DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

MOUNT GAMBIER TOWN WATER SUPPLY

COMPLETION REPORT FOR STANDBY WELL NO. 8

by

P.C. Smith

GEOLOGIST

Rept.Bk.No. 78/34
G.S. No. 6008
D.M. No. 480/77

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DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept.Bk.No. 78/34
G.S. No. 6008
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MOUNT GAMBIER TOWN WATER SUPPLY COMPLETION REPORT FOR STANDBY WELL NO. 8

ABSTRACT

This well was drilled using cable tool and rotary methods to a depth of 250 m into the confined aquifer (Dilwyn Formation), after two scout wells had proved a suitable site.

The well is equipped with a 0.9 mm stainless steel screen from 237.3 to 250 m; casing has been pressure cemented to 226 m to ensure separation from the Gambier Limestone aquifer.

Production testing consisted of a 3-stage step drawdown test followed by a 72-hour constant discharge test at a maximum pumping rate of 4260 m^3/day. This data, together with considerations of screen entrance velocity, indicate that the required yield of 7860 m^3/day should be available providing that the well is developed slowly, over a period of at least a week, to maximum capacity.

A TDS value of 612 mg/l was obtained after 72-hours pumping indicating that the water should be suitable for domestic use; further well head sampling will be necessary to confirm this.

INTRODUCTION

Town Water Supply Standby Well 8 is the second in a series of emergency production wells exploiting the confined aquifer to be drilled for the E. & W.S. Department; background to the construction of these wells is outlined in Smith (1978).

A scout well (No. 8a) was drilled on the western periphery of Mount Gambier (Fig. 1) but encountered no suitable aquifer interval to 280 m, and was abandoned after an attempt to complete it as an observation well to the confined aquifer failed. Subsequently Well No. 8b, located near the eastern limits of Mount Gambier, was drilled to 287 m and intersected a suitable production zone from 238 to 250 m.

Drilling of the production well (No. 8) commenced on 26th April, 1977 about 10 m away from Well No. 8b which was completed as an observation well.

HYDROGEOLOGY

The stratigraphic sequence in the Mount Gambier area has been summarised previously (Smith, 1978) and is shown in Table I.

Lost circulation zones in Well 8a caused severe drilling difficulties and loss of geological control (Appendix B); as a result, lithological boundaries for this well are interpreted from gamma and neutron logs run to total depth of 280 m (Fig. 2).

WELL CONSTRUCTION

Detailed construction history for each well is given in Appendix C, and the following is a summary:

Scout Well No. 8a

Rotary mud drilling was commenced on 20th October, 1976 and the site abandoned on 12th November, 1976.

Drilling was difficult with lost mud circulation encountered from 6 - 26 m and 128 - 185 m; harder zones within the Gambier Limestone also caused drilling to be slow.

Wire line logging indicated an interval suitable for screening between 200 and 202 m within the confined aquifer; this was insufficient for production and it was decided to place a small diameter screen in the well and use it for observation purposes. During cementing of the 55 mm P.V.C. pipe however, pressure build-up caused pipe failure and the hole was abandoned after the placing of a cement plug between the Dilwyn Formation and the Gambier Limestone (150 bags of cement were pumped at 180 m).

TABLE I

SUMMARY OF HYDROGEOLOGY

Geological Unit*	Lithology	Interval (m) Well 8a	Interval (m) Wells 8 & 8b	Remarks
Bridgewater Fm/ Volcanics	Aeolianite and volcanic ash	0-7	0-12	
Gambier Limestone	calcarenite, marl etc.	7-165	12-139	Unconfined Aquifer
Narrawaturk Marl (Lacepede Fm)	silty marl	missing	139-155	Intermittent confining layer
Mepunga Fm (Kongorong Sand)	Ferruginous Sand	165-185	155-157	A minor aquifer
Burrungule Member (Knight Group)	Carbonaceous, silty clay	185-196½	157-168	Main confining layer
Dilwyn Fm (Knight Group)	clay, silt, sand, and gravel	196½-280+	168-287+	Confined Aquifer

* Previous name given in brackets

Scout Well No. 8b

Cable tool drilling commenced on 10th March, 1977 down to 155.5 m, experiencing difficulties between 104 and 137 m in a zone of alternating loose and hard dolomitic material; the well was completed to its total depth of 287 m with rotary mud drilling.

A suitable aquifer thickness was interpreted between 237 and 250 m on the results of sample examination and geological logging (Fig. 3).

The well was completed as an observation well for testing of the proposed production well, with a small diameter screen set from 242.3 to 244.3 m within the productive interval.

Standby Well No. 8

Following proving of the site by Scout Well No. 8b, a production well was drilled during the period 26th April, to 21st September, 1977.

Cable tool was used to drill the Gambier Limestone and install 260 mm pipe which was subsequently cemented by the dump bailer method at 139 m.

A rotary rig (Failing 1500) was used to drill to 237 m and 203 mm casing was run to 226 m and pressure cemented to the 260 mm pipe. Drilling continued to total depth (287 m) with a roller bit and the well was geophysically logged (gamma/neutron) to check the aquifer interval before running the screen (Fig. 3); sand samples were taken from 237 to 250 m for seiving.

The 0.9 mm stainless steel screen was installed between 237.3 and 250.0 m and the hole was circulated with clean water until all mud was washed from the hole prior to development. The screen was developed for 44 hours by surging its face and airlifting; development was completed by pumping from

49 m with a turbine pump at a rate of 4300 m^3/day prior to production testing. Construction details of this well are shown in Fig. 3 and a summary of well details is given in Table 2.

TABLE 2

SUMMARY OF DETAILS FOR STANDBY WELL NO. 8

Depth: 250.5 m

Casing: See Fig. 3

Standing Water Depth: 6 m

Interval Tested: 237.3 to 250.0 m

Recommended safe yield: Not to exceed 7860 m^3/day

Recommended pump intake depth: 76 m

Pumping water level: 64 m (approx.) after 24 hours

Water salinity: 600 mg/l (approx.)

Aquifer: unconsolidated coarse sand (Dilwyn Formation)

WELL DISCHARGE TESTS

No testing was carried out on Well No. 8a which was abandoned. A detailed analysis and discussion of test results obtained from the other wells is given in Appendix C and summarised as follows:

Well No. 8b

This well was completed with small diameter pipe and a 2 m section of screen. An airlift test was carried out from about 40 m for 6 hours and water level recovery was measured. The value of transmissivity obtained conforms well with early time values obtained during testing of the production well.

This technique is recommended for future drilling projects where a scout/observation well is required as it enables more reliable predictions to be made to the client before construction of the expensive production well.

