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Report on
Additional Geotechnical Investigation

Hurlstone Agricultural High School (Hawkesbury)
Londonderry Road
Richmond

Prepared for
Conrad Gargett Pty Ltd

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Report on Additional Geotechnical Investigation
Hurlstone Agricultural High School (Hawkesbury)
Londonderry Road, Richmond

1. Introduction

This report presents the results of geotechnical investigations undertaken for the proposed Hurlstone Agricultural High School (Hawkesbury) off Londonderry Road, Richmond. The work was commissioned by Conrad Gargett Pty Ltd, architects.

The project involves the construction of a new agricultural high school campus on a largely undeveloped parcel of land adjoining the Richmond campus of Western Sydney University. The new buildings will comprise one and two-storey structures with relatively high column loads due to the spans required. Pavement areas will typically surround the new buildings.

Geotechnical investigations were undertaken to provide information on the subsurface conditions on the site and included the drilling of boreholes, cone penetration tests, the excavation of test pits, laboratory testing and engineering analysis. Details of the field work and comments relevant to design and construction are provided in this report. This report supersedes the previous geotechnical report prepared for the project by Douglas Partners (Ref. 85644.00.R.002.Rev0 dated 14 November 2016).

A preliminary site investigation for contamination assessment purposes was prepared for the project by Douglas Partners in 2016 and is reported separately.

2. Site Description

The redevelopment site is located to the south-west of the main Western Sydney University buildings on part of Lot 2 DP 1051798. The site is approximately 18 ha in area. It is bounded by Western Sydney University and an aged-care facility to the north, land used largely for agricultural purposes to the east and south, and Londonderry Road to the west. The ground surface on the site slopes very gently downwards to south-east; surface levels vary between about RL 23.5 m and RL 22.5 m AHD.

At the time of the investigation the site was divided into paddocks with very few improvements. A number of drainage swales were located between the paddocks. The surface was generally well-grassed and some trees were present along the southern boundary as well as scattered sparingly elsewhere on the site.

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

3. Regional Geology and Hydrogeology

The *Penrith 1:100 000 Geological Series Sheet* indicates that the site is underlain by the Tertiary-aged Londonderry Clay which comprises clay with patches of cemented, consolidated sand. The area to the north is shown as being underlain by the Quaternary-aged Clarendon Formation which comprises clay, clayey sand and silt. An extract from the geological map is shown in Figure 1.

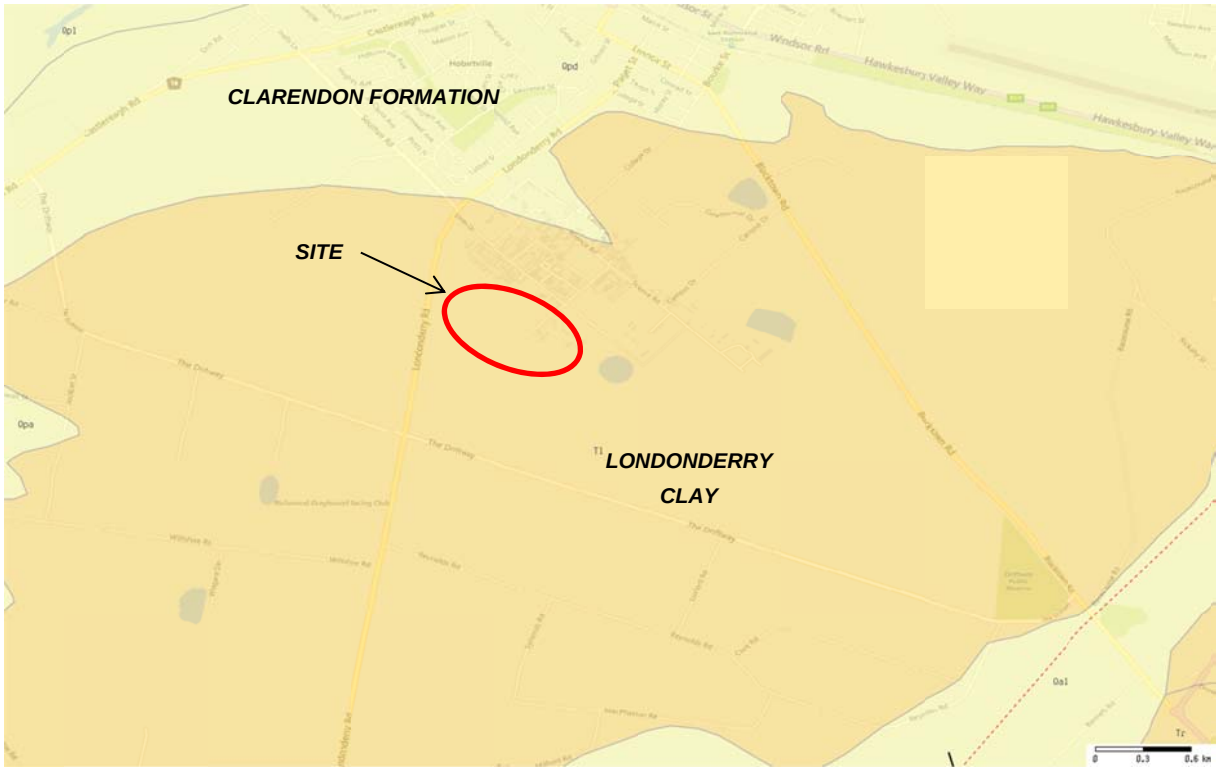


Figure 1: Extract from geological map

The topography of the site suggests that groundwater may be shallow and possibly a beneficial resource in sandy zones of the aquifer.

4. Previous Field Work

4.1 Methods

The field work for the combined geotechnical and contamination investigation included the drilling of 11 boreholes to depths of 7.5 m at the locations shown on Drawing 1 in Appendix B. All boreholes were drilled using solid flight augers. Standard penetration tests (SPTs) were undertaken at regular depth intervals and all field work was supervised on site by a geotechnical engineer.

The ground surface levels at the bores (to AHD) were interpolated from a survey plan using coordinates measured using a differential global positioning system (dGPS) receiver.

4.2 Results

The subsurface conditions encountered in the previous boreholes are presented in the borehole logs in Appendix D. Notes defining descriptive terms and classification methods are included in Appendix A.

The boreholes encountered the following materials:

- Topsoil (typically silty sand with rootlets, gravel) to depths of between 0.1 m and 0.9 m; underlain by
- Filling in BH6 only (silty sand with gravel, plastic bags, rags, plastic bottles) to a depth of 2.5 m; underlain by
- Sands (medium dense to very dense silty sand, clayey sand, clayey silty sand) to depths of between 3.9 m and 4.8 m; underlain by
- Clays (stiff to very stiff silty clay, sandy silty clay, sandy silt) to the base of the bores at 7.5 m depth.

Free groundwater was observed at depths of between 0.3 m and 2.5 m in all bores except BH2 and BH3 which were dry at the completion of drilling.

Table 1 summarises the levels at which different materials were encountered in the boreholes.

Table 1: Summary of Material Strata Levels in Boreholes

Stratum	RL of Top of Stratum (m, AHD)										
	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8	BH9	BH10	BH11
Ground Surface	23.4	23.2	23.0	23.3	23.2	23.3	23.0	22.9	23.0	23.8	22.9
Filling	NE	NE	NE	NE	NE	20.8	NE	NE	NE	NE	NE
Sands	23.1	23.0	22.5	23.0	23.0	20.8	22.9	22.6	22.1	23.3	22.7
Clays	19.4	19.2	19.0	19.3	18.4	19.3	19.1	18.9	19.0	19.5	18.7
Base of Borehole	15.9	15.7	15.5	15.8	15.7	15.8	15.5	15.4	15.5	16.3	15.4

Notes: NE = not encountered

5. Current Field Work

5.1 Methods

Six cone penetration tests (CPTs 101 to 106) were undertaken to depths of between 17.2 m and 19.1 m at the locations shown on Drawing 1 in Appendix B. A CPT involves pushing a 35 mm diameter instrumented cone and friction sleeve into the ground using 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 interpretation.

Seven test pits (TP107 to TP113) were excavated to depths of between 1.1 m and 1.4 m at the locations shown on Drawing 1 in Appendix B. The purpose of these pits was to obtain bulk soil samples for laboratory testing (TP107 and TP108) and to delineate an area around the previous borehole BH6 in which uncontrolled filling was encountered (TP109 to TP113).

The ground surface levels at the bores (to AHD) were interpolated from a survey plan using coordinates measured using a differential global positioning system (dGPS) receiver.

5.2 Results

The subsurface conditions encountered in the current CPTs and test pits are presented in the results sheets and logs in Appendix C. Notes defining descriptive terms and classification methods are included in Appendix A.

The materials interpreted from the CPTs can be described as follows:

- Sand/Silty Sand (very loose to loose) to depths of between 0.8 m and 1.4 m; underlain by
- Clay/Silty Clay (very stiff to hard) interbedded with Clayey Sand/Silty Sand (medium dense to very dense) to the base of the CPTs at depths of between 17.2 m and 19.1 m.

Refusal of the CPT equipment is likely to have occurred in very dense gravels and/or weathered bedrock. Deep cored boreholes would be required to confirm the actual depths to bedrock.

Groundwater was observed in only two CPTs: CPT101 at 2.0 m depth (RL 20.9 m AHD) and CPT105 at 7.8 m depth (RL 15.4 m AHD). Water was not measured within 10 m of the ground surface at the remaining CPT locations. No long term monitoring of groundwater levels has been carried out.

Table 2 summarises the levels at which different materials were inferred from the CPTs.

Table 2: Summary of Material Strata Levels in CPTs

Stratum	RL of Top of Stratum (m, AHD)					
	CPT101	CPT102	CPT103	CPT104	CPT105	CPT106
Ground Surface	22.9	23.0	23.0	22.9	23.2	23.0
vl to l Sands	22.9	23.0	23.0	22.9	23.2	23.0
vst to h Clays & md to d Sands	21.6	21.6	22.2	21.9	22.0	21.8
Base of Test	3.8	4.5	5.8	5.4	4.5	5.3

Notes: vl = very loose; l = loose; md = medium dense; d = dense; vst = very stiff; h = hard

The materials encountered in the test pits can be described as follows:

- Filling consisting of sands with varying proportions of rootlets, gravel, building rubble (concrete, brick, plastic, wood, rubber, metal wire, a metal drum) to depths of between 0.2 m and 1.2 m. The building rubble was encountered in TP109, TP110 and TP 111 only; underlain by
- Clayey Sand (possible filling) to the base of the pits at depths of between 1.1 m and 1.4 m.

Groundwater was observed in only one test pit: TP107 at 0.9 m depth (RL 22.0 m AHD). Water was not observed at the remaining test pit locations.

6. Laboratory Testing

Selected soil samples were analysed for California bearing ratio (CBR), Atterberg Limits (plasticity) and aggressivity (electrical conductivity, pH, chloride and sulphate). The results are summarised in Tables 3 and 4. The detailed results are included in Appendix E.

Table 3: Summary of Laboratory Test Results for CBR and Atterberg Limits

Sample/ Depth (m)	Description	CBR (%)*	Swell (%)	MDD (t/m^3)	W_P (%)	W_L (%)	PI (%)	LS (%)
BH1/0-1.5	Silty sand	30	-0.5	2.06	-	-	-	-
BH2/4.0-4.36	Silty clay	-	-	-	16	30	14	9.5
BH3/4.0-4.95	Silty clay	-	-	-	12	29	17	11.0
BH5/0.2-1.0	Silty sand	25	-0.5	1.91	-	-	-	-
BH7/4.0-4.95	Silty clay	-	-	-	14	41	27	14.0
BH8/0.1-1.0	Silty sand	11	-0.5	1.93	-	-	-	-
BH11/0-1.0	Silty sand	20	-0.5	1.89	-	-	-	-
BH11/5.5-5.95	Silty clay	-	-	-	14	42	28	17.5
TP107/1.0-1.2	Silty sand	7	-0.5	2.07	-	-	-	-
TP108/1.0-1.1	Silty sand	7	-0.5	1.98	-	-	-	-

Notes: *4-day soak, 4.5 kg surcharge, 100% Standard compaction; MDD = maximum dry density; W_P = plastic limit; W_L = liquid limit; PI = plasticity index; LS = linear shrinkage

Table 4: Summary of Laboratory Test Results for Aggressivity

Sample/ Depth (m)	Description	pH*	EC (µS/cm)*	Chloride (mg/kg)*	Sulphate (mg/kg)*
BH3/7.0-7.45	Silty clay	6.7	350	390	58
BH5/0.5	Silty sand	6.8	25	<10	<10
BH7/2.5-2.95	Clayey sand	6.9	35	10	10
BH9/0.1	Topsoil	5.6	23	<10	<10

Notes: *Sample mixed 1(soil):5(water) prior to testing

7. Geotechnical Model

The site appears to be underlain by very loose to loose topsoil/filling to depths in the order of 1 m to 1.5 m, and uncontrolled filling including building rubble in the vicinity of BH6. The possible extent of the filling that includes building rubble, based on the test pit results, is shown on Drawing 1 in Appendix B. The filling is underlain by alluvial soils which comprise very stiff to hard clays/silty clays and medium dense to very dense clayey sands/silty sands. The alluvium appears to be present to depths in the order of 17 m to 19 m in the area of the CPTs, and is likely to be underlain by either gravels or weathered bedrock.

