REPT.BK.NO. 74/132

LUCINDALE TOWN WATER SUPPLY

TEST HOLE NO.1

COMPLETION REPORT

S.R. BARNETT

Department of Mines
South Australia —

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

LUCINDALE TOWN WATER SUPPLY
TEST HOLE NO.1
COMPLETION REPORT

by

S.R. Barnett

GEOLOGIST

HYDROGEOLOGY SECTION

20/6/74

Rept.Bk.No. 74/182
G.S. No. 5448
Hyd. No. 2633
D.M. No. 224/70
(also refer 1643/65)

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PLANS

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No. 74/132
G.S. No. 5448
Hyd. No. 2633
D.M. No. 224/70
(also refer 1643/65)

LUCINDALE TOWN WATER SUPPLY
TEST HOLE NO.1
COMPLETION REPORT

LOCATION

General: 3km northeast of Lucindale

Region: 1

County: Robe

Hundred: Joyce

Section: 400

ABSTRACT

Lucindale Test Hole No.1 was drilled to test the yield and salinity of the Knight Group pressure aquifer. A supply of 18 litres/sec with a salinity of 1129 mg/l was obtained. A transmissivity of 42 metre^3/day/metre was calculated for a bore penetrating 60% of the Knight Group aquifer. The specific capacity of the bore was 0.7 litres/sec/metre. Due to incorrect siting, the bore was not developed for the town water supply and is now used for observation purposes. Water levels of the Knight Group aquifer recorded from February 1971 to May 1974 show a seasonal fluctuation of two metres due to recharge effects at the intake area.

INTRODUCTION

Following a request from the E. & W.S. Department, a test bore was drilled near Lucindale with the intention of ascertaining the salinity and yield of the Knight Group aquifer. The Gambier Limestone aquifer was considered unsuitable for a town water supply due to pollution from underground

drainage and because of its high salinity (about 2 400 mg/l).

Drilling commenced in late 1968 using a cable tool rig. The bore entered the Knight Group at 67m with the overlying Gambier Limestone aquifer being cased off. The final depth of the bore was 125m.

In early 1969, the bore was pumped for development (for 86 hours) using a 6 inch 12 stage test pump set at 55m.

The aim of this report is to analyse the pumping test performed on the bore and assess the capabilities of the aquifer.

HYDROGEOLOGY

The generalized stratigraphy in the Lucindale area is as follows:- The Bridgewater Formation overlying Gambier Limestone which in turn overlies the Knight Group.

The stranded coastlines of the Bridgewater Formation form a series of northwest trending ranges about 15m in height. It is of Pleistocene age and consists of a fine to medium grained calcareous brown sand, usually well sorted with several consolidated bands about 3m thick which contain groundwater in limited and variable supplies.

The unconfined Gambier Limestone aquifer of Oligocene age consists mainly of a marly bryozoal calcarenite which in the vicinity of Lucindale is about 80m thick. Due to the cavernous nature of the aquifer, it is easily polluted locally by subsurface drainage, and hence is unsuitable for a town water supply.

Consequently the pressure water of the underlying Knight Group of Eocene age was preferred, as it was considered to contain unpolluted water of lower salinity. The Knight Group contains lignitic clays, sands and gravels, with

the sands and gravels forming the better aquifers.

The bore penetrated 30m of Bridgewater Formation with water of salinity 2230 mg/l being cut in a consolidated band at a depth of 17m. Underlying this, 37m of Gambier Limestone was intersected with water cut at a depth of 37m from the surface with a salinity of 2640 mg/l. This suggests that the Gambier Limestone is partly confined in this area. The bore then penetrated the Knight Group at 67m. Waters cut at 89m had a salinity of 2570 mg/l. However, deeper in the Knight Group aquifer the salinity improved to 1394 mg/l.at 119m and 1129 mg/l at 121m after pumping, but increased to 1570 at 125m. Consequently the best water bearing sands were developed between 114m and 120m.

The preliminary log of percussion sludges (A.H. Morton) is presented in Appendix A. Detailed palaeontological examination is yet to be carried out. Appendix B contains full analyses for the deeper Knight Group waters.

CONSTRUCTION DETAILS

Drilling commenced on the 17th October, 1968 and was completed by the 21st February, 1969. Initially, a 10 inch hole was drilled to 86m and the casing shoe cemented at that depth using the dump bailer method. The cement plug was drilled out and the hole extended to 87.5m with 8 inch casing pressure cemented to surface. The bore was then extended to 124m and 6 inch casing installed.

Water bearing sands were cut at 89m and sand samples were taken every 0.6m for sandscreen analyses. As the sands were under considerable pressure and were heaving up to 30m inside the casing it was necessary to keep the hole full of drilling mud.

At 125m the drilling mud was bailed out and water samples taken for analysis. On receiving the analysis results, the bore was backfilled to 120m with rock fill. Casing (5 inch) was inserted from 78m to 114m with a 5 inch "Surescreen" stainless steel sandscreen with .045in. aperture set from 114m to 120m. The 6 inch casing was then removed from the bore and a stainless steel banded rubber seal was inserted between the 5 inch and 8 inch casings at 78m. A summary of the bore construction is shown diagrammatically in Fig.2.

DEVELOPMENT PROCEDURES

The drilling mud was cleaned out and the bore surged and bailed to develop the screen. A 6 inch 12 stage pump was installed at 35m and the bore pumped at approximately 10 litres/sec (8 000 gals/hr) for four hours. However, sand grains coarser than the screen aperture were discharged by the pump indicating that the seal between the 5 inch and 8 inch casings was ineffective. A lead packer type seal was consequently installed.

The bore was then pumped and developed for 86 hours due to difficulties with blowing sands. The pumping rate commenced at approximately 10 litres/sec (8 000 gals/hr) rising to 18 litres/sec (14 400 gals/hr). The bore was very slow to develop with the water containing much lignitic material which cleared on completion of pumping. However, if pumping was stopped for 10 minutes and then restarted, lignitic material and some sand discoloured the water for up to 45 minutes. At a reduced rate of 10 - 12.5 litres/sec (8 000 - 10 000 gals/hr), the water cleared immediately. The bore was not developed further.

At this stage it was discovered that the bore was not drilled at the specified location, which was closer to

Lucindale. The then Senior Geologist of the Hydrogeology Section, C. Bleys, recommended that the bore be retained for observation purposes and a supply hole be drilled closer to town to decrease the cost of laying a pipeline. At present it is equipped with a vertical drum water level recorder to monitor water levels in the pressure aquifer. Results for period February 1971 to May 1974 are shown in Fig.4 and discussed later in this report.

SCREEN SIZE ANALYSIS

The grain analyses for the developed interval from 114 to 120m (374 to 394 ft) are shown in Appendix C. Analyses for the interval from 100 to 114m are contained in the bore folder (Folder 217/69). Samples were taken every 2 ft (0.6m).

Johnson (1966) recommends that for a homogeneous formation of fine sand, the slot size should retain 40% to 50% of the aquifer material - preferably 50% if there is some doubt as to the reliability of the samples.

The screen aperture selected and installed was 0.045in. On the basis of the sand analyses, the amount of aquifer material retained for each interval is as tabulated below.

