Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Assessment

Proposed Masters Development
Rodborough Road
Frenchs Forest

Prepared for
Artro Management

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Report on Geotechnical Assessment
Proposed Masters Development
Rodborough Road Frenchs Forest

1. Introduction

This report details the results of a geotechnical assessment undertaken by Douglas Partners Pty Ltd (DP) for a proposed industrial development at Rodborough Road Frenchs Forest. The assessment was commissioned in an email dated 15 March 2012 by Mr Arthur Zouglis of Artro Management and was undertaken on the basis of DP's proposal dated 8 March 2012.

The construction of a Masters warehouse with surrounding pavements and hardstand areas is proposed. Site assessment was undertaken to provide preliminary information on subsurface conditions for due diligence and concept design purposes.

The assessment comprised a site inspection by a senior geotechnical engineer, followed by review of results from previous investigations carried out on the site and surrounding areas. The details of the assessment are presented in this report, together with comments and recommendations relating to design and construction practice.

2. Site Description and Geology

The site covers an area of approximately 3.2 ha, and is bounded by Allambie Road to the west, Warringah Road to the north, Hudson Road to the east, and Rodborough Road to the south.

At the time of inspection, the eastern portion of the site, (Lot 1), which covers about 43% of the site, was occupied by a four storey office building and an adjoining warehouse (Ricoh), with associated driveways, hardstand areas and parking areas. There was a single level underground car park under most of this building complex.

The western portion of the site, (Lot 2), was occupied by a warehouse to the south-west (Australia Post), and a double storey office complex to the north. There were also associated driveways, hardstand areas and car parking areas.

There were trees and bushes along the perimeter of the site, in particular along the northern street frontage (Warringah Road). Grassed areas and clusters of trees were also found elsewhere on the site.

The site was relatively level, with site levels falling or stepping gently towards the south east.

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site and adjoining general area is underlain by shale and laminite of an abandoned channel deposit within the

Hawkesbury Sandstone. The Hawkesbury Sandstone generally comprises medium to course grained course sandstone with minor shale and laminite lenses.

The geological mapping was generally confirmed by the field work.

3. Previous Investigations

Several investigations have previously been carried out on the site by DP and others. The investigations are summarised below:

- **DP Project 24378**, report dated April 1997, geotechnical investigation and preliminary contamination assessment for a proposed office block and warehouse, comprising eleven 300 mm diameter bores, drilled with a Pengo truck-mounted auger (bores 11 - 21). In Lot 1 the bores were taken to practical refusal on the underlying sandstone bedrock (11 - 18), whereas the bores in Lot 2 were terminated at depths between 0.7 m to 1.5 m prior to refusal (bores 19 - 21). Samples of rock core were subsequently obtained from below the level of auger refusal from bores 15 - 18 using a separate diamond core drilling rig. This investigation also included laboratory CBR testing of two soil samples collected from the natural clay in Lot 2.
- **DP Project 24378A**, report dated April 1997, preliminary contamination assessment, which included the drilling of four test bores to depths of 3.0 m with a Bobcat mounted drilling rig.
- **DP Project EW 2939**, report dated March 1987, six test pits were excavated to depths between 1.9 m and 2.2 m as part of on-going construction inspections in Lot 2. The investigation also included four dynamic cone penetrometer (DCP) tests taken to depths between 0.9 m to 1.2 m.
- **DP Project 9875**, report dated October 1986, geotechnical investigation for a proposed warehouse, including the drilling of seven 300 mm diameter bores to depths of 1.0 m to 6.5 m with a Pengo truck-mounted auger. DCPs were taken to depths between 0.4 m and 1.8 m at the test bore locations. In addition, nine cone penetration tests (CPTs) were taken to practical refusal in the underlying bedrock at depths of 2.8 m to 4.6 m. Relevant laboratory testing carried out as part of this investigation included sieve analysis and the determination of Atterberg limits for one soil sample collected from the filling on site.
- **Dames & Moore Project 1089**, report dated September 1981, geotechnical investigation comprising four auger drilled bores to depths between 4.0 m and 5.3 m.

The approximate locations of the tests are shown on Drawing 1 in Appendix B. It should be noted that the test locations on the drawing are indicative only as this drawing is based on old and sometimes sketch-like drawings.

Results from relevant laboratory tests are included in Appendix C.

4. Results of Previous Investigations

4.1 Field Work

Details of the subsurface conditions in the test locations are given in the logs included in Appendix C, together with notes defining classification methods and descriptive terms used in the preparation of the report sheets.

In summary, the field work encountered the following general subsurface profile:

- **Topsoil or pavement materials**: to depths of 0.1 - 0.3 m; underlain by;
- **Filling**: typically comprising clay, sandy clay, crushed sandstone, rubble and gravel to depths of 0.3 - 3.2 m; absent in bores 12, 16, 19, 22, 23 and 25. The filling appears to be variably compacted and the DP investigation of October 1986 indicated that the upper 0.5 – 1.5 m of the filling appears to be more well compacted than the underlying filling. The filling is overlying;
- **Residual clay**: sandy clay and gravely clay, typically firm to very stiff. The thickness of this unit varies between 0 m- 2.9m. The residual clay is in turn underlain by;
- **Weathered bedrock**: sandstone, laminite and shale of extremely low to very low strength with numerous clay seams. Weathered rock was encountered below depths of 0.9 m to 4.0 m (corresponding to RL 154.4 to 158.4 m AHD). Sandstone of at least medium strength was encountered below depths of 1.0 m to 5.4 m in bores 15 to 18 (corresponding to RL 153.1 and 155.9 m AHD).

Groundwater was encountered between depths of 1.7 m to 6.1m below surrounding ground levels. These observations, which were made either whilst auger drilling the bores or within a few days after drilling, correspond to RL 154.1 to 158.9 m AHD. It is noted that the test bores carried out in the DP investigation of October 1986 experienced substantial water seepage, and water seepage into stripped/excavated areas was also observed during subsequent construction inspections.

It should be pointed out that substantial development has taken place since the subject geotechnical investigations were carried out, and consequently site levels, depths and nature of filling etc. may vary considerably from observations made at the time of investigation.

The subsurface conditions encountered during the field work are summarised in Table 1 below.

Table 1: Summary of Investigations

Test Location	Surface RL (m AHD)	Depth to / RL of Base of Filling (m / m AHD)	Depth to / RL of ELS[1)] Rock or Better (m / m AHD)	Depth to / RL of MS[2)] Rock or Better (m / m AHD)	Depth to / RL of Groundwater (m / m AHD)
Project 24378					
11	159.2	0.6 / 158.6	3.5 / 155.7	-	-
12	157.4	-	1.3 / 156.1	-	-
13	159.3	0.7 / 158.6	2.6 / 156.7	-	-
14	156.9	0.6 / 156.3	1.1 / 155.8	-	-
15	158.5	0.2 / 158.3	1.6 / 156.9	5.4 / 153.1	3.4 /155.1
16	156.9	-	0.9 / 156.0	1.0 / 155.9	-
17	158.3	0.2 / 158.1	1.6 / 156.7	4.0 / 154.3	-
18	157.9	0.3 / 157.6	1.5 / 156.4	4.0 / 153.9	2.0 / 155.9
19	-	-	-	-	-
20	-	0.7	-	-	-
21	-	0.6	-	-	-
Project 24378A					
22	159.1	0.2 / 158.9	1.5 / 157.6	-	-
23	158.9	0.3 /158.6	1.5 / 157.4	-	-
24	159.1	0.5 /158.6	2.5 / 156.6	-	-
25	159.3	-	1.5 / 157.8	-	-
Project EW 2939					
A	-	>1.9 / -	-	-	seepage at 0.8 - 1.3 m
B	-	>1.9 / -	-	-	seepage at 1.3 m
C	-	>2.1 / -	-	-	free gw observed but pit collapsed
D	-	>2.1 / -	-	-	seepage at 1.2 m
E	-	1.7 / -	-	-	-
F	-	1.0 / -	-	-	-
Project 9875					
1	160.2	2.6 / 157.6	3.6 / 156.6	-	6.1 / 154.1 (after 5 hrs)
2	159.8	3.0 / 156.8	3.0 / 156.8	-	5.4 / 154.4 (after 2 hrs)
3	158.8	2.6 / 156.2	3.1 / 155.7	-	3.6 / 155.2 (after 2 hrs)
4	159.2	2.3 / 156.9	3.1 / 156.1	-	-
5	158.6	2.9 / 155.7	3.2 / 155.4	-	-
6	157.8	>1.0 / <156.8	-	-	-
7	156.2	>1.0 / <155.2	-	-	-
CPT 1	158.8	2.1 / 156.7	3.4 /155.4	-	-

Test Location	Surface RL (m AHD)	Depth to / RL of Base of Filling (m / m AHD)	Depth to / RL of ELS[1)] Rock or Better (m / m AHD)	Depth to / RL of MS[2)] Rock or Better (m / m AHD)	Depth to / RL of Groundwater (m / m AHD)
CPT 2	158.9	2.1 / 156.8	3.4 / 155.5	-	-
CPT 3	158.0	2.1 / 155.9	3.6 / 154.4	-	-
CPT 4	159.5	1.7 / 157.8	3.0 / 156.5	-	-
CPT 5	159.3	1.7 / 157.6	2.7 / 156.6	-	-
CPT 6	158.5	2.2 / 156.3	4.0 / 154.4	-	-
CPT 7	160.6	2.0 / 158.6	3.3 / 157.3	-	-
CPT 8	160.0	2.0 / 158.0	2.8 / 157.2	-	-
CPT 9	158.8	1.5 / 157.3	3.0 / 155.8	-	-
Project D&M					
1	160.6	2.8 / 157.8	3.2 / 157.4	-	1.7 / 158.9 (after 5 days)
2	159.7	1.4 / 158.3	2.6 / 157.1	-	3.1 / 156.6 (after 5 days)
5	160.2	3.2 / 157.0	3.2 / 157.0	-	2.0 / 158.2 (after 5 days)
6	159.5	2.8 / 156.7	3.3 / 156.2	-	2.5 / 157.0 (after 5 days)

Notes: [1)] ELS = Extremely low strength; [2)] MS = Medium strength

4.2 Laboratory Testing

As described above, a selection of soil samples was tested in the laboratory for Atterberg limits, particle size distribution and California Bearing Ratio (CBR). The details of the test results are included in Appendix D and are summarised below.

One sample of the gravelly clay sand filling was tested for measurement of Atterberg limits. The results are summarised in Table 2.

Table 2: Summary of Atterberg Limits Test Results

Test Location	Depth (m)	Material	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
Project 9875 BH 7	1.0	Gravelly clayey sand	10	23	9	14	2.5

These results are considered indicative of material of low to medium plasticity, likely to have low susceptibility to shrinkage and swell movement resulting from changes in soil moisture content.

A sample of the same material was also subject to sieve analysis to determine the particle, or grain size distribution. The results are summarised in Table 3.

Table 3: Summary of Particle Size Distribution Testing

Test Location No.	Sample Depth (m)	Percent Passing (%)							
		19.0 mm	13.2 mm	9.5 mm	6.70 mm	4.75 mm	2.36 mm	0.425 mm	75 (µm)
Project 9875 BH7	1.0	100	100	95	91	87	82	61	19

From these results a coefficient of uniformity (C_u) of approximately 7 was calculated, which together with the particle size distribution curve indicate that the soil tested is moderately to well graded.

California Bearing Ratio (CBR) tests were carried out on two samples of the natural clay over the site. The samples were prepared to Dry Density Ratio of approximately 100% Standard and moisture condition of Optimum Moisture Content and soaked for four days under a surcharge load of 4.5 kg. The results of the testing are summarised in Table 4.

Table 4: Summary of CBR Results

Test Location	Depth (m)	Material	Field Moisture Content (%)	Swell (%)	CBR (%)
Project 24378 Bore 19	0.3 – 0.7	Clay	25.4	1.6	4.0
Project 24378 Bore 21	1.2 – 1.5	Clay with some gravel	19.6	0.4	4.0

5. Proposed Development

It is understood that after the demolition of existing structures, the construction of a warehouse and office building, with plan dimensions of approximately 80 x 166 m, together with surrounding pavement areas, is proposed. At the time of preparing this report no information was available regarding structural loads or final floor and pavement levels. The comments given below are therefore of a preliminary nature and should enable preliminary designs to be prepared. When building details are available, further geotechnical assessment may be required together with detailed investigation.

6. Comments

6.1 Site Preparation

6.1.1 General

The information about design levels for the proposed building and hardstand areas was unavailable at the time of preparing this report, but it is expected that bulk earthworks will involve cut-to-fill

operations. In particular, filling will be required in the area of the existing underground car park in Lot 1, unless this basement is retained and incorporated in the new proposed building. Prior to any earthworks operations, stripping of all existing surface vegetation and organic topsoil would be required.

6.1.2 Excavation Conditions

Based on the results from previous investigations it is expected that the excavation will mainly encounter variable filling, residual clays and possibly weathered, extremely to very low strength sandstone/laminte/shale rock, however it cannot be ruled out that rock of low and medium strength may be encountered locally.

It is considered that the filling, residual clays and bedrock of extremely low to very low strength could be readily removed with conventional earthmoving equipment such as medium sized dozers and hydraulic excavators. Excavation in low or higher strength bedrock will probably require the use of a rock breaker attachment to a hydraulic excavator.

NSW EPA guidelines state that all material to be disposed off site should be the subject of a Waste Classification Assessment. It may be adequate to carry out chemical analyses on the material during bulk excavation. However, due to the risk of unexpected delays and disposal costs it may be preferable to conduct sampling and testing on the filling soils prior to excavation commencing.

Based on the results of the field work, significant groundwater inflows into the excavation are not anticipated in general. As mentioned in Section 4 above however, substantial water seepage was observed into the test bores in the DP investigation of October 1986, and localised water seepage was also observed during subsequent construction inspections in the northern part of Lot 2 in 1987. It is therefore possible that there might be areas of localised perched groundwater. There is also likely to be some seepage along the surface of the sandstone/laminate/shale bedrock and near the interface of filling and underlying residual clay, particularly after rainfall. Any seepage into the excavation should be relatively minor in general and it is suggested that drainage be provided to minimise ponding.

6.1.3 Existing Filling

The previous investigations have indicated that there is up to about 3 m filling on the site. Anecdotal evidence suggests that portions of the site previously have been mined/used as a quarry. It is therefore possible that greater filling depths exist than those observed. The current surface appears to be in reasonable condition without any obvious settlement issues. The DP investigation of October 1986 suggests that the filling is generally more well compacted in the upper 0.5 m to 1.5 m. Based on previous investigations the filling is predominantly clay, sandy clay with crushed sandstone and rubble.

When cutting is carried out in the more elevated areas of the site, it is expected that filling of variable compaction will remain over portions of the site. The variable compaction within the then remaining, existing filling could give rise to differential settlement unless some form of treatment is adopted. It would not be feasible to estimate the extent of settlement which may take place, unless the site was preloaded and settlement monitoring undertaken.

The appropriate options for the support of buildings and pavements will therefore depend on the level of risk, with regard to settlement, that the owner is willing to take.

6.1.4 Filling Conditions

Site preparation options could include complete excavation and recompaction of the existing filling; partial excavation and recompaction of the filling; high energy impact rolling of the filling or compaction of the surface only. The choice of which option to adopt will not only depend on geotechnical matters but also on other factors such as time and costs and the risk willing to be accepted by the client.

Compaction testing of all engineered filling and prepared subgrade surfaces should be carried out in accordance with AS3798, particularly the rate suggested for density testing.

6.1.4.1 Complete Excavation and Replacement

Complete excavation and replacement of the filling under Level 1 earthworks control will almost eliminate the risk of significant ongoing and differential settlements within the filling under typical warehouse and pavement loadings and reduce the risk of unacceptable differential settlements between areas underlain by filling and natural in-situ clays or weathered rock respectively. This method would involve removal of all the filling; sorting the filling; discarding unsuitable material (such as particles greater than 150 mm in size and compressible or organic material); then reuse of the filling by placement and compaction under controlled conditions. This option would be the most expensive and time consuming, but would ensure that ongoing settlements of floor slabs and pavements are low. It is recommended that this approach be adopted.

