



Douglas Partners

Geotechnics | Environment | Groundwater

Report on
Additional Geotechnical Investigation

Cranbrook School ECI
Victoria Road, Bellevue Hill

Prepared for
Cranbrook School

Project 84944.02
November 2017

Integrated Practical Solutions



Document History

Document details

Project No.	84944.02	Document No.	R.001
Document title	Report on Additional Geotechnical Investigation Cranbrook School ECI		
Site address	Victoria Road, Bellevue Hill		
Report prepared for	Cranbrook School		
File name	84944.02.R.001.DftA.Cranbrook ECI Additional Geotech		

Document status and review

Revision	Prepared by	Reviewed by	Date issued
DftA	P Oitmaa	M J Thom	22 November 2017

Distribution of copies

Revision	Electronic	Paper	Issued to
DftA	1		Cranbrook School c/- Buildcorp

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

Signature	Date
Author	
Reviewer	



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
 Fax (02) 9809 4095

Table of Contents

	Page
1. Introduction	1
2. Previous Investigations	1
3. Site Description and Geology	2
4. Field Work Methods	3
4.1 2015 Investigation.....	3
4.2 April 2017 Investigation	3
4.3 August/September 2017 Investigation.....	4
5. Field Work Results	4
6. Laboratory Testing	6
6.1 Rock Samples.....	6
6.2 Soil Samples	6
7. Geotechnical Model	8
8. Proposed Development.....	8
9. Comments.....	9
9.1 Excavation	9
9.2 Excavation Support.....	9
9.2.1 General	9
9.2.2 Earth Pressures	10
9.2.3 Rock Wedges.....	10
9.2.4 Ground Anchors.....	11
9.3 Groundwater	12
9.4 Foundations	12
9.4.1 Spread Footings.....	12
9.4.2 Raft Slabs.....	13
9.4.3 Piles	13
9.5 Seismicity.....	14
9.6 Aggressivity.....	14
10. Limitations	14

List of Appendices

Appendix A:	About this Report
Appendix B:	Drawings
Appendix C:	2017 Borehole Logs
Appendix D:	2017 CPT Results
Appendix E:	Laboratory Test Results
Appendix F:	2015 Test Results

DRAFT

Report on Additional Geotechnical Investigation

Cranbrook School ECI

Victoria Road, Bellevue Hill

1. Introduction

This report presents the results of an additional geotechnical investigation undertaken as part of an 'Early Contractor Involvement' (ECI) process for a proposed development at Cranbrook School, Victoria Road, Bellevue Hill. The work was commissioned by Cranbrook School in consultation with Buildcorp Contracting NSW Pty Ltd.

It is understood that the proposed development includes the construction of an underground sporting facility (swimming pool, sports courts) and basement parking area beneath the oval in the northern portion of the site. This will involve a deep excavation followed by the replacement of the oval on a suspended structure. A separate performing arts and indoor sporting facility (the 'War Memorial Hall') is also proposed to the south-east of the oval which will involve the demolition of several existing buildings followed by a deep excavation into the embankment.

Geotechnical investigation for the development was initially undertaken in 2015 which included the drilling of seven boreholes and six cone penetration tests (CPTs). Further investigation was undertaken in April 2017 to complement the existing information on the subsurface conditions on the site and included the drilling of seven cored boreholes, 20 augered boreholes, eight CPTs, laboratory analysis and engineering interpretation. An *In Situ Waste Classification Assessment* was undertaken at the same time as the April 2017 investigation and is reported separately (Ref. 84944.01.R.001).

Additional investigation was undertaken in August and September 2017 for the War Memorial Hall and included the drilling of eight cored boreholes, one CPT, the excavation of two test pits, laboratory analysis and engineering interpretation. Details of the field work and comments relevant to design and construction are given in this report.

The information contained in this report supersedes the previous geotechnical reports prepared under Project 84944.00 and Project 84944.01.

2. Previous Investigations

Douglas Partners has previously undertaken several geotechnical investigations on the site. Apart from those described in Section 1 of this report, these have included:

- Project 10957 (1988 & 1990): 20 boreholes adjacent to the south-western boundary;
- Project 23950A (1997): six boreholes for a proposed science and technology centre near the south-western corner of the oval; and
- Project 72080 (2010): risk assessment of the Hordern Embankment.

Relevant previous test results have been used to develop the geotechnical model of the site. The relevant previous boreholes logs, cone penetrometer test results and core photographs are provided in Appendix F.

3. Site Description and Geology

The Cranbrook School senior campus is located on the northern side of a hill that dips in a northerly direction towards Point Piper. The school is bounded by New South Head Road to the north and west, residential properties to the west, Victoria Road to the south and Rose Bay Avenue to the east. Surface levels vary from approximately RL 40 m AHD along the southern boundary to RL 15 m AHD near the northern boundary.

At the time of the investigation there were numerous buildings of varying age occupying the southern portion of the school and a large sporting oval in the northern portion. Numerous retaining structures create terrace areas down the slope and some significant embankments are also present on the site, particularly along the southern side of the oval.

The *Sydney 1:100 000 Geological Series Sheet* shows that the site is underlain by Hawkesbury Sandstone with some overlying quaternary-aged marine sands with podsols. An extract of the geological map is shown in Figure 1.

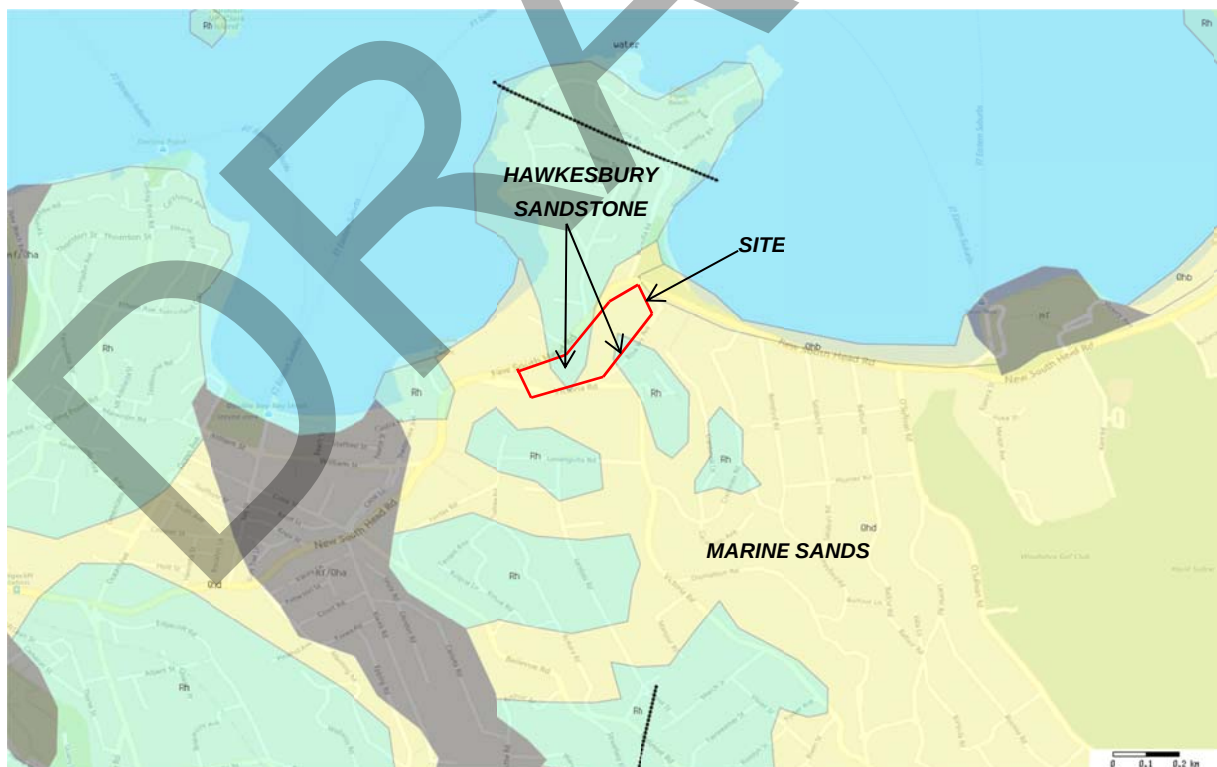


Figure 1: Extract from geological map

4. Field Work Methods

4.1 2015 Investigation

The 2015 field work included six cone penetration tests (CPTs 1 to 6), the drilling of three cored boreholes (BH2, BH4 and BH10), and the drilling of four augered boreholes (BH7, BH8, BH11 and BH12).

The CPTs were undertaken to depths of between 4.2 m and 17.8 m at which point refusal of the equipment occurred. A CPT involves pushing a 35 mm diameter instrumented cone and friction sleeve into the ground using hydraulic thrust from a ballasted truck-mounted testing rig. Measurements of cone resistance and sleeve friction are made at 20 mm depth intervals and are stored on a portable computer for subsequent analysis and interpretation.

The cored boreholes were drilled to depths of between 14.3 m and 22.2 m using a DT250 geotechnical drilling rig. They were commenced using solid flight augers to drill through the overburden materials. Disturbed soil samples were collected from the tip of the auger and Standard penetrometer tests (SPTs) were undertaken at regular depth intervals throughout the filling/soil profile. Rotary drilling equipment was used to progress the bores to prevent hole collapse at depth. Once weathered rock was encountered, NMLC-sized diamond core drilling equipment was used to obtain 50 mm diameter continuous core samples of the rock for identification and strength testing purposes.

The augered boreholes were drilled to depths of between 2.4 m and 4.1 m using a hand-auger. Dynamic penetrometer tests were also undertaken at these locations.

The locations are shown on Drawing G1 in Appendix B. The ground surface levels at the CPTs and bores were measured to AHD using an automatic level, relative to temporary benchmarks on the site.

4.2 April 2017 Investigation

The April 2017 field work included the drilling of seven cored boreholes (BH101 to BH107) to depths of between 12.4 m and 17.5 m using geotechnical investigation rigs. They were commenced using solid flight augers to drill through the overburden materials. Disturbed soil samples were collected from the tip of the auger and Standard penetrometer tests (SPTs) were undertaken in selected boreholes. Rotary drilling equipment was used to progress the bores to prevent hole collapse at depth. Once weathered rock was encountered, NMLC-sized diamond core drilling equipment was used to obtain 50 mm diameter continuous core samples of the rock for identification and strength testing purposes.

Eight cone penetration tests (CPTs 101 to 105 and 108 to 110) were undertaken to depths of between 4.1 m and 14.2 m at which point refusal of the equipment occurred.

Twenty (20) augered boreholes (BH111 to BH130) were drilled to depths of between 2.0 m and 4.0 m using geotechnical investigation rigs. The primary purpose of these boreholes was to collect samples for laboratory analysis associated with the waste classification assessment.

Two temporary groundwater wells (BH101 and BH106) were installed on the site following completion of drilling. The purpose of these wells was to allow groundwater level measurements to be made.

The test locations are shown on Drawing G1 in Appendix B. The ground surface levels have been measured relative to AHD using either an automatic level or a high-precision differential global positioning system (dGPS) receiver.

4.3 August/September 2017 Investigation

The August/September 2017 field work included the drilling of eight cored boreholes (BH202 to BH205, BH208 and BH210 to BH212) to depths of between 15.8 m and 28.2 m using geotechnical investigation rigs and similar techniques to the boreholes drilled in April 2017.

One CPT (CPT208) was undertaken to a depth of 19.3 m at which point refusal of the equipment occurred.

Two temporary groundwater wells (BH202 and BH204) were installed on the site following completion of drilling. The purpose of these wells was to allow groundwater level measurements to be made.

Two test pits (TP206 and TP207) were excavated adjacent to the Perkins Building to assess the footing and foundation conditions. These pits were initially excavated to depths of 1.5 m and 1.4 m using a small excavator with bucket attachment. The base of the footings could not be located within these pits and therefore additional pits were excavated at the same locations using a combination of a bucket attachment and an auger to achieve a greater investigation depth of 3 m.

The test locations are shown on Drawing G1 in Appendix B. The ground surface levels have been measured relative to AHD using either an automatic level or a high-precision dGPS receiver.

5. Field Work Results

The subsurface conditions encountered during the 2017 field work are presented in the borehole/test pit logs in Appendix C and the CPT results sheets in Appendix D. The 2015 field work results are included in Appendix F. Notes defining descriptive terms and classification methods are included in Appendix A.

The boreholes and/or the CPTs encountered:

- FILLING – typically silty sand, sand and silty clay filling to depths of between 0.2 m and 4.0 m;
- NATURAL SOILS – sand/silty sand to depths of between 4.1 m and 20.5 m. The sand varies from very loose to loose in some areas of the site, to medium dense to dense in others. A thin layer of clayey material (probably weathered rock) was encountered in the base of several tests;
- BEDROCK – sandstone which was typically low, medium and high strength, with some weaker bands, to the base of the cored bores at depths of between 12.4 m and 28.2 m.

Tables 1A and 1B summarise the levels at which different materials were encountered in the cored boreholes.

Table 1A: Summary of Material Strata Levels

Strata	RL of Top of Material Strata (m, AHD)									
	BH2	BH4	BH10	BH101	BH102	BH103	BH104	BH105	BH106	BH107
Ground Surface/ Filling	16.1	16.4	32.4	16.1	16.3	16.8	16.3	16.5	38.5	39.2
vl to l Sands	11.3	11.9	30.4	12.9	15.7	NE	16.1	15.9	37.7	38.2
md to d Sands	NE	11.4	28.9	8.4	9.5	16.3	NE	NE	33.0	NE
Weathered Sandstone	NE	-1.5	12.1	NE	NE	NE	NE	12.4	NE	NE
MS or HS Sandstone	4.8	-1.6	NE	1.7	4.7	8.5	9.4	12.2	26.0	34.3
Base of Test	1.8	-4.7	10.2	-1.3	-1.2	2.4	3.9	1.0	22.9	25.2

Notes: vl = very loose; l = loose; md = medium dense; d = dense; MS = medium strength; HS = high strength;
 NE = not encountered

Table 1B: Summary of Material Strata Levels

Strata	RL of Top of Material Strata (m, AHD)							
	BH202	BH203	BH204	BH205	BH208	BH210	BH211	BH212
Ground Surface/ Filling	34.9	34.1	34.1	27.4	30.5	34.0	33.7	34.3
vl to l Sands	NE	31.6	30.1	NE	NE	N/A	N/A	N/A
md to d Sands	31.9	28.6	28.6	24.6	29.7	N/A	N/A	N/A
Weathered Sandstone	29.4	24.1	14.7	6.9	12.1	N/A	N/A	20.0
MS or HS Sandstone	26.0	23.6	14.3	6.8	9.9	15.2	14.8	19.3
Base of Test	6.8	6.1	5.9	3.8	5.5	13.9	13.7	18.5

Notes: vl = very loose; l = loose; md = medium dense; d = dense; MS = medium strength; HS = high strength;
 NE = not encountered; N/A = not applicable as bore was drilled to find top of rock only

Groundwater was observed at depths of between 3.7 m and 9.4 m (RL 6.7 m to RL 12.8 m AHD) in several boreholes/CPTs during the current and previous field work. A level logger was recently installed in each of the four monitoring wells on the site (BH101, BH106, BH202 and BH204) and the monitoring results will be provided separately once available.

6. Laboratory Testing

6.1 Rock Samples

A total of 127 samples from the three investigation stages were tested for axial point load strength index (Is_{50}). The results ranged between 0.1 MPa and 4.1 MPa which correspond to very low to low strength and very high strength rock, respectively.

Five samples from the August/September 2017 investigation were tested for uniaxial compressive strength to complement the point load strength index results. These results are summarised in Table 2. Representative Is_{50} results are also included to assess a suitable UCS: Is_{50} correlation ratio.

Table 2: Summary of Uniaxial Compressive Strength Results

Borehole	Depth (m)	Description	UCS (MPa)	Is_{50} (MPa)	UCS: Is_{50} Ratio
BH202	9.00-9.20	Sandstone	2.28	0.33	6.9
BH203	11.74-11.92	Sandstone	7.59	0.63/0.43*	14.3
BH204	20.10-20.28	Sandstone	10.9	0.66	16.5
BH205	22.78-23.00	Sandstone	11.3	0.87/0.74*	14.0
BH208	24.00-24.20	Sandstone	12.4	0.52	23.8

Note: Where two results are close to the UCS sample the average result has been used to calculate the ratio

Hawkesbury Sandstone typically exhibits UCS: Is_{50} ratios of between 16 and 24, with an average ratio of 20 often adopted. The sample from BH202 exhibited a low UCS which is probably due to the steep bedding evident in the sample. The average ratio of the remaining four tests was 17.2 which falls within the typical range. There is an insufficient number of samples to provide any further statistical analysis of these results.

6.2 Soil Samples

Thirty (30) soil samples obtained from the April 2017 investigation were analysed for pH and electrical conductivity (EC) to aid in the assessment of aggressivity. The pH results ranged between 5.3 and 8.0. The EC results ranged between 8 μ S/cm and 200 μ S/cm. The results are attached in Appendix E.

Aggressivity test results from the 2016 investigation and the August/September 2017 investigation are summarised in Table 3. The detailed results are also included in Appendix E.

Table 3: Summary of Soil Aggressivity Results from 2015 and August/September 2017 Investigations

Sample/Depth (m)	Description	pH (pH units)	EC (µS/cm)	Chloride (mg/kg)	Sulphate (mg/kg)
BH2/1.0	Sandy filling	6.3	21	<10	<10
BH2/2.0	Sandy filling	6.5	13	<10	<10
BH2/3.0	Sandy filling	6.5	13	<10	<10
BH2/4.0	Sandy filling	5.8	14	<10	<10
BH4/1.0	Sandy filling	6.3	14	<10	<10
BH4/2.0	Sandy filling	6.1	12	<10	<10
BH4/3.0	Sandy filling	6.0	11	<10	<10
BH4/4.0	Sandy filling	6.2	14	<10	<10
BH10/1.0	Sandy filling	9.9	87	<10	38
BH10/2.0	Sand	7.2	36	<10	31
BH202/1-1.45	Sandy filling	5.2	14	<10	<10
BH202/5.5-5.67	Sandstone	4.8	23	10	20
BH203/2.5-2.95	Sand	5.5	74	20	89
BH203/7-7.45	Sand	6.2	22	10	<10
BH204/10-10.45	Sand	7.3	53	<10	<10
BH204/17.5-17.95	Sand	7.0	20	<10	<10
BH205/4-4.45	Sand	6.4	27	<10	<10
BH205/13-13.45	Sand	6.9	18	<10	<10
BH208/1-1.45	Sand	6.3	26	<10	26
BH208/11.25-11.7	Sand	7.0	17	<10	<10

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

7. Geotechnical Model

The geotechnical model interpreted for the site can be described as follows:

- Filling of varying depth which was primarily sandy. This material may have been natural soils that were moved around the site to level the area of the oval;
- Natural generally sandy soils that were very loose to loose. The depth of soil increased to the north and east, and in these areas the sands graded to medium dense and dense in the lower part of the profile;
- Sandstone bedrock beneath the sands. The depth to rock tends to increase towards the north and east in both the oval and embankment areas. The rock was typically low, medium and high strength with some bands/layers of weaker material present;
- The depth to groundwater is likely to vary across the site. It is likely to flow through the sandy soils until it hits the bedrock, and then along the bedrock surface. The direction of flow is likely to be towards the north-east to Rose Bay and towards the north-west to Double Bay.

This interpreted geotechnical model is shown in Sections A-A' to D-D' on Drawings G2 to G5 in Appendix B.

The test pits excavated adjacent to the northern side of the Perkins Building suggest that the building may be founded on strip footings at approximately 3 m depth. It is noted that confirmation by physically probing and inspecting the base of the footing could not be undertaken due to the depth of the pit and the safety and damage risks posed by such deep excavations in very loose sandy filling. It is noted that the nearest boreholes to the test pits encountered loose sands at this depth.

Sketches showing the conditions encountered in the test pits, including photographs, are shown in Drawing G6 (initial pits with excavator bucket only) and Drawing G7 (supplementary pits with excavator bucket and auger attachment) in Appendix B.

8. Proposed Development

It is understood that the proposed development is likely to include:

- An Aquatic Recreation Centre (ARC) in the northern portion of the oval. This is likely to require excavation to approximately RL 8 m AHD for the pool hall level which is about 8 m below the level of the oval, with the pool itself about 2 m deeper;
- An adjoining underground carpark facility which will require excavation to approximately RL 8 m AHD in the northern portion of the carpark and to about RL 12 m AHD in the southern portion;
- A separate performing arts and indoor sporting facility (War Memorial Hall – WMH) constructed into the embankment to the south-east of oval. This will require excavation to approximately RL 18 m AHD which is in the order of 17 m below the ground surface in the more elevated areas of the site.

The geotechnical issues considered relevant to the proposed development include excavation, excavation support, groundwater and foundations. Comments on seismicity and aggressivity are also provided.

9. Comments

9.1 Excavation

The excavation for the ARC and carpark structures appears to primarily be within filling and sandy soils. The excavation for the WMH will be within filling and sandy soils in the northern and eastern sections, and sandstone bedrock in the south-western area.

Excavation in the filling and sandy soils should be readily achievable using excavators with bucket attachments. Excavation in the sandstone bedrock is likely to require heavy ripping, rock hammering and/or rock sawing as the boreholes indicate that the rock is low, medium and high strength.

9.2 Excavation Support

9.2.1 General

Vertical excavations in filling and sandy soil are not expected to be stable for any extended period of time. Temporary batters may be feasible above the groundwater table and should be cut no steeper than 1.5(H):1(V) for cuts up to 3 m depth. Flatter batters or batters that incorporate intermediate benching should be provided for deeper cuts and stability analysis will need to be undertaken to confirm appropriate batter geometries in this case.

Shoring support will be required where temporary batters are not feasible. Suitable shoring systems where groundwater is below the proposed bulk excavation level include contiguous pile walls and driven steel sheet piles. Contiguous pile walls can be constructed by installing concrete or grout-injected continuous flight auger (CFA) piles around the perimeter of the excavation so that the adjacent piles are close or touching, thereby supporting the material behind the wall. Any gaps between piles can be plugged with grout as excavation proceeds.

Driven steel sheet piles are installed around the perimeter of the excavation area prior to the commencement of the works. The adjacent sheets are interlocked to provide support to the material behind the wall. Driving sheets through obstructions in the filling may prove problematic and pre-drilling in some areas of the site may be necessary. Vibrations induced by driving equipment may also cause damage to adjacent structures and detract from the suitability of this option. Steel sheet piles will also only be feasible in areas of the site where the level of bedrock is well below the excavation level so that the sheets can be driven to a sufficient depth to achieve the necessary passive restraint.

These wall types are likely to require the use of temporary ground anchors to provide lateral support during construction. Permanent lateral support would need to be provided by the finished structure or, where required, by permanent ground anchors.

9.2.2 Earth Pressures

Excavation faces retained either temporarily or permanently will be subjected to earth pressures from the ground surface down to either the base of the excavation or the top of competent medium strength sandstone, whichever is shallower. Table 4 outlines material and strength parameters that could be used for the preliminary design of excavation support structures.

Table 4: Material and Strength Parameters for Excavation Support Structures

Material	Bulk Density (kN/m ³)	Friction Angle (deg.)	Cohesion (kPa)	Young's Modulus (MPa)	Coefficient of Active Earth Pressure (K _a)	Coefficient of Earth Pressure at Rest (K ₀)	Ultimate Passive Earth Pressure
Sandy Filling	20	27	0	10	0.4	0.6	NA
vl to l Sand	20	30	0	15	0.35	0.5	K _p = 3.0
md to d Sand	20	35	0	30	0.3	0.45	K _p = 3.5
Weathered Rock	22	36	10	50	0.15	0.2	1000 kPa
MS or HS Sandstone	23	38	50	500	0	0	3000 kPa

Notes: vl = very loose; l = loose; md = medium dense; d = dense; MS = medium strength; HS = high strength;
 NA = not applicable

Cantilevered retaining walls and walls with a single row of anchors could be designed by assuming a triangular lateral earth pressure distribution (increasing linearly with depth). For preliminary design purposes, a trapezoidal lateral earth pressure distribution where the maximum pressures act over the central 60% of the wall could be assumed for retaining walls with multiple rows of anchors/support. Refinement of the design should be undertaken using a computer program such as WALLAP, PLAXIS or FLAC.

Lateral pressures due to surcharge loads from sloping ground surfaces, adjacent buildings, road pavements and construction machinery should be included where relevant. Drainage should also be provided to prevent hydrostatic pressure from acting on the shoring walls if hydrostatic pressures are not incorporated into the assumed surcharges.

9.2.3 Rock Wedges

Hawkesbury Sandstone usually contains sub-horizontal bedding. However, two major joint sets are usually present within the rock mass which strike slightly east of north and slightly south of east. These joints are often steeply inclined (i.e. approximately 70°) and can dip in either direction normal to the strike. If an excavation runs parallel to the strike of these joints and exposes a joint above the excavation level then large wedges of rock can mobilise and slide into the excavation.

The current excavation alignment where rock is expected to be exposed (i.e. the south-western corner of the WMH) is oriented north-west and north-east and is therefore unlikely to be parallel to these major joint sets. However, any changes to the building orientation should consider the potential presence of these defects and the shoring system designed accordingly.

9.2.4 Ground Anchors

Where necessary, the use of declined tie-back (ground) anchors is suggested for the temporary lateral restraint of the pile walls. Such ground anchors should be declined below the horizontal to allow anchorage into the stronger materials at depth. The design of temporary ground anchors for the support of pile wall systems may be carried out using the allowable average bond stresses at the grout-rock/soil interface given in Table 5.

Table 5: Allowable Bond Stresses for Anchor Design

Material Description	Allowable Bond Stress (kPa)
Medium Dense to Dense Sand	25
Low Strength Sandstone	200
Medium and High Strength Sandstone	500

It is unlikely that conventional anchors will have sufficient capacity unless they are installed in the bedrock. Secondary-grouted anchors could be used in the natural soils to increase the anchor capacity. This technique involves installing a conventionally-grouted anchor and then, once cured, injecting grout into the anchor at a higher pressure to crack the primary grout and densify the surrounding materials. This technique is fairly specialised and only experienced contractors should be engaged for the design and installation of secondary-grouted anchors.

Ground anchors should be designed to have a free length equal to their height above the base of the excavation and have a minimum 3 m bond length. After installation they should be proof loaded to 125% of the design working load and locked-off at no higher than 75% of the working load. Periodic checks should be carried out during the construction phase to ensure that the lock-off load is maintained and not lost due to creep effects or other causes.

The parameters given in Table 5 assume that the anchor holes are clean, with grouting and other installation procedures carried out carefully and in accordance with good anchoring practice. Careful installation and close supervision by a geotechnical specialist may allow increased bond stresses to be adopted during construction, subject to testing.

The use of permanent anchors would require careful attention to corrosion protection. Further advice on design and specification should be sought if permanent anchors are to be employed on this site.

It will be necessary to obtain permission from neighbouring landowners prior to installing anchors that will extend beyond the perimeter of the site. In addition, care should be taken to avoid damaging buried services and pipes during anchor installation.

9.3 Groundwater

The groundwater levels measured on the site during the recent investigations, where encountered, varied between RL 6.7 m and RL 12.8 m AHD. Groundwater is likely to flow along or close to the rock surface as it flows towards Rose Bay and Double Bay, and the groundwater table is likely to be at considerable depth on the site. The groundwater level is also likely to vary as a result of rainfall events.

Monitoring of groundwater levels is currently being undertaken and the results of this monitoring will be provided when sufficient data becomes available.

Groundwater levels will need to be compared to the proposed excavation levels. The proposed ARC and carpark structure is likely to be above the groundwater table in its current location. The excavation for the WMH is likely to intercept seepage as water flows through the sandy soils above the bedrock, particularly in the western portion of the building. Drainage measures will need to be incorporated into the structure to ensure the seepage can be diverted around the building. Flow rates through the sands could be significant.

9.4 Foundations

9.4.1 Spread Footings

Isolated spread footings (e.g. pad footings and strip footings) are only likely to be suitable for supporting the proposed structures in areas where sandstone bedrock is exposed at or close to the bulk excavation level. The sandy soils will not be able to support the column loads expected.

Spread footings could be designed using the parameters provided in Table 6.