The laboratory testing programme indicates that the clays are highly plastic and of moderate to high reactivity. The CBR results show that the near-surface sandy filling is of reasonable strength when compacted. The aggressivity testing indicates non-aggressive conditions.

Groundwater was observed at depths of between 0.3 m and 2.5 m in some areas of the site, 7.8 m in CPT105, and was not observed within 10 m of the surface in others. This indicates that perched water exists within the soils and that the regional groundwater table is deeper than observed. Long term monitoring would be required to confirm levels if this is important (e.g. for basements).

8. Proposed Development

The project involves the construction of a new agricultural high school campus on a largely undeveloped parcel of land adjoining the Richmond campus of Western Sydney University. The new buildings will comprise one and two-storey structures with relatively high column loads due to the spans required. Pavement areas will typically surround the new buildings.

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

9. Comments

9.1 Site Classification

The natural sandy soils in the upper 4 m of the site are expected to be largely non-plastic and therefore experience only slight movements due to changes in moisture content. As such, a site classification of Class S would be appropriate for the natural medium dense sands and re-worked non-reactive filling if footings are to be designed in accordance with *Australian Standard AS 2870 – 2011 Residential slabs and footings*. Class S sites may experience unrestrained, free-surface movements of between 0 mm and 20 mm as a result of changes in moisture content.

Areas on the site in which more than 0.4 m of filling is present, and areas in which very loose to loose sand remains, would be classified as Class P. These areas will require re-working prior to re-classification if the footings are to be designed in accordance with AS 2870 – 2011.

9.2 Site Preparation

Any existing filling that is required to support structures and pavements will need to be reworked to reduce the potential for unacceptable settlements associated with poorly or variable compacted filling. New filling will also need to be placed in accordance with an engineering specification. The following procedure could be followed during earthworks activities:

- Strip organic-rich topsoil from areas of the site in which filling, structures and/or pavements are proposed. A nominal depth of 100 mm would be appropriate but confirmation of this will need to be made on site at the commencement of construction;
- Excavate existing filling in areas of the site in which filling, structures and/or pavements are proposed;
- Compact the exposed surface and proof-roll using a roller of 10 t deadweight (or equivalent) in the presence of a geotechnical engineer. Any areas exhibiting unacceptable movements during the proof-roll may require further rectification;
- Place suitable filling in maximum 250 mm thick layers and compact to achieve a dry density ratio of between 98% and 102% relative to Standard compaction. The upper 0.5 m of pavement subgrade areas should be compacted to achieve a dry density ratio of between 100% and 102% relative to Standard compaction;
- The moisture content should be within 2% of the Standard optimum moisture content of the material if it exhibits clay-like properties;
- A layer of granular product (e.g. roadbase, recycled crushed concrete etc.) should be considered as the top layer of filling to improve trafficability on site, particularly during and following periods of wet weather;
- Density testing should be undertaken in accordance with the requirements of AS 3798 – 2007 *Guidelines on earthworks for commercial and residential developments*.

If filling is imported to the site then the engineering properties (e.g. plasticity, reactivity, CBR etc.) should ideally be equivalent, or superior, to the existing materials on the site.

It is noted that trafficability on the site could provide problematic where perched groundwater is close to the surface. The placement of granular surface materials, in conjunction with localised dewatering or drainage, should help to alleviate these issues. The near-surface sandy soils are also likely to prove challenging for rubber-tyred vehicles without some form of granular confinement.

9.3 Excavation

Excavation during earthworks and construction is expected to be required in filling and sandy soils. This should be readily achievable using conventional earthmoving equipment such as hydraulic excavators with bucket attachments, scrapers and dozers. Excavation in rock will not be required.

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

9.4 Excavation Support

Vertical excavations in filling and sandy soils are not expected to be stable. Temporary batters of 1.5(H):1(V) could be used to support the sides of excavations up to 3 m deep above the perched groundwater. Flatter batters and/or dewatering will be required for excavations below groundwater.

Permanent batters for excavations and embankments should be no steeper than 2(H):1(V) and possibly flatter where vegetation maintenance is required. Erosion protection should be provided for all permanent batters.

Surcharge loads should be placed no closer to the crest of the batter than a distance equal to the vertical height of the batter, unless specific stability analysis shows that the loads can be placed closer.

Retaining walls (if required) could be designed using the parameters provided in Table 5.

Table 5: Material and Strength Parameters for Retaining Walls

Material	Bulk Density (kN/m^3)	Coefficient of Active Earth Pressure (K_a)	Ultimate Passive Earth Pressure[1]
Filling	20	0.40	-
Medium Dense Sand	20	0.30	K_p = 3.3
Dense Sand	20	0.25	K_p = 3.8
Stiff to Very Stiff Clay	20	0.30	200 kPa
Hard Clay	20	0.25	300 kPa

Notes: [1]Minimum of 0.5 m embedment should be provided

A triangular lateral earth pressure distribution could be assumed for cantilevered walls or walls with a single row of support. Lateral pressures due to surcharge loads from adjacent buildings, sloping ground surface, pavements and construction machinery should be included where relevant. Hydrostatic pressure acting on retaining walls should also be included in the design where adequate drainage is not provided behind the full height of the walls.

9.5 Groundwater

Groundwater was encountered at relatively shallow depths in some areas of the site and was not observed to depths of up to 10 m in others. It is therefore likely that these observations were perched groundwater rather than the regional aquifer. Nevertheless, excavations below the existing surface levels may encounter water that needs to be removed by dewatering or other drainage measures. Dewatering may require the use of spear points and/or wells in highly permeable sandy soils, or possibly submersible pumps in sump pits where the soils have a sufficient clay content to effectively reduce their permeability.

Due to the sandy nature of the near-surface soils, any sub-surface structures should be tanked (i.e. designed to be watertight) to prevent groundwater ingress.

9.6 Foundations

Spread footings (i.e. pad or strip footings) may be suitable for supporting lightly loaded structures and could be designed on the basis of the preliminary allowable bearing pressure parameters provided in Table 6. Specific analysis should be undertaken once the columns loads have been determined as bearing capacity is a function of footing width and depth in cohesionless soils. Spread footings may undergo settlements in the order of 1% of the footing width and therefore large footings required to support relatively high column loads would be expected to undergo significant settlements.

It should be noted that soil movements caused by moisture variations should be considered in the design of spread footings; further advice is provided on this issue in Section 9.1 of this report.

Table 6: Preliminary Design Parameters for Spread Footings

Material Description	Allowable Bearing Pressure Above Groundwater[1] (kPa)	Allowable Bearing Pressure Within Groundwater (kPa)	Young's Modulus (MPa)
Engineered Filling	100	50	20
Medium Dense Sands	250	150	30
Dense Sands	350	200	50

Note: These parameters are based on 600 mm wide footings founded at a depth of at least 500 mm

[1]Base of footing at least 2 x footing width above groundwater

Stiffened raft slabs could also be considered to reduce settlements between columns and additional information can be provided on this if such slabs are proposed.

Alternatively, cased bored piles, continuous flight auger (CFA) piles or steel screw piles could be used to support structural loads and could be proportioned on the basis of the design parameters provided in Table 7.

Table 7: Design Parameters for Cased Bored, CFA and Steel Screw Piles

Material Description	Allowable End-Bearing Pressure (kPa)	Allowable Shaft Adhesion[1] (kPa)	Ultimate End-Bearing Pressure (kPa)	Ultimate Shaft Adhesion[1] (kPa)	Young's Modulus (MPa)
Engineered Filling	150	15	450	30	20
Medium Dense Sands	300	20	900	50	30
Dense Sands	1000	75	3000	150	50
Stiff to Very Stiff Clays	300	20	900	50	20
Gravels/ Weathered Rock	1000	75	3000	150	100

Notes: [1]Only below 1 m depth and only for CFA piles (not cased bored piles or steel screw piles)

A geotechnical strength reduction factor (ϕ_g) should be applied to the ultimate values provided in Table 7 if the limit-state design process is undertaken to design the piles. Australian Standard AS 2159 – 2009 *Piling – Design and installation* provides information on how to determine an appropriate value of ϕ_g which is based on a risk assessment. The pile designer will need to confirm a ϕ_g value when the piling contractor is selected, however it is suggested that a preliminary value of 0.50 be adopted at this stage.

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 this report should be less than 1% of the pile diameter upon application of the design load. Serviceability analysis should be undertaken if the ultimate bearing pressures (incorporating a suitable reduction factor) are used to proportion the piles.

All bored piles should be inspected by an experienced geotechnical professional during construction to check the adequacy of the foundation material and to check the socket cleanliness. It is noted that a tremie system may need to be used where groundwater in intercepted in the pile holes. Acceptance of piles installed using 'blind' techniques (i.e. CFA piles and steel screw piles) usually requires some form of load testing and rig-gauge calibration.

Driven piles would also be suitable on this site from an engineering perspective, however the noise and vibration impacts on Western Sydney University and other nearby facilities would need to be considered.

9.7 Pavements

The CBR results show that the sands will provide good support for the pavement once the pavement layers provide some confinement. A design CBR of 10% is considered suitable, with sensitivity analysis undertaken for a CBR of 7% which was the lowest recorded result in the laboratory. Any weaker areas of subgrade (if encountered) may require improvement during construction. The CBR of any imported filling should also be assessed to confirm this suggested design value is appropriate.

A total pavement thickness of 250 mm incorporating both granular (DGB20) and asphalt layers is considered appropriate for carparks that will be used by light passenger vehicles only (i.e. less than 2 t GVM). For example, the profile could comprise 250 mm of DGB20 and a bitumen seal or 200 mm of DGB20 and 50 mm of asphalt.

The pavement thickness of roads, and carparks that will be used by heavier vehicles, should be designed on the basis of the anticipated traffic loading, design life and performance requirements.

The subgrade should be prepared in accordance with Section 9.2 of this report. The granular pavement layer(s) should be compacted to achieve a dry density ratio of at least 98% relative to Modified compaction.

Suitable cross-fall and drainage should be provided to reduce the risk of the subgrade becoming saturated during the life of the pavement.

9.8 Aggressivity

The laboratory test results indicate that the samples tested are non-aggressive to buried concrete and steel elements in accordance with the provisions of Australian Standard AS 2159 – 2009 *Piling – Design and installation.*

9.9 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 C_e.

10. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for the proposed Hurlstone Agricultural High School (Hawkesbury) campus, Londonderry Road, Richmond, in accordance with DP's proposals dated 27 July 2016 and 7 August 2017, and subsequent acceptance received from Conrad Gargett Pty Ltd. The report is provided for the use of Conrad Gargett Pty Ltd 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. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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.

Douglas Partners Pty Ltd

Appendix A

About this Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

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

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.

Soil Descriptions

Douglas Partners

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.