Site preparation for complete excavation and replacement would include the following steps:

- Excavate the filling to expose underlying stiff natural clay;
- Proof roll the exposed surface with six passes of an 8-10 tonne roller, with the final pass carried out under observation by a geotechnical engineer to check for any soft or compressible zones. Any such zones should be over-excavated to a minimum depth of 300 mm and replaced with compacted granular material;
- The existing filling materials may require some sorting by removal of oversize or unsuitable material before it can be considered for use as an “engineered” filling;
- Filling should be placed in horizontal layers of 300 mm maximum loose thickness, each layer compacted to a minimum dry density ratio of 98% Standard at levels more than 500 mm below the proposed subgrade level; then to 100% Standard in the upper 500 mm of filling. The moisture content during filling should be controlled so that it is always within 2% of Standard optimum moisture content (SOMC) test.

The steps above would also be applicable to areas where natural clays are exposed at bulk excavation level.

6.1.4.2 Partial Excavation

This method of site preparation requires less bulk earthworks but presents a higher risk of subgrade settlement compared to complete excavation and replacement.

Partial removal of the filling and construction of a bridging layer using conventional filling methods could be considered. It is suggested that as a minimum, provision be made for over excavating to a

depth of say 1.5 m below the proposed subgrade level. Depending on the proposed future site levels and the resulting depths of existing filling, this method may prove to be patchy and uneconomical.

Site preparation for partial excavation and replacement should include the following steps:

- Excavate the existing filling to 1.5 m below design subgrade levels for pavements, leaving a horizontal level surface;
- Proof roll the exposed surface with six passes of an 8-10 tonne roller, with the final pass carried out under observation of a geotechnical engineer to check for any soft or saturated zones. Any such zones should be over-excavated to a minimum depth of 300 mm and replaced with compacted granular material;
- The existing filling materials may require some sorting by removal of oversize or unsuitable material to be considered for use as an "engineered" filling; then,
- Filling should be placed in maximum 300 mm thick layers with each layer compacted to a minimum dry density ratio of 100% Standard. The moisture content during filling should be controlled so that it is within ±2% of optimum.

6.1.4.3 Compaction of the Surface by High Energy Impact Roller

Compaction of the surface using a high energy impact roller would be carried out from the existing surface or final cut surface (whichever is lower) to compact the underlying filling and to provide a bridging layer. This method involves the use of a three to five sided heavy roller to compact the ground. The high energy impact roller typically has a greater depth of influence than that of a conventional drum roller.

Difficulties are sometimes encountered using impact compaction in clayey soils. Accordingly the approach should initially be carried out over a trial area to assess number of passes required and effectiveness of the process. During impact rolling of the exposed filling, it is suggested that levels are taken at regular intervals (say every 10 passes) to measure the amount of settlement. Experience would suggest that the number of passes required over the same area could be between 30 and 50.

The final surface should be levelled off and compacted to 100% standard maximum dry density.

An advantage of this method is that it is relatively quick as only the exposed surface is compacted. There remains a risk, however, of post construction settlements, which may lead to some differential settlements. This is probably the cheapest of the methods discussed above but also carries the highest risk of future settlements. The method can also give rise to significant levels of vibration. A further possible drawback is that the compaction effort is most efficient when the impact roller works at a near-constant speed. Hence it is preferable for there to be a large enough area for the roller to operate on in a continuous looping path rather than having to run back-and-forth in straight paths.

6.2 Excavation Support and Batter Slopes

Cut faces should be battered back for the safe construction of retaining walls or as temporary or permanent batters. Where space permits, a short term safe batter slope angle for the clays and extremely weathered rock of 1:1 (H:V) is suggested for batter heights of up to 3 m. For filling, short

term batter slopes of 1.5:1 (H:V) is suggested. For long term, a batter slope of 2:1 (H:V) is suggested for filling, clay and extremely weathered rock. If the slope is to be vegetated, a flatter slope of 3:1 (H:V) is recommended. For very low strength or better rock a batter slope of 0.75:1 (H:V) is suggested for short term and 1V:1H for long term.

Erosion of permanent batter slopes is likely unless the faces of the slopes are protected. This is also applicable to the faces of laminite/shale which tend to fret readily when subjected to alternate wetting and drying.

Provision should be made for drainage at the top and at the base of the slopes to control any run-off.

If there is insufficient room for battering the slopes or it is not preferred, then retaining walls will be required. These walls may be designed using active lateral earth pressure coefficients of 0.3 for the soils and 0.2 for the very low strength rock. Retaining walls should be designed with a bulk unit weight of 20 kN/m^3 for the soils and 22 kN/m^3 for the rock and should also allow for surcharge loads behind the walls. These parameters assume a level backfill behind the wall. Adequate drainage should also be provided to prevent water pressures building up behind the wall.

6.3 Foundations

Due to the presence of filling overlying the site, it is considered that conventional bored piers would be appropriate for the support of all structural loads. Bored piers could be founded in the underlying sandstone/laminite/shale of at least extremely low strength and designed for an allowable bearing pressure of 700 kPa. For bored piers with clean, roughened sockets, shaft adhesion values of 40 kPa and 70 kPa are considered appropriate for hard clay and extremely low to very low strength rock respectively. The upper 1.5 m of the bore should be disregarded in the calculation of pile capacity.

Based on the fieldwork results and previous work on the site, it is expected that most of the piles could be constructed as uncased bored piers. As mentioned above, however, there may areas where groundwater seepage into pile excavations should be expected, hence, provision should be made for temporary casing and also pumping the base of piles dry should there be any significant ingress of water. Water depth in the base of a pier immediately prior to concreting should not be greater than 25 mm. The possibility of ingress of water may be limited by pouring concrete as soon as possible after drilling, cleaning and pumping out of pier holes.

For lightly loaded structures and where tight deflection controls are not required, shallow pad or strip footings founded in the filling can be used after taking into account the comments given in with Section 6.1. Such footings can be designed for an allowable bearing pressure of 125 kPa. If all existing filling under the proposed warehouse is removed and replaced under Level 1 earthworks control as outlined in Section 6.1.4.1, consideration could be given to supporting warehouse loads on shallow footings in the new, controlled filling, however, the design would have to take potential differential settlements into account if the building in part would be founded on rock.

It is recommended that both bored piers and shallow footing excavations be inspected by a geotechnical engineer to confirm the founding material is appropriate for the design pressures adopted.

6.4 Pavements

Based on the CBR tests and previous experience from the area it is suggested that a CBR of 4% be adopted for the natural residual clay and compacted filling subgrade for preliminary design purposes. Due to the variable nature of the filling on the site, however, further laboratory testing of the filling would be required to confirm an appropriate CBR value.

The design CBR value will depend on the provision of adequate surface and subsoil drainage to maintain the subgrade as close to the OMC as possible. Subsoil drainage should be installed to not less than 500 mm depth below subgrade level adjacent to pavement areas and to any lawns or garden areas, where the ingress of water beneath the neighbouring pavement subgrade may be possible. Preparation of subgrade surfaces should be such that adequate cross-falls for the surface drainage purposes are achievable across the final pavement.

6.5 Floor Slab Design

Warehouse floor slabs are usually designed either on the basis of a Modulus of Subgrade Reaction (K) or a Young's Modulus (E). These parameters are largely determined by the nature of the full depth of the slab subgrade (i.e. equivalent stiffness; resultant settlement). These in turn will be determined by the design choices made with regard to the options presented in Section 6.1.4.

6.6 Further Investigation

When more details of the proposed development are available, it is recommended that the comments given in this report be reviewed. It is also anticipated that further site investigation and laboratory testing will be required to provide more detailed and current information on the extent and nature of the existing filling and on the groundwater conditions. In particular, there is very little information about the subsurface conditions in the southern portion of Lot 2.

7. Limitations

Douglas Partners (DP) has prepared this report for a project at Rodborough Road, Frenchs Forest NSW, in accordance with DP's proposal dated 8 March 2012 and acceptance received from Mr Arthur Zouglis of Artro Management on 15 March 2012. The report is provided for the exclusive use of Artro Management 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. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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.

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.

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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.

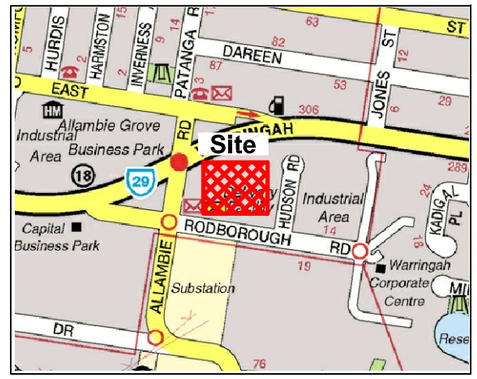
Site Inspection

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.

Appendix B

Drawing

NOTE: Base drawing from Leffler Simes Architects (Drawing 3398 - SK02)



Locality Plan

LEGEND

PREVIOUS INVESTIGATIONS:

- Test bore location - DP Report 24378, April 1997
- Test bore location - DP Report 24378A, April1997
- Cone penetration test (CPT) - DP report 9875, October 1986
- Test bore location - DP Report 9875, October 1986
- Test bore location - Dames & Moore report 1089, September 1981
- Test pit location - Contract No. EW 2939, March 1987
- DCP location - Contract No. EW 2939, March 1987

NOTE: Test locations are indicative only

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Astro Management		TITLE: **Location of Tests**	PROJECT No: 72912
OFFICE: Sydney	DRAWN BY: PSCH	**Proposed Masters Development**	DRAWING No: 1
SCALE: As shown	DATE: 10.4.2012	**Rodborough Road, FRENCH FOREST**	REVISION: A

Appendix C

Results of Previous Field Work

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.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Degree of Fracturing

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

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Douglas Partners

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

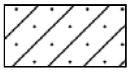
Soils


Topsoil

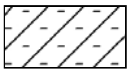

Peat


Clay

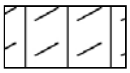

Silty clay

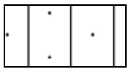

Sandy clay

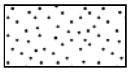

Gravelly clay

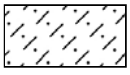

Shaly clay

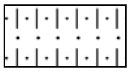

Silt


Clayey silt


Sandy silt

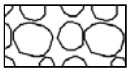

Sand

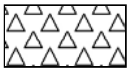

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

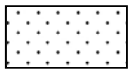

Talus

Sedimentary Rocks

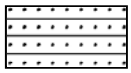

Boulder conglomerate

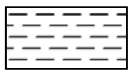

Conglomerate


Conglomeratic sandstone

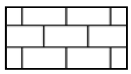

Sandstone


Siltstone


Laminite

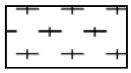

Mudstone, claystone, shale

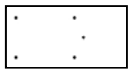

Coal


Limestone

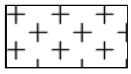
Metamorphic Rocks

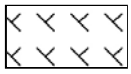

Slate, phyllite, schist

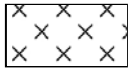

Gneiss

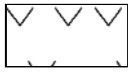

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

Cone Penetration Tests

Douglas Partners

Introduction

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

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

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

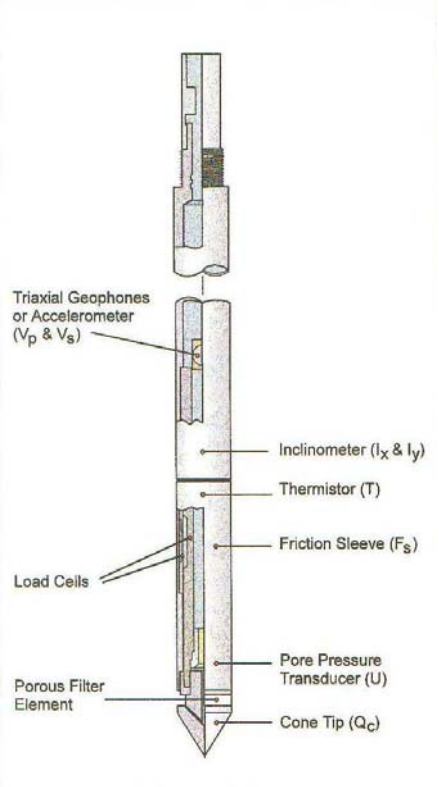


Figure 1: Cone Diagram

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

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

Figure 2: Purpose built CPT rig

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

Types of CPTs

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

Type	Measures
Standard	Basic parameters (q_c, f_s, i & z)
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

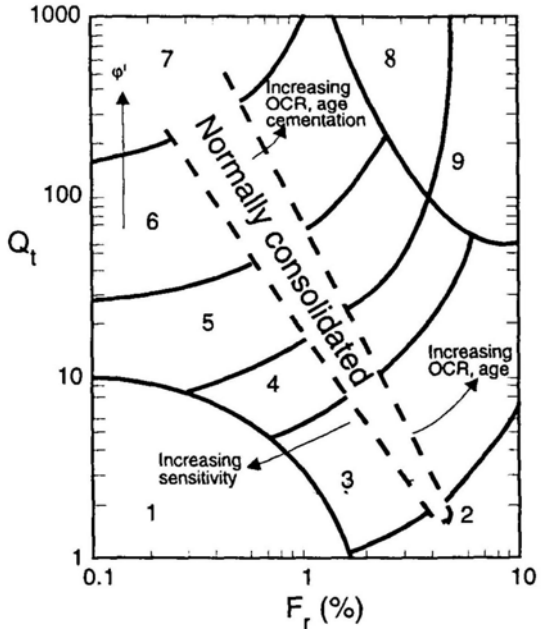


Figure 3: Soil Classification Chart

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.

