Tasmania Department of Mines — Unpublished Report 1987/67

Foundation investigation — proposed redevelopment of North Hobart oval

by R. C. Donaldson

An investigation into a proposal to widen the existing oval at North Hobart (525700 mE, 5253600 mN) by excavating into the embankment on the northern side adjacent to the Blind and Deaf Institute was carried out between 9 and 11 December 1986.

Stage 1 of the investigation involved a seismic refraction survey combined with drilling in order to ascertain the nature of subsurface materials beneath the embankment to a depth of six metres. Three semi-continuous seismic spreads were fired, and three equally-spaced holes were drilled to six metres depth using a combination of auger and diamond drilling.

The second stage involved the drilling of six auger holes across the oval to a depth of two metres. Detailed descriptions of the materials and conditions encountered are given on the appended engineering log forms. A summary of the results of the seismic refraction survey is given in Table 1.

The Hobart sheet of the 1:50 000 scale Geological Atlas Series (Leaman, 1972) shows that the oval is underlain by a mudstone/sandstone sequence. These rocks are of Triassic age and are shown to be dipping gently to the west. The nearest noted surface outcrop of these rocks was in an embankment at The Friends Junior School.

The results of the investigation (stage 1) indicate a good overall correlation between the materials encountered through drilling and those interpreted from the seismic refraction survey. The results show that the embankment is underlain by between two and four metres of low velocity material (350–700 m/s) consisting mainly of sandy clay. The variation in the depth of this material over the length of the embankment indicates that the soil/rock interface is irregular in profile. The underlying bedrock velocities of 2000–3000 m/s correlate with the highly weathered to slightly weathered sandstone/mudstone sequence intersected in the bottom two to three metres of the cored drill holes.

The ease with which materials can be excavated can be related to seismic velocity, which is in effect a composite measure of the degree of weathering and fracturing of the rock mass. In practice, rippability also relies on the orientation of discontinuities (joints, bedding etc.) relative to the face of the excavation. It is considered that under favourable conditions, the upper limit of rippability in these materials is of the order of 2500–2800 m/s. It is anticipated that the vast majority of rock to be excavated to a depth of six metres will be rippable with suitable large machinery. Ultimately, the frequency and attitude of disconformities will determine the amount of rippable material.

One of the problems associated with a clear interpretation of the results of the augering program (stage 2) is that the fill material is similar in appearance and physical properties to the natural *in situ* materials overlying bedrock. It is thought that the existing oval was probably constructed mainly by a cut/fill operation, and it is difficult to determine the origin of the materials being drilled from auger returns. This is particularly so in the case of auger holes 6 and 7. Augering has confirmed the depth to bedrock in holes 4 to 7, and shows that there is fill material to a depth in excess of two metres in holes 8 and 9.

It is anticipated that excavation of the embankment to a depth of six metres will be achieved through ripping, and blasting should not be necessary. Conversely, a sound foundation exists at between three to four metres depth should any structure be contemplated.

REFERENCE

LEAMAN, D. E. 1972. *Geological Atlas 1:50 000 scale series. Sheet 82 (8312S). Hobart*. Department of Mines, Tasmania.

[30 January 1987]

Table 1

Seismic refraction survey, North Hobart oval

Spread No.	Velocity (m/s)	Thickness (m)	Depth (m)	Geological interpretation	Excavation conditions
1	V_1: 350–600	3.1–4.2	3.1–4.2	Unconsolidated clay, dry	Backhoe
	V_2: 2300–2650			(HW)–SW rock, joints open to tight	Rippable*
2	V_1: 350–650	1.8–2.7	1.8–2.7	Unconsolidated clay, dry	Backhoe
	V_2: 1330†	2.3	4.1	Consolidated clay, EW rock	Backhoe
	V_3: 2000–3000			(HW)–SW rock, joints open	Rippable*
3	V_1: 550–700	4.1–4.3	4.1–4.3	Unconsolidated clay, dry	Backhoe
	V_2: 2200–2650			(HW)–SW rock, joints	Rippable*

† Recorded from one end only

* Anticipated upper limit of large dozer with ripper is about 2800 m/s.