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

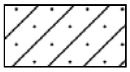
Soils


Topsoil

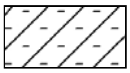

Peat


Clay

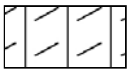

Silty clay

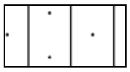

Sandy clay

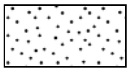

Gravelly clay

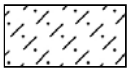

Shaly clay

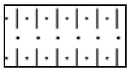

Silt


Clayey silt


Sandy silt

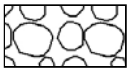

Sand

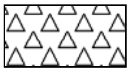

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

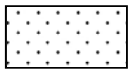

Talus

Sedimentary Rocks

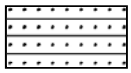

Boulder conglomerate

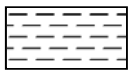

Conglomerate


Conglomeratic sandstone

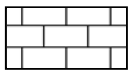

Sandstone


Siltstone


Laminite

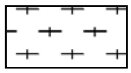

Mudstone, claystone, shale

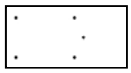

Coal


Limestone

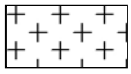
Metamorphic Rocks

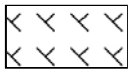

Slate, phyllite, schist

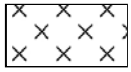

Gneiss

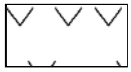

Quartzite

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

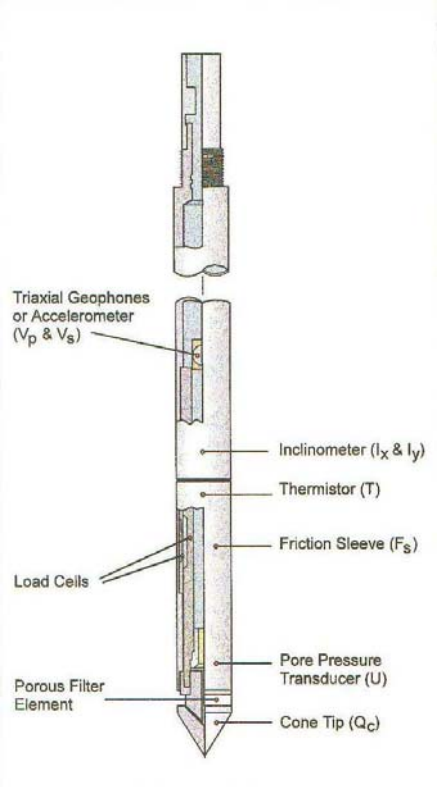


Figure 1: Cone Diagram

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)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (σ) plus basic parameters
Seismic	Shear wave velocity (V_s), compression wave velocity (V_p), plus basic parameters

Strata Interpretation

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

Cone Penetration Tests

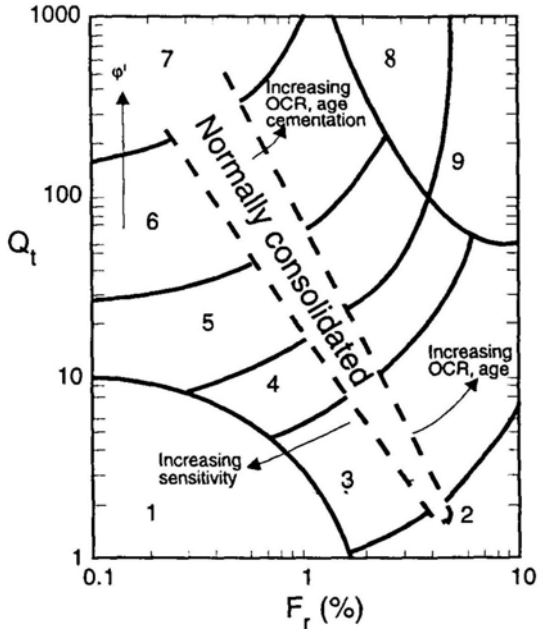


Figure 3: Soil Classification Chart

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

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

Engineering Applications

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

Settlement

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

Pile Capacity

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

Dynamic or Earthquake Analysis

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

Other Applications

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

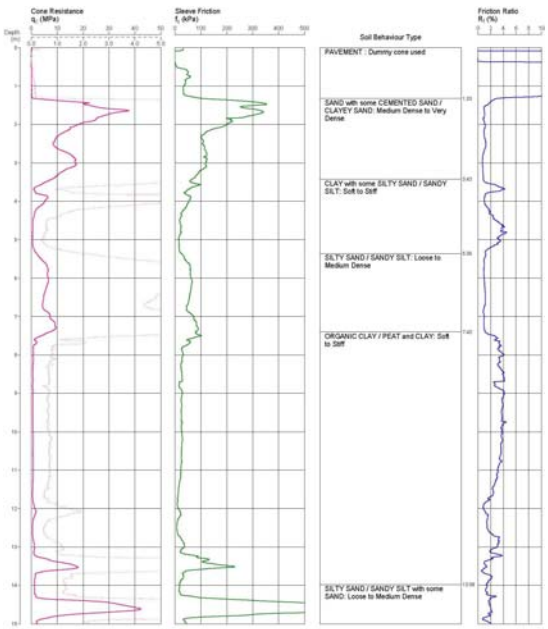


Figure 4: Sample Cone Plot

Appendix B

Drawing

0 10 20 30 40 60 80 100 150 200 250m

1:2500 @ A30

SITE BOUNDARY

BH1

BH

BH2

BH4

BH5

BH3

BH6

BH7

BH8

BH9

BH10

BH11

TP107

TP110

TP112

TP109

TP111

TP113

TP108

CPT102

CPT101

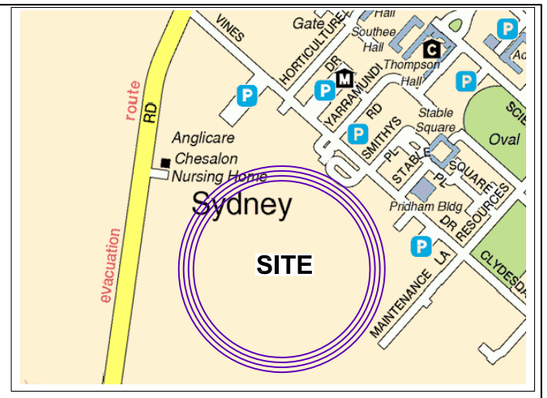
CPT103

CPT105

CPT104

CPT106

POSSIBLE EXTENT OF UNCONTROLLED FILLING



Locality Plan

NOTE:
1: Base drawing from Rygate & Company Pty Ltd (Ref. 77526, dated 9.6.2016)

LEGEND
- Previous borehole location (2016)
- Current CPT location
- Current Test Pit Location

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Conrad Gargett Pty Ltd	TITLE: **Locations of Tests** Hurlstone Agricultural High School (Hawkesbury) Londonderry Road, RICHMOND	PROJECT No: 85644.02
	OFFICE: Sydney / DRAWN BY: PSCH		DRAWING No: 1
	SCALE: 1:2500 @ A3 / DATE: 20.8.2017		REVISION: A

Appendix C

Current Field Work Results

CONE PENETRATION TEST

CLIENT: CONRAD GARGETT PTY LTD

PROJECT: HURLSTONE AGRICULTURAL HIGH SCHOOL

LOCATION: VINES DRIVE, RICHMOND

REDUCED LEVEL: 22.9

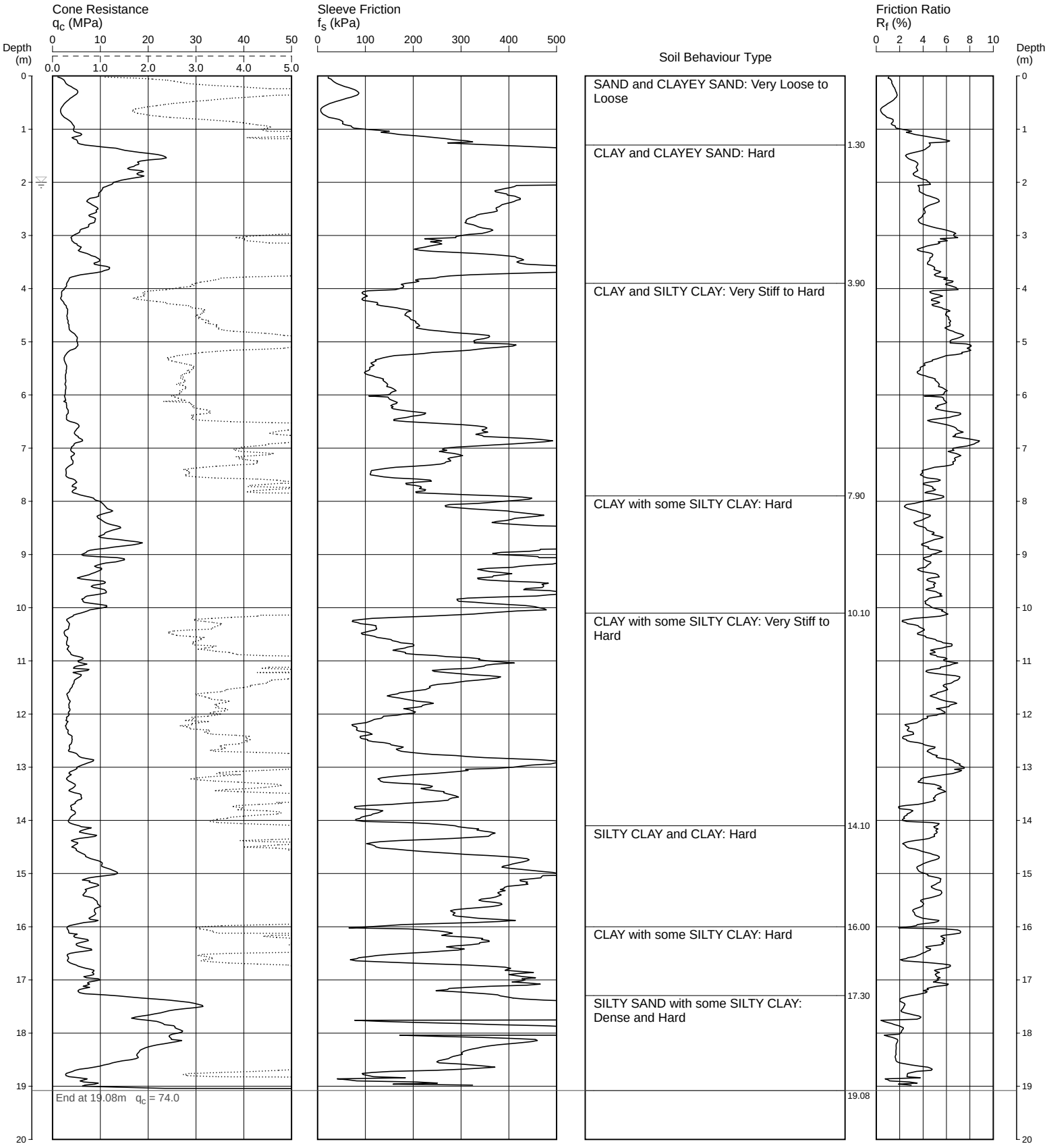
COORDINATES: 290968E 6278132N

CPT101

Page 1 of 1

DATE 28/08/2017

PROJECT No: 85644.02



REMARKS: TEST DISCONTINUED DUE TO CONE TIP REFUSAL IN PROBABLE GRAVELS
GROUNDWATER OBSERVED AT 2.0 m DEPTH AFTER WITHDRAWAL OF RODS

Water depth after test: 2.00m depth (assumed)

File: P:\85644.02 - RICHMOND STEMAg High School\4.0 Field Work\CPT\CPT101.CP5

Cone ID: 161005 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: CONRAD GARGETT PTY LTD

