RB 73/199

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

DEPARTMENT OF MINES HEAD OFFICE, GLENSIDE
Section 264, Hundred of Adelaide
REPORT ON FOUNDATION INVESTIGATIONS
Client: Public Buildings Department

by

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ENGINEERING GEOLOGY SECTION

Rept.Bk.No. 73/199
G.S. No. 5204
D.M. No. 449/73
Eng.Geol.No. 1973/13

27th August, 1973

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

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SUMMARY AND CONCLUSIONS

Interpretation of drilling results indicates the following sequence:

0 - 5 metres Surface materials and Fill.

5 - 30 metres Hindmarsh Clay equivalents.

Surface materials are prone to seasonal volume changes and any structure founded in these materials should be isolated from the main structure. Fill is unsuitable for foundations.

A suggested founding level for the main structure is indicated within the Hindmarsh Clay equivalents. Gravels at this level are almost certainly lensoidal and some piles may terminate in or near to silts or clays. Laboratory testing is recommended to ensure that these silts and clays will not be overstressed.

Basements will be below water level for at least part of the year.

Paths, pavements and grounds should be laid out to ensure that the natural moisture regime of the site is not unduly disturbed. Paths and pavements may require undercutting.

INTRODUCTION

Three cable-tool holes have been drilled to investigate foundation conditions for the proposed new Department of Mines Head Office, Parkside. Location details are shown on figure 1. Where appropriate, standard penetration tests were performed at nominal 1.5 metre intervals, and sealed tube samples were recovered for subsequent laboratory testing.

All three bores were completed with perforated p.v.c. liners and remain available as water level observation bores.

Logs of bore holes and explanatory notes form appendix 1.

TOPOGRAPHY

The site slopes gently down towards B Block and is grassed. Considerable filling has apparently taken place adjacent to the Australian Mineral Foundation but both the extent of this filling and the original ground contours are unknown.

Surface drainage is poor and during wet weather the ground surface becomes extremely soft and wet.

SITE GEOLOGY

Site geology, as interpreted from the drill core, is summarized in table 1 and illustrated in the geological cross section (Figure 2).

TABLE 1 SUMMARY OF GEOLOGICAL SUCCESSION

Unit	Thickness	Dominant Materials	Age
Surface Materials.	4.5 - 5.0 metres	Clays, silts, sands. Fill in CH1.	Pleistocene to Recent.
Hindmarsh Clay Equivalents.	26 metres +	Silts and clays with sand and gravel lenses.	Pleistocene.

A. SURFACE MATERIALS

Clays (CL-CH)*, silts (ML) and sands (SM-SC) of low to moderate strength. Poorly consolidated fill in CH2.

Bores CH2 and CH3 encountered approximately 5 metres of sands, silts and clays of low to moderate strength. The clay horizon has the characteristics of a red-brown earth profile (Taylor 1970). Subsoil lime content is moderate.

Bore CH1 encountered 5 metres of poorly consolidated fill - a mixture of black and dark brown sandy silt with minor clay, containing fragments of brick, concrete, ceramic and quartzite. At least some of this fill appears to be cinders.

B. HINDMARSH CLAY EQUIVALENTS

Silts (ML-MH), and clays (CL-CH), with interbedded lenses of sand (SM-SC) and gravel (GM, GP, GC).

All three bores encountered a sequence of silty clays and clayey silts with interbedded silty sands and gravels, here correlated with the Hindmarsh Clay of Pleistocene age.

*Terms in brackets are defined in Appendix 1.

Silty clays and clayey silts are stiff, grey, generally humid to damp, and occasionally sandy.

Sands and gravels are medium dense to dense, composed of angular to sub rounded strong to medium strong quartzite, generally in a silty or occasionally clayey matrix. Examination of similar materials exposed in investigation trenches on the site of the proposed new core library show that these gravels may range up to 15-20 cms in diameter and that they occur as discontinuous lenses within the silts and clays.

C. GROUNDWATER

Water was encountered in all bores at the levels shown on the cross section (Figure 2). No significant flows were recorded. Although water levels did not rise measurably during the 15 minute stabilization period allowed during drilling operations, final levels rose to within two metres of ground level.

FOUNDATION CONDITIONS

A. SURFACE MATERIALS

Surface materials are considered suitable as foundations for comparatively lightly loaded structures only. Bearing strengths are low to moderate and the clay horizon, which has the characteristics of a red-brown earth (RB3), is probably subject to considerable seasonal volume changes. It is strongly recommended that any structure that may be founded in or on these surface materials (e.g. annexes, floors, pavements), should be structurally isolated from

the main structure, and that allowance should be made to accommodate any movements that may occur.

The fill encountered in bore CH1 is poorly consolidated and is considered unsuitable as foundations for any structure. Should it prove necessary to found any structure in this fill, undercutting and replacement with a sufficient thickness of suitably compacted material is essential.

B. HINDMARSH CLAY EQUIVALENTS

Standard Penetration Tests indicate that silts and clays have moderate strength. Long term settlements are unlikely provided stresses are not excessive.

Gravels and sands are dense to medium dense and probably have moderate to high strength. However, Standard Penetration Tests in these materials cannot be regarded as reliable due to the possibility of a coarse fragment choking the entry to the spoon and presenting an excessively high resistance to penetration. These materials may densify and settle slightly under load but vibrations accompanying pile driving should cause some densification and reduce subsequent settlement. Long term settlements in these pervious gravels and sands are unlikely.

A suggested founding level is indicated on the geological cross section (figure 2). While correlations between bore holes appear reasonable, it is stressed that the gravels and sands are almost certainly lensoidal and it is recommended that a substantially thinner gravel horizon should be assumed in design calculations.

Some piles could terminate in or near to silts and clays and the strength of these materials is suggested as a safe design assumption. Laboratory testing of these silts and clays is recommended to ensure that safe values of shear strength and settlement will not be exceeded. Allowable settlements should be maintained as low as is possible to ensure that significant differential movements do not occur.

C. GROUNDWATER

Silts and clays at the suggested founding level are relatively impervious and are unlikely to undergo significant changes in moisture content under natural conditions. To avoid the possibility of softening and loss of strength it is important that no water should be allowed access to these materials via excavations, foundations or services.

Marked seasonal water level fluctuations are likely within the Surface Deposits. Since static water level at the completion of investigations was within 2 metres of ground level it is probable that any basement will be at least partly below water level during winter. Adequate precautions must be taken to ensure that basements remain dry.

GROUNDS

Care should be taken in laying out grounds to ensure that the moisture regime under foundations and pavements is not unduly influenced by concentration of surface run-off, watering of lawns and gardens, or by the growth of tree roots. Lawns are likely to

become unduly soft and wet during winter months and adequate paths should be provided along all likely major traffic routes.

Pavements and paths, particularly rigid pavements, may be affected by seasonal volume changes in the red-brown earth soil profile and undercutting and backfilling with suitably compacted fill is recommended.

R.F. Jeude

RFJ:AM
27.8.73

R.F. JEUDE
GEOLOGIST
ENGINEERING GEOLOGY SECTION

REFERENCE

Taylor, J.K., 1970. Soils of the Unley - Beaumont - Belair - Brown Hill Creek Area. Metropolitan Soil Map Series : 3 Department of Mines, Adelaide.