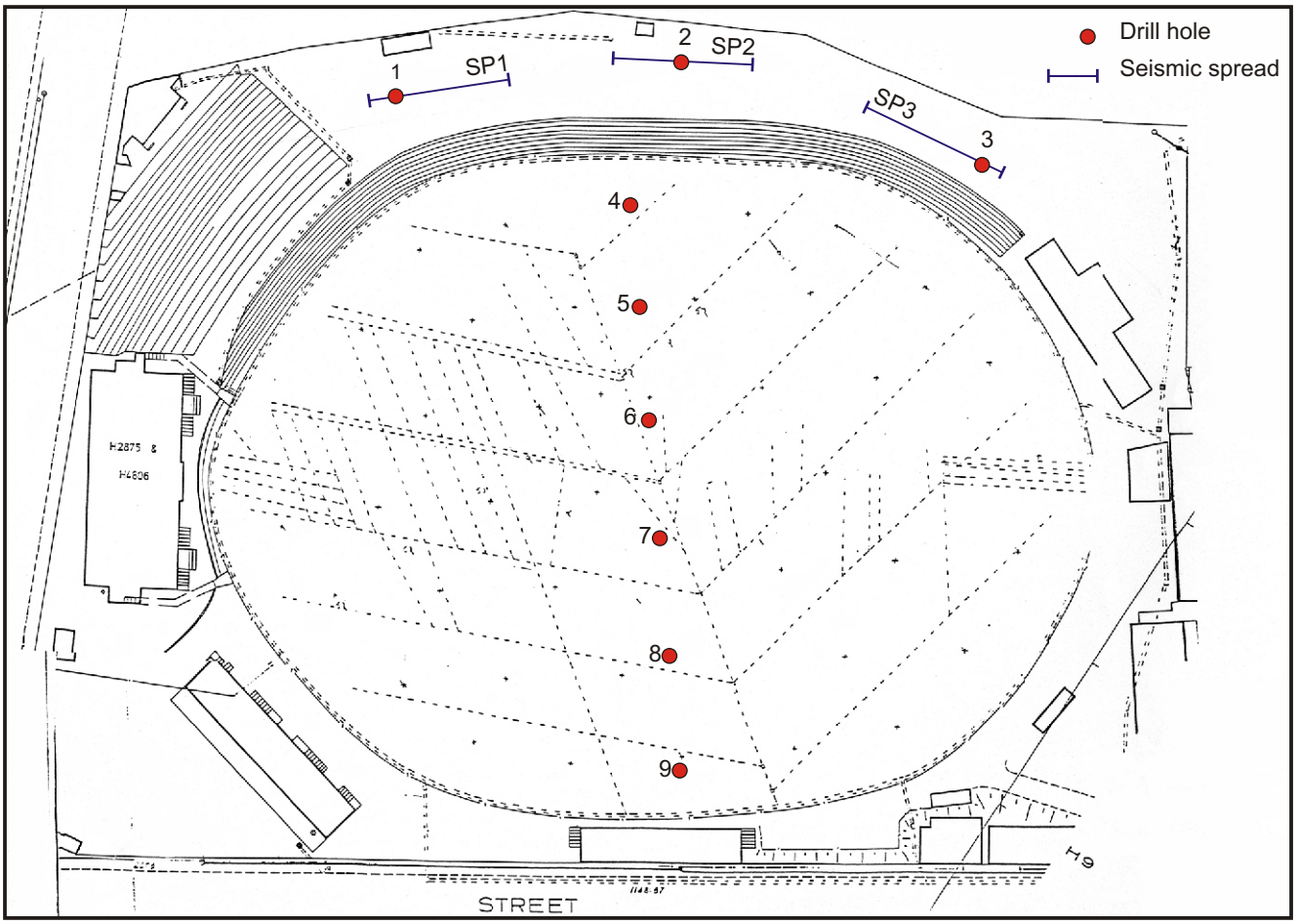

Figure 1

Location of seismic spreads and drill holes

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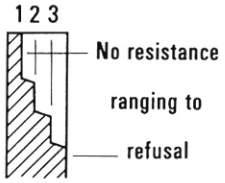
EXPLANATION SHEET FOR ENGINEERING LOGS

Borehole and excavation log

Penetration



Water

22 Jan, 80 Water level on date shown.

Water inflow.

Water outflow.

Notes - samples and tests

U50	Undisturbed sample 50mm diameter.
D	Disturbed sample.
N	Standard penetrometer blow count for 300mm.
N*	SPT + sample.

Material classification

Based on Unified Soil Classification System.

In Graphic Log materials are represented by clear contrasting symbols consistent for each project.

Moisture content

D	Dry, looks and feel dry.
M	Moist, no free water on hand when remoulding.
W	Wet, free water on hand when remoulding.
LL	Liquid limit.
PL	Plastic limit.
PI	Plasticity Index.

eg. M > PL – Moist, moisture content greater than the plastic limit.

