Tasmania Department of Mines — Unpublished Report 1986/91

Foundation investigation at the proposed Civic Square site, Hobart

by R. C. Donaldson

A foundation investigation at the site of a proposed Civic Square, in the area bounded by Argyle, Davey, Elizabeth and Morrison streets in Hobart (527000 mE, 5251900 mN), was undertaken between 1 and 8 December 1986. The investigation involved the drilling of four holes into bedrock in order to ascertain the nature of the subsurface materials beneath the site.

The work was carried out using a combination of auger and diamond drilling. Detailed descriptions of materials and conditions encountered are given on the appended engineering log forms.

According to the published geological map of the area (Leaman, 1972), the site is situated partly on fill (reclaimed land) and is partly underlain by a sandstone/mudstone bedrock of Triassic age. Old records indicate that the original shoreline of the River Derwent crossed through this site.

The investigation has shown the site has between 1–1.5 m of fill overlying a varying thickness of sand/sandy clay deposits formed under an estuarine/beach environment. These deposits are 4 –5 m thick in the vicinity of the Davey Street boundary increasing to 7–8 m at Morrison Street.

The boundary between these sandy beach-type deposits and the underlying bedrock is indistinct. The cored section from bore hole 2 (approximately 10–12.5 m) suggests that some of the bedrock has been reworked, possibly during the Quaternary or Tertiary period, to form a sandy clay deposit overlying bedrock.

Bedrock is a (quartz) sandstone/siltstone/mudstone sequence typically containing fining-upward sequences. This was encountered at approximately 9–10 m depth (Davey Street boundary) and about 13–14 m along Morrison Street.

Open hole piezometers were placed in bore holes 1 and 3 to measure and monitor water table levels and fluctuations. In broad terms, the water table lies 3–4 m below current ground surface. Measurements taken at varying intervals showed the water table to be basically static and it did not appear to be affected by tidal variations. Further observations would be necessary to fully substantiate this. The salinity (TDS) of the bores differed to the water tested in Constitution Dock by a factor of about 10 (500– 600 mg/L compared to 5800 mg/L). This further suggests that the water table beneath the site is not directly affected by the River Derwent.

In conclusion, reasonably sound foundation materials underlie the site at between 10 and 14 m depth.

REFERENCE

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

[22 December 1986]