Table 6: Design Parameters for Spread Footings

Material Description	Allowable Bearing Pressure (kPa)¹	Young's Modulus (MPa)
Weathered Sandstone	1000	100
Low Strength Sandstone	3500	500
Medium Strength Sandstone	6000	1000
High Strength Sandstone	10,000	2000

Notes: ¹Provided that adverse seams are not present within the zone of influence of the footings

Settlement of a footing is dependent on the load applied to the footing and the foundation conditions below the footing. The total settlement of a spread footing designed using the parameters provided in Table 6 would be expected to be less than 1% of the footing width upon application of the design working load.

All footing excavations should be inspected by a geotechnical engineer to check the adequacy of the foundation material. In addition, spoon testing should be carried out in 30% to 50% of all footings designed on the basis of bearing pressures greater than 3500 kPa.

9.4.2 Raft Slabs

Raft slabs are sometimes used to transfer column loads into weaker materials that cannot support spread footings (e.g. sands). However, the varying thickness of the sands and differences in density across the site would indicate that a raft slab is probably not a suitable footing solution for the proposed buildings.

9.4.3 Piles

Piles could be used to support the proposed structures where bedrock is below the proposed excavation level. Suitable pile types include concrete or grout-injected CFA piles, bored piles drilled with temporary or permanent casing, or driven pile-types such as precast concrete, steel tube or steel H-section piles.

CFA piles and bored piles could be designed using the parameters provided in Table 7. Parameters for both the working stress and limit-state design approaches have been provided.

Table 7: Design Parameters for CFA and Bored Piles in Compression

Material Description	Allowable Parameters		Ultimate Parameters		Young's Modulus (MPa)
	End-Bearing Pressure (kPa)	Shaft Adhesion (kPa) ¹	End-Bearing Pressure (kPa)	Shaft Adhesion (kPa) ¹	
Weathered Sandstone	1000	50	3000	150	100
Low Strength Sandstone	3500	300	15,000	600	500
Medium Strength Sandstone	6000	600	30,000	1200	1000
High Strength Sandstone	10,000	1000	60,000	2000	2000

Notes: ¹Only where adequate socket roughness has been achieved. Reduce by 50% for tension and analyse for cone pullout

It should be noted that the serviceability limit-state is likely to govern the design of the piles and the ultimate bearing pressures provided in Table 7 are unlikely to be able to be achieved in practice. 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 pile designed using the 'allowable' parameters provided in Table 7 would be expected to be less than 10 mm upon application of the design load.

Driven piles are often used to support high column loads on sites in which driving is practicable. The capacity of a pile driven to near-refusal in rock is likely to be governed by the structural capacity of the pile and the weight/efficiency of the driving equipment. 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.

9.5 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 based on the depths and strengths of the materials (i.e. very loose sands) encountered in the boreholes and CPTs.

9.6 Aggressivity

The laboratory test results for soil aggressivity were compared with the exposure classifications outlined in Australian Standard AS 2159 – 2009 *Piling – Design and installation*. Table 8 summarises the exposure classifications for steel and concrete piles based on the average laboratory test results.

Table 8: Exposure Classifications for Steel and Concrete Piles

Type of Laboratory Analysis	Exposure Classification for Steel Piles	Exposure Classification for Concrete Piles
Soil	Non-Aggressive	Mild

10. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for a redevelopment project at Cranbrook School, Bellevue Hill in accordance with DP's proposal SYD170801.P.001.Rev0 dated 4 July 2017 and subsequent acceptance received from Cranbrook School. The report is provided for the use of Cranbrook School for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party.

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

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions between sampling locations.

This report must be read in conjunction with all of the attached notes 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 given 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 contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP.

DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical/groundwater components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

DRAFT

Appendix A

About this Report

About this Report

Douglas Partners



Introduction

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

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

Copyright

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

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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



Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

Sampling Methods

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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



Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. 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	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

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

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

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	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 - 5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

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;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.



Rock Strength

Rock strength is defined by the Point Load Strength Index ($IS_{(50)}$) and 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 test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

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

* Assumes a ratio of 20:1 for UCS to $IS_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

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 some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

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

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

where 'sound' rock is assessed to be rock of low strength or better. 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

Douglas Partners



Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General



Asphalt



Road base



Concrete



Filling

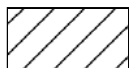
Soils



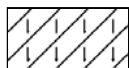
Topsoil



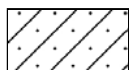
Peat



Clay



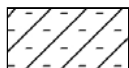
Silty clay



Sandy clay



Gravelly clay



Shaly clay



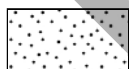
Silt



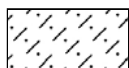
Clayey silt



Sandy silt



Sand



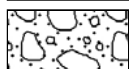
Clayey sand



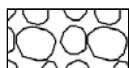
Silty sand



Gravel



Sandy gravel

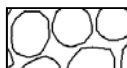


Cobbles, boulders



Talus

Sedimentary Rocks



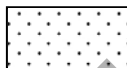
Boulder conglomerate



Conglomerate



Conglomeratic sandstone



Sandstone



Siltstone



Laminite



Mudstone, claystone, shale

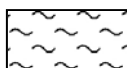


Coal

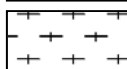


Limestone

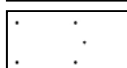
Metamorphic Rocks



Slate, phyllite, schist

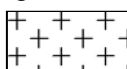


Gneiss

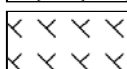


Quartzite

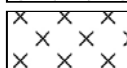
Igneous Rocks



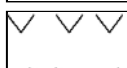
Granite



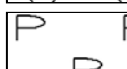
Dolerite, basalt, andesite



Dacite, epidote



Tuff, breccia



Porphyry

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

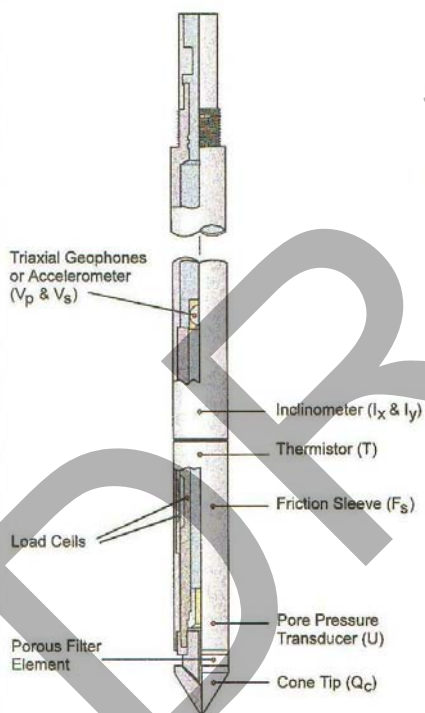


Figure 1: Cone Diagram

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)
Piezococone	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 (Q_t) and friction ratio (Fr). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

Cone Penetration Tests

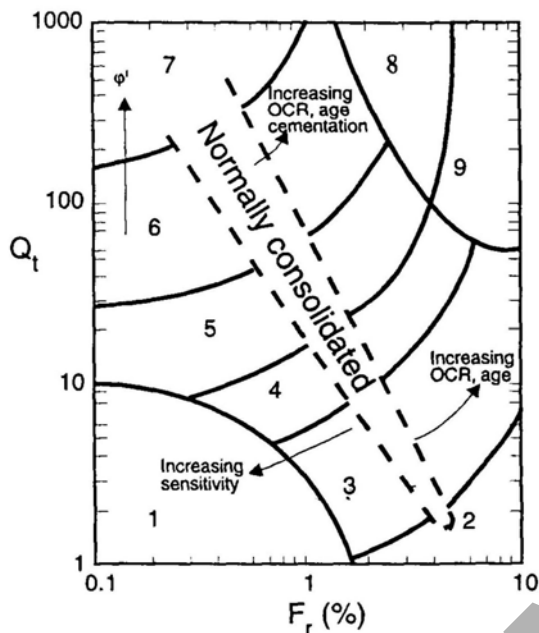


Figure 3: Soil Classification Chart

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.

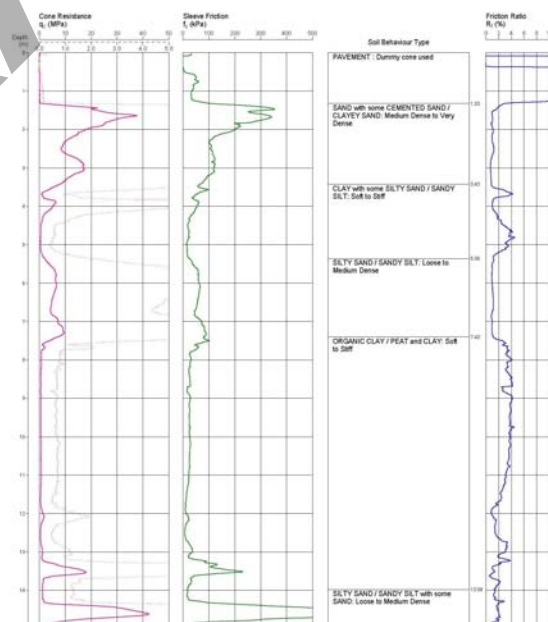
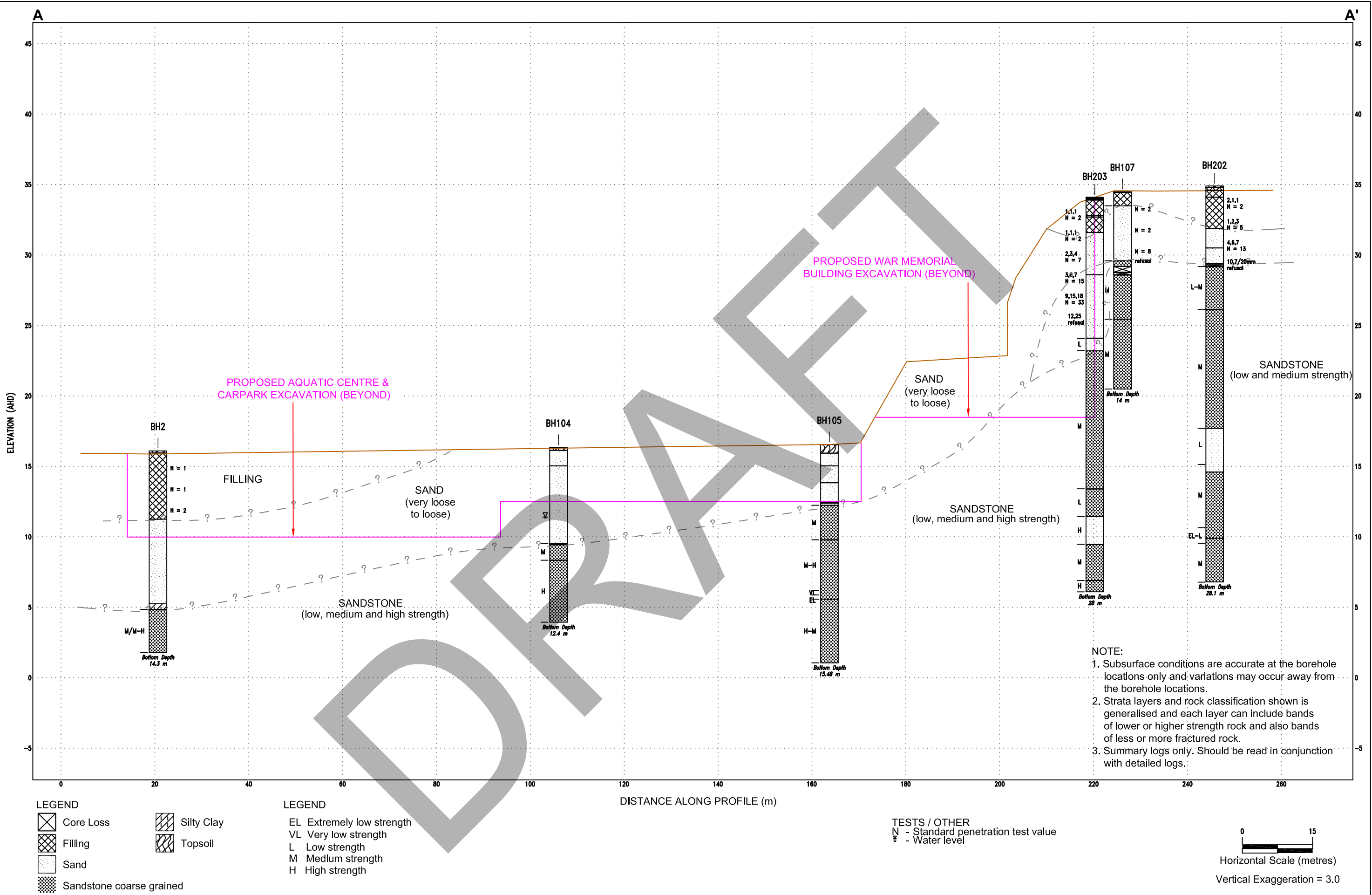


Figure 4: Sample Cone Plot

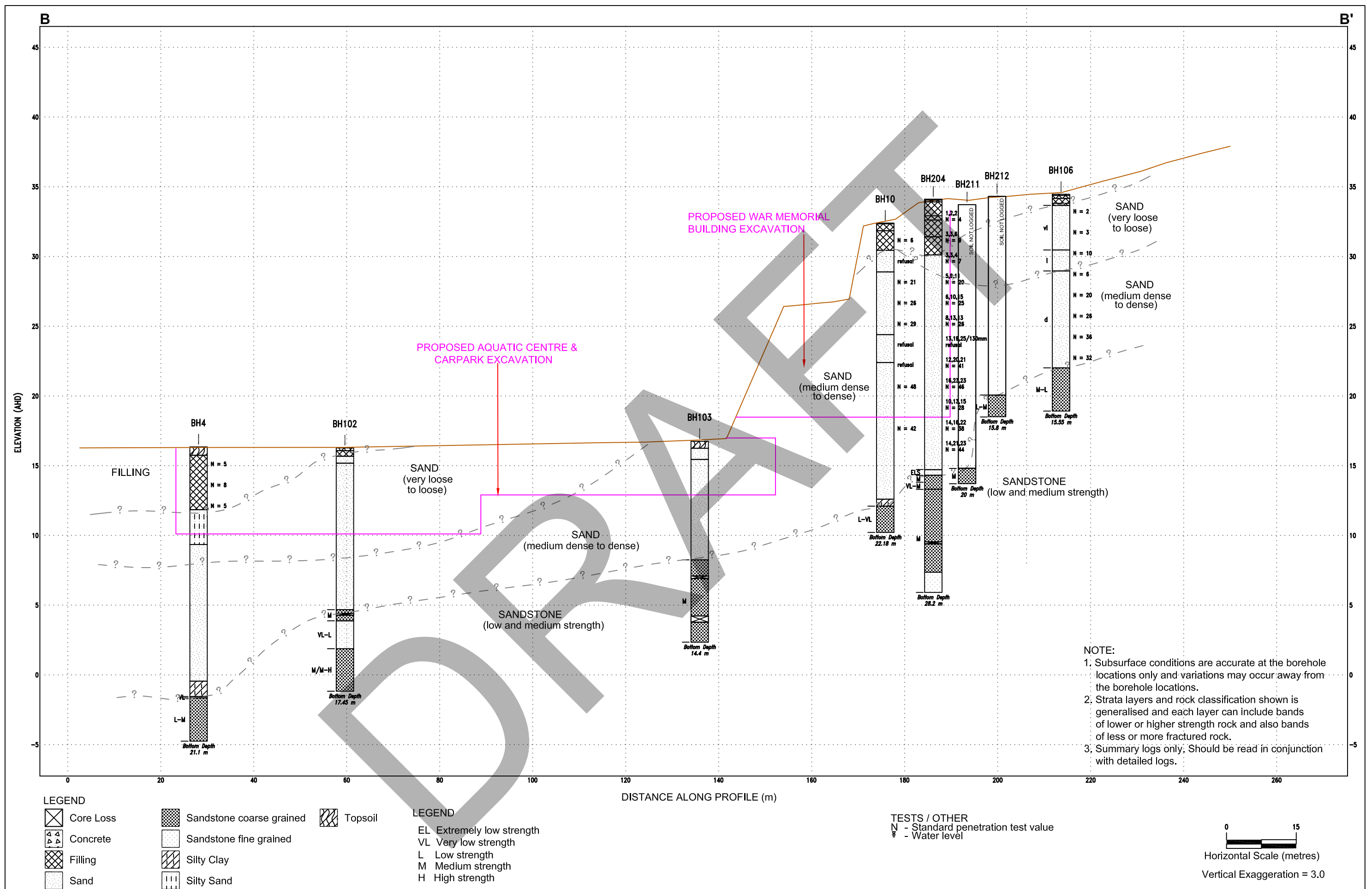
Appendix B

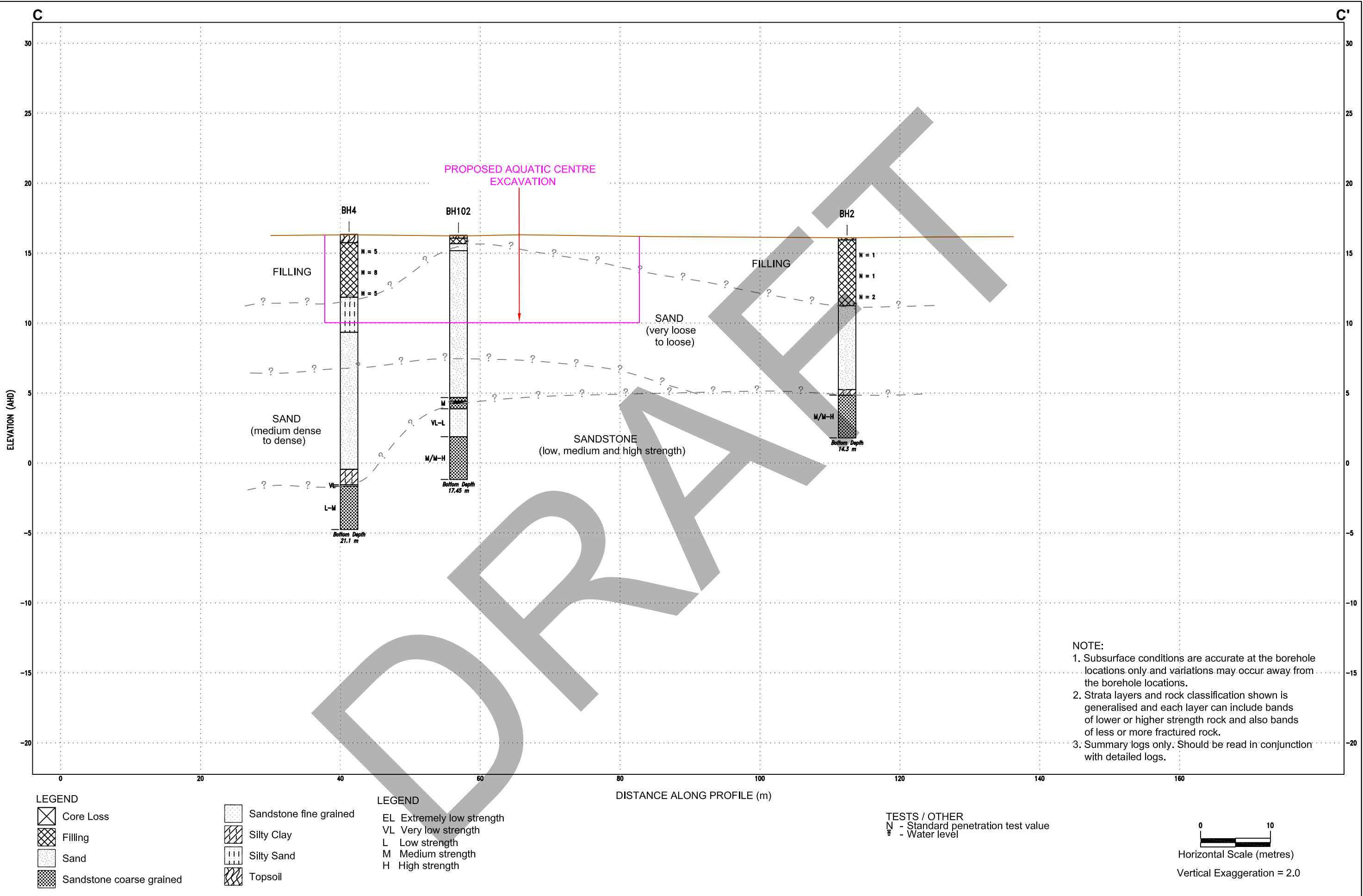
Drawings

DRAFT

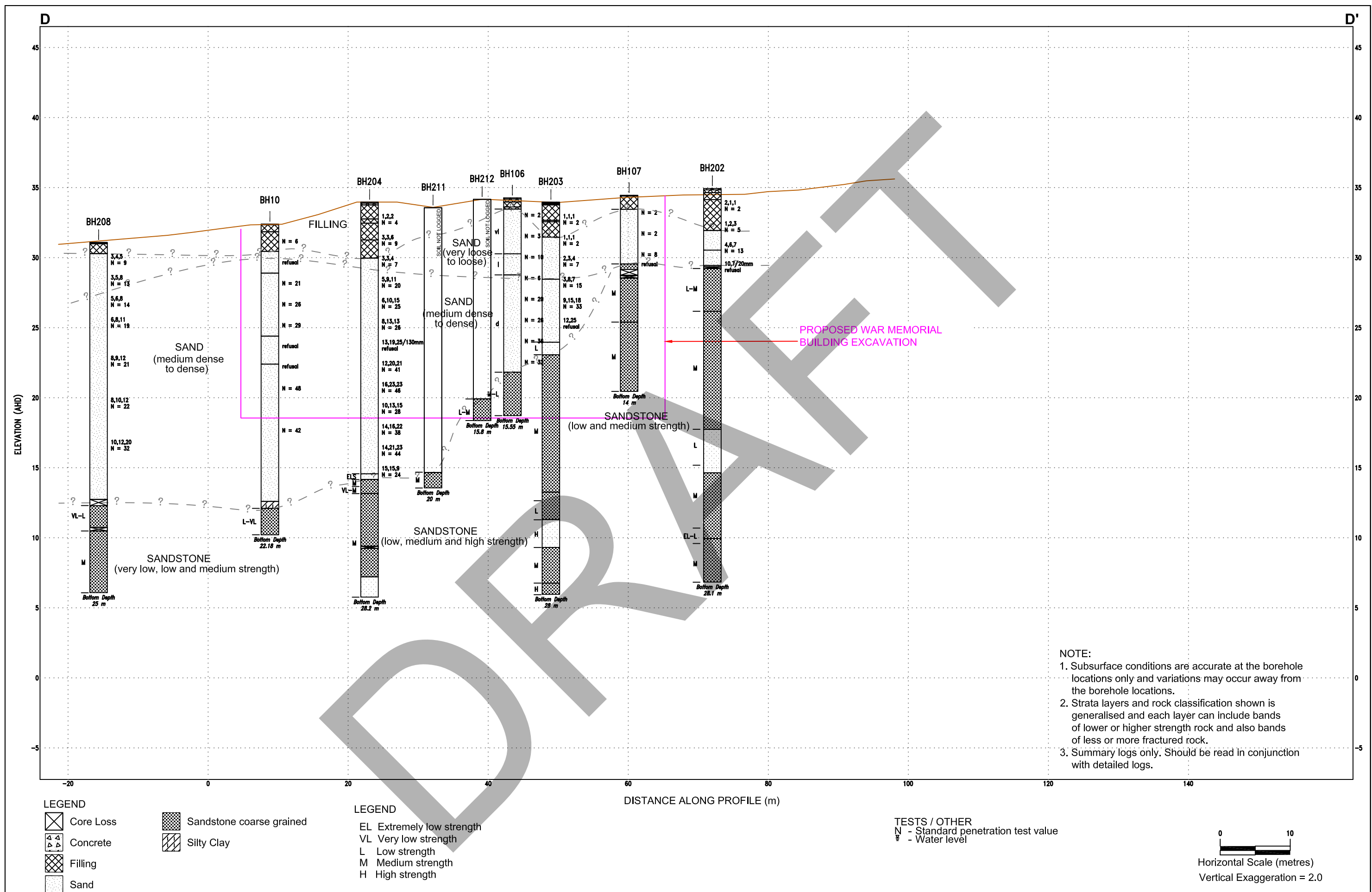


 Douglas Partners <i>Geotechnics Environment Groundwater</i>	CLIENT: Cranbrook School		TITLE: Geotechnical Cross-Section A-A' Geotechnical Investigation Cranbrook School, BELLEVUE HILL	PROJECT No: 84944.02	
	OFFICE: Sydney	DRAWN BY: PSCH		DRAWING No: G2	
	SCALE: 1:750(H) 1:250(V)	DATE: 25.10.2017		REVISION: 0	

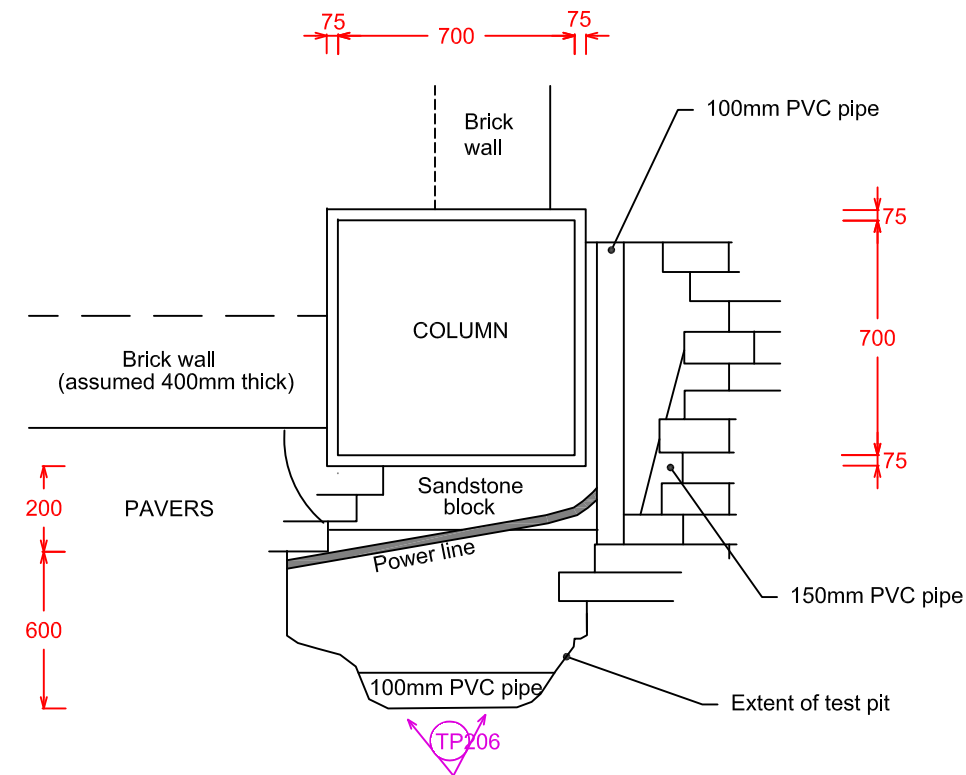




 Douglas Partners <i>Geotechnics Environment Groundwater</i>	CLIENT: Cranbrook School		TITLE: Geotechnical Cross-Section C-C' Geotechnical Investigation Cranbrook School, BELLEVUE HILL	PROJECT No: 84944.02	
	OFFICE: Sydney	DRAWN BY: PSCH		DRAWING No: G4	
	SCALE: 1:500(H) 1:250(V)	DATE: 25.10.2017		REVISION: 0	