Standby Well No. 8

This well was tested with a 3 x 100 minute step drawdown test followed by a 72 hour constant discharge test with recovery. Water level measurements were taken using an electric probe and discharge data were obtained from an inline, helical water meter; pump intake depth was 49 m with a Standing Water Depth (S.W.D.) of about 6 m.

Well 8b located 8.85 m west of the production well was used as the only observation well.

From screen entrance velocity considerations and the maximum available drawdown the required discharge rate of 7860 m^3/day (1200 gpm) should be available. However as the maximum test rate was only 4260 m^3/day it is recommended that the well be developed slowly over a period of at least a week to full capacity.

WATER QUALITY

Water samples were taken regularly during cable tool drilling and discharge testing at Well No. 8 site. No water samples were obtained during drilling with mud circulation at Well No. 8a; data are presented in Appendix A.

A Total Dissolved Solids (T.D.S.) of 612 mg/l was obtained from a sample taken after 72 hours pumping in well no. 8; all ions are within acceptable limits [Hart (1974)] and no trend in salinity was noted during pumping.

Well head analyses for iron and bacteriological parameters need to be done as these were not carried out during testing by this Department.

Regular monitoring for selected water quality parameters is suggested.

DISCUSSION

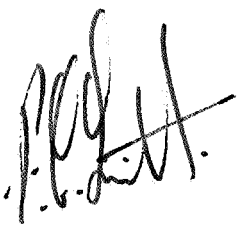
The practice of drilling a scout well to prove a suitable

interval in the confined aquifer has been well justified by this investigation. Site 8a had to be completely abandoned and the standby well relocated to site 8b.

As the production rate during discharge testing was quite high a large volume of water was generated. The water could not be removed from the site via the sewerage system so had to be ponded on Woods and Forests Department land north of the well; this necessitated construction of an embankment to prevent water innundating adjacent houses to the west.

This fact is mentioned because potential production sites with no such ponding area available will pose problems during development and production testing if the water produced cannot be otherwise stored or removed.

It is current Departmental practice to arrange for AMDEL to carry out partial water analyses on all production wells; these data are used for hydrochemical studies but cannot be regarded as adequate for a major town water supply well. It is recommended that during future production tests that the E. & W.S. Department arrange for well head sampling, particularly for iron and bacteria.



P.C. Smith

REGIONAL GEOLOGIST

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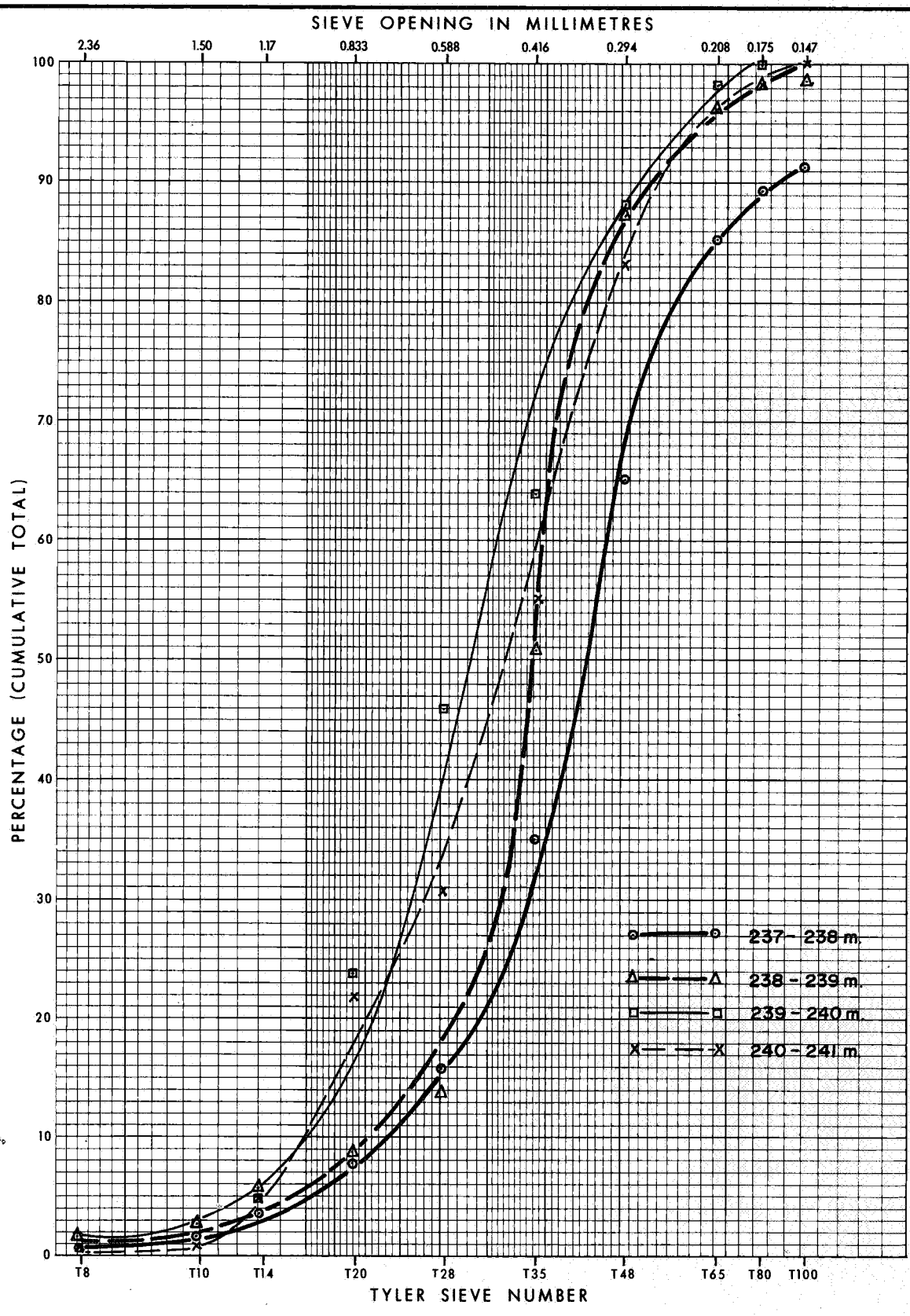
Hart, B.T., (1974). A compilation of Australian Water Quality Criteria A.W.R.C. Tech. Paper No. 7 Canberra pp. 349.

Hazel, C.P., (1973). Groundwater Hydraulics. Lecture Notes for A.W.R.C. 1973 Groundwater School, Adelaide. (Irrigation and Water Supply Commission, Qld.).

Smith, P.C., (1978). E. & W.S. Department Mount Gambier Town Water Supply Standby Well No. 7 Completion Report. S.A. Department Mines and Energy Report Book 78/9 (unpublished).