INTERVAL (ft)	% RETAINED
374 - 376	34
376 - 378	58
378 - 380	44
380 - 382	48
382 - 384	51
384 - 386	65
386 - 388	48
388 - 390	44
390 - 392	63
392 - 394	53

As can be seen from the above results, the selection of the screen aperture was quite acceptable.

AQUIFER DATA

The results of the pumping during development are summarized in Table 1. A computer programme developed by F. Kalf and K. Tan (1973) calculates transmissivity in Imperial units from one drawdown measurement utilizing a method devised by Ogden (1965).

From the Theis equation:

$$s = \frac{114.6\ Q\ W(u)}{T} \qquad \text{----- (1)}$$

where s = drawdown in feet

Q = pumping rate in galls/min

T = transmissivity in galls/day/ft

and W(u) = well function or exponential integral given by

$$W(u) = \int_u^\infty \frac{e^{-u}}{u}\, du$$

where

$$u = \frac{1.56\ r^2 s}{Tt} \qquad \text{----- (2)}$$

r = effective radius of the bore in feet

S = storage coefficient

T = transmissivity in galls/day/ft

t = pumping period in days

Equating equations (1) and (2),

$$uW(u) = \frac{1.56\ r^2\ S\ s}{114.6\ Q\ t} \qquad \text{----- (3)}$$

This programme evaluates uW(u) by substituting values for r, s, Q and t and an estimated value of S in equation (3) and calculating a value of u which is substituted in equation (2) to determine T.

TABLE 1

PUMPING LEVEL (metres)	RATE (litres/sec)	TIME (hours)	DRAWDOWN (metres)	TRANSMISSIVITY (metres^3/day/metre)
21.3	10	7	8.8	75.5
33.1	12.5	10	20.7	38.9
30.8	12.5	10	18.3	44.8
29.9	12.5	10	17.4	47.5
37.8	16.5	10	25.3	41.8
40.2	17.5	5	27.7	37.5

where $r = 2.5$ ins.

and $S = 10^{-4}$ (value determined for the upper Knight Group aquifer at Mount Gambier by Valentine and Waterhouse, 1974).

Apart from the first value, the transmissivity values are quite consistent with an average of 42 metre^3/day/metre. Due to turbulent head loss, the transmissivity appears to decrease (with increasing pumping rate).

The specific capacity of the bore, calculated by Q/s (where Q is the pumping rate and s, the drawdown) was 0.7 litres/sec/metre for 10 hours pumping at 16.5 litres/sec during the later development stages.

KNIGHT GROUP WATER LEVELS

Examination of the water levels for the Knight Group (shown in Fig.4) between February 1971 and May 1974 show a marked seasonal variation. The lowest levels are seen in April and the highest in September-October with an amplitude of approximately two metres. This could reflect the effects of recharge and/or withdrawals from the aquifer. The only bores penetrating the Knight Group within 15 km are the Lucindale Town Supply bores 3 km to the southwest. Pumping was commenced in February 1973 and although a correlation exists between pumping rate and water level as shown in Fig.4, the fact that the water level variations occurred before pumping started

suggests that this agreement is coincidental. The effect of over 100 irrigation bores 20-40 km to the west is considered insignificant considering the fact that the Knight Group thickens to about 300 m in that direction. The resulting distance-drawdown relationships are such that any effect would not be measurable at Lucindale.

Based on groundwater recharge studies and hydrochemical investigations, Floegel (1972) states that the main intake area for pressure water between Kingston, Naracoorte and Beachport lies in swampy areas around and to the south of Penola. The time taken for a pressure pulse to reach Lucindale from the recharge area was calculated using a computer programme based on a method devised by Luthin and Holmes (1960). The diagrammatic cross-section (Fig.5) was drawn using data from Floegel (1972). The Knight Group aquifer thins considerably from a thickness of about 300 m at the intake area to 75 m at Lucindale. The underlying Cretaceous sediments yield more or less stagnant connate water of very high salinities and are not considered to take part in the hydrologic cycle. Assuming transmissivities of the order of 1 500 metre^3/day/metre or higher and a storage coefficient of 10^{-4} (Valentine and Waterhouse, 1974) for the thicker portion of the Knight Group aquifer, the time taken to transmit the pressure pulse through this portion would be a maximum of approximately one month. For the remaining thinner portion of the aquifer, a transmissivity of 50 metre^3/day/metre is assigned (calculated value 42 metre^3/day/metre for Lucindale Test Hole No.1 which penetrates about 60% of the aquifer). If the pressure pulse due to recharge is to reach Lucindale by the times shown on the graph the storage coefficient must be of the order of 10^{-5}. Alternatively, for a value of 10^{-4} (calculated by Valentine and Waterhouse, 1974

and also Floegel, 1972), the transmissivity should be of the order of 500 metres^3/day/metre.

It is consideredtthat these values are within the range expected for the aquifer, and that the water level fluctuations at Lucindale are therefore caused by seasonal recharge effects at the intake area.

SUMMARY

Lucindale Test Hole No.1 was drilled to ascertain the salinity of the Knight Group aquifer. Although a supply of 18 litres/sec (14 000 galls/hr) was obtained with a salinity of 1130 mg/l, the bore was not fully developed as a town water supply bore because a misunderstanding resulted iniit being incorrectly located. It is now being used as an observation bore.

Data obtained from pumping during development was analysed using a computer programme devised by Kalf and Tan to calculate transmissivity from one value of drawdown. This is the first use of thisprogramme by this Department and very useful, consistent results were obtained.

A transmissivity of 42 metre^3/day/metre was calculated for a bore penetrating 60% of the Knight Group aquifer. The specific capacity of the bore was 0.7 litres/sec/metre.

Seasonal variations of up to two metres were recorded in the Knight Group water levels from February 1971 to May 1974. The time taken for a pressure pulse due to recharge to reach Lucindale from the intake area was computed using a method formulated by Luthin and Holmes.

20/6/74
SRB:TB

S.R. BARNETT
GEOLOGIST
HYDROGEOLOGY SECTION

REFERENCES

Floegel, H., 1972. The Position of the Lower Tertiary Artesian Aquifer Within the Hydrogeology and the Hydrochemistry of the Gambier Embayment Area (South Australia/Victoria). Unpublished Ph.D. Thesis, Munich University.

Harris, B.M., 1971. Results of Flow Testing Lucindale Bore No.2. S.A. Department Mines Report R.B. 71/26 (unpublished).

Johnson, Edward E., Inc., 1966. Ground Water and Wells.

Kalf, F., and Tan, K., 1972. PDP 8/E Focal Programme to Calculate Transmissivity from One Drawdown. W.C. and I.C. Hydrogeological Rept. No. Z02-006.

Valentine, J.T., and Waterhouse, J.D. 1974. Production Tests of the Upper Knight Group Aquifer at Mount Gambier. S.A. Dept. of Mines Report R.B. 74/81 (unpublished).

Luthin, J.N., and Holmes, J.W., 1960. An Analysis of the Flow of Water in a Shallow, Linear Aquifer, and of the Approach to a New Equilibrium after Intake. J. Geophys. Res., 65,(5):1573-1576.