TP206 PLAN

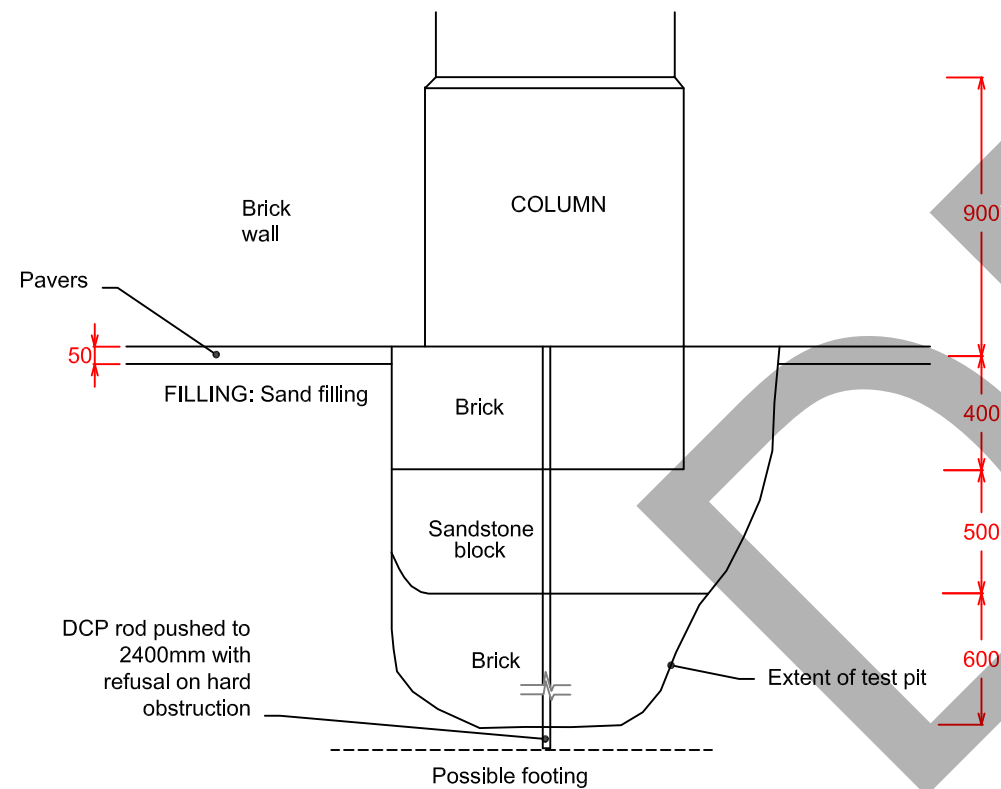
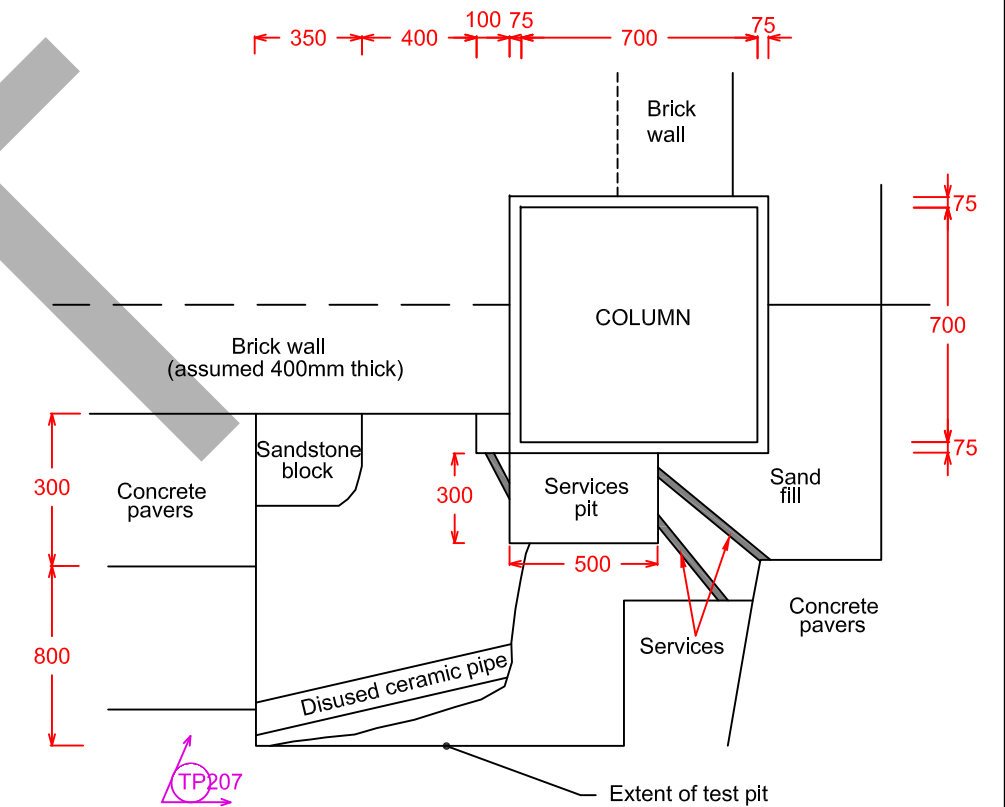


TP206

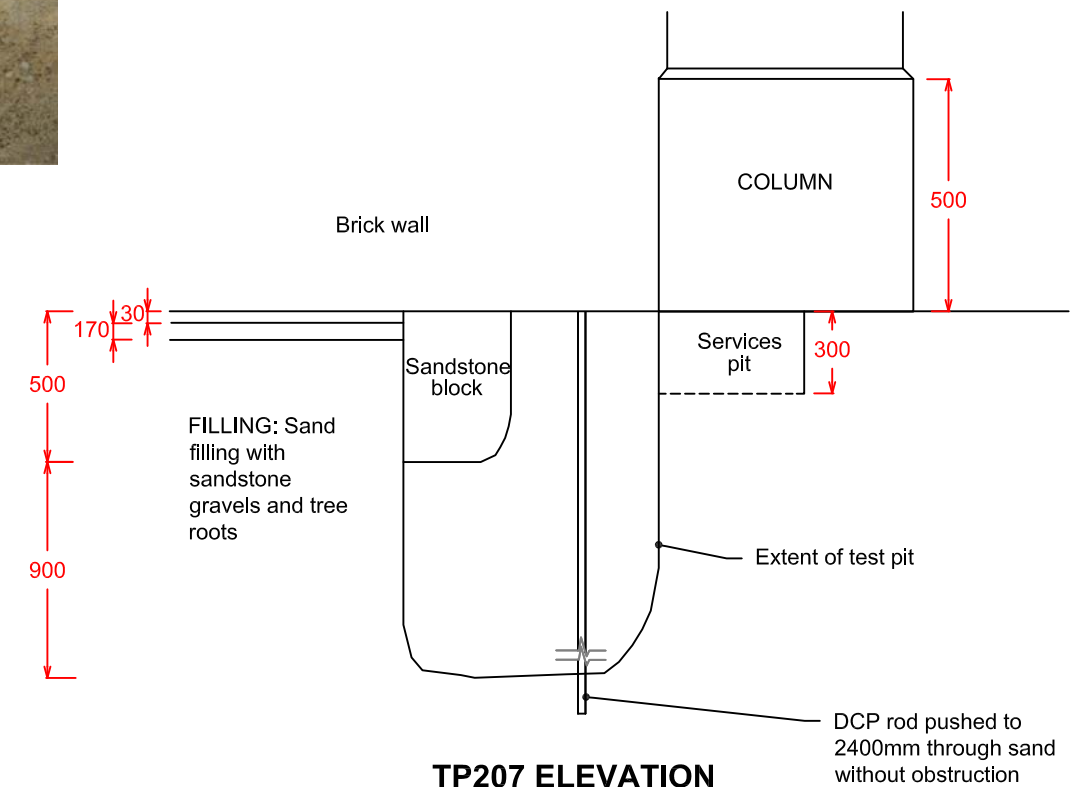


TP207

TP207 PLAN



TP206 ELEVATION

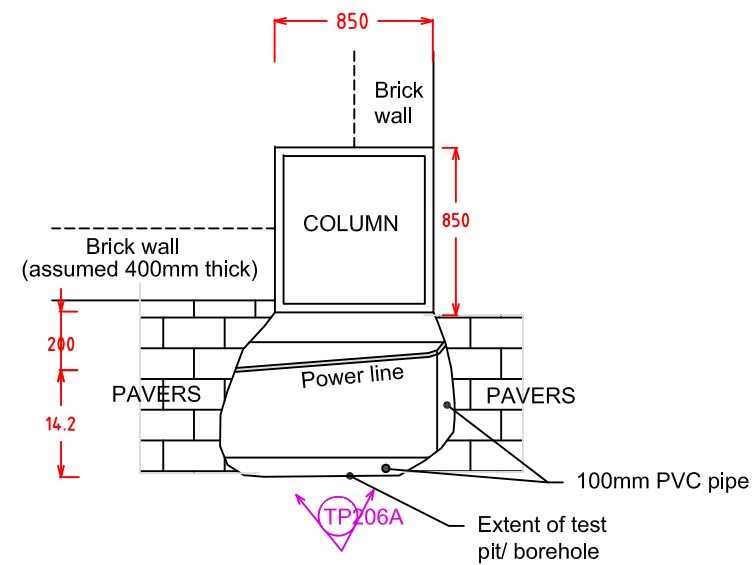


TP207 ELEVATION

LEGEND

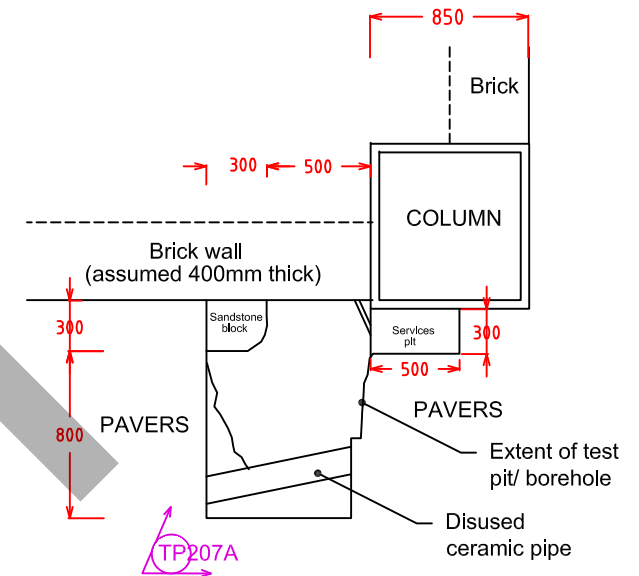
TP206 Photo number with direction of view

TP206A PLAN



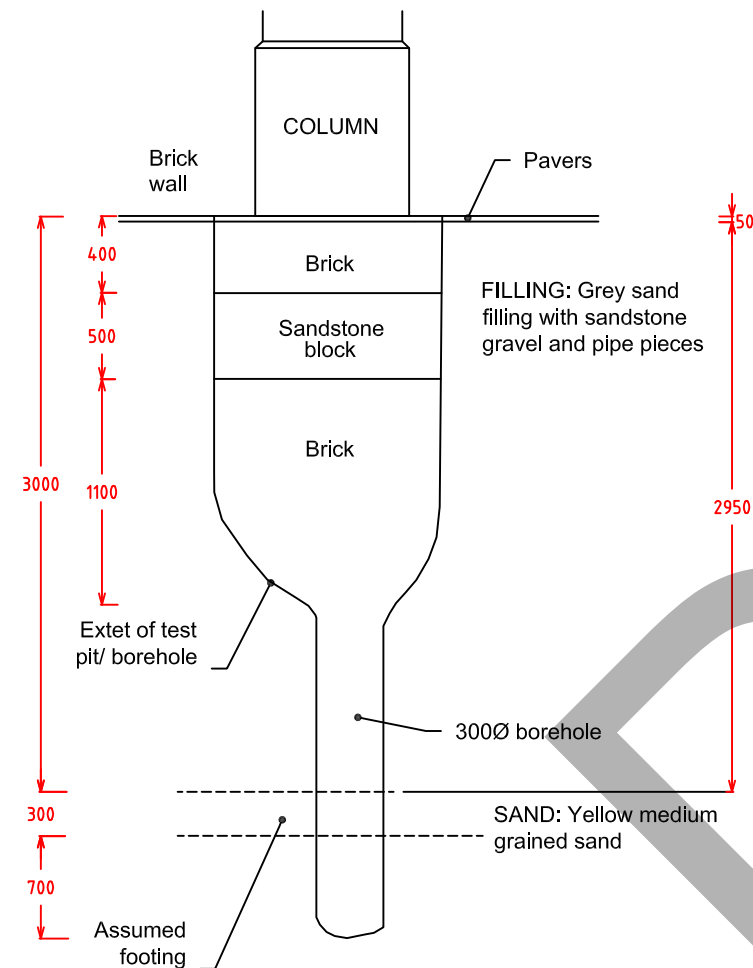
TP206A

TP207A PLAN



TP207A

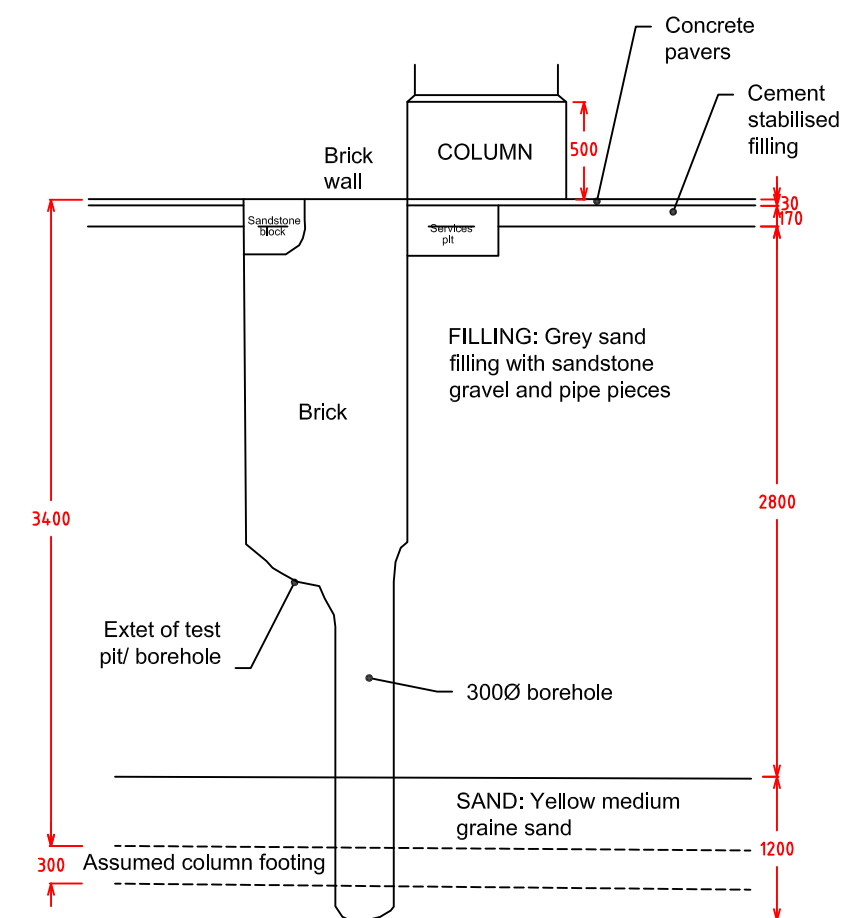
TP206A ELEVATION



LEGEND

TP207B Photo number with direction of view

TP207A ELEVATION



Appendix C

2017 Borehole Logs

DRAFT

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School EC1
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.13 AHD
EASTING: 338378.84
NORTHING: 6250846.18
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
16	0.4	TOPSOIL - dark brown, fine to medium silty sand topsoil, moist																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												

RIG: Scout 2

DRILLER: JS

LOGGED: SI/RW

CASING: HW to 5.4m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 14.35m; NMLC-Coring to 17.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 13.7m (screen 10.7-13.7m; gravel 9.7-13.7m; bentonite 8.7-9.7m; backfill to 0.1m below ground level; grass over gatic cover)

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.13 AHD
EASTING: 338378.84
NORTHING: 6250846.18
DIP/AZIMUTH: 90°/--

BORE No: BH101
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
6		SAND - yellow-brown, fine to medium sand, dry to moist (continued)																			
11																					
12																					
13																					
14																					
14.35		SANDSTONE - medium and high strength, moderately weathered, slightly fractured and unbroken, red-brown and brown, medium to coarse grained sandstone																			
15																					PL(A) = 4.14
16																					PL(A) = 0.66
17																					PL(A) = 1.52
17.4		Bore discontinued at 17.4m																			PL(A) = 0.91
18																					
19																					

RIG: Scout 2

DRILLER: JS

LOGGED: SI/RW

CASING: HW to 5.4m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 14.35m; NMLC-Coring to 17.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 13.7m (screen 10.7-13.7m; gravel 9.7-13.7m; bentonite 8.7-9.7m; backfill to 0.1m below ground level; grass over gatic cover)

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School EC1
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.28 AHD
EASTING: 338374.19
NORTHING: 6250784.3
DIP/AZIMUTH: 90°/--

BORE No: BH102
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex	Low	Very Low	Low			Medium	High	Very High	Ex	High	B - Bedding S - Shear	J - Joint F - Fault	Type
16	0.2	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist																		A/E			
16	0.6	FILLING - dark brown, fine to medium sand filling with clay, dry																		A/E			
15	1	SAND - dark brown, fine to medium sand, dry to moist (possibly filling)																		A/E			
15	1.1	SAND - grey fine to medium sand, dry to moist																		A/E			
15	1.4m: as above but becoming yellow-brown																			A/E			
15	1.8m: as above but grey-brown																			A/E			
14	2																						
14	3																						
13	4																						
13	5																						
12	6																						
12	7																						
11	8																						
10	9																						
9	8																						
9	7																						
7																							

RIG: Scout 2 **DRILLER:** JS **LOGGED:** SI/RW **CASING:** HW 11.6m
TYPE OF BORING: Solid flight auger (TC-bit) to 5.5m; Rotary to 11.6m; NMLC-Coring to 17.45m
WATER OBSERVATIONS: No free groundwater observed 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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	WL	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.28 AHD
EASTING: 338374.19
NORTHING: 6250784.3
DIP/AZIMUTH: 90°/-

BORE No: BH102
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
6		SAND - grey fine to medium sand, dry to moist (continued)																				
11																						
11.6		11.35m: yellow brown, fine to medium grained clayey sand																				
12	12.0	SANDSTONE - medium strength, highly weathered, slightly fractured, brown, coarse grained sandstone with some quartz gravel																C	86	50	PL(A) = 0.82	
12.4		SANDSTONE - very low and low strength, highly to moderately weathered, slightly fractured, light grey and red-brown, fine to medium grained sandstone with some extremely low strength bands																				
13																						PL(A) = 0.23
14																		C	100	92	PL(A) = 0.22	
14.4		SANDSTONE - medium and medium to high strength, moderately weathered, slightly fractured, brown to red-brown, medium grained sandstone																				PL(A) = 0.83
15																						PL(A) = 0.55
16																		C	100	92	PL(A) = 2.87	
17																						PL(A) = 0.84
17.45		Bore discontinued at 17.45m																				
18																						
19																						

RIG: Scout 2

DRILLER: JS

LOGGED: SI/RW

CASING: HW 11.6m

TYPE OF BORING: Solid flight auger (TC-bit) to 5.5m; Rotary to 11.6m; NMLC-Coring to 17.45m

WATER OBSERVATIONS: No free groundwater observed 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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.75 AHD
EASTING: 338361.5
NORTHING: 6250706.3
DIP/AZIMUTH: 90°/-

BORE No: BH103
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
	0.5	TOPSOIL - dark brown, silty clay topsoil with rootlets, dry																A/E			
	1	SAND - yellow-brown mottled dark brown, iron indurated, fine to medium sand, dry to moist																A/E			
	1.3	SAND - yellow-brown, fine to medium sand, dry to moist																A/E			
	2																				
	3																				
	4																				
	5																				
	6																				
	7																				
	8																				
	8.5	SANDSTONE - medium strength, slightly weathered then fresh stained, fractured and slightly fractured, light grey, medium grained sandstone with some extremely low and very low strength bands and traces of carbonaceous laminations																			
	9																				
	9.85																				

Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0° - 10°

8.96m: B0° - 5°, un, ro, fe stn
 9.45m: J20°, pl, ro, fe stn
 9.6m: Cs, 50mm
 9.65m: CORE LOSS:

RIG: Scout 2 **DRILLER:** JS **LOGGED:** RW/JN **CASING:** HQ to 8.5m
TYPE OF BORING: Solid flight auger (TC-bit) to 8.5m; NMLC-Coring to 14.4m
WATER OBSERVATIONS: No free groundwater observed 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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School EC1
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.75 AHD
EASTING: 338361.5
NORTHING: 6250706.3
DIP/AZIMUTH: 90°/-

BORE No: BH103
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		Ex Low	Very Low	Low	Medium	High	Very High		B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
		SANDSTONE - medium strength, slightly weathered then fresh stained, fractured and slightly fractured, light grey, medium grained sandstone with some extremely low and very low strength bands and traces of carbonaceous laminations (<i>continued</i>)																			
	11															200mm 10.10, 10.15m: J45°, un, ro, cln 10.13m: J70°, un, ro, cln 10.26m: Ds, 20mm		C	93	89	PL(A) = 0.7
	12															11.66m: B0° - 5°, un, ro, cbs, st 11.68m: J0° - 30°, cu, ro, cbs, st 11.97m: J0° - 30°, cu, ro, fe stn					PL(A) = 0.36
	12.52															12.52m: J30°, pl, ro, cln CORE LOSS: 450mm		C	85	75	PL(A) = 0.31
	13 12.97																				PL(A) = 0.54
	14															13.68m: Cs, 10mm 13.72, 13.76m: J30°, pl, ro, cln 13.8m: Ds, 50mm 13.88m: Cs, 30mm 14.12m: Cs, 80mm					PL(A) = 0.47
	14.4	Bore discontinued at 14.4m - target depth reached																			
	15																				
	16																				
	17																				
	18																				
	19																				

RIG: Scout 2

DRILLER: JS

LOGGED: RW/JN

CASING: HQ to 8.5m

TYPE OF BORING: Solid flight auger (TC-bit) to 8.5m; NMLC-Coring to 14.4m

WATER OBSERVATIONS: No free groundwater observed 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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.34 AHD
EASTING: 338308.87
NORTHING: 6250760.78
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 84944.01
DATE: 12/4/2017
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
16	0.2	TOPSOIL - dark brown, fine to medium silty sand topsoil, moist							A/E			
		SAND - dark brown mottled brown, iron indurated, fine to medium sand, moist (possibly filling)							A/E			
	0.8m	as above but brown and grey-brown mottled dark brown							A/E			
15	1.3	SAND - yellow brown mottled brown and dark brown, grey fine to medium sand, moist							A/E			
14												
13												
12												
11												
10												
9												
8												
7	6.8	SANDSTONE - medium strength, moderately weathered, fractured and slightly fractured, light grey and red-brown, medium grained sandstone						6.8m: CORE LOSS: 100mm				PL(A) = 0.71
	6.9							7.3-7.45m: B (x3) 0°, cly co, 1-2mm				PL(A) = 0.36
	8.0	SANDSTONE - high strength, fresh, slightly fractured and unbroken, light grey, medium grained sandstone						7.9 & 7.95m: B0°, fe	C	97	90	PL(A) = 1.19
								9.4m: B0°, cly, 5mm	C	100	100	PL(A) = 1.2

RIG: DT100

DRILLER: SS

LOGGED: RW/SI

CASING: HW to 6.8m

TYPE OF BORING: Solid flight auger (TC-bit) to 5.5m; Rotary to 6.8m; NMLC-Coring to 12.4m

WATER OBSERVATIONS: Free groundwater observed at 5.0m 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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School EC1
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.34 AHD
EASTING: 338308.87
NORTHING: 6250760.78
DIP/AZIMUTH: 90°/--

BORE No: BH104
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
6		SANDSTONE - high strength, fresh, slightly fractured and unbroken, light grey, medium grained sandstone (continued)																C	100	100	PL(A) = 1.17	
11																						PL(A) = 1.01
5																						
12																						
12.4	12.4	Bore discontinued at 12.4m																				
13																						
3																						
14																						
2																						
15																						
1																						
16																						
0																						
17																						
-1																						
18																						
-2																						
19																						
-3																						

RIG: DT100

DRILLER: SS

LOGGED: RW/SI

CASING: HW to 6.8m

TYPE OF BORING: Solid flight auger (TC-bit) to 5.5m; Rotary to 6.8m; NMLC-Coring to 12.4m

WATER OBSERVATIONS: Free groundwater observed at 5.0m 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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.54 AHD
EASTING: 338303.82
NORTHING: 6250703.09
DIP/AZIMUTH: 90°/-

BORE No: BH105
PROJECT No: 84944.01
DATE: 10/4/2017
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
16	0.6	TOPSOIL - dark brown, silty sand topsoil filling with some rootlets, damp																A/E			
1		SAND - grey-brown medium sand with some coarse graining, moist (possible filling)																A/E			
1.5		SAND - brown to dark brown medium sand, damp (possible filling)																A/E			
2																					
2.7		SAND - light brown to orange-brown medium sand, damp																A/E			
3																					
4	4.1	4.1m: becoming extremely weathered sandstone																			
4.15																					
4.3		SANDSTONE - medium strength, moderately to slightly weathered, slightly fractured, light grey-brown to red-brown, medium grained sandstone																			
5																					
6																					
7	6.75	SANDSTONE - medium and high strength, moderately to slightly weathered and fresh, slightly fractured, light grey-brown, medium grained sandstone																			
8																					
8																					
9																					

RIG: Scout 2 **DRILLER:** JS **LOGGED:** RM/SI **CASING:** HQ to 4.1m
TYPE OF BORING: Solid flight auger (TC-bit) to 4.1m; NMLC-Coring to 15.48m
WATER OBSERVATIONS: Some seepage from 0.5m
REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School EC1
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.54 AHD
EASTING: 338303.82
NORTHING: 6250703.09
DIP/AZIMUTH: 90°/-

BORE No: BH105
PROJECT No: 84944.01
DATE: 10/4/2017
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
		SANDSTONE - medium and high strength, moderately to slightly weathered and fresh, slightly fractured, light grey-brown, medium grained sandstone (<i>continued</i>) 10.35-10.66m: very low strength 10.66-10.96m: extremely low strength										
	11	10.96						10.45-10.47m: Ds 10.66-10.96m: Ds		100	91	PL(A) = 0.65 PL(A) = 0.1
	12							11.7m: J25°, pl, ro, cln 12.15m: J30°, pl, ro, fe, cly 12.22-12.36m: Cs 12.4-12.48m: Cs 12.6m: J70°, pl, ro, cln	C	100	72	PL(A) = 1.26 PL(A) = 1.06
	13											PL(A) = 1.26
	14							13.86m: B5°, cly, 10mm 14.15m: B5°, cbs co 14.75-14.9m: Cs	C	100	88	PL(A) = 1.03 PL(A) = 0.92
	15											
	15.48	Bore discontinued at 15.48m										
	16											
	17											
	18											
	19											

RIG: Scout 2 **DRILLER:** JS **LOGGED:** RM/SI **CASING:** HQ to 4.1m
TYPE OF BORING: Solid flight auger (TC-bit) to 4.1m; NMLC-Coring to 15.48m
WATER OBSERVATIONS: Some seepage from 0.5m
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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 38.47 AHD
EASTING: 338318.63
NORTHING: 6250640.39
DIP/AZIMUTH: 90°/--

BORE No: BH106
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
38	0.08	FILLING - brick pavers																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															</

RIG: Bobcat **DRILLER:** GM **LOGGED:** JN **CASING:** HW to 8.5m; HQ to 12.45m
TYPE OF BORING: Solid flight auger (TC-bit) to 8.5m; Rotary (mud) to 12.45m; NMLC-Coring to 15.55m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Standpipe installed to 12.5m (screen 9.5-12.5m; gravel 8.5-12.5m; backfill to GL with gatic cover)

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 38.47 AHD
EASTING: 338318.63
NORTHING: 6250640.39
DIP/AZIMUTH: 90°/-

BORE No: BH106
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding	J - Joint	S - Shear	F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
28	11	SAND - dense, yellow medium grained sand, moist (continued) 10.0m: becoming wet																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						

RIG: Bobcat **DRILLER:** GM **LOGGED:** JN **CASING:** HW to 8.5m; HQ to 12.45m
TYPE OF BORING: Solid flight auger (TC-bit) to 8.5m; Rotary (mud) to 12.45m; NMLC-Coring to 15.55m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Standpipe installed to 12.5m (screen 9.5-12.5m; gravel 8.5-12.5m; backfill to GL with gatic cover)