APPENDIX A

Screen Size Analyses



INTERVAL. 237 .. m TO. 241 .. m

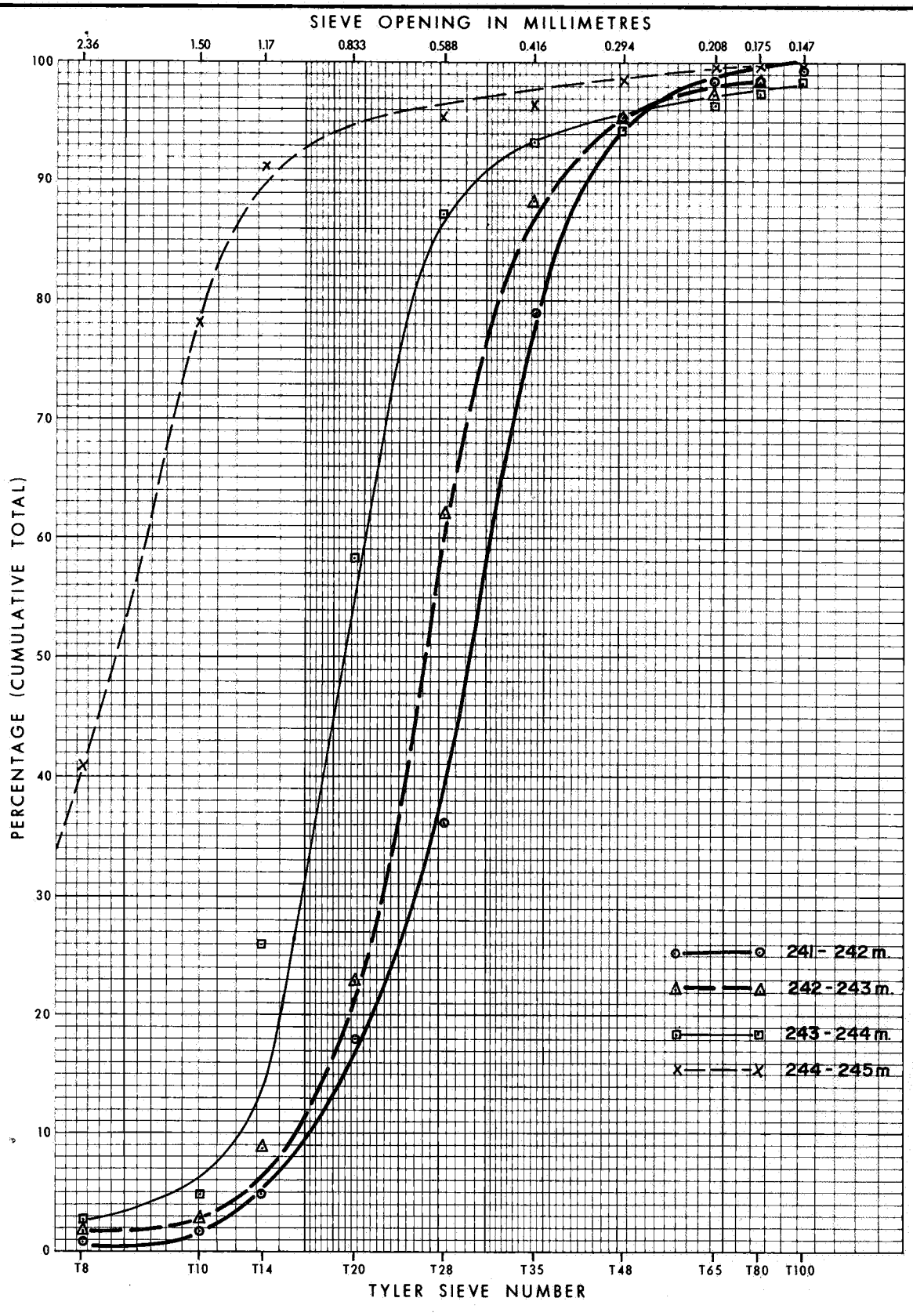
BOREHOLE STATE No. 7022330WW02676

SCREEN RECOMMENDED.....

BOREHOLE IDENTIFYING No. T.W.S. Well 8 ...

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 480/77
Compiled: P.C.S.	SCREEN SIZE ANALYSIS	Date: APRIL 1978
Drn: M.R.	MT. GAMBIER T.W.S. STANDBY WELL No. 8	Drg.No:
Ckd:	INTERVAL 237 - 241 m.	S 13368

P.F. No. 6255 MH



INTERVAL 241 m TO 245 m

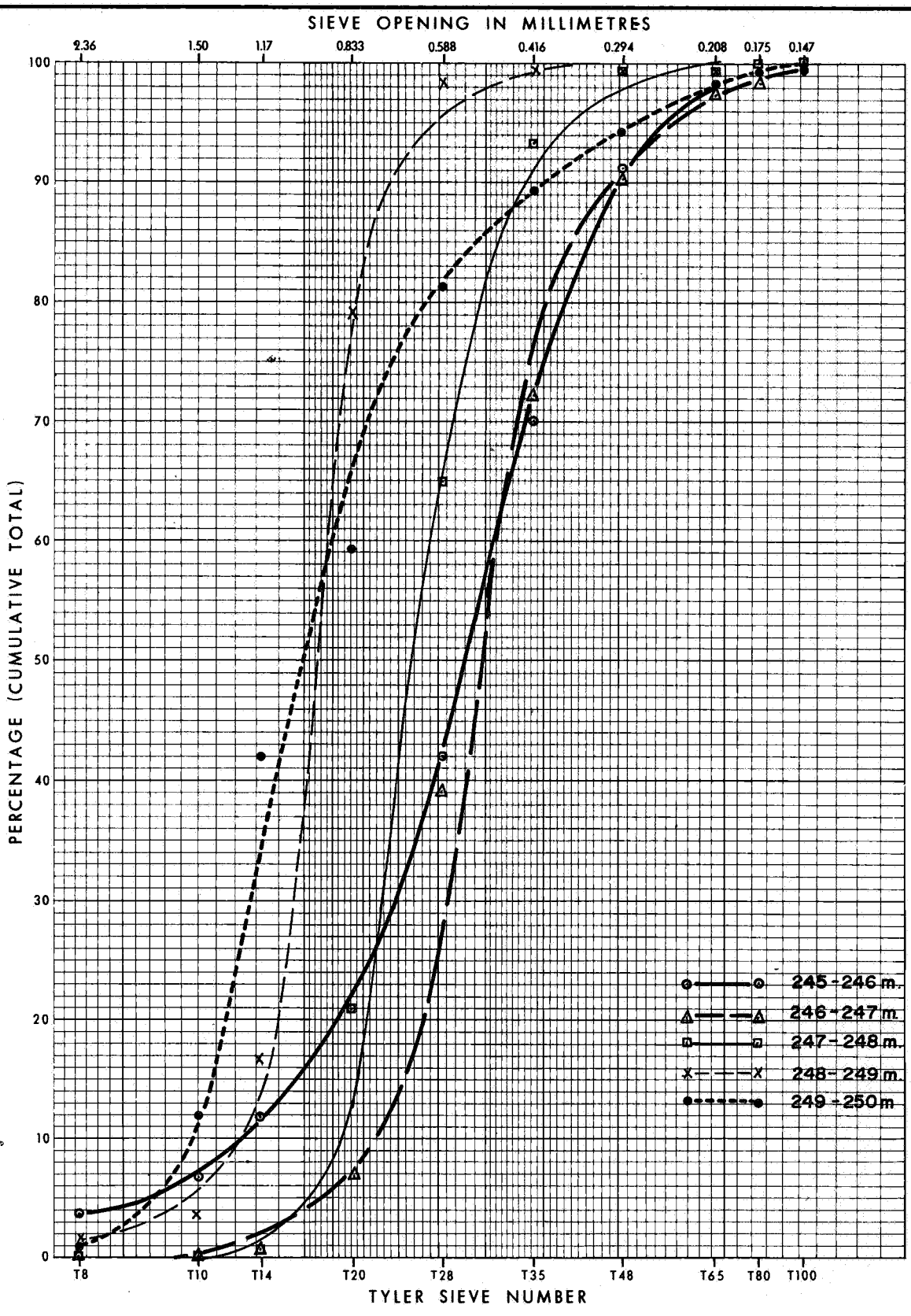
SCREEN RECOMMENDED .....