APPENDIX 1

LOGS OF INVESTIGATION BORES AND EXPLANATORY NOTES

DEPARTMENT OF MINES – SOUTH AUSTRALIA

LOG OF CABLE TOOL HOLE

HOLE NO. CH 1

SERIAL NO. 370/73

PROJECT DEPT. OF MINES HEAD OFFICE

FEATURE FOUNDATIONS

LOCATION GLENSIDE

SEC 264 HD ADELAIDE

CO-ORDS

El Collar m

El Surface m

Datum

GEOLOGICAL NOTES AND CLASSIFICATION	El. DEPTH m	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	COLOUR MOISTURE CONTENT	Consistency Compact Density	FIELD TEST DATA: BLOWS PER 30 cm (4 8 16 32 64)	SOIL TEST PENETROMETER units * (1 2 3)
PLEISTOCENE RECENT — FILL	1			FILL Loose black sandy silt, trace clay, with angular fragments of quartzite (aggregate), ceramic and brick. Poorly compacted.					
	2								
	3								BRICK IN SHOE
	4							NO CORE	CONCRETE IN SHOE
SURFACE MATERIALS	5		ML	SILT LOW PLASTICITY W.C. 22.5.73 Loose brown clayey silt		M	Ls	NO CORE	+ BASKET
PLEISTOCENE — HINDMARSH CLAY EQUIVALENTS	6		GM / SM	GRAVEL AND SAND, EXCESS SILTY FINES. Gravel, rounded, up to 3cms, and sand in silt matrix.		S	Ls		17 (5,6,6)
	7		CH	CLAY, HIGH PLASTICITY Grey/brown mottled clay, up to 20% gravel to 4cms.		MC/PL	St.		
	8		GP	GRAVEL, POORLY GRADED Gravel, rounded, up to 5cms, and sand. Trace clay in matrix.		S	D		SPT NOT VALID
	9								18 (5,5,8)
	10								A220
	11		ML / MH	SILT, MEDIUM PLASTICITY Compact grey clayey silt, trace sand.		M	C		28 (8,9,11)
	12								A 237
	13			up to 30% rounded gravel to 3cms in basal 50cms.					23 (6,7,10)
	14		GM	GRAVEL, EXCESS SILTY FINES W.C. 24.5.73 Gravel, rounded, up to 5cms, and sand, in silt matrix.		S	D		44 (11,14,19)
	15								
	16		CH	CLAY, HIGH PLASTICITY stiff grey silty clay		M	St		
	17								A123
	18								

WATER LEVELS	MOISTURE CONTENT	CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	TYPE OF SAMPLE
Water level (date) 7 Dec. '66 — Casing WC ▶ Water Cut	H — Humid D — Damp M — Moist W — Wet S — Saturated LL — Liquid Limit PL — Plastic Limit	VS — Very Soft S — Soft F — Firm St — Stiff V St — Very Stiff H — Hard	Ls — Loose MC — Moderately Compact C — Compact VC — Very Compact	VL — Very Loose L — Loose MD — Medium Dense D — Dense VD — Very Dense	OPEN TUBE ..... A Shoe ..... D Shoe SEALED TUBE WITH NUMBER A 1 2 3 4 5 STANDARD PENETRATION TESTS 9 (2,3,4) Total blows for 0.3m (in 0.1m increments)

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING | GEOLOGY SECTION

DRILL NO. 24

TYPE DM 500

DRILLER JAMIESON

START

FINISH

LOGGED BY R. F. Joune

DATE 14. 6. 73.

TRACED D.W.W.

CHECKED

SHEET 1 OF 2. DRG NO. S10425 Ha6

PF No S6676 b MB

DEPARTMENT OF MINES – SOUTH AUSTRALIA

LOG OF CABLE TOOL HOLE

HOLE NO. CH 1
SERIAL NO 370/73

PROJECT DEPT OF MINES HEAD OFFICE
FEATURE FOUNDATIONS
LOCATION GLENSIDE
SEC 264 HD ADELAIDE
CO-ORDS
El. Collar m
El. Surface m
Datum

GEOLOGICAL NOTES AND CLASSIFICATION	El. DEPTH m	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, USBR Earth Manual 2nd Edition 1966	WATER LEVEL	CORE LOSS	MOISTURE CONTENT	Consistency Compact Density	FIELD TEST DATA: BLOWS PER 30 cm (4 8 16 32 64)	FIELD TEST DATA: SOIL TEST PENETROMETER Units * (1 2 3)
	18		ML	SILT, MEDIUM PLASTICITY			PL	C		
			I	Grey fine sandy clayey silt grading			≈			
	19		MH	downwards to sand, excess silty fines.					42	(N, 11, 20)
				END OF BORE 19·05 Metres.						
	20									

WATER LEVELS	MOISTURE CONTENT	CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	TYPE OF SAMPLE
Water level (date) 17 Dec. '66 Casing; WC Water Cut	H — Humid	VS — Very Soft	Ls — Loose	VL — Very Loose	OPEN TUBE
	D — Damp	S — Soft	MC — Moderately Compact	L — Loose	A Shoe
	M — Moist	F — Firm		MD — Medium Dense	D Shoe
	W — Wet	St — Stiff	C — Compact		SEALED TUBE WITH NUMBER (A 1 2 3 4 5)
	S — Saturated	V.St — Very Stiff	VC — Very Compact	D — Dense	STANDARD PENETRATION TESTS (9 1,2,3,4) Total blows for 0·3m (in 0·1m increments)
	LL — Liquid Limit	H — Hard		VD — Very Dense	
	PL — Plastic Limit				

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL NO 24
TYPE DM 500
DRILLER JAMIESON
START
FINISH

LOGGED BY R.F. Jeune
DATE 14·6·73
TRACED
CHECKED

SHEET 2 OF 2. DRG. NO. S10425a Ha6

PF No S6676 b MB

DEPARTMENT OF MINES – SOUTH AUSTRALIA

LOG OF CABLE TOOL HOLE

HOLE NO. CH2

SERIAL NO. 369/73

PROJECT DEPT. OF MINES HEAD OFFICE

FEATURE FOUNDATIONS

LOCATION GLENSIDE

SEC 264 HD ADELAIDE

CO-ORDS

El. Collar m

El. Surface m

Datum

GEOLOGICAL NOTES, AND CLASSIFICATION	El	DEPTH m	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	CASING	MOISTURE CONTENT	Consistency Compact Density	FIELD TEST DATA: BLOWS PER 30 cm (4 8 16 32 64)	FIELD TEST DATA: SOIL TEST PENETROMETER Units * (1 2 3 4)
PLEISTOCENE – RECENT				MH	TOPSOIL				Ls		
SURFACE MATERIALS		1		CL I CH	CLAY, MEDIUM PLASTICITY Stiff, red brown silty clay			M	St	Trace Roots Causing High Blow Counts	
		2								A 87	
				SM SC	SAND, EXCESS SILTY & CLAYEY FINES Silty and clayey medium and fine sands			M	MD	5 (1,2,2)	
		3		ML	SILT, LOW PLASTICITY Brown clayey silt			E.P.L.	MC	A 205	
		4			SEEPAGE					A (1,1,2)	
PLEISTOCENE				GM	GRAVEL, EXCESS SILTY FINES Gravel, rounded, to 3 cms. Silt matrix				S		
HINDMARSH CLAY EQUIVALENTS		5		CL I CH	CLAY, MEDIUM PLASTICITY Red-brown/grey mottled silty clay			E.P.L.	St	15 (4,5,6)	
		6								A 224	
		7		GC I SC	GRAVEL and SAND, EXCESS CLAYEY FINES. Rounded gravel to 3 cms and sand in silty clay matrix			S	MD	66 (26,21, 19)	
		8								50 (17,16,17)	
		9		CL I CH	CLAY, MEDIUM PLASTICITY Grey, silty clay, trace fine sand. Occasional thin beds dense sand			E.P.L.	St.		
		10								29 (8,10,11)	
		11								A 182	
		12								31 (9,10,12)	
		13								A 211	
		14		ML I MH	SILT, MEDIUM PLASTICITY Grey clayey silt, trace fine sand, becoming sandier with increasing depth.			E.P.L.	C	A 76	
		15		GC	GRAVEL, EXCESS CLAYEY FINES				D	22 (6,7,9)	
				ML I MH	SILT, MEDIUM PLASTICITY Grey clayey silt, occasional bands of silty sand.			E.P.L.	C	A 268	
		16			SEEPAGE					37 (9,13,15)	
		17								A 121	
		18		SM	SAND, EXCESS SILTY FINES Minor silt and gravel lenses			S	MD	25 (7,8,10)	

WATER LEVELS	MOISTURE CONTENT	CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	TYPE OF SAMPLE
Water level (date) 7 Dec. '66; Casing; WC Water Cut	H — Humid; D — Damp; M — Moist; W — Wet; S — Saturated; LL — Liquid Limit; PL — Plastic Limit	VS — Very Soft; S — Soft; F — Firm; St — Stiff; V St — Very Stiff; H — Hard	Ls — Loose; MC — Moderately Compact; C — Compact; VC — Very Compact	VL — Very Loose; L — Loose; MD — Medium Dense; D — Dense; VD — Very Dense	OPEN TUBE ..... A Shoe ..... D Shoe; SEALED TUBE WITH NUMBER (A 1 2 3 4 5); STANDARD PENETRATION TESTS 9 (2,3,4) Total blows for 0·3m (in 0·1m increments)

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL NO. 24
TYPE DM 500
DRILLER JAMIESON
START
FINISH

