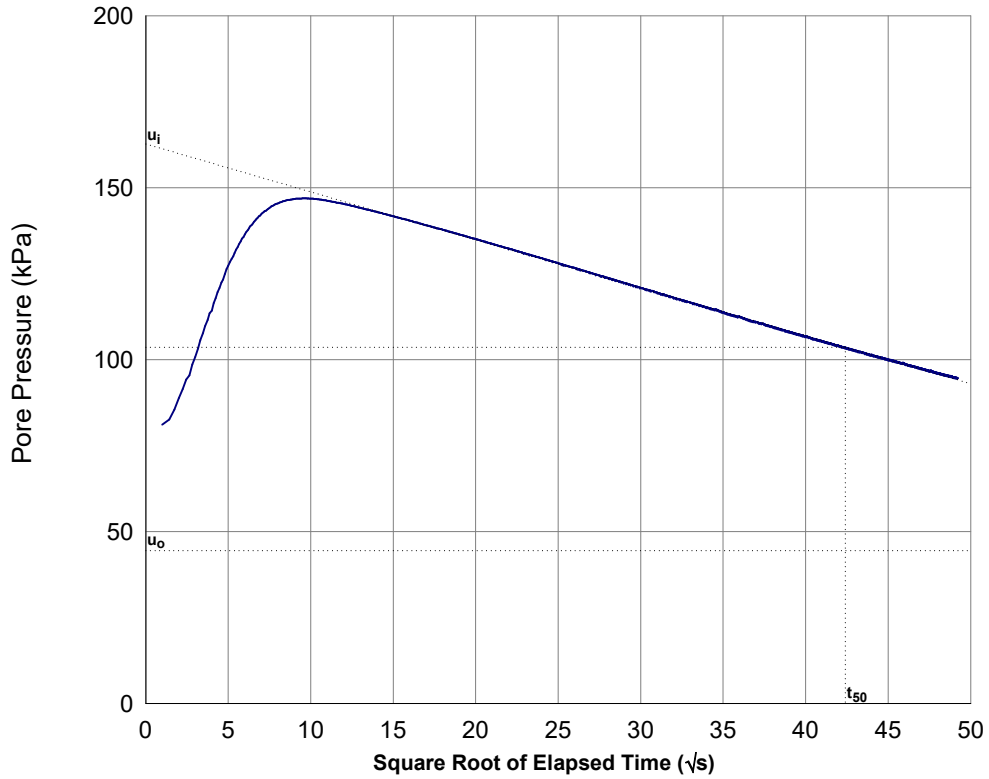


Water Level after test:	1.1	
Estimated hydrostatic pore pressure (u_0):	44.5	**kPa**
Estimated Initial Pore Pressure (u_i):	162.8	**kPa**
Final Measured Pore Pressure:	94.6	**kPa**
Time for 50% pore pressure reduction (t_{50}):	1797	**seconds**
	29.9	**minutes**

c_h:	11	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

REMARKS:

File: CPT208.T02
Cone ID: 120522T **Type:** I-CFXYP20-10

Date
Plotted
Checked

Appendix H2

Previous Dissipation Test Results

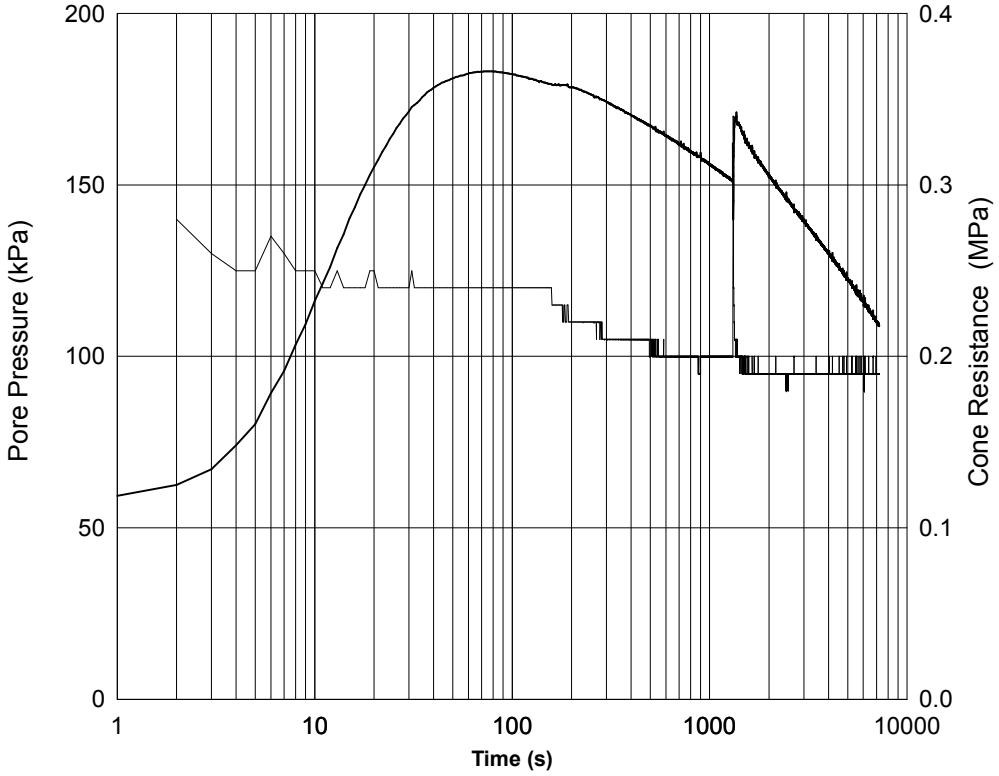
DISSIPATION TEST

CLIENT URBAN GROWTH NSW

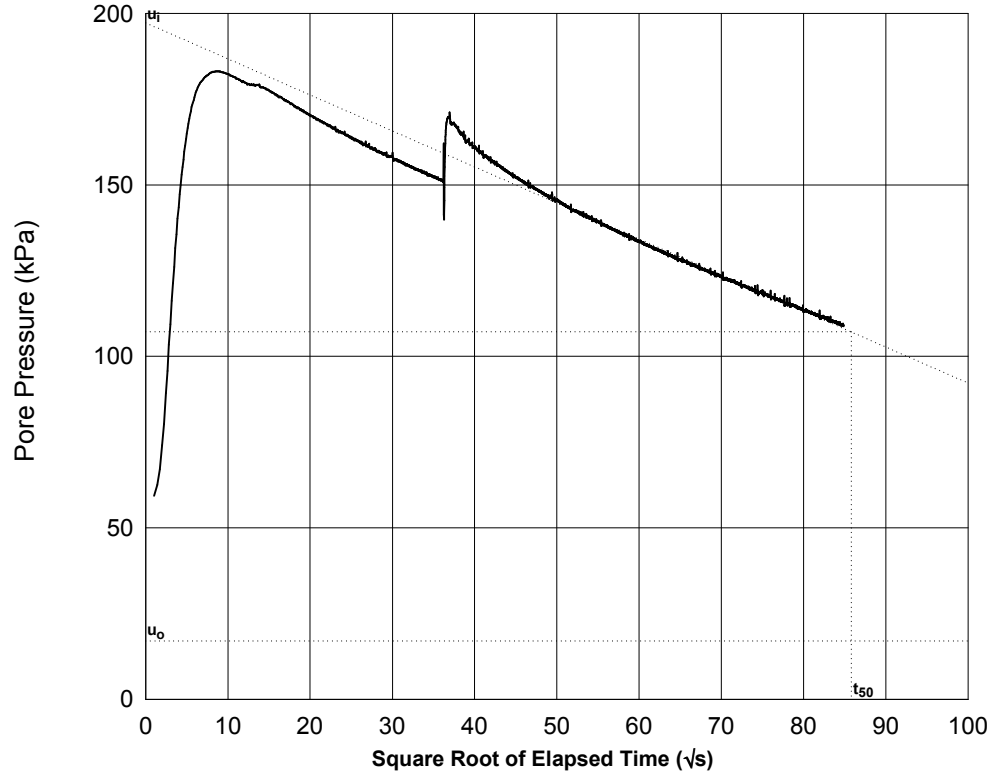
PROJECT	WENTWORTH POINT URBAN ACTIVATION PRECINCT
LOCATION	HILL RD & BURROWAY RD, WENTWORTH POINT
PROJECT No	84357

CPT3
DEPTH 3.34m
DATE 9/7/2014

PORE PRESSURE / CONE RESISTANCE



ROOT-TIME GRAPH



Water Level after test:	1.6	
Estimated hydrostatic pore pressure (u_0):	17.1	**kPa**
Estimated Initial Pore Pressure (u_i):	197.3	**kPa**
Final Measured Pore Pressure:	109.1	**kPa**
Time for 50% pore pressure reduction (t_{50}):	7359	**seconds**
	122.7	**minutes**

c_h:	3	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

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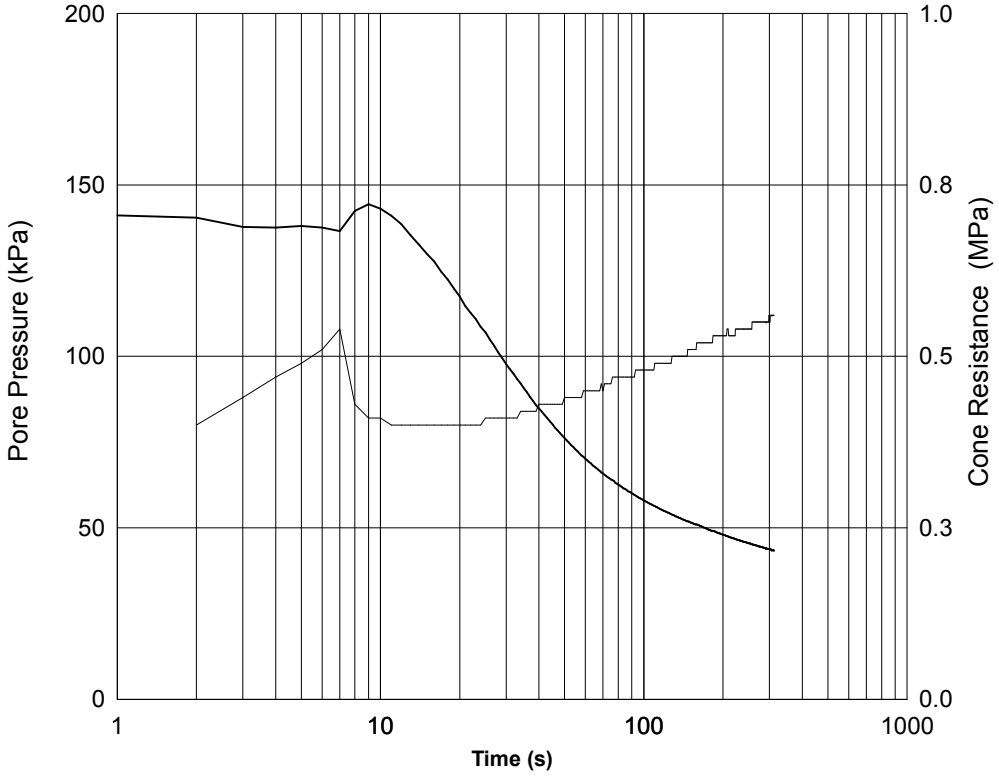
DISSIPATION TEST