BOREHOLE STATE No. 7022330WW02676

BOREHOLE IDENTIFYING No. T.W.S. Well 8

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 480/77
Compiled: P.C.S.	SCREEN SIZE ANALYSIS	Date: APRIL 1978
Drn: M.R.	MT. GAMBIER T.W.S. STANDBY WELL No. 8	Drg.No:
Ckd:	INTERVAL 241-245 m.	S 13369

P.F. No. 6255 MH



INTERVAL 245 m TO 250 m

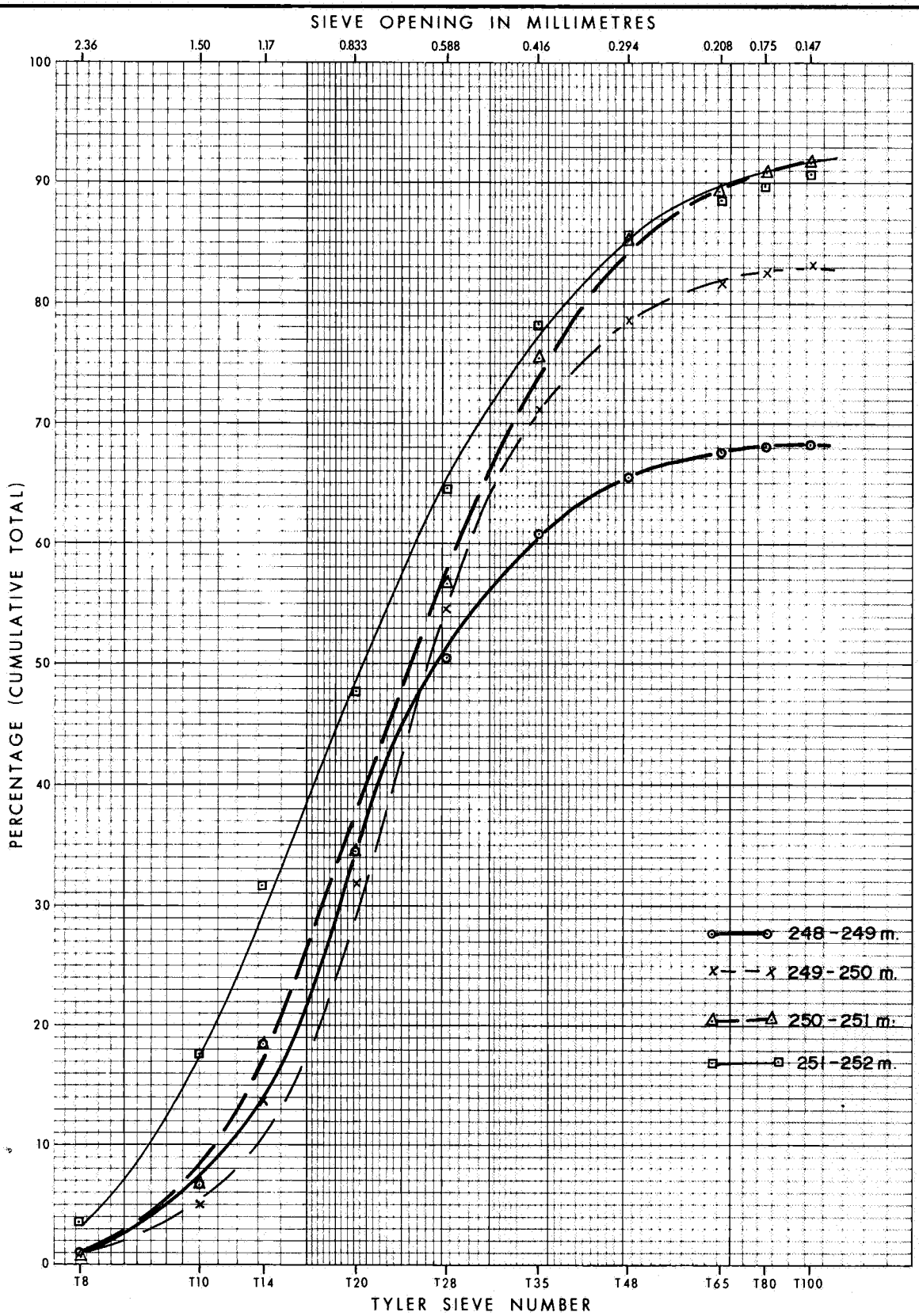
BOREHOLE STATE No. 7022330WW02676

SCREEN RECOMMENDED .....