APPENDIX A

PRELIMINARY GEOLOGICAL LOG

DEPARTMENT OF MINES SOUTH AUSTRALIA

HYDROGEOLOGY SECTION

BORE LOG

HIRER E & W & DEPT

Drill type CABLE TOOL — A.M.G. Zone — HUNDRED JOYCE

Circulation — Logged by W.H. MORTON Coords. E — SECTION 400

Driller R. TOOHEY — Date logged MARCH '69 " N — STATE No. 413040005

Start 22·10·68 — Bore Diameter — Datum Elev. — Project No. TEST HOLE N°1

Finish 20·2·69 — DEPTH 125 (m) — Ref. Pt. Elev. — Docket No. 1643/69

Surface Elev. — Bore Serial No. 17/69

Depth to Water cut (m)	Depth to standing water (m)	SUPPLY litres/sec.	SUPPLY Method of test	TOTAL DISSOLVED SOLIDS Milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis W. No.
17 m				2230	W 5487/68
37 m				2640	W 5488/68
89 m				2570	W 5489/68
121 m	12·5	17·5	PUMP	1129	W 2000/69

REMARKS Test bore now used for observation purposes.

CASING	WATERS CUT	WATER LEVEL	DEPTH (m)	CORE	GRAPHIC LOG	AGE	UNIT	DEPTH (m) from	DEPTH (m) to	DESCRIPTION
8" and 10" casing			0			Pleistocene	Bridgewater formation	0	3	ARENITE Brown, fine to medium grained.
								3	6·1	ARENITE Consolidated, calcareous, brown, fine to medium grained.
			5					6·1	15·2	ARENITE Brown, fine to medium grained, calcareous
			10							
			15							

Drn: E.B.C — Sheet 1 of 6

Date: 21·6·74 — Bore Folder No. 217

PF N° S10537 MH

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CASING | WATERS CUT | WATER LEVEL | DEPTH (m) | CORE | GRAPHIC LOG | AGE | UNIT

8" and 10" casing

Pliestocene

Bridgewater formation

Oligocene Lower Miocene

Gambier Limestone

DEPTH (m) from	to		DESCRIPTION
15·2	18·3	ARENITE	Consolidated, calcareous, brown, fine to medium grained.
18·3	21·3	ARENITE	Calcareous, brown, fine to medium grained
21·3	24·4	ARENITE	Consolidated, calcareous, brown, fine to medium grained.
24·4	30·5	ARENITE	Calcareous, brown, fine to medium grained.
30·5	42·7	CALCARENITE	Bryozoal, cream, soft.

Borehole State No.

Drn: E.B.C. | Sheet 2 of 6

Date: 21·6·74 | Bore Folder No. 217

PF Nº S10537a MH

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CASING | WATERS CUT | WATER LEVEL | DEPTH (m) | CORE | GRAPHIC LOG | AGE | UNIT

8" and 10" casing

40
45
50
55
60
65

Oligocene Lower Miocene
Gambier Limestone

DEPTH (m) from	to	DESCRIPTION
42·7	54·9	CALCARENITE Bryozoal, soft, marly, glauconitic, green.
54·9	67·1	CALCARENITE Bryozoal, soft, gray, silty and marly.

Borehole State No.

Drn: E.B.C. | Sheet 3 of 6

Date: 21·6·74 | Bore Folder No. 217

PF No S10537a MH

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CASING	WATERS CUT	WATER LEVEL	DEPTH (m)	CORE	GRAPHIC LOG	AGE	UNIT	DEPTH (m) from	DEPTH (m) to	DESCRIPTION
8" and 10" casing			65			Eocene	Kingt Group	67·1	82·3	SILTITE Sandy, brown. Some bryozoal fragments.
			70					82·3	89·0	LUTITE Carbonaceous, black, slightly silty.
			75					89·0	94·2	ARENITE Silty, very fine to very coarse quartz grains, well rounded, brown.
			80							
			85							
		89	90							

Borehole State No.

Drn: E.B.C. | Sheet 4 of 6

Date: 21·6·74 | Bore Folder No. 217

PF Nº S10537a MH

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CASING | WATERS CUT | WATER LEVEL | DEPTH (m) | CORE | GRAPHIC LOG | AGE | UNIT

DEPTH (m) from	to	DESCRIPTION
94·2	96·3	LUTITE Sandy, lignitic, fine to coarse grained quartz, rounded, black.
96·3	97·8	ARENITE Clayey, lignitic, fine to coarse grained, rounded quartz. Black.
97·8	100·0	ARENITE Silty, lignitic (as above)
100·0	111·6	ARENITE Silty, brown. Fine to very coarse quartz grains, angular and rounded. (for sieve analysis)
111·6	117·0	NO SAMPLES

86m of 5" casing

Eocene

Knight Group

Borehole State No.

Drn: E.B.C. | Sheet 5 of 6

Date: 21·6·74 | Bore Folder No. 217

PF No S10537a MH

DEPARTMENT OF MINES — SOUTH AUSTRALIA

CASING	WATERS CUT	WATER LEVEL	DEPTH (m)	CORE	GRAPHIC LOG	AGE	UNIT	DEPTH (m) from	to	DESCRIPTION
5" sandscreen (loose aperture)	121m		115–125			Eocene	Knight Group	117·0	118·3	**RUDITE** Clean, brown coarse grain, angular quartz feldspar mica pebble ½" across
								118·3	118·9	**RUDITE** dirty (silty)
								118·9	120·1	**RUDITE** Clean, water drinkable but soft taste. SWL 12·5m
								120·1	125·0	**RUDITE** Silty to medium grained. (sieve analysis of sand from 100–125m
			125							**END OF BORE**
			130							
			135							
			140							

Borehole State No.

Drn: E.B.C. | Sheet 6 of 6

Date: 21·6·74 | Bore Folder No. 217

PF Nº S10537a MH

APPENDIX B

WATER ANALYSES

CONYNGHAM ST. FREWVILLE SOUTH AUSTRALIA 5063 TELEPHONE 79 1662 TELEGRAMS 'AMDEL' ADELAIDE

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

PLEASE ADDRESS ALL CORRESPONDENCE TO THE DIRECTOR.

OUR REFERENCE: AN1/6/0 - 2411/69
YOUR REFERENCE: W5703/68

20th January, 1968

The Director,
Department of Mines,
Box 38 Rundle Street PO,
ADELAIDE. S.A. 5001.

WATER ANALYSIS

Constituent	Parts Per Million	Equivalents Per Million
Anions		
Chloride (Cl)	650	18.3
Sulphate (SO_4)	65	1.4
Bicarbonate(HCO_3)	320	5.2
Nitrate (NO_3)	Nil	
Fluoride (F)		
Cations		
Sodium (Na)	397	17.3
Potassium (K)		
Calcium (Ca)	79	3.9
Magnesium (Mg)	45	3.7
Iron (Fe)		
Silica (SiO_2)		
Total Dissolved Solids	1390 1394	49.8

Assumed Composition of Salts	Parts Per Million
Calcium bicarbonate	319
Calcium sulphate	
Calcium chloride	
Magnesium bicarbonate	96
Magnesium sulphate	81
Magnesium chloride	51.
Sodium bicarbonate	
Sodium sulphate	
Sodium chloride	1009
Sodium nitrate	
Potassium chloride	
Iron bicarbonate	
pH ..... units	
Conductivity ..... Micromhos/cm/25°C	
Sodium to Total Cations (Equivs.) Ratio 69.5 %	

Hardness (as Calcium carbonate)	Parts Per Million
Total	395
Temporary	265
Permanent	120
Due to Calcium	200
Due to Magnesium	185
Due to Iron	
Total alkalinity as Calcium carbonate	265
Free Carbon dioxide	

W.N.Metc 20/1/69
Chloride high

Name E & W S ..... Hole No. 1
Water Cut
Address Lucindale ..... Water Level
Supply
Hundred Joyce ..... Depth Hole 390'
Section adj 400 ..... Date Collected 10/12/68
Sample collected by R B Toohey 17/1/69

P. A. YOUNG
Director

CONYNGHAM ST. FREWVILLE SOUTH AUSTRALIA 5063 TELEPHONE 79 1662 TELEGRAMS 'AMDEL' ADELAIDE

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

PLEASE ADDRESS ALL CORRESPONDENCE TO THE DIRECTOR.