CLIENT URBAN GROWTH NSW

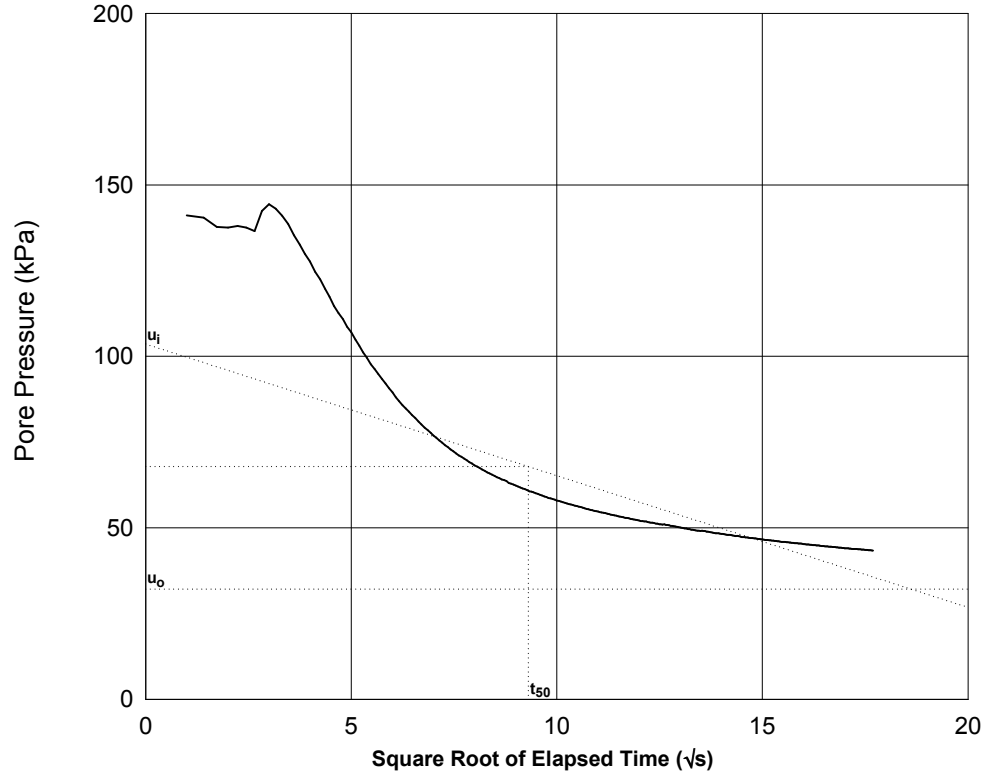
PROJECT	WENTWORTH POINT URBAN ACTIVATION PRECINCT
LOCATION	HILL RD & BURROWAY RD, WENTWORTH POINT
PROJECT No	84357

CPT3
DEPTH 4.88m
DATE 9/7/2014

PORE PRESSURE / CONE RESISTANCE



ROOT-TIME GRAPH



Water Level after test:	1.6	
Estimated hydrostatic pore pressure (u_0):	32.2	**kPa**
Estimated Initial Pore Pressure (u_i):	103.6	**kPa**
Final Measured Pore Pressure:	43.4	**kPa**
Time for 50% pore pressure reduction (t_{50}):	87	**seconds**
	1.4	**minutes**

c_h:	231	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

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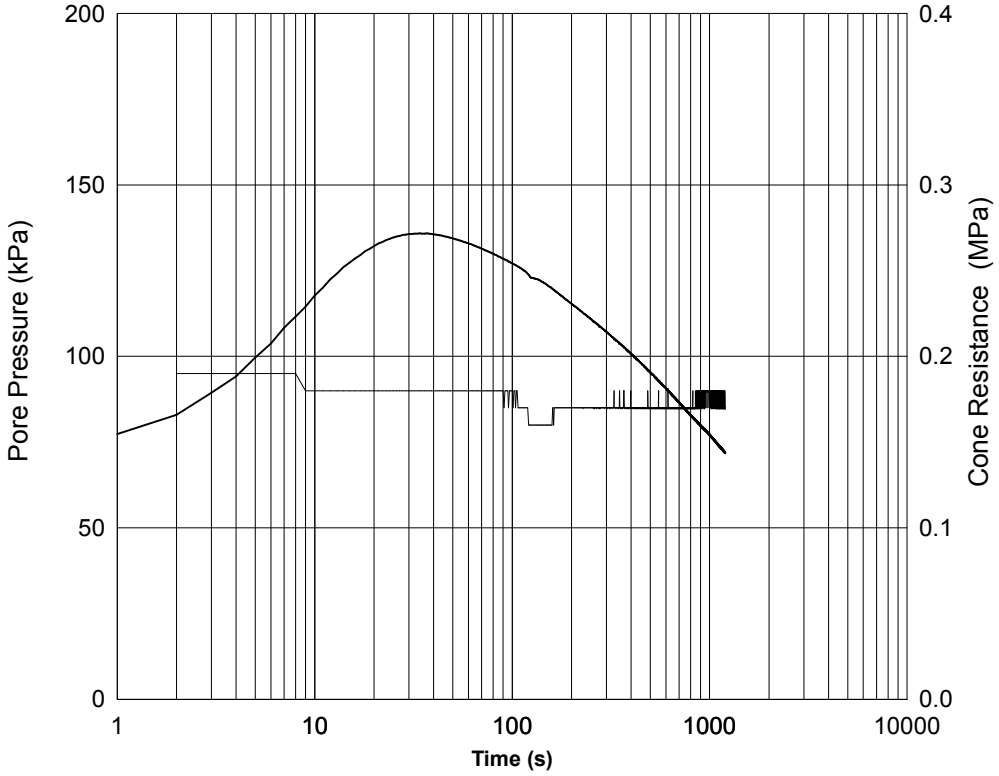
DISSIPATION TEST

CLIENT URBAN GROWTH NSW

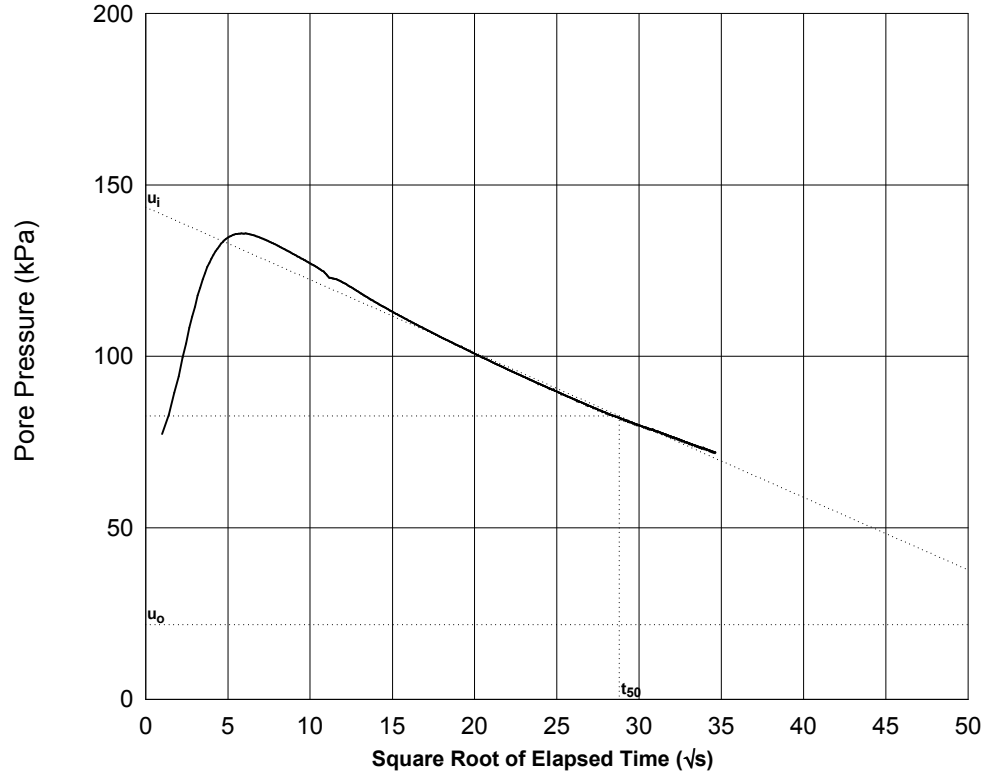
PROJECT	WENTWORTH POINT URBAN ACTIVATION PRECINCT
LOCATION	HILL RD & BURROWAY RD, WENTWORTH POINT
PROJECT No	84357

CPT8
DEPTH 3.32m
DATE 3/7/2014

PORE PRESSURE / CONE RESISTANCE



ROOT-TIME GRAPH



Water Level after test:	1.1	
Estimated hydrostatic pore pressure (u_0):	21.8	**kPa**
Estimated Initial Pore Pressure (u_i):	143.5	**kPa**
Final Measured Pore Pressure:	72.0	**kPa**
Time for 50% pore pressure reduction (t_{50}):	829	**seconds**
	13.8	**minutes**

c_h:	23	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

Douglas Partners
Geotechnics / Environment / Groundwater

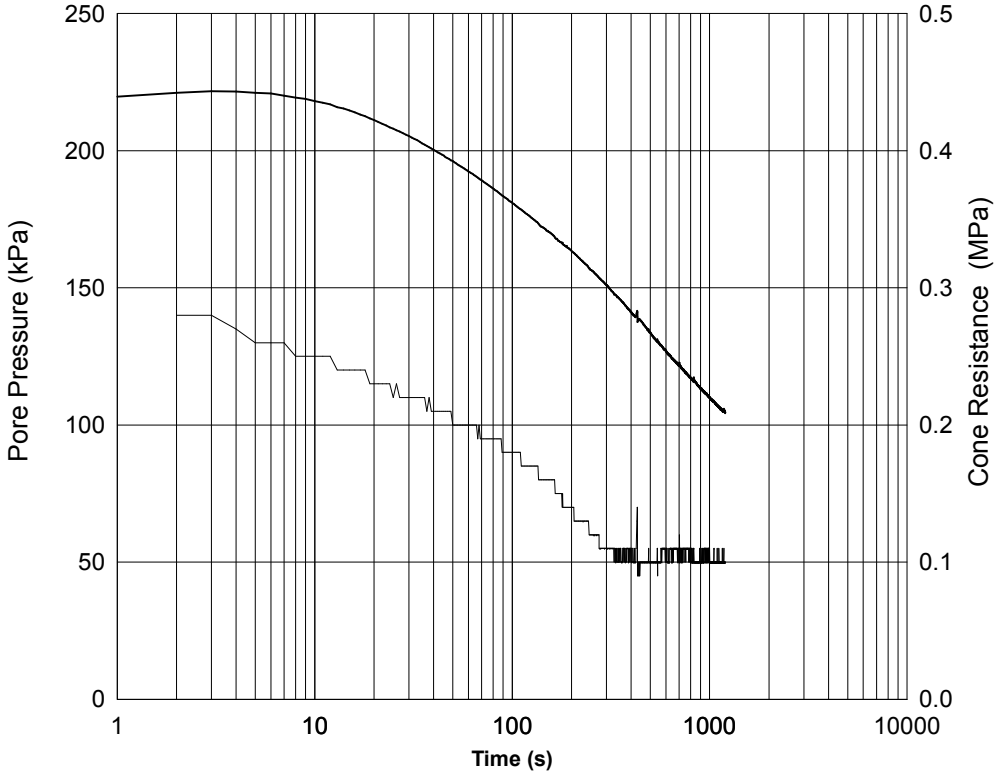
DISSIPATION TEST

CLIENT URBAN GROWTH NSW

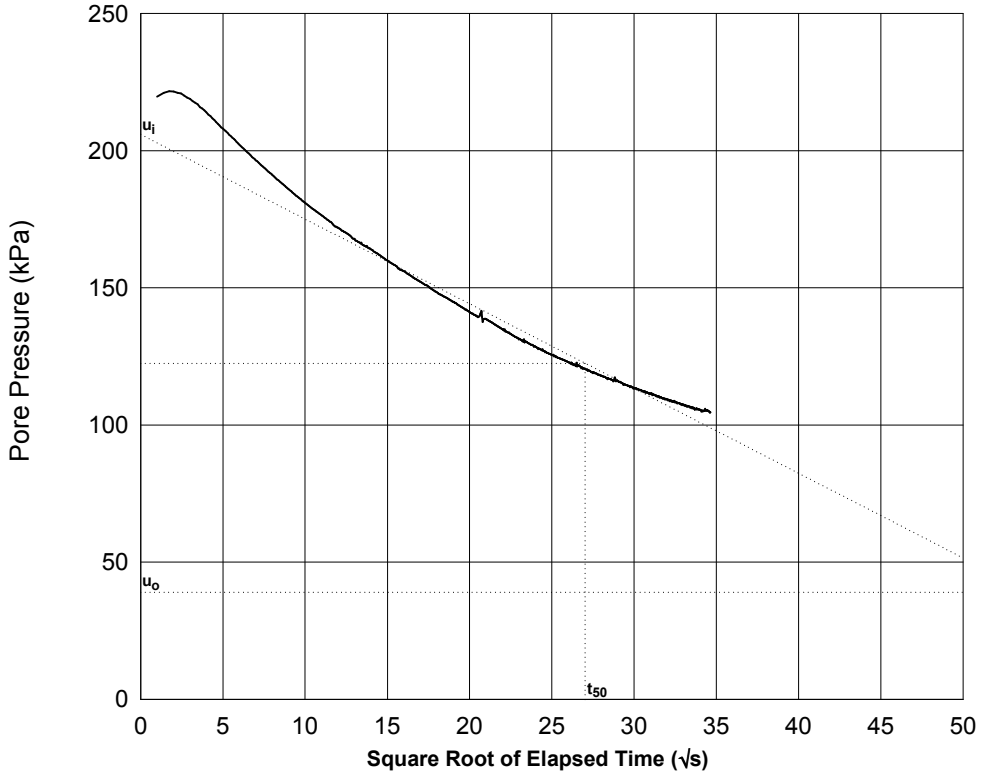
PROJECT	WENTWORTH POINT URBAN ACTIVATION PRECINCT
LOCATION	HILL RD & BURROWAY RD, WENTWORTH POINT
PROJECT No	84357