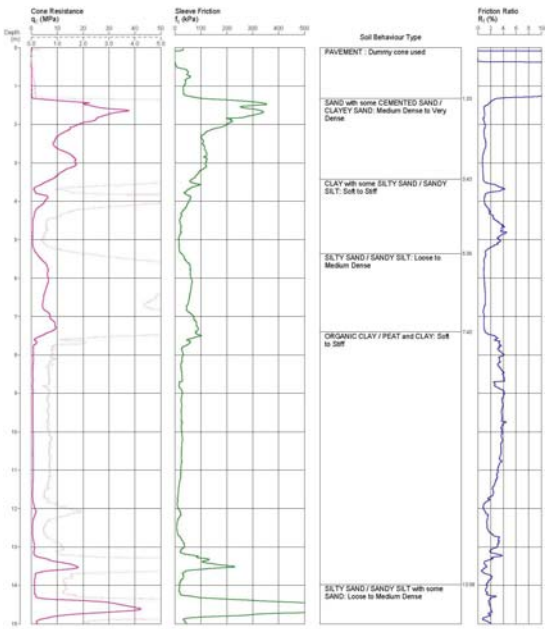


Figure 4: Sample Cone Plot

TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD
PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
LOCATION: LOTS 1 & 2 RODBOROUGH ROAD, FRENCHS FOREST

DATE: 11 MAR 97
PROJECT No.: 24378
SURFACE LEVEL: 159.15 AHD

BORE No. 11
SHEET 1 **OF** 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0	0.03 BITUMEN	A	0.1		13
	0.2 ROAD BASE - brown sandy gravel				
	FILLING - generally stiff light grey clay with pieces of crushed sandstone to 30mm diameter	D	0.5		
	0.6 CLAY - very stiff, light grey clay (an odour of hydrocarbons)	A*,D	1.0	pp=275kPa	13
1					
	1.6 CLAY - very stiff, light grey clay with some ironstained pieces	D	1.6		
2		A	2.0		15
	2.5 CLAY - firm, light grey slightly sandy clay (odour noted)	D	2.6		
	2.9 SANDY CLAY - firm, dark red brown sandy clay	A	3.0		14
3					
	3.5 SANDSTONE - very low strength, highly weathered brown sandstone with dark grey laminite lenses	D	3.6		
4					
	4.3 TEST BORE DISCONTINUED AT 4.3 METRES due to auger refusal on probable low to medium strength sandstone				
5					
6					

RIG: PENGO **DRILLER:** HANKEL **LOGGED:** LINDBECK **CASING:**

TYPE OF BORING: SOLID FLIGHT AUGER TO 4.3m

GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED

REMARKS: * DUPLICATE SAMPLE OF B11/1.0 (Z1), A - AUGER SAMPLE FOR ENVIRONMENTAL SAMPLING PURPOSES, D - AUGER SAMPLE FOR GEOTECHNICAL SAMPLING PURPOSES

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RMM
Date: 3/4/97

Douglas Partners
Geotechnics · Environment · Groundwater

TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD
PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
LOCATION: LOTS 1 & 2 RODBOROUGH ROAD, FRENCHS FOREST

DATE: 11 MAR 97
PROJECT No.: 24378
SURFACE LEVEL: 157.35 AHD

BORE No. 12
SHEET 1 OF 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0	TOPSOIL - dark brown silty sand				
0.2	CLAY - hard, light grey and light yellow brown slightly sandy clay	A	0.3		12
		D	0.5	pp>400kPa	
0.7	CLAY - hard, light grey mottled dark orange brown clay with ironstaining	A*, D	1.0	pp>400kPa	14
1.3	SANDSTONE - extremely low strength, extremely weathered sandstone with ironstaining and some evidence of laminite lenses	D	1.3		
1.8	TEST BORE DISCONTINUED AT 1.8 METRES due to auger refusal on probable low to medium strength sandstone	A	1.8		11
2					
3					
4					
5					
6					

RIG: PENGO **DRILLER:** HANKEL **LOGGED:** LINDBECK **CASING:**

TYPE OF BORING: SOLID FLIGHT AUGER TO 1.8m

GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED

REMARKS: * DUPLICATE SAMPLE OF B12/1.0 (Z2), A - AUGER SAMPLE FOR ENVIRONMENTAL SAMPLING PURPOSES, D - AUGER SAMPLE FOR GEOTECHNICAL SAMPLING PURPOSES

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RML
Date: 3/4/97

Douglas Partners
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TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD
PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
LOCATION: LOTS 1 & 2 RODBOROUGH ROAD, FRENCHS FOREST

DATE: 11 MAR 97
PROJECT No.: 24378
SURFACE LEVEL: 159.34 AHD

BORE No. 13
SHEET 1 **OF** 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0					
0.1	TOPSOIL – dark brown silty sand				
	FILLING – crushed sandstone	A	0.3		12
		D	0.4		
0.7	CLAY – hard brown and red brown clay				
		D	0.9		
1		A	1.0		15
1.7	CLAY – hard light grey mottled red brown clay with ironstone	D	1.8		
2		A	2.0		7
2.1	CLAY – hard light grey slightly sandy clay with some sandstone pieces	D	2.3		
2.6	SANDSTONE – extremely low strength extremely weathered light grey sandstone	D	2.8		
2.9	– to red brown at 2.8m				
3		A	3.0		9
	CLAY – hard grey clay				
3.3	LAMINITE – extremely low strength extremely weathered dark grey laminite	D	3.5		
4					
4.0	SANDSTONE – extremely low strength, extremely weathered, dark red brown sandstone	D	4.2		
4.3	TEST BORE DISCONTINUED AT 4.3 METRES due to auger refusal on probable low to medium strength sandstone				
5					
6					

RIG: PENGO **DRILLER:** HANKEL **LOGGED:** LINDBECK **CASING:**

TYPE OF BORING: SOLID FLIGHT AUGER TO 4.3m

GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED

REMARKS: A – AUGER SAMPLE FOR ENVIRONMENTAL PURPOSES
D – AUGER SAMPLE FOR GEOTECHNICAL PURPOSES

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RAL
Date: 3/4/97

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TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD
PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
LOCATION: LOTS 1 & 2 RODBOROUGH ROAD, FRENCHS FOREST

DATE: 11 MAR 97
PROJECT No.: 24378
SURFACE LEVEL: 156.86 AHD

BORE No. 14
SHEET 1 **OF** 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0	FILLING – dark brown silty sandy clay topsoil				
0.3	FILLING – generally very stiff light brown clay with large sandstone pieces	A	0.3		7
0.6	CLAY – hard, light grey and red brown clay with some ironstone pieces	D	0.6		
1		A	1.0	pp=400kPa	7
1.1		D	1.1		
1.2	SANDSTONE – very low strength, highly weathered dark orange brown and grey sandstone				
	TEST BORE DISCONTINUED AT 1.2 METRES due to auger refusal on probable low to medium strength sandstone				
2					
3					
4					
5					
6					

RIG: PENGO **DRILLER:** HANKEL **LOGGED:** LINDBECK **CASING:**

TYPE OF BORING: SOLID FLIGHT AUGER TO 1.2m

GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED

REMARKS: A – AUGER SAMPLE FOR ENVIRONMENTAL PURPOSES
D – AUGER SAMPLE FOR GEOTECHNICAL PURPOSES

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: PMC
Date: 3/4/97

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DOUGLAS PARTNERS PTY LTD
PROPOSED INDUSTRIAL DEVELOPMENT - FRENCH'S FOREST
BORE 15 PROJ NO 24378 MARCH 1997
5
6
7
8
90
8.4M END
5.40 - 8.40M

TEST BORE REPORT

BORE No: 15

CLIENT: NATIONAL TRUSTEES LTD **PROJECT No:** 24378 **DATE:** 11-21 MAR 97

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT **SURFACE LEVEL:** 158.48 AHD **SHEET** 1 **OF** 1

LOCATION: LOTS 1 & 2 RODBOROUGH ROAD, FRENCHS FOREST **DIP OF HOLE:** 90° **AZIMUTH:** -

Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Sampling & In Situ Testing: Sample Type	Core Rec. %	RQD %	Test Results & Comments
0	BITUMEN									
0.02										
0.2	ROAD BASE - dark brown sandy gravel						A			pp>400kPa
	CLAY - very stiff, light brown clay						D			
	- becoming light grey at 0.6m with some fine ironstaining									
1							A,D			
1.6										
1.8	SANDSTONE - extremely low strength, extremely weathered, dark red brown sandstone with grey clay						D			
2							A,D			pp>400kPa
2.2	CLAY - hard grey clay									
2.4	SANDSTONE - extremely low strength, extremely weathered, light grey sandstone with some red brown sandstone									
3	SANDY CLAY - very stiff, light grey sandy clay						A			
3.2	SANDSTONE - very low strength, highly weathered, light grey sandstone									
4										
4.3	SANDSTONE - very low strength, extremely weathered, dark orange red brown sandstone						D			
5										
5.4	SANDSTONE - high strength, slightly weathered, slightly fractured, light grey, fine grained sandstone with a low strength band from 5.4m to 5.7m				5.45m : B 5°, 2-3mm silty laminae		D			PL (A)=0.2MPa
6										PL (A)=1.9MPa
					6.38m : B 5°, 1-2mm carbonaceous laminae					PL (A)=1.7MPa
					6.53m : B 5°, 1-2mm carbonaceous laminae					
7					6.72m : B 8°, 1-2mm carbonaceous laminae		C	100	97	PL (A)=1.4MPa
7.17					7.17m : B 5°					
7.32	SHALE - medium strength, slightly weathered, unbroken, dark grey shale interlaminated with sandstone (40% sandstone)				7.32m : B 10°					
					7.35m : B 8°, 3-5mm clayey silty laminae					PL (A)=1.9MPa
8	SANDSTONE - high strength, slightly weathered, slightly fractured, light grey, fine grained sandstone with some carbonaceous laminae									
8.4	TEST BORE DISCONTINUED AT 8.4 METRES									
9										
10										

RIG: PENGO/SCOUT **DRILLER:** HANKEL/COOPER **LOGGED:** LINDBECK/PARMAR **CASING:** HW TO 5.4m

TYPE OF BORING: AUGER TO 5.4m, THEN HQ CORING TO 8.4m

WATER OBSERVATIONS: FREE GROUND WATER OBSERVED AT 3.4m WHILST AUGERING

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

CHECKED:
Initials: RML
Date: 3/4/97

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DOUGLAS PARTNERS PTY LTD
PROPOSED INDUSTRIAL DEVELOPMENT - FRENCH'S FOREST
BORE 16 PROJ NO 24378 MARCH 1997
START CORING AT 1.0 M
CORE LOSS 300 mm
3.9m EOH
1.00 - 3.90M

TEST BORE REPORT

BORE No: 16

CLIENT: NATIONAL TRUSTEES LTD
PROJECT No: 24378
DATE: 11-21 MAR 97

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
SURFACE LEVEL: 156.88 AHD
SHEET 1 **OF** 1

LOCATION: LOTS 1 & 2 RODBOROUGH ROAD, FRENCHS FOREST
DIP OF HOLE: 90°
AZIMUTH: -

Depth (m)	Description of Strata	Degree of weathering (EW, HW, MW, SW, FS, FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Sampling & In Situ Testing: Sample Type	Core Rec. %	RQD %	Test Results & Comments
0										
0.1	TOPSOIL CLAY - very stiff, light brown clay						A D			pp=350kPa
0.9										
1	SANDSTONE - extremely low strength, extremely weathered light brown sandstone						A,D			PL (A)=1.7MPa
1.0										
1.28					1.21m : B 16° CORE LOSS 300mm					
1.58	SANDSTONE - medium strength moderately weathered, fractured, light brown, fine grained sandstone with a high strength band from 1.0m to 1.1m				1.61m : B 10°					PL (A)=0.9MPa
1.82					1.69m : B 10° 1.8m : B 10°, 20mm clayey sandy seam					
2					2.19m : B 10°, ironstained, 1-2mm silty laminae 2.29m : B 10°, ironstained 2.37m : B 10°, ironstained		C	90	83	PL (A)=0.6MPa PL (A)=0.8MPa
3	SANDSTONE - medium strength, slightly weathered, slightly fractured, fine grained sandstone with an extremely low strength, extremely weathered band at 2.97m				2.97m : B 10° 3.09m : B 12°, 15-20mm clayey silty seam					PL (A)=0.9MPa
3.9	TEST BORE DISCONTINUED AT 3.9 METRES									
4										
5										
6										
7										
8										
9										
10										

RIG: PENGO/SCOUT **DRILLER:** HANKEL/COOPER **LOGGED:** LINDBECK/PARMAR **CASING:** HW TO 1.0m

TYPE OF BORING: AUGER TO 1.0m, THEN HQ CORING TO 3.9m

WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED WHILST AUGERING

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

CHECKED:
Initials: RMC
Date: 3/4/97

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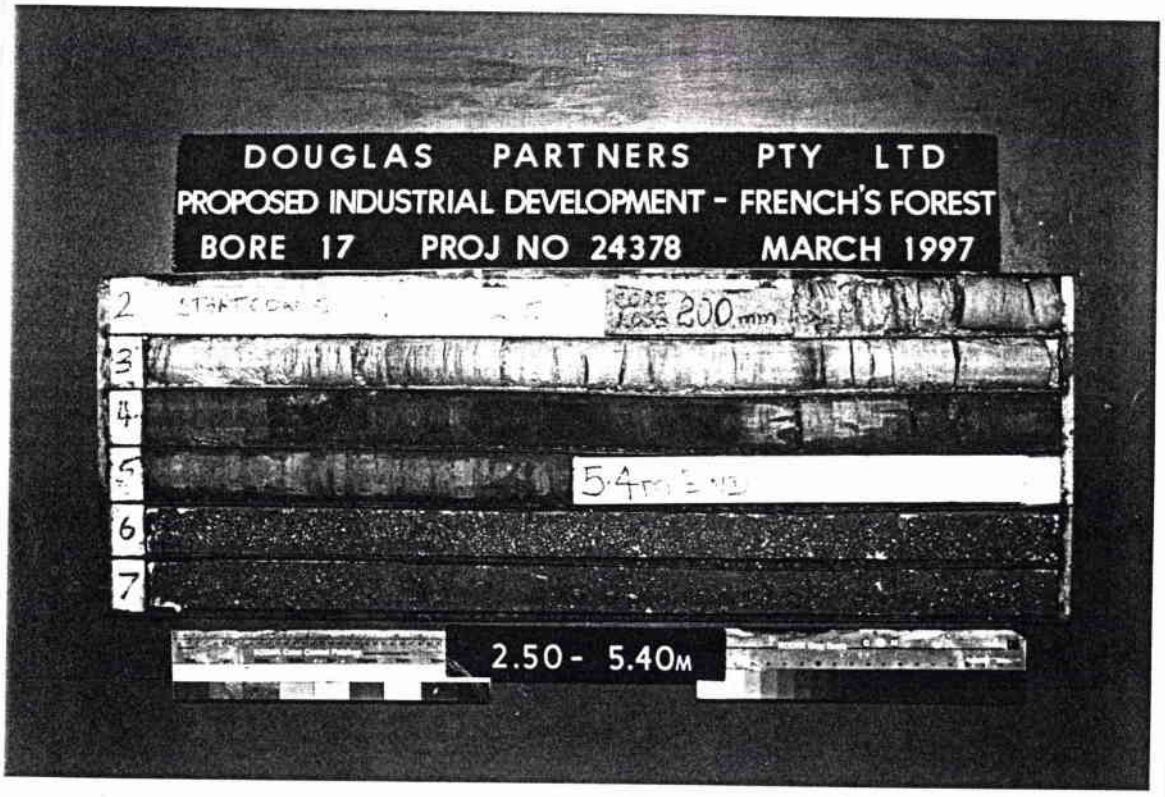
DOUGLAS PARTNERS PTY LTD
PROPOSED INDUSTRIAL DEVELOPMENT - FRENCH'S FOREST
BORE 17 PROJ NO 24378 MARCH 1997
2
3
4
5
6
7
CORE LOSS 200mm
5.4m
2.50 - 5.40m

TEST BORE REPORT

BORE No: 17

CLIENT: NATIONAL TRUSTEES LTD **PROJECT No:** 24378 **DATE:** 11-21 MAR 97

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT **SURFACE LEVEL:** 158.25 AHD **SHEET** 1 **OF** 1

LOCATION: LOTS 1 & 2 RODBOROUGH ROAD, FRENCHS FOREST **DIP OF HOLE:** 90° **AZIMUTH:** -

Depth (m)	Description of Strata	Degree of weathering (EW, HW, MW, SW, FS, FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Sampling & In Situ Testing: Sample Type	Core Rec. %	RQD %	Test Results & Comments
0	0.02 BITUMEN									
0.2	ROAD BASE - brown sandy gravel						A			pp=375kPa
0.6	CLAY - very stiff, light grey and light brown clay						D			
1	CLAY - hard, light grey and light brown clay with some ironstone and laminite pieces				Note : Unless otherwise stated, the rock is fractured along the bedding planes at 5° to 8°		A,D			
1.6	SANDSTONE - extremely low strength, extremely weathered, light grey sandstone									
2							A,D			
2.1	- red brown at 1.8m									
2.4	SANDSTONE - very low strength, extremely weathered sandstone				CORE LOSS 200mm					
2.6	SANDSTONE - extremely low to very low strength, extremely to highly weathered, fractured, light grey, fine grained sandstone									
3										
3.23	SANDSTONE - low to medium strength, slightly weathered, slightly fractured, light grey, fine grained sandstone				3.23m : B 10°					PL (A)=0.2MPa
4	4.0 SANDSTONE - medium strength, moderately weathered, slightly fractured, light grey brown, fine grained sandstone				4.14m : B 10° 4.25m : B 10°		C	93	70	PL (A)=0.4MPa
4.65	SANDSTONE - high strength, slightly weathered, slightly fractured, light grey, fine grained sandstone									PL (A)=0.5MPa
5										
5.4	TEST BORE DISCONTINUED AT 5.4 METRES									PL (A)=1.3MPa
6										
7										
8										
9										
10										