OUR REFERENCE: AN1/8/0 - 3223/69
YOUR REFERENCE: W2000/69
Vol. 2

12th May, 1969

The Director,
Department of Mines,
Box 38 Rundle Street PO,
ADELAIDE. S.A. 5001.

FORM 13

WATER ANALYSIS

Constituent	Parts Per Million	Equivalents Per Million
Anions		
Chloride (Cl)	505	14.2
Sulphate (SO_4)	< 5	
Bicarbonate (HCO_3)	405	6.6
Nitrate (NO_3)*	Nil	Nil
Fluoride (F)		
Cations		
Sodium (Na)	295	12.8
Potassium (K)		
Calcium (Ca)	79	3.9
Magnesium (Mg)	50	4.1
Iron (Fe)		
Silica (SiO_2)		

Assumed Composition of Salts	Parts Per Million
Calcium bicarbonate	320
Calcium sulphate	
Calcium chloride	
Magnesium bicarbonate	197
Magnesium sulphate	
Magnesium chloride	67
Sodium bicarbonate	
Sodium sulphate	
Sodium chloride	750
Sodium nitrate	Nil
Potassium chloride	
Iron bicarbonate	
pH ..... units	

Hardness as Calcium carbonate)	Parts Per Million
Total	400
Temporary	330
Permanent	70
Due to Calcium	195
Due to Magnesium	205
Due to Iron	
Total alkalinity as Calcium carbonate	330
Free Carbon dioxide	

REMARKS

CD 13.V.69.

Sodium to Total Cations Ratio (Equivs.) 61.5 %

Conductivity ..... Micromhos/cm/25°C

Total Dissolved Salts
a. Determined at 180°C - ppm
b. Calculated (Carbonate as CO_3) 1129 ppm

*Note: Trace NO_3 =< 20 ppm Detected. Nil NO_3 =< 20 ppm Not Detected.

Name E & W S Dept Hole No. 1

Water Cut

Address Lucindale Water Level

Supply

Hundred Joyce Depth Hole 395'