CPT8
DEPTH 5.08m
DATE 3/7/2014

PORE PRESSURE / CONE RESISTANCE



ROOT-TIME GRAPH



Water Level after test:	1.1	
Estimated hydrostatic pore pressure (u_0):	39.0	**kPa**
Estimated Initial Pore Pressure (u_i):	205.9	**kPa**
Final Measured Pore Pressure:	104.7	**kPa**
Time for 50% pore pressure reduction (t_{50}):	731	**seconds**
	12.2	**minutes**

c_h:	28	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

Douglas Partners
Geotechnics / Environment / Groundwater

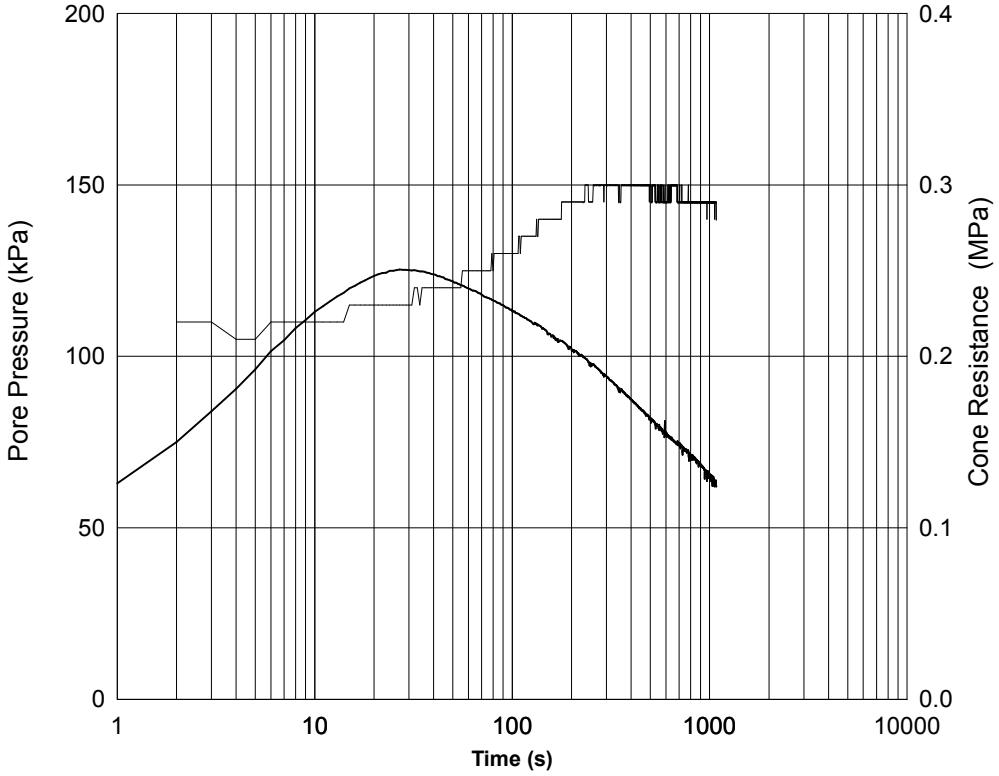
DISSIPATION TEST

CLIENT URBAN GROWTH NSW

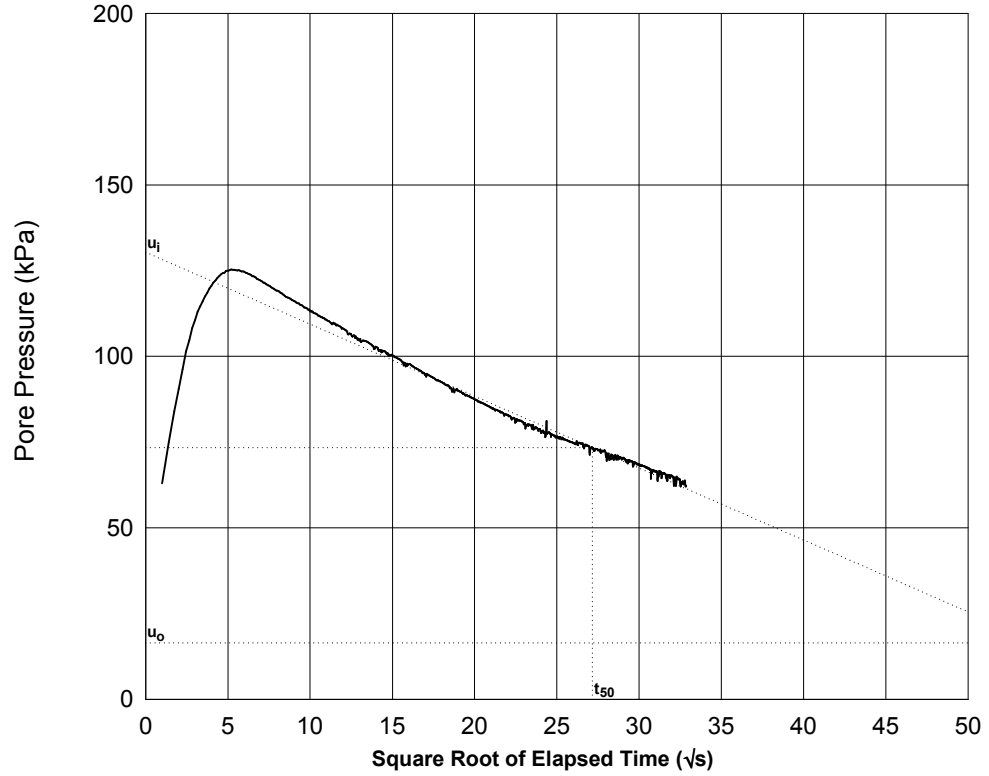
PROJECT	WENTWORTH POINT URBAN ACTIVATION PRECINCT
LOCATION	HILL RD & BURROWAY RD, WENTWORTH POINT
PROJECT No	84357

CPT17
DEPTH 2.68m
DATE 2/7/2014

PORE PRESSURE / CONE RESISTANCE



ROOT-TIME GRAPH



Water Level after test:	1.0	
Estimated hydrostatic pore pressure (u_0):	16.5	**kPa**
Estimated Initial Pore Pressure (u_i):	130.4	**kPa**
Final Measured Pore Pressure:	62.3	**kPa**
Time for 50% pore pressure reduction (t_{50}):	737	**seconds**
	12.3	**minutes**

c_h:	25	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

Douglas Partners
Geotechnics / Environment / Groundwater

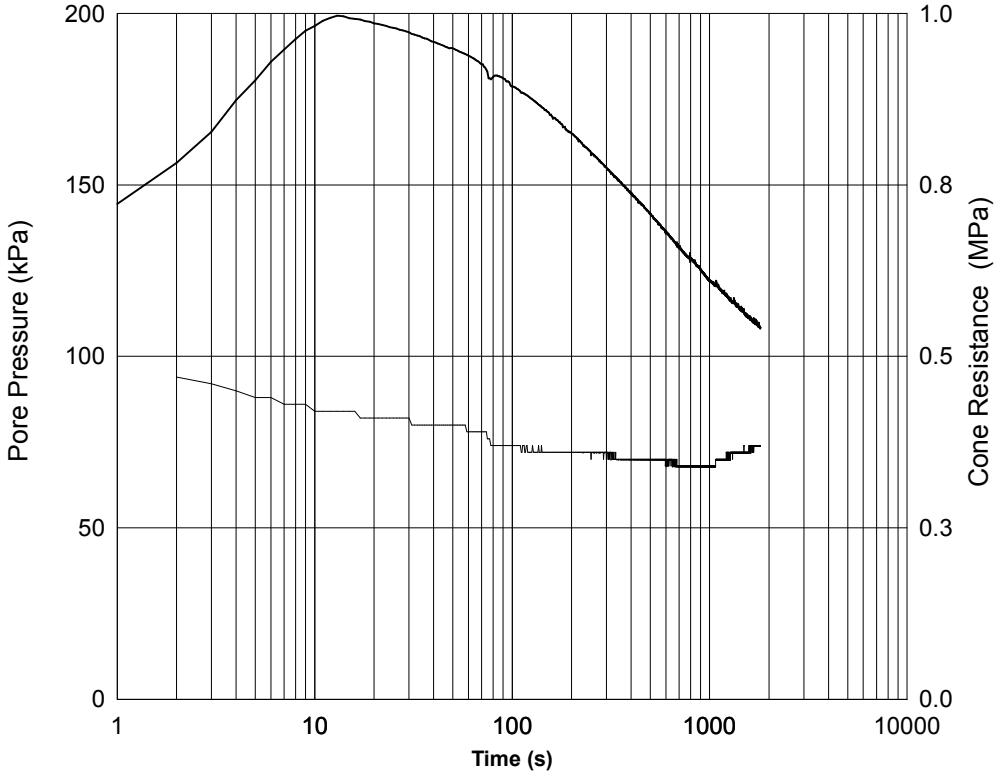
DISSIPATION TEST

CLIENT URBAN GROWTH NSW

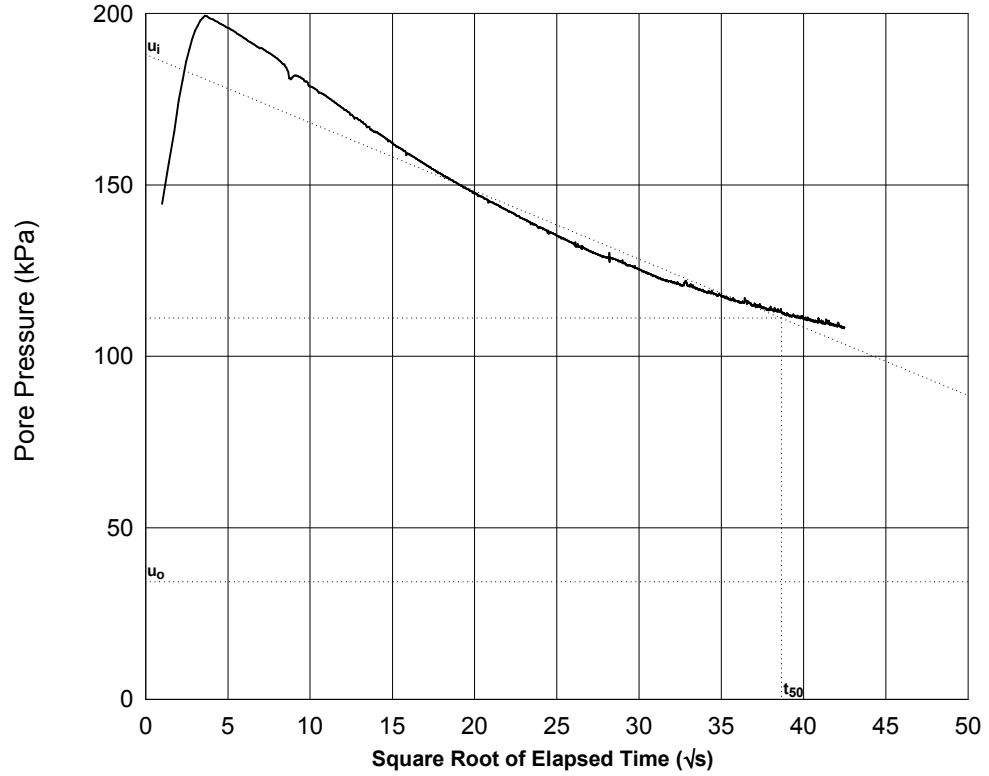
PROJECT	WENTWORTH POINT URBAN ACTIVATION PRECINCT
LOCATION	HILL RD & BURROWAY RD, WENTWORTH POINT
PROJECT No	84357

