



COMPLETION REPORT AND
PUMP TEST
FORT LARGS POLICE ACADEMY BORE

Section 720 Hundred of Port Adelaide

- M. A. COBB -

Department of Mines
South Australia —

72/227

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No.72/227
G.S.No.4991
Hyd.No.2453
D.M.No.1347/70

COMPLETION REPORT AND PUMP TEST
FORT LARGS POLICE ACADEMY BORE

SECT. 720 HUNDRED OF PT. ADELAIDE

by

M.A. COBB
GEOLOGIST
HYDROGEOLOGY SECTION

24th November, 1972

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FORT LARGS POLICE ACADEMY BORE
SECT. 720 HUNDRED OF PT. ADELAIDE

Client: PUBLIC BUILDINGS DEPARTMENT
Victoria Square,
ADELAIDE. 5001

LOCATION

General: Fort Largs Police Academy
Region: 4
County: Adelaide
Hundred: Port Adelaide
Section: 720

CONSTRUCTION DETAILS

The bore was drilled by the cable tool method commencing on the 14th March, 1972 and finishing on the 5th May, 1972 at a final depth of 105.5 m. Initially when drilling had reached a depth of 104.0 m a 6 m x 6 inch stainless steel sand screen was installed, seated at 100.69 m. However, a poor and erratic yield from the bore led to the removal of the screen and the continuation of drilling. Following collapse of the bore at 105.50 m it was decided to carry out open hole development. The 8 inch casing shoe was set at 95.82 m.

Initial development of the bore was accomplished by the air-lift method at a maximum output of 54.6 cubic metres per hour

(m³/hr), for 41 hours. Following this a line-shaft pump was installed at 74.50 m and further development continued for a period of 8 hours at 42.7 m³/hr.

Additional development of the bore was performed prior to the pump-testing (see later).

HYDROGEOLOGY

During drilling, sludge samples were collected at 1 m intervals or on a change of lithology noted by the driller, (The bore log is given in Appendix A). In addition, between 92.5 m and 104.0 m, sand samples were obtained for grain size analysis. Cumulative plots of these sand size analyses are shown in Appendix B for each interval collected.

The bore ends in Pliocene Hallet Cove Sandstone/Dry Creek Sands, a calcareous shelly sand to calcareous sandstone unit reflecting a marine environment of deposition.

This is overlain by 34 m of Pleistocene Hindmarsh Clay, a fluviatile clay or silt with thin gravel lenses, and about 31 m of Pleistocene Pooraka Clay. This sequence is overlain by about 15 m of sands of the St. Kilda Formation (Semaphore Sands) representing Recent stranded marine beach ridges.

The St. Kilda Formation sands contain the water table which was cut at a depth of 8 m with groundwater salinity being recorded at 885 milligrams per litre * (mg/l)

Additional water cuts were recorded by the driller at 26, 51, 87 and 96 m, all of which were under pressure rising up to

* Milligrams per litre (mg/l) is numerically equal to parts per million

within 20 m of the surface. The general salinity of the aquifer under development is 2030 mg/l. (See Appendix B).

WATER SAMPLING

During drilling water samples were taken regularly and subsequently analysed for approximate total dissolved salts. Additional samples were collected during the developing and pumping tests and subsequently analysed.

The results of this sampling are given in Appendix B.

PUMPING TEST

On the completion of primary development after drilling secondary development prior to pump testing was commenced on the 9th May, 1972. This entailed pumping of the bore at $17.7 \text{ m}^3/\text{hr}$ for $6\frac{1}{2}$ hours followed by 1 hour at $27.3 \text{ m}^3/\text{hr}$, $\frac{3}{4}$ hour at $33.8 \text{ m}^3/\text{hr}$, 1 hour at $43.6 \text{ m}^3/\text{hr}$ and 1 hour at $46.4 \text{ m}^3/\text{hr}$.

A 450 minute constant rate pumping test was performed on 10th May, 1972 with an average pumping rate of $42.6 \text{ m}^3/\text{hr}$ with deviation from this pumping rate not exceeding 5%. This test was followed by a recovery test of 140 minutes duration. Water level measurements were made at regular intervals with a metric tape.

On the following day a further 210 minute pump test was performed at an average pumping rate of $37.5 \text{ m}^3/\text{hr}$.

Graphs showing the drawdown measured against the logarithm (base 10) of time are given in Fig.2. From this graph the specific capacity (Q/S_p) of the bore can be calculated. This is a measure of the yield of the bore per unit of drawdown (e.g. litres per second/metre) which, however, decreases with the period of pumping as drawdown continually increases. For this bore the specific capacity is 0.5 litres per second/metre (120 g.p.h./ft.) after eight (8) hours

pumping. Assuming 8 hours pumping per day a graph showing expected drawdown against pumping rate has been constructed and is given in Fig.3. This figure can be used for estimating suitable pump settings provided it is remembered that drawdown is measured from the pre-pumping water level (approximately 17 m below ground level prior to the pump testing).

The water level recovered to within 2 m of the pre-pumping level after 2 hours and had fully recovered within 14 hours.

The results of the pumping test and the nature of the aquifer are such that it is not expected the bore can be pumped at a greater rate than $36 \text{ m}^3/\text{hr}$ (8000 gallons per hour) for any length of time without damage to the bore.

CONCLUSIONS & RECOMMENDATIONS

1. The specific capacity of the bore calculated from the pumping test is 0.5 litres per second/metre (120 g.p.h.ft.) for eight (8) hours pumping and using this value anticipated drawdowns against pumping rate are shown in Fig.3.
2. Since the pump tests did not exceed 8 hours duration no information is available on the possible existence of hydrogeological boundaries manifesting themselves for greater continuous pumping periods.
3. Fine sand from the aquifer could be produced during the initial life of the bore.
4. To prevent sand entering any distribution system the water produced should be run to waste for approximately 20 minutes after starting before connection to the watering system.

5. The bore should not be pumped at a rate greater than $36 \text{ m}^3/\text{hour}$ (8000 gallons per hour).

Ma Cobb

MAC:MFV
24th November, 1972

M.A. COBB
GEOLOGIST
HYDROGEOLOGY SECTION

APPENDIX A

BORE LOG · HYDROGEOLOGY

Purpose of Bore *Water*
 Hundred *Port Adelaide*
 Owner *Public Buildings Dept.*
 Driller *E. Jamieson*
 Commenced *15/3/72* Completed *20/4/72*
 Drill type *Circulation*
 Logged by *R.G. Hutton* Date *11/5/72*

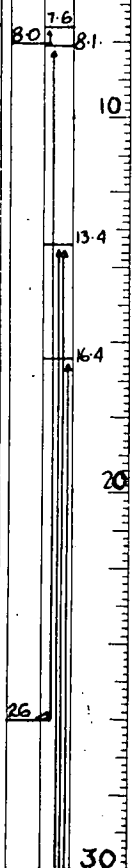
State No. *593072002*
 Bore Serial No. *31/72*
 Project No.
 Docket No. *1347/70*
 Depth *105.50 m*
 Co-ords E
 R.L. Collar (M.S.L.)
 R.L. Surface *95.82m* of
 Casing *0.203m* A.M.G. Zone N

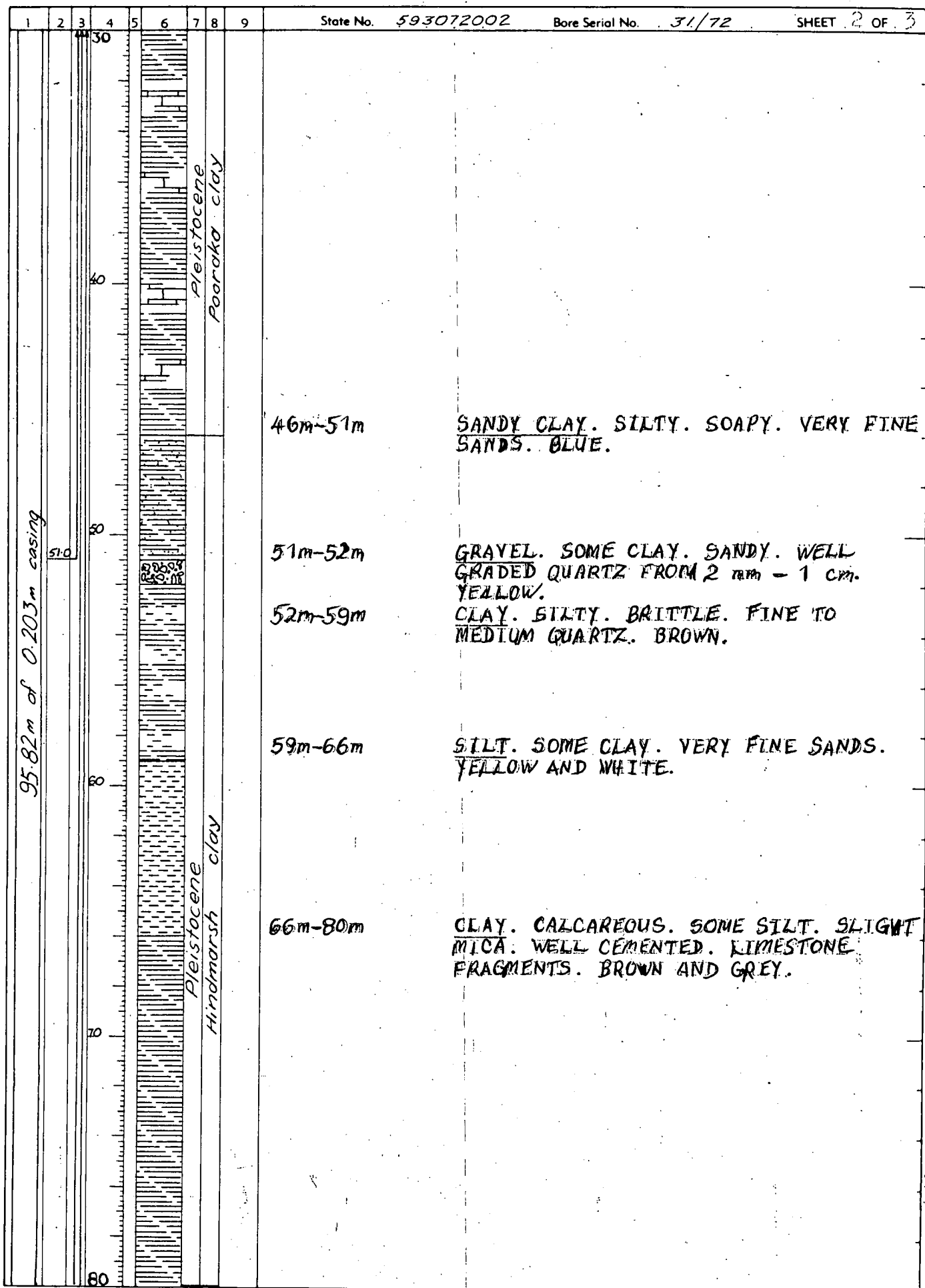
DEPTH (m)	WATER LEVEL (m)	SUPPLY- m^3/hr	HOW TESTED	TOTAL SALTS mg/l	ANALYSIS No.
8.0 m	7.60 m	42.73		885	
26.0 m	8.70 m			47,200	
51.0 m	13.40 m			68,600	
87.0 m	13.40 m			2230	
96.0 m	16.40 m			2030	