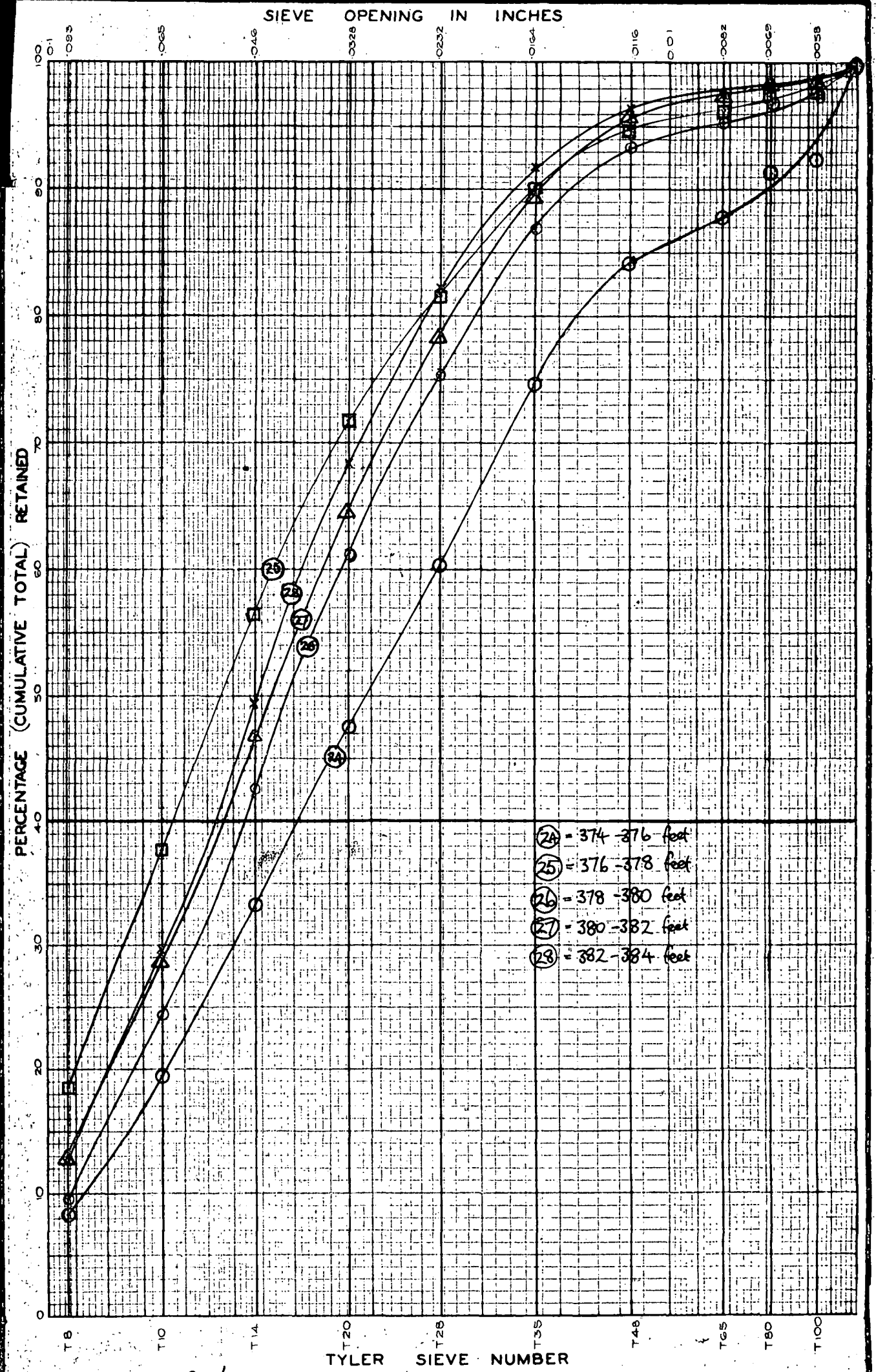
Section Adj 400 Date Collected 19/2/69

Sample collected by R. B. Tooley

Director

APPENDIX C

GRAIN SIZE ANALYSES



374 - 394 feet
SCREEN RECOMMENDED T14

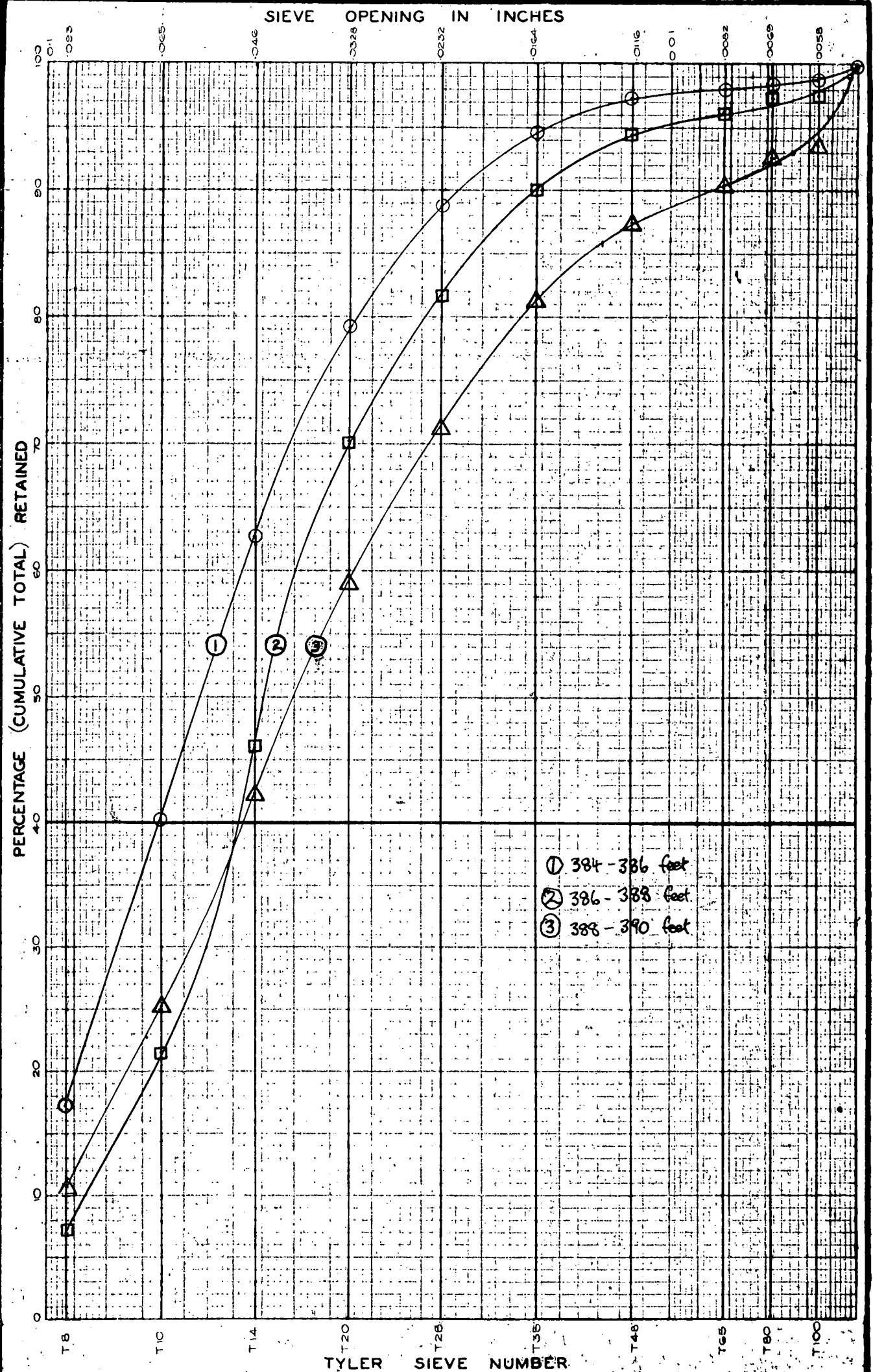
W. H. Morton

BOREHOLE IDENTIFYING No. 17/69

INTERVAL 376 FT. TO 384 FT.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

HYDROGEOLOGY SECTION	Drn. WM	LUCINDALE TOWN WATER SUPPLY	SCALE: S7163f Ke4
	Tcd. AR		
	Chd. L.V.W.	E&W S BOREHOLE 1	
SENIOR HYDROGEOLOGIST	Exd.	SCREEN SIZE ANALYSIS	DATE: 14 FEB 69