Consistency

		hand penetrometer (kPa)
VS	Very soft.	< 25
S	Soft.	25 - 50
F	Firm.	50 - 100
St	Stiff.	100 - 200
VSt	Very stiff.	200 - 400
H	Hard.	> 400
Fb	Friable.	

Notes: X on log is test result

— is range of results.

Density index

		%
VL	Very loose.	0 - 15
L	Loose.	15 - 35
MD	Medium dense.	35 - 65
D	Dense.	65 - 85
VD	Very Dense	85 - 100

Cored borehole log

Case - lift

Casing used.

Barrel withdrawn.

Fluid loss

No loss

50% loss

100% loss.

Lugeons

Lugeon units (μL) are a measure of rock mass permeability. For a 46 to 74mm diameter borehole 1 Lugeon is defined as a rate of loss of 1 litre per metre per minute. 1 Lugeon is roughly equivalent to a permeability of 1×10^{-4} mm/sec.

Graphic log

No core.

Rock substances represented by clear, contrasting symbols consistent for each project.

Weathering

Fr	Fresh.
SW	Slightly weathered.
HW	Highly weathered.
EW	Extremely weathered.

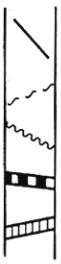
Strength

		point load strength index $I_{s\,(50)}$ (MPa)
EL	Extremely low.	< 0·03
VL	Very low.	0·03 - 0·1
L	Low.	0·1 - 0·3
M	Medium.	0·3 - 1
H	High	1 - 3
VH	Very high.	3 - 10
EH	Extremely high.	> 10

Note: X on log is test result.

Significant defects

Significant defects shown graphically.



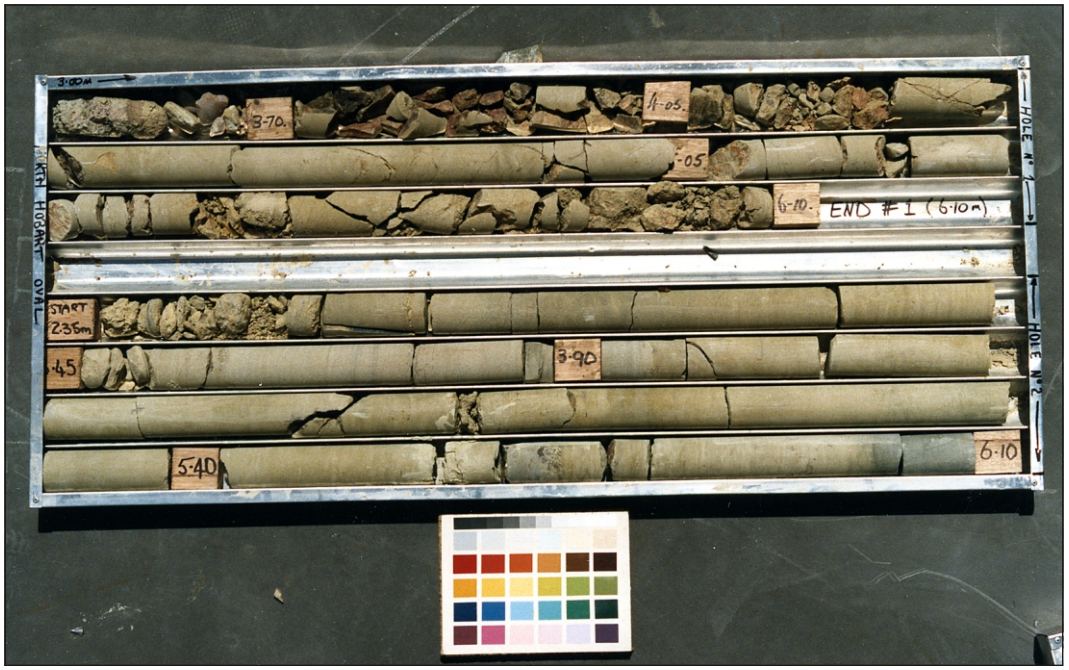
Joint.

Sheared zone.

Crushed seam.

Infill seam.

Extremely weathered seam.