LOGGED BY R.F. JEUNE
DATE 15·6·73
TRACED G.M.
CHECKED

SHEET 1 OF 2

DRG. NO. S10426 Hs6

PF No S6676b MB

DEPARTMENT OF MINES — SOUTH AUSTRALIA

LOG OF CABLE TOOL HOLE

HOLE NO. CH2

SERIAL NO 369/73

PROJECT DEPT. OF MINES HEAD OFFICE

FEATURE FOUNDATIONS

LOCATION GLENSIDE

SEC 264 HD ADELAIDE

CO-ORDS

El. Collar . . m

El. Surface . . m

Datum

GEOLOGICAL NOTES AND CLASSIFICATION	El. DEPTH m	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	SOIL MOISTURE CONTENT	Consistency Compact Density	FIELD TEST DATA: BLOWS PER 30 cm (4 8 16 32 64)	FIELD TEST DATA: SOIL TEST PENETROMETER Units * (1 2 3 4)
PLEISTOCENE HINDMARSH CLAY EQUIVALENT	18		GM						
	19			GRAVEL, EXCESS SILTY FINES Gravel up to 3cms rounded, silty sand matrix. Minor pockets of clay matrix.					
	20		GM			S	D		
	21								
	22							NO CORE	
			GC	GRAVEL, EXCESS CLAYEY FINES		S	D		
	23		CL I CH	CLAY, MEDIUM PLASTICITY Very stiff grey clay		L PL	St	55 (14,17,24)	
	24							HV66	
	25							47 (12,15,20)	
	26							A 31	
	27							35 (10,11,12)	
	28							67 (15,20,26)	
	29							A 18	
	30			END OF BORE 30·00 metres				109 (25,39,45)	

WATER LEVELS	MOISTURE CONTENT	CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	TYPE OF SAMPLE
Water level (date) 7 Dec. '66 Casing WC Water Cut	H — Humid D — Damp M — Moist W — Wet S — Saturated LL — Liquid Limit PL — Plastic Limit	VS — Very Soft S — Soft F — Firm St — Stiff V.St — Very Stiff H — Hard	Ls — Loose MC — Moderately Compact C — Compact VC — Very Compact	VL — Very Loose L — Loose MD — Medium Dense D — Dense VD — Very Dense	OPEN TUBE A Shoe D Shoe SEALED TUBE WITH NUMBER A 1 2 3 4 5 STANDARD PENETRATION TESTS 9 (2,3,4) Total blows for 0·3m (in 0·1m increments)

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL NO. 24
TYPE DM 500
DRILLER JAMIESON
START
FINISH

LOGGED BY R.F. JEUNE
DATE 15·6·73
TRACED G.M.
CHECKED

SHEET 2 OF 2

DRG. NO. S 10426 A H&G

PF No S6676 b MB

DEPARTMENT OF MINES — SOUTH AUSTRALIA

LOG OF CABLE TOOL HOLE

HOLE NO. CH 3
SERIAL NO 380/73

PROJECT DEPT. OF MINES HEAD OFFICE
FEATURE FOUNDATIONS
LOCATION GLENSIDE
SEC 264 HD ADELAIDE
CO-ORDS
El Collar m
El. Surface m
Datum

GEOLOGICAL NOTES AND CLASSIFICATION	El	DEPTH m	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification, U.S.B.R Earth Manual 2nd Edition 1966)	WATER LEVEL	SOIL MOISTURE CONTENT	Consistency Compact. Density	FIELD TEST DATA: BLOWS PER 30 cm (4 8 16 32 64)	FIELD TEST DATA: SOIL TEST PENETROMETER Units * (1 2 3)
PLEISTOCENE TO RECENT		1		CH	CLAY, MEDIUM PLASTICITY. Trace gravel.		W	S		
				SM	SAND, EXCESS SILTY FINES. Red brown silty fine sand, trace clay.		D	MD		
		2		CL – CH	CLAY, MEDIUM PLASTICITY. Red brown silty clay.		D	St	A194	
									5 (2,1,2)	
		3		ML	SILT, LOW PLASTICITY. Brown fine sandy silt, trace clay.		D	C	A156	
									7 (3,2,2)	
		4		ML	SILT, LOW PLASTICITY. Brown clayey silt, trace fine sand.		≈ PL	C		
				SM – GM	SAND AND GRAVEL, EXCESS SILTY FINES. Gravel up to 3cms. SEEPAGE		S	Ls	TUBE DAMAGED	
		5		CL – CH	CLAY, MEDIUM PLASTICITY. Grey/brown mottled silty clay.		≈ ≈ PL	St		
		6							A12	
				GM – SM	GRAVEL AND SAND, EXCESS SILTY FINES. Gravel up to 3cms, and sand in silt matrix.		S	MD	S.P.T. INAPPROPRIATE	
		7								
		8								
		9							S.P.T. INAPPROPRIATE	
PLEISTOCENE		10			CLAY, MEDIUM PLASTICITY. Grey silty clay, trace fine sand.		≈ PL	St		
		11		CL – CH					A49	
									22 (7,7,8)	
		12							A117	
									17 (5,6,6)	
		13								
		14			Scattered quartzite pebbles up to 3cms at 14·80 m.				A199	
									37 (6,14,17)	
		15								
		16			END OF BORE 15·30 Metres.					

WATER LEVELS	MOISTURE CONTENT	CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	TYPE OF SAMPLE
Water level (date) 7 Dec. '66. Casing; WC ▶ Water Cut	H — Humid	VS — Very Soft	Ls — Loose	VL — Very Loose	OPEN TUBE: A Shoe, D Shoe
	D — Damp	S — Soft	MC — Moderately Compact	L — Loose	SEALED TUBE WITH NUMBER (A 1 2 3 4 5)
	M — Moist	F — Firm		MD — Medium Dense	STANDARD PENETRATION TESTS: 9 (2,3,4) Total blows for 0·3m (in 0·1m increments)
	W — Wet	St — Stiff	C — Compact		
	S — Saturated	V St — Very Stiff	VC — Very Compact	D — Dense	
	LL — Liquid Limit	H — Hard		VD — Very Dense	
	PL — Plastic Limit				

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL NO. 24
TYPE DM 500
DRILLER JAMIESON
START
FINISH

LOGGED BY R. F. Joune
DATE 25·6·73
TRACED D.W.W.
CHECKED

SHEET 1 OF 1 DRG. NO. S10427 Ha6

PF No S6676 b MB

MARK	FEATURES	USES
E	Shoe belled out to 13.8 cm (5 7/16 in.) (just less than internal dia. of 15 cm casing)	Cleaning hole and reaming out hole.

Sealed Tube (LB) Samples

Sealed tube samples, for laboratory testing, are taken at various intervals during drilling. These are obtained by driving an "L" type sampling tube with a Mark B cutting shoe (Fig. 4) a distance of 30 cm into the material to be sampled.

Before the sample is taken the hole is cleaned out to the depth specified. The hole is not reamed or cased for at least 30 cm from the bottom, however, because these operations can cause considerable disturbance in the soil below. The sampling assembly is lowered carefully to the bottom of the hole, the sampling tube driven exactly 30 cm, and the number of blows recorded.

The sample is sealed in the tube by inserting in each end, plastic seals with rubber sealing rings, and the tube is then labelled and stored in a Laboratory Sample Box.

LB sampling equipment is a composite sampler for obtaining samples with the least possible disturbance. Details are as follows:

Sampler tube - ASSAB tube cadmium plated
"L" type 10.2 cm (4.016 in.) I.D.
10.9 cm (4.282 in.) O.D.

Mark B shoe - ASSAB tube, heat treated, cadmium plated
Area ratio 15%
Inside clearance - 0.4%
Outside clearance - nil
Cutting edge angle - 7°

Standard Penetration Test

The Standard Penetration Test (Terzaghi et al 1948) is used to test the in-situ density of sands and to give an indication of the consistency of clays, and compactness of silts. However the test results can be affected by several geological factors such as degree of cementation, and size and shape of grains. These factors should be taken into account in interpretation of results.

The equipment is illustrated in Fig. 5 and consists of a 5.1 cm (2 in.) diameter, sampling spoon (tube) and a hammer of standard weight (64 kg (140 lbs)).

APPENDIX

LOGS OF CABLE TOOL HOLES AND EXPLANATORY NOTES

NOTES ON DRILLING PROCEDURES

Equipment

The drilling is carried out with a cable tool drilling plant using sampling tubes attached, through a vacuum head, to the sampling tools (Figs. 1 and 2).