PROJECT: HURLSTONE AGRICULTURAL HIGH SCHOOL

LOCATION: VINES DRIVE, RICHMOND

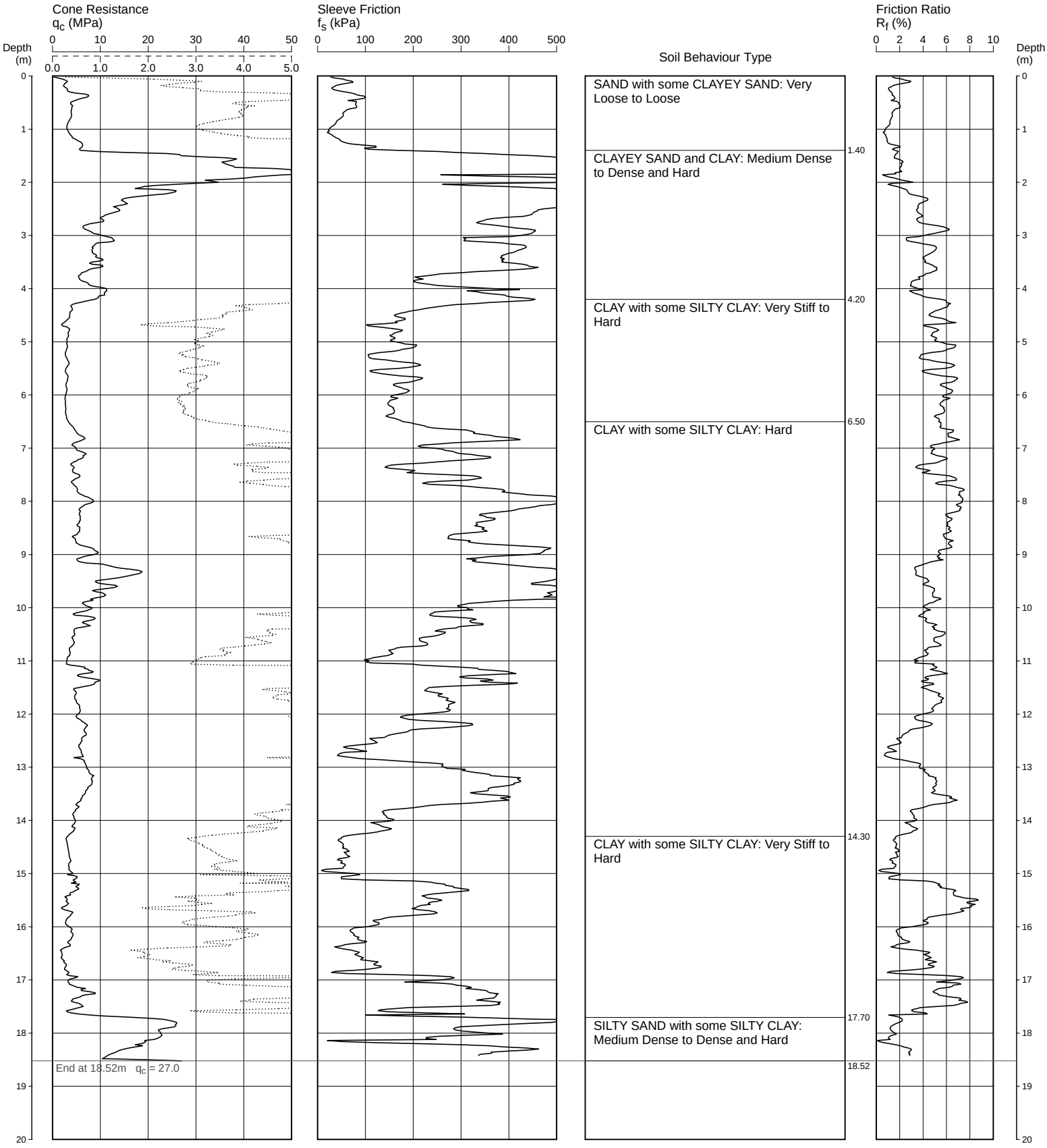
REDUCED LEVEL: 23.0

COORDINATES: 290876E 6278146N

CPT102

DATE 28/08/2017

PROJECT No: 85644.02



REMARKS: TEST DISCONTINUED DUE TO BENDING IN PROBABLE GRAVELS
NO WATER OBSERVED TO AT LEAST 10 m DEPTH (LIMIT OF TAPE MEASURE) AFTER WITHRDAWAL OF RODS

File: P:\85644.02 - RICHMOND STEMAg High School\4.0 Field Work\CPT\CPT102.CP5
Cone ID: 161005 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: CONRAD GARGETT PTY LTD

PROJECT: HURLSTONE AGRICULTURAL HIGH SCHOOL

LOCATION: VINES DRIVE, RICHMOND

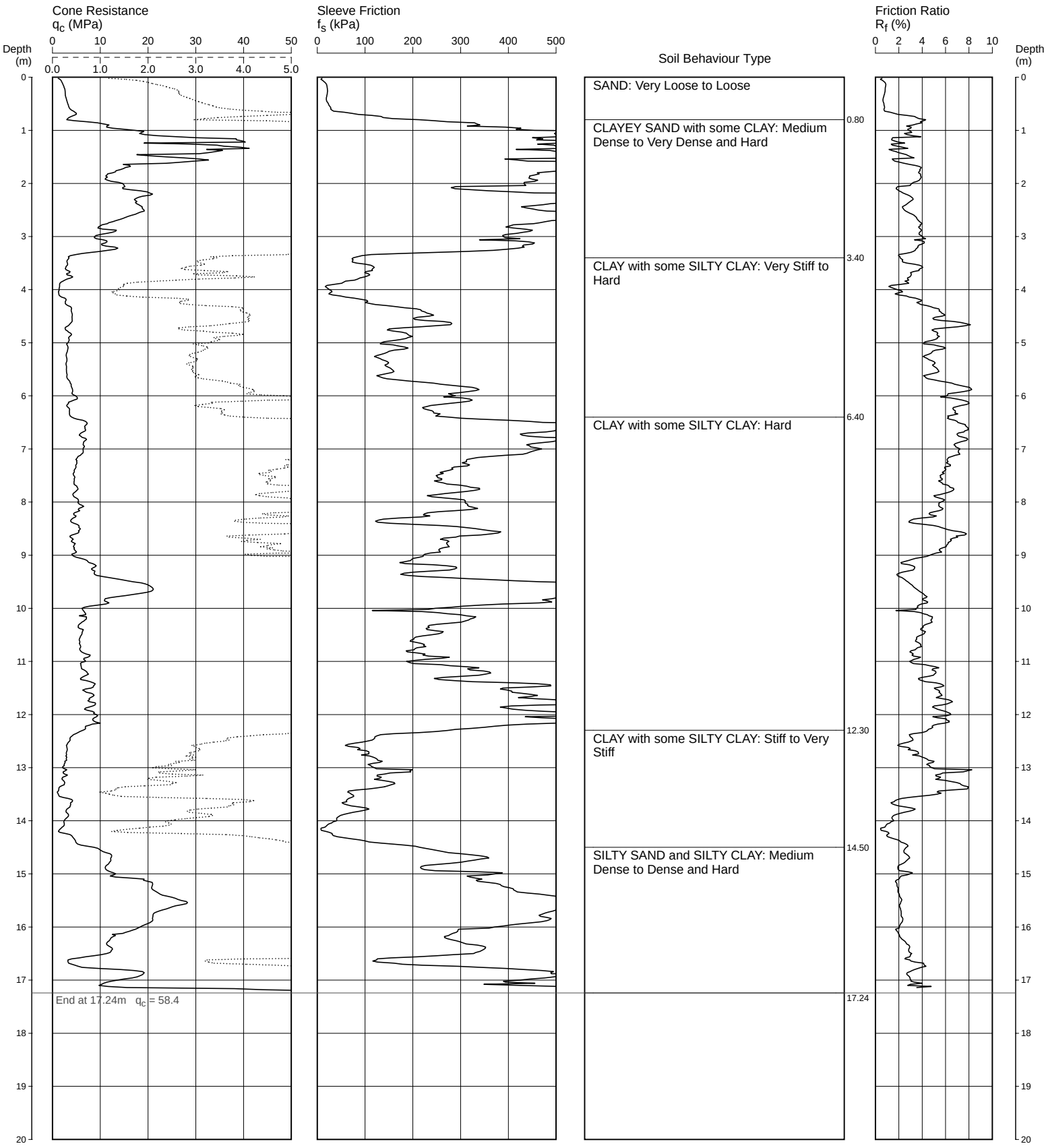
REDUCED LEVEL: 23.0

COORDINATES: 290841E 6278111N

CPT103

DATE 28/08/2017

PROJECT No: 85644.02



REMARKS: TEST DISCONTINUED DUE TO NEAR REFUSAL OF CONE TIP IN PROBABLE GRAVELS
NO WATER OBSERVED TO AT LEAST 10 m DEPTH (LIMIT OF TAPE MEASURE) AFTER WITHRDAWAL OF RODS

File: P:\85644.02 - RICHMOND STEMAg High School\4.0 Field Work\CPT\CPT103.CP5
Cone ID: 161005 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: CONRAD GARGETT PTY LTD

PROJECT: HURLSTONE AGRICULTURAL HIGH SCHOOL

LOCATION: VINES DRIVE, RICHMOND

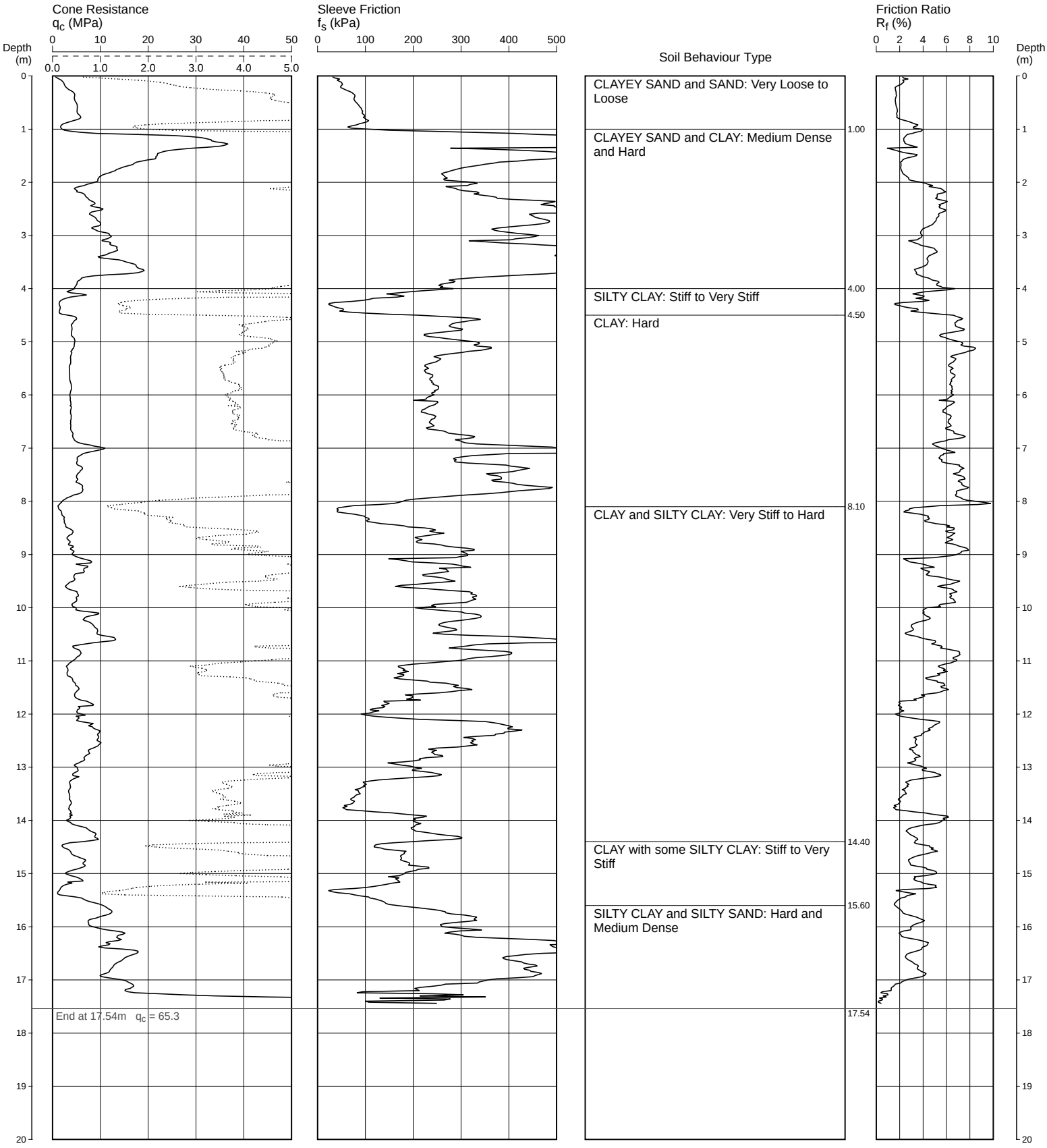
REDUCED LEVEL: 22.9

COORDINATES: 290890E 6278072N

CPT104

DATE 28/08/2017

PROJECT No: 85644.02



REMARKS: TEST DISCONTINUED DUE TO BENDING IN PROBABLE GRAVELS
NO WATER OBSERVED TO AT LEAST 10 m DEPTH (LIMIT OF TAPE MEASURE) AFTER WITHRDAWAL OF RODS

File: P:\85644.02 - RICHMOND STEMAg High School\4.0 Field Work\CPT\CPT104.CP5
Cone ID: 161005 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: CONRAD GARGETT PTY LTD