374 – 394 feet.
SCREEN RECOMMENDED T 14

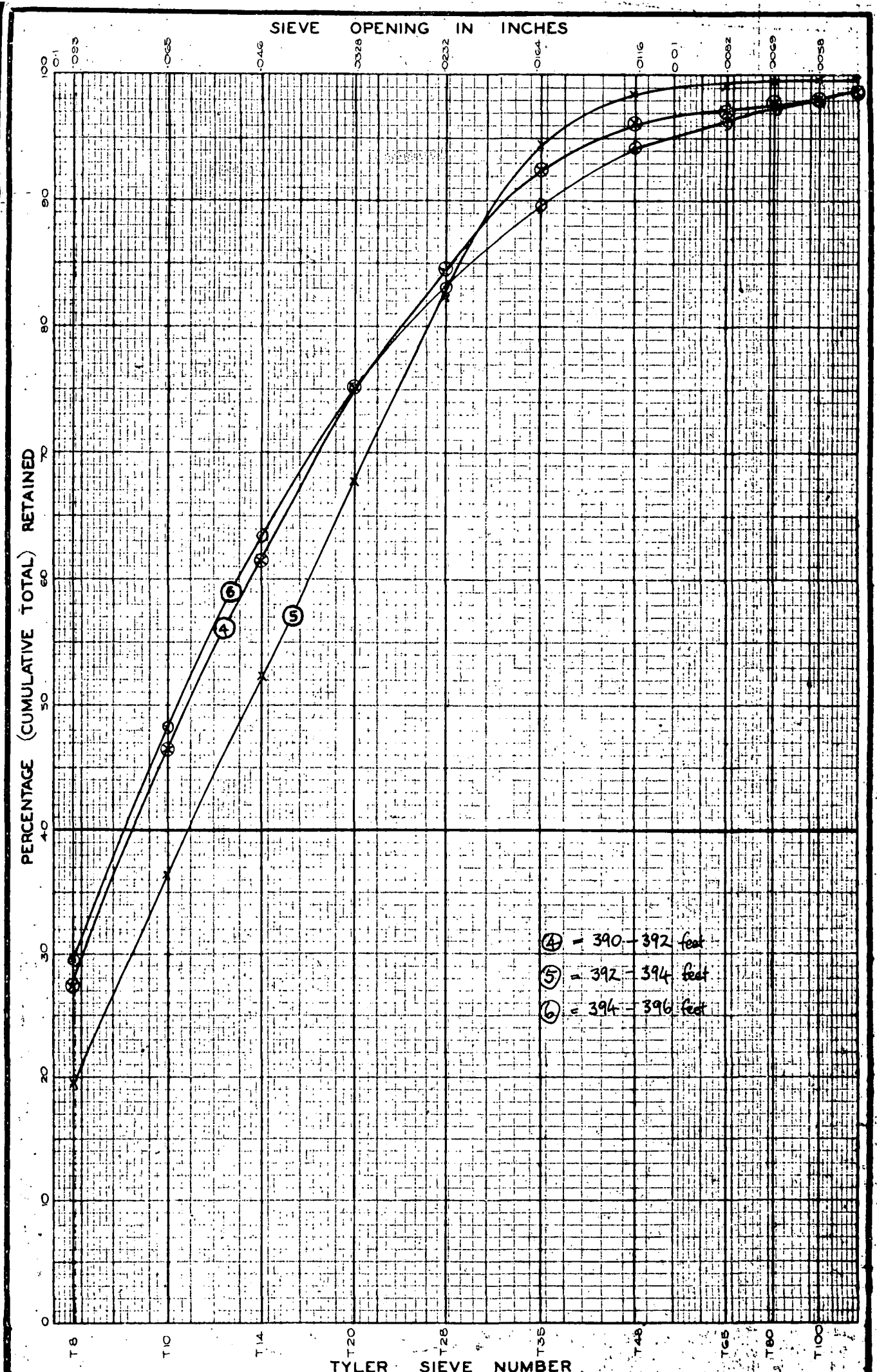
W.H. Morton

BOREHOLE IDENTIFYING No. 17/69

INTERVAL 384 FT. TO 390 FT. Nos 1-3

DEPARTMENT OF MINES — SOUTH AUSTRALIA

HYDROGEOLOGY SECTION	Drn. WM	LUCINDALE TOWN WATER SUPPLY	SCALE:
	Tcd. AR		S7163g
	Ckd. LVW.	E&WS BOREHOLE 1	Ke 4
SENIOR HYDROGEOLOGIST	Exd.	SCREEN SIZE ANALYSIS	DATE: 14 FEB 69



SCREEN RECOMMENDED..... BOREHOLE IDENTIFYING No. 17/69.....

INTERVAL 390 FT. TO 396 FT. Nos. 4-6

DEPARTMENT OF MINES — SOUTH AUSTRALIA

HYDROGEOLOGY SECTION	Drn. WM	LUCINDALE TOWN WATER SUPPLY	SCALE:
	Tcd. AR		57163h
SENIOR HYDROGEOLOGIST	Ckd. I.V.W.	E&WS BOREHOLE 1	No. 4
	Exd.	SCREEN SIZE ANALYSIS	DATE: 14 FEB 69

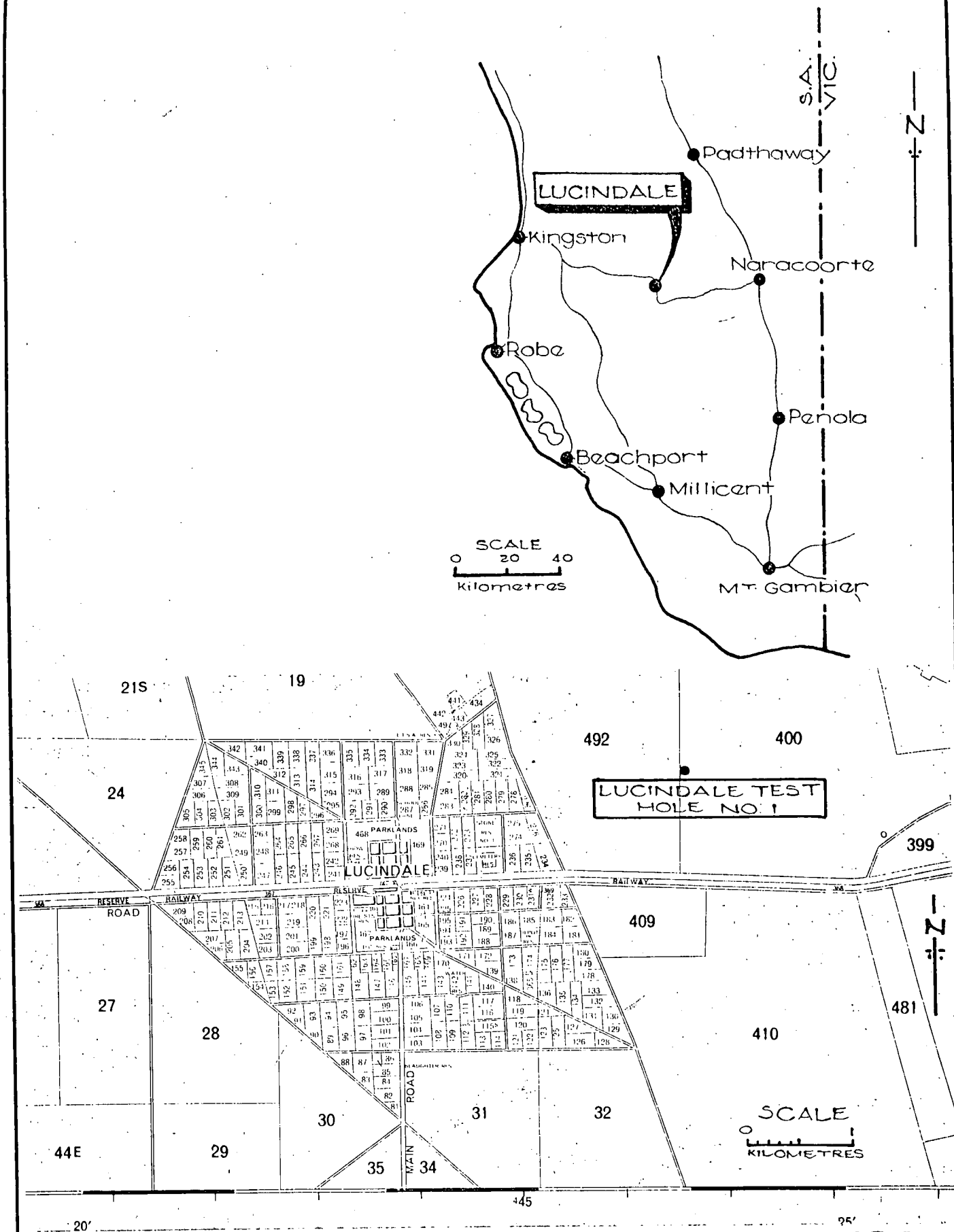


FIG. 1

	DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale : 1:50000
Compiled : S.R.B.	LUCINDALE TEST HOLE NO. 1	Date : 17 MAY 1974
Drn. R.B. Ckd A.F.	SEC 400 HD JOYCE	Drg. No. S 10886
	LOCALITY PLAN	Ke 4