Sampling Procedures

S.A. Samples

To obtain, for logging purposes, an almost continuous series of samples, with a relatively small amount of sample disturbance, SA type samples are taken. These are obtained by driving an "S" tube, fitted with a Mark A shoe (Fig. 2), into the material to be sampled.

The assembly is lowered carefully to the bottom of the hole, and the tube driven exactly 30 cm, and the number of blows required for the 30 cm of penetration recorded.

The sample, or core, is extruded from the sampling tube using an hydraulic ram. The extruded core is sealed in a labelled plastic bag and stored in a core box (Fig. 3).

The hole is reamed with a "D" or "E" shoe (Fig. 2) and then the next sample is taken, using the same procedure as above. Thus the hole proceeds by alternate sampling, reaming (and where required, casing) operations, and the samples form a continuous record of the materials penetrated except for a few centimetres which may be lost between samples during reaming operations.

SA sampling equipment is a composite sampler for simple class sampling. Details are as follows:-

"S" SERIES CUTTING SHOES

MARK	FEATURES	USES
A	Inside clearance 3%. Area Ratio 33%.	Continuous open-tube sampling in strong soils, in which it causes little deformation. Samples extruded and used for logging purposes. Hole is reamed after each sample.
D	Shoe belled out to 12.5 cm (4 29/32 in.) (just greater than outside dia. of vacuum head)	Continuous open tube sampling where considerable deformation of sample is permissible. Essentially self-reaming.

With the equipment assembled as in Fig. 5 the hammer is allowed to fall on to the drill rods until the sampling shoe has penetrated 15 cm into the soil. The Standard Penetration Test is the number of blows (N) required to produce the next 30 cm of penetration.

NOTES ON DRILL LOG SHEETS

The logs are plotted on a standard cable-tool log form.

Near the centre of the form a graphic log of the materials encountered is shown.

In the column to the right of the graphic log, the soils are classified and described according to the Unified Soil Classification (U.S. Dept. of Interior, Bureau of Reclamation 1966) as shown on Figure 6.

To the left of the graphic log is a geological description of the materials sampled. This includes:-

.....Geological age)
.....Soil unit name) Printed vertically
.....Type of material)
.....Mineral composition
.....Grain shape
.....Cementation
.....Organic materials

Water levels are indicated by a small arrow with the date at which the observation was made.

In the blows per 30 cm column, a continuous histogram is made of the number of blows required to drive the sampling tube through each 30 cm of material. A hatching code is used to distinguish various types of sample. This code is reproduced at the bottom of each log sheet.

In the column on the far right of the log sheet, readings of unconfined compressive strength (qu) made with a Soiltest Penetrometer, are recorded. The readings are plotted as a histogram. The Soiltest Penetrometer only gives true values of qu when used in clays in which $\phi = 0$.

REFERENCES

TERZAGHI, K. and PECK, R.B., 1948. Soil Mechanics in Engineering Practice. John Wiley and Sons.

UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION, 1966. Earth Manual, 2nd Edition.

ENGINEERING CLASSIFICATION OF SOILS

The Unified Soil Classification System

COARSE-GRAINED SOILS — More than 50% of material is larger than No. 200 B.S. sieve size

FIELD INVESTIGATION PROCEDURES (Excluding particles larger than 7·5cm and basing fractions on estimated weights)			GROUP SYMBOL	GROUP NAME and typical materials
GRAVELS More than 50% of the coarse fraction is larger than 2mm. (retained on B.S.7 sieve)	**CLEAN GRAVELS** Little or no fines	Wide range in grain sizes, and substantial amounts of all intermediate particle sizes	GW	GRAVEL, well graded; gravel sand mixtures, little or no fines
		Predominantly one size or a range of sizes, with some intermediate sizes missing	GP	GRAVEL, poorly graded; gravel sand mixtures, little or no fines
	DIRTY GRAVELS Appreciable amount of fines	Non-plastic fines—for identification see ML below	GM	GRAVEL, excess silty fines; poorly graded gravel-sand-silt mixtures
		Plastic fines—for identification see CL below	GC	GRAVEL, excess clayey fines; poorly graded gravel-sand-clay mixtures
SANDS More than 50% of the coarse fraction is smaller than 2mm. (passing B.S.7 sieve)	**CLEAN SANDS** Little or no fines	Wide range in grain sizes, and substantial amounts of all intermediate particle sizes	SW	SAND, well graded; well graded sands, gravelly sands, little or no fines
		Predominantly one size or a range of sizes, with some intermediate sizes missing	SP	SAND, poorly graded; poorly graded sands, gravelly sands, little or no fines
	DIRTY SANDS Appreciable amount of fines	Non-plastic fines—for identification see ML below	SM	SAND, excess silty fines; poorly graded sand-silt mixtures
		Plastic fines—for identification see CL below	SC	SAND, excess clayey fines; poorly graded sand-clay mixtures

FINE-GRAINED SOILS — More than 50% of material is smaller than No. 200 B.S. sieve size

FIELD INVESTIGATION PROCEDURES on fraction smaller than 0·4mm. (passing B.S. 36 sieve)							GROUP SYMBOL	GROUP NAME and typical materials
	SOIL CAST (soil wet)	SOIL THREAD	SHINE	DILATANCY	ODOUR	DRY STRENGTH		
SILTS AND CLAYS Liquid limit less than 50	Forms fragile cast Cracks form when kneaded while moist	Thick crumbly thread; readily broken	None to very dull	Distinct	Not significant	None to slight	ML	SILT SOIL, low plasticity; inorganic silts and very fine silty or clayey sands, rock flour
	Cast maybe handled freely without breaking Can be kneaded moist without cracking Material adheres to the hand	Thread can be pointed as fine as a hat pencil but is fragile	Moderate	None to slight	Not significant	Moderate	CL	CLAY SOIL, low plasticity; inorganic clays of low to medium plasticity, gravelly clay, sand, clays, silty clays, lean clays
	Cast fragile to cohesive material will adhere somewhat to the hand	Soft, weak thread	None to very dull	Slight to distinct	Decayed organic matter	Low	OL	ORGANIC SOIL, low plasticity; organic silts and silt clays of low plasticity
SILTS AND CLAYS Liquid limit more than 50	Moderately plastic and cohesive Material adheres somewhat to the hand	Weak to medium thread May be crumbly	Dull	None to slight	Not significant	Moderate Powdered soil feels floury	MH	SILT SOIL, high plasticity; inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	Very plastic and cohesive Material very sticky to the hand Greasy to touch	Very tough thread, can be rolled to a pin point	Very glossy	None	Strong earthy	High to very high Cannot be powdered by finger pressure	CH	CLAY SOIL, high plasticity; inorganic clays of high plasticity, fat clays
	Plastic and cohesive Feels slightly spongy Greasy to touch	Weak to medium thread Often soft and fibrous	Moderate to very glossy	None	Decayed organic matter	Moderate to high Powdered soil may be fibrous	OH	ORGANIC SOIL, high plasticity; organic clays of medium to high plasticity
	Readily identified by colour, odour, spongy feel and frequently by fibrous texture						Pt	PEATY SOIL; Peat and other highly organic soils

LABORATORY CLASSIFICATION CRITERIA

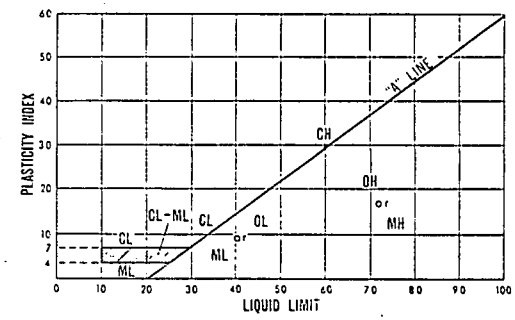
GRAIN SIZE CURVES to be used to identify soil fractions

Coarse-grained soil classified on basis of percentage of fines, as follows

PERCENT OF FINES — GRAVELS: GW GP GM GC; SANDS: SW SP SM SC

Less than 5 — More than 12 — 5 to 12 Borderline cases, use 2 symbols

$Cu = \frac{D60}{D10}$ Greater than 4 $Cc = \frac{(D30)^2}{D10 \times D60}$ Between 1 and 3		
Not meeting all gradation requirements for GW		
Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols	
Atterberg limits below "A" line or PI greater than 7		
$Cu = \frac{D60}{D10}$ Greater than 6 $Cc = \frac{(D30)^2}{D10 \times D60}$ Between 1 and 3		
Not meeting all gradation requirements for SW		
Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols	
Atterberg limits below "A" line or PI greater than 7		