Core, Holes 1 and 2

Core, Hole 3

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ENGINEERING LOG – BOREHOLE

borehole no. 1

sheet 1 of 2

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type GEMCO 210 D
drill method AUGER
drill fluid

hole commenced 9 DEC 1986
hole completed 9 DEC 1986
drilled by G.BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

penetration 1 2 3	support	water	notes samples, tests	metres R.L / depth	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa (25 50 100 200 400)	structure, geology
		NOT ENCOUNTERED				GW GC	GRAVEL - Clayey GRAVEL: fine to coarse, blue grey and yellow brown, some sand, clay of high plasticity.	D	D		FILL (SURFACING AGGREGATE)
				1		CH (SC)	Sandy CLAY: high plasticity, grey and green grey, sand fine to medium, some coarse, trace fine gravel. Some clayey SAND lenses.	M > PL	St	*	RESIDUAL (IN-SITU) CLAY
				2		CH	Sandy CLAY: high plasticity, mottled yellow-brown and off white, sand fine to medium, trace coarse.			*	
				3			MUDSTONE: red/purple, remoulds in part to CH clay. Some SANDSTONE: fine grained yellow brown and white.	D			E.W. BEDROCK

refer sheet 2 for cored section

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ENGINEERING LOG – CORED BOREHOLE

borehole no. 1

sheet 2 of 2

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type GEMCO 210D
drill method NQ TRIPLE TUBE
drill fluid

hole commenced 9 DEC 1986
hole completed 9 DEC 1986
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

drilling information						rock substance				rock mass defects	
case-lift	fluid loss	water	notes	lugeons 0.3 1 3 10 30 100	metres R.L / depth	graphic log	substance description: rock type, grain characteristics, colour, structure, minor components.	weathering	strength EL VL L M H VH EH	defect spacing mm. 30 100 300 1000 3000	defect description: thickness, type, inclination, planarity, roughness, coating. significant / general
					1						
					2						
					3		MUDSTONE: red/purple, green grey, remoulds in part to CH clay.	E.W.			
					4		SANDSTONE: med. grained, off-white	HW			
							MUDSTONE: light green brown. Bedding mathin to weakly laminated at 5° to horizontal.	HW – SW			← Crush seam, 5-10mm, dip 60°
					5						← Crush seam 50mm
					6						Most defects are joints either parallel to bedding or steeply dipping. Joint surfaces are rough, irregular, stained, some with clay film.
							HOLE TERMINATED @ REQUIRED DEPTH OF 6.10m IN MUDSTONE				

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ENGINEERING LOG – BOREHOLE

borehole no. 2

sheet 1 of 2

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL.

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type GEMCO 210 D
drill method AUGER
drill fluid

hole commenced 9 DEC '86
hole completed 9 DEC '86
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

penetration 1 2 3	support	water	notes samples, tests	metres R.L / depth	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa (25, 50, 100, 200, 400)	structure, geology
		NOT ENCOUNTERED				GW GC	GRAVEL - Clayey GRAVEL: fine to coarse, blue grey, and yellow brown, some sand, clay of high plasticity.	D	D		FILL
				1		SC	Clayey SAND: fine to medium, green grey and brown, clay of high plasticity. Some sandy CLAY lenses.	M ≥ PL	MD		RESIDUAL CLAY
				2		CH	Sandy CLAY: high plasticity, yellow brown and off-white, sand fine to medium.		St		
							MUDSTONE: yellow brown, remoulds in part to CH clay. Some SANDSTONE.	D			E.W BEDROCK
				3			refer sheet 2 for cored section.				

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ENGINEERING LOG – CORED BOREHOLE

borehole no. 2

sheet 2 of 2

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type GEMCO 210D
drill method NQ TRIPLE TUBE
drill fluid

hole commenced 9 DEC '86
hole completed 9 DEC '86
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

drilling information | **rock substance** | **rock mass defects**

case-lift	fluid loss	water	notes	lugeons (0.3 1 3 10 30 100)	metres R.L.	metres depth	graphic log	substance description (rock type: grain characteristics, colour, structure, minor components.)	weathering	strength (EL VL L M H VH EH)	defect spacing mm. (30 100 300 1000 3000)	defect description (thickness, type, inclination, planarity, roughness, coating.) significant	general
						1							
						2							
						3		SANDSTONE: fine grained, yellow brown, upto 40% mud pellets	HW				
								MUDSTONE: light green brown, massive – weakly laminated	HW SW				
						4		SANDSTONE: fine grained, dapple grey white and brown. Bedding thin to laminated @ 5° to hor'l.					
								MUDSTONE: light green brown, massive – weakly laminated.				← Crush seam, CH, 50 mm.	
						5						← EW Seam, CH, 30-50 mm.	
						6							
								HOLE TERMINATED AT REQUIRED DEPTH OF 6.10m IN MUDSTONE.					