PROJECT: HURLSTONE AGRICULTURAL HIGH SCHOOL

LOCATION: VINES DRIVE, RICHMOND

REDUCED LEVEL: 23.2

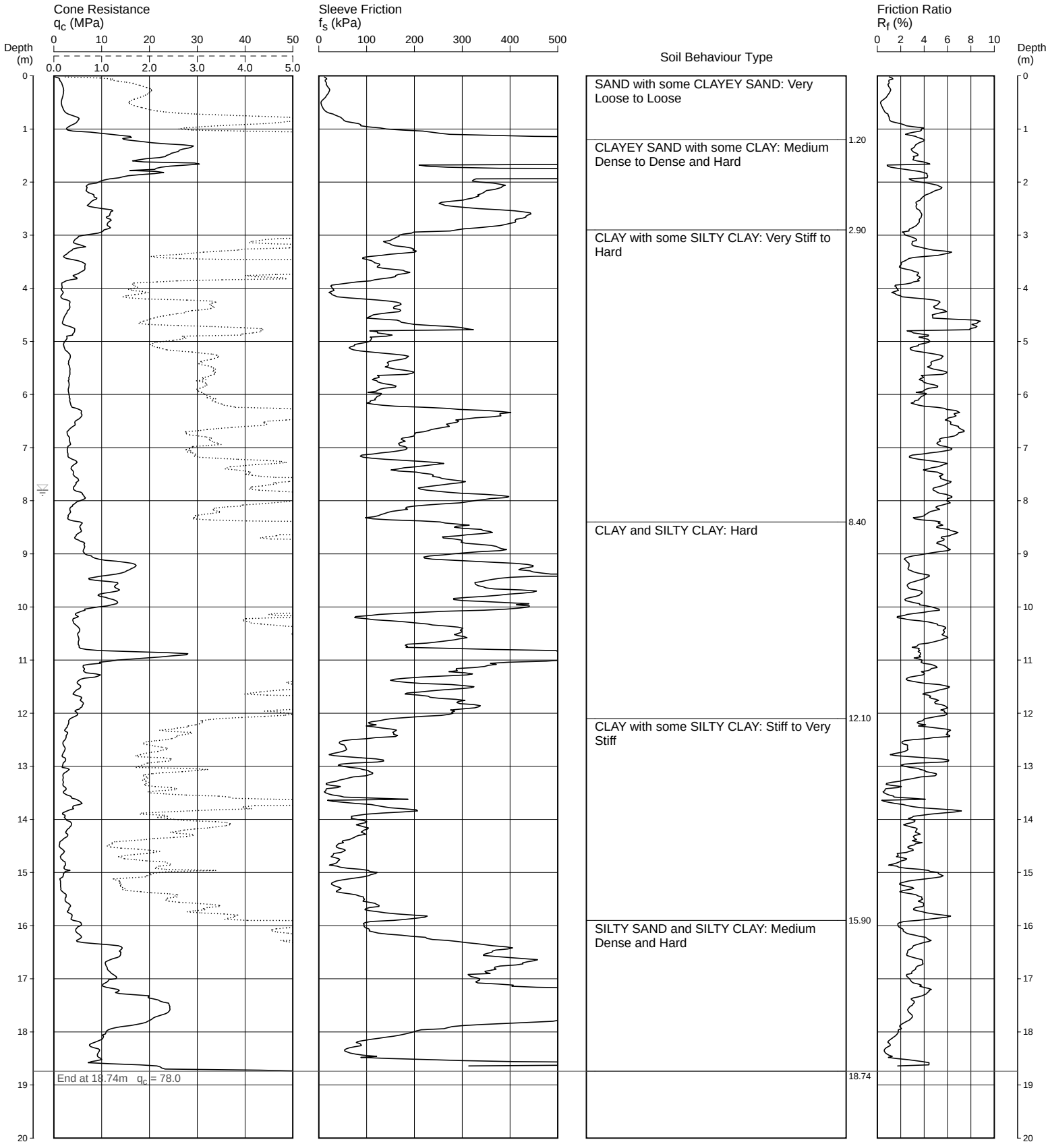
COORDINATES: 290790E 6278094N

CPT105

Page 1 of 1

DATE 28/08/2017

PROJECT No: 85644.02



REMARKS: TEST DISCONTINUED DUE TO REFUSAL OF CONE TIP IN PROBABLE GRAVELS
GROUNDWATER OBSERVED AT 7.8 m AFTER WITHRDAWAL OF RODS

Water depth after test: 7.80m depth (measured)

File: P:\85644.02 - RICHMOND STEMAg High School\4.0 Field Work\CPT\CPT105.CP5

Cone ID: 161005 **Type:** I-CFXY-10

ConePlot Version 5.9.2

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CONE PENETRATION TEST

CLIENT: CONRAD GARGETT PTY LTD

PROJECT: HURLSTONE AGRICULTURAL HIGH SCHOOL

LOCATION: VINES DRIVE, RICHMOND

REDUCED LEVEL: 23.0

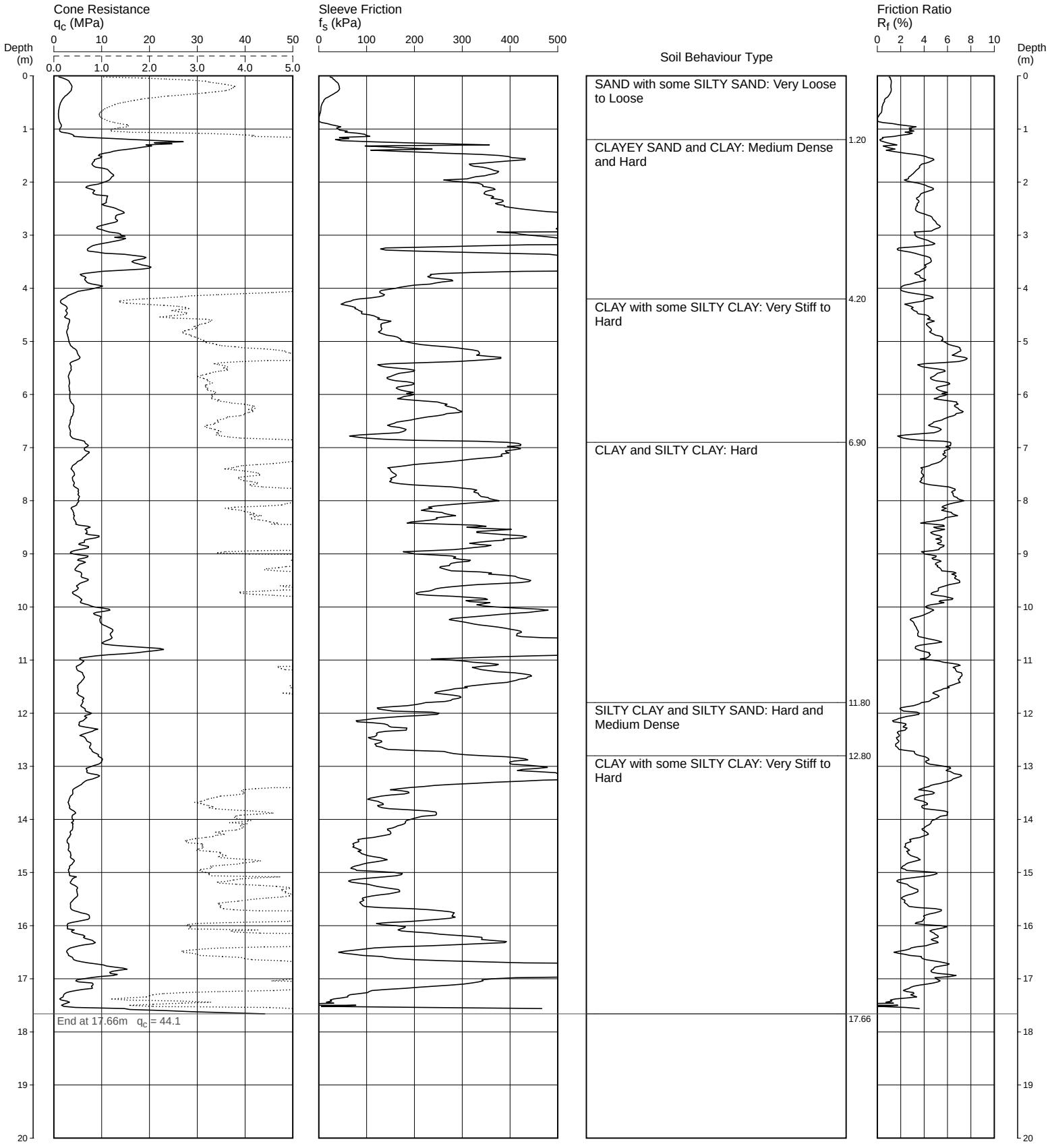
COORDINATES: 290896E 6278033N

CPT106

Page 1 of 1

DATE 28/08/2017

PROJECT No: 85644.02



REMARKS: TEST DISCONTINUED DUE TO BENDING IN GRAVELS
NO WATER OBSERVED TO AT LEAST 10 m DEPTH (LIMIT OF TAPE MEASURE) AFTER WITHRDAWAL OF RODS

File: P:\85644.02 - RICHMOND STEMAg High School\4.0 Field Work\CPT\CPT106.CP5
Cone ID: 161005 **Type:** I-CFXY-10

ConePlot Version 5.9.2
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TEST PIT LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 22.9 AHD
EASTING: 290995
NORTHING: 6278190

PIT No: 107
PROJECT No: 85644.02
DATE: 6/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		FILLING - dark grey silty fine to medium sand filling with trace rootlets, damp to moist - some rootlets at 0.1m		A	0.1				
					0.2				
	0.3	SILTY SAND - loose to medium dense, brown, silty fine to medium sand, moist		A	0.5				
					0.6				
22		0.9m: becoming wet		A	0.9				
	1.0	CLAYEY SAND - medium dense, grey mottled orange-brown clayey fine sand		A	1.0		1.0-1.2m: bulk sample		1
					1.1				
	1.2	Pit discontinued at 1.2m - limit of investigation							
21									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4.5T excavator - 600mm bucket

LOGGED: JAP

SURVEY DATUM: MGA94

WATER OBSERVATIONS: Free groundwater observed at 0.9m

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

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TEST PIT LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.1 AHD
EASTING: 290845
NORTHING: 6278070

PIT No: 108
PROJECT No: 85644.02
DATE: 6/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
23		TOPSOIL - dark grey, silty, fine sand filling with trace of gravel, damp		A	0.1				
	0.2	SILTY SAND - medium dense, brown, silty, fine to medium sand, damp to moist		A	0.2				
				A	0.6				
					0.7				
	1 1.0	CLAYEY SAND - medium dense, grey mottled brown-orange, clayey fine sand, damp		A	1.0		1.0-1.1m: bulk sample		1
22	1.1	Pit discontinued at 1.1m - limit of investigation			1.1				

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4.5T excavator - 600mm bucket

LOGGED: JAP

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

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TEST PIT LOG

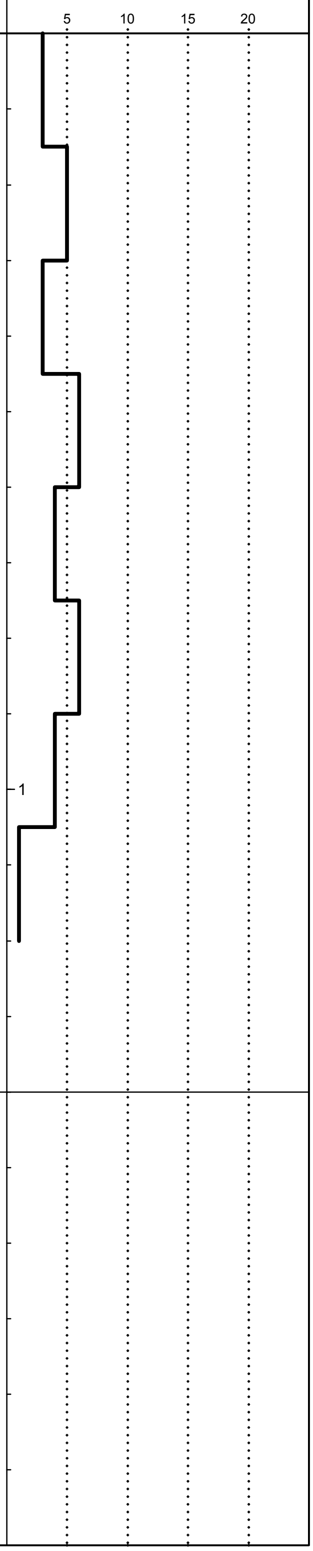
CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.2 AHD
EASTING: 290777
NORTHING: 6278053