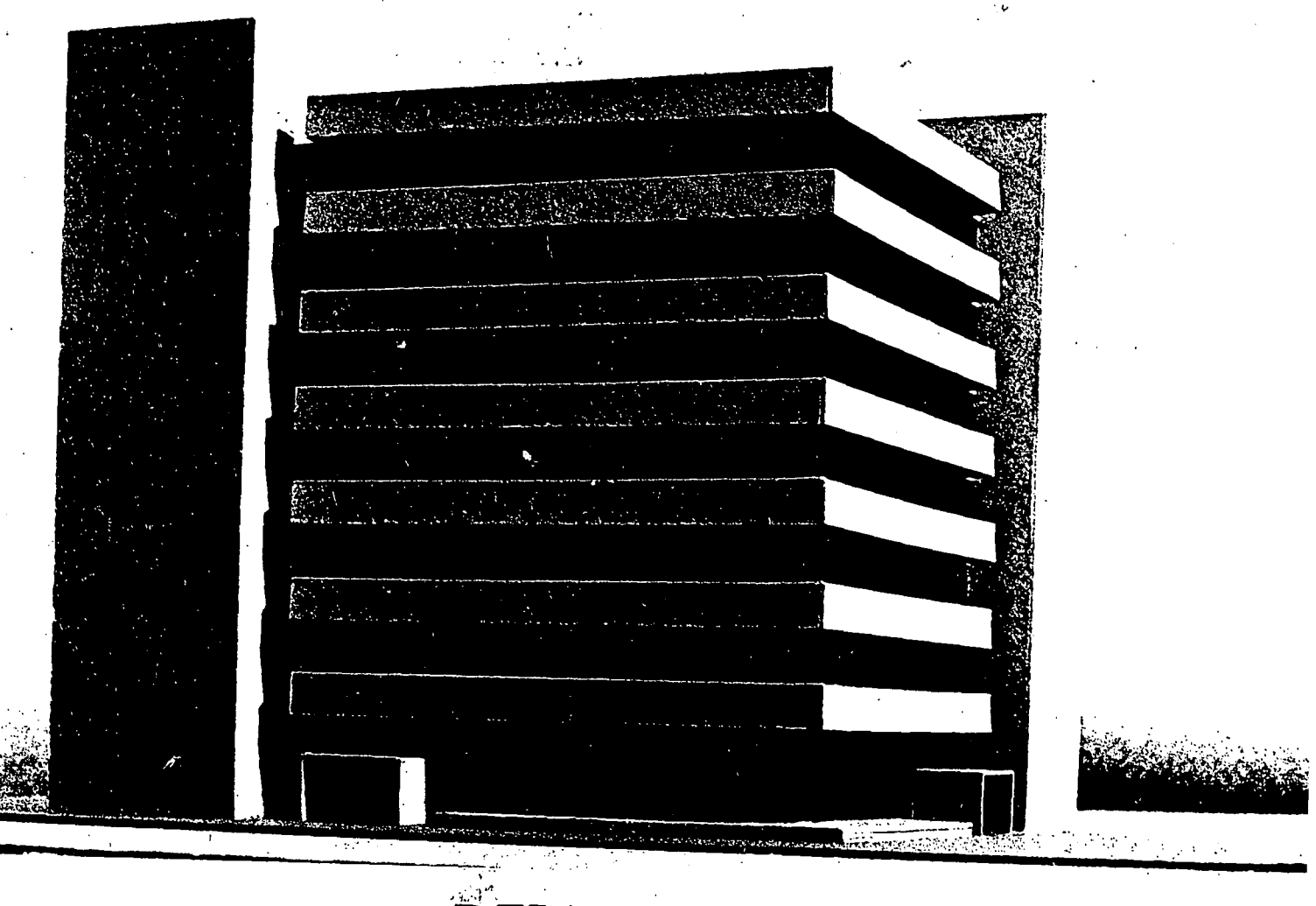
PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE-GRAINED SOILS

NOTE: BOUNDARY CLASSIFICATIONS: Soil possessing characteristics of two groups are shown as a combination of two group symbols, eg. GW-GC, well graded gravel with clay binder.

Based on "The Unified Soil Classification System" United States Department of the Interior, Bureau of Reclamation "Earth Manual" First Edition, Denver COLARADO 1960.

Bull.44 70—641

70—641 Bull.44



DEPARTMENT OF MINES OFFICES

CHEESMAN DOLEY NEIGHBOUR & RAFFEN PTY LTD · ARCHITECTS

RB 73/199

DESIGN STUDY REPORT FOR

THE DEPARTMENT OF MINES - OFFICE BUILDING

CHEESMAN DOLEY NEIGHBOUR & RAFFEN PTY. LTD.
- Architects

BARNES & ASSOCIATES
- Consulting Structural Engineers

W.E. BASSETT & PARTNERS
- Consulting Engineers

CRISP, KAVANAGH & PARTNERS
- Quantity Surveyors

CONTENTS

1. INTRODUCTION

This report with accompanying drawings and model is submitted as the proposal for a new office building for the Department of Mines at Glenside as part of the Australian Mineral Sciences Centre.

The scheme has been prepared in accordance with accommodation schedules and design requirements as outlined in the brief prepared by the Public Buildings Department and with consultation with officers from the Department of Mines. Additional accommodation requested by the department is noted in the schedule at the end of this section of the report.

The scheme as presented does not indicate detailed planning of the particular floors. Functional planning to determine the optimum floor size and area in relation to the disposition of departments and sections has been carried out and appears in the schedule. Although final layouts have not yet been determined the estimate includes allowances for all partitioning of all the floors based on work done to date.

2. THE SITE

The site at the Mineral Sciences Centre at Glenside is between the recently completed Natural Gas Pipeline Authority and the Australian Mineral Foundation, currently under construction.

On Commission from the Public Buildings Department, this office prepared a master plan for the centre determining the approximate disposition of the proposed buildings and laying out the network of roads and parkings areas for the whole site.

Concurrent with this submission is our proposal for the Core Library for the Department of Mines. This complex is sited on the north-west corner of the site. The site allocated for the office building lies between the service ring road and visitors' entry loop road, on a tract of land between the two other buildings that is being developed on a segregated pedestrian "campus" concept.