REMARKS

1 CASING	2 WATERS CUT	3 WATER LEVEL	4 DEPTH (m)	5 CORE	6 GRAPHIC LOG	7 AGE	8 UNIT	9 PENETRATION RATE	DESCRIPTION
									0m-15.11m SAND. CALCAREOUS. SILTY. VERY FINE TO FINE QUARTZ LENSES. WHITE TO 3 m AND GREY.
									15.11-16.5 CLAY. CALCAREOUS. SLIGHT SANDS. MODERATE PLASTICITY. SOME SHELLS. GREY.
									16.5-20 m CLAY. CALCAREOUS. LIMESTONE AND SHELL FRAGMENTS. SOAPY AND STICKY. MODERATE PLASTICITY. YELLOWISH.
									20 m - 46 m CLAY. CALCAREOUS. SILTY. LIMESTONE NODULES. FINE SANDS. YELLOW.

95.82m of 0.203m casing

Recent semaphore sands
Pleistocene Pooraka clay



1	2	3	4	5	6	7	8	9	State No. 593072002	Bore Serial No. 31/72	SHEET 3 OF 3
95.82m of 0.203m casing 87.0 86.0 75.82 80 90 120											
Pliocene Hallett core sandstone / dry creek sands											
80-82m									CLAYEY LIMESTONE. SILTY. SOME QUARTZ. GREY.		
82m-86m									SANDY LIMESTONE. SILTY. FINE QUARTZ LENSES. SLIGHT CLAY. WHITE AND YELLOW.		
86m-92.5m									LIMESTONE. SOME SILT. FINE TO MEDIUM QUARTZ. WHITISH.		
92.5m-94m									SAND. SILTY. VERY FINE QUARTZ LENSES. SHELL AND LIMESTONE FRAGMENTS. GREY.		
94m-96.45m									LIMESTONE. SOME SILT. SHELL FRAGMENTS. FINE SANDS. GREY.		
96.45m-97m									SAND. CALCAREOUS. FINE QUARTZ. ABUNDANT SHELL. LIGHT GREY.		
97m-99m									SHELL. LIMESTONE FRAGMENTS 40% GREY AND WHITE.		
99m-104m									SAND. CALCAREOUS. FINE QUARTZ. ABUNDANT SHELL. LIGHT GREY.		
104m-105.50m									SHELL. SOME SILT. LIMESTONE FRAGMENTS AND FOSSILS. SOME FINE QUARTZ LENSES. GREY.		

APPENDIX B

WATER SAMPLE ANALYSES, FORT LARGS POLICE ACADEMY BORE

DRILLING SAMPLES

Depth (m)	Water Level (m)	Water Cut (m)	Salinity milligrams/litre (mg/l)	pH
8.5	7.6	8.0	885	7.0
30	8.1	26	47200	8.0
51.5	13.4	51	68600	8.0
94	24	90	2230	7.0
99	-	96	2230	7.0

PUMP TESTING

Depth (m)	Water Level (m)	Water Cut (m)	Salinity milligrams/litre (mg/l)	pH	Comments
105.5	19.32	96	2030	7.0	After 50 min
"	20.96	"	"	"	100
"	22.78	"	"	"	200
"	23.14	"	"	"	300
"	23.62	"	"	"	400
"	123.61	"	"	"	End of Test
"	123.61	"	"	-	To AMDEL

WATER ANALYSIS REPORT

SAMPLE NO. W2145/72

JOB NO. AN5715/72

CHEMICAL COMPOSITION

		Milligrams per litre mg/l	Milliequivalents per litre me/l
<i>Cations</i>			
Calcium	(Ca)	107	5.3
Magnesium	(Mg)	85	7.0
Sodium	(Na)	530	23.1
Potassium	(K)	16	0.4
Iron	(Fe)		
<i>Anions</i>			
Carbonate	(CO ₃)		
Bicarbonate	(HCO ₃)	345	5.7
Sulphate	(SO ₄)	215	4.5
Chloride	(Cl)	890	25.1
Fluoride	(F)		
Nitrate	(NO ₃)	Nil	Nil
Phosphate	(PO ₄)		

TOTALS and BALANCE

Cations me/l	Anion me/l
35.8	35.3
diff Δ 0.5	sum Σ 71.1
	% ($\frac{\Delta \times 100}{\Sigma}$) 0.70

DERIVED AND OTHER DATA

Conductivity (E.C.) μ S/cm at 25°C	3600	Milligrams per litre mg/l
Total Dissolved Solids:		
a. Based on E.C.		
b. Calculated (HCO ₃ =CO ₃)	1999	
c. Residue on evaporation at 180°C		
Total Hardness as CaCO ₃	615	
Carbonate Hardness as CaCO ₃	280	
Non-carbonate Hardness as CaCO ₃	335	
Total Alkalinity as CaCO ₃	280	
Free Carbon Dioxide (CO ₂)		
Suspended Solids		
Silica (SiO ₂)		
Boron (B)		
Reaction—pH		Units
Turbidity (Jackson)		
Colour (Hazen)		
Sodium Absorption Ratio	63.8	

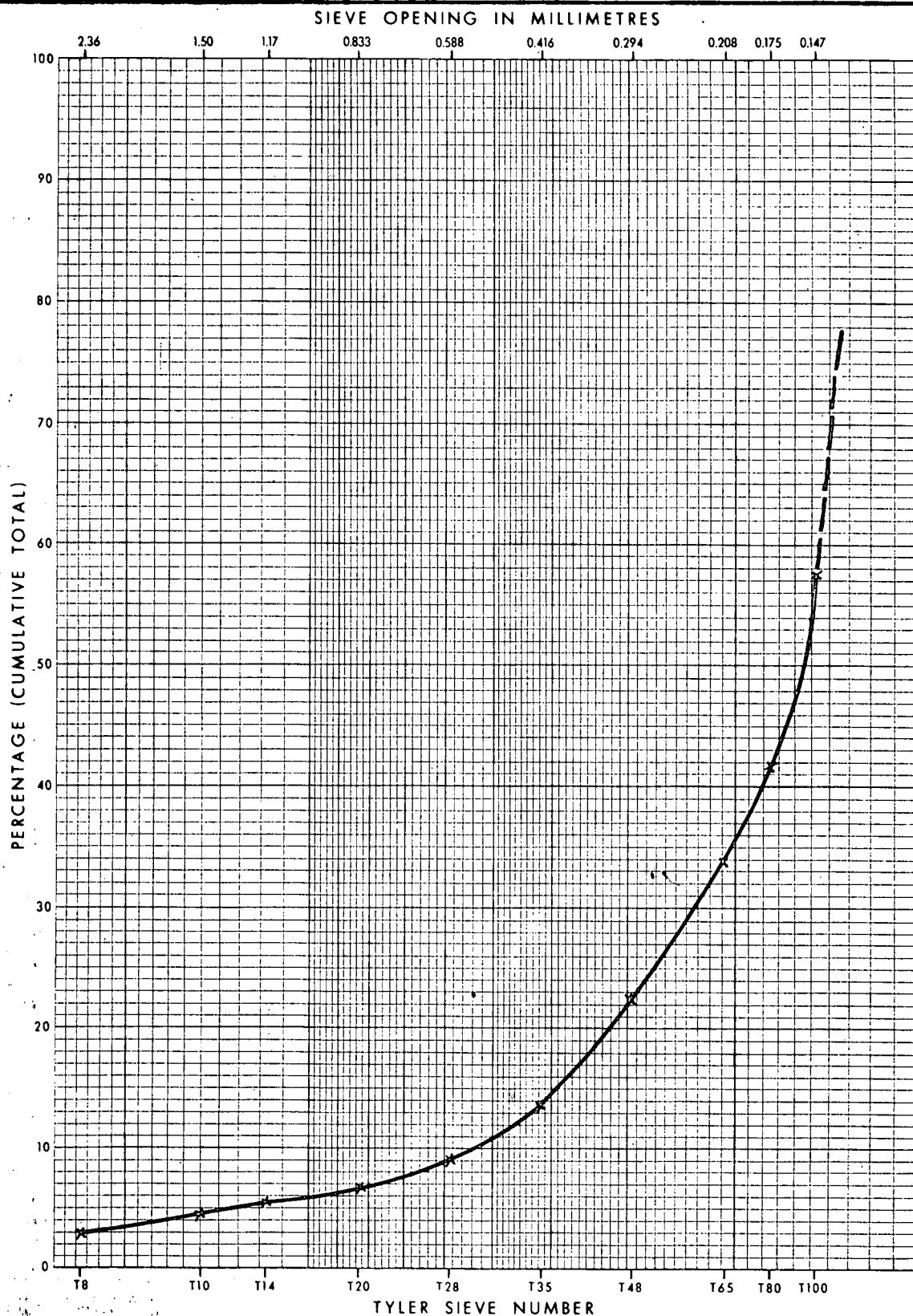
Name P. Building Dept. Hundred Pt Adelaide Supply 9480
 Section 3 Depth Hole 105.50^m
 Address Police Academy Hole No. Date Collected 10/5/72
 Fort Largs Water Cut Sample Collected by J. Mirus
 Water Level 23.61^m Date Received
 S/N 31/72.