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 39.22 AHD
EASTING: 338301.69
NORTHING: 6250640.1
DIP/AZIMUTH: 90°/--

BORE No: BH107
PROJECT No: 84944.01
DATE: 13/4/2017
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
39	0.05	FILLING - brick pavers																A			1,1,1 N = 2
		FILLING - brown silty sand filling with some fine to medium sandstone gravel, moist																A			
																		A			
1	1.0	SAND - very loose then loose, light grey medium grained sand, moist																S			1,1,1 N = 2
38																					
2																					
37																		S			2,3,5 N = 8
3																					
36																					
4																		S			10/149mm refusal
35																					
5	4.9	SANDSTONE - medium strength, slightly weathered, slightly fractured, orange and light grey medium grained sandstone																S			
34																					
	5.71																	C	58	56	PL(A) = 0.48
6	5.91																				PL(A) = 0.54
33																					
7																					
32																					PL(A) = 0.46
8																					
31																		C	100	92	PL(A) = 0.45
9	9.05	SANDSTONE - medium strength, fresh, slightly fractured then unbroken, light grey medium grained sandstone with traces of carbonaceous laminations																			PL(A) = 0.48
30																		C	100	100	

RIG: Bobcat

DRILLER: GM

LOGGED: JN

CASING: HW to 4.9m; HQ to 4.9m

TYPE OF BORING: Solid flight auger (TC-bit) to 4.9m; NMLC-Coring to 14.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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



Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School EC1
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 39.22 AHD
EASTING: 338301.69
NORTHING: 6250640.1
DIP/AZIMUTH: 90°/-

BORE No: BH107
PROJECT No: 84944.01
DATE: 13/4/2017
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing						
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
29		SANDSTONE - medium strength, fresh, slightly fractured then unbroken, light grey medium grained sandstone with traces of carbonaceous laminations (continued)																				PL(A) = 0.5	
11																							
28																							
12																							PL(A) = 0.64
27																							
13																							PL(A) = 0.49
26																							
14	14.0	Bore discontinued at 14.0m - target depth reached																					PL(A) = 0.71
25																							
15																							
24																							
16																							
23																							
17																							
22																							
18																							
21																							
19																							
20																							

RIG: Bobcat

DRILLER: GM

LOGGED: JN

CASING: HW to 4.9m; HQ to 4.9m

TYPE OF BORING: Solid flight auger (TC-bit) to 4.9m; NMLC-Coring to 14.0m

WATER OBSERVATIONS: No free groundwater observed 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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.28 AHD
EASTING: 338412.68
NORTHING: 6250794.55
DIP/AZIMUTH: 90°/--

BORE No: BH111
PROJECT No: 84944.01
DATE: 13/4/2017
SHEET 1 OF 1

[illegible]

RIG: DT100

DRILLER: SS

LOGGED: AT

CASING: Uncased

TYPE OF BORING: Auger to 3.1m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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



BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.61 AHD
EASTING: 338380.55
NORTHING: 6250730.19
DIP/AZIMUTH: 90°/--

BORE No: BH112
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.4	TOPSOIL - dark brown, silty clay topsoil with rootlets, dry		A/E	0.1					
		SAND - dark brown mottled yellow-brown, fine to medium grained sand, dry to moist (possibly filling)		A	0.5					
	1.0	SAND - yellow-brown mottled dark brown, fine to medium sand, dry to moist		A/E	1.0					
		1.5m: as above but yellow-brown								
	2.0	Bore discontinued at 2.0m - target depth reached		A/E	2.0					

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.22 AHD
EASTING: 338402.54
NORTHING: 6250814
DIP/AZIMUTH: 90°/--

BORE No: BH113
PROJECT No: 84944.01
DATE: 13/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
15	0.2	FILLING - brown, medium grained sand filling (topsoil) with some red-brown clay, traces of rootlets		A/E	0.1 0.15					
		FILLING - dark brown, medium sand filling		A/E	0.5 0.55					
1	0.7	FILLING - pale brown mottled dark brown, medium sand filling		A/E	1.0 1.05					
2				A/E	1.95 2.0					
14	2.3	SAND - pale brown and yellow, medium sand, moist								
3	3.0	Bore discontinued at 3.0m - target depth reached		A/E	3.0					
13										
4										
11										
5										
6										
10										
7										
8										
9										

RIG: DT100

DRILLER: SS

LOGGED: AT

CASING: Uncased

TYPE OF BORING: Auger to 3.0m

WATER OBSERVATIONS: No free groundwater observed

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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.40 AHD
EASTING: 338395.64
NORTHING: 6250774.08
DIP/AZIMUTH: 90°/--

BORE No: BH114
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
16	0.2	TOPSOIL - dark brown, fine to medium silty sand topsoil, moist		A/E	0.1					
		SAND - dark brown mottled-brown, fine to medium sand, moist (possibly filling)		A/E	0.5					
1				A/E	1.0					
1.8										
2	1.8	SAND - dark brown mottled yellow-brown, fine to medium sand with iron indurated pockets, moist		A/E	2.0					
3	3.0	Bore discontinued at 3.0m - target depth reached		A/E	3.0					
4										
5										
6										
7										
8										
9										

RIG: Scout 2

DRILLER: JS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 3.0m

WATER OBSERVATIONS: No free groundwater observed

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	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)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.43 AHD
EASTING: 338384.73
NORTHING: 6250747.66
DIP/AZIMUTH: 90°/--

BORE No: BH115
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.3	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A/E	0.1					
		SAND - grey-brown, fine to medium sand, dry to moist (possibly filling)		A/E	0.5					
		0.8m: as above but becoming dark brown and grey-brown								
	1.1	SAND - pale grey, fine to medium sand, dry to moist		A/E	1.0					
	2.0	Bore discontinued at 2.0m - target depth reached		A/E	2.0					

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.45 AHD
EASTING: 338357.98
NORTHING: 6250734.72
DIP/AZIMUTH: 90°/--

BORE No: BH116
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.3	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A/E	0.1					
	0.7	SAND - dark brown and yellow-brown, fine to medium sand, dry to moist (possibly filling)		A/E	0.5					
	1.0	SAND - dark grey, fine to medium sand, moist		A/E	1.0					
	1.5m	1.5m: as above but becoming pale grey								
	2.2	SAND - dark brown mottled brown, fine to medium sand, iron indurated, dry to moist		A/E	2.0					
	3.0	Bore discontinued at 3.0m - target depth reached		A/E	3.0					

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 3.0m

WATER OBSERVATIONS: No free groundwater observed

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	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)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.04 AHD
EASTING: 338392.47
NORTHING: 6250837.21
DIP/AZIMUTH: 90°/--

BORE No: BH117
PROJECT No: 84944.01
DATE: 13/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
16.0	0.2	TOPSOIL - grey and dark brown, silty sand filling (topsoil), traces of rootlets		A/E	0.1 0.15					
		FILLING - dark brown, medium sand filling		A/E	0.45 0.5					
15.0	1			A/E	0.95 1.0					
14.0	2			A/E	1.95 2.0					
13.0	2.5	FILLING - pale grey and dark brown, medium sand filling		A/E	2.95 3.0					
12.0	3.2	SAND - pale grey, brown and brown, medium sand (possibly filling)								
11.0	4.0	Bore discontinued at 4.0m - target depth reached								
10.0	5									
9.0	6									
8.0	7									
7.0	8									
6.0	9									

RIG: Scout 2

DRILLER: JS

LOGGED: AT

CASING: Uncased

TYPE OF BORING: Auger to 4.0m

WATER OBSERVATIONS: No free groundwater observed

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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.14 AHD
EASTING: 338382.59
NORTHING: 6250811.43
DIP/AZIMUTH: 90°/--

BORE No: BH118
PROJECT No: 84944.01
DATE: 13/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
16	0.2	TOPSOIL - grey-brown, medium silty sand (topsoil), traces of rootlets, organic odour		A/E	0.1 0.15					
		FILLING - dark brown medium sand filling, traces of silt		A/E	0.45 0.5					
	0.7	SAND - pale brown and yellow, medium sand, moist		A/E	0.95 1.0					
1										
1.8		SAND - pale brown and brown, medium sand, moist		A/E	1.95 2.0					
2										
2.5		Bore discontinued at 2.5m - target depth reached								
3										
4										
5										
6										
7										
8										
9										

RIG: DT100

DRILLER: SS

LOGGED: AT

CASING: Uncased

TYPE OF BORING: Auger to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.38 AHD
EASTING: 338353.07
NORTHING: 6250757.73
DIP/AZIMUTH: 90°/--

BORE No: BH119
PROJECT No: 84944.01
DATE: 10/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
16	0.2	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A/E	0.1					
	0.6	SAND - grey-brown, fine to medium sand, dry to moist (possibly filling)		A/E	0.5					
1		SAND - yellow, fine to medium sand, dry to moist		A/E	1.0					
1.5		1.0m: as above but dark brown								
2		1.5m: as above but grey-brown mottled yellow-brown								
2	2.0	1.9m: as above but dark grey		A/E	2.0					
		Bore discontinued at 2.0m - target depth reached								
3										
3										
4										
4										
5										
5										
6										
6										
7										
7										
8										
8										
9										
9										

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.70 AHD
EASTING: 338333.04
NORTHING: 6250703.65
DIP/AZIMUTH: 90°/--

BORE No: BH120
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.2	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A	0.1					
		SAND - brown-yellow, fine to medium sand, dry to moist (possibly filling)		A	0.5					
	0.7	SAND - dark brown and yellow-brown, fine to medium sand, iron indurated, dry to moist		A	1.0					
	1			E	1.5					
	2	2.0		A/E	2.0					
		Bore discontinued at 2.0m - target depth reached								
	3									
	4									
	5									
	6									
	7									
	8									
	9									

RIG: Scout 2

DRILLER: JS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.11 AHD
EASTING: 338357.75
NORTHING: 6250821.77
DIP/AZIMUTH: 90°/--

BORE No: BH121
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
16.11	0.2	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A/E	0.1					
		FILLING - yellow-brown fine to medium sand filling, dry to moist		A/E	0.5					
15.11	0.75	SAND - yellow-brown and grey-brown mottled dark brown, fine to medium sand, dry to moist (possibly filling)		A/E	1.0					
14.11	2.2	SAND - yellow-brown, fine to medium sand, dry to moist		A/E	2.0					
13.11	3.0	Bore discontinued at 3.0m - target depth reached		A/E	3.0					

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 3.0m

WATER OBSERVATIONS: No free groundwater observed

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	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)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.22 AHD
EASTING: 338349.17
NORTHING: 6250799.56
DIP/AZIMUTH: 90°/--

BORE No: BH122
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
15	0.3	FILLING - dark brown, fine to medium silty sand filling, dry to moist		A/E	0.1					
		SAND - dark brown mottled grey, fine to medium sand, dry to moist (possibly filling)		A/E	0.5					
1				A/E	1.0					
15	1.2	SAND - yellow-brown, fine to medium sand, dry to moist								
2	2.0	Bore discontinued at 2.0m - target depth reached		A/E	2.0					
14										
3										
15										
4										
15										
5										
11										
6										
10										
7										
9										
8										
9										

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.31 AHD
EASTING: 338341.92
NORTHING: 6250774.57
DIP/AZIMUTH: 90°/--

BORE No: BH123
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
16.31	0.2	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A/E	0.1					
		SAND - grey-brown, fine to medium sand, dry to moist (possibly filling)		A/E	0.5					
	0.7	SAND - dark brown, fine to medium sand, iron indurated, dry to moist		A/E	1.0					
	1.5	SAND - yellow-brown, fine to medium sand, dry to moist								
	2.0	Bore discontinued at 2.0m - target depth reached		A/E	2.0					

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.51 AHD
EASTING: 338327.48
NORTHING: 6250748.48
DIP/AZIMUTH: 90°/--

BORE No: BH124
PROJECT No: 84944.01
DATE: 10/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.3	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A	0.1					
	0.75	SAND - grey-brown, fine to medium sand, dry to moist (possible filling)		A/E	0.5					
	1	SAND - grey-brown mottled yellow-brown, fine to medium sand with occasional dark brown pockets of iron indurated sand, dry to moist		A	1.0					
	2.0	Bore discontinued at 2.0m - target depth reached		A/E	2.0					

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.50 AHD
EASTING: 338319.11
NORTHING: 6250727.97
DIP/AZIMUTH: 90°/--

BORE No: BH125
PROJECT No: 84944.01
DATE: 10/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.2	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A	0.1					
		SAND - dark brown and grey-brown, fine to medium sand, dry to moist (possibly filling)		A	0.5					
	0.7	SAND - grey mottled yellow-brown, fine to medium sand, dry to moist		A/E	1.0					
	1	1.2m: as above but yellow-brown mottled brown								
	2.0	Bore discontinued at 2.0m - target depth reached		A/E	2.0					

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

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	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)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.10 AHD
EASTING: 338357.72
NORTHING: 6250849.98
DIP/AZIMUTH: 90°/--

BORE No: BH126
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
16.10	0.3	TOPSOIL - dark brown, fine to medium silty sand topsoil, trace gravel, dry to moist		A/E	0.1					
		FILLING - yellow brown, fine to medium sand filling, dry to moist		A/E	0.5					
15.0	1			A/E	1.0					
		1.3m: as above but grey-brown								
14.0	2			A/E	2.0					
		2.4m: as above but becoming grey-brown and dark brown								
13.0	3			A/E	3.0					
	3.4	SAND - yellow-brown, fine to medium sand, moist								
12.0	4	Bore discontinued at 4.0m - target depth reached		A	4.0					
11.0	5									
10.0	6									
9.0	7									
8.0	8									
7.0	9									

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 4.0m

WATER OBSERVATIONS: No free groundwater observed

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	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)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.07 AHD
EASTING: 338330.67
NORTHING: 6250807.63
DIP/AZIMUTH: 90°/--

BORE No: BH127
PROJECT No: 84944.01
DATE: 11/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
16	0.3	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A/E	0.1					
		SAND - dark brown mottled yellow-brown, fine to medium sand with iron indurated pockets, dry to moist (possibly filling)		A/E	0.5					
1	1.2	SAND - yellow-brown, fine to medium sand, moist		A/E	1.0					
2	2.0	Bore discontinued at 2.0m - target depth reached		A/E	2.0					
3										
4										
5										
6										
7										
8										
9										

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 15.95 AHD
EASTING: 338327.14
NORTHING: 6250830.2
DIP/AZIMUTH: 90°/--

BORE No: BH128
PROJECT No: 84944.01
DATE: 12/4/2017
SHEET 1 OF 1

[illegible]

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 3.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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



Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.35 AHD
EASTING: 338293.77
NORTHING: 6250744.3
DIP/AZIMUTH: 90°/--

BORE No: BH129
PROJECT No: 84944.01
DATE: 10/4/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
16.0	0.3	TOPSOIL - dark brown, fine to medium silty sand topsoil, dry to moist		A/E	0.1					
		SAND - grey-dark brown, fine to medium sand, dry to moist (possibly filling)		A/E	0.5					
1				A/E	1.0					
1.5	1.2	SAND - mottled grey-brown and yellow-brown sand with pockets of iron induration, moist								
2				A/E	2.0					
2.5		2.5m: as above but grey-brown								
3				A	3.0					
3.5										
4	4.0	SAND - yellow-brown, fine to medium sand with clay, wet 3.9m: as above but pale-grey		A	4.0					
		Bore discontinued at 4.0m - target depth reached								

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 4.0m

WATER OBSERVATIONS: No free groundwater observed

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	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)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Cranbrook School ECI
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.44 AHD
EASTING: 338282.32
NORTHING: 6250716.51
DIP/AZIMUTH: 90°/--

BORE No: BH130
PROJECT No: 84944.01
DATE: 10/4/2017
SHEET 1 OF 1

[illegible]

RIG: DT100

DRILLER: SS

LOGGED: RW

CASING: Uncased

TYPE OF BORING: Auger to 2.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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



BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.9 AHD
EASTING: 338288
NORTHING: 6250632
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 84944.02
DATE: 24 - 25/8/2017
SHEET 1 OF 3

[illegible]

Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.9 AHD
EASTING: 338288
NORTHING: 6250632
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 84944.02
DATE: 24 - 25/8/2017
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium				High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
24	11	SANDSTONE - medium strength, fresh, unbroken then slightly fractured, light grey, medium grained sandstone with some carbonaceous laminations and some low strength bands (continued)														9.95m: B0°, pl, ro, cly, 2mm		C	100	100	PL(A) = 0.72	
23	12																				PL(A) = 0.65	
22	13																	C	100	100	PL(A) = 0.59	
21	14																				PL(A) = 0.2	
20	15																				PL(A) = 0.7	
19	16	SANDSTONE - low strength, moderately to slightly weathered, fractured, light grey and red, fine to medium grained sandstone with some medium and high strength, iron-cemented bands and traces of extremely low and very low strength seams														14.14m: B0°, pl, ro, cly, 5mm					PL(A) = 0.52	
18	17																16.9m: B0°, pl, ro, cly, 1mm		C	100	100	PL(A) = 0.88
17.2	17.2																17.51m: B0°, pl, ro, fe stn					PL(A) = 0.19
17	18																18.23m: J60°- 90°, un, ro, cly, 5mm 18.28m: B0°- 10°, un, ro, cly 18.4-18.7m: J70°- 90°, un, ro, cly, 1mm, he		C	100	94	PL(A) = 0.16
16	19																19.43m: B0°, pl, ro, fe stn 19.5m: Cs, 20mm 19.58m: fg, 40mm					PL(A) = 0.73
15																						

RIG: DT250

DRILLER: GM

LOGGED: JN

CASING: HW to 5.5m

TYPE OF BORING: Hand tools to 1.0m; Solid flight auger (TC-bit) to 5.5m; Rotary (water) to 5.6m; NMLC-Coring to 28.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 5.5m (screen 5.5-2.5m; blank 2.5-0.0m; gravel to 2.0m; bentonite to 0.3m; backfill to 0.2m; gatic cover; concrete plug

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



Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.9 AHD
EASTING: 338288
NORTHING: 6250632
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 84944.02
DATE: 24 - 25/8/2017
SHEET 3 **OF** 3

[illegible]

RIG: DT250

DRILLER: GM

LOGGED: JN

CASING: HW to 5.5m

TYPE OF BORING: Hand tools to 1.0m; Solid flight auger (TC-bit) to 5.5m; Rotary (water) to 5.6m; NMLC-Coring to 28.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 5.5m (screen 5.5-2.5m; blank 2.5-0.0m; gravel to 2.0m; bentonite to 0.3m; backfill to 0.2m; gatic cover; concrete plug

SAMPLING & IN SITU TESTING LEGEND

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



Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.1 AHD
EASTING: 338314
NORTHING: 6250634
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 84944.02
DATE: 21 - 24/8/2017
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
34	0.06	PAVERS																A			
	0.1	FILLING - yellow fine to medium grained sand filling, humid																A			
	0.15																				
	0.2	CONCRETE PAVERS																			
		FILLING - light grey, medium grained sand filling, damp																A			
1		FILLING - grey silty sand filling with some tree roots and gravel, damp																S			1,1,1 N = 2
33	1.3																				
	1.4	FILLING - light grey, medium grained sand filling, damp																			
		FILLING - brown, medium grained sand filling, damp																			
2																					
32																					
	2.5	SAND - loose, light grey, medium grained sand, damp																S			1,1,1 N = 2
3																					
31																					
4																					
30																		S			2,3,4 N = 7
5																					
29																					
	5.5	SAND - medium dense, yellow, medium grained sand, damp																S			3,8,7 N = 15
6																					
28																					
7		- becoming dense to very dense																S			9,15,18 N = 33
27																					
8																					
26																					
9																		S			12,25 refusal
25																					
10.0																					

Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0° - 10°

Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0° - 10°

RIG: DT250

DRILLER: GM

LOGGED: JN

CASING: HW to 5.5m; HQ to 10.0m

TYPE OF BORING: Hand tools to 0.8m; Solid flight auger (TC-bit) to 5.5m; Rotary (mud) to 10.0m; NMLC-Coring to 28.0m

WATER OBSERVATIONS: No free groundwater observed 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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.1 AHD
EASTING: 338314
NORTHING: 6250634
DIP/AZIMUTH: 90°/-

BORE No: 203
PROJECT No: 84944.02
DATE: 21 - 24/8/2017
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
24		SANDSTONE - low then medium strength, moderately weathered, fractured, white and red fine to medium grained sandstone with traces of extremely low strength bands														10.16m: Cs, 10mm 10.28m: B0° - 10°, un, ro, cly, 5mm					PL(A) = 0.3
11	10.9	SANDSTONE - medium strength, slightly weathered then fresh, slightly fractured and unbroken, light grey, medium grained sandstone with some carbonaceous laminations and traces of extremely low strength bands and very low strength decomposed seams														11.05-11.18m: J70°, pl, ro, cln 11.2m: B10°, pl, ro, cln	C	100	100		PL(A) = 0.63 11.74-11.92m: UCS Sample
22	12															12.53m: B5°, pl, ro, cly, 2mm					PL(A) = 0.43
21	13																				PL(A) = 0.43
20	14																C	100	99		PL(A) = 0.47
19	15															14.73m: B5°, pl, ro, cly, 2mm					PL(A) = 0.87
18	16															15.72, 15.75, 15.82m: J70° - 90°, cu, he					PL(A) = 0.51
17	17															16.62m: J30°, cu, ro, cln					
16	18															18.1-18.3m: J60° - 90°, un, ro, partially he 18.47m: Cs, 10mm	C	100	100		PL(A) = 0.48
15	19																				PL(A) = 0.74

RIG: DT250

DRILLER: GM

LOGGED: JN

CASING: HW to 5.5m; HQ to 10.0m

TYPE OF BORING: Hand tools to 0.8m; Solid flight auger (TC-bit) to 5.5m; Rotary (mud) to 10.0m; NMLC-Coring to 28.0m

WATER OBSERVATIONS: No free groundwater observed 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	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)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.1 AHD
EASTING: 338314
NORTHING: 6250634
DIP/AZIMUTH: 90°/-

BORE No: 203
PROJECT No: 84944.02
DATE: 21 - 24/8/2017
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
14																					
20.7		SANDSTONE - medium then low strength, slightly then moderately weathered, fractured, light grey and red, medium to coarse grained sandstone with some extremely low strength bands and some very low strength decomposed seams																			
21																					
22																					
22.66																					
23		SANDSTONE - high strength, fresh, slightly fractured, light grey fine to medium grained sandstone with some carbonaceous laminations																			
24																					
24.65																					
25																					
26		SANDSTONE - medium strength, fresh, unbroken then slightly fractured, light grey medium grained sandstone with a trace of carbonaceous laminations and some extremely low strength bands																			
27																					
27.2																					
28																					
28.0		Bore discontinued at 28.0m - limit of investigation																			
29																					

RIG: DT250

DRILLER: GM

LOGGED: JN

CASING: HW to 5.5m; HQ to 10.0m

TYPE OF BORING: Hand tools to 0.8m; Solid flight auger (TC-bit) to 5.5m; Rotary (mud) to 10.0m; NMLC-Coring to 28.0m

WATER OBSERVATIONS: No free groundwater observed 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	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)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.1 AHD
EASTING: 338340
NORTHING: 6250642
DIP/AZIMUTH: 90°/--

BORE No: 204
PROJECT No: 84944.02
DATE: 16 - 18/8/2017
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
34	0.07	CONCRETE PAVERS																				
	0.2	FILLING - yellow fine to medium grained sand filling, damp																A				
		FILLING - grey silty sand filling with a trace of roots and gravel, and some glass fragments, damp																A				
1	1.2	FILLING - yellow-brown, medium grained sand filling, damp																S				1,2,2 N = 4
	1.5	FILLING - grey, medium grained sand, damp																				
2																						
	2.7	FILLING - light grey, medium grained sand filling, damp																S				3,3,6 N = 9
3																						
	4.0	SAND - loose, yellow medium grained sand, moist																S				3,3,4 N = 7
4																						
5																						
	5.5	SAND - medium dense then dense, yellow medium grained sand																S				5,9,11 N = 20
6																						
7																		S				6,10,15 N = 25
8																						
																		S				8,13,13 N = 26
9																						

RIG: DT250

DRILLER: GM/SS

LOGGED: JN

CASING: HW to 7.5m; HQ to 17.6m

TYPE OF BORING: Solid flight auger (TC-bit) to 8.5m; Rotary (mud) to 19.8m; NMLC-Coring to 28.2m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 28.2m (blank 28.2-19.2m; screen 19.2-16.2m; blank 16.2-0.0m; cave-in to 10.0m; bentonite to 9.5m; gravel to 0.2m; gatic cover; concrete plug

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.1 AHD
EASTING: 338340
NORTHING: 6250642
DIP/AZIMUTH: 90°/-

BORE No: 204
PROJECT No: 84944.02
DATE: 16 - 18/8/2017
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
24		SAND - medium dense then dense, yellow medium grained sand (continued)																S			13,19,25/130mm refusal
11																					
23																		S			12,20,21 N = 41
12																					
22																					
13																		S			16,23,23 N = 46
21																					
14																		S			10,13,15 N = 28
20																					
15																					
19																					
16																		S			14,16,22 N = 38
18																					
17																					
17																					
18																		S			14,21,23 N = 44
16																					
19																					
15																		S			15,15,9 N = 24
19.4		SANDSTONE - extremely low strength, orange, fine to medium grained sandstone with some medium strength iron-cemented																S			
19.8																					
																		C	100	84	

Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0° - 10°

RIG: DT250

DRILLER: GM/SS

LOGGED: JN

CASING: HW to 7.5m; HQ to 17.6m

TYPE OF BORING: Solid flight auger (TC-bit) to 8.5m; Rotary (mud) to 19.8m; NMLC-Coring to 28.2m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 28.2m (blank 28.2-19.2m; screen 19.2-16.2m; blank 16.2-0.0m; cave-in to 10.0m; bentonite to 9.5m; gravel to 0.2m; gatic cover; concrete plug

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.1 AHD
EASTING: 338340
NORTHING: 6250642
DIP/AZIMUTH: 90°/-

BORE No: 204
PROJECT No: 84944.02
DATE: 16 - 18/8/2017
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
14		bands																			20.10-20.28m: UCS Sample
	20.8	SANDSTONE - medium strength, highly weathered, fractured, orange and red, medium and medium to coarse grained sandstone with some extremely low strength bands and some low strength decomposed seams (continued)																C	100	84	PL(A) = 0.66
	21	SANDSTONE - medium strength, moderately then slightly weathered, slightly fractured, light grey and orange, medium and medium to coarse grained sandstone																			PL(A) = 0.59
	22																				PL(A) = 0.67
	23																	C	100	100	
	24																				PL(A) = 0.69
	24.72	SANDSTONE - medium strength, fresh, fractured, light grey, medium grained sandstone with some carbonaceous laminations and some extremely low strength bands																C	91	85	PL(A) = 0.75
	25																				PL(A) = 0.61
	26																				
	26.75	SANDSTONE - medium strength, slightly weathered, unbroken, light grey and brown, fine to medium grained sandstone																C	100	86	PL(A) = 0.13
	27																				PL(A) = 0.73
	28																				
	28.2	Bore discontinued at 28.2m - limit of investigation																			
	29																				

RIG: DT250

DRILLER: GM/SS

LOGGED: JN

CASING: HW to 7.5m; HQ to 17.6m

TYPE OF BORING: Solid flight auger (TC-bit) to 8.5m; Rotary (mud) to 19.8m; NMLC-Coring to 28.2m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 28.2m (blank 28.2-19.2m; screen 19.2-16.2m; blank 16.2-0.0m; cave-in to 10.0m; bentonite to 9.5m; gravel to 0.2m; gatic cover; concrete plug

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 27.4 AHD
EASTING: 338392
NORTHING: 6250662
DIP/AZIMUTH: 90°/-

BORE No: 205
PROJECT No: 84944.02
DATE: 15 - 16/8/2017
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
27	0.02	PAVERS																								
		FILLING - yellow-brown, fine to medium grained sand filling with some fine igneous gravel, damp																					A			
1	0.8	FILLING - grey silty sand filling, damp																					A			
26	1.3	FILLING - light grey, medium grained sand filling, damp																					S			1,1,3 N = 4
2																										
25	2.8	SAND - medium dense, orange-brown, medium grained sand, damp																					S			4,5,5 N = 10
3	3.5	SAND - dense, grey, medium grained sand, moist																								
24	4.2	SAND - medium dense, yellow, medium grained sand																					S			28,25/130mm refusal
4																										
5																										
6																							S			7,10,15 N = 25
7																										
20	7.0m: becoming dense to very dense																						S			10,13,17 N = 30
8																										
19																										
9																							S			10,14,16 N = 30
18																										