RIG: PENGO/SCOUT **DRILLER:** HANKEL/COOPER **LOGGED:** LINDBECK/PARMAR **CASING:**

TYPE OF BORING: AUGER TO 2.4m, THEN HQ CORING TO 5.4m

WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED WHILST AUGERING

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

CHECKED:
Initials: RML
Date: 3/4/97

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DOUGLAS PARTNERS PTY LTD
PROPOSED INDUSTRIAL DEVELOPMENT - FRENCH'S FOREST
BORE 18 PROJ NO 24378 MARCH 1997
4
5
7
8
4.00 - 7.00M

TEST BORE REPORT

BORE No: 18

CLIENT: NATIONAL TRUSTEES LTD
PROJECT No: 24378
DATE: 11-21 MAR 97

PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
SURFACE LEVEL: 157.92 AHD
SHEET 1 **OF** 1

LOCATION: LOTS 1 & 2 RODBOROUGH ROAD, FRENCHS FOREST
DIP OF HOLE: 90°
AZIMUTH: -

Depth (m)	Description of Strata	Degree of Weathering (EW, HW, MW, SW, F-S, F-R)	Graphic Log	Rock Strength (Ex. Low, Very Low, Low, Medium, High, Very High, Ex. High)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Sampling & In Situ Testing: Sample Type	Core Rec. %	RQD %	Test Results & Comments
0	0.03 BITUMEN									
	0.3 ROAD BASE - brown sandy gravel						A			
	CLAY - very stiff to hard light grey clay									
1							A,D			
	1.5 SANDSTONE - extremely low strength, extremely weathered dark red brown sandstone									
2	- to light grey at 1.8m (odour noted at 2.0m)						A D			
	- to red brown and light grey at 2.6m									
3							A,D			
							D			
4	4.0									
	4.3 SANDSTONE - medium strength, highly to moderately weathered, fractured, light grey brown, fine grained sandstone				4.04m : B 8° 4.11m : B 10° 4.19m : B 10°					PL (A)=0.4MPa
	SANDSTONE - medium to high strength, slightly weathered, slightly fractured, light grey, fine grained sandstone with 50-70mm medium strength shale bands at 5.97m and 6.25m				4.49m : B 10°, 2-3mm silty laminae 4.74m : B 10°, 3-5mm silty laminae					PL (A)=1.0MPa
5	- with some carbonaceous laminae below 5.0m						C	100	91	
6					6.03m : B 10° 6.22m : B 5° 6.32m : B 5°					PL (A)=1.6MPa
										PL (A)=0.6MPa
7	7.0 TEST BORE DISCONTINUED AT 7.0 METRES									
8										
9										
10										

RIG: SCOUT **DRILLER:** HANKEL/COOPER **LOGGED:** LINDBECK/PARMAR **CASING:** HW TO 2.4m

TYPE OF BORING: AUGER TO 4.0m, THEN HQ CORING TO 7.0m

WATER OBSERVATIONS: FREE GROUND WATER OBSERVED AT 2.0m WHILST AUGERING

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp pocket penetrometer (kPa)	V Shear Vane (kPa)

CHECKED:
Initials: RML
Date: 3/4/97

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TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD
PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
LOCATION: LOT 2 RODBOROUGH ROAD, FRENCHS FOREST

DATE: 11 MAR 97
PROJECT No.: 24378
SURFACE LEVEL: -

BORE No. 19
SHEET 1 **OF** 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0	TOPSOIL - dark brown silty sand				
0.3	CLAY - hard light grey brown clay	B	0.3		
0.7	TEST BORE DISCONTINUED AT 0.7 METRES		0.7		
1					
2					
3					
4					
5					
6					

RIG: PENGO **DRILLER:** HANKEL **LOGGED:** LINDBECK **CASING:**
TYPE OF BORING: SOLID FLIGHT AUGER TO 0.7m
GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RML
Date: 24/3/97

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TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD
PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
LOCATION: LOT 2 RODBOROUGH ROAD, FRENCHS FOREST

DATE: 11 MAR 97
PROJECT No.: 24378
SURFACE LEVEL: -

BORE No. 20
SHEET 1 OF 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0	TOPSOIL - dark brown silty sand				
0.3	FILLING - generally stiff, brown and red brown slightly sandy clay with some sandstone pieces				
0.7	CLAY - stiff light grey brown clay	B	0.8		
1 1.0	TEST BORE DISCONTINUED AT 1.0 METRES		1.0		
2					
3					
4					
5					
6					

RIG: PENGO **DRILLER:** HANKEL **LOGGED:** LINDBECK **CASING:**
TYPE OF BORING: SOLID FLIGHT AUGER TO 1.0m
GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RML
Date: 24/3/97

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TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD
PROJECT: PROPOSED INDUSTRIAL DEVELOPMENT
LOCATION: LOT 2 RODBOROUGH ROAD, FRENCHS FOREST

DATE: 11 MAR 97
PROJECT No.: 24378
SURFACE LEVEL: –

BORE No. 21
SHEET 1 **OF** 1

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0	TOPSOIL – dark brown silty sand				
0.2	FILLING – generally stiff dark orange brown mottled brown clay				
0.6	CLAY – hard red brown mottled light brown clay with ironstone pieces to 30mm diameter				
1		B	1.2		
1.5	TEST BORE DISCONTINUED AT 1.5 METRES		1.5		
2					
3					
4					
5					
6					

RIG: PENGO **DRILLER:** HANKEL **LOGGED:** LINDBECK **CASING:**
TYPE OF BORING: SOLID FLIGHT AUGER TO 1.5m
GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

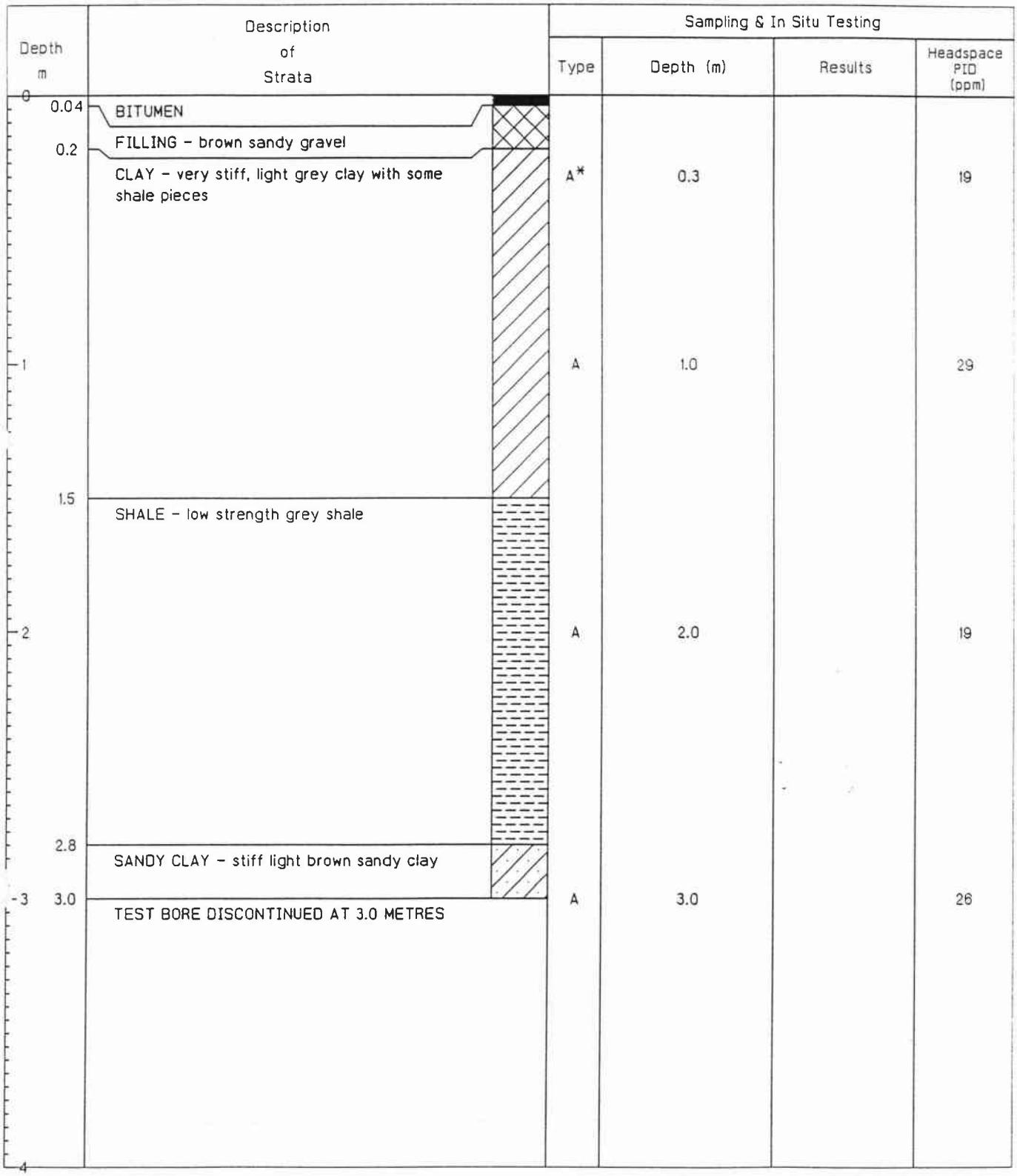
A auger sample	PL point load strength I_S (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RM
Date: 24/3/97

Douglas Partners
Geotechnics · Environment · Groundwater

TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD **DATE:** 26 MAR 97 **BORE No.** 22
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24378A **SHEET** 1 OF 1
LOCATION: LOT 2 RODBOROUGH RD, FRENCHS FOREST **SURFACE LEVEL:** 159.13 AHD



RIG: BOBCAT **DRILLER:** ELLIS **LOGGED:** LINDBECK **CASING:**
TYPE OF BORING: 200mm DIAMETER SOLID FLIGHT AUGER TO 3.0m
GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED
REMARKS: * Z_1 - DUPLICATE OF B22/0.3

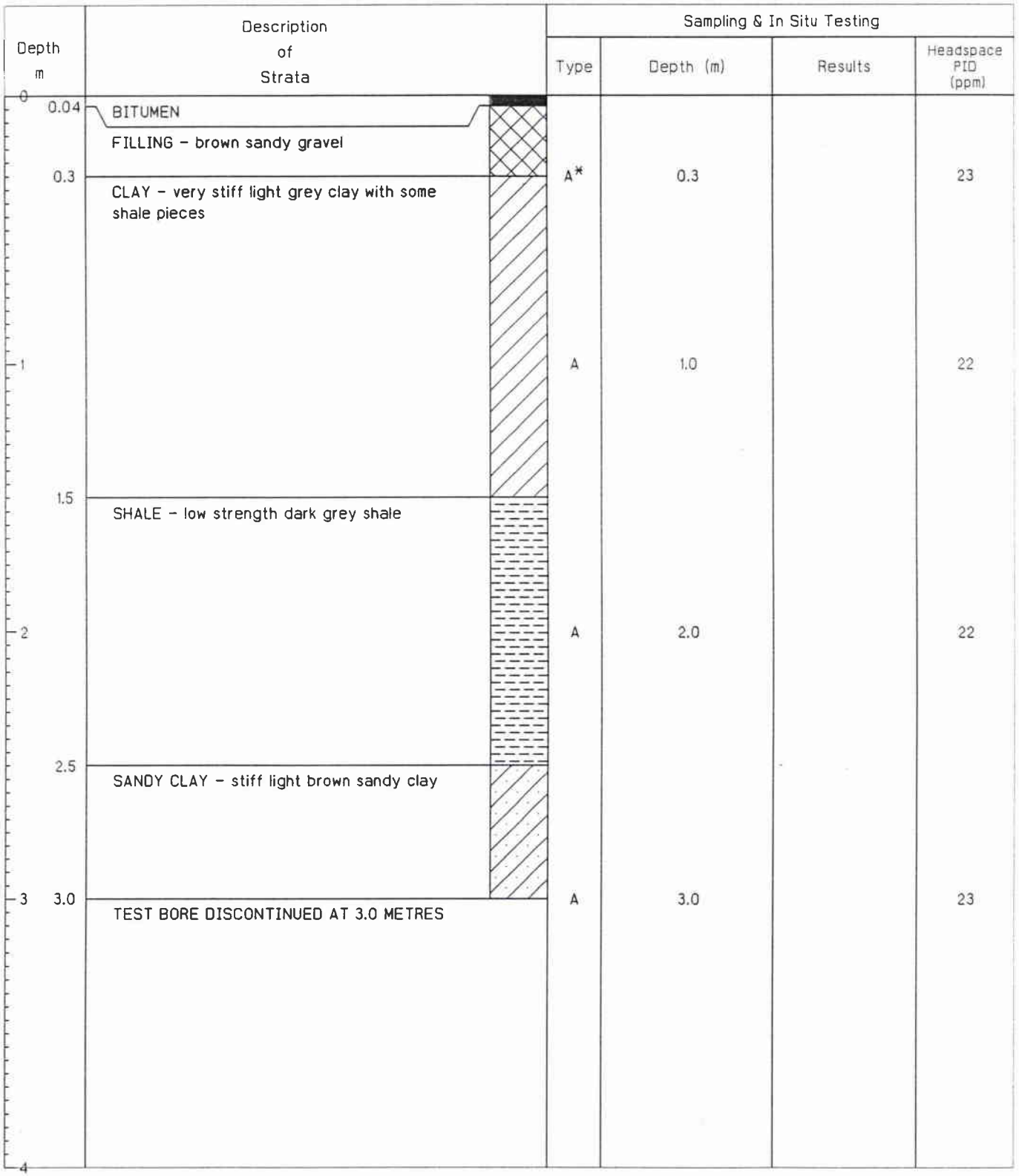
SAMPLING & IN SITU TESTING LEGEND	
A auger sample	PL point load strength I_s (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RML
Date: 14/4/97

Douglas Partners
Geotechnics · Environment · Groundwater

TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD **DATE:** 26 MAR 97 **BORE No.** 23
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24378A **SHEET** 1 **OF** 1
LOCATION: LOT 2 RODBOROUGH RD, FRENCHS FOREST **SURFACE LEVEL:** 158.87 AHD



RIG: BOBCAT **DRILLER:** ELLIS **LOGGED:** LINDBECK **CASING:**
TYPE OF BORING: 200mm DIAMETER SOLID FLIGHT AUGER TO 3.0m
GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED
REMARKS: * Z_2 – DUPLICATE OF B23/0.3

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_s (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RMM
Date: 4/4/97

Douglas Partners
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TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD **DATE:** 26 MAR 97 **BORE No.** 24
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT **PROJECT No.:** 24378A **SHEET** 1 OF 1
LOCATION: LOT 2 RODBOROUGH RD, FRENCHS FOREST **SURFACE LEVEL:** 159.90 AHD

Depth m	Description of Strata	Sampling & In Situ Testing: Type	Depth (m)	Results	Headspace PID (ppm)
0					
0.1	TOPSOIL – dark brown sandy clay				
	FILLING – mottled brown and orange brown clay	A	0.3		24
0.5	CLAY – very stiff to hard light brown clay				
0.8	CLAY – very stiff light brown mottled red brown clay	A	1.0		27
1					
2		A	2.0		26
2.5	SHALE – very low strength highly weathered shale				
3		A	3.0		22
3.0	TEST BORE DISCONTINUED AT 3.0 METRES				
4					

RIG: BOBCAT **DRILLER:** ELLIS **LOGGED:** LINDBECK **CASING:**
TYPE OF BORING: 200mm DIAMETER SOLID FLIGHT AUGER TO 3.0m
GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_s (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RMC
Date: 4/4/97

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TEST BORE REPORT

CLIENT: NATIONAL TRUSTEES LTD
DATE: 26 MAR 97
BORE No. 25
PROJECT: PRELIMINARY CONTAMINATION ASSESSMENT
PROJECT No.: 24378A
SHEET 1 **OF** 1
LOCATION: LOT 2 RODBOROUGH RD, FRENCHS FOREST
SURFACE LEVEL: 159.33 AHD

Depth m	Description of Strata	Sampling & In Situ Testing			
		Type	Depth (m)	Results	Headspace PID (ppm)
0	CLAY – stiff light orange brown clay	A	0.3		15
0.5	CLAY – very stiff light grey and orange brown clay	A	1.0		17
1.5	SHALE – extremely low strength extremely weathered brown shale	A	2.0		15
2.5	SHALE – low strength dark grey shale	A	3.0		17
3.0	TEST BORE DISCONTINUED AT 3.0 METRES				
4					

RIG: BOBCAT **DRILLER:** ELLIS **LOGGED:** LINDBECK **CASING:**
TYPE OF BORING: 200mm DIAMETER SOLID FLIGHT AUGER TO 3.0m
GROUND WATER OBSERVATIONS: NO FREE GROUND WATER OBSERVED
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A auger sample	PL point load strength I_s (50)MPa
B bulk sample	S standard penetration test
C core drilling	Ux x mm dia. tube
pp Pocket Penetration (kPa)	V shear vane (kPa)

CHECKED:
Initials: RML
Date: 14/4/97

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TEST BORE REPORT

BORE No. A

CLIENT WARDS CIVIL ENGINEERING PTY. LTD. DATE 18/3/87

SITE LOT 2, WARRINGAH ROAD, CONTRACT No. EW 2939

LOCATION FRENCHS FOREST SURFACE LEVEL

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery
	S.L.				%
		A	0.50		
FILLING - brown silty clayey fine and medium sand with sandstone fragments to 400mm and occasional clay lumps. Dry to 0.1m then moist to 0.8m, wet to 1.0m, then saturated.		A	1.00		
		A	1.50		
FILLING - stiff to very stiff and red-brown silty clay	1.70				
	1.90				
BORE DISCONTINUED AT 1.90 METRES					

RIG DRILLER A.J.T. CASING

TYPE OF BORING Backhoe

WATER LEVEL OBSERVATIONS Water entering pit from 1.0m, later also at 0.8m - 1.3m.