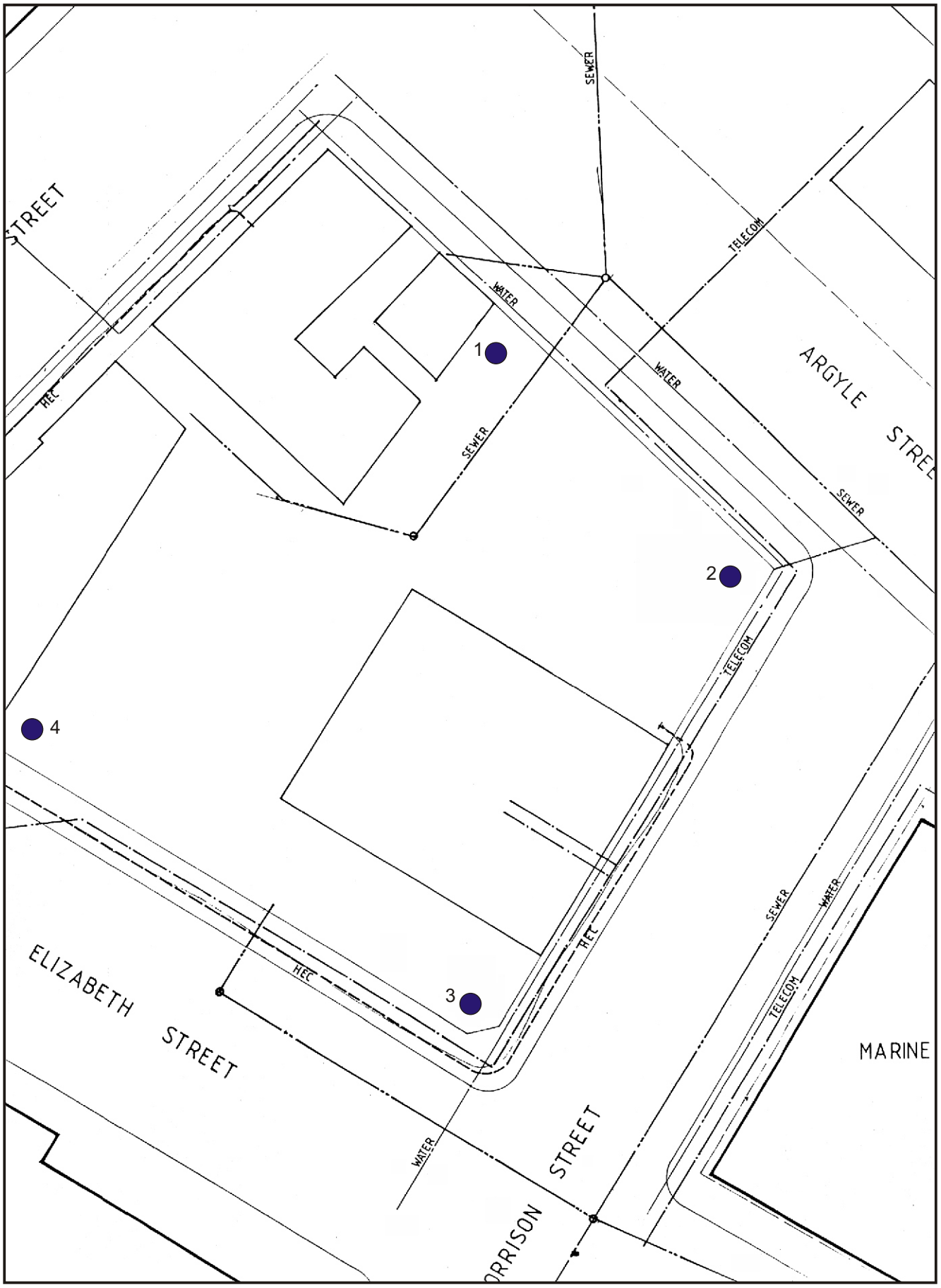

Figure 1

Location of boreholes

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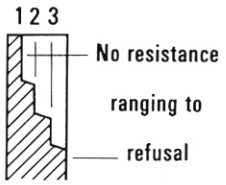
EXPLANATION SHEET FOR ENGINEERING LOGS

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.

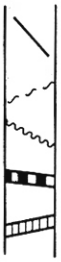
Strength

		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.



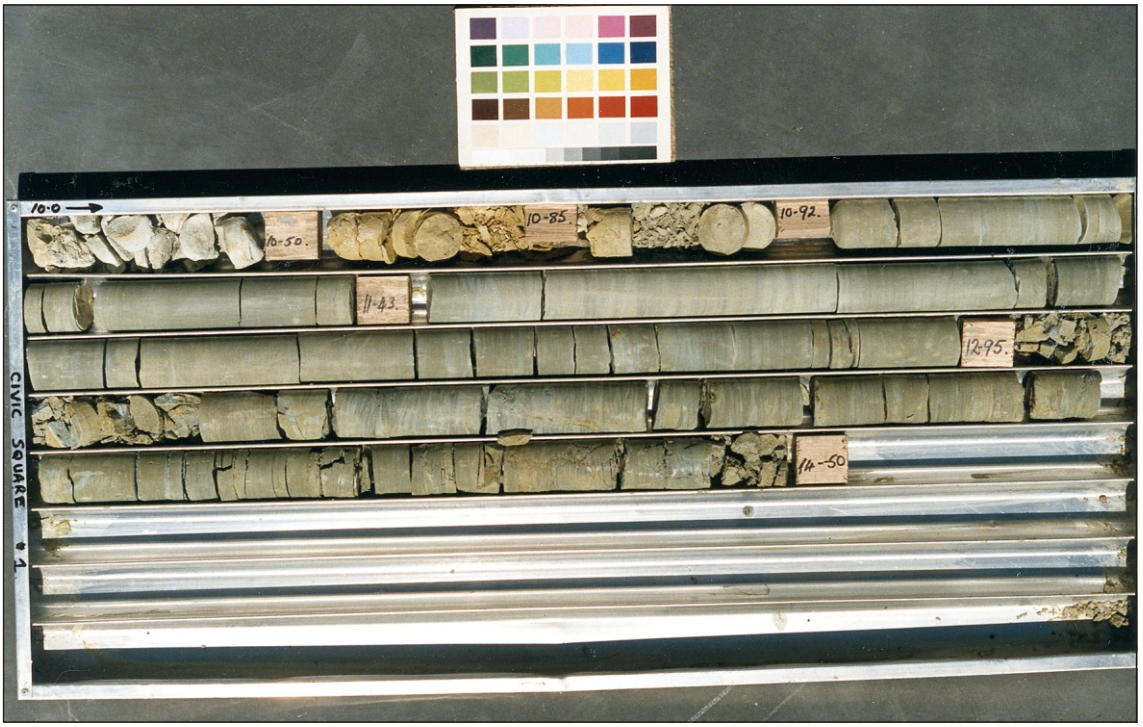
Joint.