BOREHOLE IDENTIFYING No. T.W.S. Well 8

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 480/77
Compiled: P.C.S.	SCREEN SIZE ANALYSIS	Date: APRIL 1978
Drn: M.R.	**MT. GAMBIER T.W.S. STANDBY WELL No 8.**	Drg.No:
Ckd:	**INTERVAL 245 - 250 m.**	**S 13370**

P.F. No. 6255 MH



INTERVAL 248 m TO 252 m

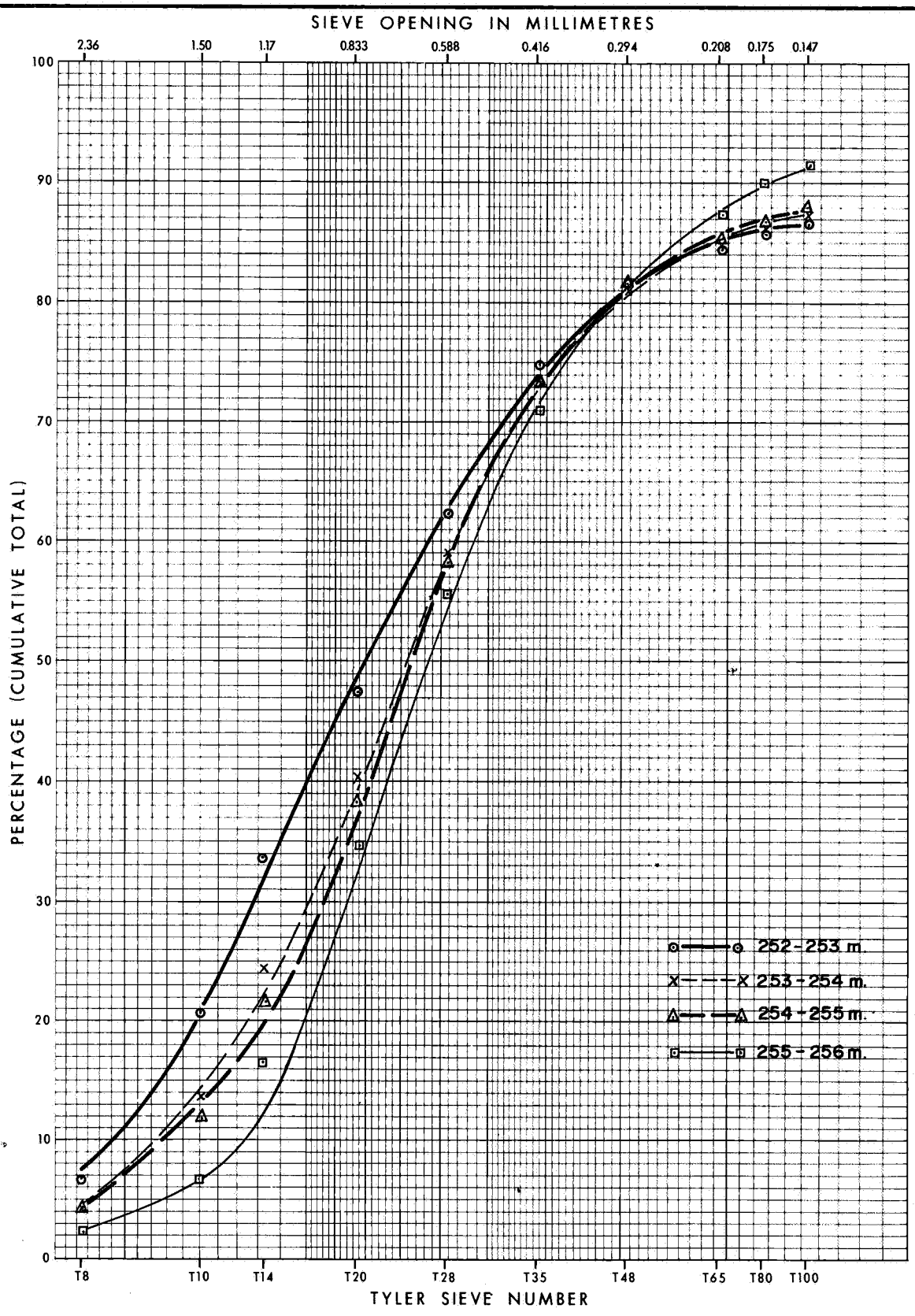
BOREHOLE STATE No. 70223300W01999

SCREEN RECOMMENDED .....

BOREHOLE IDENTIFYING No. T.W.S. Well 8a

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 748/74
Compiled: P.C.S.	SCREEN SIZE ANALYSIS	Date: APRIL 1978
Drn: M.R.	MT. GAMBIER T.W.S. STANDBY WELL No. 8a	Drg.No:
Ckd:	INTERVAL 248-252 m.	S 13371

P.F. No. 6255 MH



INTERVAL 252 m TO 256 m

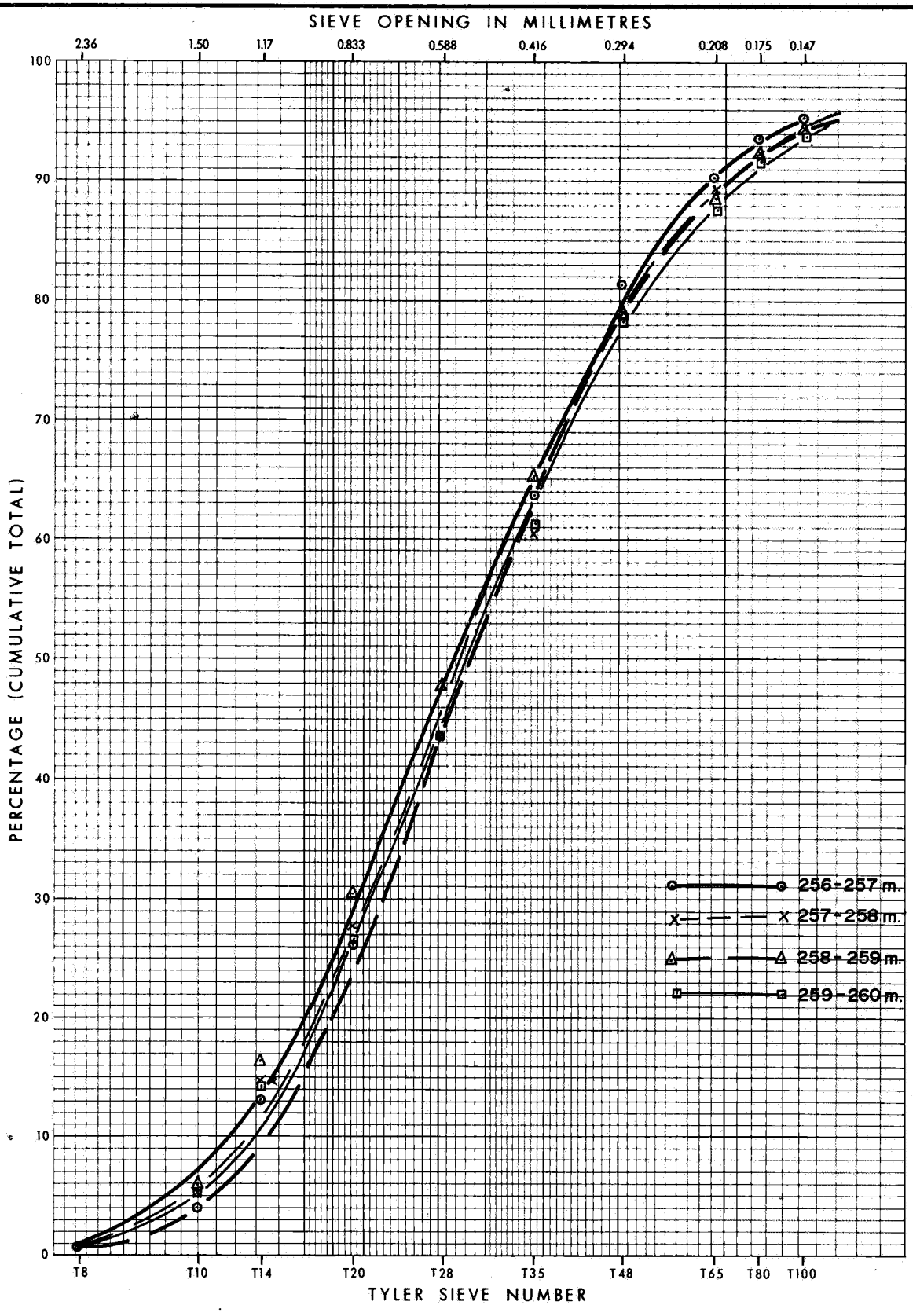
SCREEN RECOMMENDED .....