REMARKS:

for Director

MAR
19/7/72

APPENDIX C



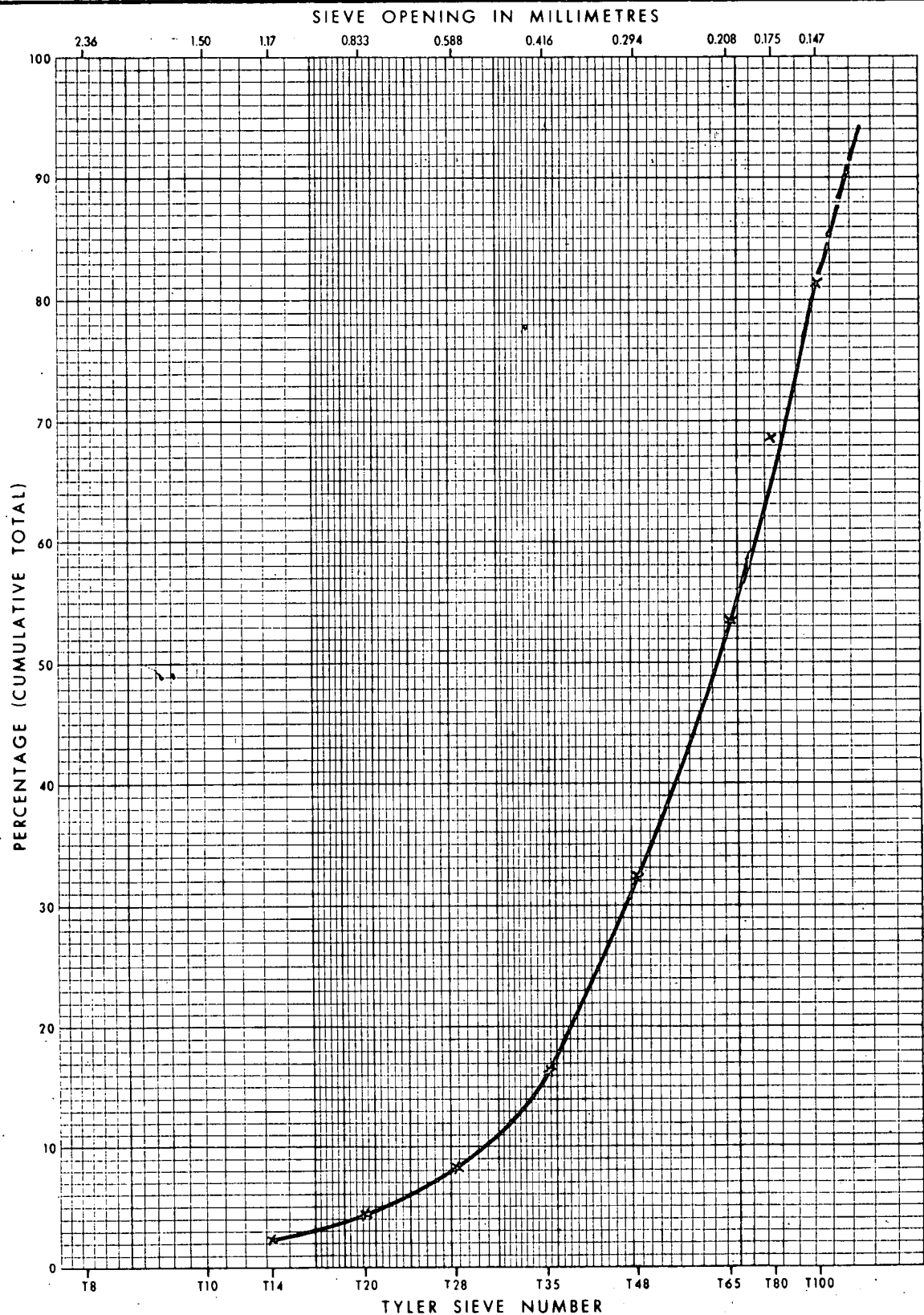
INTERVAL 92.5 m TO 94.0 m

BOREHOLE STATE No. 593072002

SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N 31/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1347/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS	Date: 24 NOV. 1972
Dwn: D.W.W.	FORT LARGS POLICE ACADEMY BORE NO.1	Drg. No:
Ckd: A.F.	SECTION 720 HD. PORT ADELAIDE	S 10050
	PUBLIC BUILDINGS DEPARTMENT	Ha1



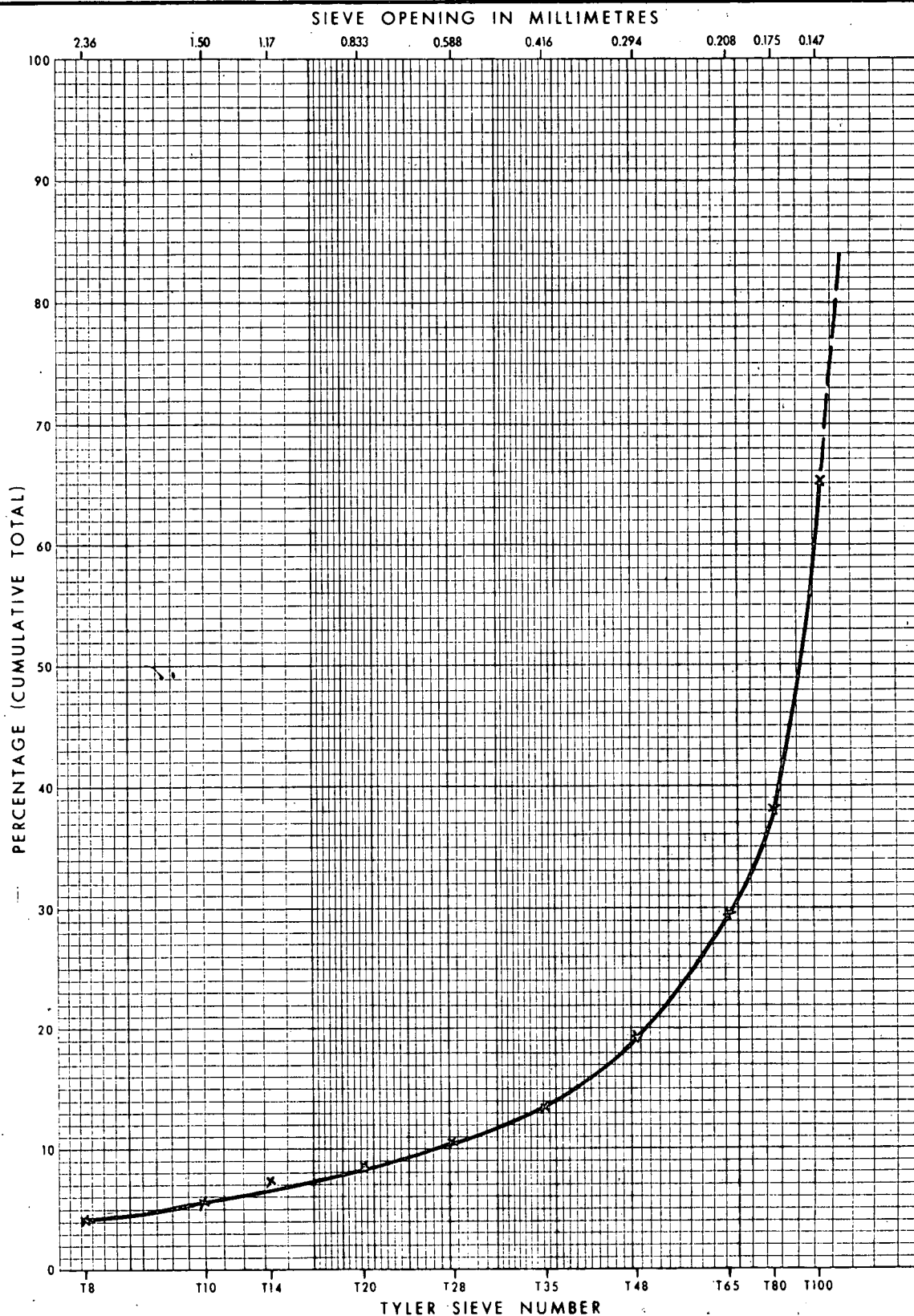
INTERVAL 94.0 m TO 95.0 m

BOREHOLE STATE No. 593072002

SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N. 3/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1347/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS	Date: 24 NOV. 1972
Drn: D.W.W.	FORT LARGS POLICE ACADEMY BORE NO.1	Drg.No:
Ckd: A.F.	SECTION 720 HD PORT ADELAIDE	S10050a Ha1
	PUBLIC BUILDINGS DEPARTMENT	