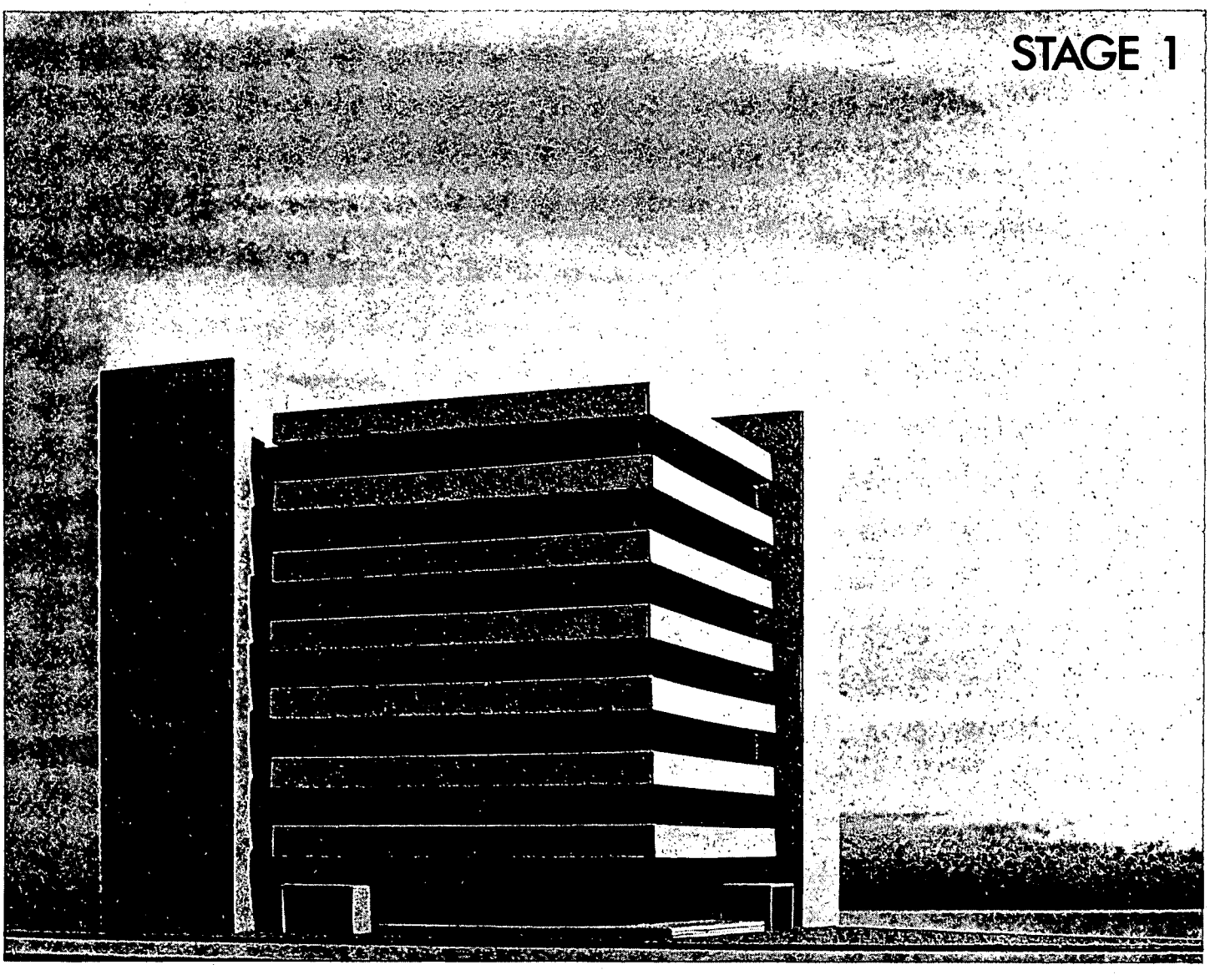
3. BUILDING PROPOSAL

This proposal is for a seven storey building, of square plan form with service cores set into the north-west and south-east corners.

Influencing factors which led to the evolution of this concept were:-

- With the development of the Mineral Sciences Centre as set out in the master plan, the site available for the Department of Mines office building is limited. The open spaces between the buildings must be sufficient in size to be properly landscaped and be meaningful in terms of the "campus" concept.
- Existing buildings and the proposed core library are of one and two storey construction. In terms of massing of buildings in the Centre it is desirable to have a taller element as a balance to the setting. The office accommodation provided by this building is appropriately expressed as a multi-storey structure.
- The Department is made up of many interrelated sections. Analytical studies were made to determine near optimum floor areas to provide best disposition and grouping of sections and internal communication.
- The expressed desire to adopt office landscaping principles where appropriate influenced the plan area and form which is best resolved in a multi-storey building.

Consideration was given to providing the accommodation in a three level building as suggested in the brief also in two which is more reasonable if no lifts are provided. However, the parameters and criteria, with their influences are best met with a multi-storey building, which is our recommendation in this proposal.


STAGE 1

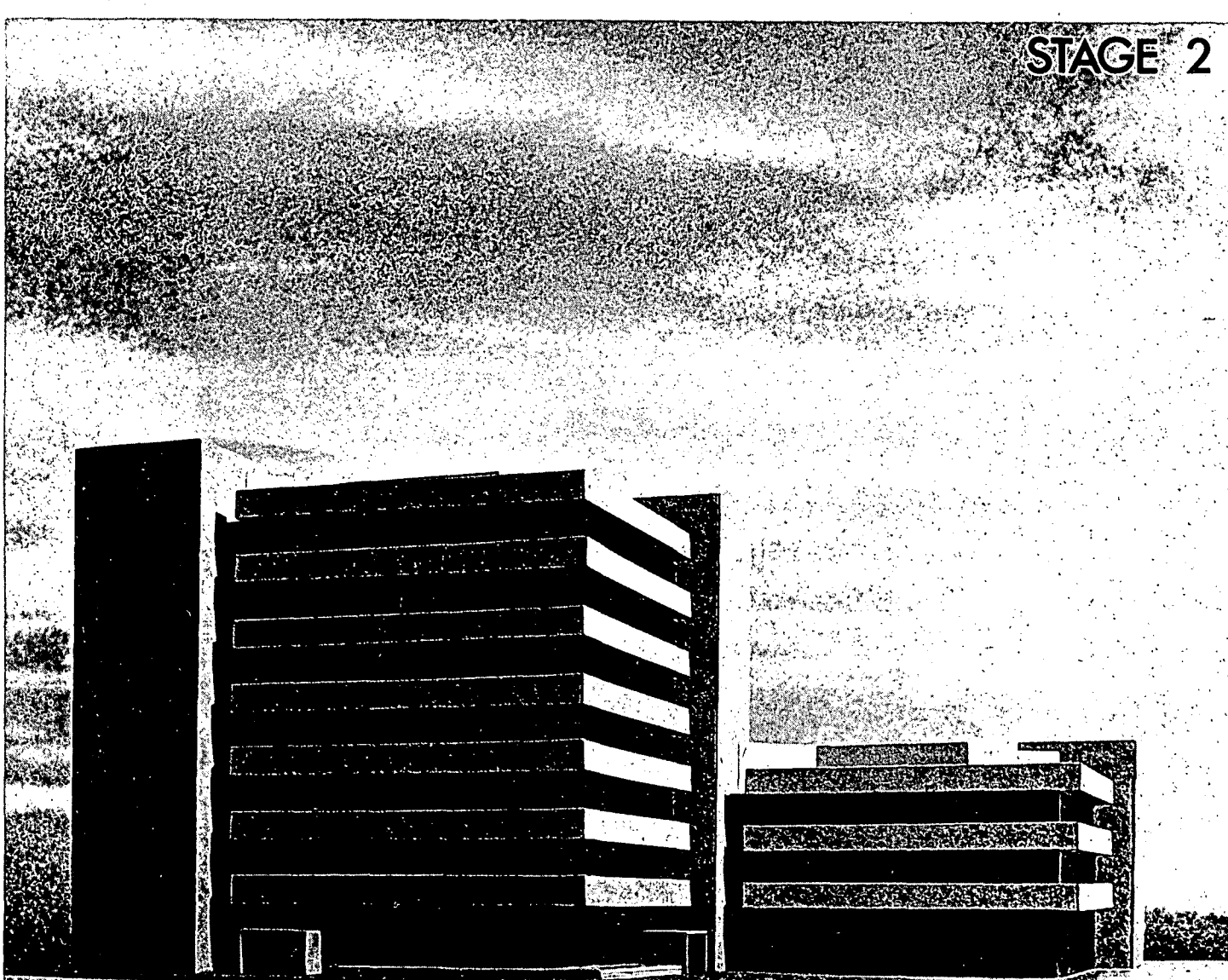
4. EXPANSION

The brief requires that provision be made for expansion of the Department. Stage one allows for some expansion within the building by taking up excess space allocation and efficient utilization of office landscaping. Within twenty years a further 18,000 square feet of office accommodation is proposed as the second stage when a major reallocation of space will be made.

Careful consideration has been given to alternative possibilities for the second stage. Vertical expansion and additional wings were rejected in favour of a linked annexe building.

The annexe is envisaged as a three storey building, identical in plan form to the first stage linked into and sharing the N - W corner core. The lift lobby will provide a link between the buildings at each level. The lift service has been designed to handle the additional load of the annex without diminishing the performance. Provision is also made in Stage 1 for a duct for air conditioning service to the annex.

Although the brief stipulates a specific figure for the additional area, the proposal presents a flexible solution. With some modification to the core any number of floors could be accommodated in the second stage development.


STAGE 2

5. PLANNING

The plan form is basically an 84'0" square with two 26'0" square service cores set on diagonally opposite corners. One core contains toilets, stair, cleaners and tea room and the other the lifts and second stair. This core is planned to allow linking with the proposed annexe extensions. Both cores provide for mechanical and electrical services.

A 4'0" planning module has been adopted with window mullions aligning with this grid to give partitioning flexibility at the window wall. A staggered pattern of 1'4" wide light fitting in the middle third of the 4'0" module gives ultimate flexibility of moving partitions without having to move light fittings.

The 4'0" module is compatable with the preferred metric multimodule of 1200 m.m. The Metric Conversion Board is recommending that for dimensional co-ordination, a basic module of 100 m.m. be adopted, with preferred multi-modules of 300, 600, 900, 1200 m.m. etc. The soft conversion of 4'0" is 1219 m.m.