BOREHOLE STATE No. 70223300W01999

BOREHOLE IDENTIFYING No. T.W.S. Well 8a

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 748/74
Compiled: P.C.S.	SCREEN SIZE ANALYSIS	Date: APRIL 1978
Drn: M.R.	MT. GAMBIER TWS STANDBY WELL No. 8a	Drg.No: S 13372
Ckd:	INTERVAL 252 - 256 m.	

P.F. No. 6255 MH



INTERVAL. 256 . . m TO . 260 . . m

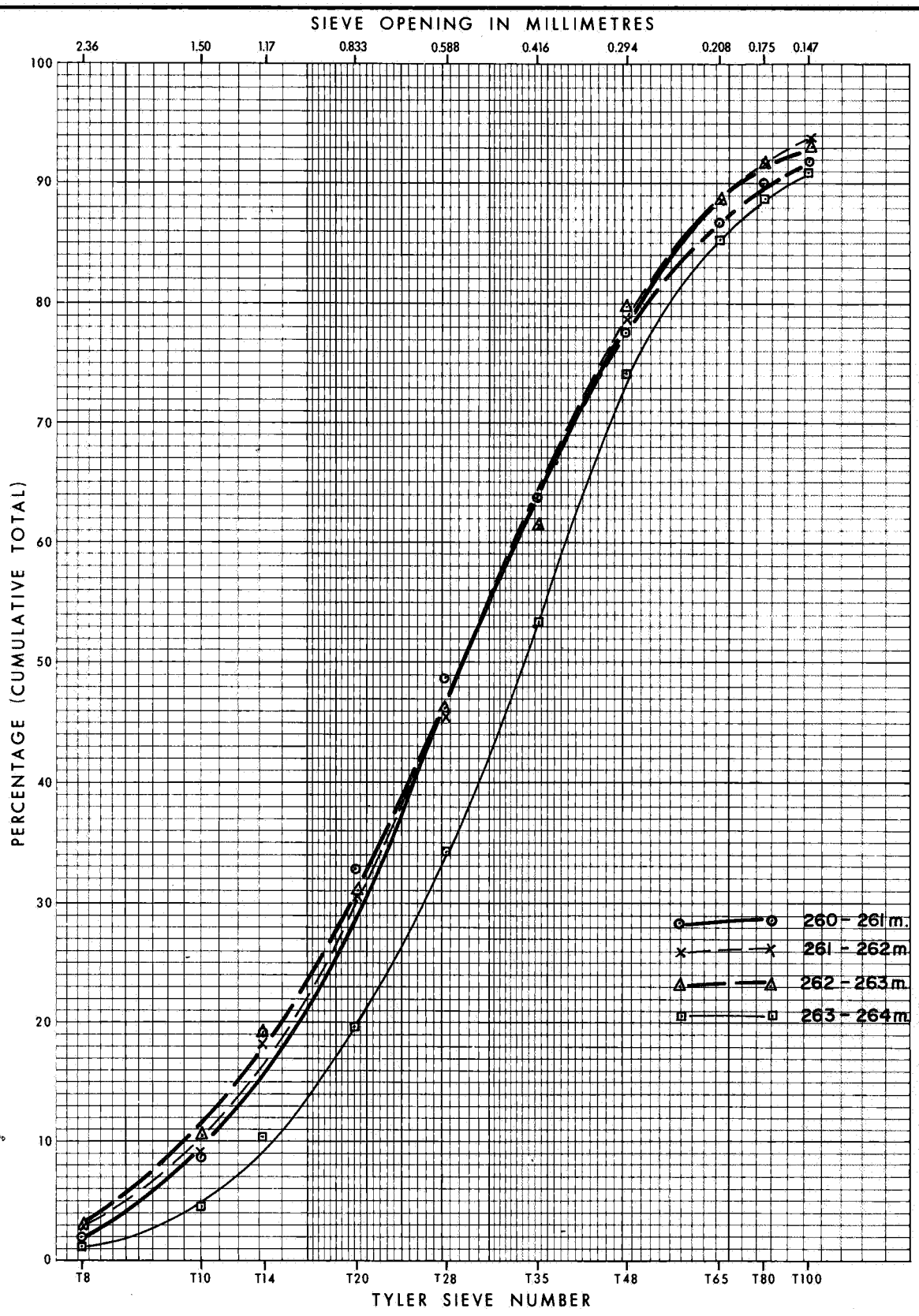
BOREHOLE STATE No. 70223300W01999

SCREEN RECOMMENDED.....

BOREHOLE IDENTIFYING No. T.W.S. Well 8a

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 748/74
Compiled: P.C.S.	SCREEN SIZE ANALYSIS	Date: APRIL 1978
Drn: M.R.	MT. GAMBIER T.W.S. STANDBY WELL No. 8a	Drg.No:
Ckd:	INTERVAL 256 - 260 m.	S 13373

P.F. No. 6255 MH



INTERVAL 260 m TO 264 m

SCREEN RECOMMENDED .....