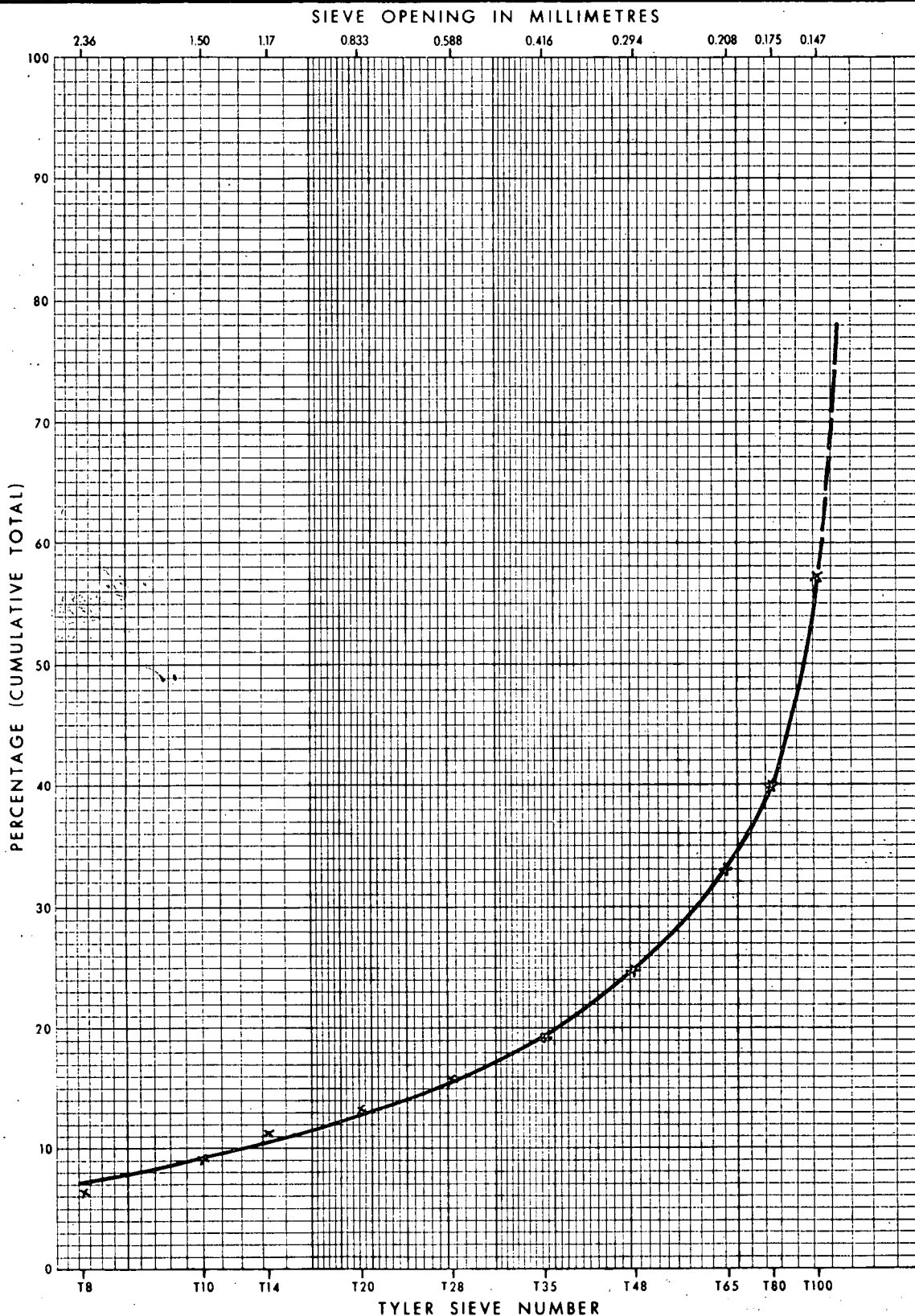
INTERVAL 96.0 m TO 97.0 m

BOREHOLE STATE No. 593072002

SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N 31/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1347/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS	Date: 24 NOV. 1972
Drn: D.W.W.	FORT LARGS POLICE ACADEMY BORE NO.1	Drg. No:
Ckd: A.F.	SECTION 720 HD. PORT ADELAIDE	S10050 b
	PUBLIC BUILDINGS DEPARTMENT	Ho.1



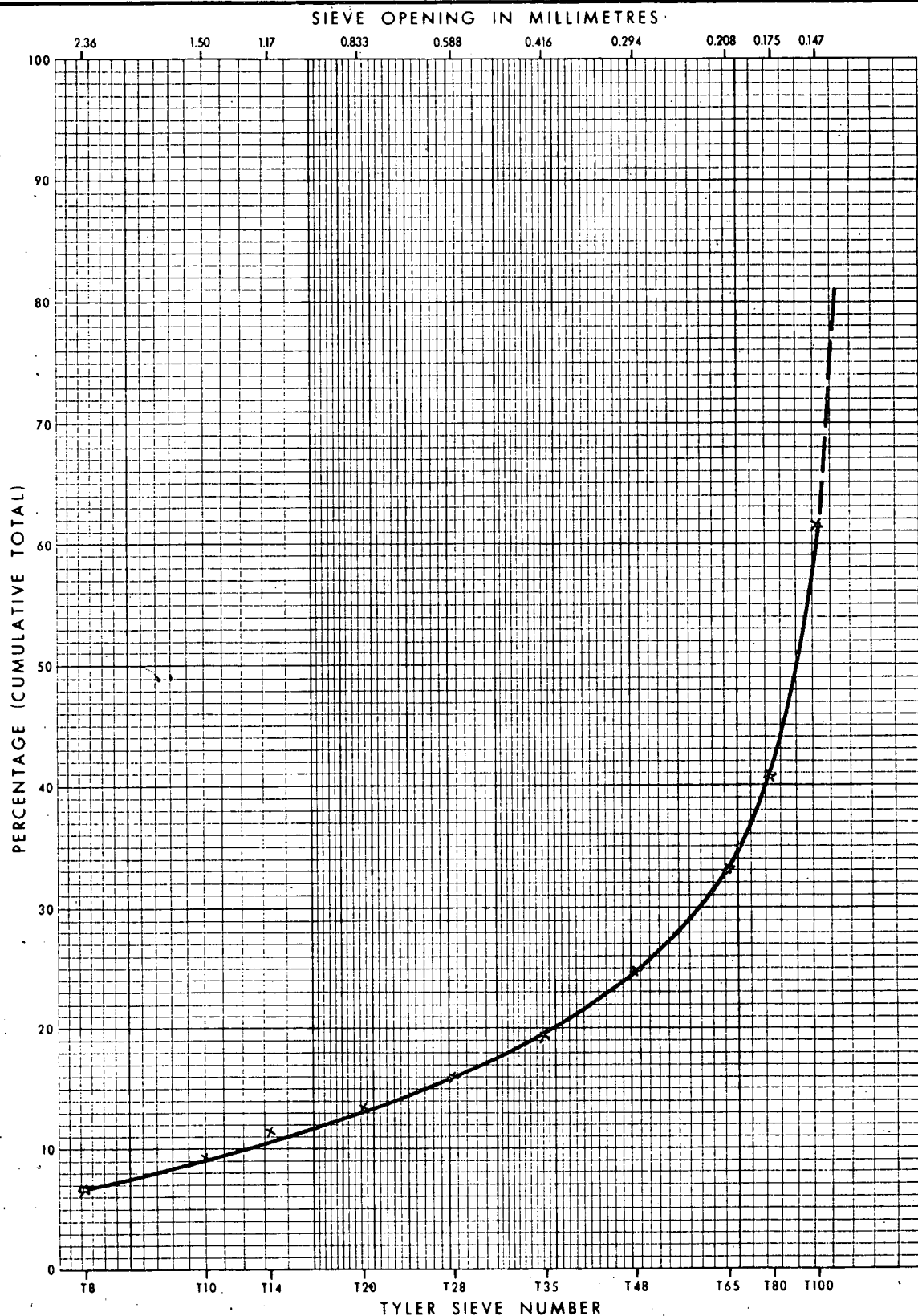
INTERVAL 97.0 m TO 98.0 m

BOREHOLE STATE No. 593072002

SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N 31/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1347/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS FORT LARGS POLICE ACADEMY BORE NO.1 SECTION 720 HD. PORT ADELAIDE PUBLIC BUILDINGS DEPARTMENT	Date: 24 NOV. 1972
Drn: D.W.W.		Drg. No:
Ckd: A.F.		S10050c Ha1



