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REPORT
on
GEOTECHNICAL INVESTIGATION

NORWEST PRIVATE HOSPITAL AND MEDICAL CENTRE
ELIZABETH MACARTHUR DRIVE, BELLA VISTA

Prepared for
A W EDWARDS PTY LTD

Project 44715
April 2007

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Douglas Partners Pty Ltd
ABN 75 053 980 117

96 Hermitage Road
West Ryde NSW 2114
Australia

PO Box 472
West Ryde NSW 1685

Phone (02) 9809 0666
Fax: (02) 9809 4095
sydney@douglaspartners.com.au

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Results of Field Work

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JCB:ss
Project 44715
30 April 2007

GEOTECHNICAL REPORT
NORWEST PRIVATE HOSPITAL AND MEDICAL CENTRE
ELIZABETH MACARTHUR DRIVE, BELLA VISTA

1. INTRODUCTION

This report presents the results of a geotechnical investigation for the Norwest Private Hospital and Medical Centre, Elizabeth Macarthur Drive, Bella Vista. The report was commissioned by A W Edwards Pty Ltd, the builder for the project.

It is understood that the proposed development will comprise the construction of a 4 level private hospital with a single level basement car park. The investigation was carried out to provide information on the subsurface conditions for site preparation and foundation design purposes.

The investigation comprised 8 boreholes drilled to depths of 8.7 m to 14.5 m through a backfilled shale pit into medium and high strength shale. Details of the field work and subsequent analysis are given in the report, together with recommendations on foundation design and construction requirements.

2. SITE DESCRIPTION

The site is located on the southeastern side of the roundabout at the end of Elizabeth Macarthur Drive, off Norwest Boulevard, Bella Vista. It is roughly rectangular in shape, being some 230 m long by 105 m wide with its western, short side, fronting onto Elizabeth Macarthur Drive and its northern and eastern boundaries fronting onto the unformed Norbrick Drive. Its southern side is bounded by a future building site.

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The site was part of the Norbrick shale quarry which has been recently backfilled to form the Norwest Business Park. During the field work the site still had a stockpile of shaly filling with minor quantities of building rubble, covering the central portion of the eastern half of the site. The site generally sloped south from RL 81 - 82 along the unformed Norbrick Drive to RL 76 - 77 along its southern boundary.

3. GEOLOGY

The Sydney 1:100 000 Series Geological sheet shows the site to be underlain by Triassic aged sediments of the Bringelly Shale formation, comprising shale, siltstone and fine to medium grained sandstone.

The geological profile intersected by the investigation was consistent with the above, though with 4.1 m to 9.2 m of shaly filling overlying the former ground surface.

4. FIELD INVESTIGATION

4.1 Methods

The field investigation comprised eight boreholes drilled to depths of 8.7 m to 14.5 m, some 2.5 m to 4 m below the top of reasonably consistent medium strength shale. Four of the holes were drilled by a soil and rock sampling drill rig mounted on a Bobcat, the other four by a Scout soil and rock sampling drill rig mounted on a truck.

All boreholes were drilled using continuous spiral flight auger to depths of 5.0 m to 8.9 m within the filling and clayey soil (where encountered). All bores were then extended into medium or high strength shale by coring using NMLC sized diamond-core equipment. Standard Penetration tests were carried out in most of the boreholes at approximately 1.5 m intervals to help assess the consistency of compaction within the filling.

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The boreholes were set out by tape from the site boundaries and their collar levels were surveyed by A W Edwards contract surveyor. The locations of the boreholes are shown on Drawing 1.

4.2 Results

The detailed borehole logs are given in Appendix A together with notes which define the terms used to classify the strata in the logs, and notes for this report.

The investigation encountered a relatively consistent subsurface profile comprising variable depths of filling, in places overlying residual soil then extremely low to very low strength shale with low and medium strength bands followed by medium then high strength shale.

The filling generally comprised stiff to hard clay with shale and ironstone fragments. A few concrete fragments were also encountered with brick fragments, pieces of plastic and metal lying on the surface in places. Where drilled, the filling was 4.1 m to 9.2 m thick, well compacted with N values of 11 to 38 and a median value of 22.

In three boreholes, BH 1, 5 and 8, the filling was underlain by approximately 1 m of firm to hard clay or shaly clay. Elsewhere the filling lay directly on top of weathered shale at reduced levels of between RL 68.9 and RL 74.8 (see Table 1).

Table 1 – Level of Top of Rock Profile Layers

Borehole No.	Collar RL	RL Top of Rock	RL Top of Medium Strength	RL Top of High Strength	Depth to Top Medium Strength from Bulk Excavation Level (RL 78.00)
1	80.96	74.5	73.7	71.6	4.25
2	77.85	73.7	72.8	72.1	5.15
3	78.8	70.0	68.0	66.8	10.1
4	80.68	74.8	70.1	69.0	7.9
5	76.39	68.9	66.6	64.6	11.4
6	~79	70.3	69.4	69.0	8.7
7	82.4	73.2	72.4	71.1	5.6
8	77.04	69.5	67.8	67.0	10.2

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Point load strength indices ($Is_{(50)}$) measurements in the medium and high strength shale generally gave values of 0.5 – 0.7 MPa and 1.0 to 1.3 respectively, equivalent to UCS values of 8 – 11 and 16 – 21 MPa respectively, using a multiplier of 16 x $Is_{(50)}$ = UCS. Within the high strength shale there were a few values of 3.5 to 6.2 MPa (UCS = 56 – 99 MPa).

Groundwater was intersected in only one borehole while augering. This was BH 3 at a depth of 3.5 m. As water was used as a flushing medium while coring this prevented observation of free groundwater within the rockmass whilst drilling.

5. PROPOSED DEVELOPMENT

It is understood that the proposed development will comprise the construction of a 4 level hospital building underlain by a single level basement car park, with its bulk excavation level at RL 78.0.

Site preparation will involve excavating filling from much of the site with up to 4.4 m depth of excavation in the vicinity of BH 7.

It is understood that column loads will vary from 260 kN to 2800 kN.

6. COMMENTS

6.1 Excavation Conditions

Excavation for the basement car park will be within stiff to hard, compacted gravelly clay which has some associated building rubble. Excavation will be readily carried out using bulldozer blading or excavators.

The material to be excavated has been sampled and tested for a preliminary Waste Classification Assessment (see separate Report No 44715A).

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6.2 Excavation Batters

As the building footprint is well away from the site boundaries it will be possible to batter the excavation rather than use shoring. Temporary batter slopes of 1.5H:1V can be used. However long term slopes should be no steeper than 2H:1V.

6.3 Foundations

From the investigation it appears that the site is underlain by a former valley with its lowest point near Boreholes BH 5 and BH 8 and rising gently towards the northeast.

As there is 3 m to 9 m of filling and soil overlying the top of rock, column loads will need to be carried down to probably medium strength rock by use of piles.

From Table 1 the depth to top of medium strength rock from bulk excavation level varies from 4.3 m to 11.4 m.

From the point load strength values the allowable bearing capacities and skin friction values for the different shale strengths are given in Table 2.

Table 2 – Allowable Bearing Capacities and Skin Friction Values for Shale

Shale Strength	Allowable Bearing Capacity (KPa)	Allowable Skin Friction (KPa)
Extremely low to very low strength	500	25
Medium strength	4000	400
High strength	8000	800

6.4 Ground Slabs and Pavements

The basement floor will be constructed on compacted filling. Prior to pouring the base slab it will be necessary to proof roll the excavated area. Any soft spots should be over excavated and replaced with compacted granular filling.

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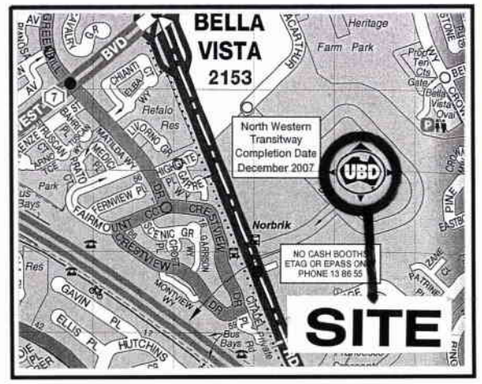
6.4 Further Investigation

Following excavation to the design level further sampling and laboratory testing should be undertaken to assess the California Bearing Ratio (CBR) of the subgrade soils for use in design of ground slabs and pavements.