Most defects are joints either parallel to bedding or steeply dipping. Joint surfaces are rough, irregular, some iron-stained, some with clay film.

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ENGINEERING LOG – BOREHOLE

borehole no. 3

sheet 1 of 2

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type GEMCO 210 D
drill method AUGER
drill fluid

hole commenced 9 DEC '86
hole completed 10 DEC '86
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

penetration 1 2 3	support	water	notes samples, tests	metres R.L / depth	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa (25 50 100 200 400)	structure, geology
		NOT ENCOUNTERED.				GW	GRAVEL: fine-medium, blue grey.	D	MD		FILL
						CH	Sandy CLAY: high plasticity, grey brown, sand fine-coarse, some fine-medium gravel.	M > PL	F/St		
				1		SC	Clayey SAND: fine-medium, yellow brown and off-white, some sandy CLAY lenses.		MD		RESIDUAL CLAY.
				2		CH	Sandy CLAY: high plasticity, yellow brown, sand fine-medium, some light grey clay (CH) lenses towards base?	M ≤ PL	St/VSt		
				3			refer sheet 2 for cored section.				

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – CORED BOREHOLE

borehole no. 3

sheet 2 of 2

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type GEMCO 210D
drill method NQ TRIPLE TUBE
drill fluid

hole commenced 9 DEC '86
hole completed 10 DEC '86
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

drilling information						rock substance				rock mass defects	
case-lift	fluid loss	water	notes	lugeons 0.3 1 3 10 30 100	metres R.L. / depth	graphic log	substance description: rock type: grain characteristics, colour, structure, minor components.	weathering	strength EL VL L M H VH EH	defect spacing mm. 30 100 300 1000 3000	defect description: thickness, type, inclination, planarity, roughness, coating. significant / general
					1						
					2						
					3						
					4		MUDSTONE: mottled yellow brown and light grey. Remoulds to CH clay.	EW			← EW Seam, CH, 30mm
								HW			← " " , 70mm
							MUDSTONE: brown, thinly bedded to (laminated) @ 3-5° to horizontal.				← " " , 30mm
					5						← " " , 15mm
							SILTSTONE: fine grained, light green-brown, thinly bedded to (laminated) @ 5° to horizontal.	HW - SW			← Crush seam 30-50mm
					6		SANDSTONE: fine grained green-brown, thinly bedded to (laminated).				Most defect are joints; surfaces are rough, irregular, some iron-stained. Some with 0.1-2mm clay
							HOLE TERMINATED AT REQUIRED DEPTH OF 6.0m IN SANDSTONE.				

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ENGINEERING LOG – BOREHOLE

borehole no. 4

sheet 1 of 1

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL.

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type TRIEFUS
drill method AUGER
drill fluid

hole commenced 10 DEC 1986
hole completed 10 DEC 1986
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

penetration 1 2 3	support	water	notes samples, tests	metres R.L / depth	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa (25 50 100 200 400)	structure, geology
		NONE				SM	Silty SAND: fine, brown, roots and rootlets	M	MD		TOPSOIL
						GP	GRAVEL: fine-medium, blue grey	D	D		SUB-BASE
				0.5			SILTSTONE: fine-medium grained, light brown, low-medium strength, highly weathered.				BEDROCK
				1.0			REFUSAL @ 0.5m IN BEDROCK				

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ENGINEERING LOG – BOREHOLE

borehole no. 5

sheet 1 of 1

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL.

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type TRIEFUS
drill method AUGER
drill fluid

hole commenced 10 DEC 1986
hole completed 10 DEC 1986
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

penetration 1 2 3	support	water	notes samples, tests	metres R.L / depth	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa 25 50 100 200 400	structure, geology
						SM	Silty SAND: fine, brown, roots + rootlets	M	MD		TOPSOIL
						GP	GRAVEL: fine-medium, blue grey	D	D		SUB BASE
				0.5			SANDSTONE: fine grained, yellow brown & brown, low-medium strength, highly weathered.				BEDROCK
				1.0			REFUSAL @ 0.6m IN BEDROCK				

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – BOREHOLE

borehole no. 6

sheet 1 of 1

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL.