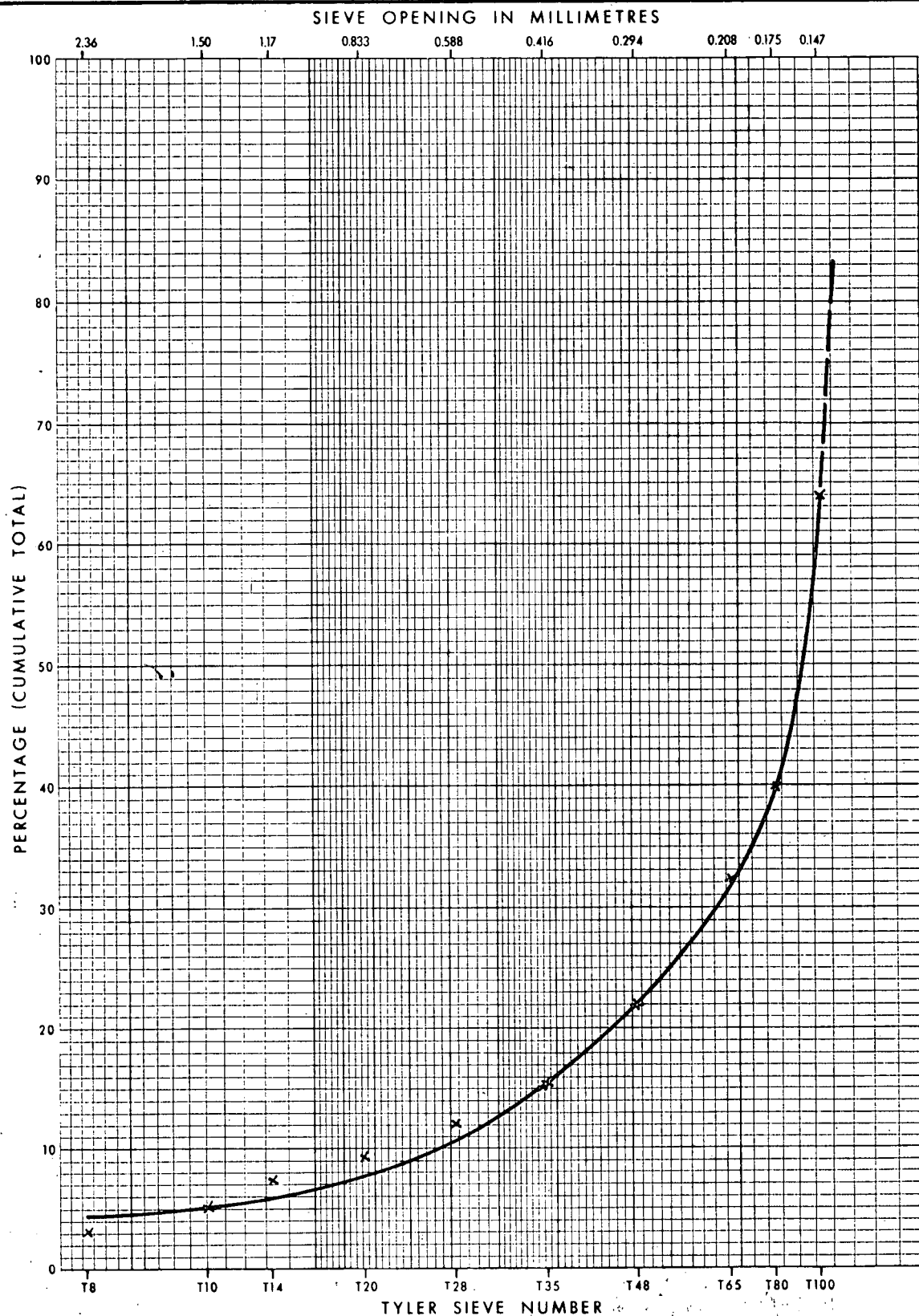
INTERVAL 98.0 m TO 99.0 m

BOREHOLE STATE No. 593072002

SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N 31/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1347/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS FORT LARGS POLICE ACADEMY BORE NO.1 SECTION 720 HD PORT ADELAIDE PUBLIC BUILDINGS DEPARTMENT	Date: 24 NOV. 1972
Drn: D.W.W.		Drg. No: S10050d Ha1
Ckd: A.F.		



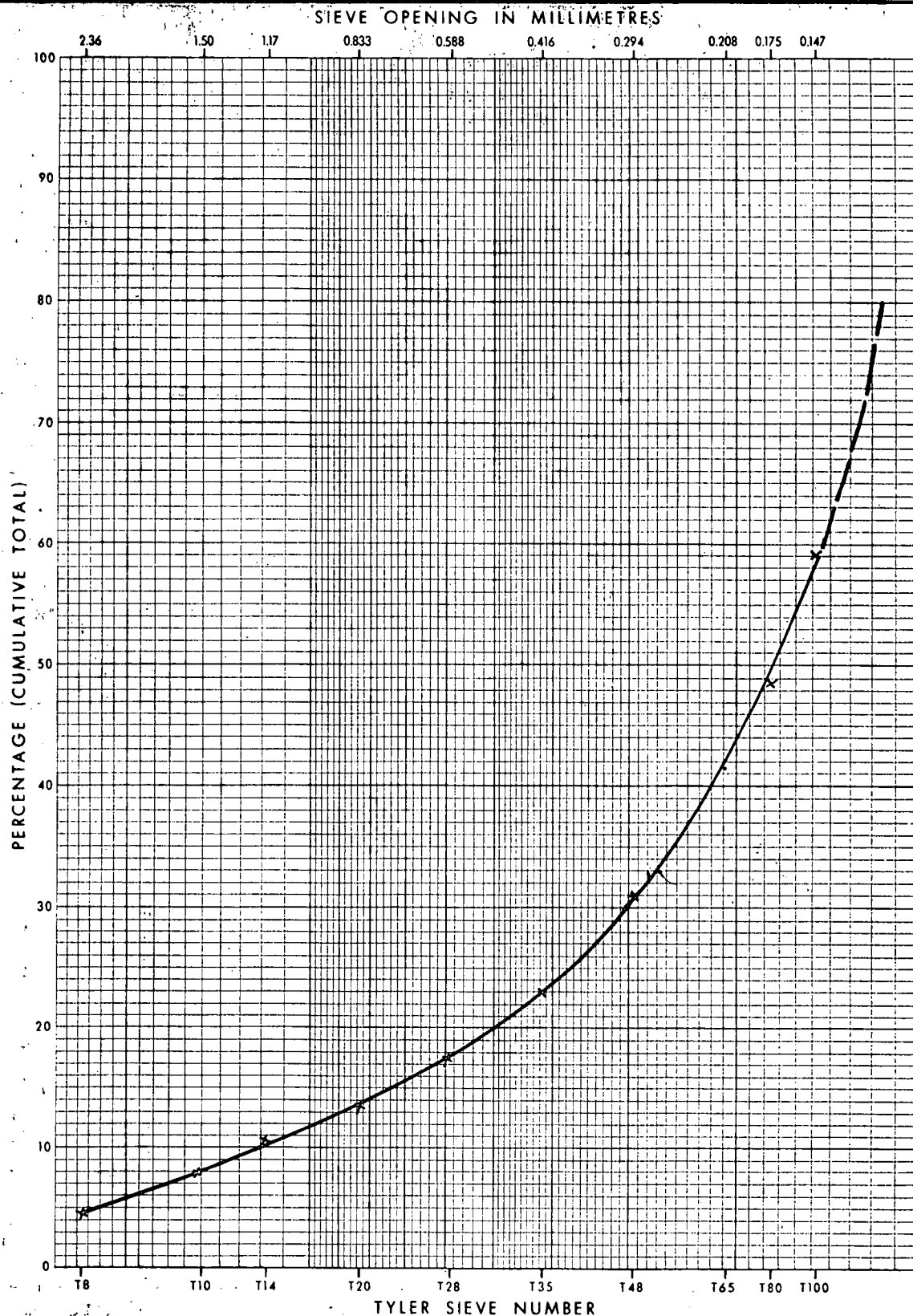
INTERVAL 99.0 m TO 100.0 m

BOREHOLE STATE No. 593072002

SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N 31/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1347/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS FORT LARGS POLICE ACADEMY BORE NO. 1 SECTION 720 HD. PORT ADELAIDE PUBLIC BUILDINGS DEPARTMENT	Date: 24 NOV. 1972
Drn: D.W.W.		Drg. No:
Ckd: A.F.		S10050e Ha1