The plan form allows for several planning approaches. Conventional double corridor layouts are possible with offices on the window walls with an internal zone for storage or special use. The large open floors are ideally suited for office landscaping. The square 84'0" plan is also suited to having some offices on the north and south walls and still have a broad enough

floor for office landscaping. This approach is seen as being most appropriate for several of the floors.

There is a predominant bias to a male population in the Department. The toilet accommodation is planned with the cubicles in the adjoining male and female toilets to be in line so that on any particular floor the partition can be located to suit the make up of the population of that section.

The mechanical plant room is located on the roof of the building. It is recognised that the plant can be a source of excessive noise to the top floor of the offices. Items of plant that constitute the greatest hazard are located over one service core with the air handling plant on the roof enclosure, suitably isolated from the structure to minimize excessive noise.

At this stage no provision has been made for staff recreation areas as it is envisaged that this will be one of the facilities provided in common to the Mineral Sciences Centre in the amenities building, presently the 'Y-block'.

To summarise, it is recognised that flexible accommodation is essential in planning to the Department as its complexion is constantly changing. To this end every endeavour has been made to present a solution that provides a great degree of flexibility in planning and use.

6. ACCOMMODATION SCHEDULE

The schedule below sets out the accommodation as set out in the brief and also shows where additional space has been requested and has been included in the planning. The schedule also shows what accommodation is provided on each floor based on planning studies done to date.

ACCOMMODATION (AS PER BRIEF)		PROPOSED ADDITIONAL AREA	
1. GROUND FLOOR			
correspondence-gen.counter	1,380	security room	100
registration	240		
editorial & technical inf.	620		
supply	300		
museum & mineral display	1,400		
study cubicles	480		
sub total	4,420	sub total	4,520
2. FIRST FLOOR			
records	4,720		
accounts	1,410		
sub total	6,130	sub total	6,130
3. SECOND FLOOR			
field survey division	520		
reproduction, compilation	2,160		
illustration & display	960		
chief survey draftsman	150		
cartographer	120		
registration and gen. drafting	2,210		
sub total	6,120	sub total	6,120
4. THIRD FLOOR			
registration and gen. drafting	2,180	palaeontology library	300
mineral develop. engineer	270		
palaeontology section	1,740		
state mining branch	1,680		
sub total	5,870	sub total	6,170
5. FOURTH FLOOR			
hydrogeology	1,710		
engineering geology	1,310		
geochemical exploration	1,030		
exploration geophysics	2,150		
sub total	6,200	sub total	6,200

6. FIFTH FLOOR				
petroleum engineer	420			
seismic geophysics	950			
petroleum exploration	850			
regional surveys	1,930			
mineral resources div.	2,120			
sub total	6,270		sub total	6,270
7. SIXTH FLOOR				
chief geologist	240	board room		400
exploration division	600	wardens clerk		300
wardens	240	board room		400
head department	870	conference room		1,500
sub total	1,950	reading room-lounge		1,000
		sub total		5,550
TOTAL	36,960	TOTAL		40,960
plus counters 4 depts.	480			480
TOTAL NET AREA	37,440	TOTAL NET AREA		41,451

TOTAL NET AREA AS PER SCHEDULE = 41,451 sq. ft.

TOTAL GROSS AREA AS MEASURED = 59,120 sq. ft.
(including plant room)

7. ESTIMATE SUMMARY

The complete estimate and cost plan prepared by Crisp, Kavanagh & Partners is submitted under separate cover, this summary is an extract from their report

Building works	881,260
Engineering Services	
1. Mechanical & air conditioning	241,833
2. Electrical & Thermal fire alarm system	112,069
Lifts	88,475
Total	$1,323,638
10% contingency	132,363
Total	$1,456,001

The anticipated cost increases in wages and materials up till March, 1973 have been included in the above figures.

8. MECHANICAL AND ELECTRICAL ENGINEER'S REPORT.

8.1 MECHANICAL SERVICES

(a) Air Conditioning:

The basis taken for air conditioning design is as follows:-

Outside conditions - summer 100°F D.B. 70°F W.B.
winter 45°F D.B.

Inside conditions - summer 75°F D.B.
winter 70°F D.B.

Occupancy - One person per 80 sq. ft. floor area.

Fresh air - 15 c.f.m. per person minimum.

The perimeter areas of each floor to a depth of 12'0" will be served by a variable volume dual conduit system with separate air handling units for the primary and secondary air.

The internal areas of each floor will be served by a single duct variable volume system.

A minimum of six separate controlled areas per floor is envisaged the final arrangement being dependent on the ultimate occupation.

The internal zone conditioner and perimeter secondary air handling unit would be capable of using 100% outside air whenever the air temperature is suitable in order to provide to provide good operating cost economies.

All air handling equipment is located at roof level over the centre of the floor area with equipment and ductwork suitably isolated from the structure.

The refrigeration plant will be of the direct expansion type with two compressors and prime surface evaporative condensers located at roof level over one service core.

Two hot water heating boilers will be provided and located with the air handling plants. Boilers will be oil or gas fired as decided from final tariff information.

Each compressor and boiler will have a capacity of not less than 60% of the peak load requirements.

Return air will in general be taken back through the false ceiling space in order to minimise the necessity for grilles in walls and doors.

(b) Ventilation:

An exhaust system will be provided for toilets, cleaners and tea rooms etc.

A plenum system will serve the lift motor room.

(c) Hot Water:

Hot water will be provided by means of a calorifier serviced by the heating boilers detailed in (a) above.

8.2 ELECTRICAL SERVICES

Main 415/240 volt supply will be taken from an ETSA supply point of an external pad-mounted transformer unit and the main switchboard will supply both the Office and Core Library buildings. Sub-main cables will provide supply to the Distribution Boards at each floor, the Mechanical Services switchboard and the Lift Motor Room board.

General office lighting will employ recessed fluorescent units with hinged flat sheet prismatic diffusers to provide open area levels of illumination better than 550 lux. Each luminaire will be capable of fitting an additional tube to provide for loss of illumination should the areas be divided by full height partitions.

Emergency lighting from storage batteries will be installed in the stairways and at key locations at each floor.

General purpose outlets will be installed throughout the building to serve office requirements, cleaning services and special purposes called for by the Client.

Final sub-circuit cabling will be protected by the miniature circuit breakers on the distribution boards.

External lighting will be installed at entrances and the service and parking areas. The selection of units and their location will be co-ordinated with the external lighting of adjacent buildings.

The fire alarm system will employ the electro-pneumatic detectors to operate local and fire station alarms.

For the building telephone services, a main distribution frame will serve two intermediate distribution frames on each floor, through two riser systems of block cabling. Wall boxes, with draw-wires for cabling by the P.M.G., will be installed on Columns and perimeter wall. It is expected that the Client will arrange for all facility cabling from the intermediate frames.

8.3 COST ESTIMATES

The preliminary estimation of cost for the above services are:-

Mechanical	$205,000.00
Electrical	$95,000.00

9. STRUCTURAL ENGINEER'S REPORT

The structure consists of reinforced concrete construction generally with steel framed construction used only for the plant room at main roof level and in the roof over the service cores.

Floors are of flat slab construction with drop panels at columns. Service core walls will generally be load bearing reinforced concrete with external finish as off form concrete to suit the Architect's requirements. The external wall to the N-W core has been designed to allow openings into any future extension.

Footings at this stage are provisional and are subject to the results of a thorough site investigation. They are based at present on a permissible bearing pressure of 3 kips per square foot at a depth of 5'0" below ground level.

Preliminary borings done on 23rd November, 1972, indicate fill material up to approximately 16'0" to 17'0" deep at the Southern end of the present building location on site. This filling extends about 15'0" Northwards from the South side of the building. It would be beneficial to resite the building 20' - 25' Northwards from the present location.

The preliminary holes indicate silty, sandy soils overlying gravel at varying depths from 7'0" to about 17'0" below ground level. We are advised

that perched water tables will probably exist in the upper zones down to the gravel. (Probably old creek bed).

The indications are that footings will need to be based on the gravel provided that the depth of same is adequate and that the soils underlying the gravel are firm.

For the present we suggest that the provisional design be used for estimating but that a contingency of $10,000 be allowed against the need for deeper based footings.

EXISTING Z BLOCK

Existing brick wall.

POSSIBLE FUTURE EXTENSIONS

CH2

CH3

PROPOSED DEPARTMENT OF MINES HEAD OFFICE

CH1

0 10 20 30 metres.