IM--270 A1810

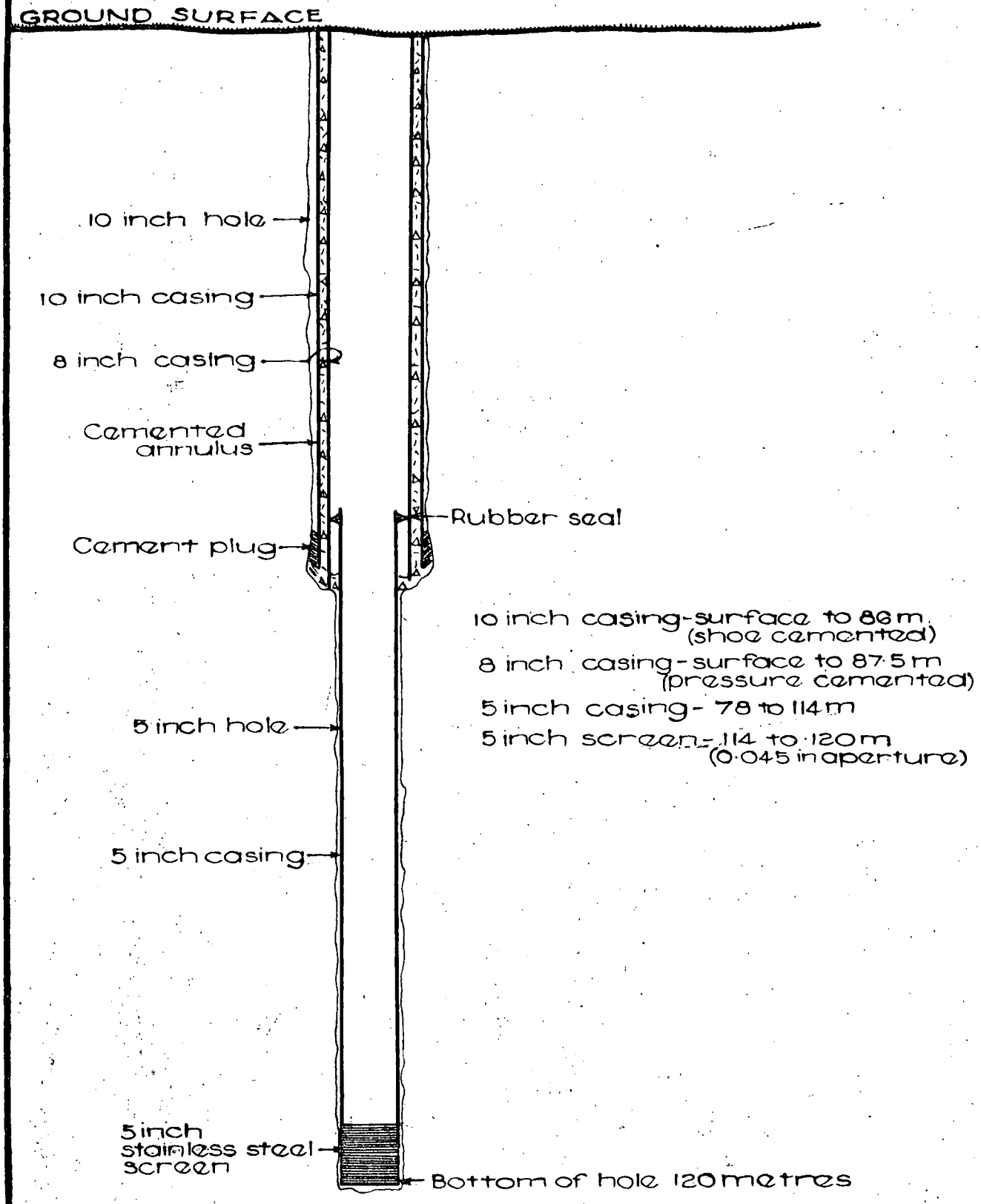


FIG.2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

HYDROGEOLOGY SECTION	Drn. S.R.B.	LUCINDALE TEST HOLE No. 1 SEC. 400 HD JOYCE	SCALE: NO SCALE
	Tcd. R.B.		S10887 Ke 4
	Ckd. A.F.		
	Exd.	BORHOLE CONSTRUCTION DETAILS	DATE: 21 May 1974

500—2.69 665

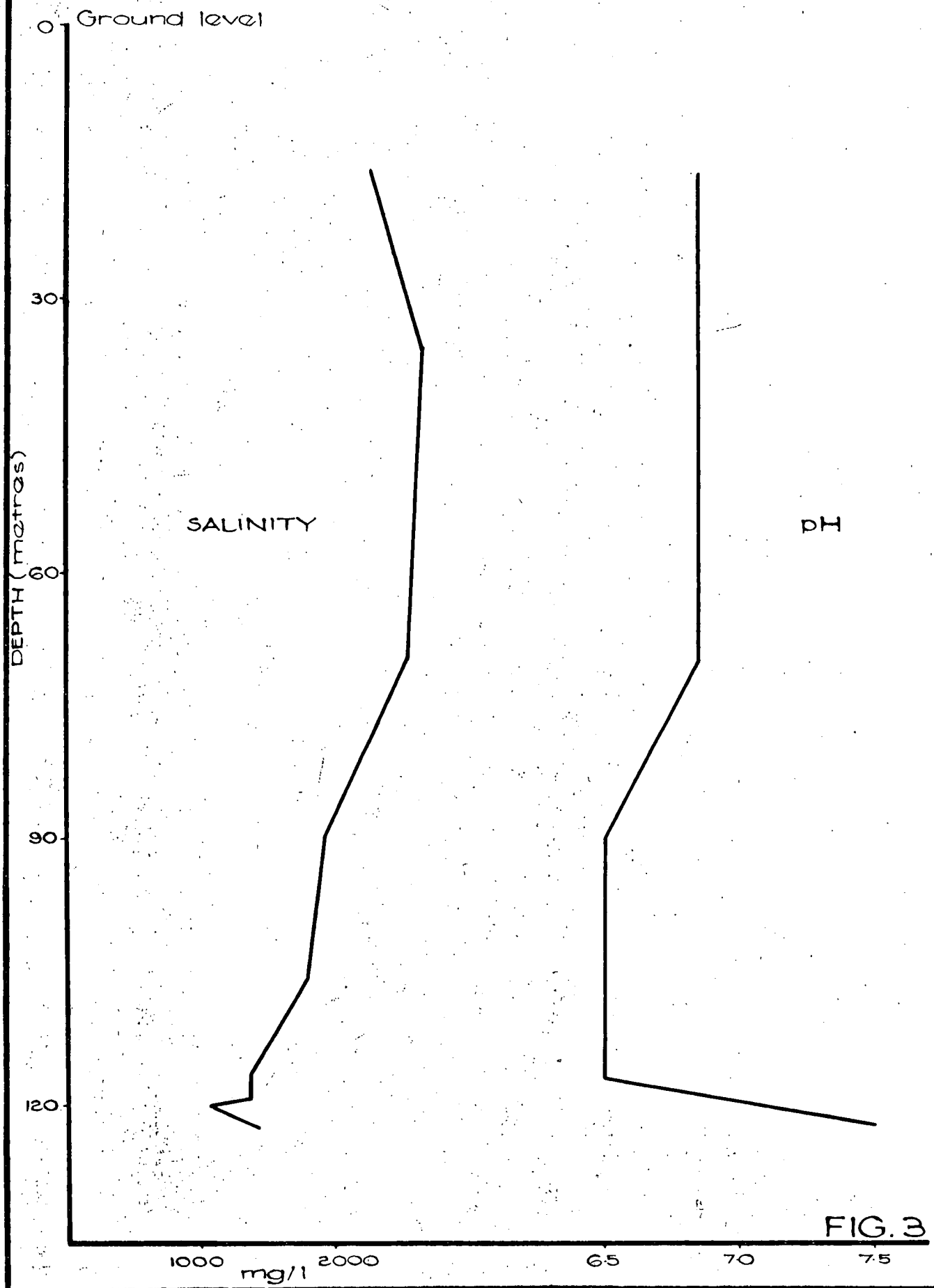


FIG. 3

DEPARTMENT OF MINES — SOUTH AUSTRALIA

HYDROGEOLOGY SECTION	Drn. S.R.B	LUCINDALE TEST HOLE NO. 1	SCALE: 1·600
	Tcd. R.B	SEC. 400 HD. JOYCE	S10888 Ke 4
	Ckd. A.F.	SALINITY AND ph PROFILES	DATE: 22ND MAY 1974
	Exd.		