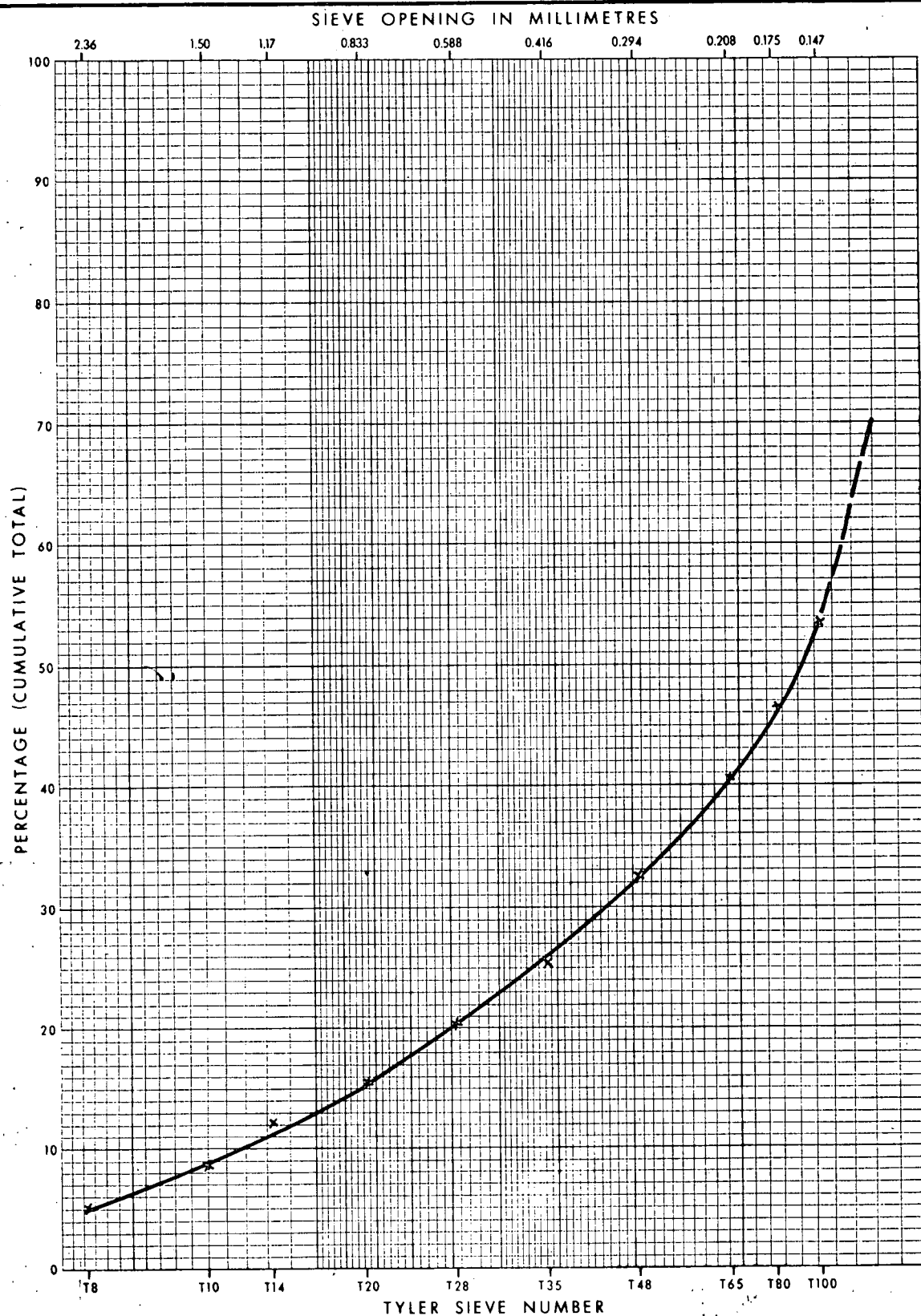
INTERVAL 100.0 m TO 101.0 m

BOREHOLE STATE No. 593072002

SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N. 31/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1347/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS FORT LARGS POLICE ACADEMY BORE NO.1 SECTION 720 HD. PORT ADELAIDE PUBLIC BUILDINGS DEPARTMENT	Date: 24 NOV. 1972
Dwn: D.W.W.		Drg. No:
Ckd: A.F.		S10050f Ha1



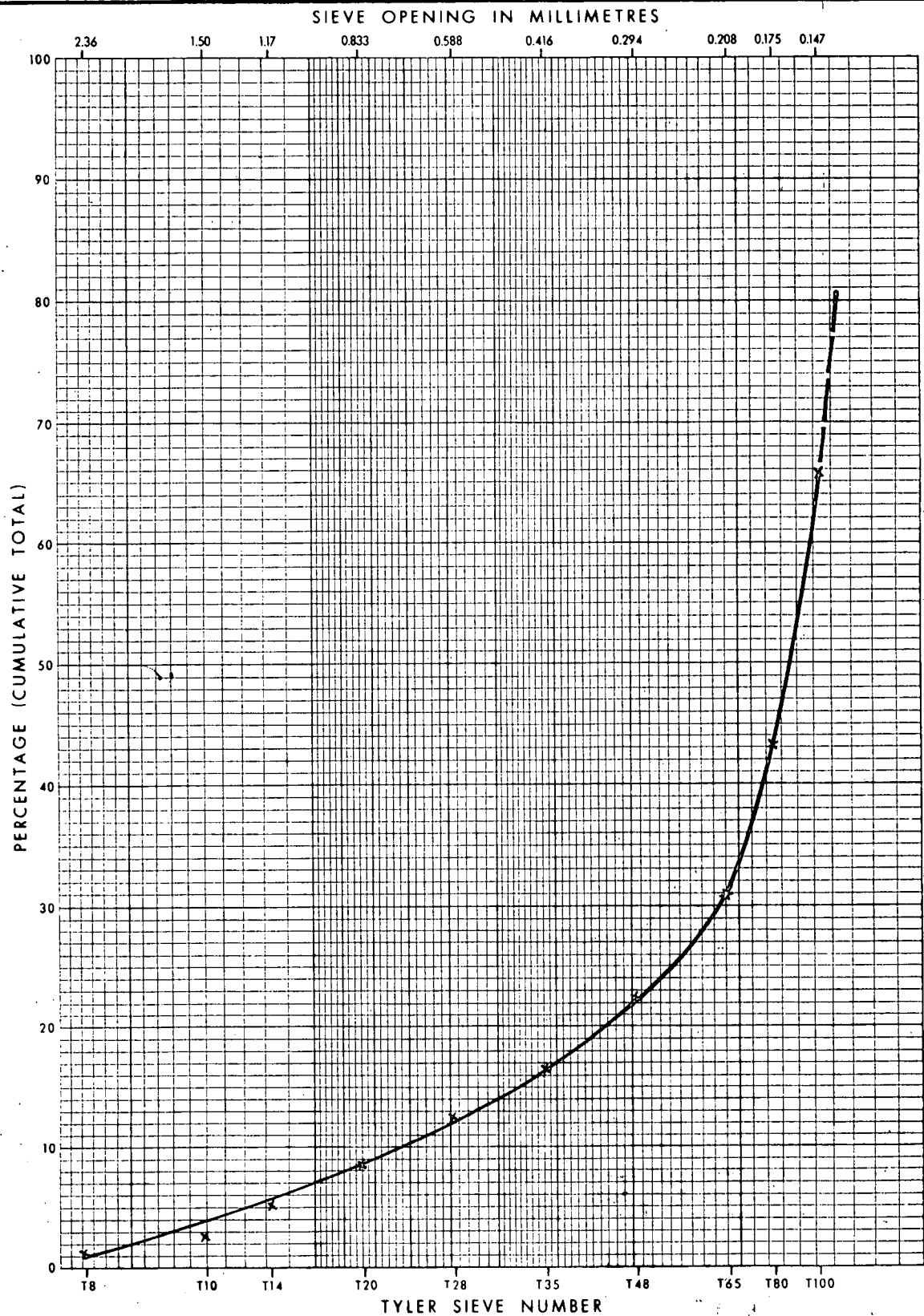
INTERVAL 101.0 m TO 102.0 m

BOREHOLE STATE No. 593072002

SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N 31/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1347/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS	Date: 24 NOV 1972
Drn: D.W.W.	FORT LARGS POLICE ACADEMY BORE NO.1	Drg.No:
Ckd: A.F.	SECTION 720 HD. PORT ADELAIDE	S10050g Ha1
	PUBLIC BUILDINGS DEPARTMENT	