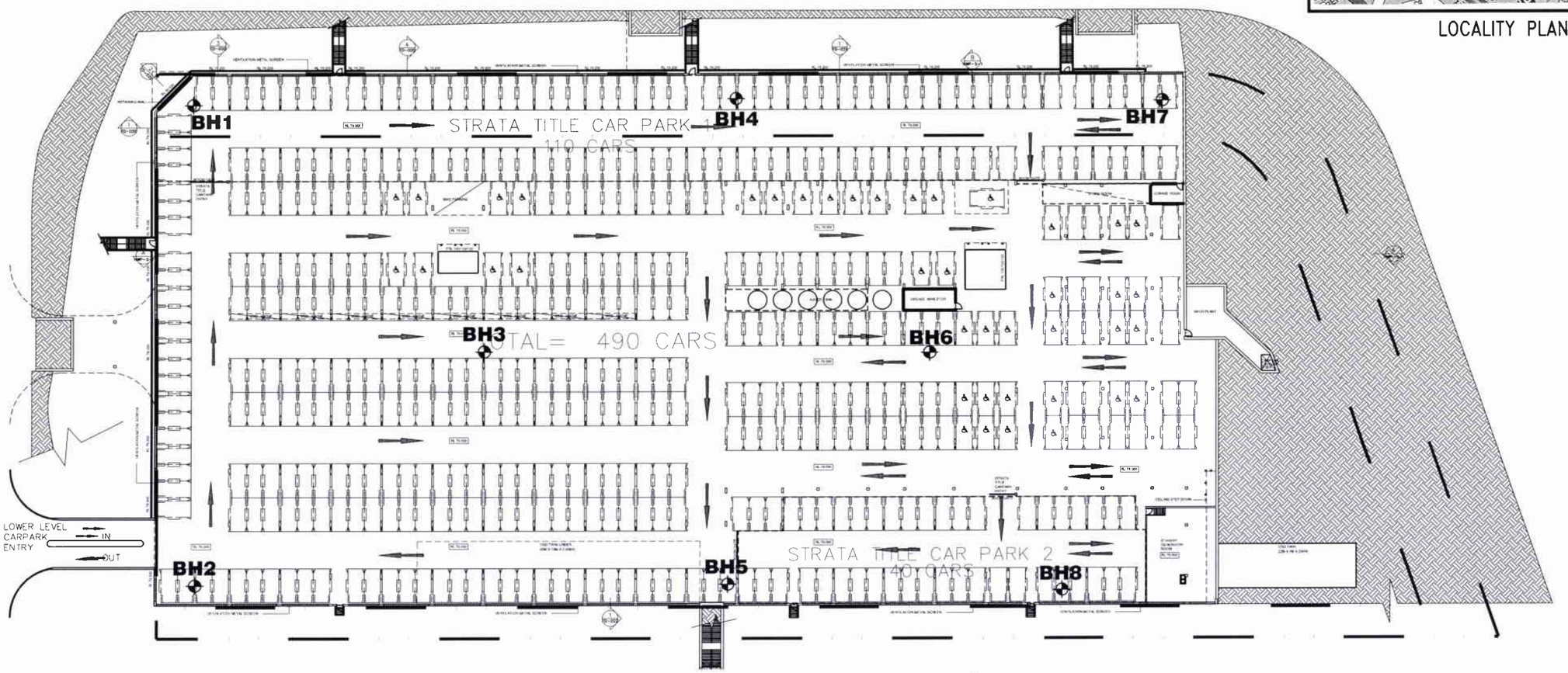
DOUGLAS PARTNERS PTY LTD

John Braybrooke
Principal

David Duff
Associate



LOCALITY PLAN



LEGEND

⊕ TEST BORE LOCATION

SCALE
0 10 20 30 40 50m
1:800 Approx.

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Sydney, Newcastle, Brisbane, Melbourne, Wyong, Canberra, Campbelltown, Townsville, Perth, Cairns, Wollongong, Darwin, Gold Coast, Sunshine Coast

TITLE:
Location of Test Bores
Norwest Private Hospital
E Macarthur Drive
BELLA VISTA

CLIENT: A W Edwards Pty Ltd			
DRAWN BY: PSCH	SCALE: As shown	PROJECT No: 44715	OFFICE: SYDNEY
APPROVED BY:		DATE: 30.4.2007	DRAWING No: 1

P:\44715 BELLA VISTA, Norwest Private Hospital JCB\Drawings\44715-1.dwg, 4/30/2007 10:29:19 AM

APPENDIX A
Notes Relating to this Report
Results of Field Work

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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring 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.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

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

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling 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 with 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.

Details of the type and method of sampling are given in the report.

Drilling Methods.

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

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

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

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

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in

clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

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

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

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

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in 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 short of full penetration, 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 tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

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

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

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

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

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

q_c = (12 to 18) c_u

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

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

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. 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 relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein 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. 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 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, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

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

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

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company 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 condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

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

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, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation 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. The Company 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 aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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DESCRIPTION AND CLASSIFICATION OF ROCKS FOR ENGINEERING PURPOSES

DEGREE OF WEATHERING

Term	Symbol	Definition
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining or discolouration of the rock substance usually by limonite has taken place. The colour of the fresh rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh Stained	Fs	Rock substance unaffected by weathering, but showing limonite staining along joints.
Fresh	Fr	Rock substance unaffected by weathering.

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index ($I_{S(50)}$) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by Australian Standard 4133.4.1 - 1993.

Term	Symbol	Field Guide*	Point Load Index $I_{S(50)}$ MPa	Approx Unconfined Compressive Strength q_u ** MPa
Extremely low	EL	Easily remoulded by hand to a material with soil properties	<0.03	< 0.6
Very low	VL	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; too hard to cut a triaxial sample by hand. SPT will refuse. Pieces up to 3 cm thick can be broken by finger pressure.	0.03-0.1	0.6-2
Low	L	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long 40 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.	0.1-0.3	2-6
Medium	M	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.	0.3-1.0	6-20
High	H	Can be slightly scratched with a knife. A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow, rock rings under hammer.	1 - 3	20-60
Very high	VH	Cannot be scratched with a knife. Hand specimen breaks with pick after more than one blow, rock rings under hammer.	3 - 10	60-200
Extremely high	EH	Specimen requires many blows with geological pick to break through intact material, rock rings under hammer.	>10	> 200

Note that these terms refer to strength of rock material and not to the strength of the rock mass, which may be considerably weaker due to rock defects.

* The field guide assessment of rock strength may be used for preliminary assessment or when point load testing is not able to be done.

** The approximate unconfined compressive strength (q_u) shown in the table is based on an assumed ratio to the point load index of 20:1. This ratio may vary widely.

STRATIFICATION SPACING

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

DEGREE OF FRACTURING

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude known artificial fractures such as drilling breaks. The orientation of rock defects is measured as an angle relative to a plane perpendicular to the core axis. Note that where possible, recordings of the actual defect spacing or range of spacings is preferred to the general terms given below.

Term	Description
Fragmented	The core consists mainly of fragments with dimensions less than 20 mm.
Highly Fractured	Core lengths are generally less than 20 mm - 40 mm with occasional fragments.
Fractured	Core lengths are mainly 40 mm - 200 mm with occasional shorter and longer sections.
Slightly Fractured	Core lengths are generally 200 mm - 1000 mm with occasional shorter and longer sections.
Unbroken	The core does not contain any fracture.

ROCK QUALITY DESIGNATION (RQD)

This is defined as the ratio of sound (i.e. low strength or better) core in lengths of greater than 100 mm to the total length of the core, expressed in percent. If the core is broken by handling or by the drilling process (i.e. the fracture surfaces are fresh, irregular breaks rather than joint surfaces) the fresh broken pieces are fitted together and counted as one piece.

SEDIMENTARY ROCK TYPES

This classification system provides a standardised terminology for the engineering description of sandstone and shales, particularly in the Sydney area, but the terms and definitions may be used elsewhere when applicable.

Rock Type	Definition
Conglomerate	More than 50% of the rock consists of gravel-sized (greater than 2 mm) fragments
Sandstone:	More than 50% of the rock consists of sand-sized (0.06 to 2 mm) grains
Siltstone:	More than 50% of the rock consists of silt-sized (less than 0.06 mm) granular particles and the rock is not laminated.
Claystone:	More than 50% of the rock consists of clay or sericitic material and the rock is not laminated.
Shale:	More than 50% of the rock consists of silt or clay-sized particles and the rock is laminated.

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, eg. clayey sandstone, sandy shale.

BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 80.96
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 44715
DATE: 15 Mar 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
80	1	FILLING - grey brown silty clay, shale and ironstone fragments filling							A			
79	2											
78	3								A			
77	4	4.0-4.5m: very stiff, grey and brown clay with ironstone gravel filling							S			3,5,9 N = 14
76	5											
	5.5	SILTY CLAY - firm, light grey silty clay, damp							S			3,2,4 N = 6
75	6											
	6.5	SHALE - extremely to very low strength, highly weathered, grey shale						Note: Unless otherwise stated, rock is fractured along rough planar bedding planes or joints dipping 0°- 10°				
74	7											
	7.2	SHALE - medium strength, slightly weathered, fractured to slightly fractured, grey brown shale with extremely low to very low strength bands						7.2m: CORE LOSS: 150mm 7.6m: J25° ironstained 7.68m: J45° ironstained 7.81m: J30° ironstained 8.16m: B0° clay 8.44m: J30° smooth 8.61m: B0° 10mm clay 8.86m: B0° clay 9.16m: J25° rough 9.35m: J20° rough 9.4m: J85° rough	C	94	69	PL(A) = 0.6MPa PL(A) = 0.6MPa
73	8											
72	9											
	9.35	SHALE - high strength, fresh, slightly fractured, grey shale with approximately 10% sandstone laminae							C	100	97	PL(A) = 1.3MPa

RIG: Bobcat **DRILLER:** E Grima **LOGGED:** SI **CASING:** HQ to 7.0m

TYPE OF BORING: Solid flight auger to 7.0m; Rotary to 7.2m; NMLC-Coring to 12.25m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▽ Water level