RIG: DT250

DRILLER: GM

LOGGED: JN

CASING: HW to 4.0m; HQ to 13.0m

TYPE OF BORING: Solid flight auger (TC-bit) to 4.0m; Rotary (mud) to 20.5m; NMLC-Coring to 23.6m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 23.0m (blank 23.0-20.5m; screen 20.5-17.5m; blank 17.5-0.0m; cave-in to 13.0m; bentonite to 13.5m; gravel to 0.1m; gatic cover; concrete plug

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 27.4 AHD
EASTING: 338392
NORTHING: 6250662
DIP/AZIMUTH: 90°/--

BORE No: 205
PROJECT No: 84944.02
DATE: 15 - 16/8/2017
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High		Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %
17		SAND - medium dense, yellow, medium grained sand (continued)																								13,15,23 N = 38	
11																											
16																											
12																											11,24,31 N = 55
15																											
13																											
14																											11,14,16 N = 30
14																											
13																											
15																											14,14,19 N = 33
12																											
16																										18,27 refusal	
17																											
10																											
18																										17,25/130mm refusal	
19																											
19.25		SAND - dense, light grey, medium grained sand																								12,14,23 N = 37	
8																											

RIG: DT250

DRILLER: GM

LOGGED: JN

CASING: HW to 4.0m; HQ to 13.0m

TYPE OF BORING: Solid flight auger (TC-bit) to 4.0m; Rotary (mud) to 20.5m; NMLC-Coring to 23.6m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 23.0m (blank 23.0-20.5m; screen 20.5-17.5m; blank 17.5-0.0m; cave-in to 13.0m; bentonite to 13.5m; gravel to 0.1m; gatic cover; concrete plug

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 27.4 AHD
EASTING: 338392
NORTHING: 6250662
DIP/AZIMUTH: 90°/-

BORE No: 205
PROJECT No: 84944.02
DATE: 15 - 16/8/2017
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
	7	SAND - dense, light grey, medium grained sand (continued)																			
	20.5 20.62	SANDSTONE - very low strength, slightly weathered, fractured, light grey, fine to medium grained sandstone with some carbonaceous laminations																			PL(A) = 0.07
	21	SANDSTONE - medium strength, slightly weathered, light grey and orange, medium grained sandstone with traces of extremely low strength bands and some very low strength seams																C	100	92	PL(A) = 0.91 PL(A) = 0.87
	22																				22.78-23.00m: UCS sample
	23																				PL(A) = 0.74
	23.6	Bore discontinued at 23.6m - limit of investigation																			
	24																				
	25																				
	26																				
	27																				
	28																				
	29																				

RIG: DT250

DRILLER: GM

LOGGED: JN

CASING: HW to 4.0m; HQ to 13.0m

TYPE OF BORING: Solid flight auger (TC-bit) to 4.0m; Rotary (mud) to 20.5m; NMLC-Coring to 23.6m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Standpipe installed to 23.0m (blank 23.0-20.5m; screen 20.5-17.5m; blank 17.5-0.0m; cave-in to 13.0m; bentonite to 13.5m; gravel to 0.1m; gatic cover; concrete plug)

SAMPLING & IN SITU TESTING LEGEND

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

TEST PIT LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.1 AHD
EASTING: 338315
NORTHING: 6250632

PIT No: 206
PROJECT No: 84944.02
DATE: 28/8/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
34.05	0.05	PAVERS										
34.07	0.07	FILLING - poorly compacted, grey cement stabilised sand filling, humid										
34.12	0.12	FILLING - poorly compacted, yellow medium grained sand filling, humid										
		FILLING - poorly compacted, grey medium grained sand filling with sandstone gravel and ceramic pipe pieces, damp										
33.0	1.0											
32.5	1.5	Pit discontinued at 1.5m - limit of reach of excavator										
32.0	2.0											
31.0	3.0											
30.0	4.0											

RIG: 1.8t excavator - 300mm bucket to 1.5m

LOGGED: JN

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 33.5 AHD
EASTING: 338336
NORTHING: 6250644

PIT No: 207
PROJECT No: 84944.02
DATE: 28/8/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
	0.03	CONCRETE PAVERS							
	0.2	CONCRETE							
		FILLING - poorly compacted, grey and brown sand filling with sandstone gravel and tree roots, humid							
	1.4	Pit discontinued at 1.4m - limit of reach of excavator							

RIG: 1.8t excavator - 300mm bucket to 1.4m

LOGGED: JN

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 30.5 AHD
EASTING: 338371
NORTHING: 6250655
DIP/AZIMUTH: 90°/-

BORE No: 208
PROJECT No: 84944.02
DATE: 18 - 19/9/2017
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
	0.05	ASPHALT																								
	0.1	FILLING - dark grey roadbase gravel filling, damp																				A				
30																						A				
	0.8	FILLING - grey sand filling with some fine to medium sandstone gravel, damp																								
1		SAND - medium dense, yellow medium grained sand, humid																				A				
29																						S				3,4,5 N = 9
2																										
28																										
3		3.0m: becoming moist																				S				3,5,8 N = 13
27																										
4																										
26																						S				5,6,8 N = 14
5																										
25																										
6																						S				6,8,11 N = 19
24																										
7																										
23																										
8																										
22																						S				8,9,12 N = 21
9																										
21																										

RIG: Explora 130 **DRILLER:** JS **LOGGED:** JN/SI **CASING:** HW to 5.65m; HQ to 18.35m
TYPE OF BORING: Solid flight auger (TC-bit) to 5.5m; Rotary (mud) to 18.35m; NMLC-Coring to 25.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 30.5 AHD
EASTING: 338371
NORTHING: 6250655
DIP/AZIMUTH: 90°/--

BORE No: 208
PROJECT No: 84944.02
DATE: 18 - 19/9/2017
SHEET 2 OF 3

[illegible]

RIG: Explora 130 **DRILLER:** JS **LOGGED:** JN/SI **CASING:** HW to 5.65m; HQ to 18.35m
TYPE OF BORING: Solid flight auger (TC-bit) to 5.5m; Rotary (mud) to 18.35m; NMLC-Coring to 25.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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



BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 30.5 AHD
EASTING: 338371
NORTHING: 6250655
DIP/AZIMUTH: 90°/-

BORE No: 208
PROJECT No: 84944.02
DATE: 18 - 19/9/2017
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing			
			EW	HW	SW	FS		Ex Low	Very Low	Low	Medium	High			Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
	20.35	SANDSTONE - very low and very low to low strength, highly weathered, fractured and slightly fractured, light grey-brown medium grained sandstone with medium strength band (continued)												20m: Ds, 50mm	C	77	60	PL(A) = 0.43	
	20.6													20.1-20.3m: J70°- 90°, un, ro, cln 20.3m: Ds, 50mm 20.35m: CORE LOSS: 250mm 20.6m: J70°, un, ro, cln 20.9m: B0°- 5°, un, ro, cln					
	21	SANDSTONE - medium strength, slightly weathered, slightly fractured, light grey and brown medium grained sandstone with some extremely low and very low strength bands												21.5m: J80°, pl, ro, cln 21.6m: B10°, pl, ro, cln	C	92	87	PL(A) = 0.52	
	22																		
	23													22.4m: Cs, 10mm 22.5m: Cs, 20mm				PL(A) = 0.48	
	24													22.85m: J50°, pl, cly, 10mm 23.15-23.7m: B (x3) 0°- 5°, cly, 10mm				PL(A) = 0.46	
	25													23.75m: J70°, he/ti	C	100	79	PL(A) = 0.52 24.00-24.20m: UCS Sample	
	25.0													24.15m: J50°, pl, ro, fe 24.5m: J45°, pl, ro, cln					
	25.0	Bore discontinued at 25.0m - limit of investigation																	
	26																		
	27																		
	28																		
	29																		

RIG: Explora 130 **DRILLER:** JS **LOGGED:** JN/SI **CASING:** HW to 5.65m; HQ to 18.35m
TYPE OF BORING: Solid flight auger (TC-bit) to 5.5m; Rotary (mud) to 18.35m; NMLC-Coring to 25.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.0 AHD
EASTING: 338329
NORTHING: 6250630
DIP/AZIMUTH: 90°/--

BORE No: 210
PROJECT No: 84944.02
DATE: 19 - 20/9/2017
SHEET 1 OF 3

[illegible]

CASING: HW to 9.0m; HQ to 18.5m

TYPE OF BORING: Solid flight auger (TC-bit) to 9.0m; Rotary (mud) to 18.75m; NMLC-Coring to 18.75m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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



BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.0 AHD
EASTING: 338329
NORTHING: 6250630
DIP/AZIMUTH: 90°/--

BORE No: 210
PROJECT No: 84944.02
DATE: 19 - 20/9/2017
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength						Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High	Very High		Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
24		SAND - yellow medium grained sand, moist (continued)																								
23	11																									
22	12																									
21	13																									
20	14																									
19	15																									
18	16																									
17	17																									
16	18																									
15	18.75	SANDSTONE - medium strength highly to moderately weathered, fractured and slightly fractured, light grey-brown medium grained sandstone																								
19.1	19.1	19.1-19.6m: very low strength																								
19.27	19.27																									
Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0° - 10°																										
19.1m: CORE LOSS: 170mm 19.27-19.4m: Ds 19.5m: B10°, fe 19.55m: J55°, he/ti 19.62m: B0°, cly, 20mm																C		88	48	PL(A) = 0.4 PL(A) = 0.5						

RIG: Explora 130

DRILLER: JS

LOGGED: JN/SI

CASING: HW to 9.0m; HQ to 18.5m

TYPE OF BORING: Solid flight auger (TC-bit) to 9.0m; Rotary (mud) to 18.75m; NMLC-Coring to 18.75m

WATER OBSERVATIONS: No free groundwater observed 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	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	S	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.0 AHD
EASTING: 338329
NORTHING: 6250630
DIP/AZIMUTH: 90°/--

BORE No: 210
PROJECT No: 84944.02
DATE: 19 - 20/9/2017
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault
14	20.1	Bore discontinued at 20.1m - limit of investigation														19.87m: J80°, pl, ro, fe 19.92m: J70°, un, ro, fe 20.0-20.07m: fg 20.07m: J50°, pl, ro, fe				
13	21																			
12	22																			
11	23																			
10	24																			
9	25																			
8	26																			
7	27																			
6	28																			
5	29																			

RIG: Explora 130 **DRILLER:** JS **LOGGED:** JN/SI **CASING:** HW to 9.0m; HQ to 18.5m
TYPE OF BORING: Solid flight auger (TC-bit) to 9.0m; Rotary (mud) to 18.75m; NMLC-Coring to 18.75m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 33.7 AHD
EASTING: 338331
NORTHING: 6250647
DIP/AZIMUTH: 90°/--

BORE No: 211
PROJECT No: 84944.02
DATE: 19 - 20/9/2017
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding	J - Joint	S - Shear	F - Fault	Type
		SOIL NOT LOGGED																					
	33																						
	32																						
	31																						
	30																						
	29																						
	28																						
	27																						
	26																						
	25																						
	24																						

RIG: DT250 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 9.0m; HQ to 15.0m
TYPE OF BORING: Solid flight auger (TC-bit) to 9.0m; Rotary (mud) to 18.9m; NMLC-Coring to 20.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 33.7 AHD
EASTING: 338331
NORTHING: 6250647
DIP/AZIMUTH: 90°/--

BORE No: 211
PROJECT No: 84944.02
DATE: 19 - 20/9/2017
SHEET 2 OF 2

[illegible]

RIG: DT250 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 9.0m; HQ to 15.0m
TYPE OF BORING: Solid flight auger (TC-bit) to 9.0m; Rotary (mud) to 18.9m; NMLC-Coring to 20.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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



BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.3 AHD
EASTING: 338324
NORTHING: 6250648
DIP/AZIMUTH: 90°/--

BORE No: 212
PROJECT No: 84944.02
DATE: 18/9/2017
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
34		SOIL NOT LOGGED																								
1																										
33																										
2																										
32																										
3																										
31																										
4																										
30																										
5																										
29																										
6																										
28																										
7																										
27																										
8																										
26																										
9																										
25																										

RIG: DT250 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 8.0m; HQ to 14.2m
TYPE OF BORING: Hand tools to 0.8m; Solid flight auger (TC-bit) to 8.5m; Rotary (mud) to 14.25m; NMLC-Coring to 15.8m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Additional Investigation
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.3 AHD
EASTING: 338324
NORTHING: 6250648
DIP/AZIMUTH: 90°/--

BORE No: 212
PROJECT No: 84944.02
DATE: 18/9/2017
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
24		SOIL NOT LOGGED <i>(continued)</i>																			
11																					
23																					
12																					
22																					
13																					
21																					
14																					
20	14.25	SANDSTONE - low then medium strength, slightly weathered, slightly fractured, light grey-brown medium grained sandstone																			PL(A) = 0.25
15																					PL(A) = 0.6
19																					
15.8		Bore discontinued at 15.8m - limit of investigation																			
16																					
17																					
17																					
18																					
16																					
19																					
15																					

RIG: DT250 **DRILLER:** GM **LOGGED:** SI **CASING:** HW to 8.0m; HQ to 14.2m
TYPE OF BORING: Hand tools to 0.8m; Solid flight auger (TC-bit) to 8.5m; Rotary (mud) to 14.25m; NMLC-Coring to 15.8m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BORE:101

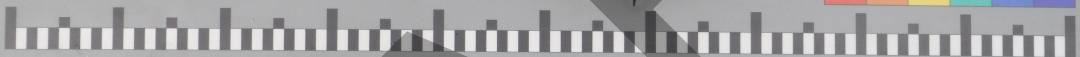
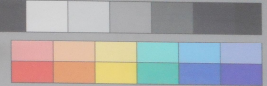
PROJECT: 84944.01

APR 2017



Douglas Partners
Geotechnics | Environment | Groundwater

Project No: 84944.01
BH ID: 101
Depth: 14.35 - 17.40m
Core Box No.: 1



14.35 - 17.4m

BORE: 102

PROJECT: 84944.01

APR 2017



Project No: 84944.01

BH ID: 102

Depth: 11.60 - 16.00m

Core Box No.: 1



11.6 - 16.0m

BORE: 102

PROJECT: 84944.01

APR 2017



Project No: 84944.01

BH ID: 102

Depth: 16.00 - 17.45m

Core Box No.: 2



16.0 - 17.45m

DOUGLAS PARTNERS PTY LTD
CRANBROOK SCHOOL, BELLEVUE HILL

BORE 103

PROJECT 84944.01

April 2017



4.90 – 9.00 m

DOUGLAS PARTNERS PTY LTD
CRANBROOK SCHOOL, BELLEVUE HILL

BORE 103

PROJECT 84944.01

April 2017



9.00 – 14.00 m

BORE: 104

PROJECT: 84944.01

APR 2017



Project No: 84944.01
BH ID: 104
Depth: 6.80 - 10.00 m
Core Box No.: 1



6.8 - 10.0 m

BORE: 104

PROJECT: 84944.01

APR 2017



Project No: 84944.01
BH ID: 104
Depth: 10.00 - 12.40
Core Box No.: 2



10.0 - 12.4 m

BORE: 105

PROJECT: 84944.01

APR 2017



Project No: 84944.01

BH ID: 105

Depth: 13.00 - 15.50 m

Core Box No.: 2



4.1 - 8.0m

BORE: 105

PROJECT: 84944.01

APR 2017



Project No: 84944.01

BH ID: 105

Depth: 8.00 - 13.00 m

Core Box No.: 2



8.0 - 13.0m

BORE:105

PROJECT: 84944.01

APR 2017



Douglas Partners
Geotechnics | Environment | Groundwater

Project No: 84944.01
BH ID: 105
Depth:
Core Box No.: 2



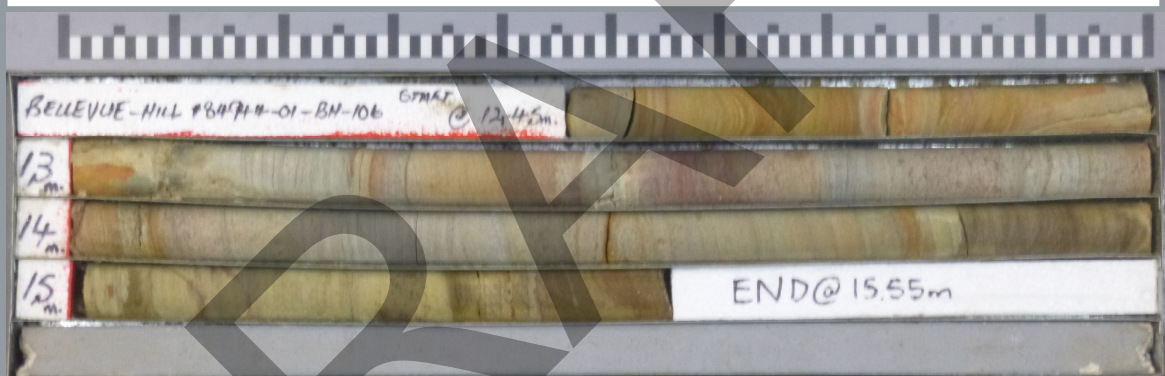
13.0 – 15.48m

DOUGLAS PARTNERS PTY LTD
CRANBROOK SCHOOL, BELLEVUE HILL

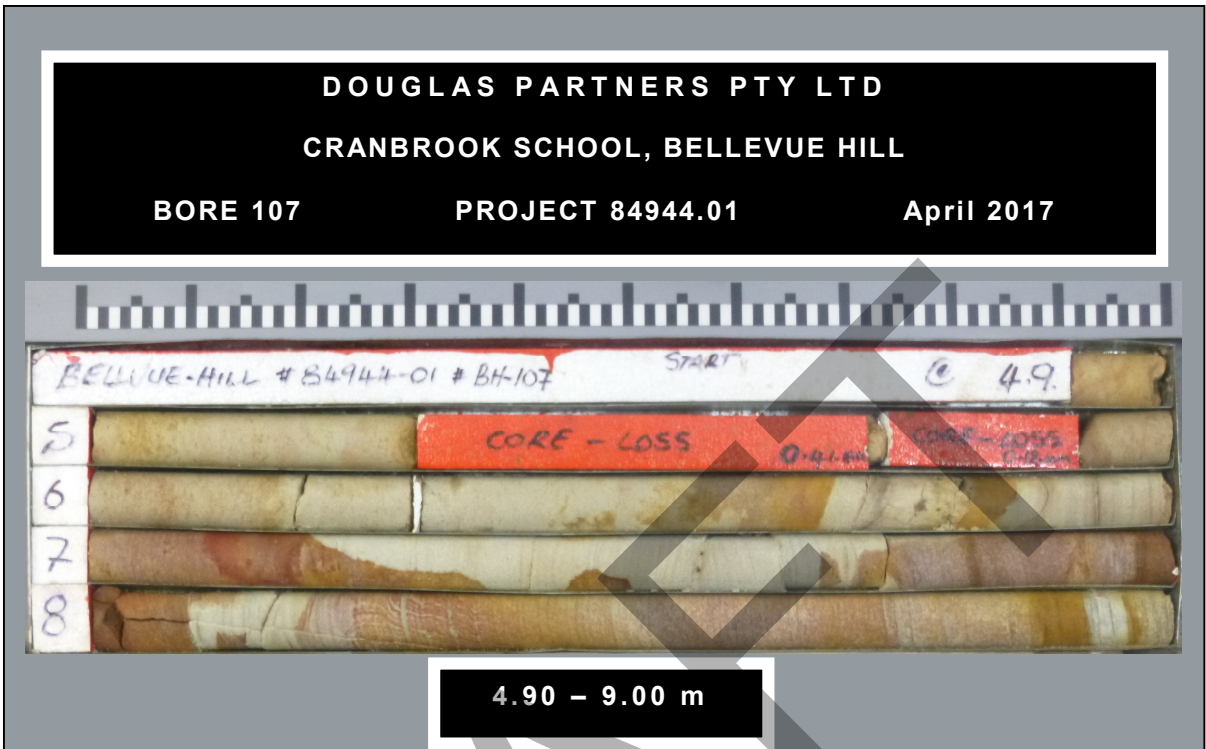
BORE 106

PROJECT 84944.01

APRIL 2017



12.45 – 15.55 m



DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 202

PROJECT 84944.02

AUGUST 2017



5.60 – 10.00 m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 202

PROJECT 84944.02

AUGUST 2017



10.00 – 15.00 m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 202

PROJECT 84944.02

AUGUST 2017



15.00 – 20.00 m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 202

PROJECT 84944.02

AUGUST 2017



20.00 – 25.00 m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 202

PROJECT 84944.02

AUGUST 2017



25.00 – 28.10 m

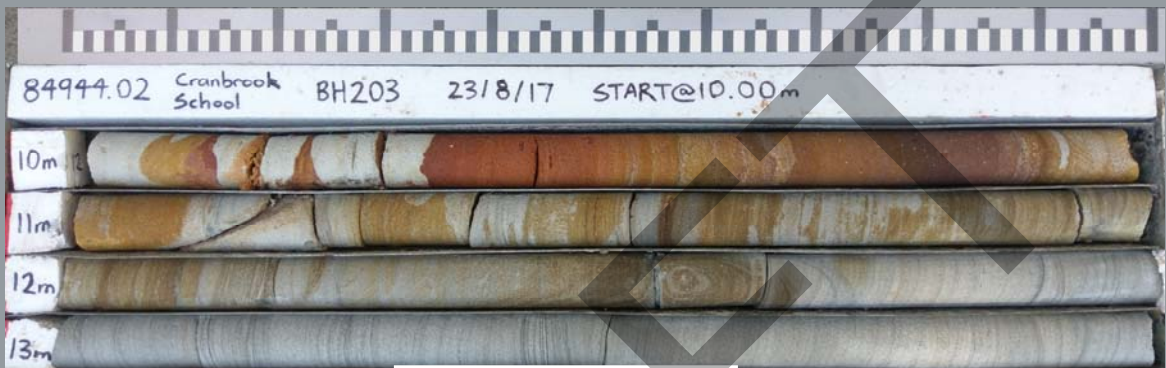
DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 203

PROJECT 84944.02

AUGUST 2017



10.00 – 14.00 m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 203

PROJECT 84944.02

AUGUST 2017



14.00 – 19.00 m

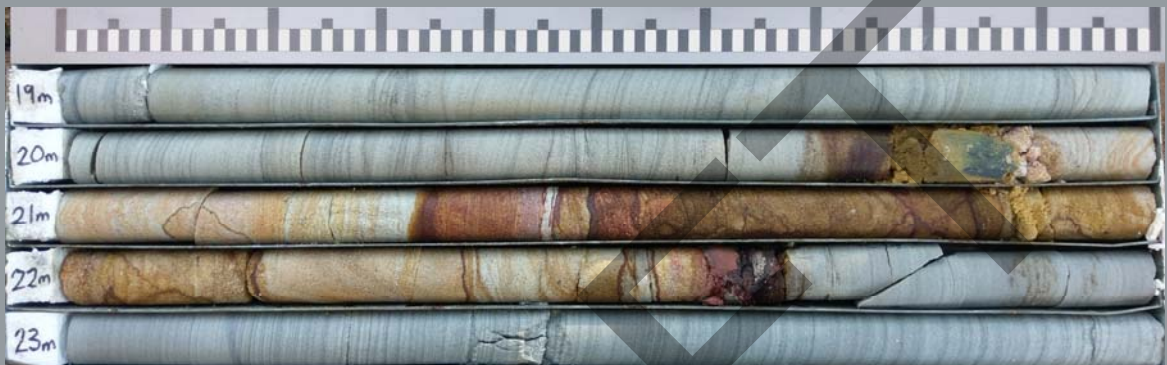
DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 203

PROJECT 84944.02

AUGUST 2017



19.00 – 24.00 m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 203

PROJECT 84944.02

AUGUST 2017



24.00 – 28.00 m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 204

PROJECT 84944.02

AUGUST 2017



19.80 – 24.00 m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 204

PROJECT 84944.02

AUGUST 2017



24.00 – 28.20 m

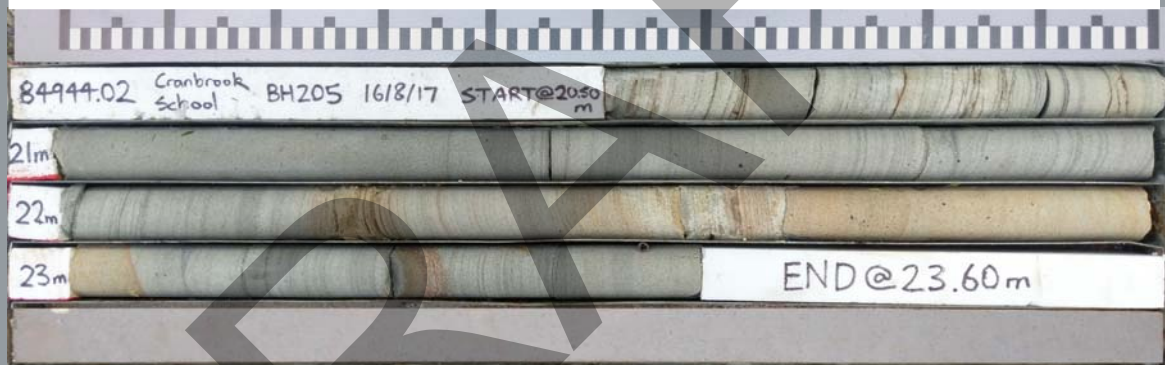
DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 205

PROJECT 84944.02

AUGUST 2017



20.50 – 23.60 m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 208

PROJECT 84944.02

SEPTEMBER 2017



18.35 – 23.00m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 208

PROJECT 84944.02

SEPTEMBER 2017



23.00 – 25.00m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 210

PROJECT 84944.02

SEPTEMBER 2017



18.75 – 20.10m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 211

PROJECT 84944.02

SEPTEMBER 2017



18.9 – 20.0m

DOUGLAS PARTNERS PTY LTD

ADDITIONAL INVESTIGATION – CRANBROOK SCHOOL

BORE 212

PROJECT 84944.02

SEPTEMBER 2017



14.25 – 15.80m

Appendix D

2017 CPT Results

DRAFT

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL

PROJECT: CRANBROOK SCHOOL ECI

LOCATION: VICTORIA ROAD, BELLEVUE HILL

REDUCED LEVEL: 16.13

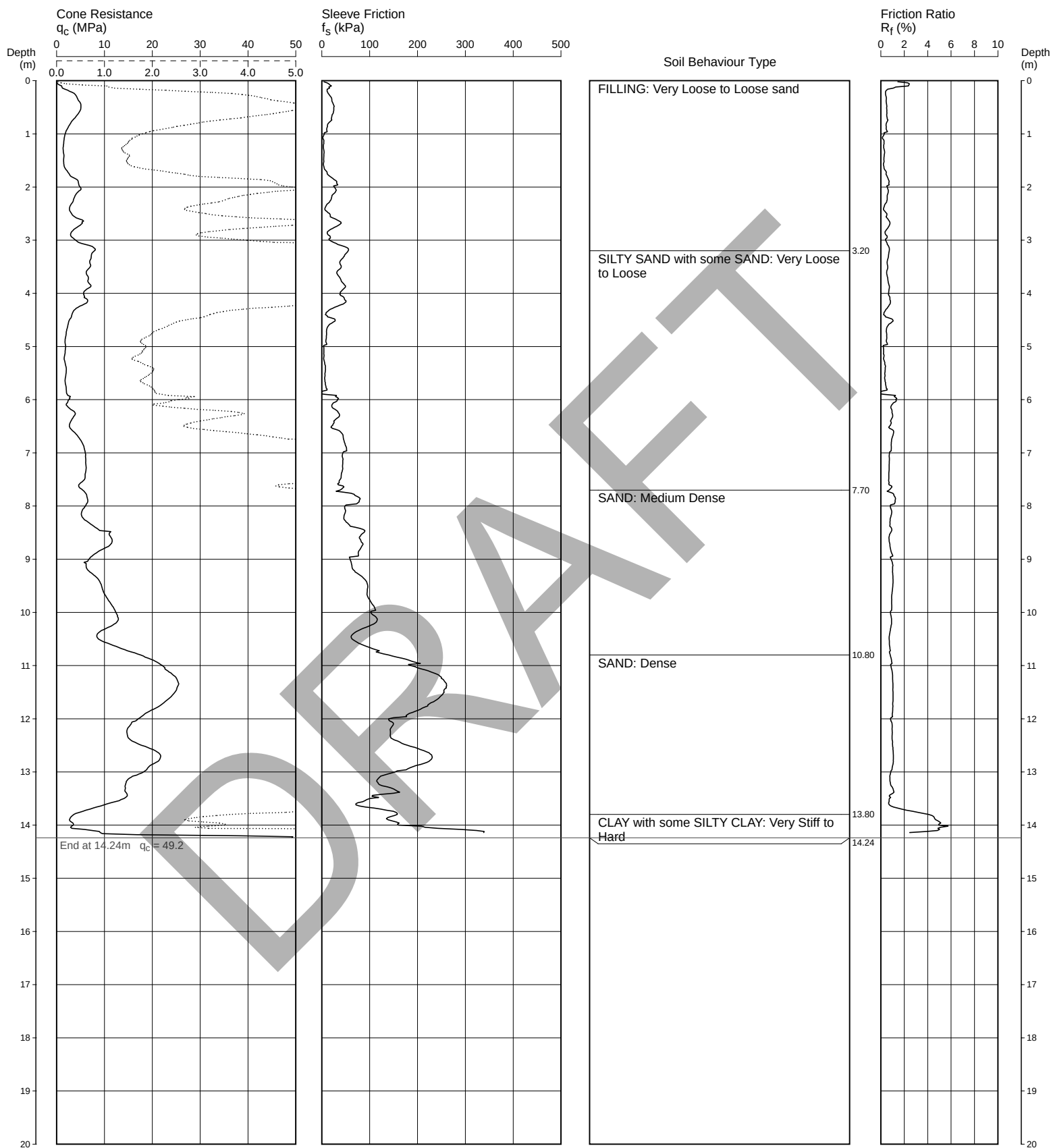
COORDINATES:

CPT 101

Page 1 of 1

DATE 12/04/2017

PROJECT No: 84944.01



REMARKS: TEST DISCONTINUED DUE TO CONE TIP REFUSAL;
GROUNDWATER WAS NOT OBSERVED DUE TO HOLE COLLAPSE AT 9.0 m DEPTH AFTER WITHDRAWAL OF RODS

PROJECT: CRANBROOK SCHOOL ECI

COORDINATES:

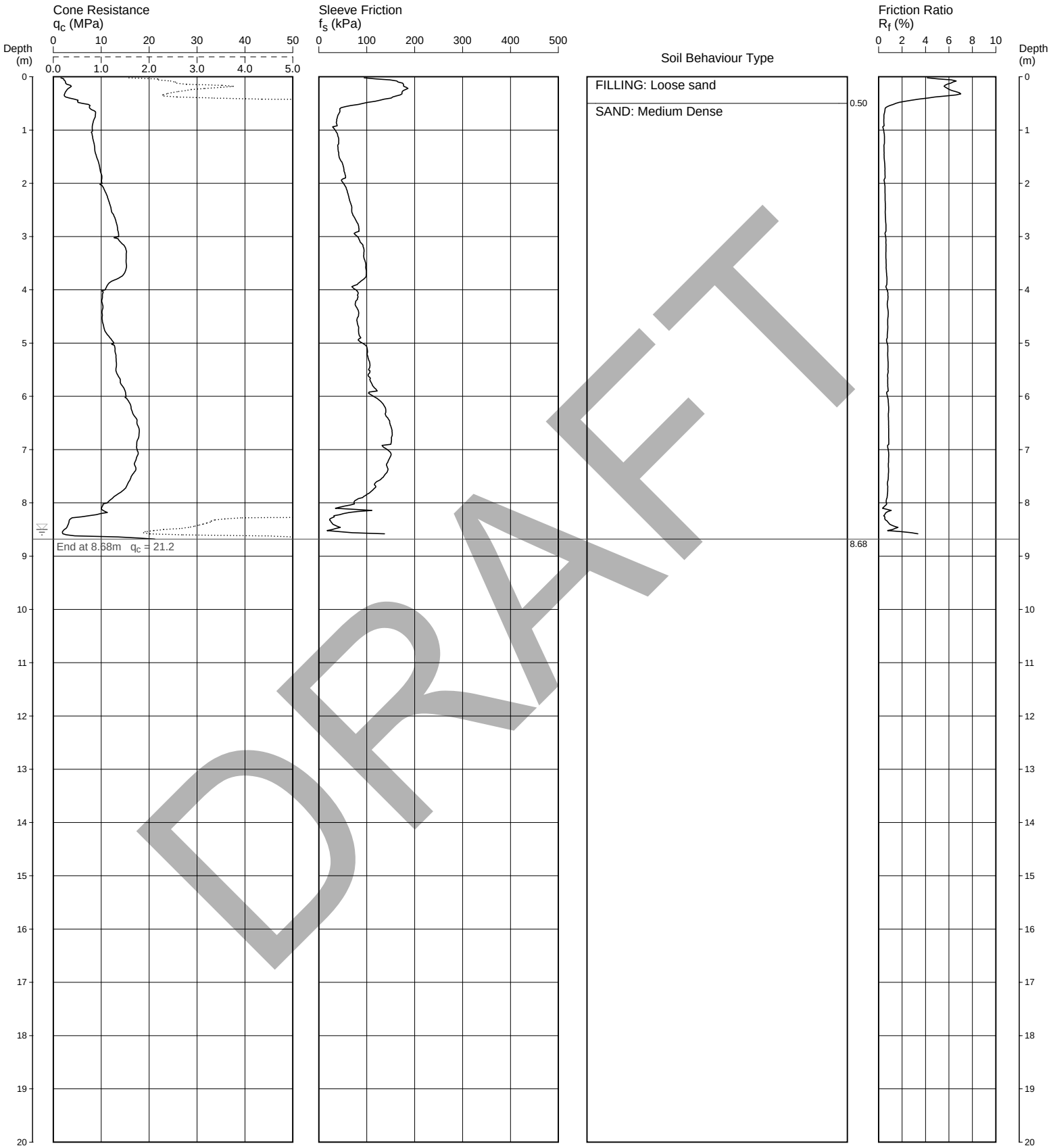
PROJECT No: 84944.01

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL
PROJECT: CRANBROOK SCHOOL ECI

LOCATION: VICTORIA ROAD, BELLEVUE HILL
REDUCED LEVEL: 16.75
COORDINATES:

CPT 103
Page 1 of 1
DATE 11/04/2017
PROJECT No: 84944.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE BENDING ON ROCK
GROUNDWATER WAS OBSERVED AT 8.5 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 8.50m depth (assumed)
File: P:\84944.01 - BELLEVUE HILL Cranbrook School ECI\4.0 Field Work\CPT Results\CPT 103.CP5
Cone ID: 120620 Type: I-CFYX-10

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL

PROJECT: CRANBROOK SCHOOL ECI

LOCATION: VICTORIA ROAD, BELLEVUE HILL

REDUCED LEVEL: 16.34

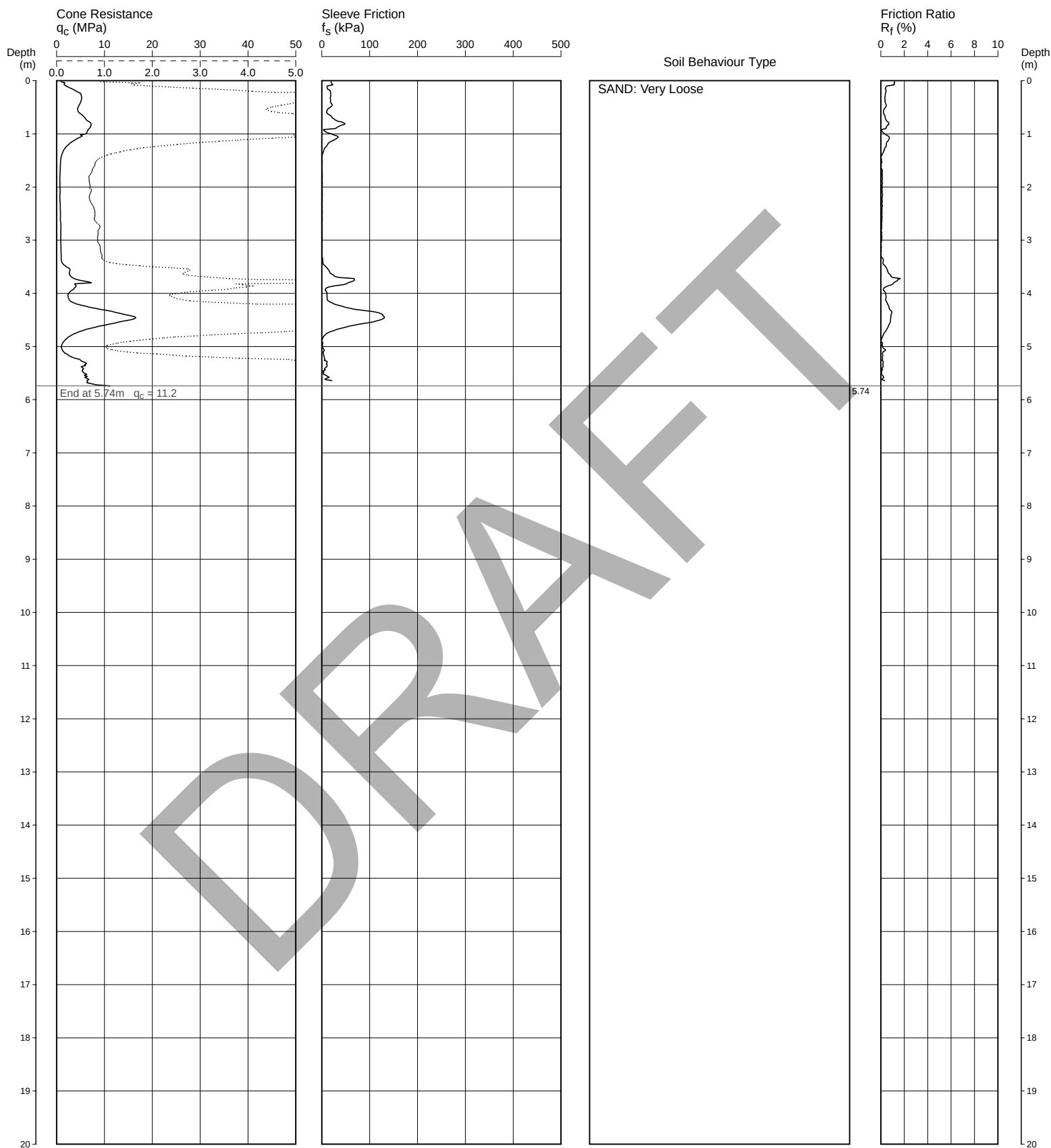
COORDINATES:

CPT 104

Page 1 of 1

DATE 12/04/2017

PROJECT No: 84944.01

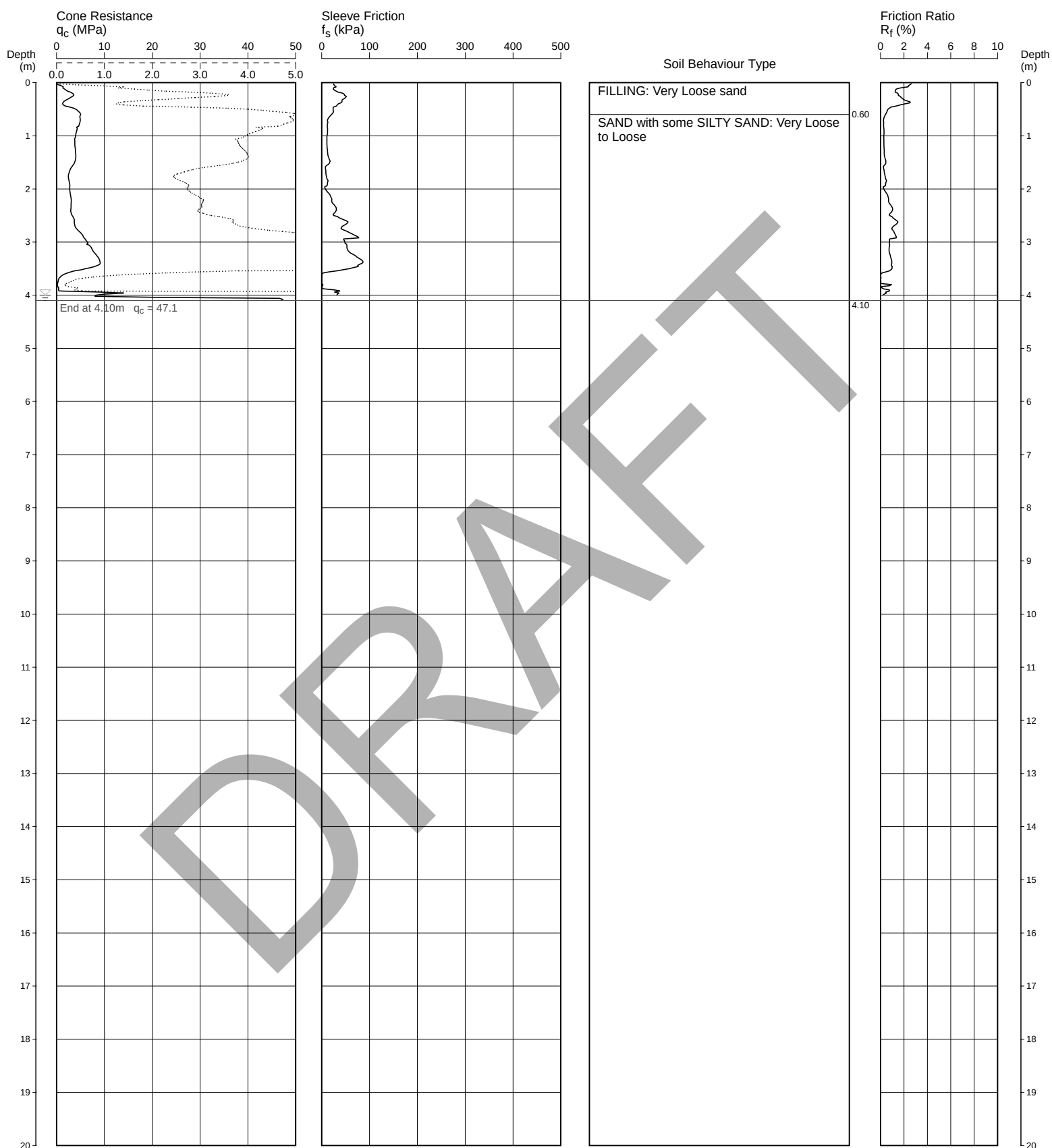


REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE BENDING IN POSSIBLE ROCK
NO GROUNDWATER WAS OBSERVED DUE TO HOLE COLLAPSE AT 4.2 m DEPTH AFTER WITHDRAWAL OF RODS

PROJECT: CRANBROOK SCHOOL ECI

COORDINATES:

PROJECT No: 84944.01



Douglas Partners
Geotechnics | Environment | Groundwater

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL

PROJECT: CRANBROOK SCHOOL ECI

LOCATION: VICTORIA ROAD, BELLEVUE HILL

REDUCED LEVEL: 16.44

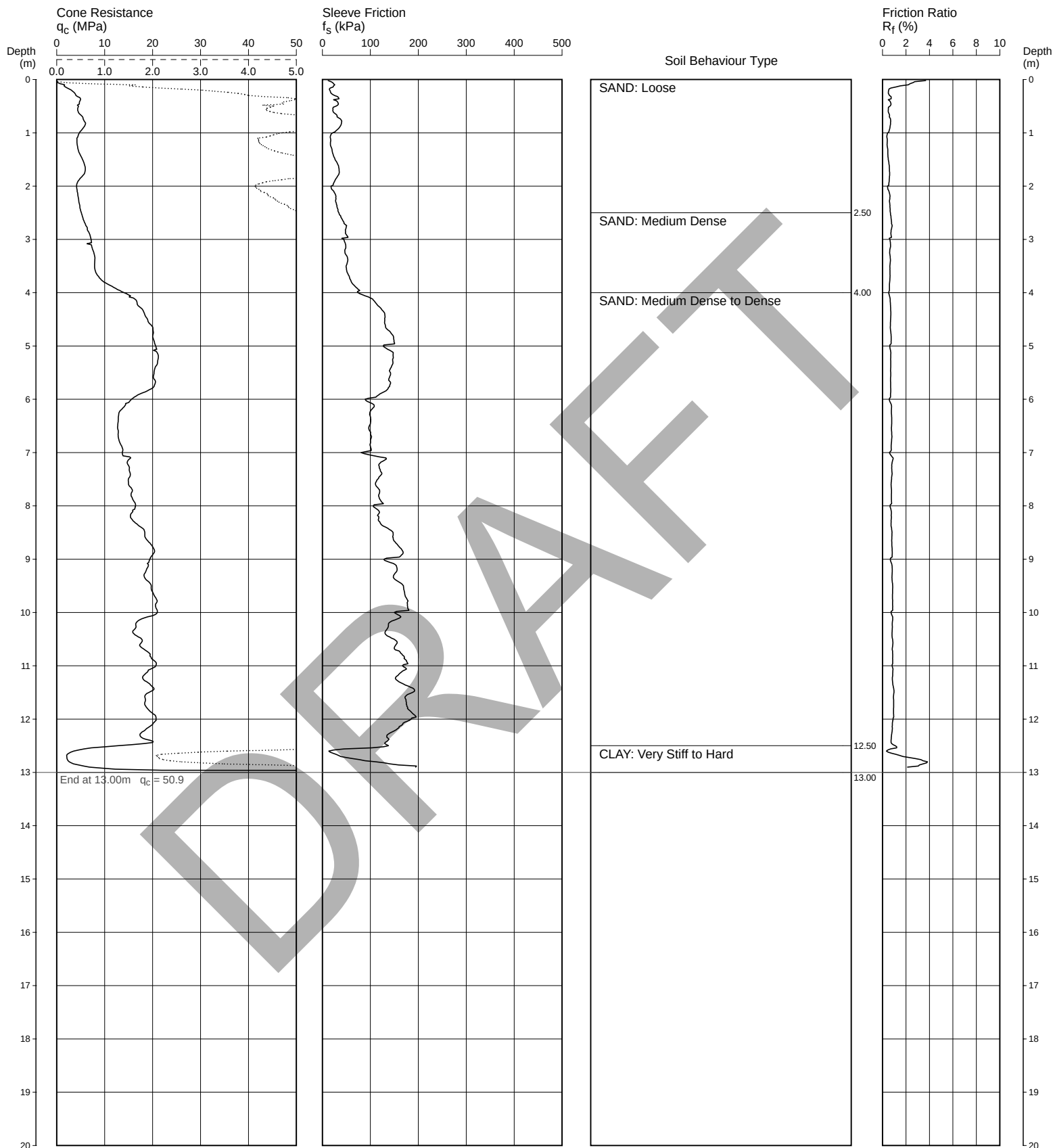
COORDINATES:

CPT 108

Page 1 of 1

DATE 11/04/2017

PROJECT No: 84944.01



REMARKS: TEST DISCONTINUED DUE TO CONE TIP REFUSAL;
NO GROUNDWATER WAS OBSERVED AFTER WITHDRAWAL OF RODS

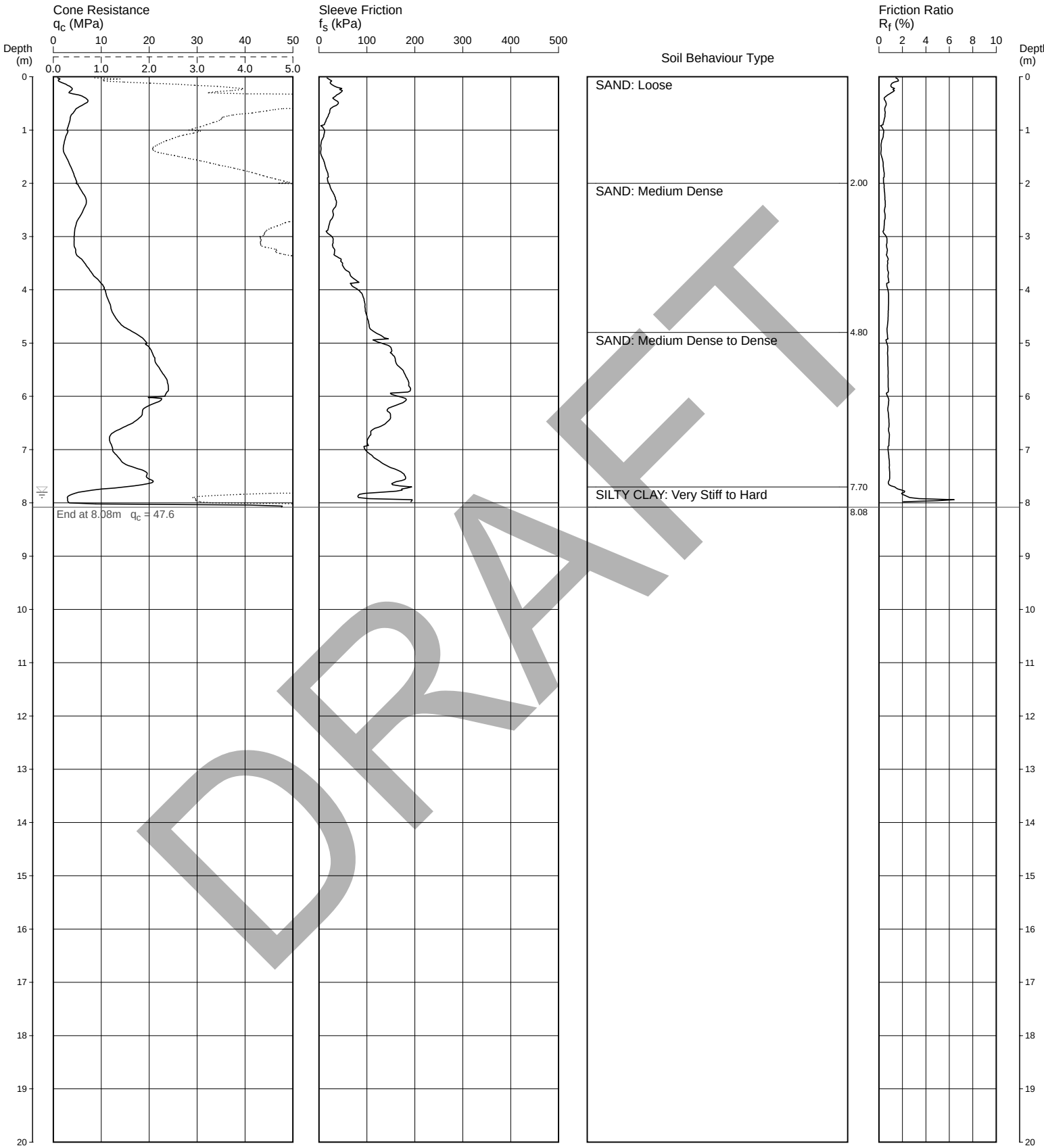
CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL
PROJECT: CRANBROOK SCHOOL ECI

LOCATION: VICTORIA ROAD, BELLEVUE HILL
REDUCED LEVEL: 16.51
COORDINATES:

CPT 109

Page 1 of 1
DATE 11/04/2017
PROJECT No: 84944.01



REMARKS: TEST DISCONTINUED DUE TO CONE TIP REFUSAL;
GROUNDWATER WAS OBSERVED AT 7.8 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 7.80m depth (assumed)
File: P:\84944.01 - BELLEVUE HILL Cranbrook School ECI\4.0 Field Work\CPT Results\CPT 109.CP5
Cone ID: 120620 Type: I-CFYX-10

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL

PROJECT: CRANBROOK SCHOOL ECI

LOCATION: VICTORIA ROAD, BELLEVUE HILL

REDUCED LEVEL: 16.22

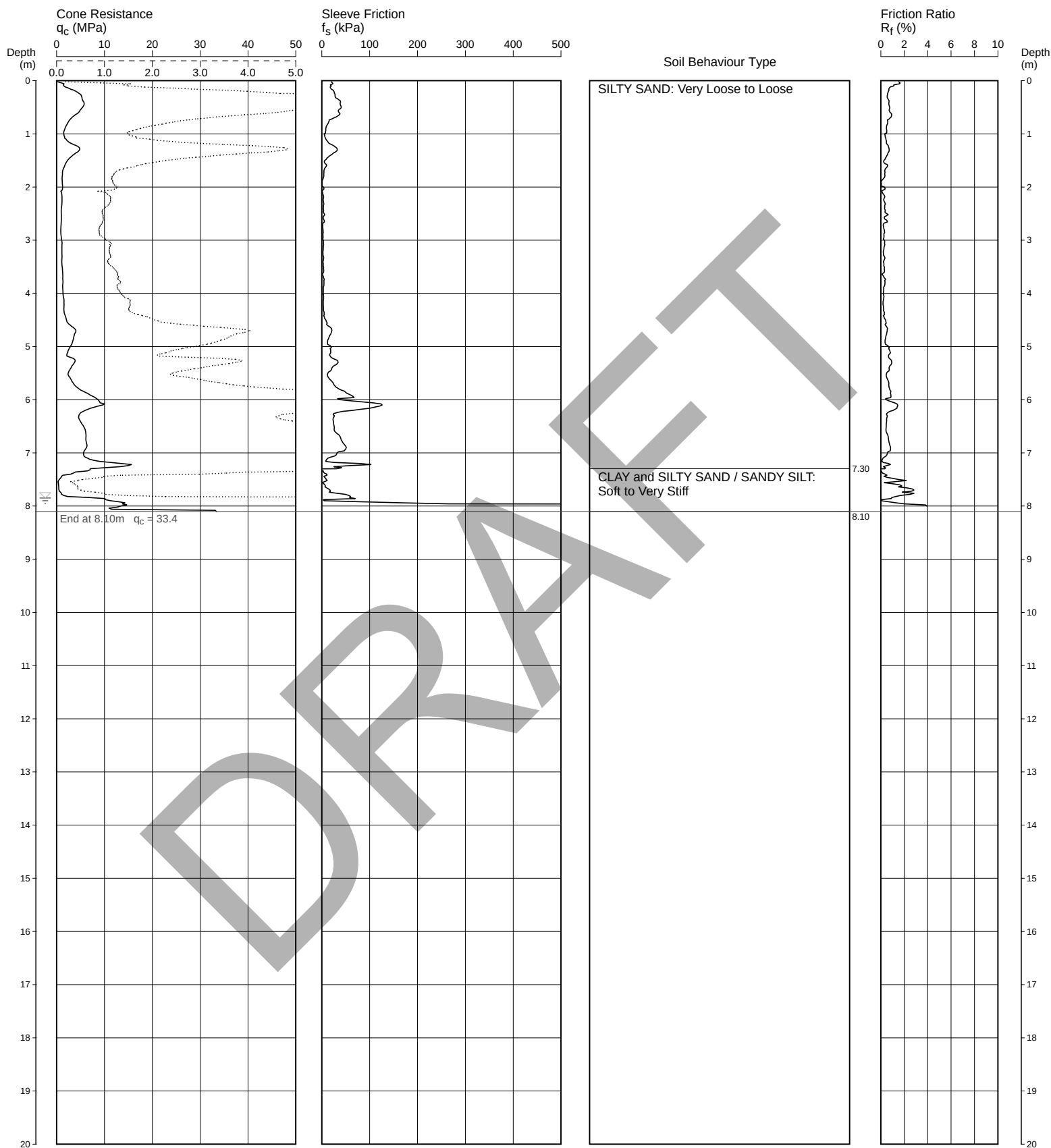
COORDINATES:

CPT 110

Page 1 of 1

DATE 12/04/2017

PROJECT No: 84944.01



REMARKS: TEST DISCONTINUED DUE TO EXCESSIVE BEND ON POSSIBLE ROCK;
GROUNDWATER WAS OBSERVED AT 7.85 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 7.85m depth (assumed)

File: P:\84944.01 - BELLEVUE HILL Cranbrook School ECI\4.0 Field Work\CPT Results\CPT 110.CP5