PIT No: 109
PROJECT No: 85644.02
DATE: 6/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water
		FILLING - dark grey/brown, silty fine sand filling, some medium to coarse gravel and building rubble (concrete, brick) sandstone		A	0.1–0.2			
23	0.3	FILLING - dark grey, silty fine sand filling, some medium to coarse sandstone gravel and trace building rubble (brick and concrete)		A	0.5–0.6			
22	1.2	CLAYEY SAND - grey mottled orange-brown clayey sand, possibly filling		A	1.3–1.4			
	1.4	Pit discontinued at 1.4m - limit of investigation						

Dynamic Penetrometer Test (blows per 150mm)



RIG: 4.5T excavator - 600mm bucket **LOGGED:** JAP **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_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.3 AHD
EASTING: 290772
NORTHING: 6278068

PIT No: 110
PROJECT No: 85644.02
DATE: 6/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
									5 10 15 20
		FILLING - dark grey, silty fine sand filling			0.1				
				A					
	0.2				0.2				
23		FILLING - dark grey/brown, silty fine sand filling with some building rubble (plastic, wood, rubber etc)			0.4				
				A					
					0.5				
	1								1
	1.1	CLAYEY SAND - grey mottled orange-brown clayey sand, moist (possibly filling)			1.2				
				A					
22	1.3	Pit discontinued at 1.3m - limit of investigation			1.3				

RIG: 4.5T excavator - 600mm bucket

LOGGED: JAP

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

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TEST PIT LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.2 AHD
EASTING: 290760
NORTHING: 6278053

PIT No: 111
PROJECT No: 85644.02
DATE: 6/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
23	0.2	FILLING - dark grey, silty fine sand filling, trace building rubble (brick), humid		A	0.1				
		FILLING - dark grey silty sand filling with building rubble from 0.3m (metal wire, concrete slab, metal drum)			0.2				
22	1.2	CLAYEY SAND - grey mottled orange brown clayey sand, moist (possibly filling)		A	1.2				
	1.3	Pit discontinued at 1.3m - limit of investigation			1.3				

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20; 1

RIG: 4.5T excavator - 600mm bucket

LOGGED: JAP

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

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TEST PIT LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.3 AHD
EASTING: 290762
NORTHING: 6278064

PIT No: 112
PROJECT No: 85644.02
DATE: 6/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
									5 10 15 20
		FILLING - dark grey, silty fine sand filling with some clay, damp		A	0.0				
					0.1				
23	0.3	FILLING - mottled dark grey-brown, silty fine sand filling with some fine to medium sandstone gravel, moist							
	1								1
	1.1	CLAYEY SAND - grey mottled orange-brown clayey sand, moist (possible filling)		A	1.1				
					1.2				
22	1.3	Pit discontinued at 1.3m - limit of investigation							

RIG: 4.5T excavator - 600mm bucket

LOGGED: JAP

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

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TEST PIT LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.1 AHD
EASTING: 290762
NORTHING: 6278047

PIT No: 113
PROJECT No: 85644.02
DATE: 6/9/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
23	0.4	FILLING - dark grey, silty fine sand filling							5 10 15 20
		FILLING - dark grey-brown, silty fine sand filling with some fine to medium gravel, damp		A	0.4 0.5				
22	1.1	CLAYEY SAND - grey mottled orange-brown clayey sand, moist (possible filling)		A	1.1				
	1.3	Pit discontinued at 1.3m - limit of investigation			1.3				

RIG: 4.5T excavator - 600mm bucket

LOGGED: JAP

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

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Appendix D

Previous Field Work Results

BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.4 AHD
EASTING: 290646
NORTHING: 6278336
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 85644.00
DATE: 21/10/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
					0.0		0.0-1.5m: Bulk sample		
23	0.3	TOPSOIL - dark grey-brown silty fine grained sand topsoil with rootlets, dry to humid		A	0.1				
		SILTY SAND - medium dense, dark grey-brown silty fine grained sand, humid		A	0.5				
22	1	- with some clay, grey-brown fine to medium grained, moist below 0.9m depth - becoming slightly clayey below 1.2m depth		A	1.0		2,4,7 N = 11 Rec = 350mm		
				S	1.35				
				A	1.5				
21	2							▼	
				S	2.5		8,1216 refusal Rec = 0.4m		
	3				2.9				
20	3.4	CLAYEY SAND - medium dense, grey clayey fine to medium grained sand, moist to wet		D	3.5				
	4	SILTY CLAY - very stiff, grey and orange-brown mottled, silty, high plasticity clay with a trace of fine grained sand, moist		S	4.0		4,8,10 N = 18 Rec = 350mm pp = 400		
19					4.35				
	5								
18					5.5				
		- becoming grey and slightly sandy below 5.7m depth. Sand fraction fine grained		S			6,11,13 N = 24 Rec = 450mm pp = 200-250		
	6				5.95				
17									
	7				7.0				
	7.0	SANDY SILTY CLAY - very stiff, grey sandy silty medium plastic clay. Sand fraction fine grained		S			8,12,16 N = 28 Rec = 350mm pp = 350		
16	7.45	Bore discontinued at 7.45m - limit of investigation			7.35 7.45				
	8								
15									
	9								
14									

RIG: DT250 **DRILLER:** GM **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: Free groundwater observed at 2.5m

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

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BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.2 AHD
EASTING: 290641
NORTHING: 6278178
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 85644.00
DATE: 21/10/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
23	0.2	TOPSOIL - dark grey-brown silty fine grained sand topsoil with rootlets, dry to humid		A	0.0				
		SILTY SAND - medium dense, grey-brown silty fine grained sand, humid		A	0.1 0.5				
22	1	- with some clay, grey-brown and orange-brown mottled, with fine to medium grained sand, moist below 0.9m depth - becoming dense below 1.0m depth - becoming fine grained, slightly clayey below 1.1m depth		A S A	1.0 1.45 1.5		3,13,24 N = 37 Rec = 450mm		
21	2								
		- with some clay, becoming orange-brown below 2.6m depth		S	2.5 2.83		10,18,21 N = 39 Rec = 330		
20	3								
19	4	4.0 SILTY CLAY -stiff, grey with orange-brown mottled, silty high plasticity clay with a trace of fine grained sand, moist		S	4.0 4.36		3,5,7 N = 12 Rec = 360 pp = 150-200		
18	5								
		- becoming very stiff and grey below 5.5m depth		S	5.5 5.84		5,10,11 N = 21 Rec = 340mm pp = 300		
17	6								
16	7			S	7.0		6,9,11 N = 20 Rec = 450mm pp = 200-250		
	7.45	- becoming grey and orange-brown and black mottled below 7.3m depth			7.45				
15	8	Bore discontinued at 7.45m - limit of investigation							
14	9								

RIG: DT250 **DRILLER:** GM **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

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

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BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.0 AHD
EASTING: 290634
NORTHING: 6278036
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 85644.00
DATE: 27/9/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
23		TOPSOIL - dark grey-brown silty fine grained sand topsoil with a trace of fine grained gravel, dry to moist		A/E	0.1				
	0.5			A/E	0.5				
22	1	SILTY SAND - dense to very dense, light grey-brown silty fine grained sand, slightly clayey, damp to moist		A/E	1.0				1
				S	1.45		13,25,28 N = 53		
21	2				2.5				2
				S	2.95		16,22,20 N = 42		
20	3								3
19	4				4.0				4
	4.0	SILTY CLAY - very stiff, light grey and orange-brown mottled, silty clay with a trace of fine grained sand, clay fraction is low to medium plasticity, M<Wp		S	4.45		7,9,11 N = 20		
18	5								5
		5.5m: becoming light grey below 5.5m			5.5				
				S	5.95		6,10,13 N = 23		
17	6								6
16	7				7.0				7
		7.0m: becoming hard, light grey, orange-brown and yellow brown mottled below 7.0m		S			10,15,22 N = 37		
	7.45				7.45				
		Bore discontinued at 7.45m - limit of investigation							
15	8								8
14	9								9

RIG: Explora 140 **DRILLER:** JS **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.3 AHD
EASTING: 290772
NORTHING: 6278209
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 85644.00
DATE: 27/9/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
23	0.3	TOPSOIL - dark grey-brown, silty fine grained sand topsoil with a trace of fine grained rounded gravel, dry to moist		A	0.2				
				A	0.5				
		SILTY SAND - dense, light grey, silty fine grained sand, slightly clayey, dry to moist		A	1.0		20,30/140mm refusal		
22	1			S	1.14				
	2							▼	
21	2.5	CLAYEY SAND - medium dense, light grey and brown mottled, clayey, fine grained sand		S	2.5		9,11,18 N = 29		
	3				2.95				
20	4				4.0				
19	4.0	SILTY CLAY - very stiff, light grey and brown mottled, silty clay with a trace of fine grained sand. Clay fraction is low plasticity - becoming light grey below 4.1m		S	4.45		7,9,11 N = 20		
	5				5.5				
18				S	5.95		5,9,11 N = 20		
	6								
17	7				7.0				
16	7.0	SANDY SILT - hard, light grey-brown sandy silt, slightly clayey. Sand fraction is fine grained		S			12,15,18 N = 33		
	7.45	Bore discontinued at 7.45m - limit of investigation			7.45				
15	8								
14	9								

RIG: Explora 140 **DRILLER:** JS **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: Free groundwater observed at 1.9m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.2 AHD
EASTING: 290712
NORTHING: 6278122
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 85644.00
DATE: 28/9/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
23	0.2	TOPSOIL - dark grey-brown, silty fine grained sand topsoil, dry to moist		A/E	0.1 0.2		0.2-1.0m: Bulk sample		
		SILTY SAND - medium dense, grey-brown silty fine grained sand, moist		A	0.5			▼	
		- becoming wet below 0.9m							
22	1.0	CLAYEY SAND - medium dense, light grey and orange-brown mottled, clayey fine grained sand		A S	1.0 1.35		3,4,19 N = 23		
21		- becoming orange-brown below 2.5m		S	2.5 2.95		9,15,13 N = 28		
19				S	4.0 4.4		5,6,5 N = 11		
18	4.8	SILTY CLAY - very stiff, grey and orange-brown mottled silty clay. Clay fraction is low to medium plasticity, M<Wp to M~Wp		S	5.5 5.95		6,10,13 N = 23 pp = 400		
16				S	7.0		5,8,12 N = 20 pp = 400		
	7.45	Bore discontinued at 7.45m - limit of investigation			7.45				

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: Free groundwater observed at 0.9m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.3 AHD
EASTING: 290772
NORTHING: 6278063
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 85644.00
DATE: 27/9/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
23	0.2	TOPSOIL - dark grey-brown silty fine grained sand topsoil with some fine to medium subangular to angular gravel, dry		A	0.1				
				A	0.5				
		FILLING - very loose, dark grey-brown silty fine grained sand filling, slightly gravelly. Gravel fraction fine to medium subangular to angular							
22	1	- with rubbish inclusions, plastic bags, rags and plastic bottles below 0.5m		A	1.0			▼	1
		- becoming slightly clayey below 1.0m		S	1.45		0,1,2 N = 3		
21	2								2
	2.5	CLAYEY SAND - medium dense to dense, light yellow-grey and orange-brown mottled, clayey fine grained sand		S	2.5		13,14,16 N = 30		
	3				2.95				3
20	4	4.0							4
		SILTY CLAY - stiff, light grey and yellow-brown mottled, silty clay with some sand. Sand fraction is fine grained, clay is low plasticity		S	4.0		3,3,8 N = 11		
19	5				4.45				5
	5.25	SILTY CLAY - very stiff, grey-brown and brown, silty clay with a trace of fine grained sand							
18	6			S	5.5		8,10,15 N = 25		6
					5.95				
17	7	- becoming hard below 7.0m		S	7.0		10,14,17 N = 31		7
16	7.45	Bore discontinued at 7.45m			7.45				
		- limit of investigation							
15	8								8
	9								9
14									

RIG: Explora 140 **DRILLER:** JS **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: Free groundwater observed at 1.0m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.0 AHD
EASTING: 291004
NORTHING: 6278212
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 85644.00
DATE: 27/9/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
23	0.1	TOPSOIL - dark grey-brown silty fine grained sand topsoil		A/E	0.1			▼	
		SILTY SAND - dense, grey silty fine grained sand, wet - becoming yellow-brown below 0.4m							
22	1	- becoming slightly clayey below 1.2m		S	1.0 1.45		11,24,15/100mm refusal		1
21	2								2
	2.5	CLAYEY SAND - dense, light grey clayey fine grained sand, moist		S	2.5 2.95		10,13,17 N = 30		
20	3								3
	3.9	SILTY CLAY - very stiff, grey and yellow-brown mottled, silty clay with a trace of fine grained sand. Clay fraction is low plasticity, M<Wp		S	4.0		4,9,15 N = 24		
19	4								4
18	5				4.85 5.5				5
				S			6,11,13 N = 24		
17	6				5.95				6
16	7	- becoming hard below 7.0m depth		S	7.0		15,22,22 N = 44		7
	7.45	Bore discontinued at 7.45m - limit of investigation			7.45				
15	8								8
14	9								9