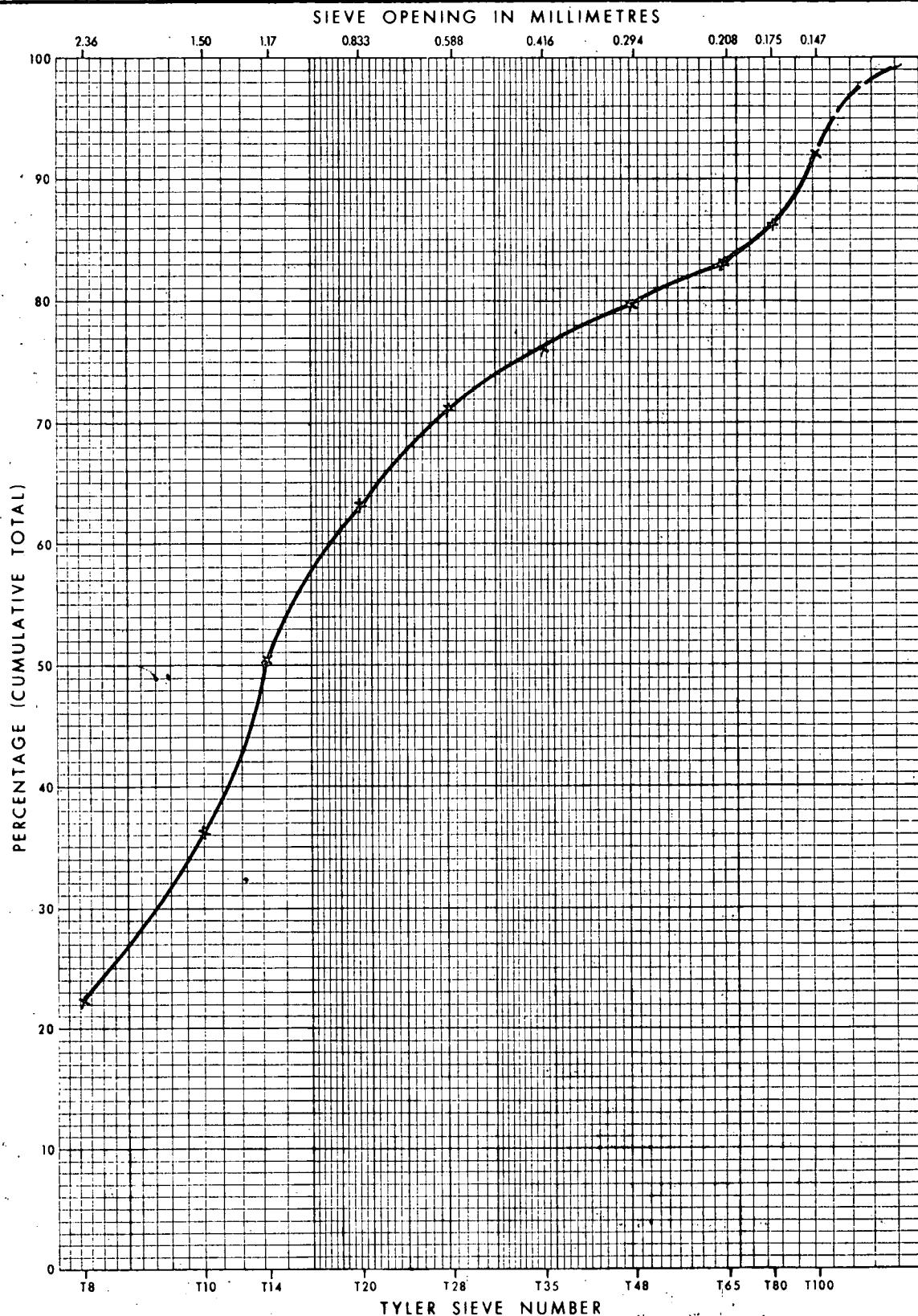
INTERVAL 02.0 m TO 03.0 m

BOREHOLE STATE No. 593072002

SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N 3/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1347/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS	Date: 24 NOV 1972
Drn: D.W.W.	FORT LARGS POLICE ACADEMY BORE NO.1	Drg. No.
Ckd: AF	SECTION 720 MD. PORT ADELAIDE	S10050 h
	PUBLIC BUILDINGS DEPARTMENT	Ha1