AUSTRALIAN MINERAL FOUNDATION

R O A D W A Y

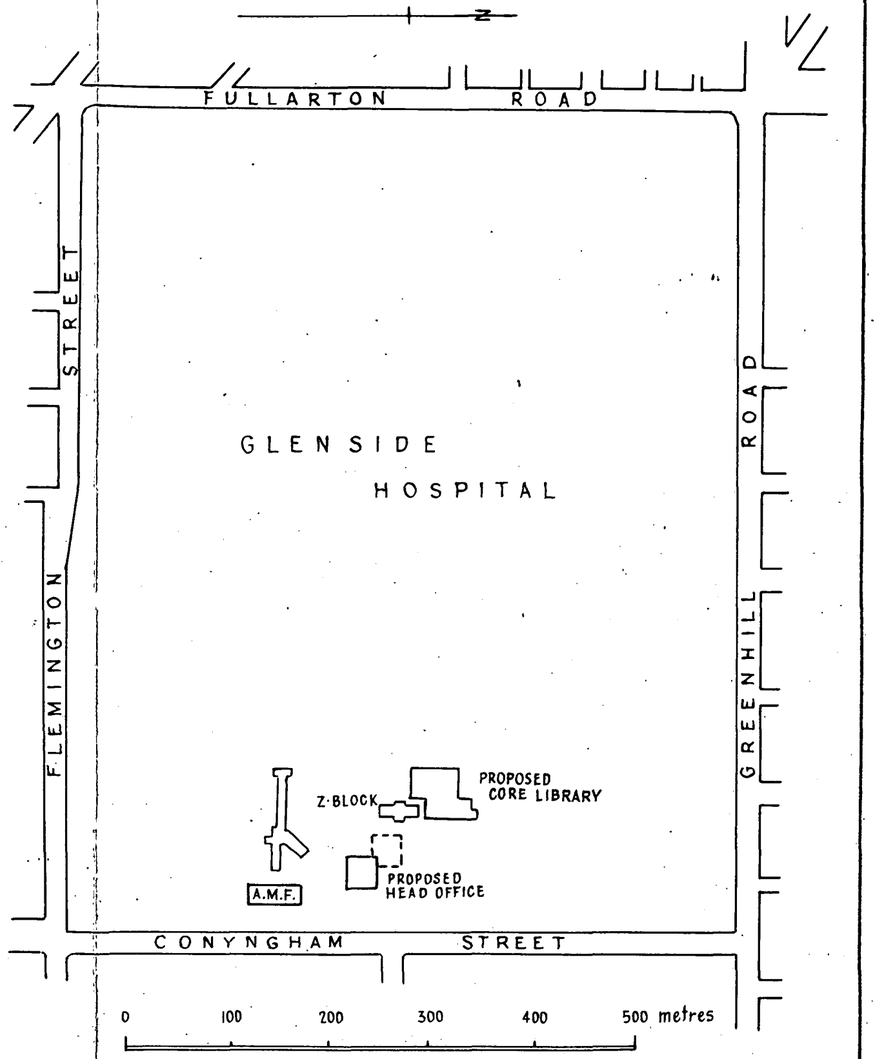
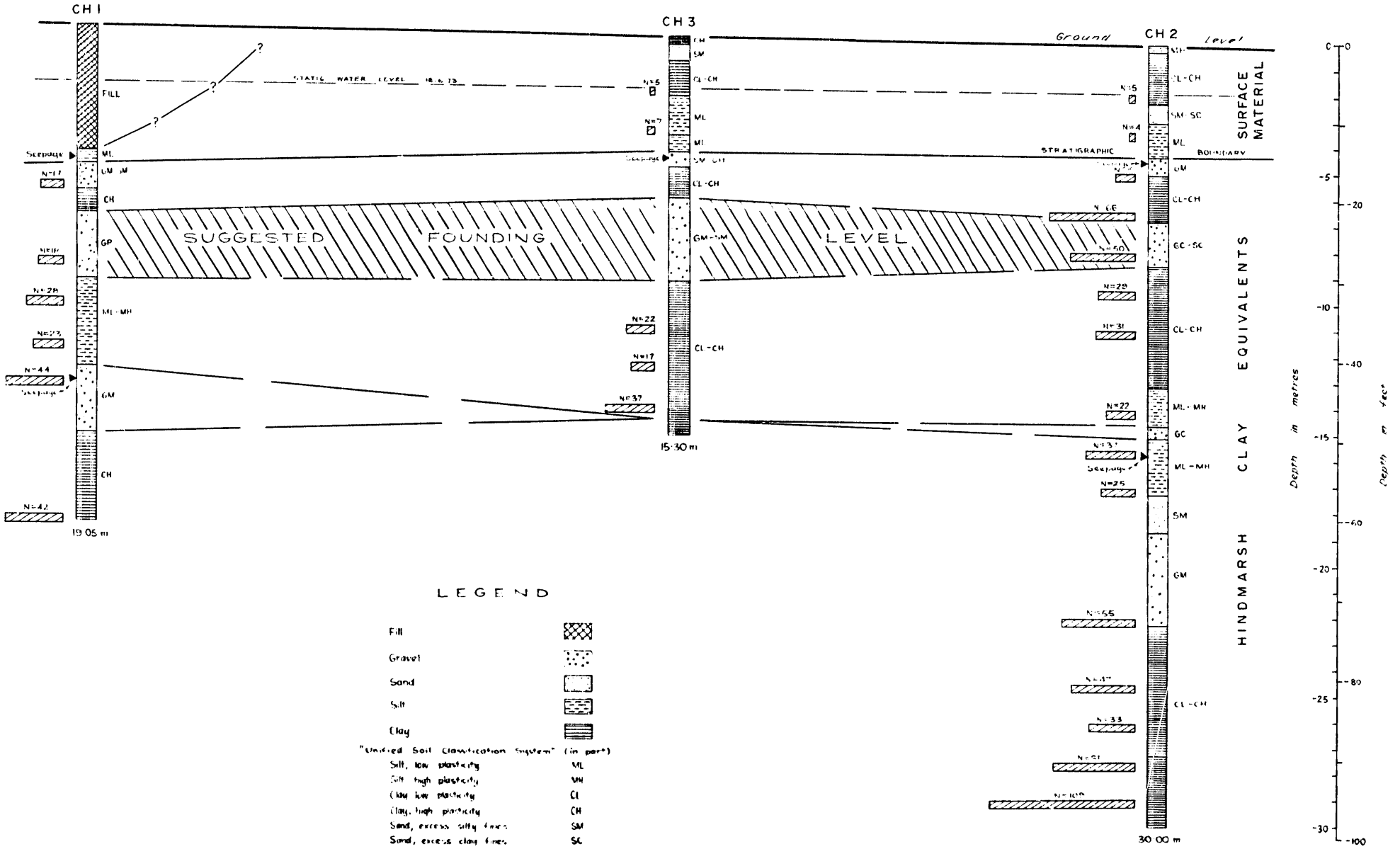


FIG 1.

ENGINEERING GEOLOGY SECTION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: -
Compiled: R. F. Jeune	DEPARTMENT OF MINES - GLENSIDE HEAD OFFICE -FOUNDATION INVESTIGATION LOCATION PLAN	Date: 18th July '73.
Drn. B.S.G. Ckd.		Drg. No. 73·496 Hag.

IM–2.70 A1811



LEGEND

Fill	
Gravel	
Sand	
Silt	
Clay	
"Unified Soil Classification System" (in part)	
Silt, low plasticity	ML
Silt, high plasticity	MH
Clay, low plasticity	CL
Clay, high plasticity	CH
Sand, excess silty fines	SM
Sand, excess clay fines	SC
Gravel, poorly graded	GP
Gravel, excess silty fines	GM
Gravel, excess clay fines	GC
Water Cut	
Standard Penetration Test	N=60

Note: This is a 'natural-scale' section

SCALE IN METRES

6 0 6 10

10 0 10 20 30

SCALE IN FEET

For site plan, showing location of this section, see plan number 73-496

DEPARTMENT OF MINES — SOUTH AUSTRALIA

DEPARTMENT OF MINES HEAD OFFICE -- GLENSIDE
FOUNDATION INVESTIGATIONS
GEOLOGICAL SECTION

ENGINEERING GEOLOGY SECTION		Drn. RAJ	SCALE 1:100
		Tcd. DJM	73-496
Director of Mines		Chd. RJ	Hard
		Exd.	DATE: 7th Aug '73