Sheared zone.

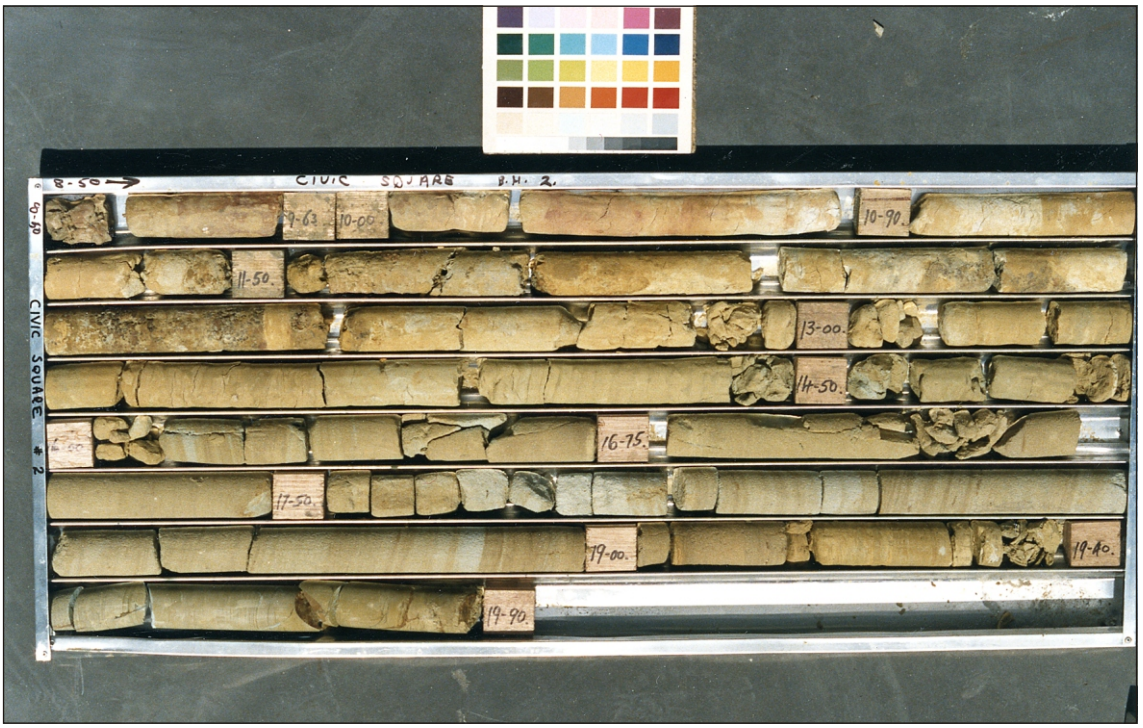
Crushed seam.

Infill seam.