RIG: Explora 140 **DRILLER:** JS **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: Free groundwater observed at 0.3m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 22.9 AHD
EASTING: 290940
NORTHING: 6278122
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 85644.00
DATE: 27/9/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
					0.0		0.0-1.0m: Bulk sample		
22	0.3	TOPSOIL - dark grey-brown silty fine grained sand topsoil, dry to moist		A	0.1				
		SILTY SAND - dense, dark grey-brown, silty fine grained sand, dry to moist		A	0.5			▼	
	1	- becoming light grey-brown below 0.9m		A	1.0				
		- becoming slightly clayey below 1.1m		S			6,13,21 N = 34		
21	2				1.45				
		- becoming medium dense below 2.5m			2.5				
				S			7,11,15 N = 26		
20	3				2.95				
19	4				4.0				
	4.0	SILTY CLAY - stiff, light grey and orange-brown mottled, silty clay with a trace of fine grained sand, M<Wp		S			4,6,8 N = 14		
18	5				4.45				
					5.5				
		- becoming very stiff below 5.5m		S			5,8,13 N = 21		
17	6				5.95				
16	7				7.0				
				S			7,10,11 N = 21		
	7.45				7.45				
15	8	Bore discontinued at 7.45m - limit of investigation							
14	9								
13									

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: Free groundwater observed at 0.7m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 23.0 AHD
EASTING: 290856
NORTHING: 6278041
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 85644.00
DATE: 27/9/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
23		TOPSOIL - dark grey-brown, silty fine grained sand topsoil, dry to moist		A	0.1				
				A	0.5			▼	
22	1								1
	0.9	CLAYEY SILTY SAND - medium dense, light grey and brown mottled clayey silty fine grained sand, wet		S	1.0		7,9,13 N = 22		
					1.45				
21	2								2
	2.5	SILTY SAND - dense, light grey and brown mottled, silty fine grained sand, slightly clayey		S	2.5		14,19,19 N = 38		
					2.95				
20	3								3
19	4								4
	4.0	SANDY SILT - stiff, light grey and brown mottled, sandy silt, slightly clayey, sand fraction is fine grained		S	4.0		4,5,5 N = 10		
					4.45				
18	5								5
	5.0	SILTY CLAY - very stiff, light grey and brown mottled, silty clay with a trace of fine grained sand, M<Wp							
					5.5				
				S			5,9,11 N = 20		
17	6				5.95				6
16	7								7
		- becoming hard below 7.0m		S	7.0		7,13,19 N = 32		
	7.45	Bore discontinued at 7.45m - limit of investigation			7.45				
15	8								8
14	9								9

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: Free groundwater observed at 0.9m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 22.8 AHD
EASTING: 291041
NORTHING: 6277983
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 85644.00
DATE: 27/9/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
22	0.5	TOPSOIL - dark grey-brown silty sand topsoil, dry							
		SILTY SAND - medium dense, light grey-brown silty sand with a trace of clay, moist			1.0			▼	
	1.2	CLAYEY SILTY SAND - medium dense, light grey and brown mottled, clayey silty fine grained sand		S	1.45		4,9,9 N = 18		
21					2.5				
				S	2.95		5,10,9 N = 19		
20					4.0				
				S	4.45		5,9,12 N = 21		
19	4.3	SILTY CLAY - very stiff, grey and brown mottled silty clay with a trace of fine grained sand, clay fraction is low plasticity			5.5				
				S	5.95		3,7,10 N = 17		
18					7.0				
				S			6,11,18 N = 29		
17	7.45	Bore discontinued at 7.45m - limit of investigation			7.45				
16									
15									
14									
13									

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: Free groundwater observed at 0.9m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Conrad Gargett Pty Ltd
PROJECT: Hurlstone Agricultural High School (Hawkesbury)
LOCATION: Londonderry Road, Richmond

SURFACE LEVEL: 22.9 AHD
EASTING: 290991
NORTHING: 6277929
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 85644.00
DATE: 27/9/2016
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
					0.0		0.0-1.0m: Bulk sample		
22	0.2	TOPSOIL - dark grey-brown, silty fine grained sand topsoil with rootlets, dry		A/E	0.1				
		SILTY SAND - medium dense, dark grey-brown, silty fine grained sand, dry		A/E	0.5				
	1	- becoming light grey-brown and moist below 0.6m		A/E	1.0			▼	1
	1.2	CLAYEY SAND - medium dense, light grey and orange-brown mottled, clayey fine grained sand with some silt, moist		S	1.45		3,3,19 N = 22		
21	2			S	2.5		3,7,9 N = 16		2
20	3				2.95				3
19	4			S	4.0		6,9,12 N = 21		4
	4.2	SILTY CLAY - very stiff, light grey and orange-brown mottled, silty clay with a trace of fine grained sand. Clay fraction is low plasticity, M<Wp			4.45				
18	5								5
		5.5m: becoming light grey below 5.5m		S	5.5		5,8,9 N = 17		
17	6				5.95				6
16	7			S	7.0		5,7,12 N = 19		7
	7.45	Bore discontinued at 7.45m - limit of investigation			7.45				
15	8								8
14	9								9
13									

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** DCH **CASING:** Uncased

TYPE OF BORING: Solid flight auger to 7.0m

WATER OBSERVATIONS: Free groundwater observed at 0.9m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix E

Laboratory Test Results

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Newcastle Laboratory
15 Callistemon Close Warabrook Newcastle NSW 2310
Phone: (02) 4960 9600
Fax: (02) 4960 9601
Email: dave.millard@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA WORLD RECOGNISED ACCREDITATION

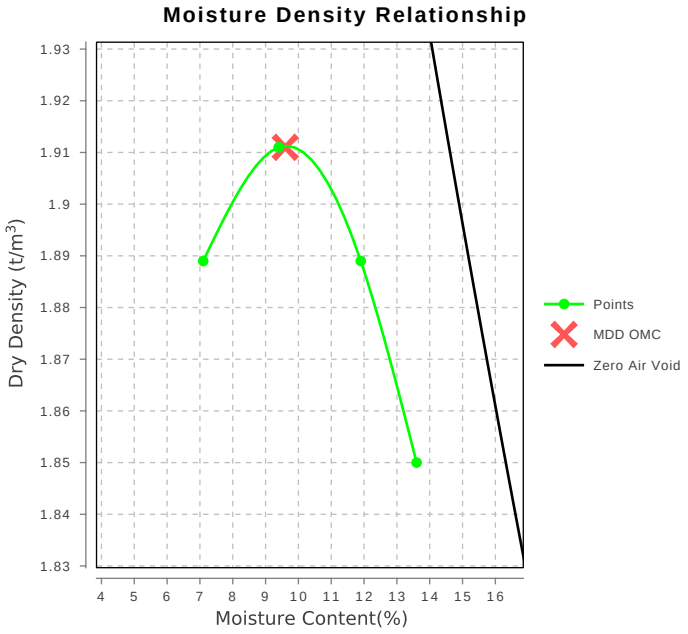
Approved Signatory: Dave Millard
Nata Accredited Laboratory Number: 828

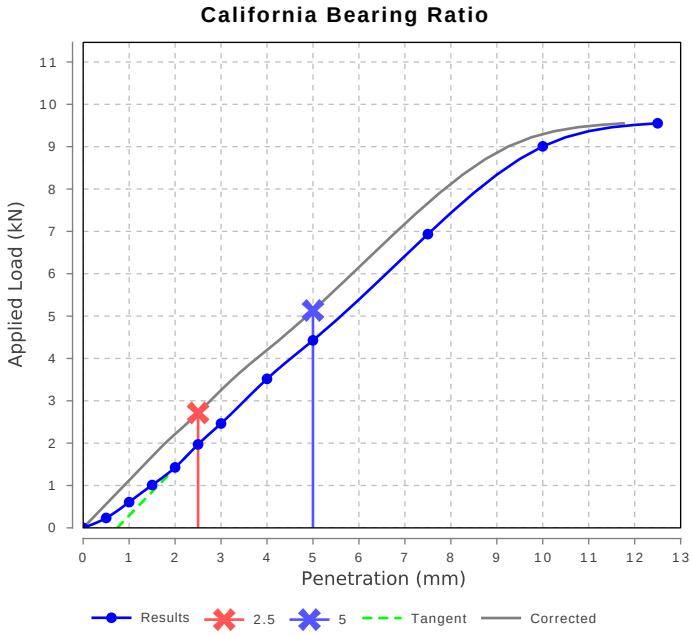
Report Number: **85644.00-1**
Issue Number: 1
Date Issued: 01/11/2016
Client: Conrad Gargett Pty Ltd
Suite C.3.18/22-36 Mountain Street, ULTIMO NSW 2007
Project Number: 85644.00
Project Name: Hurlstone Hawkesbury STEMAg High School
Project Location: Londonderry Road, Richmond
Work Request: 146
Sample Number: 16-146A
Date Sampled: 05/10/2016
Sampling Method: Sampled by Engineering Department
Sample Location: **Bore 5 (0.2 - 1.0m)**
Material: Silty SAND

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	12.2

Moisture Density Relationship (AS 1289 5.1.1 & 2.1.1)	
Mould Type	1 LITRE MOULD A
Compaction	Standard
No. Layers	3
No. Blows / Layer	25
Maximum Dry Density (t/m^3)	1.91
Optimum Moisture Content (%)	9.5
Oversize Material (%)	0

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**25**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Maximum Dry Density (t/m^3)	1.91		
Dry Density after Soaking (t/m^3)	1.94		
Optimum Moisture Content (%)	9.5		
Laboratory Moisture Ratio (%)	103.0		
Laboratory Density Ratio (%)	99.5		
Moisture Content at Placement (%)	9.9		
Moisture Content Top 30mm (%)	10.7		
Moisture Content Rest of Sample (%)	11.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		





Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
Newcastle Laboratory
15 Callistemon Close Warabrook Newcastle NSW 2310
Phone: (02) 4960 9600
Fax: (02) 4960 9601
Email: dave.millard@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA
WORLD RECOGNISED ACCREDITATION

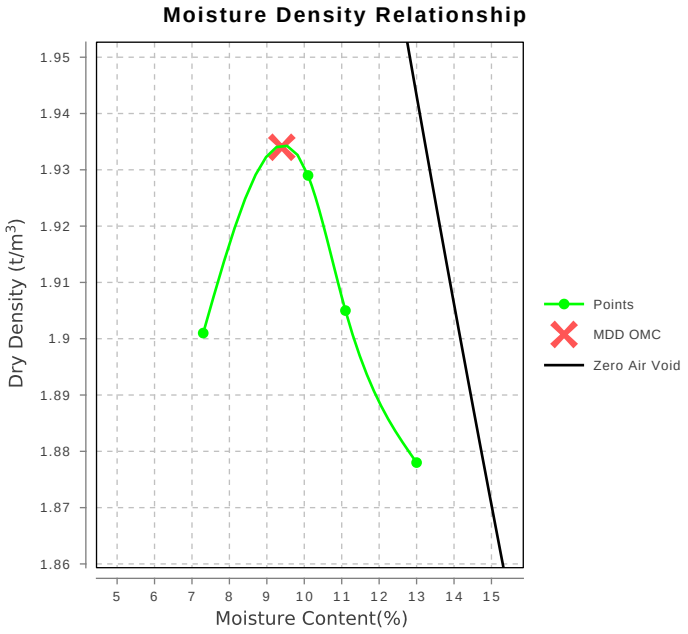
Approved Signatory: Dave Millard
Nata Accredited Laboratory Number: 828