CHECKED
Initials:
Date: 30/4

Douglas Partners
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BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 80.96
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 44715
DATE: 15 Mar 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
70	11	SHALE - high strength, fresh, slightly fractured, grey shale with approximately 10% sandstone laminae *(continued)*						10.23m: J30° rough 10.56m: J30° rough, ironstained 10.69m: J25° smooth 10.93m: J90° smooth	C	100	97	PL(A) = 1.3MPa PL(A) = 1MPa
	11.3											
69	12	SHALE - medium strength, slightly weathered, fractured to slightly fractured, grey brown shale						11.42m: J55° rough 11.55m: J60° rough 11.62m: J30° rough 11.71m: J85°- 90° rough ironstained			PL(A) = 0.8MPa
	12.25	Bore discontinued at 12.25m										
68	13											
67	14											
66	15											
65	16											
64	17											
63	18											
62	19											

RIG: Bobcat **DRILLER:** E Grima **LOGGED:** SI **CASING:** HQ to 7.0m

TYPE OF BORING: Solid flight auger to 7.0m; Rotary to 7.2m; NMLC-Coring to 12.25m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▽ Water level

CHECKED
Initials:
Date: 3/4

Douglas Partners
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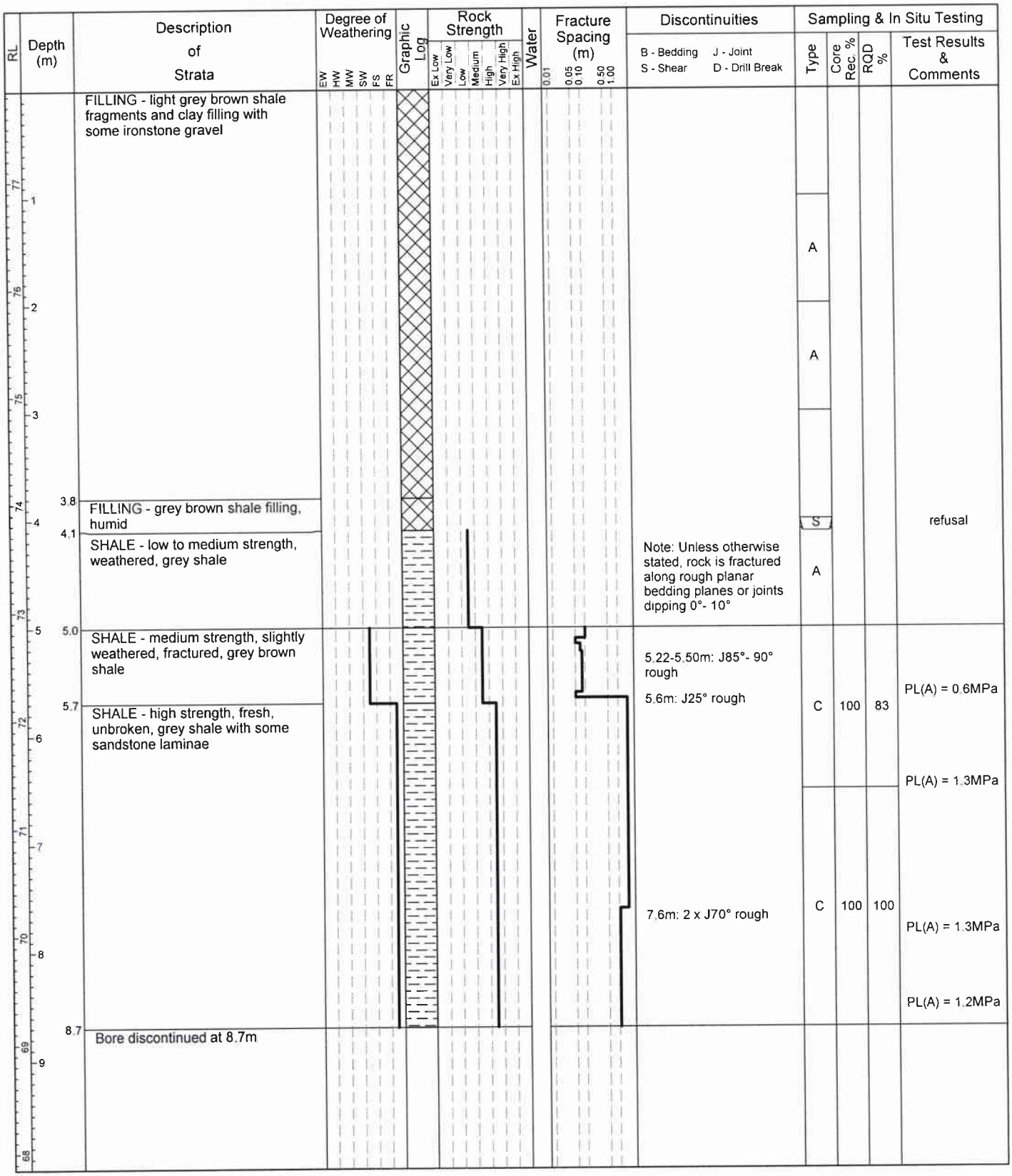
BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 77.85
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 44715
DATE: 14 Mar 07
SHEET 1 OF 1



RIG: DT 100 **DRILLER:** G Cooper **LOGGED:** SI **CASING:** HW to 5.0m

TYPE OF BORING: Solid flight auger to 5.0m; NMLC-Coring to 8.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▽ Water level

CHECKED
Initials:
Date: 30/4/07

Douglas Partners
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BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 78.8
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 44715
DATE: 16 Mar 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
78	0	FILLING - light grey silty clay, with some fine to medium grained sand and gravel, fragments of shale and ironstone filling, humid										
	1								A			
77	1.5	FILLING - light grey brown silty clay with some gravel filling, humid										
	2								A			
76	3					▼						
	3.7	FILLING - grey silty clay, fine sand and gravel filling, wet										
75	4								S			5,9,18 N = 27
	5											
74									S			11,10,8 N = 18
	6											
73	7	7.0-7.45m: very stiff to hard, brown clay with ironstone gravel							S			8,14,17 N = 31
72	8											
	8.5	8.5-8.8m: hard, grey shaly clay with ironstone gravel						Note: Unless otherwise stated, rock is fractured along rough planar bedding planes or joints dipping 0°- 10°	S			12,26,25/100mm refusal
71	8.8	SHALE - very low strength, highly weathered, mottled orange grey shale, damp										
70	9											
	9.5	SHALE - description next page						9.62m: 2 x J55° & 85° rough	C	80	48	
69												

RIG: Bobcat **DRILLER:** E Grima **LOGGED:** SI **CASING:** HQ to 8.5m

TYPE OF BORING: Solid flight auger to 8.5m; Rotary to 9.5m; NMLC-Coring to 14.5m

WATER OBSERVATIONS: Free groundwater observed at 3.5m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPA
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 3/4/07

Douglas Partners
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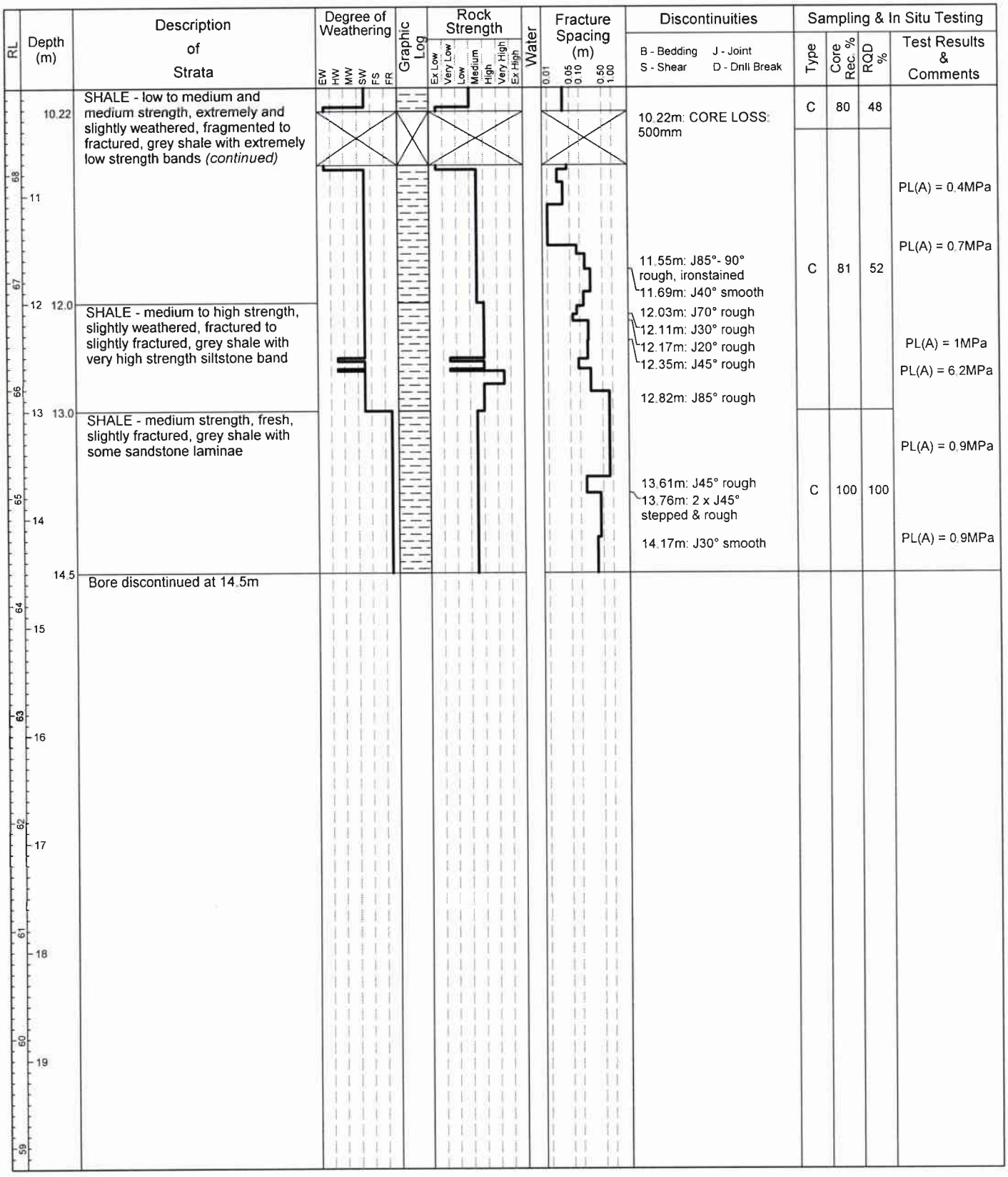
BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 78.8
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 44715
DATE: 16 Mar 07
SHEET 2 OF 2