BOREHOLE STATE No. 70223300W01999

BOREHOLE IDENTIFYING No. T.W.S. Well 8a

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 748/74
Compiled: P.C.S.	SCREEN SIZE ANALYSIS	Date: APRIL 1978
Drn: M.R.	MT. GAMBIER T.W.S. STANDBY WELL No. 8a	Drg.No:
Ckd:	INTERVAL 260 - 264 m.	S 13374

P.F. No. 6255 MH

APPENDIX B

Well Construction Reports

DM 748/74

TO THE CHIEF DRILLING & MECHANICAL ENGINEER:

Observation Well 8A - Mt. Gambier

Rotary drilling on Mt. Gambier site 8A commenced on 20/10/76 and the hole was abandoned on 12/11/76. Considerable difficulties were encountered in drilling and attempting completion as an observation well.

Loss of circulation at 6 m required 26 m of 5" I.D. flush joint pipe to be installed to gain returns of fluid. Loss of circulation again occurred at 128 m and drilling continued without returns to 141 m. The casing was removed, the hole reamed to 141 m and the casing replaced to this depth. Circulation was again lost at 141.50 m and drilling continued again without returns to 185 m. Casing was again withdrawn, the hole reamed to 185 m and casing replaced. Drilling continued to a total of 280 m, with some fine sands (with clays) between 248 m and 264 m. Hard bars were encountered at 218 m 233 m and 265 m requiring several hours drilling to penetrate a few centimetres.

The hole was logged on 9th and 10th November and an interval (200-202 m) was selected to set a screen for a Knight Group observation well completion.

During the cementing of P.V.C. pipe pressure built up and top solvent weld connection blew off and the P.V.C. pipe slipped through the surface clamp. Fishing operations located the top of the pipe at 80 m and after several attempts 17 lengths of P.V.C. were recovered, totalling 102 m.

Further attempts to recover the fish were unsuccessful and after discussion with the C.D. & M.E. on the site it was decided to abandon the hole. Fifty (50) sacks of cement were pumped into the well at 180 m to ensure sealing between confined and Gambier aquifers and a cement plug installed at surface.

Approximate final cost $10 900
Debit 71-2051 applied
Bore Serial No. 923/77

MRO:MKG
25th January 1977

M.R. Obst
ROTARY DRILLING SUPERINTENDENT

DM 553/75

TO THE CHIEF DRILLING & MECHANICAL ENGINEER:

Through the Drilling Engineer

Completion of drilling Collar hole for Scout
Bore No. 8B Adj. site for T.W.S. bore No. 8 Mt. Gambier

The hole was drilled 203 mm to 108 mm then reduced to 152 mm to 155.50 m and lined with 152 mm casing to enable the Rotary section to sample the knight formation and determine if a suitable aquifer is present for a T.W.S. well.

Considerable difficulty was encountered in working the casing through a very hard dolomite formation from 104 m to 137 m. This formation was fractured and contained patches of sand and had to be redrilled and reamed continually before it was cased off.

Tabulated below are the details of the bore:-

Commenced	10/1/77
Completed	18/2/77
Depth	155.50 m
203 mm casing	Sur - 18 m To be removed
152 mm casing	Sur - 143 m To be removed
Water cut	33.50 m
Static level	31.80 m

J. Perry
DRILLING SUPERINTENDENT

TO THE CHIEF DRILLING & MECHANICAL ENGINEER:

Completion Report - Rotary Drilling -
Bore No. 8b, Mt. Gambier - Dept. of Mines

As requested by the Hydrogeology section this well was deepened by the failing rotary rig RD 3 from 155.90 m to 287.30 m - section from surface to 155.50 m was drilled with cable tool rig.

The purpose of the well was to test the aquifer in Knight group sands and if proved successful a water production well will be drilled for the E. & W.S. Department.

Driller R. Blatchford operated the failing rotary rig RD 3 drilling with 4¼" roller bit and taking samples at 2 m intervals or on change of strata. On completion of drilling the well was logged and a position was selected for setting of the screen by site geologist.

A 2 m x 3" (76.2 mm) stainless steel screen with 0.5 mm aperture was installed from 242.25 m to 244.25 m with a cementing non return valve, 2 linatex seals from 234.60 m to 235.25 m with perspex disc just below the cementing non return valve, 2½" (63.50 mm) galvanised pipe run from top of screen 242.25 m to surface and annulus between 2½" (63.50 mm) pipe and hole was cemented from 235.25 m to surface.

On completion of setting screen and cementing annulus, attempt was made to pull the 6" casing which was installed by cable tool rig. This proved too tight for the rotary rig winch. So it was decided to move rotary rig off hole and set cable tool rig over and jack casing out. Also for the cable tool rig to develop well. A report on final development and completion of well will be submitted by cable tool section.

Details of the rotary drilled section are as below:-

Bore No. 8B
Bore Serial No. 996/77
Drilled from 155.50 to 287.30 m
Well diameter 4¼" (120.65 mm)
3" (76.2 mm) 0.5 mm aperture stainless steel screen from 242.25 to 244.25 m
2½" (63.50 mm) galvanised pipe from 242.25 to surface
2 linatex seals and cementing valve in 2½" (63.50 mm) pipe line set at 234.60 to 235.25 m

A detailed drawing of completion of well is attached.

.../2

Total metreage drilled 131.80 metres.
Project commenced on 28/2/77 and concluded on 10/3/77.
Debit No. 55-0138 applies.
Approximate actual cost total - $5 400.

MRO:MKG
24th March, 1977

M.R. Obst
DRILLING SUPERINTENDENT

DM 553/75

TO THE CHIEF DRILLING & MECHANICAL ENGINEER:

Completion of further work Bore 8B Dept. Mines
Permit not required Mt. Gambier

The rotary drill RD 3 was removed from the site after sampling the knight formation from 155.50 m to 287.30 m and setting a S/S screen from 242.25 m to 244.25 m with 2½" galv. pipe from surface to screen.

The rotary drill was unable to clean out the screen and remove the 152 mm casing.

Plant No. 38 was placed on site on 10/3/77 and the 152 mm casing and 203 mm casings were jacked free and removed.

Approximately 0.50 m of cement was drilled out with a weighted chisel tool on the sandline and the perspex disc below the seals broken.

The hole was then air lifted for 20 hours to develop the screen and obtain water samples.

The Annulus between the 2½" galv. pipe and the 203 mm hole was cement grouted from surface during the above operations.

Details of the bore are tabulated below.

Work commenced (Plant 38)	10/3/77
Work completed	19/3/77
Depth on Completion	244 m- base of screen
2½" galv. pipe	Sur - 242.25 m
2½" S/Slscreen	242.25 m - 244.25 m
Linatex seals from 2½" pipe to 120.65mm hole	235 m
Water cut	236 m
Static Level	5.46 m
Airlifted for 20 hours at	4 1/sec.