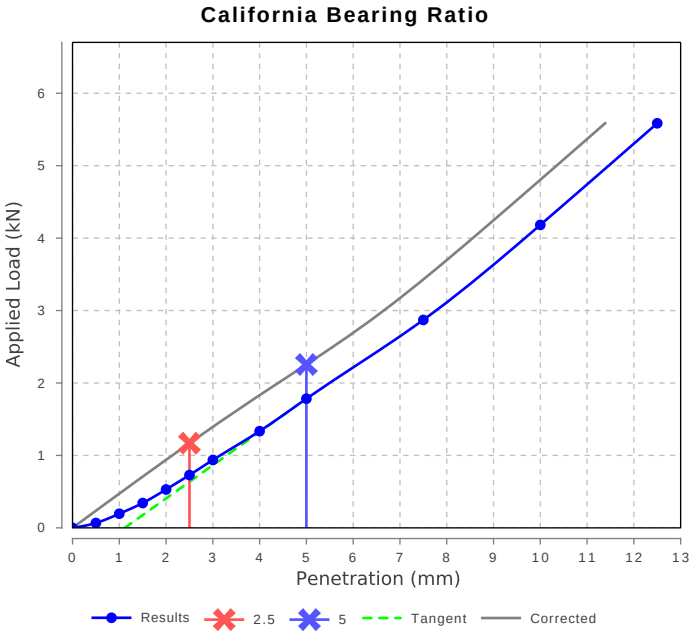
Report Number: **85644.00-1**
Issue Number: 1
Date Issued: 01/11/2016
Client: Conrad Gargett Pty Ltd
Suite C.3.18/22-36 Mountain Street, ULTIMO NSW 2007
Project Number: 85644.00
Project Name: Hurlstone Hawkesbury STEMAg High School
Project Location: Londonderry Road, Richmond
Work Request: 146
Sample Number: 16-146B
Date Sampled: 05/10/2016
Sampling Method: Sampled by Engineering Department
Sample Location: **Bore 8 (0.0 - 1.0m)**
Material: Silty SAND

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	10.2

Moisture Density Relationship (AS 1289 5.1.1 & 2.1.1)	
Mould Type	1 LITRE MOULD A
Compaction	Standard
No. Layers	3
No. Blows / Layer	25
Maximum Dry Density (t/m^3)	1.93
Optimum Moisture Content (%)	9.5
Oversize Material (%)	0

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**11**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Maximum Dry Density (t/m^3)	1.93		
Dry Density after Soaking (t/m^3)	1.94		
Optimum Moisture Content (%)	9.5		
Laboratory Moisture Ratio (%)	103.0		
Laboratory Density Ratio (%)	99.5		
Moisture Content at Placement (%)	9.7		
Moisture Content Top 30mm (%)	11.2		
Moisture Content Rest of Sample (%)	11.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		





Material Test Report

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NATA
WORLD RECOGNISED ACCREDITATION

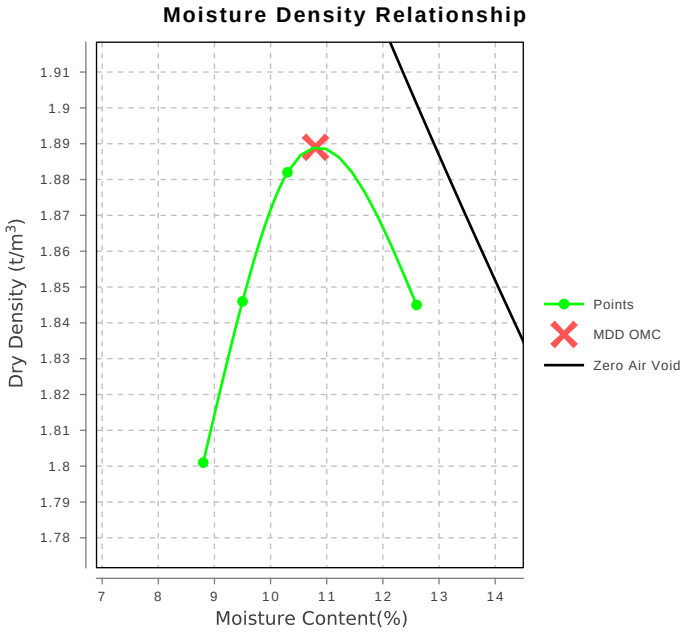
Approved Signatory: Dave Millard
Nata Accredited Laboratory Number: 828

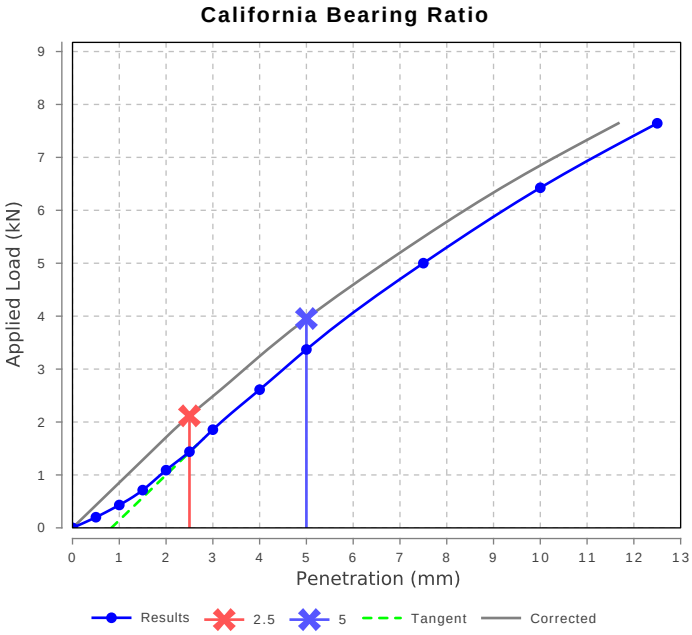
Report Number: **85644.00-1**
Issue Number: 1
Date Issued: 01/11/2016
Client: Conrad Gargett Pty Ltd
Suite C.3.18/22-36 Mountain Street, ULTIMO NSW 2007
Project Number: 85644.00
Project Name: Hurlstone Hawkesbury STEMAg High School
Project Location: Londonderry Road, Richmond
Work Request: 146
Sample Number: 16-146C
Date Sampled: 05/10/2016
Sampling Method: Sampled by Engineering Department
Sample Location: **Bore 11 (0.0 - 1.0m)**
Material: Silty SAND

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	10.5

Moisture Density Relationship (AS 1289 5.1.1 & 2.1.1)	
Mould Type	1 LITRE MOULD A
Compaction	Standard
No. Layers	3
No. Blows / Layer	25
Maximum Dry Density (t/m^3)	1.89
Optimum Moisture Content (%)	11.0
Oversize Material (%)	0

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**20**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Maximum Dry Density (t/m^3)	1.89		
Dry Density after Soaking (t/m^3)	1.88		
Optimum Moisture Content (%)	11.0		
Laboratory Moisture Ratio (%)	104.5		
Laboratory Density Ratio (%)	99.0		
Moisture Content at Placement (%)	11.3		
Moisture Content Top 30mm (%)	12.4		
Moisture Content Rest of Sample (%)	11.5		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		





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Report Number: **85644.00-1**
Issue Number: 1
Date Issued: 01/11/2016
Client: Conrad Gargett Pty Ltd
Suite C.3.18/22-36 Mountain Street, ULTIMO NSW 2007
Project Number: 85644.00
Project Name: Hurlstone Hawkesbury STEMAg High School
Project Location: Londonderry Road, Richmond
Work Request: 146
Sample Number: 16-146D
Date Sampled: 05/10/2016
Sampling Method: Sampled by Engineering Department
Sample Location: **Bore 3 (4.00 - 4.95m)**
Material: Silty CLAY

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	16.0

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Preparation Method	Dry Sieve		
Sample History	Oven Dried		
Liquid Limit (%)	29		
Plastic Limit (%)	12		
Plasticity Index (%)	**17**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	11.0		
Cracking Crumbling Curling	Curling		

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Approved Signatory: Dave Millard
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Report Number: **85644.00-1**
Issue Number: 1
Date Issued: 01/11/2016
Client: Conrad Gargett Pty Ltd
Suite C.3.18/22-36 Mountain Street, ULTIMO NSW 2007
Project Number: 85644.00
Project Name: Hurlstone Hawkesbury STEMAg High School
Project Location: Londonderry Road, Richmond
Work Request: 146
Sample Number: 16-146E
Date Sampled: 05/10/2016
Sampling Method: Sampled by Engineering Department
Sample Location: **Bore 7 (4.00 - 4.95m)**
Material: Silty CLAY

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	18.7

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Preparation Method	Dry Sieve		
Sample History	Oven Dried		
Liquid Limit (%)	41		
Plastic Limit (%)	14		
Plasticity Index (%)	**27**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	14.0		
Cracking Crumbling Curling	Curling		

Material Test Report

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Report Number: **85644.00-1**
Issue Number: 1
Date Issued: 01/11/2016
Client: Conrad Gargett Pty Ltd
Suite C.3.18/22-36 Mountain Street, ULTIMO NSW 2007
Project Number: 85644.00
Project Name: Hurlstone Hawkesbury STEMAg High School
Project Location: Londonderry Road, Richmond
Work Request: 146
Sample Number: 16-146F
Date Sampled: 05/10/2016
Sampling Method: Sampled by Engineering Department
Sample Location: **Bore 11 (5.50 - 5.95m)**
Material: Silty CLAY

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	17.6

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Preparation Method	Dry Sieve		
Sample History	Oven Dried		
Liquid Limit (%)	42		
Plastic Limit (%)	14		
Plasticity Index (%)	**28**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Linear Shrinkage (%)	17.5		
Cracking Crumbling Curling	Curling		

Material Test Report

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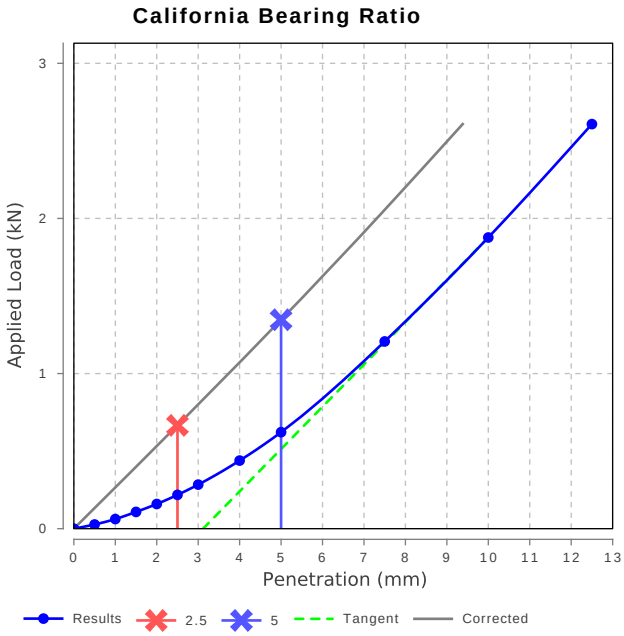
NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: Mark Matthews
NATA Accredited Laboratory Number: 828

Report Number: **85644.02-1**
Issue Number: 1
Date Issued: 20/09/2017
Client: Conrad Gargett Pty Ltd
Suite C.3.18/22-36 Mountain Street, ULTIMO NSW 2007
Contact: Mark Cassar
Project Number: 85644.02
Project Name: Hurlstone Hawkesbury STEMAg High School
Project Location: Londonderry Road, Richmond
Work Request: 1524
Sample Number: 17-1524A
Date Sampled: 06/09/2017
Sampling Method: Sampled by Engineering Department
Sample Location: **TP107 (1.0-1.2m)**
Material: Clayey sand

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**7**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Maximum Dry Density (t/m^3)	2.07		
Optimum Moisture Content (%)	9.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.0		
Dry Density after Soaking (t/m^3)	2.08		
Field Moisture Content (%)	9.9		
Moisture Content at Placement (%)	9.3		
Moisture Content Top 30mm (%)	10.0		
Moisture Content Rest of Sample (%)	9.9		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

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Approved Signatory: Mark Matthews
NATA Accredited Laboratory Number: 828

Report Number: **85644.02-1**
Issue Number: 1
Date Issued: 20/09/2017
Client: Conrad Gargett Pty Ltd
Suite C.3.18/22-36 Mountain Street, ULTIMO NSW 2007
Contact: Mark Cassar
Project Number: 85644.02
Project Name: Hurlstone Hawkesbury STEMAg High School
Project Location: Londonderry Road, Richmond
Work Request: 1524
Sample Number: 17-1524B
Date Sampled: 06/09/2017
Sampling Method: Sampled by Engineering Department
Sample Location: **TP108 (1.0-1.1m)**
Material: Clayey sand

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**7**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Maximum Dry Density (t/m^3)	1.98		
Optimum Moisture Content (%)	11.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	101.0		
Dry Density after Soaking (t/m^3)	1.98		
Field Moisture Content (%)	11.5		
Moisture Content at Placement (%)	11.1		
Moisture Content Top 30mm (%)	12.3		
Moisture Content Rest of Sample (%)	11.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	-0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0