Cone ID: 120620

Type: I-CFY-10

ConePlot Version 5.9.2

© 2003 Douglas Partners Pty Ltd

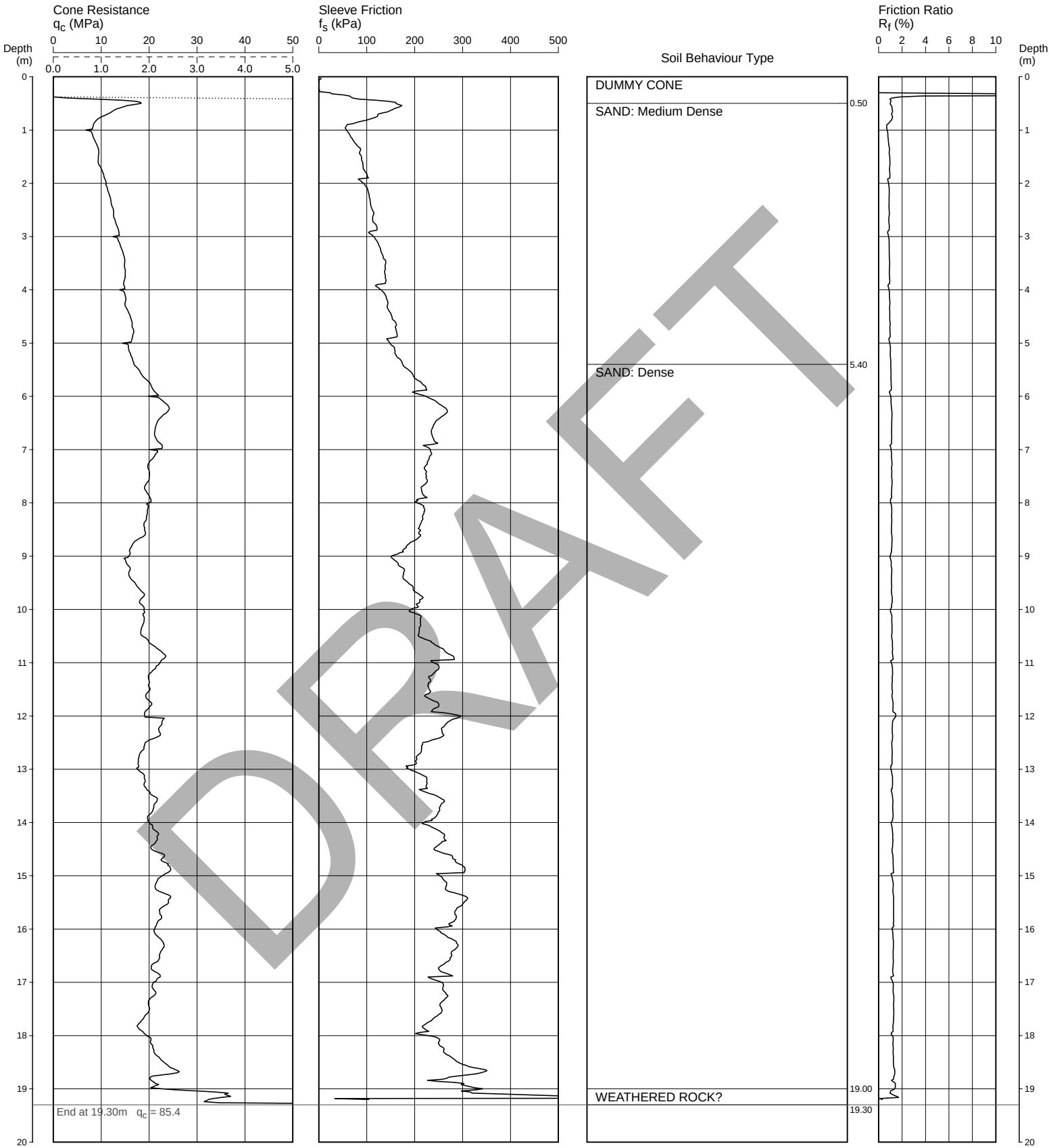
CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL
PROJECT: ADDITIONAL INVESTIGATION

LOCATION: VICTORIA ROAD, BELLEVUE HILL
REDUCED LEVEL: 30.53
COORDINATES:

CPT208

Page 1 of 1
DATE 18/09/2017
PROJECT No: 84944.02



REMARKS: DUMMY CONE USED FROM 0.0 TO 0.5 m DEPTH, TEST DISCONTINUED DUE TO CONE TIP REFUSAL
NO WATER OBSERVED IN CPT HOLE TO AT LEAST 10 m AFTER WITHDRAWAL OF RODS

DRAFT

Appendix E

Laboratory Test Results

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK REPORT

Client:	Douglas Partners	Source:	202 9-9.2m
Address:	PO Box 472 West Ryde NSW 1685	Sample Description:	Sandstone
Project:	Cranbrook School (84944.02)	Report No.:	S27795-UCS
Job No.:	S17389	Lab No.:	S27795

Test Procedure:	☐ AS4133 4.2.1 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength >50MPa
	☒ AS4133 4.2.2 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength < 50 Mpa

Sampling:	Sampled by Client	Date Sampled:	Unknown
------------------	-------------------	----------------------	---------

Preparation:	Prepared in accordance with the test method
---------------------	---

Date Tested	28/09/2017	Machine Type	Matest	Sample Storage Conditions	Wrapped
--------------------	------------	---------------------	--------	----------------------------------	---------



Before Test



After Test

TEST RESULTS

Average Diameter (mm)	Specimen Height (mm)	Length/Diameter Ratio	Specimen Condition	Description of Failure	Duration of Test (Sec)	Load at Fracture (kN)	Moisture Content at Time of Test (%)	Compressive Strength (MPa)
52.10	135.6	2.60	As received	Mixed mode	614	5	6.8	2.28

Notes:



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. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

5/10/2017

Date:



Macquarie Geotechnical
U8 10 Bradford Street
Alexandria NSW 2015

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK REPORT

Client:	Douglas Partners	Source:	203 11.74-11.92m
Address:	PO Box 472 West Ryde NSW 1685	Sample Description:	Sandstone
Project:	Cranbrook School (84944.02)	Report No.:	S27796-UCS
Job No.:	S17389	Lab No.:	S27796

Test Procedure:	☐ AS4133 4.2.1 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength >50MPa
	☒ AS4133 4.2.2 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength < 50 Mpa

Sampling:	Sampled by Client	Date Sampled:	Unknown
------------------	-------------------	----------------------	---------

Preparation:	Prepared in accordance with the test method
---------------------	---

Date Tested	28/09/2017	Machine Type	Matest	Sample Storage Conditions	Wrapped
--------------------	------------	---------------------	--------	----------------------------------	---------



Before Test



After Test

TEST RESULTS

Average Diameter (mm)	Specimen Height (mm)	Length/Diameter Ratio	Specimen Condition	Description of Failure	Duration of Test (Sec)	Load at Fracture (kN)	Moisture Content at Time of Test (%)	Compressive Strength (MPa)
51.80	135.7	2.62	As received	Mixed mode	607	16	7.5	7.59

Notes:



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. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

5/10/2017

Date:



Macquarie Geotechnical
U8 10 Bradford Street
Alexandria NSW 2015

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK REPORT

Client:	Douglas Partners	Source:	204 20.1-20.28m
Address:	PO Box 472 West Ryde NSW 1685	Sample Description:	Sandstone
Project:	Cranbrook School (84944.02)	Report No.:	S27797-UCS
Job No.:	S17389	Lab No.:	S27797

Test Procedure:	☐ AS4133 4.2.1 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength >50MPa
	☒ AS4133 4.2.2 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength < 50 Mpa

Sampling:	Sampled by Client	Date Sampled:	Unknown
------------------	-------------------	----------------------	---------

Preparation:	Prepared in accordance with the test method
---------------------	---

Date Tested	28/09/2017	Machine Type	Matest	Sample Storage Conditions	Wrapped
--------------------	------------	---------------------	--------	----------------------------------	---------



Before Test



After Test

TEST RESULTS

Average Diameter (mm)	Specimen Height (mm)	Length/Diameter Ratio	Specimen Condition	Description of Failure	Duration of Test (Sec)	Load at Fracture (kN)	Moisture Content at Time of Test (%)	Compressive Strength (MPa)
51.80	97.2	1.88	As received	Mixed mode	612	23	3.1	10.9

Notes: Test specimen length to diameter ratio falls outside of standard limitations of 2.5-3.0.



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. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

5/10/2017

Date:



Macquarie Geotechnical
U8 10 Bradford Street
Alexandria NSW 2015

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK REPORT

Client:	Douglas Partners	Source:	205 22.78-23m
Address:	PO Box 472 West Ryde NSW 1685	Sample Description:	Sandstone
Project:	Cranbrook School (84944.02)	Report No.:	S27798-UCS
Job No.:	S17389	Lab No.:	S27798

Test Procedure:	☐ AS4133 4.2.1 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength >50MPa
	☒ AS4133 4.2.2 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength < 50 Mpa

Sampling:	Sampled by Client	Date Sampled:	Unknown
------------------	-------------------	----------------------	---------

Preparation:	Prepared in accordance with the test method
---------------------	---

Date Tested	28/9/17	Machine Type	Matest	Sample Storage Conditions	Wrapped
--------------------	---------	---------------------	--------	----------------------------------	---------



Before Test



After Test

TEST RESULTS

Average Diameter (mm)	Specimen Height (mm)	Length/Diameter Ratio	Specimen Condition	Description of Failure	Duration of Test (Sec)	Load at Fracture (kN)	Moisture Content at Time of Test (%)	Compressive Strength (MPa)
51.80	134.8	2.60	As received	Mixed mode	614	24	9.4	11.3

Notes:



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. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

5/10/2017

Date:



Macquarie Geotechnical
U8 10 Bradford Street
Alexandria NSW 2015

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK REPORT

Client:	Douglas Partners	Source:	208 24-24.2m
Address:	PO Box 472 West Ryde NSW 1685	Sample Description:	Sandstone
Project:	Cranbrook School (84944.02)	Report No.:	S27799-UCS
Job No.:	S17389	Lab No.:	S27799

Test Procedure:	☐ AS4133 4.2.1 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength >50MPa
	☒ AS4133 4.2.2 Rock strength tests - Determination of uniaxial compressive strength - Rock Strength < 50 Mpa

Sampling:	Sampled by Client	Date Sampled:	Unknown
------------------	-------------------	----------------------	---------

Preparation:	Prepared in accordance with the test method
---------------------	---

Date Tested	28/09/2017	Machine Type	Matest	Sample Storage Conditions	Wrapped
--------------------	------------	---------------------	--------	----------------------------------	---------



Before Test



After Test

TEST RESULTS

Average Diameter (mm)	Specimen Height (mm)	Length/Diameter Ratio	Specimen Condition	Description of Failure	Duration of Test (Sec)	Load at Fracture (kN)	Moisture Content at Time of Test (%)	Compressive Strength (MPa)
51.70	134.5	2.60	As received	Mixed mode	606	26	4.0	12.4

Notes:



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. This document shall not be reproduced, except in full.

NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

5/10/2017

Date:



Macquarie Geotechnical
U8 10 Bradford Street
Alexandria NSW 2015

Misc Inorg - Soil Our Reference: Your Reference	UNITS ----- -	165477-1 BH101	165477-2 BH101	165477-3 BH102	165477-4 BH102	165477-5 BH103
Depth	-----	0.5	4.0	0.5	2.0	0.1
Date Sampled		12/04/2017	12/04/2017	12/04/2017	12/04/2017	11/04/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
Date analysed	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
pH 1:5 soil:water	pH Units	6.4	6.1	6.2	6.0	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	22	8	27	9	200

Misc Inorg - Soil Our Reference: Your Reference	UNITS ----- -	165477-6 BH103	165477-7 BH104	165477-8 BH105	165477-9 BH111	165477-10 BH111
Depth	-----	1.0	1.0	1.0	0.45-0.5	2.9-3.0
Date Sampled		11/04/2017	12/04/2017	10/04/2017	13/04/2017	13/04/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
Date analysed	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
pH 1:5 soil:water	pH Units	5.7	5.8	6.5	6.3	6.1
Electrical Conductivity 1:5 soil:water	µS/cm	31	11	18	12	10

Misc Inorg - Soil Our Reference: Your Reference	UNITS ----- -	165477-11 BH112	165477-12 BH113	165477-13 BH114	165477-14 BH115	165477-15 BH116
Depth	-----	0.5	1.0-1.05	1.0	0.1	1.0
Date Sampled		11/04/2017	13/04/2017	11/04/2017	11/04/2017	11/04/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
Date analysed	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
pH 1:5 soil:water	pH Units	5.6	6.1	6.0	6.1	6.4
Electrical Conductivity 1:5 soil:water	µS/cm	64	12	13	32	14

Misc Inorg - Soil Our Reference: Your Reference	UNITS ----- -	165477-16 BH117	165477-17 BH118	165477-18 BH119	165477-19 BH120	165477-20 BH121
Depth	-----	1.95-2.0	0.1-0.15	0.5	0.5	1.0
Date Sampled		13/04/2017	13/04/2017	10/04/2017	11/04/2017	12/04/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
Date analysed	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
pH 1:5 soil:water	pH Units	6.1	5.8	5.8	8.0	6.6
Electrical Conductivity 1:5 soil:water	µS/cm	14	27	12	130	12

Misc Inorg - Soil Our Reference: Your Reference	UNITS ----- -	165477-21 BH122	165477-22 BH123	165477-23 BH124	165477-24 BH125	165477-25 BH126
Depth	-----	1.0	0.5	0.1	0.5	2.0
Date Sampled		11/04/2017	11/04/2017	10/04/2017	10/04/2017	12/04/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
Date analysed	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
pH 1:5 soil:water	pH Units	6.6	6.4	6.2	6.1	6.4
Electrical Conductivity 1:5 soil:water	µS/cm	18	15	28	17	8

Misc Inorg - Soil Our Reference: Your Reference	UNITS ----- -	165477-26 BH127	165477-27 BH128	165477-28 BH129	165477-29 BH129	165477-30 BH130
Depth	-----	0.5	1.0	0.5	2.0	0.1
Date Sampled		11/04/2017	12/04/2017	10/04/2017	10/04/2017	10/04/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
Date analysed	-	22/04/2017	22/04/2017	22/04/2017	22/04/2017	22/04/2017
pH 1:5 soil:water	pH Units	5.9	6.2	6.0	6.1	5.7
Electrical Conductivity 1:5 soil:water	µS/cm	13	11	16	15	25



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 176470

Client Details

Client	Douglas Partners Pty Ltd
Attention	Julian Ng
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	<u>84944.02, Bellevue Hill</u>
Number of Samples	10 soils
Date samples received	26/09/2017
Date completed instructions received	26/09/2017

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	04/10/2017
Date of Issue	29/09/2017
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

David Springer, General Manager

Soil Aggressivity

Our Reference		176470-1	176470-2	176470-3	176470-4	176470-5
Your Reference	UNITS	BH202 / 1.00-1.45	BH202 / 5.50-5.67	BH203 / 2.50-2.95	BH203 / 7.00-7.45	BH204 / 10.00-10.45
Date Sampled		24/08/2017	24/08/2017	21/08/2017	23/08/2017	16/08/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
pH 1:5 soil:water	pH Units	5.2	4.8	5.5	6.2	7.3
Electrical Conductivity 1:5 soil:water	µS/cm	14	23	74	22	53
Chloride, Cl 1:5 soil:water	mg/kg	<10	10	20	10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	<10	20	89	<10	<10

Soil Aggressivity

Our Reference		176470-6	176470-7	176470-8	176470-9	176470-10
Your Reference	UNITS	BH204 / 17.50-17.95	BH205 / 4.00-4.45	BH205 / 13.00-13.45	BH208 / 1.00-1.45	BH208 / 11.25-11.70
Date Sampled		17/08/2017	15/08/2017	15/08/2017	18/09/2017	18/09/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
pH 1:5 soil:water	pH Units	7.0	6.4	6.9	6.3	7.0
Electrical Conductivity 1:5 soil:water	µS/cm	20	27	18	26	17
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	<10	<10	<10	26	<10

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

DRAFT

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]	1	5.2	5.1	2	102	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	14	21	40	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	<10	<10	0	97	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	<10	<10	0	103	[NT]

DRAFT

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.	

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 (+/-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.

DRAFT

Appendix F

2015 Test Results

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.10 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 84944
DATE: 7/7/2015
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
16	0.15	TOPSOIL - dark brown, silty sand topsoil with trace rootlets, damp																								
		FILLING - poorly compacted, dark brown and light grey-brown mottled, silty sand, damp																								
15	1																					E				1,0,1 N = 1
																						S				
14	2																					E				
																							S			0,0,1 N = 1
13	3																					E				
12	4																					E				
																							S			1,1,1 N = 2
11	4.85	SAND - light yellow-brown, medium grained sand, damp																					E			
10	6																									
9	7																									
8	8																									
7	9																									

RIG: Bobcat **DRILLER:** SY **LOGGED:** MP/SI **CASING:** HQ to 9.5m
TYPE OF BORING: Solid flight auger to 9.5m; Rotary to 11.25m; NMLC-Coring to 14.3m
WATER OBSERVATIONS: No free groundwater observed 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	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)

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.10 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 84944
DATE: 7/7/2015
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
6		SAND - light yellow-brown, medium grained sand, damp (<i>continued</i>)										
10.85		SILTY CLAY - light grey, silty clay										
11.25		SANDSTONE - medium and medium to high strength, moderately weathered then fresh, slightly fractured and unbroken, red-brown then light grey-brown, medium grained sandstone with some very low strength bands										
12												PL(A) = 0.5
13												PL(A) = 0.7
14		13.85-14.15m: very low strength siltstone bands										PL(A) = 1.2
14.3		Bore discontinued at 14.3m										PL(A) = 0.4
15												
16												
17												
18												
19												

RIG: Bobcat **DRILLER:** SY **LOGGED:** MP/SI **CASING:** HQ to 9.5m
TYPE OF BORING: Solid flight auger to 9.5m; Rotary to 11.25m; NMLC-Coring to 14.3m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.35 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/-

BORE No: 4
PROJECT No: 84944
DATE: 3/7/2015
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High			Very High	Ex High	B - Bedding	J - Joint	S - Shear	F - Fault	Type
16	0.6	TOPSOIL - dark brown, silty sand topsoil with trace rootlets, damp																		E			
1		FILLING - dark brown and grey-brown, silty sand filling, damp																		S			2,2,3 N = 5
15																							
2		- becoming slightly silty and yellow-brown mottled below 2.0m																		E			
14																							
3																				S			3,4,4 N = 8
13																				E			
4		4.0-4.5m: trace organic material																		E			
12	4.5																			S			1,2,3 N = 5
5		SILTY SAND - brown and brown-grey, fine to medium grained sand, damp																					
11																							
6																							
10																							
7	7.0	SAND - yellow-brown, medium grained sand, damp																					
9																							
8																							
8																							
9																							
7																							

RIG: Bobcat **DRILLER:** SY **LOGGED:** MP/SI **CASING:** HW to 11.5m
TYPE OF BORING: Solid flight auger to 9.5m; Rotary to 18.0m; NMLC-Coring to 21.1m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.35 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 84944
DATE: 3/7/2015
SHEET 2 OF 3

[illegible]

RIG: Bobcat

DRILLER: SY

LOGGED: MP/SI

CASING: HW to 11.5m

TYPE OF BORING: Solid flight auger to 9.5m: Rotary to 18.0m: NMLC-Coring to 21.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

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



Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 16.35 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 84944
DATE: 3/7/2015
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
-4	21.1	SANDSTONE - low and medium strength, highly to moderately then slightly weathered, slightly fractured, red-brown then light brown, medium grained sandstone with some very low strength bands <i>(continued)</i>														20.2m: B10°, cly vn, ti 20.45m: J70°, pl, ro, fe, cly 20.82m: B0°, cly	C	100	91	PL(A) = 0.5 PL(A) = 0.4	
-5		Bore discontinued at 21.1m																			
-6																					
-7																					
-8																					
-9																					
-10																					
-11																					
-12																					
-13																					

RIG: Bobcat **DRILLER:** SY **LOGGED:** MP/SI **CASING:** HW to 11.5m
TYPE OF BORING: Solid flight auger to 9.5m; Rotary to 18.0m; NMLC-Coring to 21.1m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

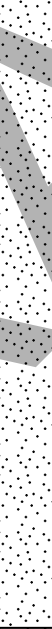
SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 30.0 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 84944
DATE: 6/7/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
29	0.07	TOPSOIL - dark brown, silty sand with trace rootlets, damp FILLING - poorly compacted, dark brown, grey and red-brown, silty sand filling with some sandstone gravel and cobbles										
28	0.94	SAND - loose, yellow-brown and brown, slightly silty, medium grained sand, damp										
28	1.95	SAND - loose, pale yellow-brown, medium grained sand, damp - becoming medium dense below 2.70m										
27	3											
26	4.05	Bore discontinued at 4.05m - target depth reached										

RIG: Hand tools

DRILLER: MP

LOGGED: MP

CASING: Uncased

TYPE OF BORING: Hand auger to 4.05m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 34.3 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 84944
DATE: 6/7/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.08	BRICK PAVEMENT										
		FILLING - poorly compacted, red-brown, brown and light grey, sand filling with some ripped sandstone gravel and some silt, damp										
	0.53	SAND - very loose, light grey and dark brown, slightly silty sand, damp										
	1											
		- clean sand below 1.20m										
	2											
		- becoming slightly clayey and wet below 2.27m - very wet to saturated below 2.35m										
	2.4	Bore discontinued at 2.4m - hole collapse										
	3											
	4											

RIG: Hand tools

DRILLER: MP

LOGGED: MP

CASING: Uncased

TYPE OF BORING: Hand auger to 2.40m

WATER OBSERVATIONS: Free groundwater observed at 2.35m

REMARKS:

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

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 32.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 84944
DATE: 6/7/2015
SHEET 1 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing					
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium		High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
	0.05	CONCRETE SLAB																								
32		FILLING - dark brown, silty sand, medium to coarse grained sand, damp																								
0.55		FILLING - light grey, medium grained sand with trace of silt, damp																								
1																						E				3,3,3 N = 6
31																						S				
1.95		SAND - yellow-brown, medium grained sand with a trace of silt, damp																				E				
2																										
30		- loose																					S			6,8,11* refusal
3																										
29		3.5 - medium dense below about 3.5m																								
4																										
28																						S				7,9,12 N = 21
5																										
27																										
6																						S				9,12,14 N = 26
26																										
7																										
25																						S				8,13,16 N = 29
8		8.0 - dense below about 8.0m																								
24																										
9																						S				13,20,20/100mm refusal
23																										
10.0																										

RIG: Bobcat **DRILLER:** SY **LOGGED:** MP/SI **CASING:** HW to 8.5m; HQ to 17.5m
TYPE OF BORING: Solid flight auger to 8.5m; Rotary to 20.3m; NMLC-Coring to 22.18m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: *SPT pushed 0.5m in collapsed sand prior to SPT. Numbers higher than realistic

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

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 32.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 84944
DATE: 6/7/2015
SHEET 2 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength						Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High	Very High		Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
22		SAND - yellow-brown, medium grained sand with a trace of silt, damp																				S			12,26/150mm refusal	
11																										
21																							S			13,24,24 N = 48
12																										
20																										
13																										
19																										
14																										
18																										
15																							S			13,16,26 N = 42
17																										
16																										
16																										
17																										
15																										
18																										
14																										
19																										
13																										
19.8																										

Note: Unless otherwise
stated, rock is fractured
along rough planar
bedding dipping 0°- 10°

Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0° - 10°

RIG: Bobcat **DRILLER:** SY **LOGGED:** MP/SI **CASING:** HW to 8.5m; HQ to 17.5m
TYPE OF BORING: Solid flight auger to 8.5m; Rotary to 20.3m; NMLC-Coring to 22.18m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: *SPT pushed 0.5m in collapsed sand prior to SPT. Numbers higher than realistic

SAMPLING & IN SITU TESTING LEGEND

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



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 32.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 84944
DATE: 6/7/2015
SHEET 3 OF 3

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
12	20.3	SILTY CLAY - light grey and red-brown, silty clay with trace ironstone bands (continued)						1													PL(A) = 0.2
21		SANDSTONE - low and very low strength, highly to moderately then slightly weathered, slightly fractured, light grey-brown, medium to coarse grained sandstone																C	100	80	PL(A) = 0.2
22	22.18	Bore discontinued at 22.18m																			PL(A) = 0.1
23																					
24																					
25																					
26																					
27																					
28																					
29																					

RIG: Bobcat

DRILLER: SY

LOGGED: MP/SI

CASING: HW to 8.5m; HQ to 17.5m

TYPE OF BORING: Solid flight auger to 8.5m; Rotary to 20.3m; NMLC-Coring to 22.18m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *SPT pushed 0.5m in collapsed sand prior to SPT. Numbers higher than realistic

SAMPLING & IN SITU TESTING LEGEND

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



Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 22.7 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 84944
DATE: 6/7/2015
SHEET 1 OF 1

[illegible]

RIG: Hand tools

DRILLER: MP

LOGGED: MP

CASING: Uncased

TYPE OF BORING: Hand auger to 4.0m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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



Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Cranbrook School
PROJECT: Stage 1 Development
LOCATION: Victoria Road, Bellevue Hill

SURFACE LEVEL: 26.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 84944
DATE: 6/7/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.35	TOPSOIL - dark brown, silty sand with trace rootlets, damp										
	1.03	FILLING - poorly compacted, brown-grey and brown, silty sand with trace ripped sandstone gravel, damp										
	1.03	SAND - loose, pale yellow-brown, slightly silty, medium grained sand										
		- clean sand below 1.50m										
		- becoming medium dense below 2.85m										
	4.05	Bore discontinued at 4.05m - target depth reached										

RIG: Hand tools

DRILLER: MP

LOGGED: MP

CASING: Uncased

TYPE OF BORING: Hand auger to 4.05m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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