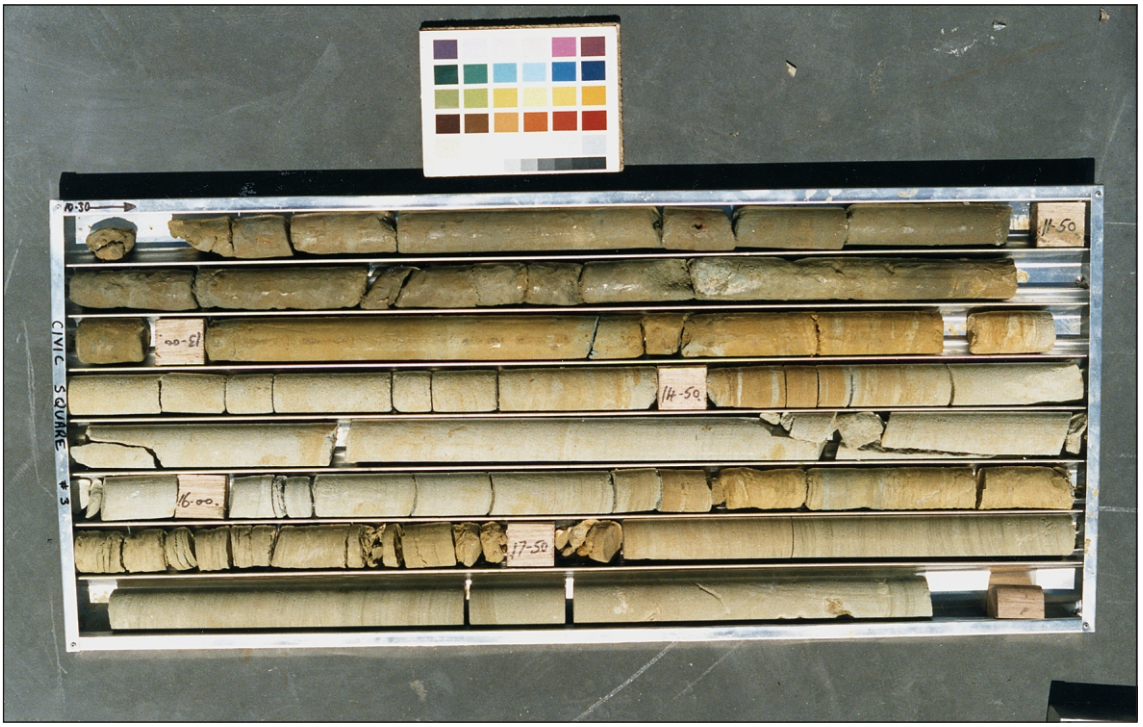
Extremely weathered seam.