REMARKS

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. B

CLIENT WARDS CIVIL ENGINEERING PTY. LTD.

SITE LOT 2, WARRINGAH ROAD,

LOCATION FRENCHS FOREST.

DATE 18/3/87

CONTRACT No. EW 2939

SURFACE LEVEL

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery %
	S.L.				
FILLING - brown silty clayey fine and medium sand with sandstone fragments to 400mm and occasional clay lumps. Moist to 0.3m, wet to 0.6m, then saturated.					
	1.40				
FILLING - firm to stiff red-brown mottled silty clay with rock and rubble fragments					
	1.90				
BORE DISCONTINUED AT 1.90 METRES					

RIG DRILLER A.J.T. CASING

TYPE OF BORING Backhoe

WATER LEVEL OBSERVATIONS Water entering pit from 1.3m.

REMARKS Pit collapsed prior to back filling

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. C

CLIENT WARDS CIVIL ENGINEERING PTY. LTD.
DATE 18/3/87
SITE LOT 2, WARRINGAH ROAD,
CONTRACT No. EW 2939
LOCATION FRENCHS FOREST
SURFACE LEVEL

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery
	S.L.				%
FILLING - brown silty clayey fine and medium sand with sandstone fragments to 400mm and occasional clay lumps. Damp to moist to 0.8m, wet to 1.0m, then saturated.					
	1.50	A	1.50		
FILLING - firm dark grey organic sandy clay grading into stiff red brown grey clay					
	2.10				
BORE DISCONTINUED AT 2.10 METRES					

RIG DRILLER A.J.T. CASING

TYPE OF BORING Backhoe

WATER LEVEL OBSERVATIONS Free ground water observed, but depth unknown due to collapse of pit

REMARKS

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. D

CLIENT WARDS CIVIL ENGINEERING PTY. LTD.

SITE LOT 2, WARRINGAH ROAD,

LOCATION FRENCHS FOREST

DATE 18/3/87

CONTRACT No. EW 2939

SURFACE LEVEL

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery %
	S.L.				
FILLING - brown silty clayey fine and medium sand with sandstone fragments to 400mm and occasional clay lumps. Wet to 0.3m, then saturated					
	1.00				
FILLING - firm dark grey organic sandy clay	1.10				
FILLING - mottled light grey and grey brown clay, stiff to very stiff. Also with occasional rubble fragments		A	1.50		
	2.10				
PIT DISCONTINUED AT 2.10 METRES					

RIG DRILLER A.P. CASING

TYPE OF BORING Backhoe

WATER LEVEL OBSERVATIONS 1.2m water was starting to seep

REMARKS

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. E

CLIENT WARDS CIVIL ENGINEERING PTY. LTD.

SITE LOT 2, WARRINGAH ROAD,

LOCATION FRENCHS FOREST

DATE 18/3/87

CONTRACT No. EW 2939

SURFACE LEVEL

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery
					%
FILLING - brown silty clayey fine and medium sand with sandstone fragments to 400mm and occasional clay lumps. Moist to 0.4m.	S.L.				
	0.40				
FILLING - light grey mottled slightly red-brown silty clay with traces of organics, stiff to very stiff.					
		A	1.50		
	1.70	A	1.70		
SHALEY CLAY - light grey silty shaley clay					
	2.10				
BORE DISCONTINUED AT 2.10 METRES					

RIG DRILLER A.J.T. CASING

TYPE OF BORING Backhoe

WATER LEVEL OBSERVATIONS No free ground water observed

REMARKS

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. F

CLIENT WARDS CIVIL ENGINEERING PTY. LTD.

DATE 18/3/87

SITE LOT 2, WARRINGAH ROAD,

CONTRACT No. EW 2939

LOCATION FRENCHS FOREST

SURFACE LEVEL

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery %
FILLING - brown silty clayey fine and medium sand with sandstone fragments to 400mm and occasional clay lumps. Moit to wet.	S.L.				
FILLING - grey brown sandy clay with sandstone fragments	0.60	A	0.60		
FILLING - dark grey organic sandy clay	0.90	A	0.90		
CLAY - firm to stiff moist grey lightly mottled red-brown silty clay	1.00				
		A	1.90		
BORE DISCONTINUED AT 2.20 METRES	2.20				

RIG DRILLER A.P. CASING

TYPE OF BORING Backhoe

WATER LEVEL OBSERVATIONS No free ground water observed

REMARKS

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

RESULTS OF DYNAMIC PENETROMETER TESTS

CLIENT WARDS CIVIL ENGINEERING PTY. LTD. DATE 18/3/87

PROJECT WAREHOUSE SITE PROJECT NO. EW 2939

LOCATION LOT 2, WARRINGAH ROAD, FRENCHS FOREST

TEST LOCATION / DEPTH m	PENETRATION RESISTANCE BLOWS/150mm													
	P1	P2	P3	P4										
0.00 – 0.15	3	1	1	1										
0.15 – 0.30	6	3	4	7										
0.30 – 0.45	13	3	2	6										
0.45 – 0.60	9	5	1	8										
0.60 – 0.75	3	4	3	8										
0.75 – 0.90	6	2	1	8										
0.90 – 1.05		3	4	9										
1.05 – 1.20		2												
1.20 – 0.35														
1.35 – 1.50														
1.50 – 1.65														
1.65 – 1.80														
1.80 – 1.95														
1.95 – 2.10														
2.10 – 2.25														
2.25 – 2.40														
2.40 – 2.55														
2.55 – 2.70														
2.70 – 2.85														
2.85 – 3.00														

TEST METHOD AS 1289. F3.2, CONE PENETROMETER ☒
AS 1289. F3.3, FLAT END PENETROMETER ☐

TESTED A.P.
CHECKED

LABORATORY LOCATION Sydney REPORT NO. EW 2939

SIGNED S.M.C. Becket.

This laboratory is registered by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of registration.

GROUND TEST PTY LIMITED
A subsidiary of D.J. Douglas & Partners Pty Ltd

TEST BORE REPORT

BORE No. 1

CLIENT MERES OSBORNE & ASSOCIATES
DATE 14th October, 1986
SITE LOT 2 WARRINGAH ROAD
CONTRACT No. SSI/9875
LOCATION FRENCHS FOREST
SURFACE LEVEL 160.2

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery
	S.L.				%
FILLING - brown very stiff sandy clay sandstone and rubble		A	0.50		
	0.70				
		A	1.00		
FILLING - red brown sandy clay, very stiff at first, becoming only firm to stiff		U	1.40 - 1.70		
		A	1.50		
	2.20				
FILLING - firm dark grey sandy clay		A	2.50		
	2.60				
GRAVELLY CLAY - soft brown sandy gravelly clay		U	3.00 - 3.30		
	3.20				
SANDY CLAY - stiff light grey sandy clay with very weak sandstone fragments		A	3.50		
	3.60				
		A	4.50		
		U	4.50 - 4.65		
SANDSTONE - weak light grey fine grained sandstone					
		A	5.50		
	6.50	A	6.50		
BORE DISCONTINUED AT 6.50 metres					

RIG Pengo **DRILLER** Thompson **CASING**

TYPE OF BORING 300 mm auger

WATER LEVEL OBSERVATIONS No free ground water observed while drilling, free ground water observed at 6.30 m after 15 minutes, 6.20 m after 1 hour 30 minutes and 6.10 m after 5 hours.

REMARKS Bore collapsed to 6.30 m immediately after drilling.

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. 2

CLIENT MERES OSBORNE & ASSOCIATES
DATE 14th October, 1986

SITE LOT 2 WARRINGAH ROAD
CONTRACT No. SSI/9875

LOCATION FRENCHS FOREST
SURFACE LEVEL 159.8

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery
	S.L.				%
FILLING - brown stiff and very stiff sandy clay and sandstone		A	0.50		
		A	1.00		
	1.40	A	1.50		
FILLING - bituminous concrete and crushed dolerite					
	2.20				
FILLING - brown sandy clay and rubble		A	2.50		
LAMINITE - interbedded very weak brown shale and grey fine grained sandstone	3.00	A	3.00		
	3.40	A	3.50		
SANDSTONE - weak grey and brown fine grained sandstone with occasional ironstone layers		A	4.50		
		A	5.50		
	6.50	A	6.50		
BORE DISCONTINUED AT 6.50 metres					

RIG Pengo **DRILLER** Thompson **CASING**

TYPE OF BORING 300 mm auger

WATER LEVEL OBSERVATIONS No free ground water observed while drilling, free ground water observed at 6.45 m after 15 minutes and at 5.40 m after 2 hours.

REMARKS

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. 3

CLIENT MERES OSBORNE & ASSOCIATES **DATE** 14th October, 1986

SITE LOT 2 WARRINGAH ROAD **CONTRACT No.** SSI/9875

LOCATION FRENCHS FOREST **SURFACE LEVEL** 158.8

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery
	S.L.				%
FILLING - brown clayey sand, sands medium dense at first, becoming loose and wet at 1.50 m		A	0.50		
		A	1.00		
		U	1.40 - 1.70		
	1.60	A	1.50		
FILLING - brown and grey sandy clay and sandstone filling					
	2.60	A	2.50		
SANDY CLAY - firm light grey sandy clay	3.10	U	3.00 - 3.30		
SANDSTONE - very weak to weak light grey fine grained sandstone		A	3.50		
	4.00				
SANDSTONE - weak light brown fine grained sandstone with some medium strong ferruginous sandstone layers		A	4.50		
		U	4.50 - 4.70		
	5.50	A	5.50		
BORE DISCONTINUED AT 5.50 metres					

RIG Pengo **DRILLER** Thompson **CASING**

TYPE OF BORING 300 mm auger

WATER LEVEL OBSERVATIONS No free ground water observed while drilling, free ground water observed at 3.60 m after 2 hours.

REMARKS Bore began caving at 0.50 metres, finally collapsed to 3.60 metres 15 minutes after drilling stopped.

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. 4

CLIENT MERES OSBORNE & ASSOCIATES
DATE 14th October, 1986

SITE LOT 2 WARRINGAH ROAD
CONTRACT No. SSI/9875

LOCATION FRENCHS FOREST
SURFACE LEVEL 159.2

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery
	S.L.				%
FILLING - brown stiff and very stiff sandy clay and sandstone		A	0.50		
		A	1.00		
		A	1.50		
		A	2.00		
GRAVELLY CLAY - firm brown sandy gravelly clay	2.30	A	2.50		
SANDY CLAY - firm dark grey mottled brown sandy clay	2.70	A	3.00		
	3.10	A	3.50		
SANDSTONE - very weak to weak light grey fine grained sandstone		A	4.50		
		A	5.50		
SANDSTONE - weak to medium strong brown and light grey fine grained sandstone	5.90				
	6.00	A	6.00		
BORE DISCONTINUED AT 6.00 metres					

RIG Pengo **DRILLER** Thompson **CASING**

TYPE OF BORING 300 mm auger

WATER LEVEL OBSERVATIONS No free ground water observed

REMARKS

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. 5

CLIENT MERES OSBORNE & ASSOCIATES
DATE 14th October, 1986

SITE LOT 2 WARRINGAH ROAD
CONTRACT No. SSI/9875

LOCATION FRENCHS FOREST
SURFACE LEVEL 158.6

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery
	S.L.				%
		A	0.50		
FILLING - brown sandy clay rubble and shale - clay stiff to very stiff at first, becoming only firm to stiff below 1.5 m		A	1.00		
		U	1.40 - 1.70		
		A	1.50		
		A	2.50		
SANDY CLAY - firm light grey sandy clay	2.90	U	3.00 - 3.30		
SANDSTONE - very weak to weak light grey fine grained sandstone	3.20	A	3.50		
	3.80				
SANDSTONE - weak light grey fine grained sandstone		A	4.50		
		U	4.50 - 4.60		
SANDSTONE - weak light brown fine grained sandstone with some laminite layers	5.30				
	5.50	A	5.50		
BORE DISCONTINUED AT 5.50 metres					

RIG Pengo **DRILLER** Thompson **CASING**

TYPE OF BORING 300 mm auger

WATER LEVEL OBSERVATIONS No free ground water observed

REMARKS

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J.Douglas & Partners

TEST BORE REPORT

BORE No. 6 and 7

CLIENT MERES OSBORNE & ASSOCIATES
DATE 14th October, 1986
SITE LOT 2 WARRINGAH ROAD
CONTRACT No. SSI/9875
LOCATION FRENCHS FOREST
SURFACE LEVEL

Description of Strata	Depth metres	Sampling and in-situ Testing			
		Type	Depth	'N' value	Core recovery
					%
BORE 6 R.L. 157.8	S.L.				
FILLING - brown sandy clay and rubble filling		A	0.50		
	1.00	A	1.00		
BORE DISCONTINUED AT 1.00 metre					
BORE 7 R.L. 156.2	S.L.				
FILLING - brown sandy clay and rubble filling		A	0.50		
	1.00	A	1.00		
BORE DISCONTINUED AT 1.00 metre					

RIG Pengo **DRILLER** Thompson **CASING**

TYPE OF BORING 300 mm auger

WATER LEVEL OBSERVATIONS No free ground water observed

REMARKS

TYPE

A — auger sample
S — standard penetration test sample
U — mm diameter undisturbed sample
C — continuous diamond core
V — field vane shear test

"N" VALUE

blows of a 63.5 kg hammer falling 760 mm to drive a standard 50 mm O.D. split penetrometer for the last 300 mm of test (where thin walled undisturbed sample tubes are driven in the same manner, the values are shown bracketed).