500—2.69 685

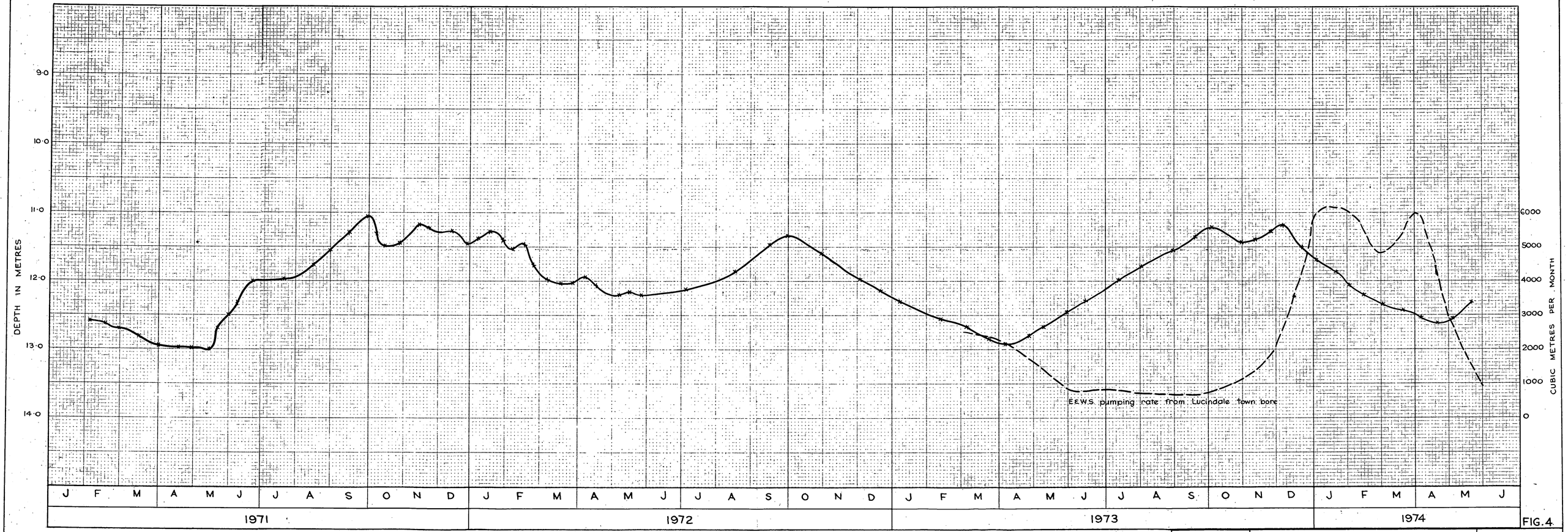


FIG.4

	DEPARTMENT OF MINES — SOUTH AUSTRALIA.	Scale :
Compiled : S.R.B.	LUCINDALE TEST HOLE NO. 1	Date : JUNE 1974
Drn. A.F. | Ckd.	WATER LEVELS — KNIGHT GROUP	Drg. No.
	FEB 1971 TO MAY 1974	74-461 Ke4

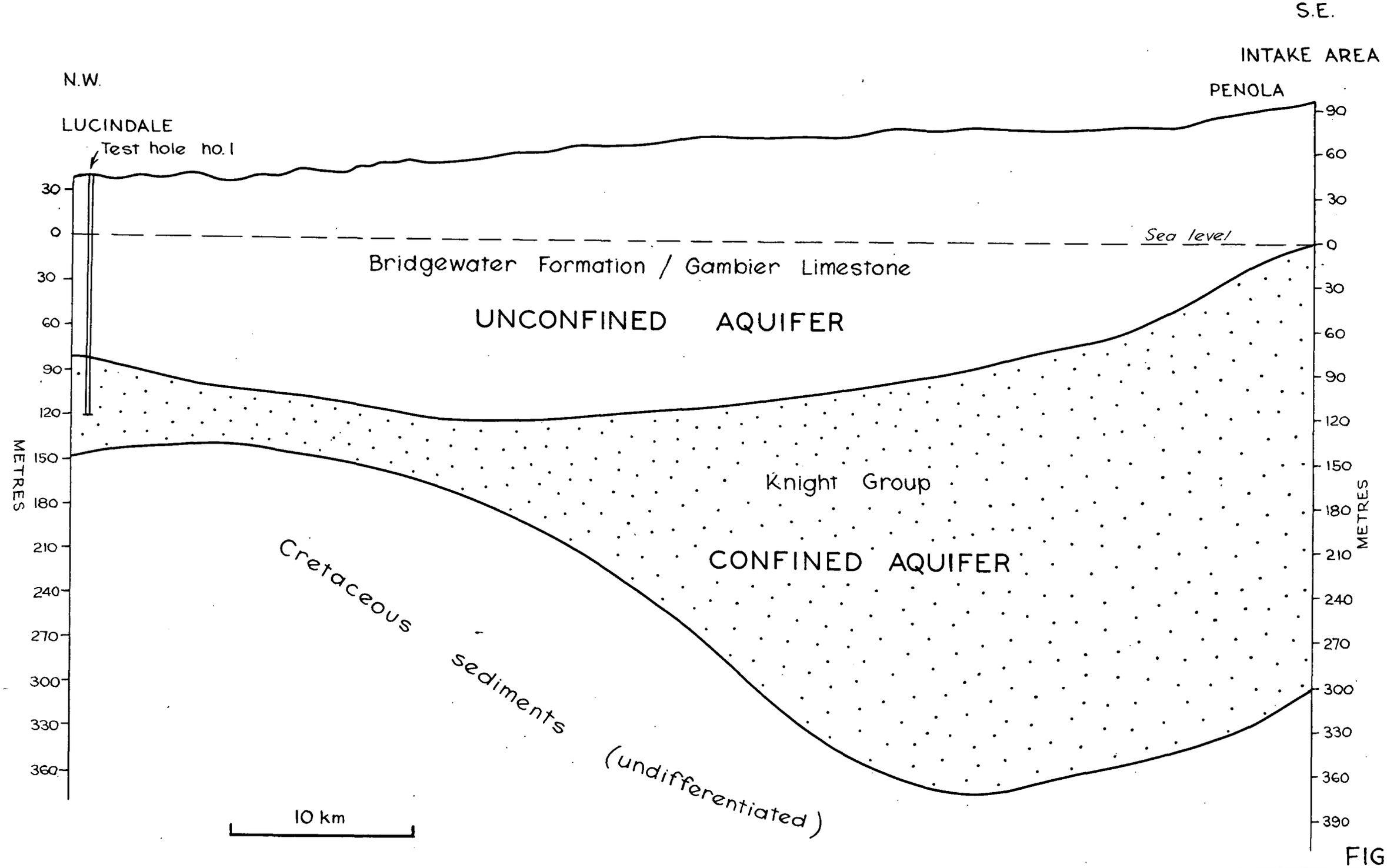


FIG. 5

DEPARTMENT OF MINES — SOUTH AUSTRALIA

DIAGRAMMATIC CROSS-SECTION — KNIGHT GROUP INTAKE AREA TO LUCINDALE

HYDROGEOLOGY SECTION	S.R. Barnett GEOLOGIST	Drn. S.R.B.	SCALE: H 1:250000
		Tcd. A.F.	74 - 460 Ke4
Director of Mines		Ckd.	
		Exd.	DATE: JUNE 1974