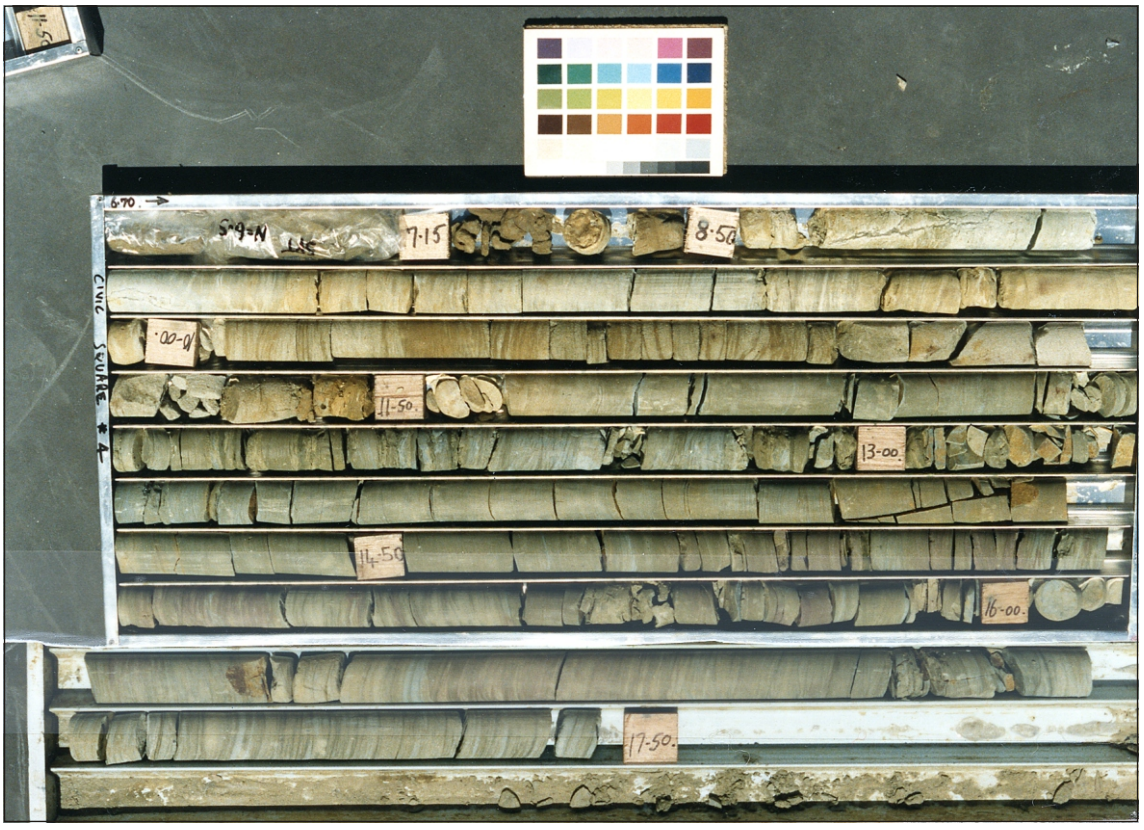
Bore Hole 1



Bore Hole 2



Bore Hole 3



Bore Hole 4

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – BOREHOLE

borehole no. 1

sheet 1 of 2

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST.

co-ordinates

R.L.

inclination VERTICAL

bearing

drill type GEMCO 210D.

drill method AUGER.

drill fluid

hole commenced 1 DEC 1986

hole completed —"— "— .

drilled by MINES DEPT.

logged by R. DONALDSON.

checked by

penetration 1 2 3	support	water	notes, samples, tests	metres R.L.	metres 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
							GC	Clayey GRAVEL: fine-medium, brown, clay of medium-high plasticity, some sand.	D	L MD		FILL
					1		SP	SAND: fine, greeny grey, some shell fragments.		VL		ESTUARINE BEACH DEPOSITS
		▼	19/12 21/12.		2		CH	CLAY: high plasticity, yellow brown, some fine sand, trace medium-course.	M > PL	F to St.		
		▼	1/12/86		3							
					4							
					5		SC	Clayey SAND: fine, green grey, trace shell fragments, clay of medium to high plasticity.	W	L		
			50mm PVC installed to 14.5m		6		CH	Sandy CLAY: high plasticity, yellow brown, sand fine.	M > PL	F to V St.		
					7							
					8							
					9							
					10			Similar - mottled yellow brown / light grey, rock fabric preserved.	M ≤ PL			E.W. BEDROCK

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ENGINEERING LOG – CORED BOREHOLE

borehole no. 1
sheet 2 of 2

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST

co-ordinates
R.L.
inclination VERTICAL
bearing

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

hole commenced 1 DEC 1986
hole completed — " — " —
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by

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
			R.Q.D.					SANDSTONE: fine-medium grained, light green grey, trace mica.	SW			
			0					MUDSTONE: yellow brown, some mica on bedding planes.	HW			
			0		11			SILTSTONE: coarse grained, green grey and brown, grading downward to SANDSTONE: very fine-fine grained, blue green grey and brown. Sequence is thinly bedded (x-bedded) to laminated. Laminae 5°-10° to horizontal. Mica on bedding planes. Cyclic sequence @ 1-1.5m intervals.	HW – SW			Most defects are joints parallel to bedding. Some steeply dipping joints occur. Joint surfaces rough, irregular, some iron stained, some with clay film, often micaceous, rarely cemented.
			0									
			65		12							
					13							
			40		14							
					15			HOLE TERMINATED @ 14.5m				

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – BOREHOLE

borehole no. 2

sheet 1 of 3

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST

co-ordinates

R.L.

inclination VERTICAL

bearing

drill type GEMCO 210 D.

drill method AUGER

drill fluid

hole commenced 2 DEC 1986

hole completed —"—"—

drilled by G. BAKER (MINES)

logged by R. DONALDSON.

checked by

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
				1		GC	Clayey GRAVEL: fine to medium, brown, clay of medium to high plasticity, some sand.	D	L to MD		FILL
		▽	2/12/86	2		SP	SAND: fine, (green) grey, some shells and shell fragments.	M	VL		ESTUARINE-BEACH DEPOSITS
				3			similar to above – some clay.	W			
				4		SC	Clayey SAND: fine, yellow brown/green grey, clay of medium to high plasticity, some shells and shell fragments. Some sandy CLAY lenses (CH).				
				5		SP	SAND: fine, green grey, some shells and shell fragments.				
				6			similar to above – green brown, some clay.				
				7		CH	Sandy CLAY: high plasticity, red brown, sand fine.	M > PL	St to V.St		
				8							
							refer sheets 2+3 for cored section				