D.J. Douglas & Partners

RESULTS OF DYNAMIC PENETROMETER TESTS

CLIENT MERES OSBORNE & ASSOCIATES DATE 14th October, 1986

PROJECT LOT 2 WARRINGAH ROAD PROJECT No. SSI/9875

LOCATION FRENCHS FOREST

LOCN. / DEPTH m	PENETRATION RESISTANCE BLOWS / 150 mm										
	B1	B2	B3	B4	B5	B6	B7				
0.00 – 0.15	2	3	4	1	3	4	3				
0.15 – 0.30	4	7	10	2	2	11	3				
0.30 – 0.45	5	11	8	4	8	20/100mm	11				
0.45 – 0.60	10/50mm	7	3	13	14		5				
0.60 – 0.75		3	4	12	13		6				
0.75 – 0.90		6	11	6	6		9				
0.90 – 1.05		6	11	10	4		5				
1.05 – 1.20		5	7	8	21/100mm		4				
1.20 – 1.35		20	7	5			5				
1.35 – 1.50		10	7	15			3				
1.50 – 1.65		8	20/100mm	10/50mm			4				
1.65 – 1.80		7					8				
1.80 – 1.95											
1.95 – 2.10											
2.10 – 2.25											
2.25 – 2.40											
2.40 – 2.55											
2.55 – 2.70											
2.70 – 2.85											
2.85 – 3.00											
3.00 – 3.15											
3.15 – 3.30											
3.30 – 3.45											
3.45 – 3.60											
3.60 – 3.75											

TEST METHOD AS.1289. F.3.2, CONE PENETROMETER ☐ TESTED BY DATE
AS.1289 F.3.3, FLAT END PENETROMETER ☐ CHECKED BY DATE

REPORT No. SIGNED

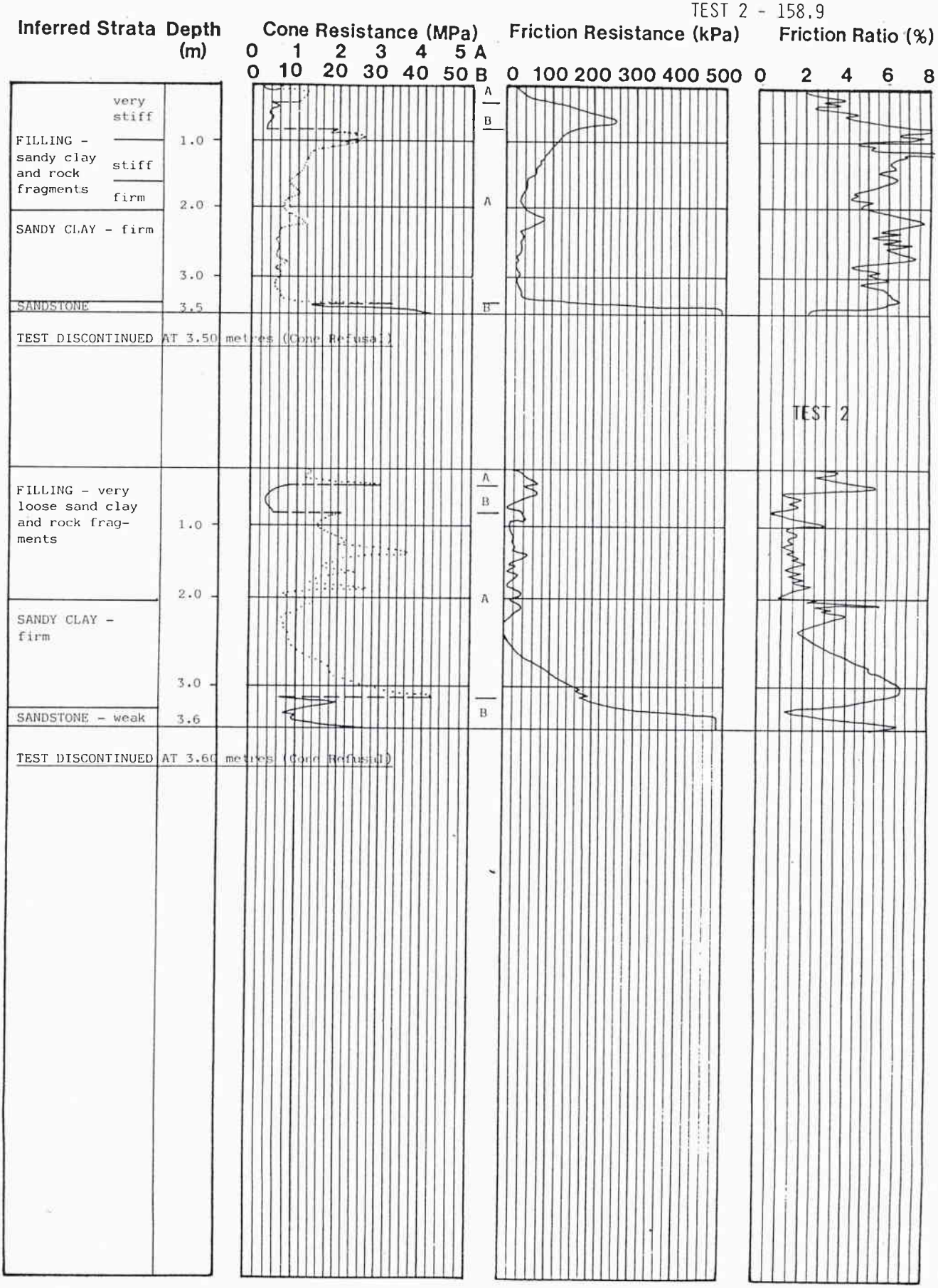
GROUND TEST PTY LIMITED
A subsidiary of D.J. Douglas & Partners Pty Ltd

RESULTS OF CONE PENETROMETER TESTS

CLIENT MERES OSBORNE & ASSOCIATES **DATE** 15/10/86 **TEST No.** 1 & 2

SITE LOT 2 WARRINGAH ROAD **CONTRACT No.** SSI/9875

LOCATION FRENCHS FOREST **SURFACE LEVEL** TEST 1 - 158.8
TEST 2 - 158.9



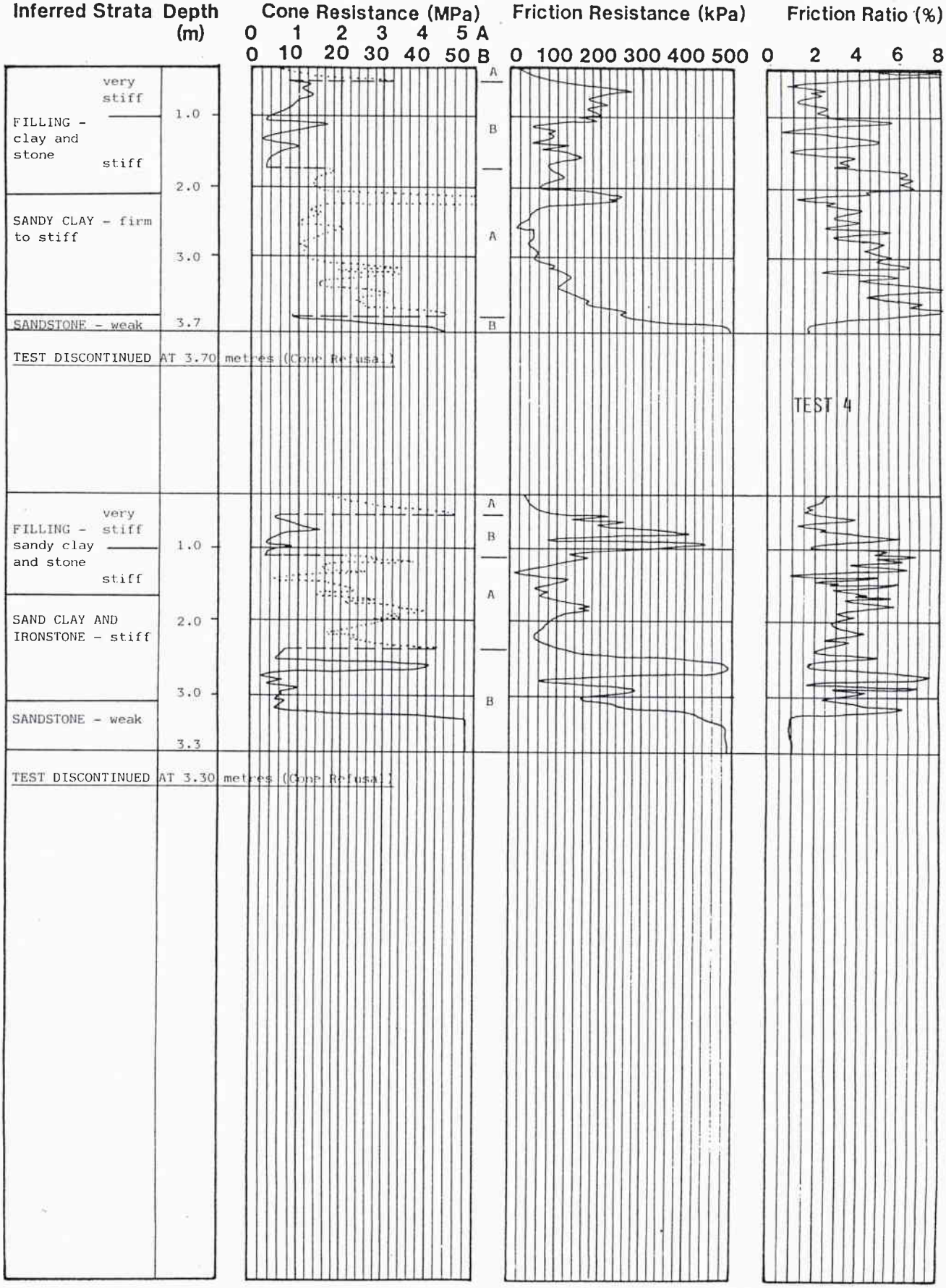
Remarks:

D.J.Douglas & Partners

RESULTS OF CONE PENETROMETER TESTS

CLIENT MERES OSBORNE & ASSOCIATES
SITE LOT 2 WARRINGAH ROAD
LOCATION FRENCHS FOREST

DATE 15/10/86 **TEST No.** 3 & 4
CONTRACT No. SSI/9875
SURFACE LEVEL TEST 3 - 158.0
TEST 4 - 159.5

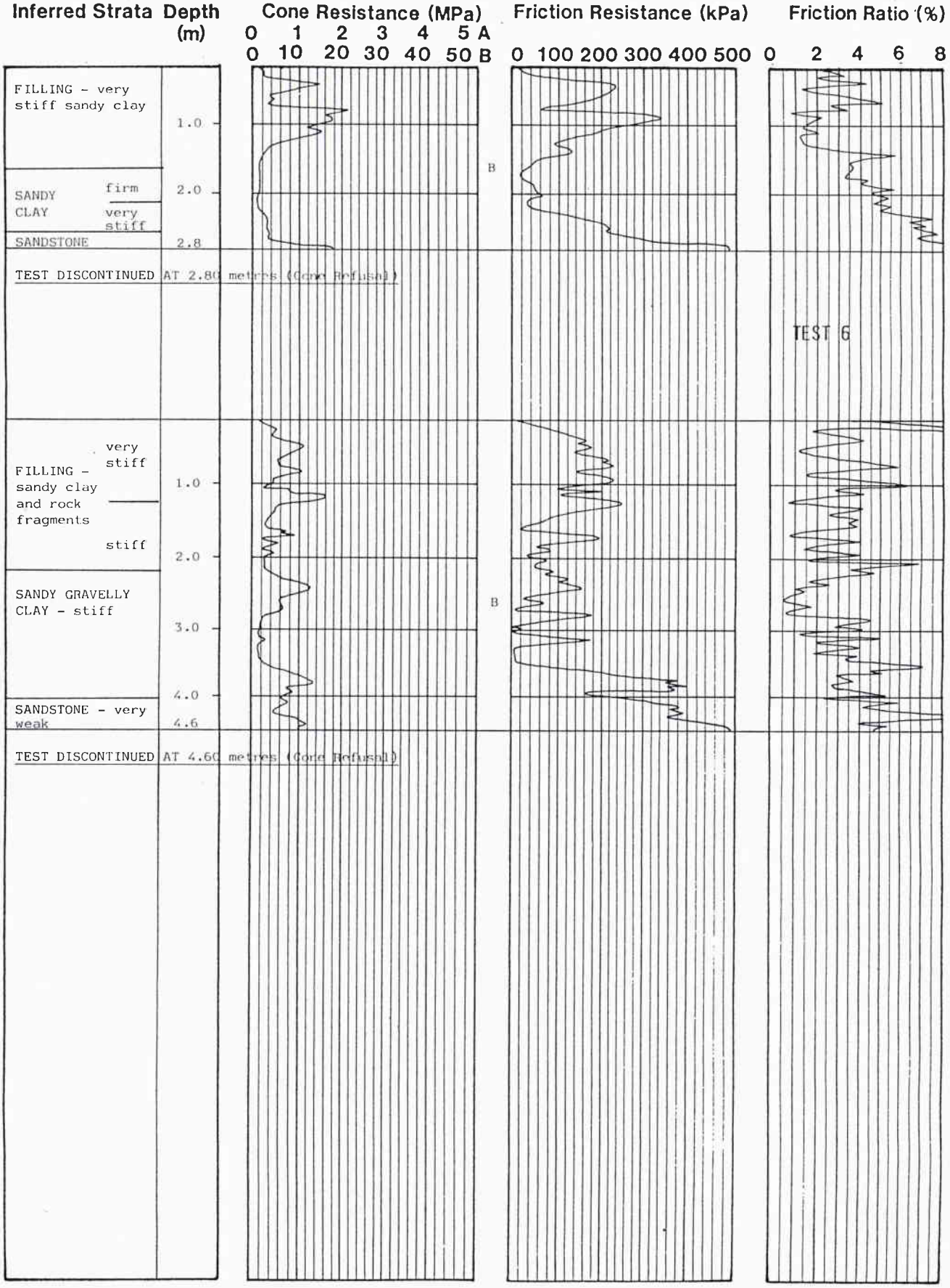


Remarks:

D.J.Douglas & Partners

RESULTS OF CONE PENETROMETER TESTS

CLIENT MERES OSBORNE & ASSOCIATES
DATE 15/10/86 **TEST No.** 5 & 6
SITE LOT 2 WARRINGAH ROAD
CONTRACT No. SSI/9875
LOCATION FRENCHS FOREST
SURFACE LEVEL TEST 5 - 159.3
TEST 6 - 158.5



Remarks:

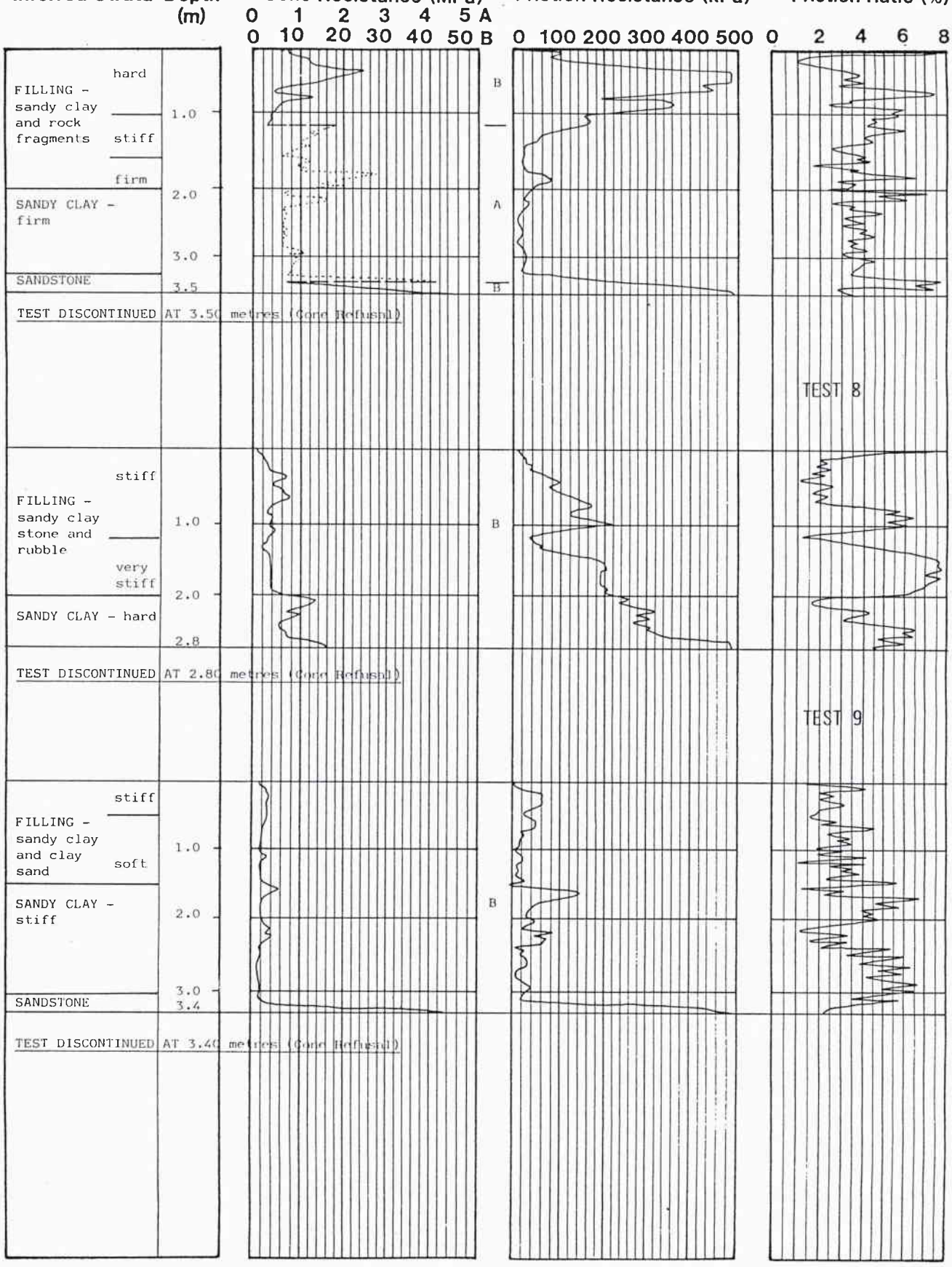
D.J.Douglas & Partners

RESULTS OF CONE PENETROMETER TESTS

CLIENT MERES OSBORNE & ASSOCIATES **DATE** 15/10/86 **TEST No.** 7, 8 & 9

SITE LOT 2 WARRINGAH ROAD **CONTRACT No.** SSI/9875

LOCATION FRENCHS FOREST **SURFACE LEVEL** TEST 7 - 160.6
TEST 8 - 160.0
TEST 9 - 158.8



Remarks:

D.J.Douglas & Partners

ENGINEERING LOG

BOREHOLE No. 1 SHEET 1 OF 1

SOIL DESCRIPTION	CLASSIFICATION SYMBOL	DEPTH (m)	GRAPHIC LOG	SAMPLES	FIELD SHEAR STRENGTH (kPa)	* SPT TEST	COMMENTS
							RL 160.6
SILTY SANDY CLAY: Brown, medium, fine to medium, some fine to medium gravel moist. (Firm/Stiff).	CL/CH						FILL
SILTY SAND: White to light grey. fine, some clay, cohesive, moist (Loose).	SM						
CLAYEY SAND: Brown and red brown, fine to medium, low plasticity, some pockets of sand, moist (Loose)	SC	1.0					
SILTY SANDY CLAY: Red brown, low to medium, fine to medium, some fine to medium gravel, gravelly in parts, moist. (Firm/Stiff). Grading brown, wet (Firm).	CL						▽ Water Table on 14-9-81.
- grading silty clay: Dark grey grading brownish grey, low to medium, some fine to medium sand, trace of fine gravel, some roots & rootlets, wet (Soft/Firm). - grading mottled brown, light brown and white, with rootlets, fragments of coke, small roots, wet. (Firm).		2.0		SPT		5	——? ——? ——?
- grading mottled red, orange and light brown and white		3.0					
CLAYEY SANDY SILT: White, low, fine to very fine, dry to moist (E/W siltstone / sandstone).	ML						- slow drilling penetration
SANDSTONE: White, fine to very fine, extremely weathered, soft and weak. grading harder. RL 157		4.0					
- grading highly weathered.				SPT		>50 225	Refusal with V-bit.
BOREHOLE 1 TERMINATED AT 4.25 m		5.0					
		6.0					
		7.0					

DRILLING DATA

Date Commenced: 9-9-81 Date Finished: 9-9-81

Supervised by: SRL Checked by: SRL

Drilling Methods: AUGER DRILLING

Surface R.L.:

* SPT N VALUE

BIOTECHNOLOGY AUSTRALIA PTY LTD

FRENCHS FOREST

JOB No.: 8099-010-WI59 FIGURE No.: A - 3

DAMES & MOORE 17 MYRTLE STREET, CROWS NEST N.S.W. 2065, AUSTRALIA TELEPHONE: 929-7744 TELEX: 21378

ENGINEERING LOG

BOREHOLE No. 2 SHEET 1 OF 1

SOIL DESCRIPTION	CLASSIFICATION SYMBOL	DEPTH (m)	GRAPHIC LOG	SAMPLES	FIELD SHEAR STRENGTH (kPa)	SPT TEST *	COMMENTS
							159.7
GRAVELLY SAND: Brown, medium, fine to medium gravel, some clay and silt, moist (Loose).	SP						FILL
SANDY SILTY CLAY: Brown with white, red and light brown, low, fine to medium, some fine to medium gravel, and gravelly beds, some pockets of sand, some rootlets, moist (Firm/Stiff). - grading wet (Firm). - grading dark grey with small roots. - grading brown with pockets of medium sand and thin beds of silty clay. RL 157.1	CL	1.0 2.0					——— ? ——— ? ———
SANDSTONE: White to light grey, fine, with some beds of siltstone, extremely weathered grading less weathered, soft and weak grading harder, occasional soil infilled seams to 200mm.		3.0		SPT Dist.		11	Note: Blow count of 1,1,10. ▽ Water table on 14-9-81. Refusal with V-bit
BOREHOLE 2 TERMINATED AT 4.0m		4.0 5.0 6.0 7.0					

DRILLING DATA

Date Commenced: 9-9-81 Date Finished: 9-9-81

Supervised by: SRL Checked by: SRL

Drilling Methods: AUGER DRILLING

Surface R.L.:

* SPT N VALUE.

BIOTECHNOLOGY AUSTRALIA PTY LTD

FRENCHS FOREST

JOB No.: 8099 - 010 - WI59 FIGURE No.: A - 3

DAMES & MOORE 17 MYRTLE STREET, CROWS NEST N.S.W. 2065, AUSTRALIA TELEPHONE: 928-7744 TELEX: 21378

ENGINEERING LOG

BOREHOLE No. 5 SHEET 1 OF 1

SOIL DESCRIPTION	CLASSIFICATION SYMBOL	DEPTH (m)	GRAPHIC LOG	SAMPLES	FIELD SHEAR STRENGTH (kPa)	SPT TEST *	COMMENTS
							RL 160.2
SAND: Brown, medium, with thin beds and pockets of clayey sand, some fine to medium sandstone gravel, moist, (Loose / Medium Dense).	SP						FILL
- gravelly.	SP/GP	1.0					
- grading clayey sand: brown, white and light grey with dolerite gravel (blue metal).	SC						
- grading wet, (Loose).		2.0					▽ Water table on 14-9-81
				SPT		15	Note: rock fragment on end of shoe giving artificially high blow counts.
CLAYEY SILT: Light grey, low to medium, some fine sand, gravel, some laminations of silty clay, dry (E/W Siltstone). RL 155.6		3.0					
SANDSTONE: Light grey to white, fine, soft and weak, extremely weathered, occasional carbon stringers, some interbeds of siltstone, occasional clayey silt seams to 250mm.		4.0		SPT		>50 (Ref.)	Near Refusal with V-bit
		5.0					
BOREHOLE 5 TERMINATED AT 5.30 m.		6.0					
		7.0					

DRILLING DATA

Date Commenced: 9-9-81 Date Finished: 9-9-81

Supervised by: SRL Checked by: SRL

Drilling Methods: AUGER DRILLING

Surface R.L.:

* SPT N VALUE

BIOTECHNOLOGY AUSTRALIA PTY LTD

FRENCHS FOREST

JOB No.: 8099 - 010 - WI59 FIGURE No.: A - 3

DAMES & MOORE 17 MYRTLE STREET, CROWS NEST N.S.W. 2065, AUSTRALIA TELEPHONE 929-7744 TELEX: 21378

ENGINEERING LOG

BOREHOLE No. 6 SHEET 1 OF 1

SOIL DESCRIPTION	CLASSIFICATION SYMBOL	DEPTH (m)	GRAPHIC LOG	SAMPLES	FIELD SHEAR STRENGTH (kPa)	* SPT TEST	COMMENTS
							RL 159.5
SILTY CLAY: Brown, medium, some fine to medium sand and gravel, gravelly in parts, occasional coke fragments and rootlets, moist, (Firm/Stiff).	CL/CH	1.0		SPT		6	FILL
CLAYEY GRAVELLY SAND: Grey and brown, fine to medium sand and gravel, some pockets of white to light brown silty clay to 30 mm, wet, (Loose).		2.0					▽ Water Table on 14-9-81.
CLAYEY SAND: Dark to mid grey, fine to medium, cohesive, some fine to medium sand and gravel pockets, wet (Loose). Possibly fill. RL 156.7		3.0					
SILTSTONE / SANDSTONE: Interbedded white, light grey & light brown, siltstone and fine sandstone, extremely weathered with occasional firm to stiff clayey silt and silty clay seams							- Refusal with V-bit, slow penetration using T.C. bit to 4.0m.
- grading harder.		4.0					
		5.0		Dist.			Refusal with V-bit.
BOREHOLE 6 TERMINATED AT 5.20m		6.0					
		7.0					

DRILLING DATA

Date Commenced: 8-9-81 Date Finished: 8-9-81

Supervised by: SRL Checked by:

Drilling Methods: AUGER DRILLING.

Surface R.L.:

* SPT N VALUE.

BIOTECHNOLOGY AUSTRALIA PTY LTD

FRENCHS FOREST

JOB No.: 8099-010-70 FIGURE No.: A - 3

DAMES & MOORE 17 MYRTLE STREET, CROWS NEST N.S.W. 2065, AUSTRALIA TELEPHONE: 929-7744 TELEX: 21370

Appendix D

Results of Previous Laboratory Tests

RESULTS OF COMPACTION TEST

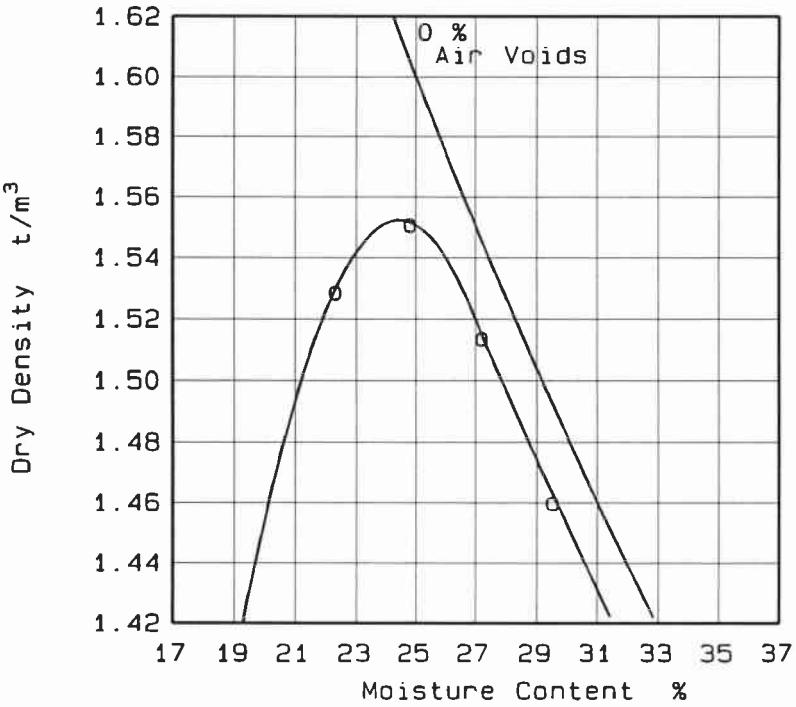
CLIENT National Trustees Limited

DATE 24/03/1997

PROJECT Proposed Industrial Development

PROJECT No. 24378

LOCATION Lot 2 Roxborough Road, Frenchs Forest



TEST LOC. Bore 19

DEPTH 0.3- 0.7m

DESCRIPTION
Grey/white CLAY

SPECIFIC GRAVITY
(Assumed) —

Particles >19mm -

FIELD MOISTURE
CONTENT 25.4 %

OPTIMUM MOISTURE
CONTENT 24.5 %

MAXIMUM DRY
DENSITY 1.55 t/m^3

TEST METHOD AS1289.5.1.1
(Standard)

TESTED S.M.

CHECKED S.M.

LABORATORY Newcastle 1670 REPORT No N97-065

SIGNED

Douglas Partners
Geotechnics · Environment · Groundwater

RESULTS OF COMPACTION TEST

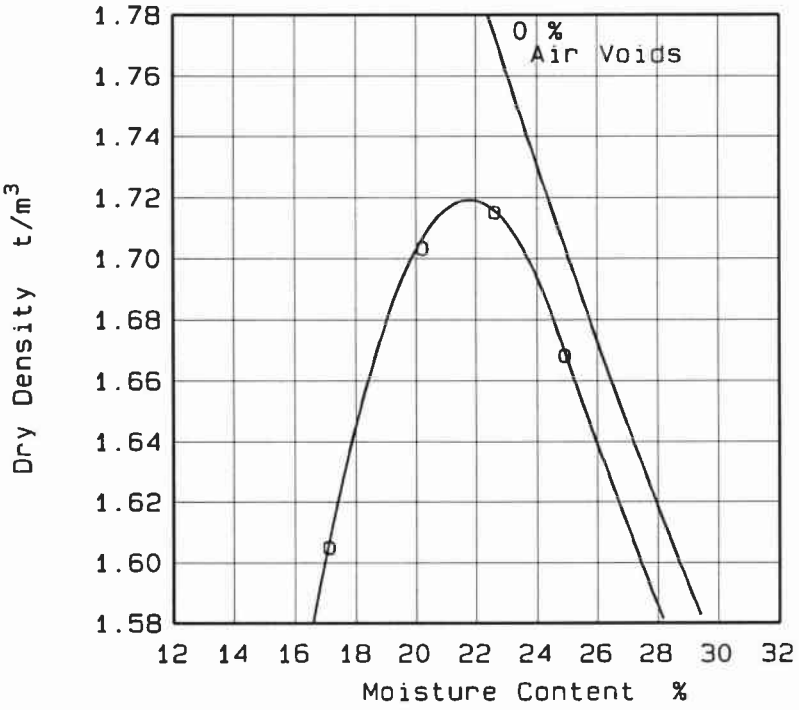
CLIENT National Trustees Limited

DATE 24/03/1997

PROJECT Proposed Industrial Development

PROJECT No. 24378

LOCATION Lot 2 Roxborough Road, Frenchs Forest



TEST LOC. Bore 21

DEPTH 1.2- 1.5m

DESCRIPTION
Red CLAY with some gravel

SPECIFIC GRAVITY (Assumed) –

Particles >19mm -

FIELD MOISTURE CONTENT 19.6 %

OPTIMUM MOISTURE CONTENT 22.0 %

MAXIMUM DRY DENSITY 1.72 t/m^3

TEST METHOD AS1289.5.1.1 (Standard)

TESTED J.A.