CPT17
DEPTH 4.5m
DATE 2/7/2014

PORE PRESSURE / CONE RESISTANCE



ROOT-TIME GRAPH



Water Level after test:	1.0	
Estimated hydrostatic pore pressure (u_0):	34.3	**kPa**
Estimated Initial Pore Pressure (u_i):	188.0	**kPa**
Final Measured Pore Pressure:	108.4	**kPa**
Time for 50% pore pressure reduction (t_{50}):	1494	**seconds**
	24.9	**minutes**

c_h:	14	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

Douglas Partners
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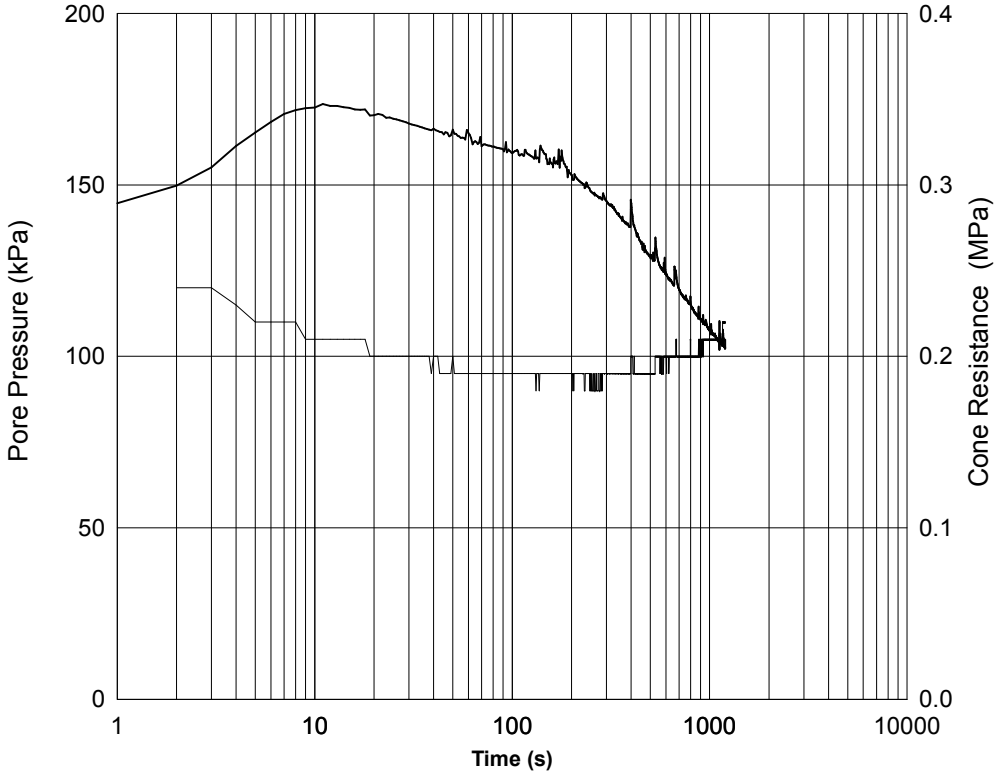
DISSIPATION TEST

CLIENT URBAN GROWTH NSW

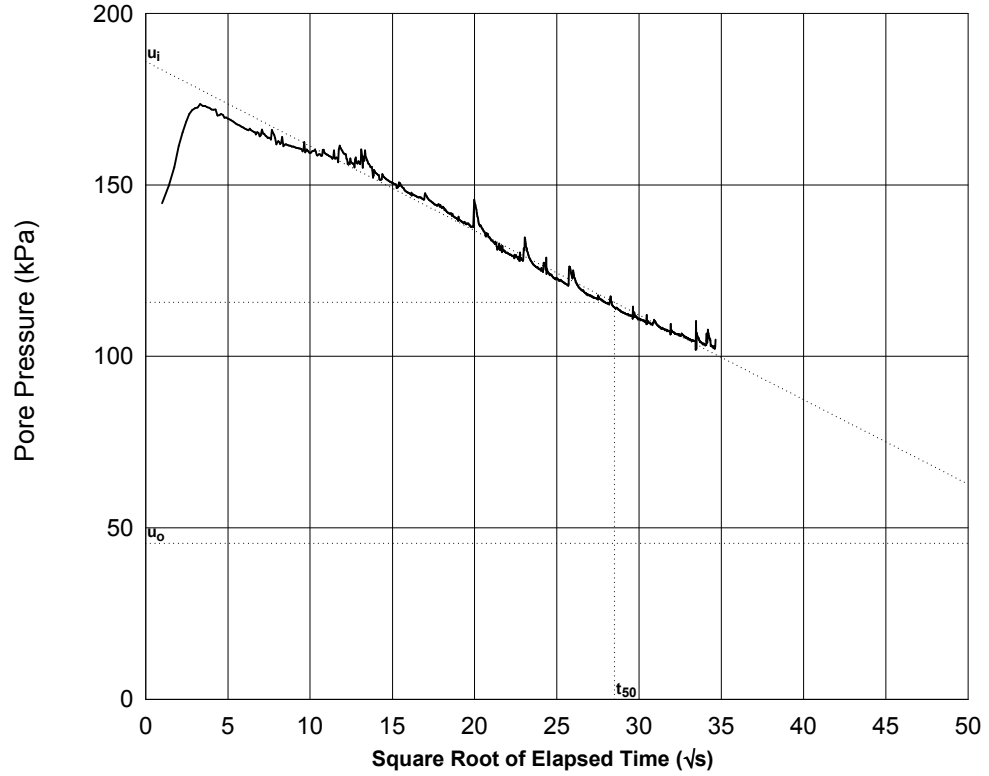
PROJECT	WENTWORTH POINT URBAN ACTIVATION PRECINCT
LOCATION	HILL RD & BURROWAY RD, WENTWORTH POINT
PROJECT No	84357

CPT17
DEPTH 5.64m
DATE 2/7/2014

PORE PRESSURE / CONE RESISTANCE



ROOT-TIME GRAPH



Water Level after test:	1.0	
Estimated hydrostatic pore pressure (u_0):	45.5	**kPa**
Estimated Initial Pore Pressure (u_i):	186.0	**kPa**
Final Measured Pore Pressure:	104.9	**kPa**
Time for 50% pore pressure reduction (t_{50}):	812	**seconds**
	13.5	**minutes**

c_h:	25	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

Douglas Partners
Geotechnics / Environment / Groundwater

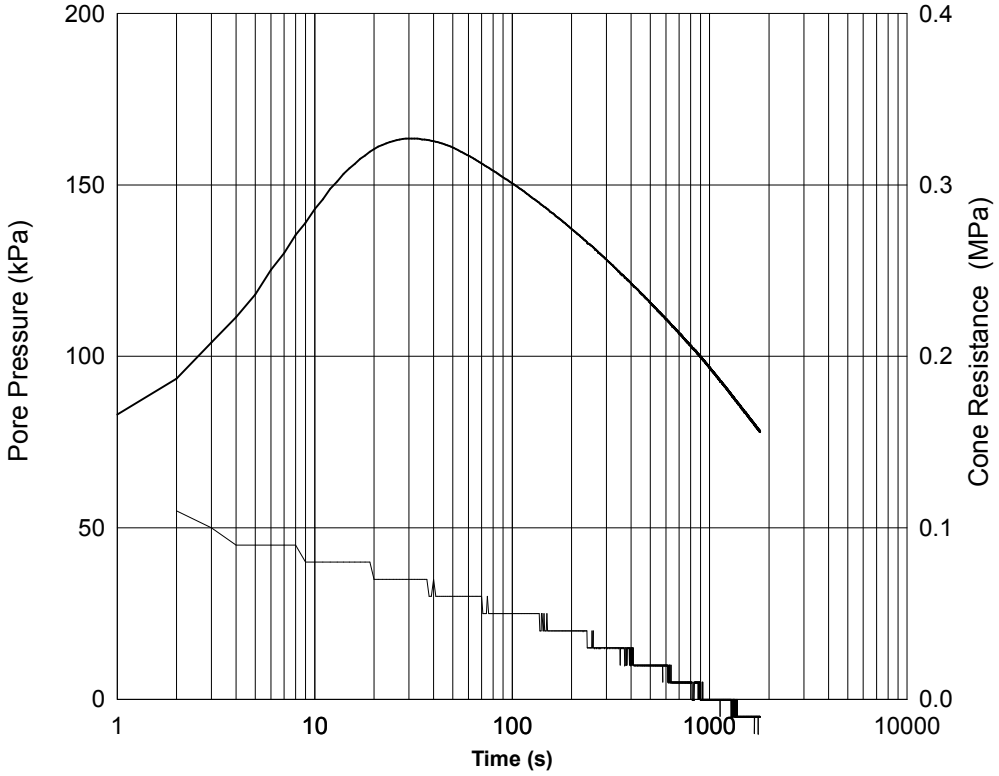
DISSIPATION TEST

CLIENT URBAN GROWTH NSW

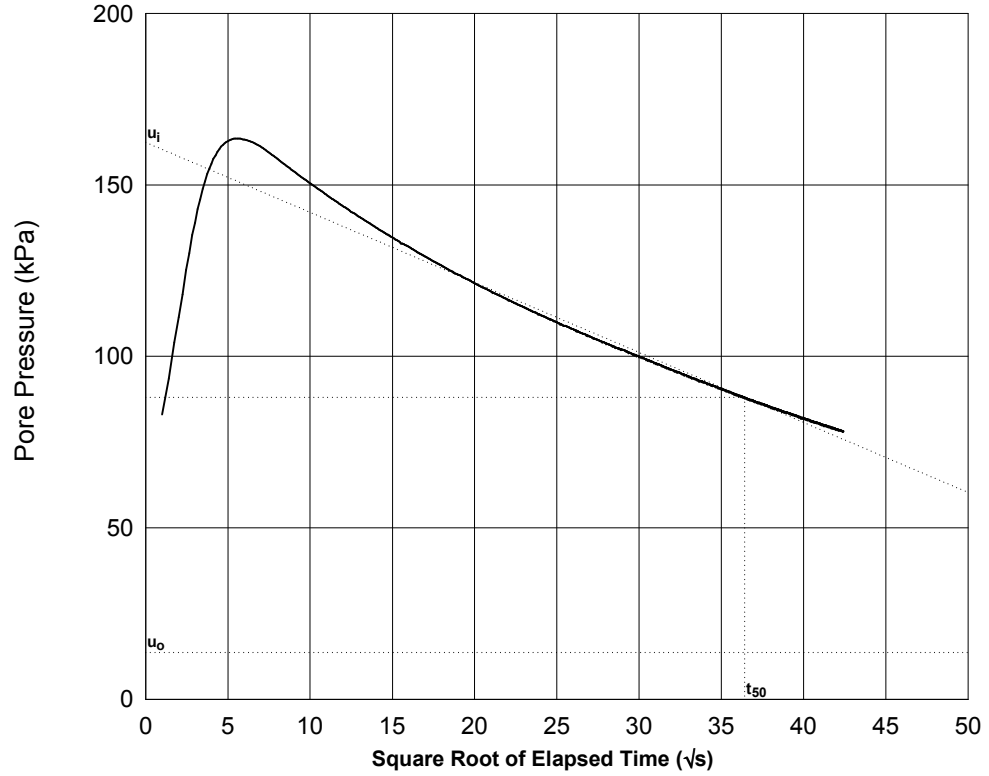
PROJECT	WENTWORTH POINT URBAN ACTIVATION PRECINCT
LOCATION	HILL RD & BURROWAY RD, WENTWORTH POINT
PROJECT No	84357