RIG: Bobcat **DRILLER:** E Grima **LOGGED:** SI **CASING:** HQ to 8.5m

TYPE OF BORING: Solid flight auger to 8.5m; Rotary to 9.5m; NMLC-Coring to 14.5m

WATER OBSERVATIONS: Free groundwater observed at 3.5m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▽ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 80.68
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 44715
DATE: 16 Mar 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Type	Core Rec. %	RQD %	Test Results & Comments
80	0	FILLING - grey brown shale with ironstone filling						Note: Unless otherwise stated, rock is fractured along rough planar bedding planes or joints dipping 0°- 10°				
79	1								A			
78	2								A			
77	3											
76	3.6	FILLING - moderately to highly compacted, silty clay, concrete gravel, shale and sandstone fragments filling						3.6-7.1m: filling-silty clay, concrete gravel with shale and sandstone fragments	C	100	0	
75	4								C	79	0	
	4.43							4.43m: CORE LOSS: 150mm				
	4.85	5.0-5.9m: grey brown shale filling						4.85m: CORE LOSS: 750mm	C	25	0	
74	5											
	5.9	SHALE - very low strength, grey brown shale							S			6,7,10 N = 17
73	6											
	7.1	SHALE - extremely low and very low strength, extremely and highly weathered, fractured to slightly fractured, grey shale with low to medium strength bands							S			15/08 refusal
	7.37							7.37m: CORE LOSS: 50mm	C	83	30	
72	8							7.42m: 2 x J30°, 45°, ? rough 7.6m: J30° rough 7.69m: J90° 7.91m: J30° 8.08m: J30°	C	100	27	
	8.4	SHALE - low to medium strength, slightly weathered, fractured to slightly fractured, grey shale with very low strength bands						8.23m: B0° 10mm clay 8.34m: B0° 15mm clay 8.46m: J60° healed 8.68m: J85° 9.1m: J85°- 90° 9.31m: J60°	C	100	64	PL(A) = 0.3MPa
71	9								C	100	50	PL(A) = 0.3MPa

RIG: DT 100 **DRILLER:** G Cooper **LOGGED:** SI **CASING:** 6.0m

TYPE OF BORING: Solid flight auger to 3.0m; Rotary to 5.1m; NMLC-Coring to 14.2m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▽ Water level

CHECKED
Initials:
Date: 30/4/07

Douglas Partners
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BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 80.68
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 44715
DATE: 16 Mar 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
70	10.55	SHALE - description previous page							C	100	50	PL(A) = 0.5MPa
69	11	SHALE - medium strength, highly and slightly weathered, fractured to slightly fractured, grey shale with very low strength bands						11.05m: J30°	C	100	81	PL(A) = 0.9MPa
68	11.7	SHALE - high strength, fresh, unbroken, grey shale							C	100	100	PL(A) = 1.1MPa PL(A) = 1.2MPa PL(A) = 1.1MPa
67	12											
66	13											
65	14											
64	14.2	Bore discontinued at 14.2m										
63	15											
62	16											
61	17											
	18											
	19											

RIG: DT 100 **DRILLER:** G Cooper **LOGGED:** SI **CASING:** 6.0m

TYPE OF BORING: Solid flight auger to 3.0m; Rotary to 5.1m; NMLC-Coring to 14.2m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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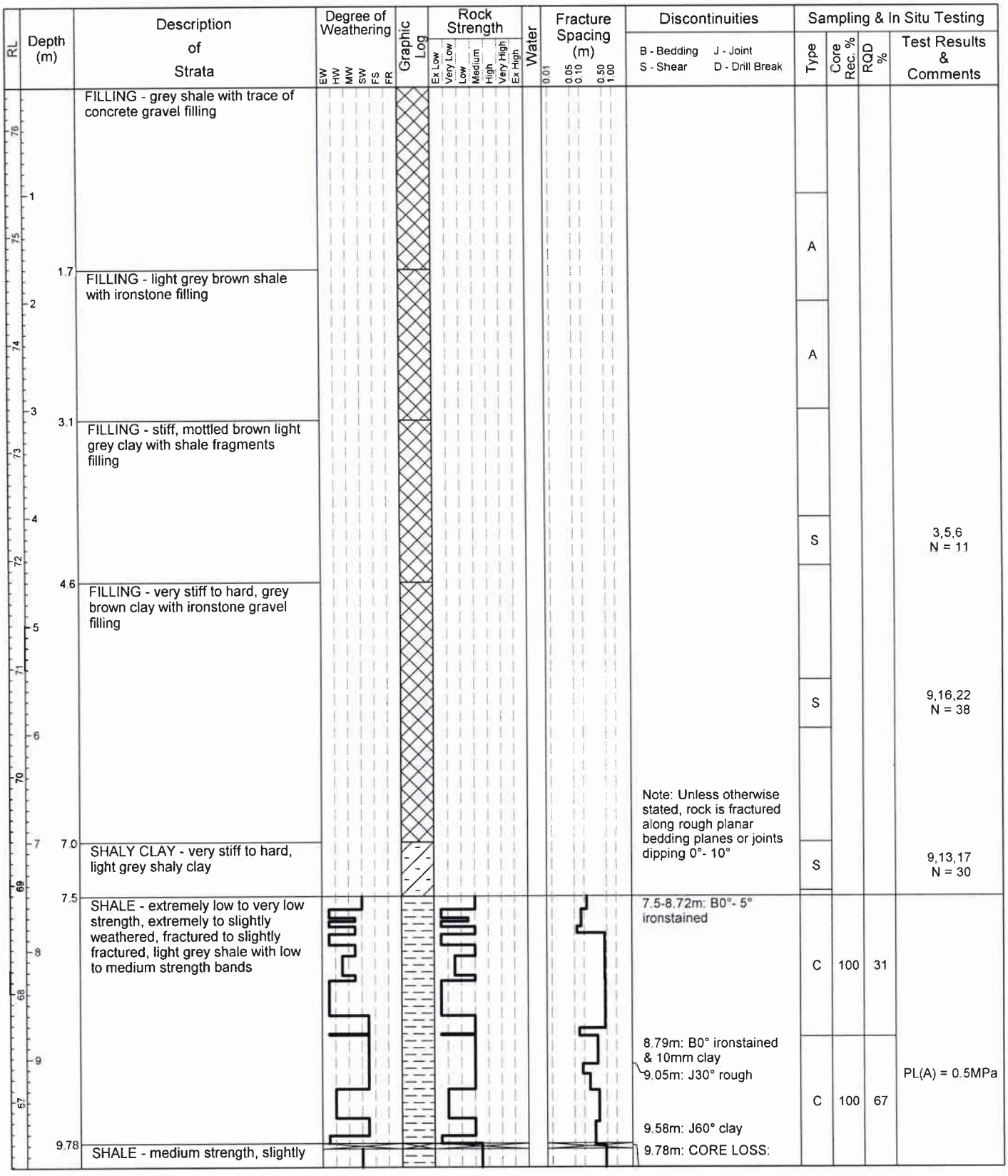
BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 76.39
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 44715
DATE: 15 Mar 07
SHEET 1 OF 2



RIG: DT 100 **DRILLER:** G Cooper **LOGGED:** SI **CASING:** HQ to 5.5m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 7.5m; NMLC-Coring to 14.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 30/4/07

Douglas Partners
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BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 76.39
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 44715
DATE: 15 Mar 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
66		weathered and fresh, fractured to slightly fractured, grey shale						50mm 9.8m: J90° rough 10.31m: J25° smooth 10.47m: J45° rough 10.74m: J60°- 70° rough 10.94m: J30° rough				PL(A) = 0.5MPa
65	11								C	97	73	PL(A) = 0.8MPa
	11.78											PL(A) = 0.9MPa
64	12	SHALE - high strength, fresh, slightly fractured and unbroken, grey shale with some sandstone laminae						11.78m: CORE LOSS: 50mm				PL(A) = 1.3MPa
63	13								C	100	100	
	14											PL(A) = 1.1MPa
	14.1	Bore discontinued at 14.1m										
62	15											
61	16											
60	17											
59	18											
58	19											
57												