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type TRIEFUS
drill method AUGER
drill fluid

hole commenced 10 DEC 1986
hole completed 10 DEC 1986
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

penetration 1 2 3	support	water	notes samples, tests	metres R.L / depth	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa (25 50 100 200 400)	structure, geology
		NOT ENCOUNTERED				SP	SAND: fine, brown, some silt, roots.	M	MD		TOPSOIL
				0.5		GP	GRAVEL: fine-medium, blue grey	D	D		SUB BASE
						CH	Sandy CLAY: high plasticity, yellow brown and black, sand fine-medium, some gravel (mudstone/sandstone) fine-medium	M	F		ORIGINAL SOIL HORIZON?
				1.0			Similar to above - yellow brown, gravel (mudstone/sandstone) coarse.	> PL	St.		RESIDUAL (IN-SITU) CLAY
				1.5			MUDSTONE: brown, low-medium strength, highly weathered. Some SANDSTONE rock chips.				BEDROCK

REFUSAL @ 1.5M IN BEDROCK.

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ENGINEERING LOG – BOREHOLE

borehole no. 7

sheet 1 of 1

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type TRIEFUS
drill method AUGER
drill fluid

hole commenced 10 DEC 1986
hole completed 10 DEC 1986
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

penetration 1 2 3	support	water	notes samples, tests	metres R.L / depth	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa (25 50 100 200 400)	structure, geology
		10 DEC '86				SM	Silty SAND: fine, brown, roots + rootlets.	M	MD		TOPSOIL
						GP	GRAVEL: fine-medium, blue grey.	D	D		SUB-BASE
				1		SC	Clayey SAND: dark grey-yellow brown, sand fine, clay of high plasticity.	M > PL	MD		PROBABLE FILL
						CH			St		
						SC	Sandy CLAY: high plasticity, yellow brown, sand fine-medium, some gravel.	W	MD		
							Gravelly clayey SAND: fine-medium, light grey, clay of high plasticity, gravel fine-coarse (H.W. sandstone/mudstone rock fragments)				
						CH	Sandy CLAY: high plasticity mottled yellow brown and grey. Some gravel (as above).	M ≈ PL	St V.St		RESIDUAL (IN-SITU) CLAY?
				2			REFUSAL @ 1.95m AT SANDY CLAY-BEDROCK INTERFACE.				

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – BOREHOLE

borehole no. 8

sheet 1 of 1

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL.

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type TRIEFUS
drill method AUGER
drill fluid

hole commenced 10 DEC 1986
hole completed 10 DEC 1986
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

penetration 1 2 3	support	water	notes samples, tests	metres R.L / depth	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa (25 50 100 200 400)	structure, geology
		NOT ENCOUNTERED.				SM	Silty SAND: fine, brown, roots and rootlets	M	MD		TOPSOIL
						GP	GRAVEL: fine-medium, blue grey.	D	D		SUB-BASE
				1		CH	Sandy CLAY: high plasticity, yellow brown, sand fine-medium, some gravel (H.w. sandstone-mudstone rock fragments)	M > PL	St		FILL
						SC	Clayey SAND: fine-medium light grey and yellow brown, clay of high plasticity. Similar to above, some gravel (as described above).				
						SP	SAND: fine-medium, light grey, some clay (CH)				
				2		CH	Sandy CLAY: high plasticity, yellow brown, sand fine-medium, some gravel (as described previously.		V.St.		
							HOLE TERMINATED AT REQUIRED DEPTH OF 2.0 m IN SANDY CLAY (FILL)				

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – BOREHOLE

borehole no. 9

sheet 1 of 1

project PROPOSED REDEVELOPMENT location NORTH HOBART OVAL.

co-ordinates REFER PLAN
R.L.
inclination VERTICAL
bearing

drill type TRIEFUS
drill method AUGER
drill fluid

hole commenced 10 DEC 1986
hole completed 10 DEC 1986
drilled by G.BAKER (MINES)
logged by R. DONALDSON
checked by W. MOORE

penetration 1 2 3	support	water	notes samples, tests	metres R.L / depth	graphic log	classification symbol	material: soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa 25 50 100 200 400	structure, geology
						SM	Silty SAND: fine, brown, roots + root lets.	M	MD		TOPSOIL
						GP	GRAVEL: fine-medium, blue grey.	D	D		SUB-BASE
				1		CH	Sandy CLAY: high plasticity, yellow brown + green grey, sand fine-medium, some gravel (bricks, china).	M > PL			FILL
						SC	clayey SAND: fine-medium, light grey, clay of high plasticity.				
						GC	Gravelly CLAY: high plasticity, yellow brown, gravel fine-coarse (brick, mudstone/sandstone rock fragments.				
				2			NOTE: Above materials occurred randomly throughout section				
							HOLE TERMINATED AT REQUIRED DEPTH OF 2.0m IN FILL				