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – CORED BOREHOLE

borehole no. 2

sheet 2 of 3

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST.

co-ordinates

R.L.

inclination VERTICAL

bearing

drill type GEMCO 210D

drill method NQ TRIPLE TUBE

drill fluid

hole commenced 2 DEC 1986

hole completed —"— —"—

drilled by G. BAKER (MINES)

logged by R. DONALDSON

checked by

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						
					5						
					6						
					7						
					8						
					9		Sandy CLAY: high plasticity, mottled yellow/brown, light grey and red. Some fine gravel (ironstone nodules) trace coarse (angular quartz sandstone). [M>PL ; St - V.St]				
					10						

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – CORED BOREHOLE

borehole no. 2
sheet 3 of 3

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST

co-ordinates
R.L.
inclination VERTICAL
bearing

drill type GEMCO 210
drill method NQ TRIPLE TUBE
drill fluid

hole commenced 2 DEC 1986
hole completed —"—"—
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by

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
			RQD		11		as above.				
			62		12						
			43		13		SANDSTONE: fine-(medium) grained, yellow brown/light green grey. Bedding massive to laminated – 10° @ 15° & horizontal. Mica on bedding planes.	EW – HW			
			0		14						
			40		15						
			75		16			HW			← Joints x2, 60-90°
			65		17						← Fractured
			62		18			HW – SW			
			70		19		MUDSTONE: brown to yellow/brown with some thinly interbedded sandstone!				← Joint 30°
					20		HOLE TERMINATED @ 19.9m				

Most defects are joints parallel to bedding. Some steeply dipping joints occur. Joint surfaces rough, irregular, some iron stained, some with clay film, often micaceous, rarely cemented.

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – BOREHOLE

borehole no. 3
sheet 1 of 3

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST.

co-ordinates
R.L.
inclination VERTICAL
bearing

drill type GEMCO 210 D
drill method AUGER
drill fluid

hole commenced 3 DEC 1986
hole completed — " — " —
drilled by G. BAKER (MINES)
logged by R. DONALDSON.
checked by

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
				1		SW-GW	SAND: fine-medium, red (crushed brick) GRAVEL: fine-medium, some timber	D	L-MD		FILL
				2		SP	SAND: fine, (green) grey, some shell fragments.	M	VL		ESTUARINE-BEACH DEPOSITS
		▼	3/12/86.					W			
		▼	19/12 21/12	3		SC	Clayey SAND: fine, grey green, clay of medium to high plasticity, some shells and shell fragments.				
				4		CH	Sandy CLAY: high plasticity, yellow brown, sand fine to medium, trace fine gravel.	M > PL	St to V.St		
			50 mm PVC installed to 19.0 m.	5							
				6		SP	SAND: fine, green grey, some shells and shell fragments.	W	L to VL		
				7			Similar to above - green brown, some clay.				
				8			Similar - trace clay.				
				9		CH	Sandy CLAY: high plasticity, brown, sand fine.	M > PL	St to V.St		
				10							

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – BOREHOLE

borehole no. 3

sheet 2 of 3

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST

co-ordinates

R.L.

inclination VERTICAL

bearing

drill type GEMCO 210 D

drill method AUGER

drill fluid

hole commenced 3 DEC 1986

hole completed —"— —"—

drilled by G.BAKER (MINES)

logged by R.DONALDSON

checked by

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
							as above				
				11			refer sheet 3 for cored section.				

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – CORED BOREHOLE

borehole no. 3
sheet 3 of 3

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST.

co-ordinates
R.L.
inclination VERTICAL
bearing

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

hole commenced 2 DEC 1986
hole completed —"— "—
drilled by G. BAKER (MINES)
logged by R. DONALDSON.
checked by

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
			RQD		11		Sandy CLAY: high plasticity, mottled yellow brown/green grey. [M>PL ; St-V.St.]				
					12						
					13						
			67		14		SANDSTONE: fine-medium grained, yellow brown/light green grey, trace mica. Bedding massive and laminated (10°-20° to hor^{l})	EW – HW / HW – SW / HW / HW – SW			← Joint 50°
			70		15						
					16						← Joint 75°
			40		17		MUDSTONE: brown to yellow brown, with some thinly interbedded sandstone	HW			
			100		18		SANDSTONE: fine grained, yellow brown/light green grey, trace mica. Bedding massive to laminated.	HW – SW			
					19		HOLE TERMINATED @ 19.0m				

Most defects are joints parallel to bedding. Some steeply dipping joints occur. Joint surfaces rough, irregular, locally iron stained. Some with clay film, often micaceous, rarely cemented.