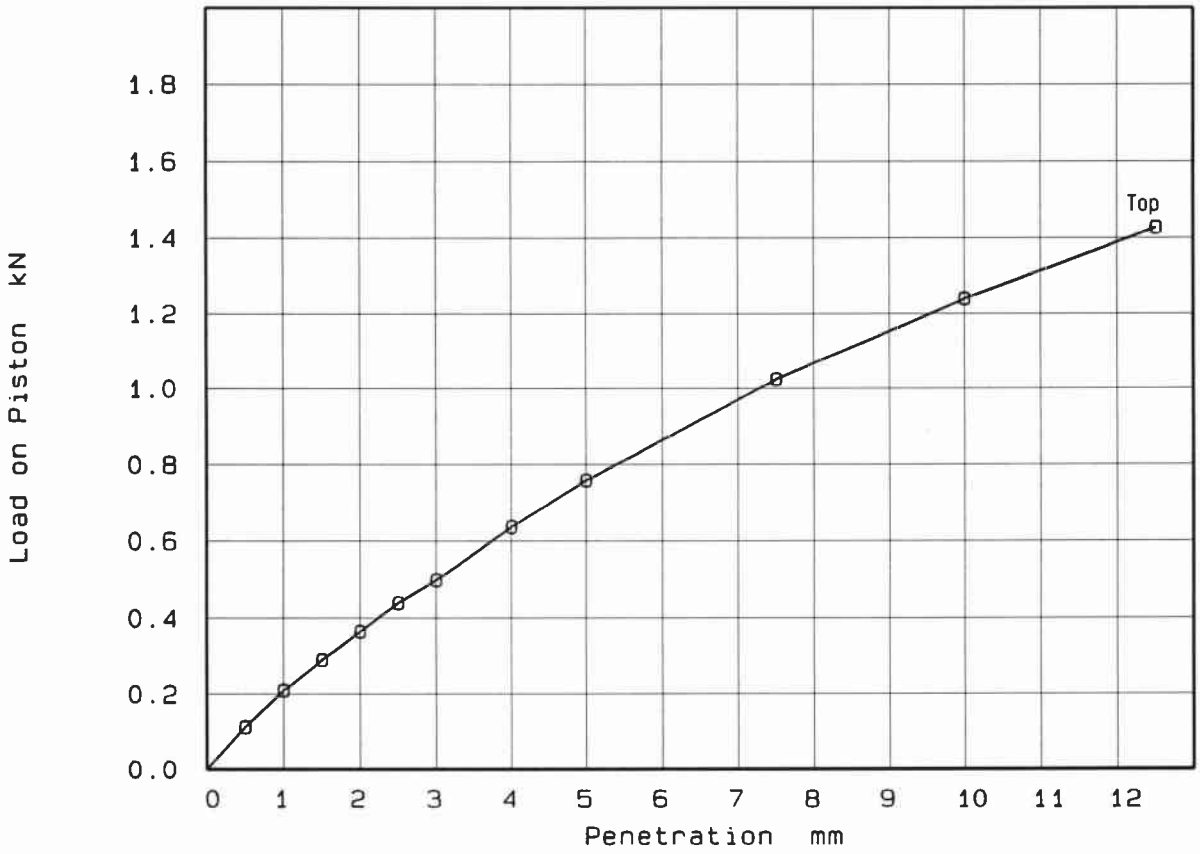
CHECKED S.M.

LABORATORY Newcastle 1670 REPORT No N97-065a SIGNED

Douglas Partners
Geotechnics · Environment · Groundwater

RESULTS OF CALIFORNIA BEARING RATIO TEST

CLIENT	National Trustees Limited	DATE	24/03/1997
PROJECT	Proposed Industrial Development	PROJECT No.	24378
LOCATION	Lot 2 Roxborough Road, Frenchs Forest	TEST LOC. DEPTH	Bore 19 0.3- 0.7m



DESCRIPTION Grey/white CLAY

PREPARATION Remoulded to approximate Maximum Dry Density and Optimum Moisture Content, then soaked for four days.

LEVEL OF COMPACTION 99 % Standard

SURCHARGE 4.5 kg SWELL 1.6 %

CONDITION	MOISTURE CONTENT %	DRY DENSITY t/m^3
At Compaction	25.0	1.54
After Soaking	27.5	1.52
After Test Top 30mm	29.3	-
- Remainder	26.2	-
Field Values	25.4	-
Standard Compaction	24.5	1.55

RESULTS		
Type	Penetration	CBR (%)
Top	- 2.5 mm	3.5
	- 5.0 mm	4.0

TEST METHOD AS 1289.F1.1

TESTED D.R.
CHECKED S.M.

LABORATORY Newcastle 1670 REPORT No N97-065b SIGNED

Douglas Partners
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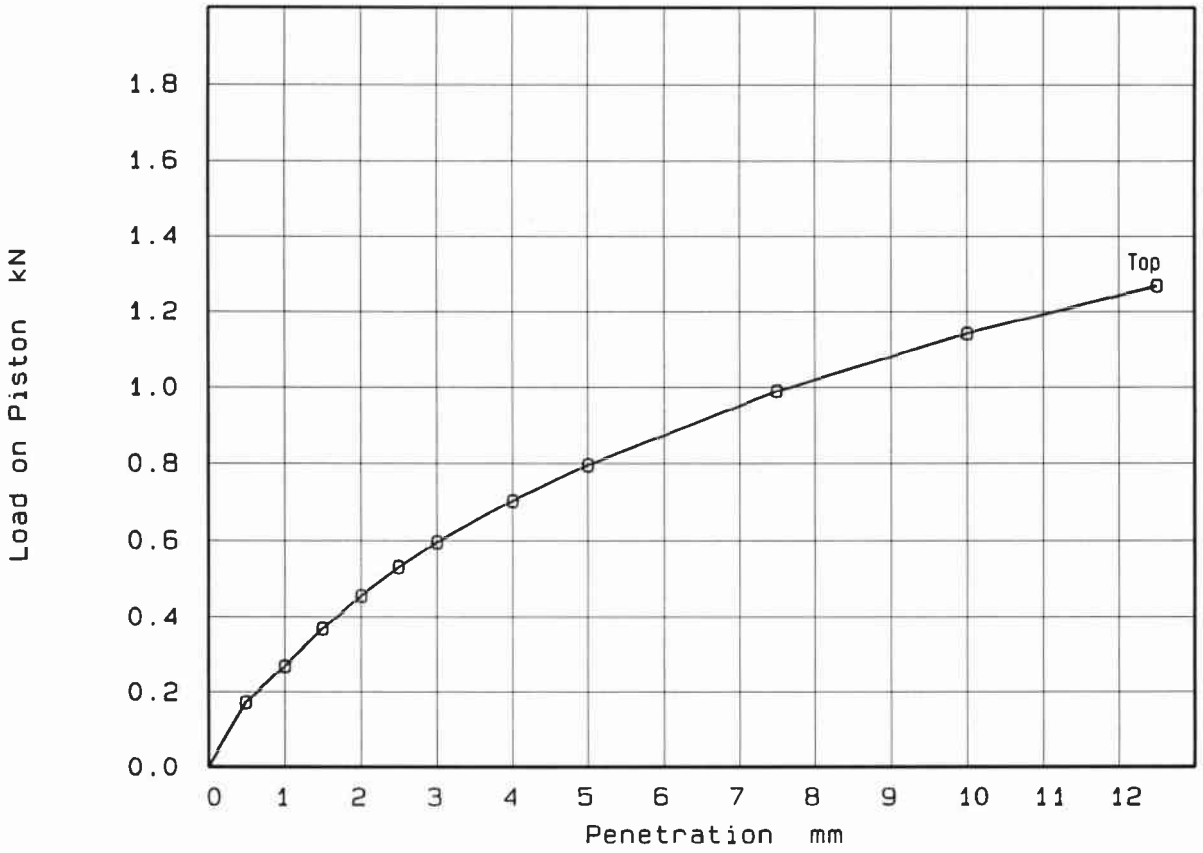
RESULTS OF CALIFORNIA BEARING RATIO TEST

CLIENT	National Trustees Limited	DATE	24/03/1997
PROJECT	Proposed Industrial Development	PROJECT No.	24378
LOCATION	Lot 2 Roxborough Road, Frenchs Forest	TEST LOC. DEPTH	Bore 21 1.2- 1.5m



DESCRIPTION Red CLAY with some gravel

PREPARATION Remoulded to approximate Maximum Dry Density and Optimum Moisture Content, then soaked for four days.

LEVEL OF COMPACTION 101 % Standard

SURCHARGE 4.5 kg SWELL 0.4 %

CONDITION	MOISTURE CONTENT %	DRY DENSITY t/m^3
At Compaction	21.3	1.73
After Soaking	22.2	1.72
After Test Top 30mm	23.7	-
- Remainder	24.7	-
Field Values	19.6	-
Standard Compaction	22.0	1.72

RESULTS Type	Penetration	CBR (%)
Top	- 2.5 mm	4.0
	- 5.0 mm	4.0

TEST METHOD AS 1289.F1.1

TESTED D.R.
CHECKED S.M.

LABORATORY Newcastle 1670 REPORT No N97-065c SIGNED

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Geotechnics • Environment • Groundwater

LOCATION		7					
DEPTH (metres)		1.0					
DESCRIPTION		SAND - brown gravelly clayey sand					
NATURAL MOISTURE CONTENT %		10.4					
PARTICLE SIZE DISTRIBUTION							
Percent passing A.S. sieve	75·0 mm						
	37·5 mm						
	26·5 mm						
	19·0 mm	100					
	13·2 mm						
	9·5 mm	95					
	6·7 mm	91					
	4·75 mm	87					
	2·36 mm	82					
	0·600 mm						
	0·425 mm	61					
	0·075 mm	19					
	0·0135mm						
ATTERBERG LIMITS %							
Liquid Limit		23					
Plastic Limit		9					
LINEAR SHRINKAGE %		2.5					
MAXIMUM DRY DENSITY t/m^3							
OPTIMUM MOISTURE CONTENT %							
SOAKED C.B.R. %							
ESTIMATED C.B.R. %							
* MR76 G.R.							
MR76 S.M.R.							
ø R.C.A. of Vic. %		15					

* Department of Main Roads, N.S.W. Form MR 76
ø Road Construction Authority of Victoria, Bulletin No. 31

SUMMARY OF LABORATORY TEST RESULTS

SITE WAREHOUSE DEVELOPMENT, FRENCHS FOREST

CLIENT MERES OSBORNE & ASSOCIATES

REPORT No. 9875/1

DATE 29/10/86

This Laboratory is registered by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of registration.

GROUND TEST PTY LIMITED
A subsidiary of D J Douglas & Partners Pty Ltd

BORE	7
DEPTH	1.0 m
DESCRIPTION	SAND - brown gravelly clayey sand
NATURAL MOISTURE CONTENT	10.4 %
LIQUID LIMIT	23 %
PLASTIC LIMIT	9 %
PLASTICITY INDEX	14 %
LINEAR SHRINKAGE	2.5 %
BORE	
DEPTH	
DESCRIPTION	
NATURAL MOISTURE CONTENT	%
LIQUID LIMIT	%
PLASTIC LIMIT	%
PLASTICITY INDEX	%
LINEAR SHRINKAGE	%

RESULTS OF PLASTICITY TESTS

SITE WAREHOUSE DEVELOPMENT, FRENCHS FOREST

CLIENT MERES OSBORNE & ASSOCIATES

REPORT No. 9875/2

DATE 29/10/86

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RESULTS OF PARTICLE SIZE DISTRIBUTION TEST

CLIENT MERES OSBORNE & ASSOCIATES

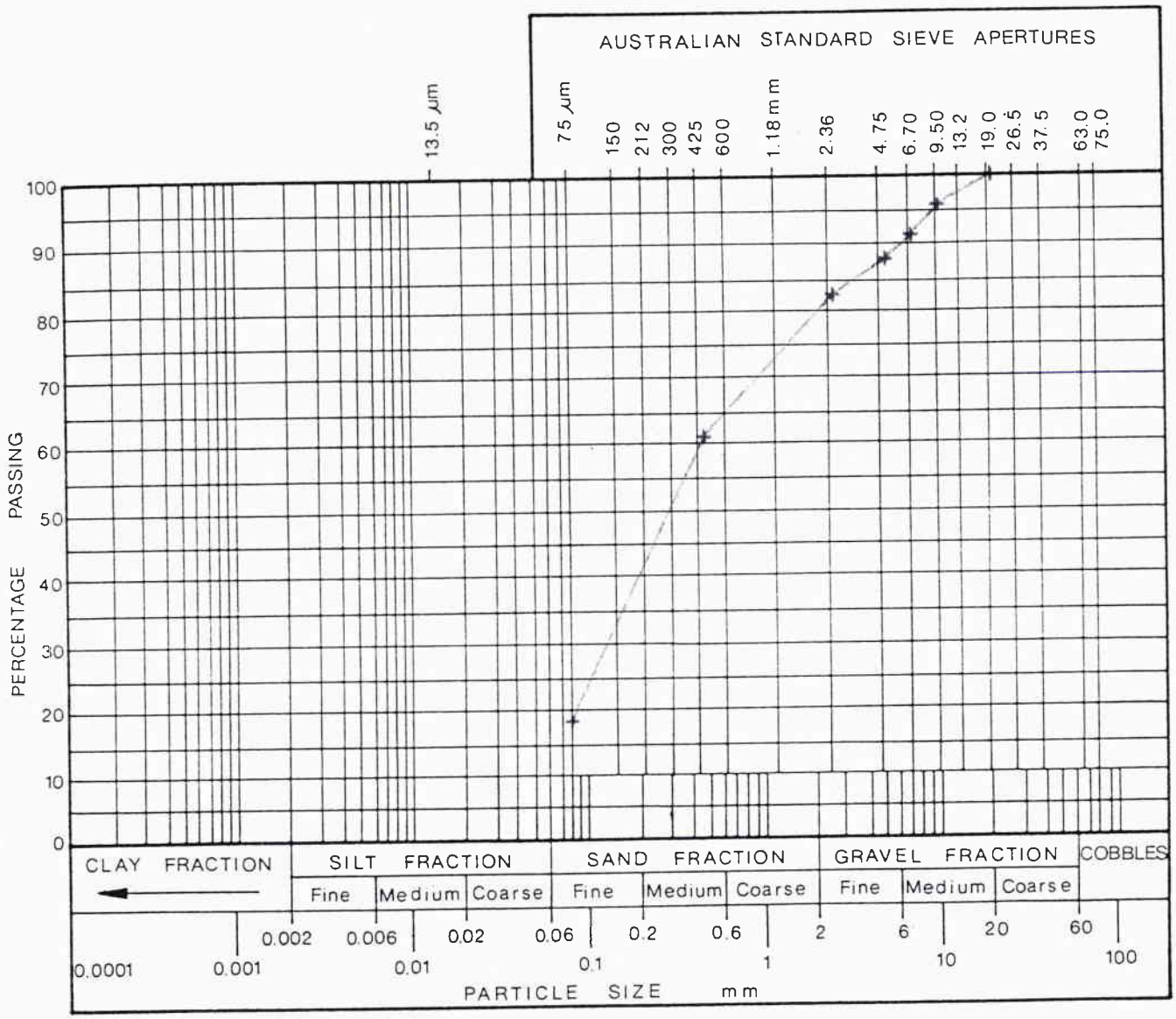
PROJECT WAREHOUSE DEVELOPMENT

LOCATION FRENCHS FOREST

DATE 29/10/86

PROJECT No. 9875

LOCN. No. 7 DEPTH 1.0 m



DESCRIPTION SAND - brown gravelly clayey sand

NATURAL MOISTURE CONTENT 10.4 %

SPECIFIC GRAVITY - t/m^3

PRE-TREATMENT Low temp. oven dried

LOSS IN MASS ON PRE TREATMENT - %

TEST METHOD AS 1289 C6.1 - 1977

TESTED BY BA DATE 28/10

CHECKED BY KF DATE 29/10

REPORT No. 9875/3

SIGNED

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