RIG: DT 100 **DRILLER:** G Cooper **LOGGED:** SI **CASING:** HQ to 5.5m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 7.5m; NMLC-Coring to 14.1m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: ~79.0
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 44715
DATE: 19 Mar 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		FILLING - light grey brown clay with some concrete gravel filling, wet										
	1.3	FILLING - grey and brown silty clay and shale fragments filling, with trace of fine to medium sand and ironstone gravel							E			
									E			
									S			7,12,12 N = 24
		- brown silty clay with ironstone gravel							S			11,7,9 N = 16
		- grey silty clay with shale and ironstone gravel							S			6,10,12 N = 22
	8.65	SHALE - extremely low to very low strength, highly weathered, grey shale						Note: Unless otherwise stated, rock is fractured along rough planar bedding planes or joints dipping 0°- 10°	S			9,21,18 N = 39
	9.6	SHALE - description next page						9.65m: J85° rough 9.8m: J45° smooth	C	100	98	PL(A) = 0.9MPa

RIG: Bobcat **DRILLER:** E Grima **LOGGED:** SI **CASING:** HQ to 8.5m

TYPE OF BORING: Solid flight auger to 8.5m; Rotary to 9.6m; NMLC-Coring to 12.65m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 30/4/07

Douglas Partners
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BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: ~79.0
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 44715
DATE: 19 Mar 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SHALE - medium then high strength, fresh, slightly fractured, grey shale *(continued)*										PL(A) = 1.1MPa
								10.7m: J60° rough				
	11								C	100	98	
	11.6	SHALE - medium strength, fresh, slightly fractured and unbroken, grey shale										PL(A) = 0.7MPa
	12											PL(A) = 0.6MPa
								12.35-12.65m: J90° rough irregular				
	12.65	Bore discontinued at 12.65m										
	13											
	14											
	15											
	16											
	17											
	18											
	19											

RIG: Bobcat **DRILLER:** E Grima **LOGGED:** SI **CASING:** HQ to 8.5m

TYPE OF BORING: Solid flight auger to 8.5m; Rotary to 9.6m; NMLC-Coring to 12.65m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▽ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 82.40
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 44715
DATE: 20 Mar 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
82		FILLING - grey clay with ironstone filling										
	1											
81									A			
	2											
80									A			
	3											
79												
	3.5	FILLING - mottled orange grey shale with clay filling (moderately compacted)										
	4								S			6,13,13 N = 26
78												
	5											
77									S			4,7,11 N = 18
	6											
76												
	7								S			6,9,14 N = 23
75												
	8											
74									S			10,10 refusal
	9											
73	9.2	SHALE - very low strength, highly weathered, dark grey shale										

RIG: DT 100 **DRILLER:** G Cooper **LOGGED:** SI **CASING:** HQ to 10.0m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 9.7m; NMLC-Coring to 14.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 30/4/07

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BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 82.40
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 44715
DATE: 20 Mar 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
72	10.0	SHALE - medium strength, slightly weathered, fractured to slightly fractured, grey shale						Note: Unless otherwise stated, rock is fractured along rough planar bedding planes or joints dipping 0°- 10°	C	100	65	PL(A) = 0.5MPa
11								10.07m: J85° rough 10.21m: J20° rough 10.55m: J45° rough 10.64m: J45° rough 10.96m: B0°- 5° clay	C	100	47	
71	11.27	SHALE - high strength, slightly weathered, slightly fractured and unbroken, grey shale with very high strength siltstone bands										PL(A) = 1.2MPa
12								12.23m: J60°- 85° rough				PL(A) = 1.1MPa
70									C	100	94	
13	13.1	SHALE - medium strength, fresh, unbroken, grey shale						12.95m: J45° smooth				PL(A) = 3.5MPa
69												PL(A) = 0.9MPa
14	14.0	Bore discontinued at 14.0m										
68												
15												
67												
16												
66												
17												
65												
18												
64												
19												
63												

RIG: DT 100 **DRILLER:** G Cooper **LOGGED:** SI **CASING:** HQ to 10.0m

TYPE OF BORING: Solid flight auger to 5.5m; Rotary to 9.7m; NMLC-Coring to 14.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 77.04
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 44715
DATE: 15 Mar 07
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
77		FILLING - grey shale with ironstone filling, humid							A			
76	1											
75	2								A			
74	3											
73	4	4.0 FILLING - mottled orange grey shale with ironstone gravel filling, damp							S			4,7,10 N = 17
72	5								S			9,9,11 N = 20
71	6	6.5 SHALY CLAY - hard, mottled orange grey shaly clay with ironstone bands							S			7,13,19 N = 32
70	7	7.5 SHALE - very low strength, highly weathered, grey shale						Note: Unless otherwise stated, rock is fractured along rough planar bedding planes or joints dipping at 0°- 10°	S			35,25/50mm refusal
69	8											
68	9	9.2 SHALE - medium strength, slightly weathered, fragmented to slightly fractured, grey shale						9.59m: J30° healed	C	100	87	PL(A) = 0.6MPa

RIG: Bobcat **DRILLER:** E Grima **LOGGED:** SI **CASING:** HQ to 8.5m

TYPE OF BORING: Solid flight auger to 8.5m; Rotary to 9.2m; NMLC-Coring to 12.2m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 30/4/07

Douglas Partners
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BOREHOLE LOG

CLIENT: A W Edwards Pty Ltd
PROJECT: Norwest Private Hospital
LOCATION: E Macarthur Drive, Bella Vista

SURFACE LEVEL: 77.04
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 44715
DATE: 15 Mar 07
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
67	10.0	SHALE - medium to high strength, fresh, slightly fractured, grey shale with very high strength siltstone band										PL(A) = 1MPa
66	11								C	100	87	PL(A) = 3.5MPa
	11.35	SHALE - medium strength, fresh, unbroken, grey shale										PL(A) = 1MPa
65	12											PL(A) = 0.7MPa
	12.2	Bore discontinued at 12.2m										
64	13							12.86m: J90° healed				
63	14											
62	15											
61	16											
60	17											
59	18											
58	19											

RIG: Bobcat **DRILLER:** E Grima **LOGGED:** SI **CASING:** HQ to 8.5m

TYPE OF BORING: Solid flight auger to 8.5m; Rotary to 9.2m; NMLC-Coring to 12.2m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▽ Water level

CHECKED
Initials:
Date:

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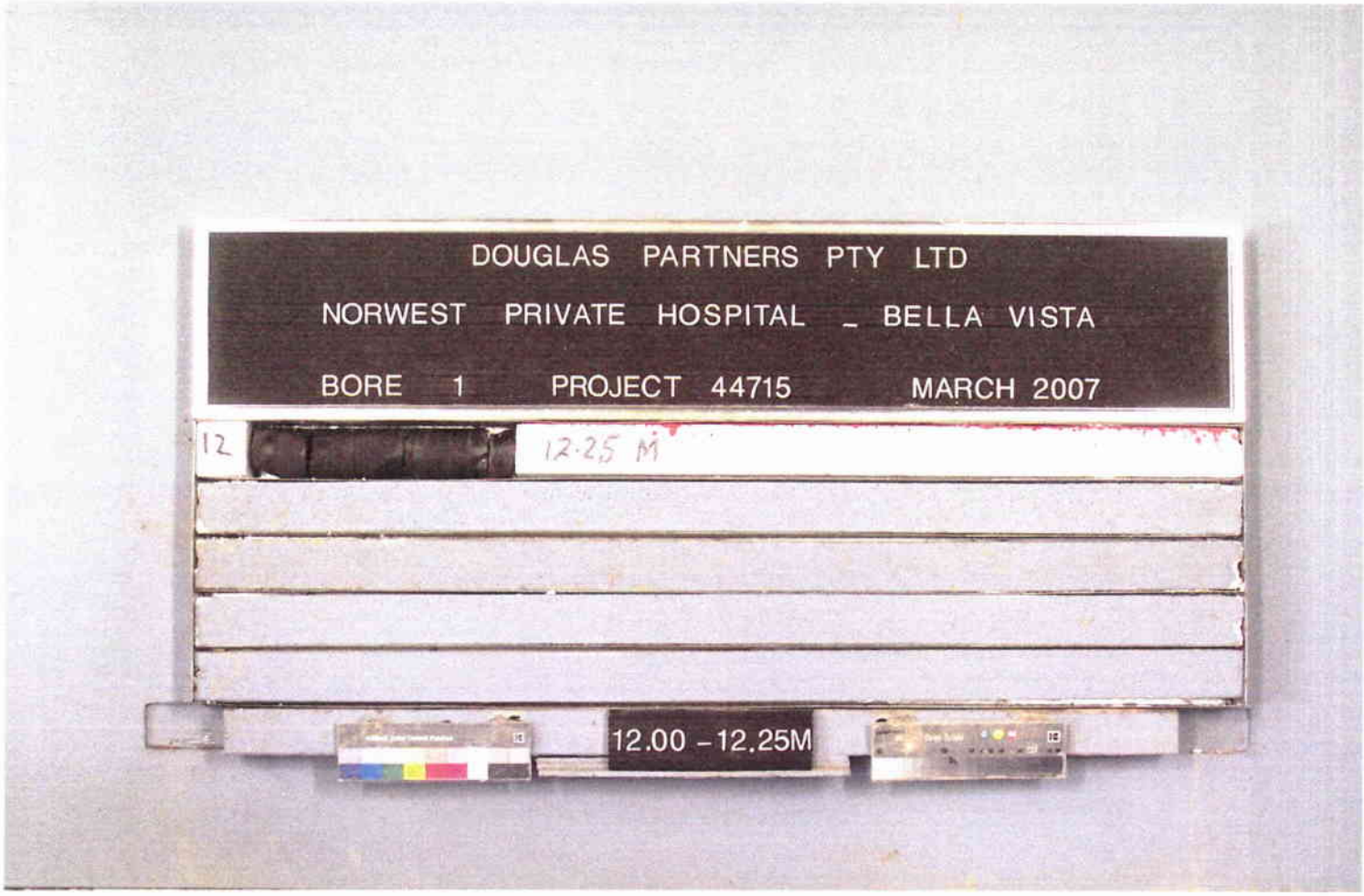
DOUGLAS PARTNERS PTY LTD
NORWEST PRIVATE HOSPITAL - BELLA VISTA
BORE 1 PROJECT 44715 MARCH 2007
CORE LOSS-0.15
7.20 - 12.00M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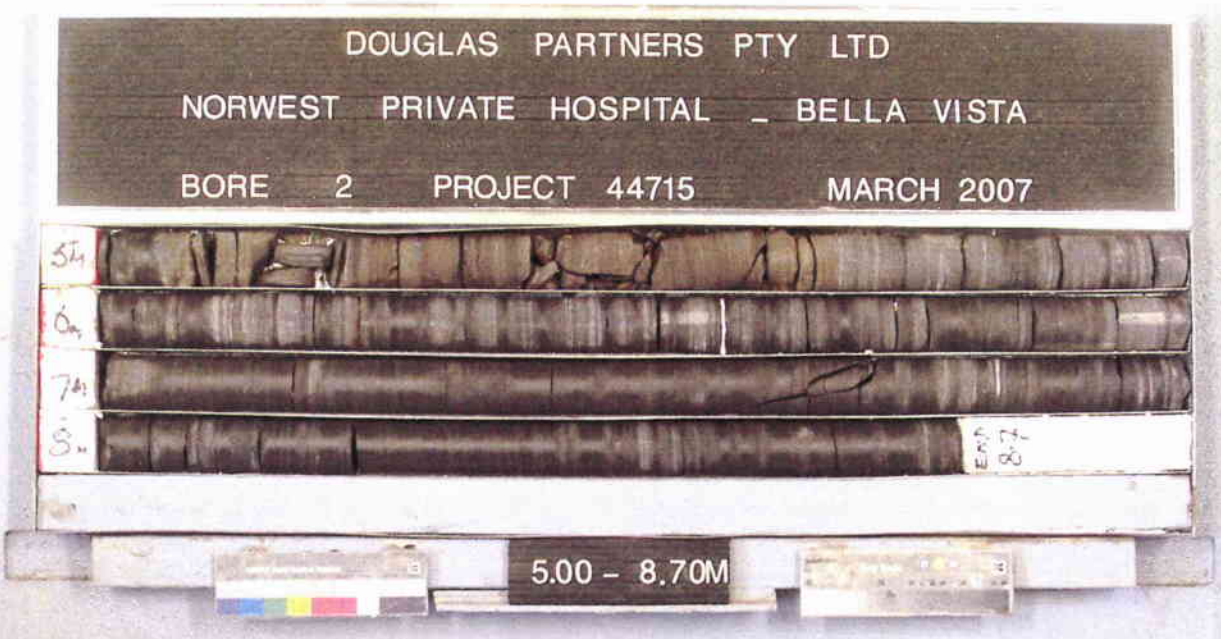
NORWEST PRIVATE HOSPITAL _ BELLA VISTA
BORE 1 PROJECT 44715 MARCH 2007
12
12.25 M
12.00 - 12.25M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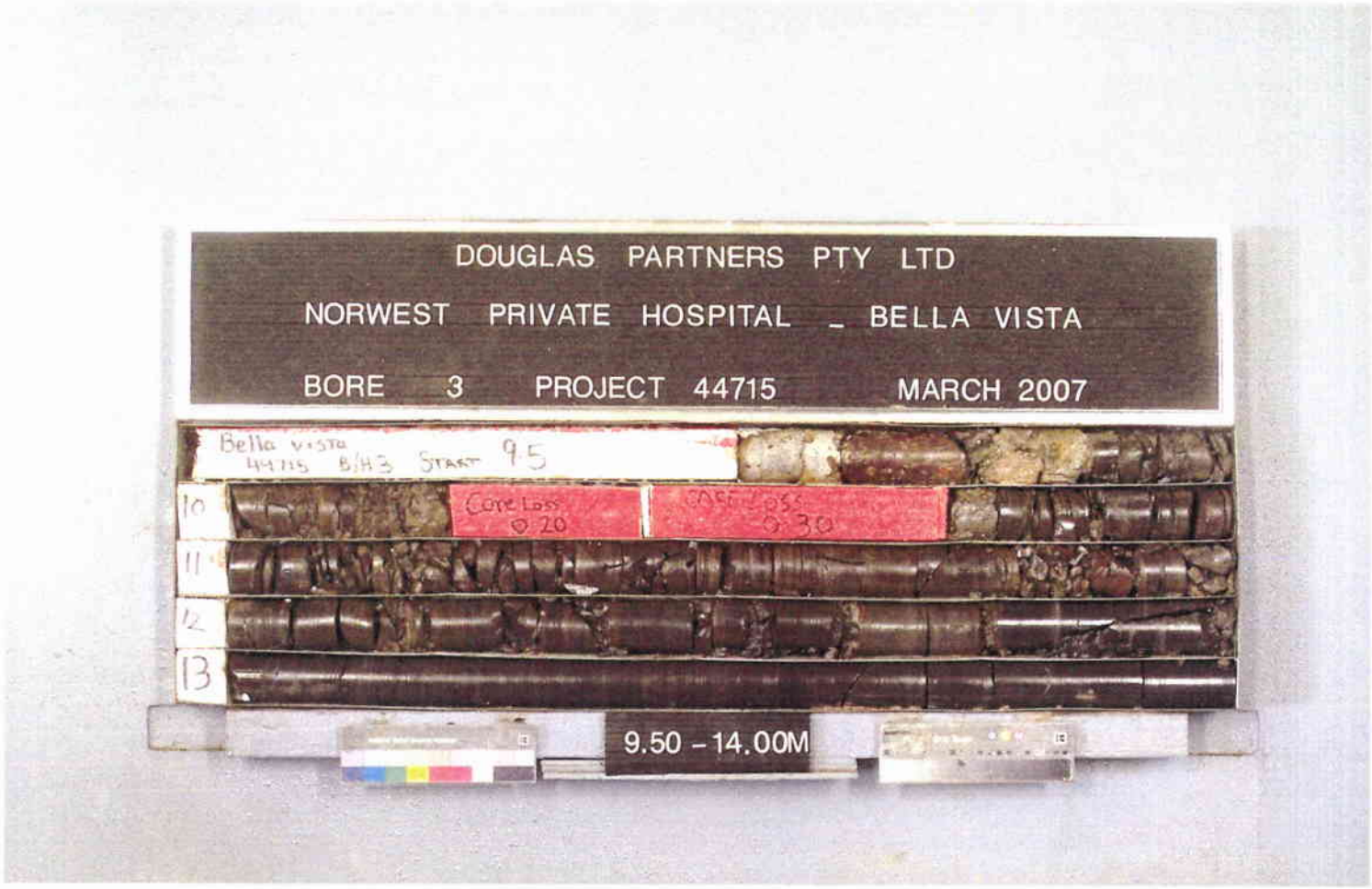
NORWEST PRIVATE HOSPITAL _ BELLA VISTA
BORE 2 PROJECT 44715 MARCH 2007