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – BOREHOLE

borehole no. 4

sheet 1 of 3

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST.

co-ordinates

R.L.

inclination VERTICAL

bearing

drill type GEMCO 210 D

drill method AUGER

drill fluid

hole commenced 4 DEC 1986

hole completed 8 DEC 1986

drilled by G. BAKER (MINES)

logged by R. DONALDSON.

checked by

penetration 1 2 3	support	water	notes samples, tests	metres R.L.	metres 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
					1		SW-GW	SAND: fine to medium, (crushed brick), red. GRAVEL: (at base) fine to medium, blue grey (dolerite), some painted timber.	D	MD-VD		FILL
					2		SC-SP	Clayey SAND: fine, yellow brown and green. clay of medium to high plasticity. Lenses of SAND (S.P) - fine	M	L		ESTUARINE-BEACH DEPOSITS
					3							
		▼	4/12/86				CH	Sandy CLAY: high plasticity, brown, sand fine.	M > PL	F		
		▼	19/12 21/12		4							
							SC	Clayey SAND: fine, green grey, some shells.	W	L		
					5		CH	Sandy CLAY: high plasticity, grey green, sand fine.	M > PL	F st.		
					6							
			1 3 4 N* 9		7			Similar to above - mottled yellow brown/ grey green colour.		St.		
								refer sheets 2+3 for cored section				

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – CORED BOREHOLE

borehole no. 4
sheet 2 of 3

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST

co-ordinates
R.L.
inclination VERTICAL
bearing

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

hole commenced 4 DEC 1986
hole completed 5 DEC 1986
drilled by G. BAKER (MINES)
logged by R DONALDSON.
checked by

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						
						4						
						5						
						6						
						7						
			RQD			8		Sandy CLAY: high plasticity, mottled green grey/yellow brown, sand fine. [M > PL ; St – V.St.]				
			58			9		SILTSTONE: coarse grained, green grey/yellow brown, grading down/wards into SANDSTONE: fine-medium grained, yellow brown/light green grey, trace mica. Finely bedded & laminated. (5°–15° & horiz')	EW – HW HW – SW			← Crush seam 3-5mm, dip 70°
						10						

TASMANIA DEPARTMENT OF MINES

ENGINEERING LOG – CORED BOREHOLE

borehole no. 4
sheet 3 of 3

project PROPOSED CIVIC SQUARE location ELIZABETH/DAVEY/MORRISON/ARGYLE ST.

co-ordinates
R.L.
inclination VERTICAL
bearing

drill type GEMCO 200
drill method NQ TRIPLE TUBE
drill fluid

hole commenced 4 DEC 1986
hole completed 8 DEC 1986
drilled by G. BAKER (MINES)
logged by R. DONALDSON
checked by

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
			RQD 15			11		as above				← Joint 30°
								MUDSTONE: yellow brown.				← EW Seam (CH), 50 mm
			47			12		SILTSTONE: coarse grained, brown and green grey, grading downwards into SANDSTONE: (very) fine – fine grained, light blue green grey, brown and red. Sequence thinly bedded to laminated. X-bedding evident in sandy units. Bedding 5–10° to horizontal. Mica on bedding planes.				← Numerous EW (clay) seams (CH) 3–5 mm parallel to bedding
			10			13						← EW (clay) seam 3 mm
						14		Sandstone/Siltstone sequence as described is cyclic over 1–2 m intervals.				← Joint 70°
			23			15						
						16			SW.			
			60			17						← Joint 80°
								HOLE TERMINATED @ 17.5m				

Most defects are joints parallel to bedding, some steeply dipping joints occur. Joint surfaces rough, irregular, some iron stained, often micaceous, rarely cemented.