CPT19
DEPTH 3.3m
DATE 7/7/2014

PORE PRESSURE / CONE RESISTANCE



ROOT-TIME GRAPH



Water Level after test:	1.9	
Estimated hydrostatic pore pressure (u_0):	13.7	**kPa**
Estimated Initial Pore Pressure (u_i):	162.4	**kPa**
Final Measured Pore Pressure:	78.1	**kPa**
Time for 50% pore pressure reduction (t_{50}):	1326	**seconds**
	22.1	**minutes**

c_h:	14	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

Douglas Partners
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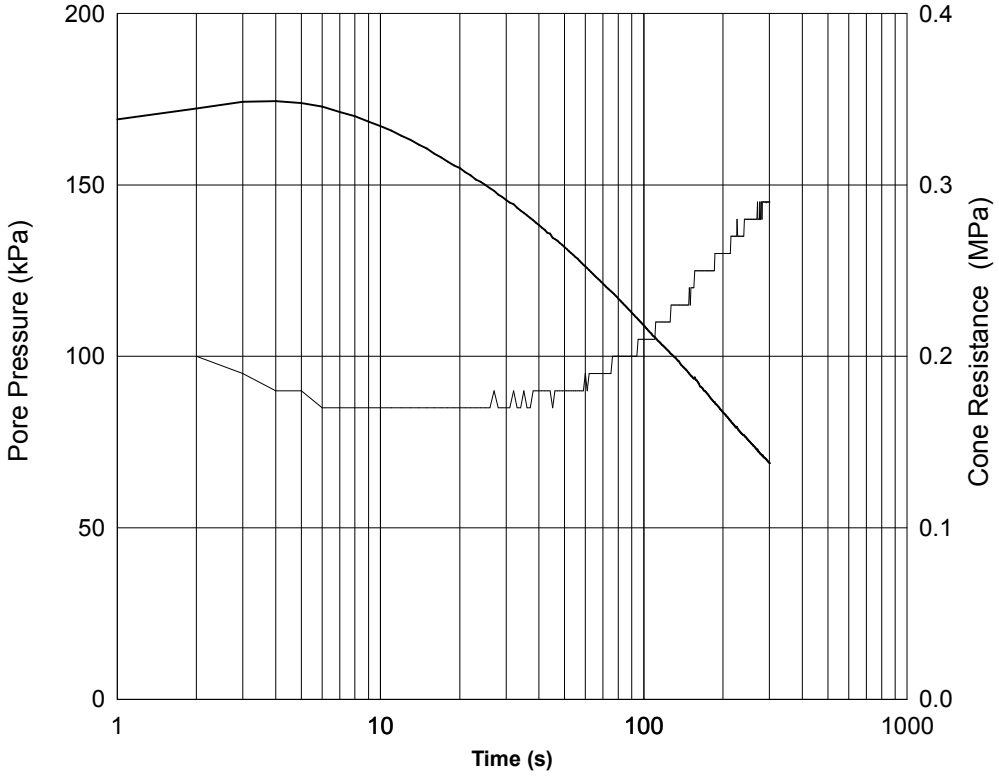
DISSIPATION TEST

CLIENT URBAN GROWTH NSW

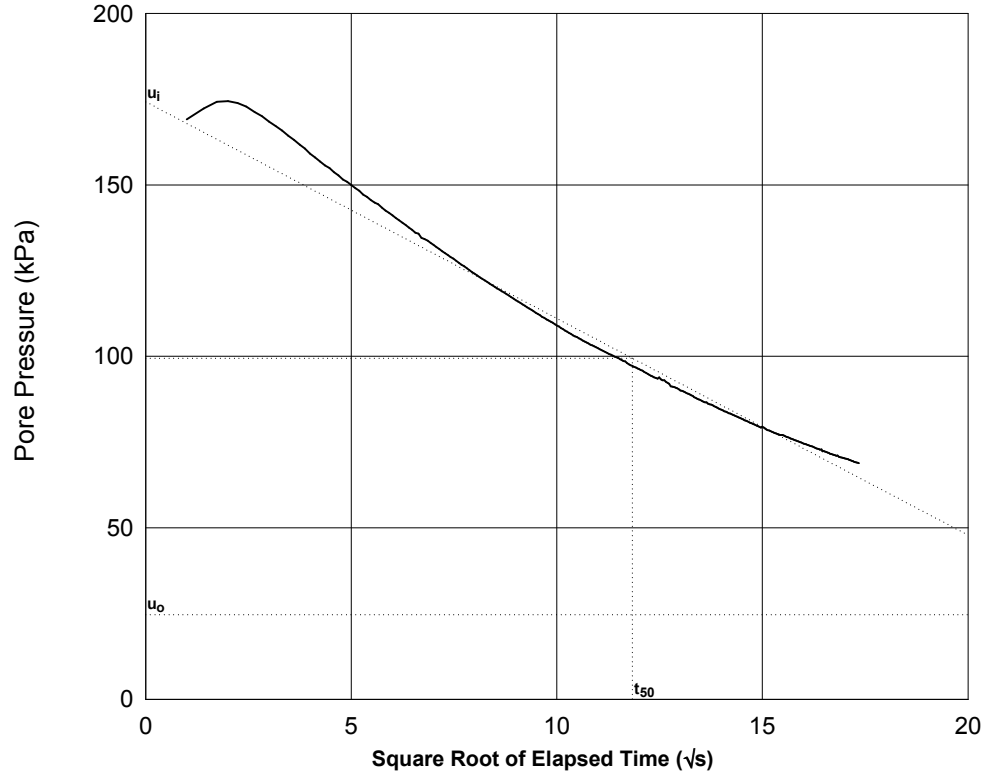
PROJECT	WENTWORTH POINT URBAN ACTIVATION PRECINCT
LOCATION	HILL RD & BURROWAY RD, WENTWORTH POINT
PROJECT No	84357

CPT19
DEPTH 4.42m
DATE 7/7/2014

PORE PRESSURE / CONE RESISTANCE



ROOT-TIME GRAPH



Water Level after test:	1.9	
Estimated hydrostatic pore pressure (u_0):	24.7	**kPa**
Estimated Initial Pore Pressure (u_i):	174.2	**kPa**
Final Measured Pore Pressure:	68.9	**kPa**
Time for 50% pore pressure reduction (t_{50}):	140	**seconds**
	2.3	**minutes**

c_h:	141	**m²/year**
Location of Filter Element:	2 (behind tip)	
Diameter of Cone:	35.7	**mm**

Reference: 'EVALUATION OF FIELD CPTU DISSIPATION DATA IN OVERCONSOLIDATED FINE-GRAINED SOILS'
J.P. Sully, R.G. Campanella XIII ICSMFE, 1994 New Delhi, India

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Appendix I1

Recent Laboratory Testing Results

Douglas Partners
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CHAIN OF CUSTODY DESPATCH SHEET

Project No:	202029.00	**Suburb:**	Wentworth Point	**To:**	*Envirolab Services*
Project Manager:	SB	**Order Number:**		**Sampler:**	NB		*12 Ashley St, Chatswood NSW 2067*
Email:	Sam.Balian@douglaspartners.com.au					**Attn:**	*Sample Receipt*
Turnaround time:	☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day					**Contact:**	*(02) 9910 6200 samplereceipt@envirolab.com.au*
Prior Storage:	☐ Fridge ☐ Freezer ☑ Shelf	**Do samples contain 'potential' HBM?**	☐ No ☐ Yes (If YES, then handle, transport and store in accordance with FPM HAZID)				

	Sample ID				Sample Type	Container Type	Analytes											
Lab ID	Location / Other ID	Depth From	Depth To	Date Sampled	S - soil W - water	G - glass P - plastic	Combo 8a	Combo 3a	Combo 3	ASS Field Screen	metals	Aggressivity (Cl, pH, SO4, EC)						Notes/ Preservation/ Additional Requirements
1	BH204	0.1	0.2.									✓						
2	BH204	0.9	1m.									✓						
3	BH204	8	8.45									✓						
4	BH207	14.										✓						
5	BH 204	5	5.45.									✓						
6	BH 210	11.0	11.45									✓						
7	BH 201	2	2.1									✓						

ENVIROLAB GROUP
Envirolab Services
12 Ashley St
Chatswood NSW 2
Ph: (02) 9910 6200

Job No: 268947

Date Received: 06/05/21
Time Received: 1630
Received By: CA
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Metals to analyse:		**LAB RECEIPT**	
Number of samples in container:	**Transported to laboratory by:**	**Lab Ref. No:**	
Send results to:	Douglas Partners Pty Ltd	**Received by:**	Christine GCS SYD
Address:	96 Hermitage Road, West Ryde NSW 2114 **Phone:** (02) 9809 0666	**Date & Time:**	1630 06/05/21
Relinquished by:	N Balian **Date:** 6.5.21 **Signed:**	**Signed:**	

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

CERTIFICATE OF ANALYSIS 268447

Client Details

Client	Douglas Partners Pty Ltd
Attention	Sam Balian
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**202029.00, Wentworth Point**
Number of Samples	7 Soil
Date samples received	06/05/2021
Date completed instructions received	06/05/2021

Analysis Details

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

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

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

Report Details

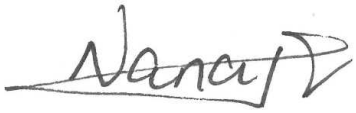
Date results requested by	13/05/2021
Date of Issue	13/05/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Diego Bigolin, Team Leader, Inorganics

Authorised By



Nancy Zhang, Laboratory Manager

Soil Aggressivity						
Our Reference		268447-1	268447-2	268447-3	268447-4	268447-5
Your Reference	UNITS	BH204	BH204	BH204	BH207	BH204
Depth		0.1-0.2	0.9-1.0	8-845	14	5-5.45
Type of sample		Soil	Soil	Soil	Soil	Soil
pH 1:5 soil:water	pH Units	8.8	10.4	5.0	7.4	8.0
Electrical Conductivity 1:5 soil:water	µS/cm	290	340	1,800	2,200	1,100
Chloride, Cl 1:5 soil:water	mg/kg	150	130	2,400	3,200	1,400
Sulphate, SO4 1:5 soil:water	mg/kg	260	250	360	210	230

Soil Aggressivity			
Our Reference		268447-6	268447-7
Your Reference	UNITS	BH210	BH201
Depth		11.0-11.45	2-2.1
Type of sample		Soil	Soil
pH 1:5 soil:water	pH Units	9.1	8.3
Electrical Conductivity 1:5 soil:water	µS/cm	1,400	120
Chloride, Cl 1:5 soil:water	mg/kg	1,900	22
Sulphate, SO4 1:5 soil:water	mg/kg	160	25

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

QUALITY CONTROL: Soil Aggressivity						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	4	7.4	7.4	0	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	4	2200	2300	4	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	4	3200	3400	6	89	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	4	210	230	9	90	[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.