5.00 - 8.70M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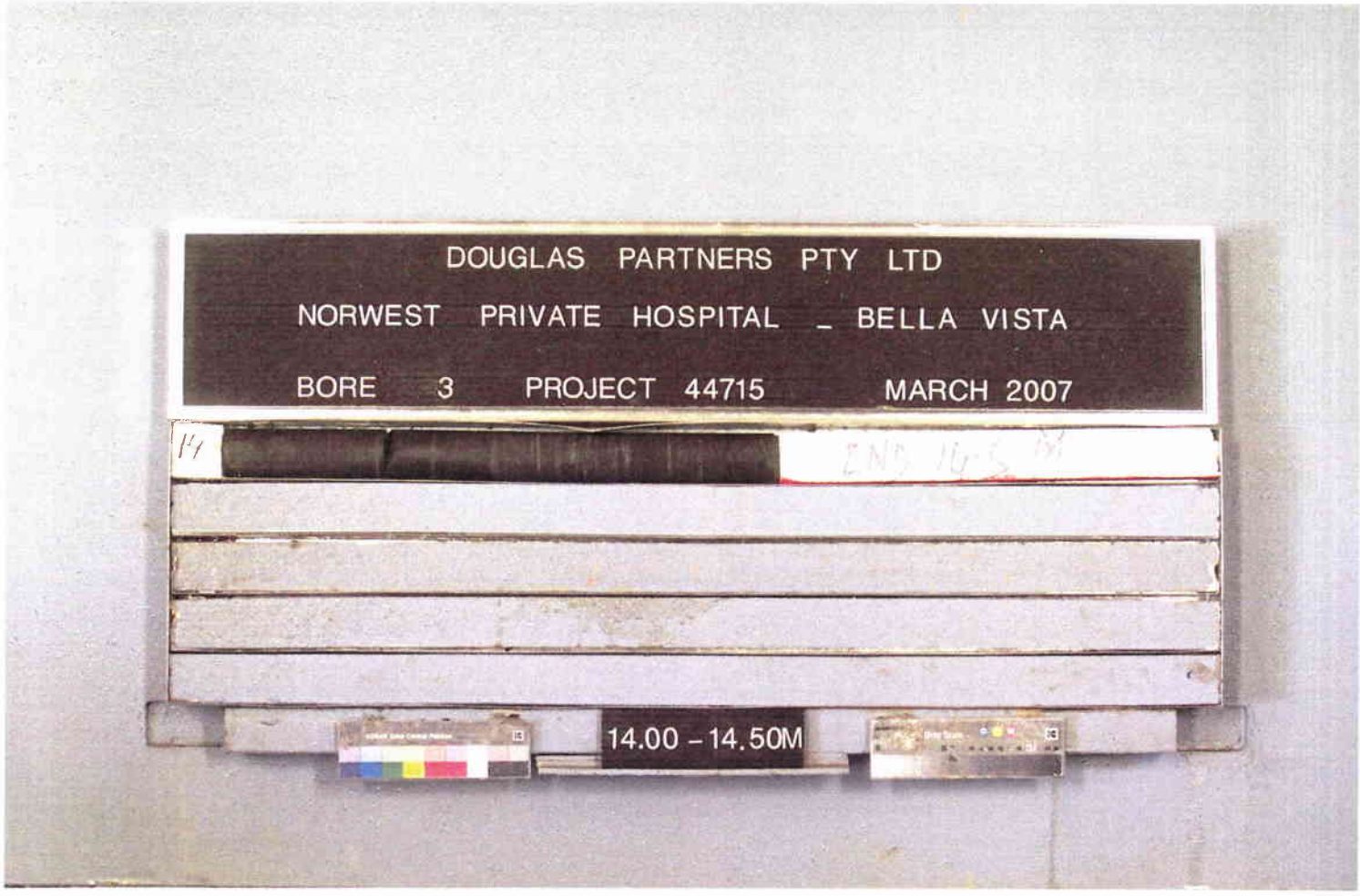
NORWEST PRIVATE HOSPITAL _ BELLA VISTA
BORE 3 PROJECT 44715 MARCH 2007
Bella Vista
44715 B/H3 Start 9.5
Core Loss
@ 20
Core Loss
@ 30
10
11
12
13
9.50 - 14.00M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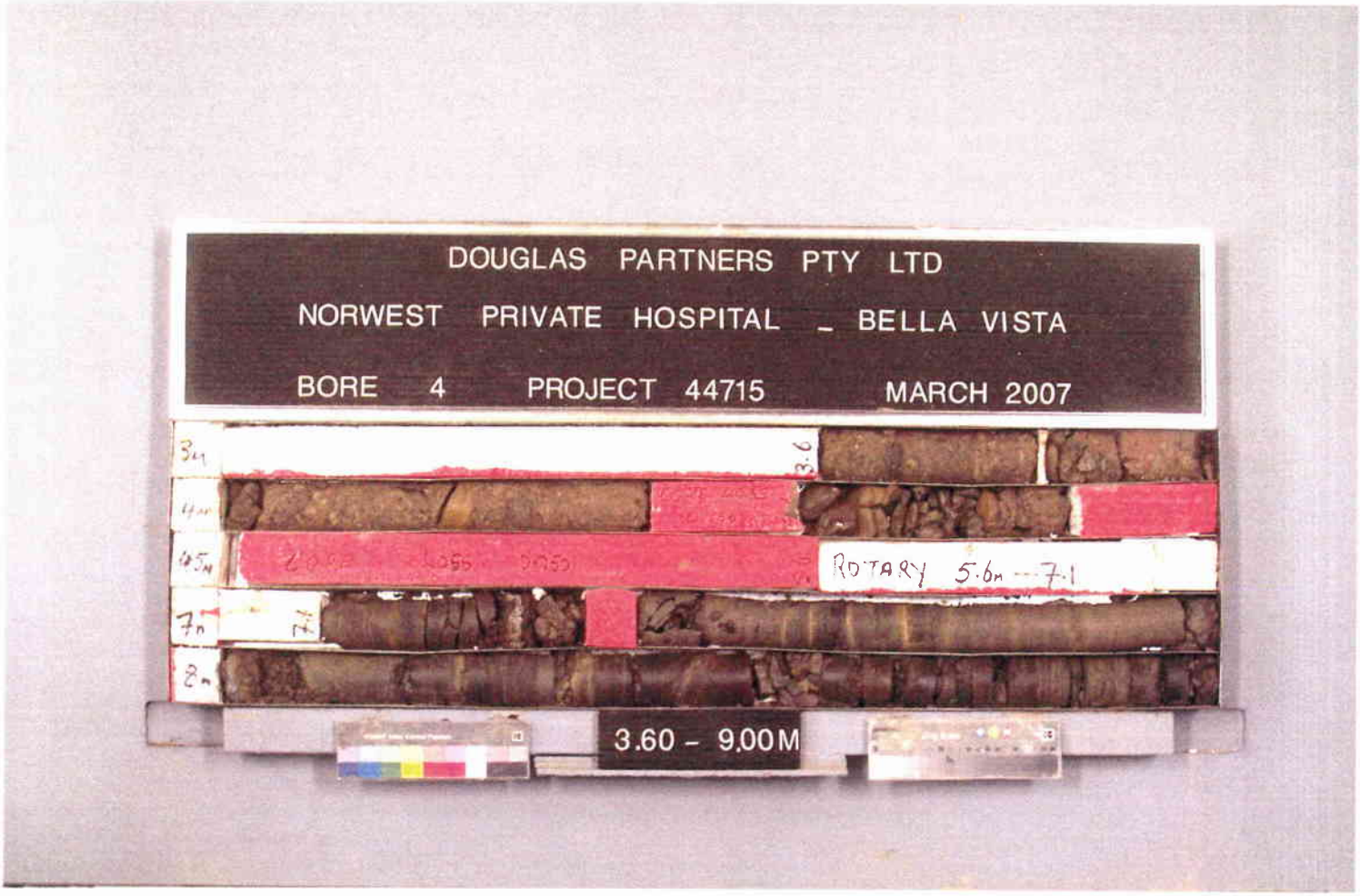
NORWEST PRIVATE HOSPITAL _ BELLA VISTA
BORE 3 PROJECT 44715 MARCH 2007
14.00 - 14.50M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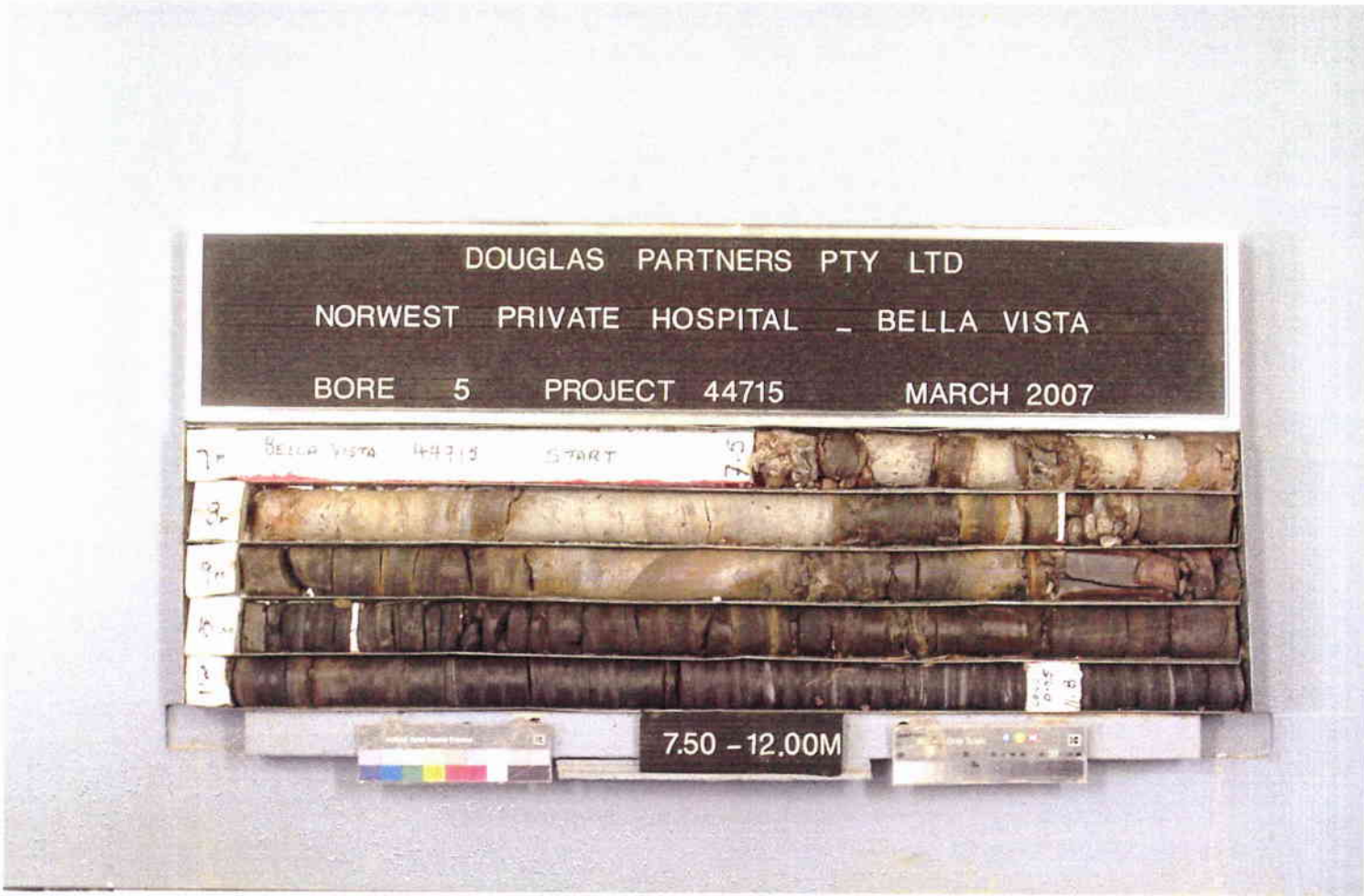
NORWEST PRIVATE HOSPITAL - BELLA VISTA
BORE 4 PROJECT 44715 MARCH 2007
ROTARY 5.6m - 7.1
3.60 - 9.00M