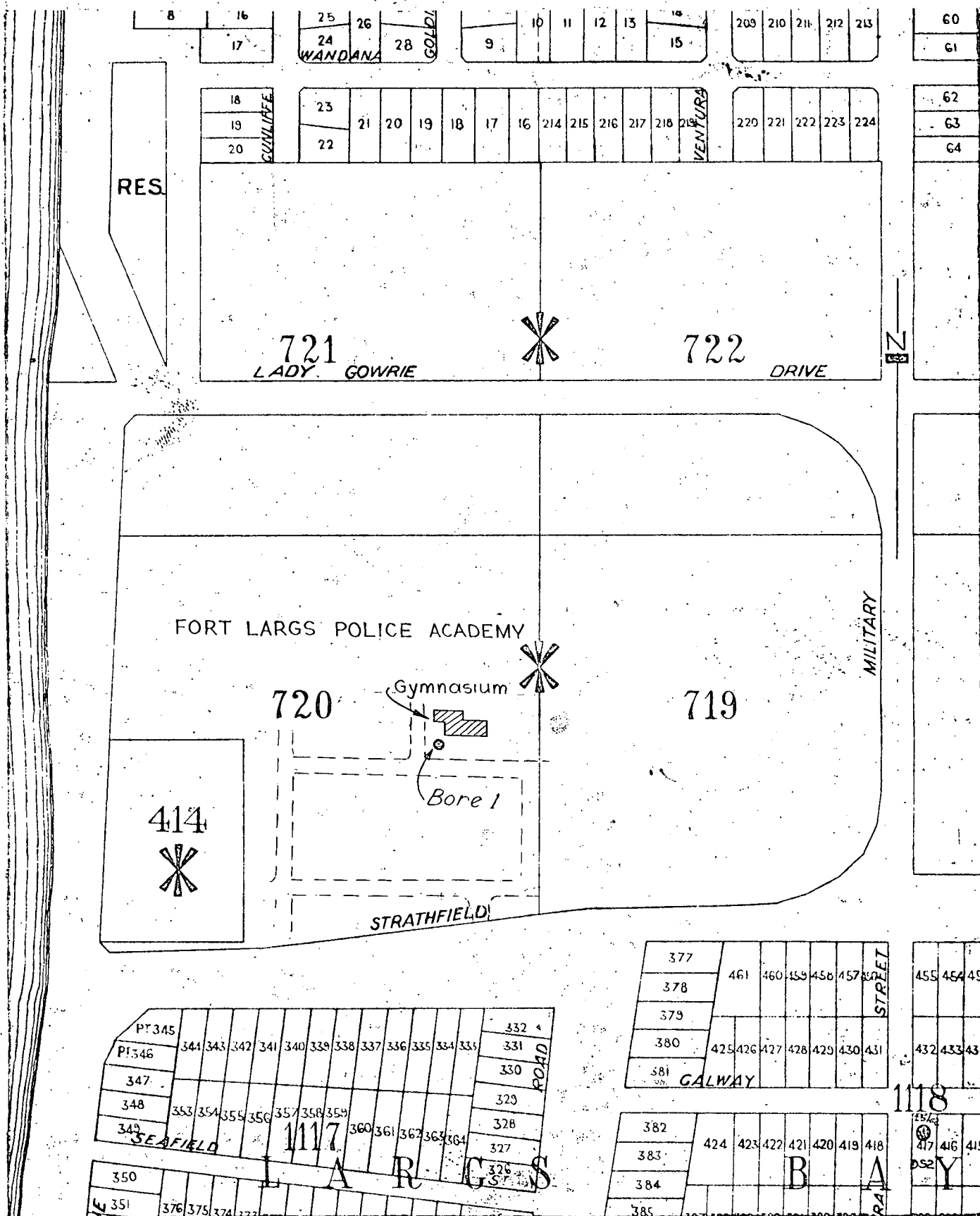
INTERVAL 03.0 m TO 04.0 m

BOREHOLE STATE No. 593072002

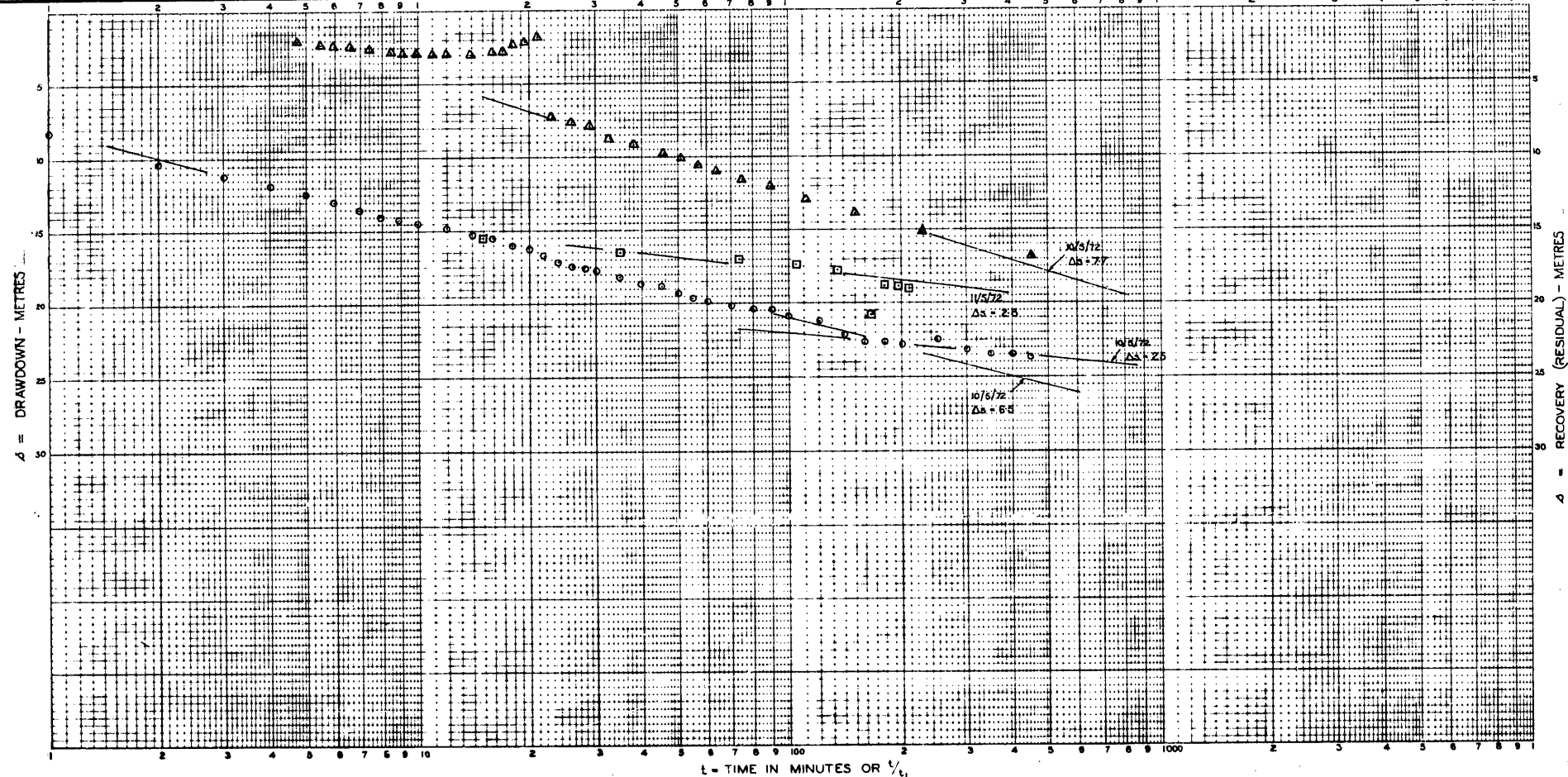
SCREEN RECOMMENDED

BOREHOLE IDENTIFYING No. S/N. 31/72

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM. 1374/70
Compiled: M.A. COBB	SCREEN SIZE ANALYSIS	Date: 24 NOV. 1972
Drn: D.W.W.	FORT LARGS POLICE ACADEMY BORE NO.1	Drg. No:
Ckd: A.F.	SECTION 720 HD. PORT ADELAIDE	S100501
	PUBLIC BUILDINGS DEPARTMENT	Ha1



		DEPARTMENT OF MINES - SOUTH AUSTRALIA	Scale: <i>lin reps 4 chains</i>
Compiled: M.A.C.		FORT LARGS POLICE ACADEMY BORE No 1	Date: 23 Nov 1972
Drn. A.F.	Ckd.	SECTION 720 HD PT. ADELAIDE	Drg. No.
		LOCALITY PLAN	S10044 Hal



BOREHOLE STATE N° 593072002
 DEPTH TO WATER LEVEL 17.1m (L)
 AT TEST START (t₀) 7.6m (L)
 PUMP INTAKE DEPTH (t₁) 54.5m (L)
 * AVAILABLE DRAWDOWN 108.5m (L)

TYPE OF PUMP POMONA
 DISCHARGE STARTED AT ON
 STOPPED AT ON
 AQUIFER FROM TO (L)
 HOLE DEPTH 108.5m (L)

EQUATIONS

$T = \frac{0.183 \times Q}{\Delta_s}$
 $S = \frac{2.25 \times T t_0}{r^2}$

In which
 T = Transmissivity (L³/t/L)
 Q = Pumping Rate (L³/t)
 Δ_s = Drawdown per log cycle (L)

S = Storage Coefficient
 t₀ = Zero drawdown time- (t)
 r = Distance to Observation Bore- (L)
 1 day = 8.64 × 10⁴ secs

DATA

Q Δ_s t₀
 10/5/72 42.6 m³/hr 2.5 (late)
 11/5/72 37.5 m³/hr 2.8

CALCULATIONS

T = 0.183
 S = 2.25

Specific Capacity = $\frac{Q}{\Delta}$ = 0.5 litres per second/metre
 or 120 gallons per hour/foot

- Drawdown 10/5/72
- Drawdown 11/5/72
- ▲ Recovery 10/5/72

* Available drawdown = t₁ - (t₂ + ...)
 ** L = unit of length
 t = time unit.

FIG. 2

HYDROGEOLOGY SECTION		DEPARTMENT OF MINES-SOUTH AUSTRALIA	DM 1347/ 70
COMPILED: A.F. Williams		FORT LARGS POLICE ACADEMY BORE No. 1	DATE: 17 Nov. 1972
DRN. T.J.E.	CHD. A.F.	SEC. 720 HD. PORT ADELAIDE	DRG. No.
		DRAWDOWN VS. TIME (PUMP TEST CURVE)	72-995
		(PUBLIC BUILDINGS DEPARTMENT)	Ha. 1

Constructed for 8 hours pumping

1 litre per second (l/s) = 3.6 m³/hr or 792 gph.

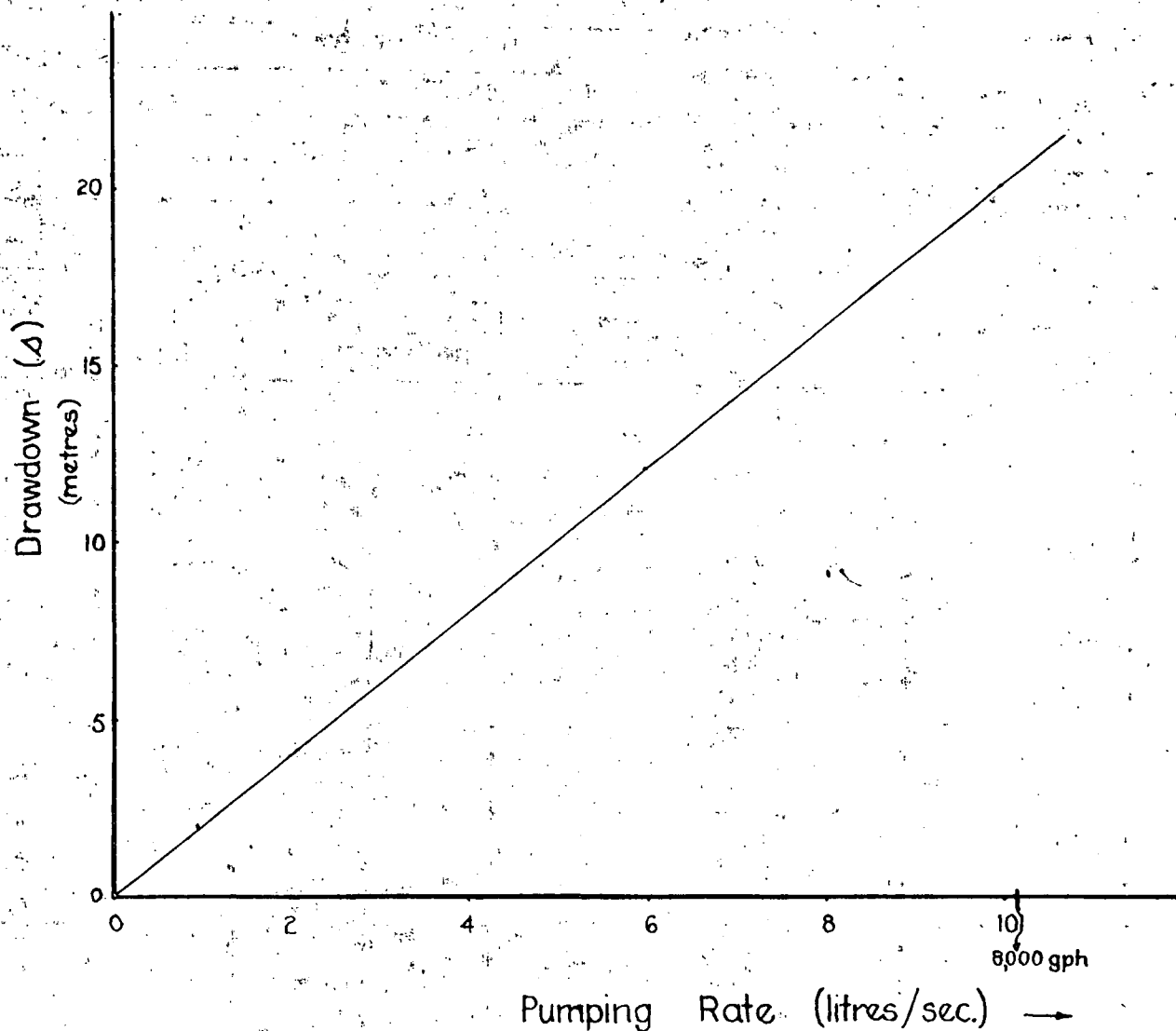


FIG. 3

		DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale: Graphical
Compiled: M. Cobb		FORT LARGS. POLICE ACADEMY BORE No.1 SEC. 720 HD. PORT ADELAIDE ANTICIPATED DRAWDOWNS	Date: 17 Nov. 1972
Drn. TJE	Ckd. A. F.		Drg. No. S 10042 Ha I.