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CHAIN OF CUSTODY DESPATCH SHEET

Project No:	202029.00	**Suburb:**	Wentworth Point	**To:**	*Envirolab Services*
Project Manager:	SB	**Order Number:**		**Sampler:** NB	*12 Ashley St, Chatswood NSW 2067*
Email:	Sam.Balian@douglaspartners.com.au			**Attn:**	*Sample Receipt*
Turnaround time:	☑ Standard ☐ 72 hour ☐ 48 hour ☐ 24 hour ☐ Same day			**Contact:**	*(02) 9910 6200 samplereceipt@envirolab.com.au*
Prior Storage:	☐ Fridge ☐ Freezer ☑ Shelf	**Do samples contain 'potential' HBM?**	☐ No ☐ Yes (If YES, then handle, transport and store in accordance with FPM HAZID)		

Lab ID	Sample ID: Location / Other ID	Depth From	Depth To	Date Sampled	Sample Type: S - soil W - water	Container Type: G - glass P - plastic	Analytes: Combo 8a	Combo 3a	Combo 3	ASS Field Screen	metals	Aggressivity (Cl, pH, SO4, EC)					Notes/ Preservation/ Additional Requirements
1	BH201	2.5	2.95		S	P				✓							
2	BH207	11.0	11.45		S	P				✓							
3	BH207	5.0	5.45		S	P				✓							
4	BH207	2.0	2.1		S	P				✓							
5	BH207	4.0	4.1		S	P				✓							
6	BH204	2.5	2.95		S	P				✓							
7	BH204	4	4.1		S	P				✓							
	[illegible]	[illegible]	[illegible]		S	P				✓							
8	BH210	3.5	3.95		S	P				✓							
9	BH210	8m.	8.45		S	P				✓							
10	BH210	5.0	5.45		S	P				✓							
11	BH208	2.0	2.1	CH						✓							

ENVIROLAB Limited Services 12 Ashley St Chatswood NSW Ph: (02) 9910 6200

Job No: 268408

Date Received: 06/05/21

Time Received: 1630

Received By: CH

Temp: Cool/Ambient

Cooling: Ice/Icepack

Security: Intact/Broken/None

Metals to analyse:

Number of samples in container:

Transported to laboratory by:

Send results to: Douglas Partners Pty Ltd

Address: 96 Hermitage Road, West Ryde NSW 2114 **Phone:** (02) 9809 0666

Relinquished by: N Bowers **Date:** 6 May **Signed:**

LAB RECEIPT

Lab Ref. No:

Received by: Christine ECS SYD

Date & Time: 1630 06/05/21

Signed:

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

CERTIFICATE OF ANALYSIS 268448

Client Details

Client	Douglas Partners Pty Ltd
Attention	Sam Balian
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**202029.00, Wentworth Point**
Number of Samples	11 Soil
Date samples received	06/05/2021
Date completed instructions received	06/05/2021

Analysis Details

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

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

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

Report Details

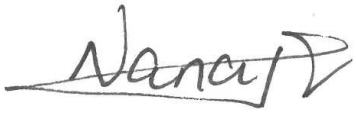
Date results requested by	10/05/2021
Date of Issue	10/05/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

sPOCAS field test						
Our Reference		268448-1	268448-2	268448-3	268448-4	268448-5
Your Reference	UNITS	BH201	BH207	BH207	BH207	BH207
Depth		2.5-2.95	11.0-11.45	5.0-5.45	2.0-2.1	4.0-4.1
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	07/05/2021	07/05/2021	07/05/2021	07/05/2021	07/05/2021
Date analysed	-	07/05/2021	07/05/2021	07/05/2021	07/05/2021	07/05/2021
pH_F (field pH test)*	pH Units	8.1	6.5	8.2	11.0	10.2
pH_{FOX} (field peroxide test)*	pH Units	7.9	6.6	3.5	8.9	7.3
Reaction Rate*	-	Medium reaction	High reaction	Volcanic reaction	Volcanic reaction	Extreme reaction

sPOCAS field test						
Our Reference		268448-6	268448-7	268448-8	268448-9	268448-10
Your Reference	UNITS	BH204	BH204	BH210	BH210	BH210
Depth		2.5-2.95	4-4.1	3.5-3.95	8-8.45	5.0-5.45
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	07/05/2021	07/05/2021	07/05/2021	07/05/2021	07/05/2021
Date analysed	-	07/05/2021	07/05/2021	07/05/2021	07/05/2021	07/05/2021
pH_F (field pH test)*	pH Units	8.7	8.2	7.8	7.9	8.2
pH_{FOX} (field peroxide test)*	pH Units	4.2	6.5	6.1	6.0	6.2
Reaction Rate*	-	High reaction	Volcanic reaction	Volcanic reaction	Extreme reaction	Volcanic reaction

sPOCAS field test		
Our Reference		268448-11
Your Reference	UNITS	BH208
Depth		2.0-2.1
Type of sample		Soil
Date prepared	-	07/05/2021
Date analysed	-	07/05/2021
pH_F (field pH test)*	pH Units	8.0
pH_{FOX} (field peroxide test)*	pH Units	5.9
Reaction Rate*	-	Volcanic reaction

Method ID	Methodology Summary
Inorg-063	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. Based on section H, Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions.

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.

Ming To

From: Jeremy Faircloth
Sent: Wednesday, 12 May 2021 12:41 PM
To: Sam Balian
Cc: Samplereceipt
Subject: RE: Results for Registration 268448 202029.00, Wentworth Point

Ref: 268448-A.
TAT: Standard.
Due: 19/05/2021
MT.

No problem at all Sam,
Standard turnaround ok?

Kind Regards,

Jeremy Faircloth | Operations Manager | Envirolab Services

Great Science. Great Service.

12 Ashley Street Chatswood NSW 2067
T 612 9910 6200
E JFaircloth@envirolab.com.au | W www.envirolab.com.au

Follow us on: LinkedIn | Facebook | Twitter

Samples will be analysed per our T&C's.

From: Sam Balian <Sam.Balian@douglaspartners.com.au>
Sent: Wednesday, 12 May 2021 12:31 PM
To: Jeremy Faircloth <JFaircloth@envirolab.com.au>
Subject: RE: Results for Registration 268448 202029.00, Wentworth Point

Thanks Jeremy,

Can you please carry out reducible chromium suite on the following samples:

- 6 BH204 – 2.5 to 2.95m
- 5 BH207 – 4.0 to 4.1m
- 3 BH207 – 5.0 to 5.45m
- 11 BH208 – 2.0 to 2.1m

Kind Regards,

Sam Balian | Associate / Geotechnical Engineer
Douglas Partners Pty Ltd | ABN 75 053 980 117 | www.douglaspartners.com.au
96 Hermitage Road West Ryde NSW 2114 | PO Box 472 West Ryde NSW 1685
P: 02 9809 0666 | M: 0414 716 493 | E: Sam.Balian@douglaspartners.com.au

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

CERTIFICATE OF ANALYSIS 268448-A

Client Details

Client	Douglas Partners Pty Ltd
Attention	Sam Balian
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**202029.00, Wentworth Point**
Number of Samples	11 Soil
Date samples received	06/05/2021
Date completed instructions received	12/05/2021

Analysis Details

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

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

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

Report Details

Date results requested by	19/05/2021
Date of Issue	20/05/2021

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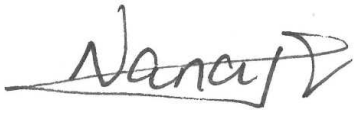
Results Approved By
Matt Mansfield, QHSE manager

Authorised By



Nancy Zhang, Laboratory Manager

Chromium Suite					
Our Reference		268448-A-3	268448-A-5	268448-A-6	268448-A-11
Your Reference	UNITS	BH207	BH207	BH204	BH208
Depth		5.0-5.45	4.0-4.1	2.5-2.95	2.0-2.1
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	19/05/2021	19/05/2021	19/05/2021	19/05/2021
Date analysed	-	19/05/2021	19/05/2021	19/05/2021	19/05/2021
pH $_{kcl}$	pH units	7.4	9.1	9.6	8.2
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+ /t	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	0.91	0.13	0.006	0.21
a-Chromium Reducible Sulfur	moles H^+ /t	570	82	3	130
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	0.19	0.023	0.010	0.038
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	2.0	8.3	2.2	2.7
s-ANC_{BT}	%w/w S	0.66	2.7	0.72	0.86
s-Net Acidity	%w/w S	0.47	<0.005	<0.005	<0.005
a-Net Acidity	moles H^+ /t	300	<5	<5	<5
Liming rate	kg $CaCO_3$ /t	22	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+ /t	570	82	<5	130
Liming rate without ANCE	kg $CaCO_3$ /t	43	6.1	<0.75	10
s-Net Acidity without ANCE	%w/w S	0.91	0.13	0.0060	0.21

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	-			19/05/2021	3	19/05/2021	19/05/2021		19/05/2021	[NT]
Date analysed	-			19/05/2021	3	19/05/2021	19/05/2021		19/05/2021	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	3	7.4	7.4	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	3	<0.01	<0.01	0	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	3	<5	<5	0	95	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	3	0.91	0.99	8	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	3	570	620	8	112	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	3	[NT]	[NT]		[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	3	0.19	<0.005	190	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	3	[NT]	[NT]		[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	3	2.0	1.9	5	[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	3	0.66	0.61	8	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	3	0.47	0.58	21	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	3	300	360	18	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	3	22	27	20	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	3	570	620	8	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	3	43	46	7	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	3	0.91	0.99	8	[NT]	[NT]

Result Definitions

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NA	Test not required
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PQL	Practical Quantitation Limit
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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 I2

Previous Laboratory Testing Results

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
231 Normanby Road
PO Box 5051
South Melbourne VIC 3205
Phone (03) 9673 3500
Fax (03) 9673 3599

One Dimensional Consolidation Test Results

(DOUBLE DRAINED)

Client :	Urban Growth NSW	**Project No. :**	84357.00
		Report No. :	M14495001
Project :	Wentworth Point UAP	**Report Date :**	16 Jul 2014
		Date Sampled :	-
Location :	Wentworth Point, Burroway Rd, NSW 2127	**Date of Test:**	07 Jul 2014
Test Location :	BHC3	**Sample Type:**	Undisturbed
Depth / Layer :	5.4-5.75(m)	**Page:**	1 of 3
Sample Description:	Silty CLAY		

STAGE DETAILS

STAGE	Stress range (kPa)	Settlement (%)	$H_{initial}$ (mm)	H_{final} (mm)	$e_{initial}$	e_{final}	c_v (m^2/yr)	m_v (m^2/MN)
1	**6-50**	0.41	18.00	17.93	0.54	0.53	2.35	0.09
2	**50-100**	1.09	17.93	17.80	0.53	0.52	1.49	0.13
3	**100-200**	2.21	17.80	17.60	0.52	0.50	1.64	0.11

SPECIMEN DETAILS

	Initial	Final	
Mass (g):	59.59	59.3	
Moisture content (%):	20.8	20.2	
Height (mm):	18.00	17.39	
Soil particle density (t/m3):	2.65		(Assumed)
Dry density (t/m3):	1.72		
Void ratio:	0.54	0.49	
Degree of saturation (%):	102.5		
Inundation pressure (kPa):	6.0		

NOTES

$H_{initial}$ = sample height at start of loading increment
H_{final} = sample height at end of loading increment
$e_{initial}$ = void ratio at start of loading increment
e_{final} = void ratio at end of loading increment
c_v = coefficient of consolidation
m_v = coefficient of volume compressibility
Number of loading stages = 3
Settlement is cumulative
####### = Not determinable, behaviour not in accordance with the 1-D consolidation theory
X = Sample Swelling

Test Method(s): AS 1289.6.6.1, AS 1289.2.1.1

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number 828
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025

Tested:	AD
Checked:	AD

Brian Ims
Principal

Douglas Partners
Geotechnics / Environment / Groundwater

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ABN 75 053 980 117
www.douglaspartners.com.au
231 Normanby Road
PO Box 5051
South Melbourne VIC 3205
Phone (03) 9673 3500
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One Dimensional Consolidation Test Results

(DOUBLE DRAINED)