DOUGLAS PARTNERS PTY LTD
NORWEST PRIVATE HOSPITAL - BELLA VISTA
BORE 4 PROJECT 44715 MARCH 2007
9.00 - 14.00M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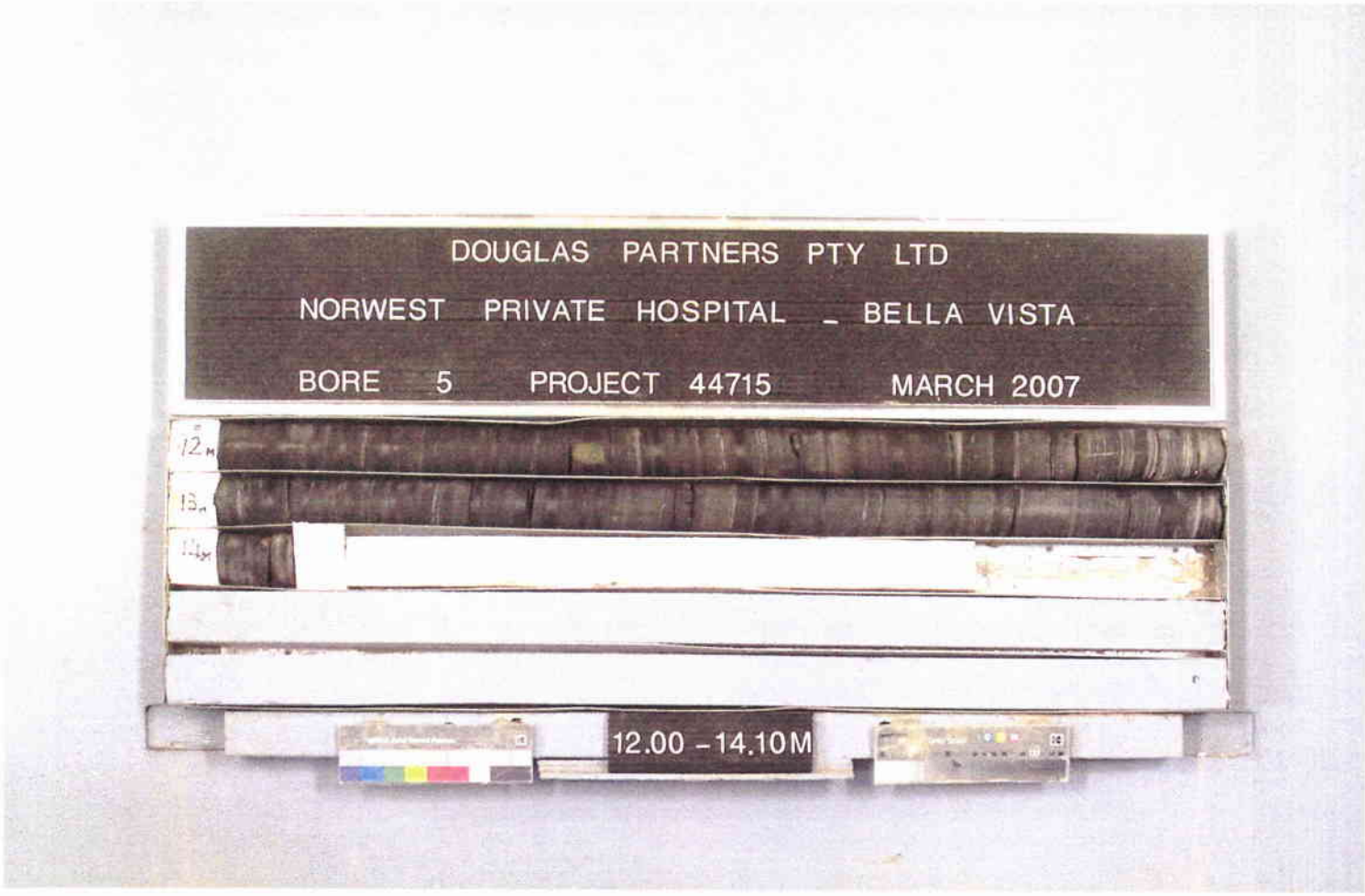
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NORWEST PRIVATE HOSPITAL - BELLA VISTA
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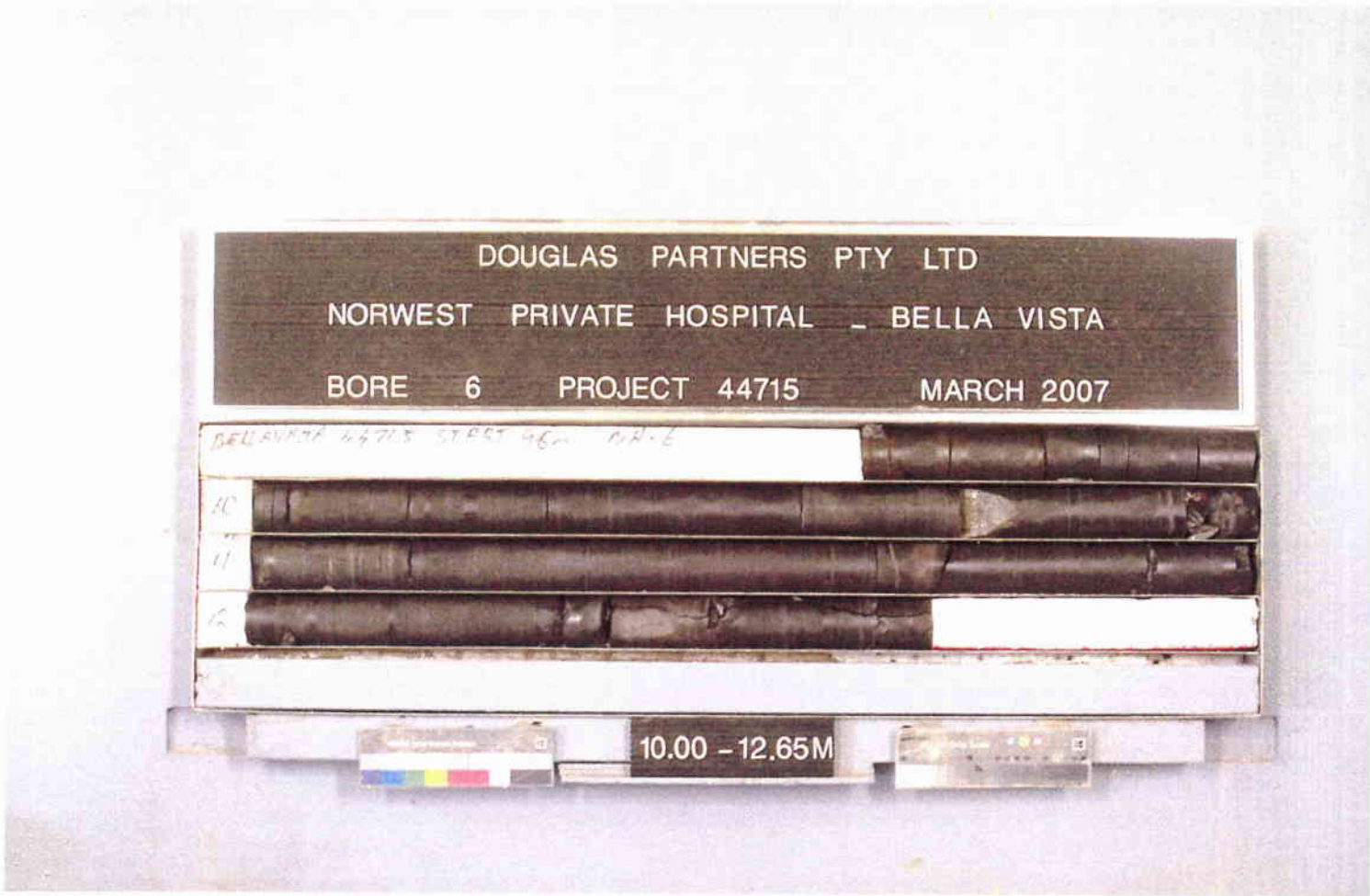
DOUGLAS PARTNERS PTY LTD
NORWEST PRIVATE HOSPITAL _ BELLA VISTA
BORE 6 PROJECT 44715 MARCH 2007
10.00 - 12.65M


DOUGLAS PARTNERS PTY LTD
NORWEST PRIVATE HOSPITAL - BELLA VISTA
BORE 7 PROJECT 44715 APRIL 2007
10.00 - 14.00M


DOUGLAS PARTNERS PTY LTD
NORWEST PRIVATE HOSPITAL _ BELLA VISTA
BORE 8 PROJECT 44715 MARCH 2007
END CORE 12.15
9.20 - 12.15M