Douglas Partners
 Geotechnics | Environment | Groundwater

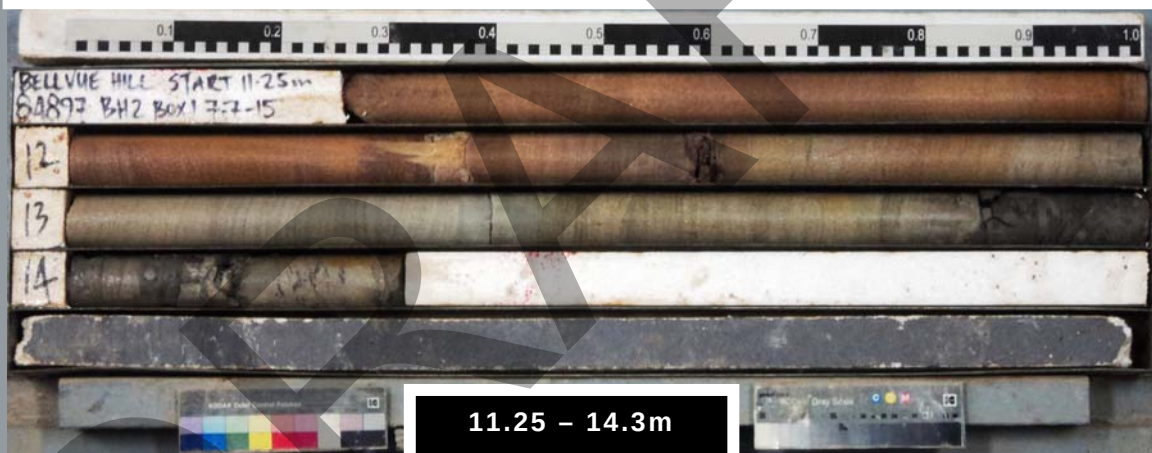
DOUGLAS PARTNERS PTY LTD

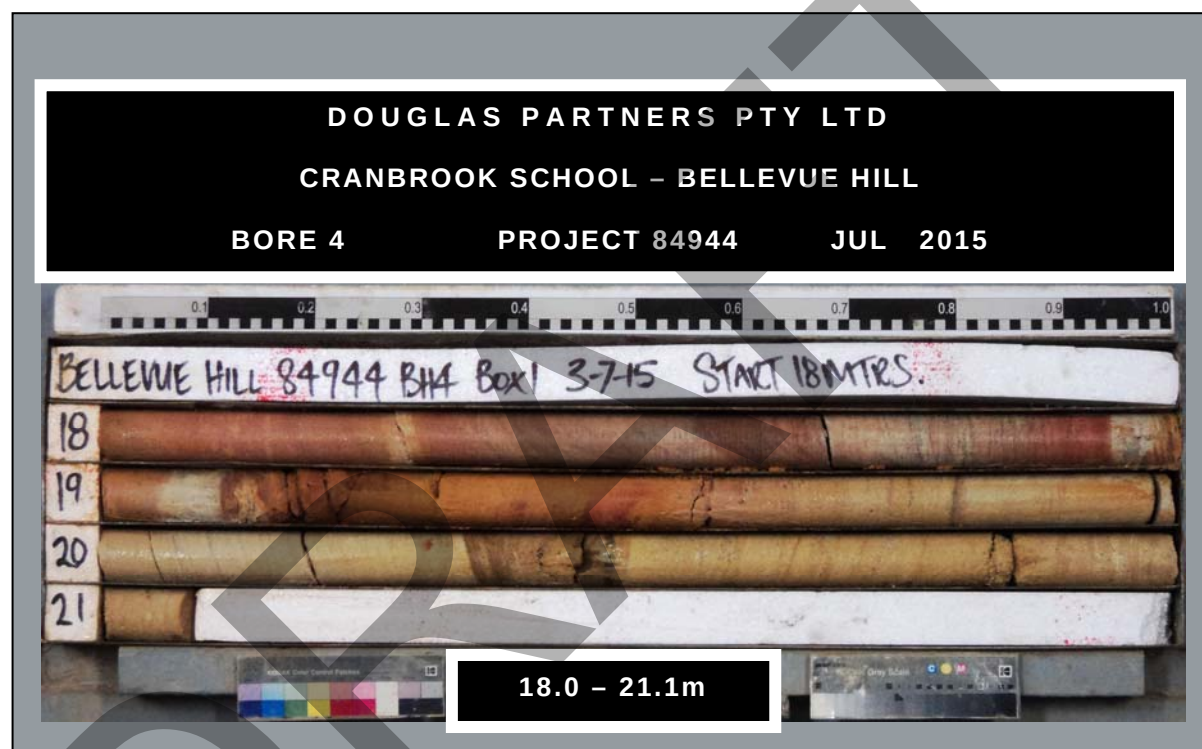
CRANBROOK SCHOOL - BELLEVUE HILL

BORE 2

PROJECT 84944

JUL 2015





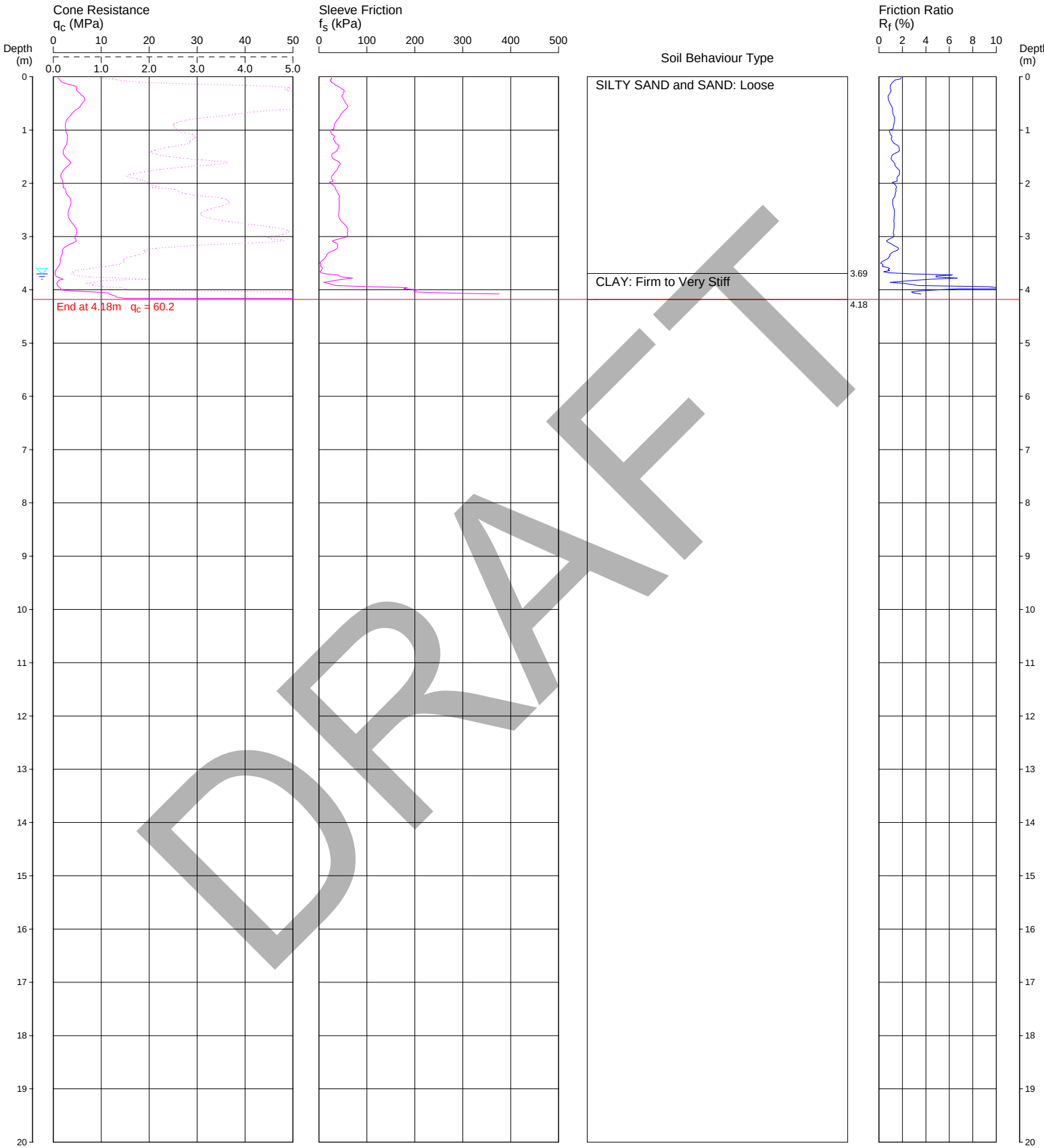


CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL
PROJECT: STAGE 1 DEVELOPMENT

LOCATION: VICTORIA ROAD, BELLEVUE HILL
REDUCED LEVEL: 16.50
COORDINATES:

CPT1
Page 1 of 1
DATE 1/7/2015
PROJECT No: 84944



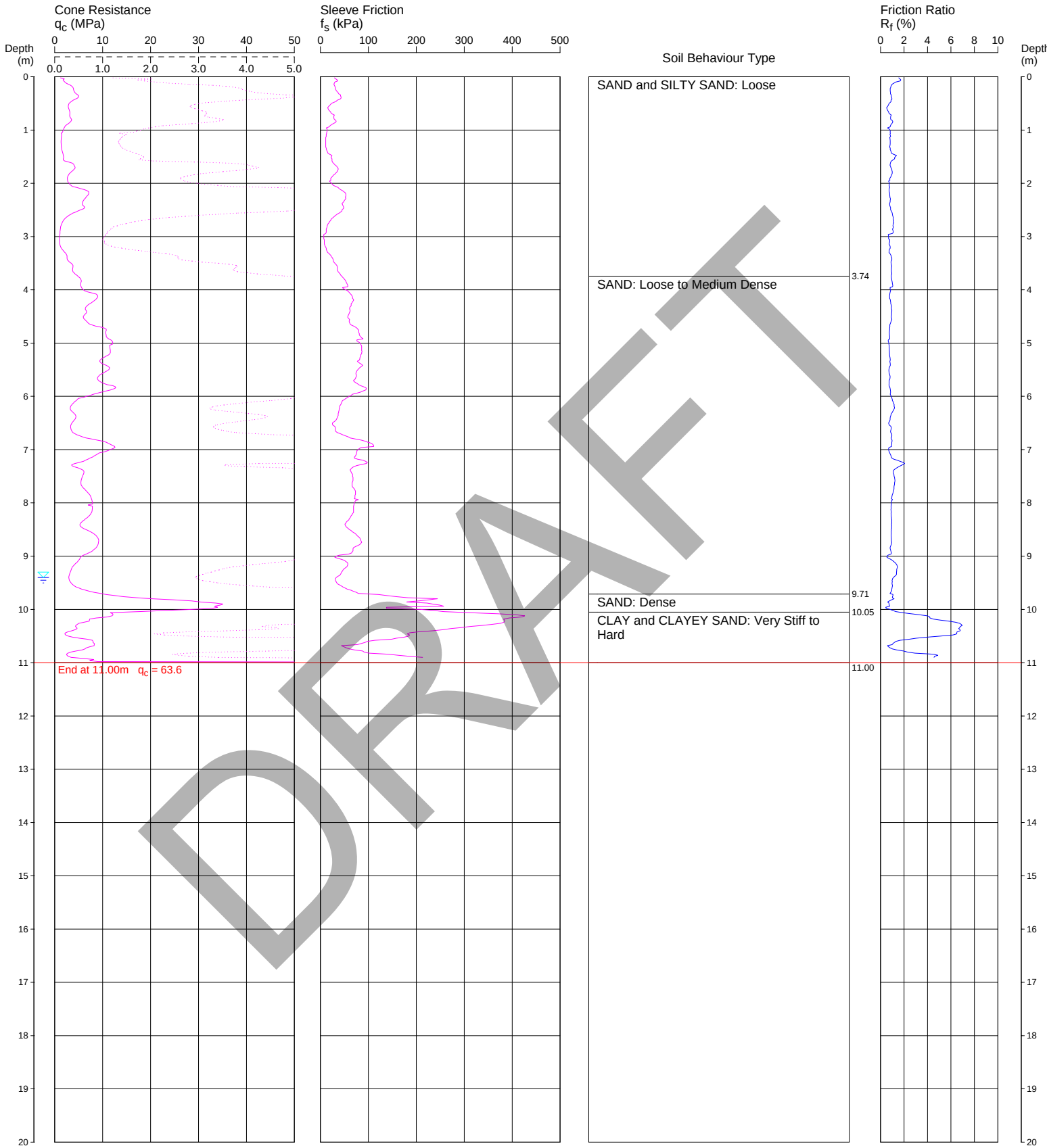
REMARKS: HOLE DISCONTINUED DUE TO CONE TIP REFUSAL;
GROUNDWATER OBSERVED AT 3.7 m DEPTH AFTER WITHDRAWAL OF RODS.

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL
PROJECT: STAGE 1 DEVELOPMENT

LOCATION: VICTORIA ROAD, BELLEVUE HILL
REDUCED LEVEL: 16.10
COORDINATES:

CPT2
Page 1 of 1
DATE 1/7/2015
PROJECT No: 84944



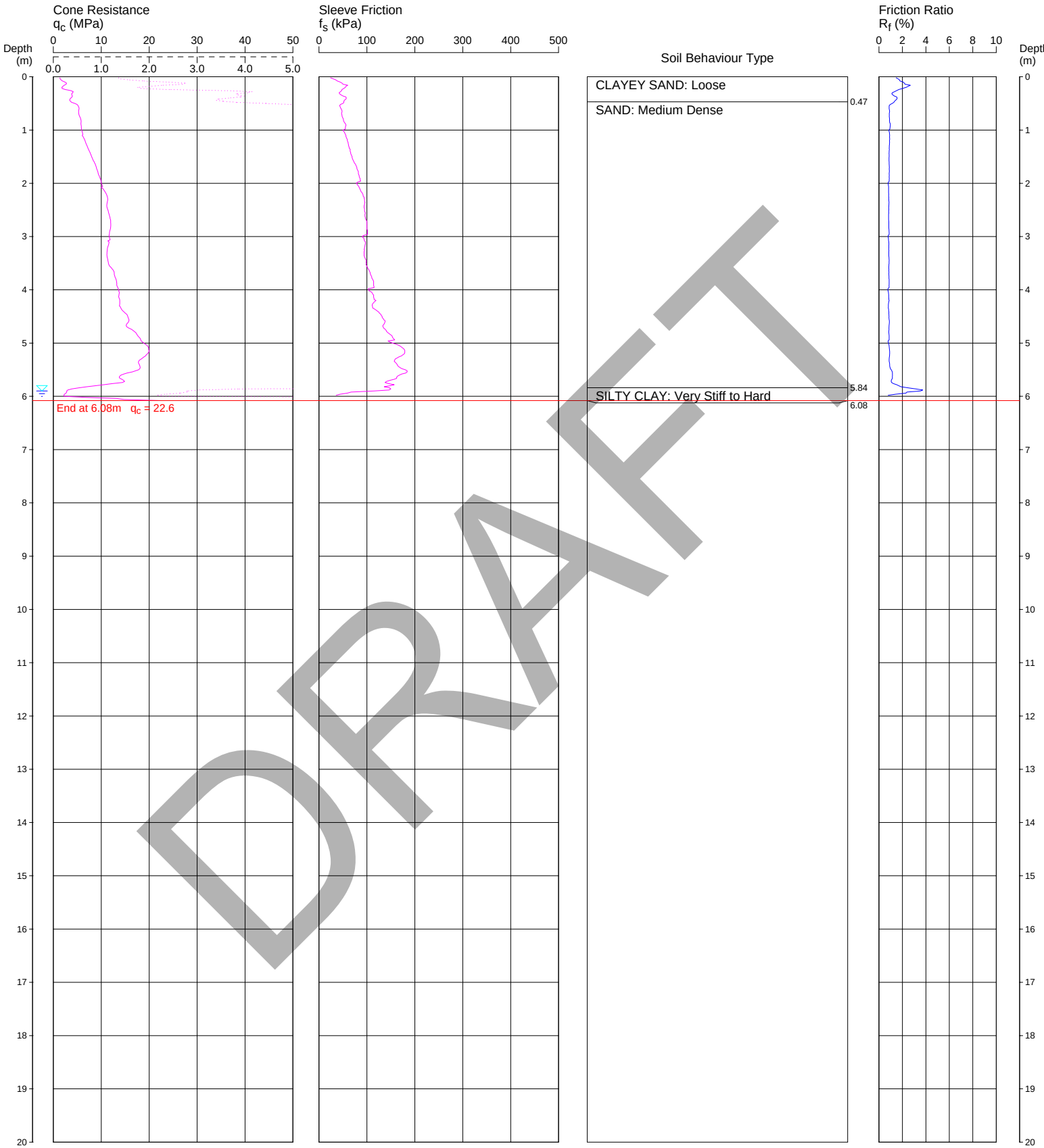
REMARKS: HOLE DISCONTINUED DUE TO CONE TIP REFUSAL;
GROUNDWATER OBSERVED AT 9.4 m DEPTH AFTER WITHDRAWAL OF RODS.

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL
PROJECT: STAGE 1 DEVELOPMENT

LOCATION: VICTORIA ROAD, BELLEVUE HILL
REDUCED LEVEL: 16.60
COORDINATES:

CPT3
Page 1 of 1
DATE 1/7/2015
PROJECT No: 84944



REMARKS: HOLE DISCONTINUED DUE TO BENDING;
GROUNDWATER OBSERVED AT 5.9 m DEPTH AFTER WITHDRAWAL OF RODS.

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL

PROJECT: STAGE 1 DEVELOPMENT

LOCATION: VICTORIA ROAD, BELLEVUE HILL

REDUCED LEVEL: 16.35

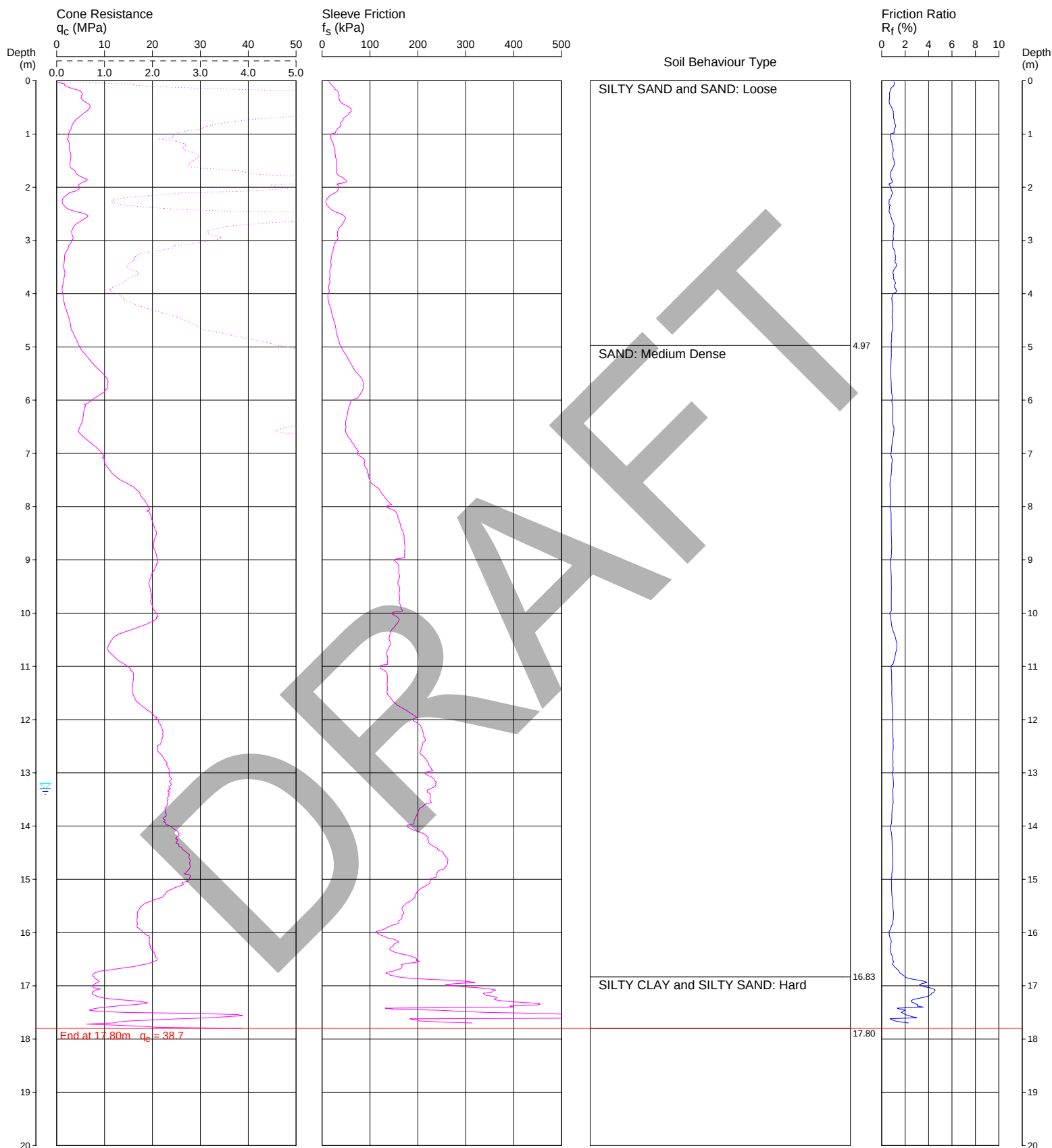
COORDINATES:

CPT4

Page 1 of 1

DATE 1/7/2015

PROJECT No: 84944



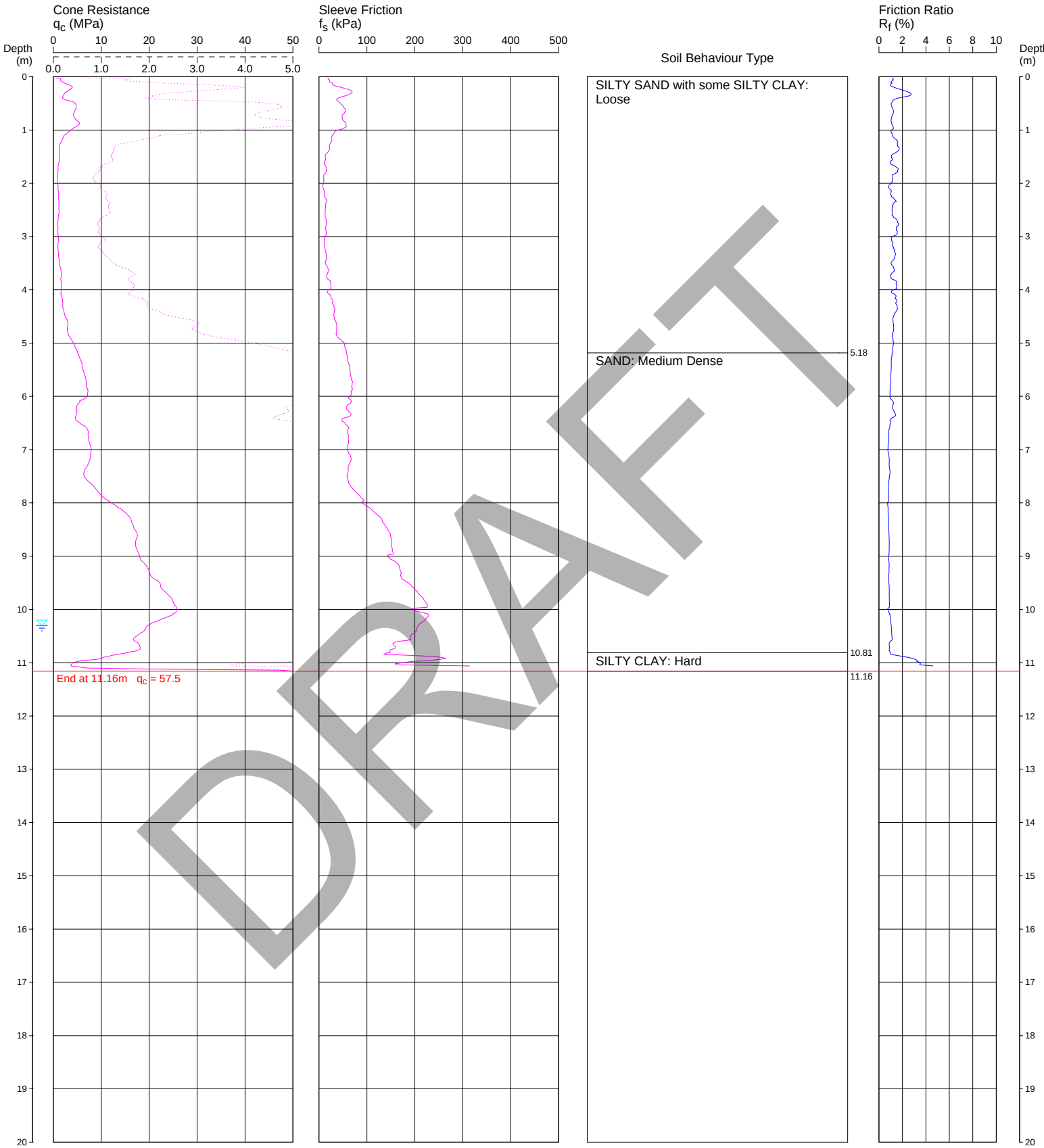
REMARKS: HOLE DISCONTINUED DUE TO CONE TIP REFUSAL;
HOLE COLLAPSE AT 13.3 m AFTER WITHDRAWAL OF RODS.

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL
PROJECT: STAGE 1 DEVELOPMENT

LOCATION: VICTORIA ROAD, BELLEVUE HILL
REDUCED LEVEL: 16.40
COORDINATES:

CPT5
Page 1 of 1
DATE 1/7/2015
PROJECT No: 84944



REMARKS: HOLE DISCONTINUED DUE TO CONE TIP REFUSAL;
HOLE COLLAPSE AT 10.3 m DEPTH AFTER WITHDRAWAL OF RODS.

CONE PENETRATION TEST

CLIENT: CRANBROOK SCHOOL

PROJECT: STAGE 1 DEVELOPMENT

LOCATION: VICTORIA ROAD, BELLEVUE HILL

REDUCED LEVEL: 22.90

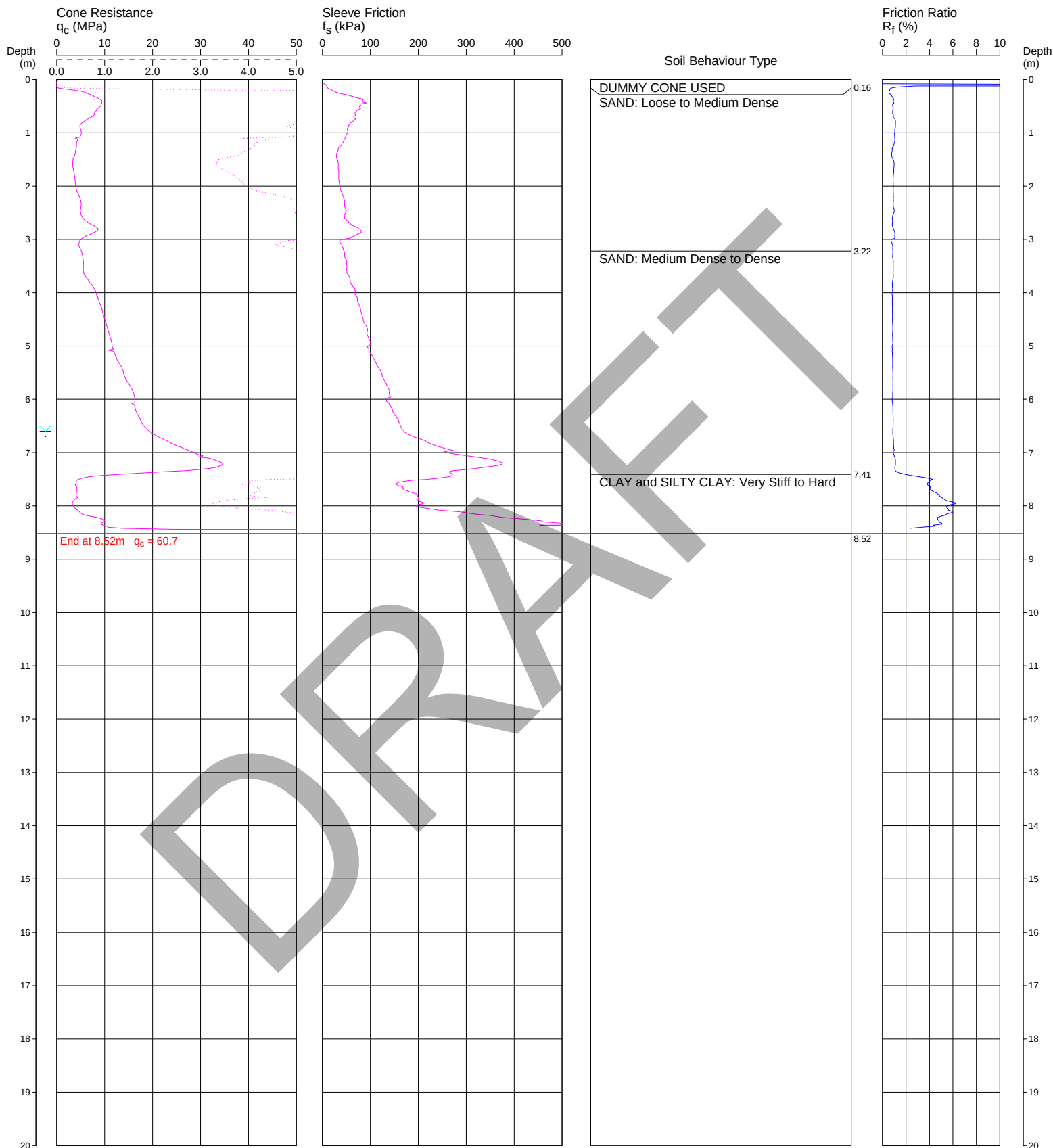
COORDINATES:

CPT6

Page 1 of 1

DATE 1/7/2015

PROJECT No: 84944



REMARKS: DUMMY CONE USED FROM 0.0 TO 0.2 m DEPTH TO PENETRATE CONCRETE SLAB; HOLE DISCONTINUED DUE TO CONE TIP REFUSAL;
HOLE COLLAPSE AT 6.6 m DEPTH AFTER WITHDRAWAL OF RODS.