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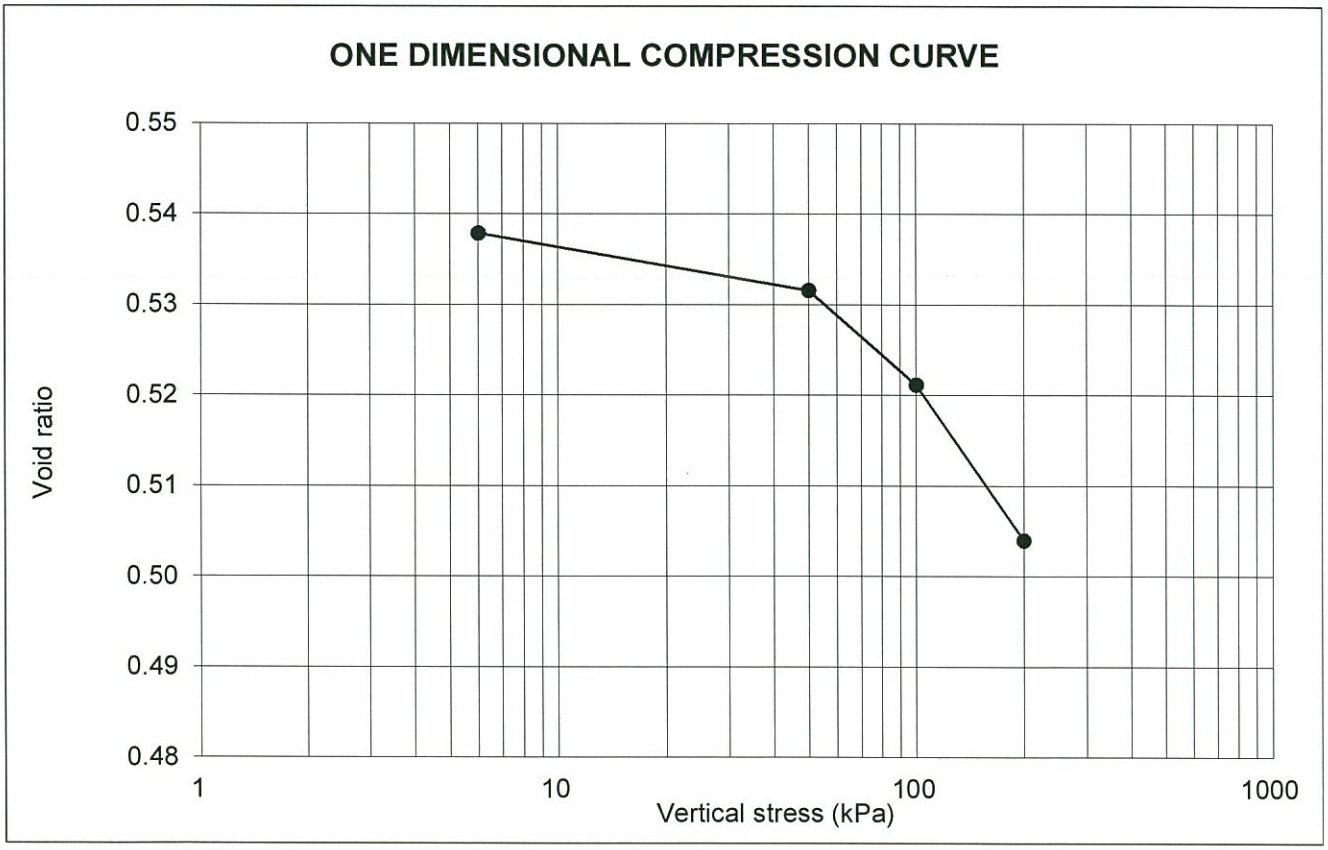
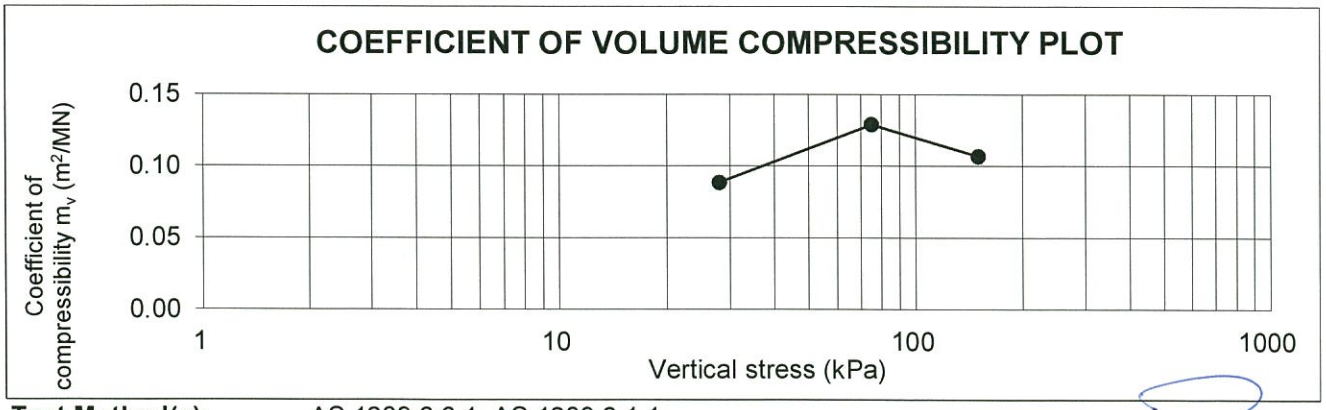
		Report No. :	M14495001
Project :	Wentworth Point UAP	**Report Date :**	16 Jul 2014
		Date Sampled :	-
Location :	Wentworth Point, Burroway Rd, NSW 2127	**Date of Test:**	07 Jul 2014
Test Location :	BHC3	**Sample Type:**	Undisturbed
Depth / Layer :	5.4-5.75(m)	**Page:**	2 of 3
Sample Description:	Silty CLAY		

GRAPHICAL PLOTS





Test Method(s): AS 1289.6.6.1, AS 1289.2.1.1

NATA
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Tested:	AD
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Brian Ims
Principal

Douglas Partners
Geotechnics / Environment / Groundwater

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One Dimensional Consolidation Test Results

(DOUBLE DRAINED)

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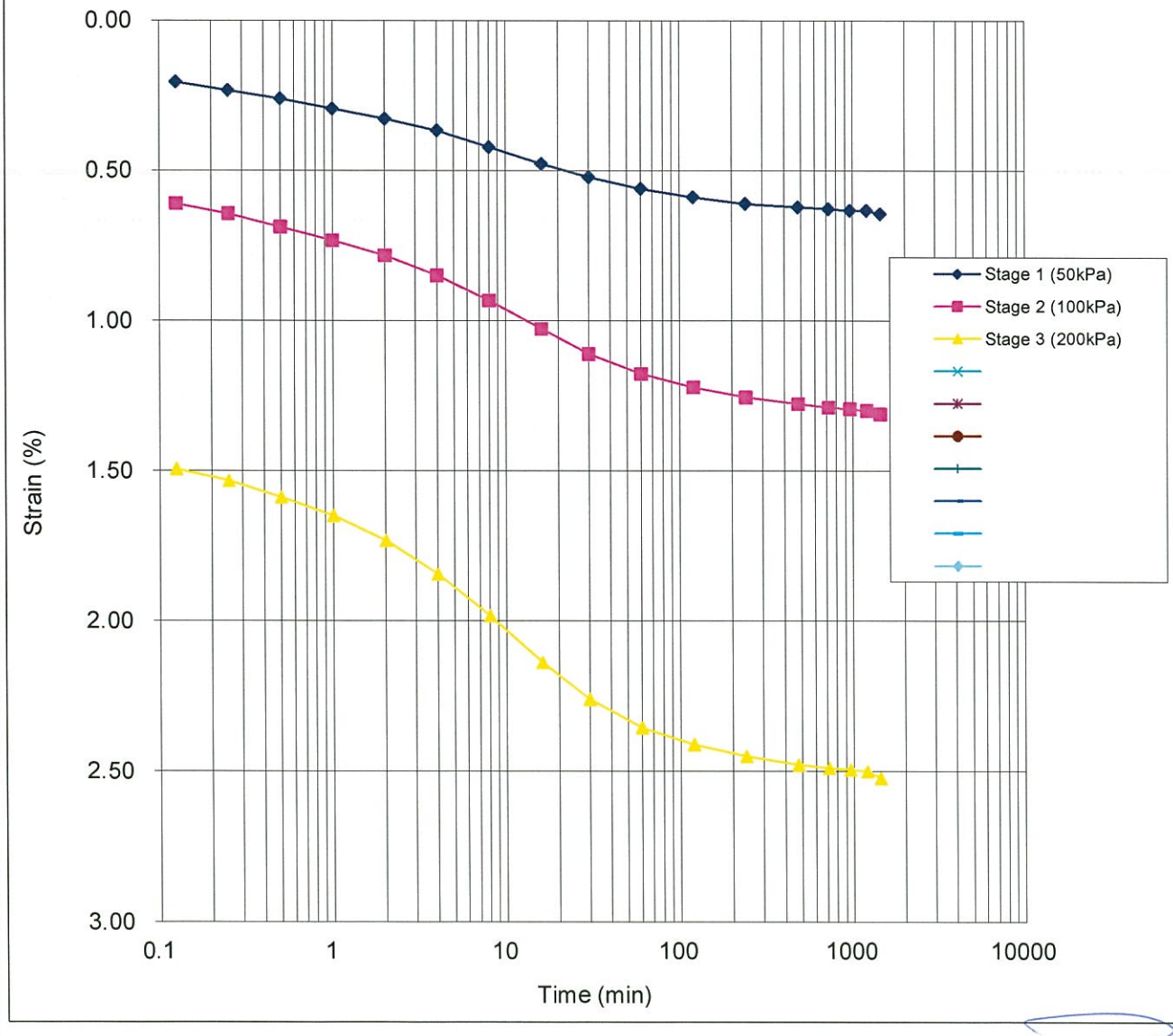
		Report No. :	M14495001
Project :	Wentworth Point UAP	**Report Date :**	16 Jul 2014
		Date Sampled :	-
Location :	Wentworth Point, Burroway Rd, NSW 2127	**Date of Test:**	07 Jul 2014
Test Location :	BHC3	**Sample Type:**	Undisturbed
Depth / Layer :	5.4-5.75(m)	**Page:**	3 of 3
Sample Description:	Silty CLAY		

DEFORMATION VS TIME CURVES



Test Method(s): AS 1289.6.6.1, AS 1289.2.1.1

NATA ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number 828
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Tested:	AD
Checked:	AD

Brian Ims
Principal

Results of Acid Sulphate Screening Tests

Client: Urban Growth NSW
Project: Wentworth Point UAP
Location: Hill Road, Wentworth Point

Project No: 84357
pH Meter: PL 600
Calibration Buffer: pH4, pH7, pH10

Sample Location	Depth (m)	pH_F (in distilled water) Date: 3/07/14 Time: 15:45	pH_{FOX} (oxidised in H_2O_2) Date: 3/07/14 Time: 16:15	Strength of Reaction[1]	Soil Description
BHA8	1.4	8.3	6.3	1	Silty Sand
BHC3	1.6-1.8	7.2	6.8	2	Clayey Silt
	2.5-2.95	7.3	6.1	2(F)	Silty Sand
	4.0	7.6	5.1	2	Silty Clay
	5.75	7.4	6.2	1	Silty Clay
	8.4-8.85	6.7	5.3	1	Silty Clay
	11.4-11.85	6.0	3.4	1	Silty Clay
BHC4	2.5	7.4	7.4	1	Sand
	2.8-2.95	7.7	6.6	2	Silty Clay
	5.4-5.95	6.8	6.5	1	Sand/Silty Clay

[1] (F) indicates a bubbling/frothy reaction (organics)

Operator: KMcPhee
Date: 3/07/14

Douglas Partners
Geotechnics / Environment / Groundwater

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

CERTIFICATE OF ANALYSIS 112681

Client:
Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Peter Oitmaa, Kelly McPhee

Sample log in details:

Your Reference:	**84357, Wentworth Point**		
No. of samples:	10 Soils		
Date samples received / completed instructions received	7/7/2014	/	7/7/2014

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	15/07/14	/	15/07/14
Date of Preliminary Report:	Not Issued		

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

Results Approved By:

Jacinta Hurst
Laboratory Manager

sPOCAS Our Reference: Your Reference Depth Date Sampled Type of sample	UNITS ---------- ----------	112681-1 BHA6 2.4 2/07/2014 Soil	112681-2 BHA7 2 2/07/2014 Soil	112681-3 BHC2 8.35-8.8 26/06/2014 Soil	112681-4 BHC3 11.4-11.85 27/06/2014 Soil	112681-5 BHC5 8.35-8.8 30/06/2014 Soil
Date prepared	-	10/7/2014	10/7/2014	10/7/2014	10/7/2014	10/7/2014
Date analysed	-	10/7/2014	10/7/2014	10/7/2014	10/7/2014	10/7/2014
pH $_{kcl}$	pH units	8.9	3.9	6.6	4.3	7.3
TAA pH 6.5	moles H^+/t	<5	210	<5	35	<5
s-TAA pH 6.5	%w/w S	<0.01	0.34	<0.01	0.06	<0.01
pH $_{Ox}$	pH units	2.7	1.8	6.7	4.5	7.1
TPA pH 6.5	moles H^+/t	150	1,200	<5	10	<5
s-TPA pH 6.5	%w/w S	0.24	1.9	<0.01	0.02	<0.01
TSA pH 6.5	moles H^+/t	150	970	<5	<5	<5
s-TSA pH 6.5	%w/w S	0.24	1.6	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	<0.05	<0.05	0.12	<0.05	0.12
a-ANC_E	moles H^+/t	<5	<5	24	<5	25
s-ANC_E	%w/w S	<0.05	<0.05	<0.05	<0.05	<0.05
S_{KCl}	%w/w S	0.09	1.4	0.03	0.03	0.03
S_P	%w/w	1.3	2.5	0.02	0.03	0.02
S_{POS}	%w/w	1.2	1.1	<0.005	<0.005	<0.005
a-S_{POS}	moles H^+/t	770	710	<5	<5	<5
Ca_{KCl}	%w/w	0.24	1.1	0.04	0.08	0.04
Ca_P	%w/w	0.95	0.93	0.04	0.08	0.05
Ca_A	%w/w	0.71	<0.005	<0.005	<0.005	0.006
Mg_{KCl}	%w/w	0.043	0.032	0.051	0.087	0.049
Mg_P	%w/w	0.096	0.029	0.051	0.079	0.048
Mg_A	%w/w	0.053	<0.005	<0.005	<0.005	<0.005
S_{HCl}	%w/w S	[NT]	1.8	[NT]	0.042	[NT]
S_{NAS}	%w/w S	[NT]	0.42	[NT]	0.011	[NT]
a-S_{NAS}	moles H^+/t	[NT]	200	[NT]	5	[NT]
s-S_{NAS}	%w/w S	[NT]	0.31	[NT]	<0.01	[NT]
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+/t	360	1,100	<10	40	<10
Liming rate	kg $CaCO_3$/t	27	84	<0.75	3.0	<0.75
a-Net Acidity without ANCE	moles H^+/t	NA	NA	<10	NA	<10
Liming rate without ANCE	kg $CaCO_3$/t	NA	NA	<0.75	NA	<0.75

Chromium Suite						
Our Reference:	UNITS	112681-1	112681-2	112681-3	112681-4	112681-5
Your Reference	----------	BHA6	BHA7	BHC2	BHC3	BHC5
Depth	----------	2.4	2	8.35-8.8	11.4-11.85	8.35-8.8
Date Sampled		2/07/2014	2/07/2014	26/06/2014	27/06/2014	30/06/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Chromium Reducible Sulfur	%w/w	0.83	0.13	<0.005	<0.005	0.01
a-Chromium Reducible Sulfur	moles H^+/t	520	81	<3	<3	6

Miscellaneous Inorg - soil						
Our Reference:	UNITS	112681-6	112681-7	112681-8	112681-9	112681-10
Your Reference	----------	BHC1	BHC2	BHC3	BHC4	BHC5
Depth	----------	5.8-6.25	8.35-8.8	2.5-2.95	2.5-2.95	8.35-8.8
Date Sampled		25/06/2014	25/06/2014	26/06/2014	27/06/2014	27/06/2014
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/07/2014	10/07/2014	10/07/2014	10/07/2014	10/07/2014
Date analysed	-	11/07/2014	11/07/2014	11/07/2014	11/07/2014	11/07/2014
pH 1:5 soil:water	pH Units	7.8	7.0	8.0	8.5	7.3
Electrical Conductivity 1:5 soil:water	µS/cm	4,000	2,700	1,800	320	1,800
Sulphate, SO4 1:5 soil:water	mg/kg	2,300	350	1,500	310	400
Chloride, Cl 1:5 soil:water	mg/kg	4,900	3,800	1,300	110	2,500

Method ID	Methodology Summary
Inorg-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.
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.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 22nd ED, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 22nd ED, 4110 -B.

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			10/7/2014	[NT]	[NT]	LCS-1	10/7/2014
Date analysed	-			10/7/2014	[NT]	[NT]	LCS-1	10/7/2014
pH kcl	pH units		Inorg-064	[NT]	[NT]	[NT]	LCS-1	94%
TAA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	113%
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
pH ox	pH units		Inorg-064	[NT]	[NT]	[NT]	LCS-1	110%
TPA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	96%
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
TSA pH 6.5	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	95%
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
ANC_E	% $CaCO_3$	0.05	Inorg-064	<0.05	[NT]	[NT]	[NR]	[NR]
a-ANC_E	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
s-ANC_E	%w/w S	0.05	Inorg-064	<0.05	[NT]	[NT]	[NR]	[NR]
S_{KCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	110%
S_P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	87%
S_{POS}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	81%
a-S_{POS}	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	LCS-1	81%
Ca_{KCl}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	105%
Ca_P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
Ca_A	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
Mg_{KCl}	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	LCS-1	100%
Mg_P	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
Mg_A	%w/w	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
S_{HCl}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
S_{NAS}	%w/w S	0.005	Inorg-064	<0.005	[NT]	[NT]	[NR]	[NR]
a-S_{NAS}	moles H^+/t	5	Inorg-064	<5	[NT]	[NT]	[NR]	[NR]
s-S_{NAS}	%w/w S	0.01	Inorg-064	<0.01	[NT]	[NT]	[NR]	[NR]
Fineness Factor	-	1.5	Inorg-064	<1.5	[NT]	[NT]	[NR]	[NR]
a-Net Acidity	moles H^+/t	10	Inorg-064	<10	[NT]	[NT]	LCS-1	82%
Liming rate	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	[NT]	[NT]	LCS-1	82%

QUALITY CONTROL sPOCAS	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
a-Net Acidity without ANCE	moles H^+/t	10	Inorg-064	<10	[NT]	[NT]	[NR]	[NR]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	[NT]	[NT]	[NR]	[NR]
QUALITY CONTROL Chromium Suite	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	[NT]	[NT]	LCS-1	105%
a-Chromium Reducible Sulfur	moles H^+/t	3	Inorg-068	<3	[NT]	[NT]	[NR]	[NR]
QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			10/07/2014	112681-10	10/07/2014 || 10/07/2014	LCS-1	10/07/2014
Date analysed	-			11/07/2014	112681-10	11/07/2014 || 11/07/2014	LCS-1	11/07/2014
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	112681-10	7.3 || 7.3 || RPD: 0	LCS-1	101%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	112681-10	1800 || 1800 || RPD: 0	LCS-1	104%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	112681-10	400 || 390 || RPD: 3	LCS-1	99%
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	112681-10	2500 || 2500 || RPD: 0	LCS-1	94%

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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.

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC 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.

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ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

SAMPLE RECEIPT ADVICE

Client:

Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde NSW 2114

ph: 02 9809 0666
Fax: 02 9809 4095

Attention: Peter Oitmaa, Kelly McPhee

Sample log in details:

Your reference:	**84357, Wentworth Point**
Envirolab Reference:	**112681**
Date received:	7/7/2014
Date results expected to be reported:	**15/07/14**

Samples received in appropriate condition for analysis:	YES
No. of samples provided	10 Soils
Turnaround time requested:	Standard
Temperature on receipt (°C)	7.0
Cooling Method:	Ice Pack
Sampling Date Provided:	YES

Comments:

If there is sufficient sample after testing, samples will be held for the following time frames from date of receipt of samples:
Water samples - 1 month
Soil and other solid samples - 2 months
Samples collected in canisters - 1 week. Canisters will then be cleaned.
All other samples are not retained after analysis
If you require samples to be retained for longer periods then retention fees will apply as per our pricelist.

Contact details:

Please direct any queries to Aileen Hie or Jacinta Hurst
ph: 02 9910 6200 fax: 02 9910 6201
email: ahie@envirolabservices.com.au or jhurst@envirolabservices.com.au

CHAIN OF CUSTODY

Douglas Partners
Geotechnics / Environment / Groundwater

Client: Douglas Partners	**Project Number** 84357	**To:**	Envirolab Services
Contact Person: Kelly McPhee	**Project Name:** Wentworth Point	**Contact Person:**	Aileen Hie
Project Mgr: Peter Oitmaa	**PO No.:**	**Address:**	12 Ashley Street
Sampler: Kelly McPhee	**lab Quote No. :**		Chatswood NSW 2068
Address: 96 Hermitage Road West Ryde NSW 2114	**Date results required:** Standard **Or choose:** standard / same day / 1 day / 2 day / 3 day *Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	**Phone:**	02 9910 6200
		Fax:	02 9910 6201
Phone: 9809 0666 **Mob:** 0419 781 366	**Report format:** esdat / PDF / Excel	**Email:**	ahie@envirolab.com.au
Email: kelly.mcphee @douglaspartners.com.au	**Comments:**	**Laboratory Report No:**	
Prior Storage (Fridge, Esky, Shelf) (Fridge) + Freezer		**Lab Comments:**	

	Sample information					Tests Required											Comments
	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	SPOCAS and SCr	pH	Conductivity	Chloride	Sulphate							
1	BHA6	2.4	2/07/2014	bag	soil	X											
2	BHA7	2	2/07/2014	bag	soil	X											
3	BHC2	8.35-8.80	26/06/2014	bag	soil	X											
4	BHC3	11.4-11.85	27/06/2014	bag	soil	X											
5	BHC5	8.35-8.80	30/06/2014	bag	soil	X											
6	BHC1	5.8-6.25	25/06/2014	bag	soil		X	X	X	X							
7	BHC2	8.35-8.80	25/06/2014	bag	soil		X	X	X	X							
8	BHC3	2.5-2.95	26/06/2014	bag	soil		X	X	X	X							
9	BHC4	2.5-2.95	27/06/2014	bag	soil		X	X	X	X							
10	BHC5	8.35-8.80	27/06/2014	bag	soil		X	X	X	X							

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

Job No: 112681

Date Received: 7/7/14
Time Received: 17:00
Received by: JYH
Temp: Cool/Ambient
Cooling: Icepack
Security: Intact/Broken/None

Relinquished by: Douglas Partners	**Sample Receipt**	***Lab use only:***	
Hand delivered / Courier (by whom)	**Received by (Company):** ELS	**Samples Received: Cool or Ambient (circle one)**	
Condition of Sample at dispatch Cool or Ambient (circle)	**Print Name:** JYH	**Temperature Received at:** (if applicable)	
Temperature (if Applicable):	**Date & Time:** 7/7/14 1700	**Transported by: Hand delivered / courier**	
Print Name: Kelly McPhee	**Signature:**		
Date & Time: 7/07/2014 3pm			
Signature:			