WDW:JP
21st March, 1977

J. Perry
DRILLING SUPERINTENDENT

TO THE CHIEF DRILLING & MECHANICAL ENGINEER:

Completion of drilling — T.W.S. Well No. 8
E. & W.S. Department — Mt. Gambier
Permit No. 1003

The hole was commenced 324 mm and lined with 324 mm cas ing to 20 m, then continued 305 mm open hole to 121.60 m and lined with 273 mm welded joint tubing. The 273 mm tubing was cemented by the dump bailer method, 30 gallons of grout was used. At this stage the plant was moved off the hole to allow the rotary section to penetrate the aquifer and set a sandscreen.

Drilling through the hard, broken dolomite section from 106 m to 138 m was extremely difficult, and a 11¼" star drill was lost at 121 m which took 3 weeks of total effort to recover.

Inclement weather, with continual rain, hail and strong winds impeded progress and made working conditions hazardous and very uncomfortable. The area around the boresite was a quagmire and the drill crew, B.W. Chaplin and A.D. Wilson are to be commended for their determined and persistant efforts in carrying on with their duties despite very difficult conditions and lack of shelter.

Details of Rotary operations are as follows:

A 205 mm dia hole drilled to 237 mm
230 mm Aust. swell joint casing set from surface to 226 m and pressure cemented from 226 m back to 77 m from surface.

A 187 mm diameter hole drilled from 238 m to 250 m. Aquifer sands sampled from 237 m to 250 m.

A 152 mm pipe size screen set from 237.34 m to 250 m with 152 mm I.D. pipe from 205.05 m to top of screen.

Rubber seals to the 203 mm casing were banded to the 152 mm I.D. pipe at 205.50 m.

On completion of the rotary operations the site was filled and levelled and plant CT/7 was reset over the hole. The left hand screwed joint in the 203 mm casing at 88 m could not be unscrewed and finally a joint at 77 m was slotted and pulled apart and 77 m of 203 mm casing was recovered.

The 324 mm casing, originally set from surface to 20 m, pulled apart at 2 m whilst trying to recover it and the remainder was left in the hole.

When trying to re-enter the screen after the removal of the 203 mm casing it was found that large quantities of cement, sand and drilling mud from the annulus between 203 mm and 273 mm casing had fallen into the well and a further 5½ days were spent cleaning it out before development could begin. Apparently an excessive amount of cement grout was used by the rotary section when pressure cementing and the 203 mm casing was cemented much higher than planned. The screen was developed for 44 hours, by

surging the face of the screen and airlifting. Then the 180 mm test pump was installed to 49 m and after initial pumping to complete development and establish flow rates and drawdown, 3 x 100 minute step drawdown tests were conducted followed by a 4 320 minute continuous test and recovery.

Details of the bore are as follows:-

Commenced	26/4/77
Completed	21/9/77
Depth drilled	250 m
Water cuts	34.50 m : 237.30 m
Static levels	28.80 m : 5.90 m
324 mm casing (collar joints)	From 2 m to 20 m
237 mm welded joint tubing	From surface to 139 m
203 mm Aust. swell joing casing	From 77 m to 226 m
152 mm I.D. pipe (collar joints)	From 205.05 m to 237.34 m
153 mm I.D. stainless steel sandscreen	From 237.34 m to 250 m
Developed for	44 hours
Pump tested	72 hours
Average flow rate	39 100 g.p.h.
Maximum drawdown	31.50 m

Details of Sandscreen

"Surescreen" stainless steel

I.D. 153 mm
O.D. 166 mm

Length - 3 sections

1. 4.14 m inc. female coupling
2. 4.14 m inc. female coupling
3. 4.20 m inc. female coupling

Total length 12.48 m

Apertures - .99 mm

Debit No. 71-4077
Approval $46 000.00
Plant Hours (C/tool) 538

WDW:YMW
23rd September, 1977

W.D. Wilson
DRILLING SUPERINTENDENT

DM 553/75

TO THE CHIEF DRILLING & MECHANICAL ENGINEER:

Through the Drilling Engineer

Completion Report - Mt. Gambier, Bore No. 8

This hole was started by cable tool section who drilled to 139 m and lined hole with 260.350 I.D. pipe. R. Blatchford set failing 1500 over hole 2/8/77 and commenced drilling 3/8/77.

A 250 mm (9 7/8") hole was drilled to 237 m, then 203 mm (8") casing with left hand joint at 88 m and drillable float on bottom was run to 226 m. Casing was pressure cemented through F.E.D.P. rod connected to float with L.H. fitting. 71 bags of cement mixed with 1900 litres of water, follow up water was 390 litres which should have put cement 34 m inside 260.350 mm casing. After cement had set drilling proceeded to 250 m using 187.525 mm (7 3/8") roller bit.

After hole was logged at 250 m w/wound surescreen M^k2 with 0.9 mm aperture 12 m long with 32.34 m of 152.400 I.D. pipe on top was run into hole on end of F.E.D.P. rod. When screen seated at 250 m rods were backed off and clean water circulated till all mud washed out of hole.

Equipment was then packed up and returned Depot 16/8/77.

Hole being left for cable tool to develop.

Machine hours - 107.
Bore Serial No. - 909.78.
Debit No. 71-2078.

TJ:MKG
23rd August, 1977

T. Jarvis
DRILLING OVERSEER

APPENDIX C

Well Discharge Test Calculations

Contents

Figures

WELL NO. 8b

Airlift Recovery Test

Airlift at a rate of about 300 kl/day was carried out from a depth of about 40 m (submergence ratio 6:1) for 360 minutes. Discharge rate was measured periodically during the test by measuring the time to fill a 900 litre tank. Surging problems inherent in airlifting prevented use of a smaller measuring vessel. On completion of airlift, the top flange was quickly removed and recovery measurements commenced within 2 minutes. A value of $T = 297 m^3/day/m$ was obtained which compares favourably with an average Early Time value of $T = 239 m^3/day/m$ calculated from the constant discharge testing. See Figure 1 for details.

WELL NO. 8

Step Drawdown Test

The 3 x 100 minute step test was carried out with no recovery between steps and reduced by the method outlined in Hazel (1973) p. VII - 26. Table 1 summarises the data and calculations. Drawdown Data and the Well Equation derivation are shown on Fig. 2.

TABLE 1

STEP DRAWDOWN TEST DATA

Step	$Q(m^3/min)$	$Q(m^3/day)$	Δs	$Q/\Delta s$	$T(m^3/day/m)$
1	1.36	1960	1.01	1.35	355
2	2.10	3020	1.68	1.25	329
3	2.91	3720	2.58	1.12	297

The assumptions used in deriving the Well Equation are outlined in Smith (1978) Appendix C and will not be repeated here.

The Well Equation is:-

$$s = (3.88Q + 0.59Q^2) + 0.81 \log t\, Q$$

well loss aquifer loss

where s = drawdown in metres

Q = discharge rate in m^3/min (kl/min)

t = time (since pump started) in minutes

Constant Discharge Test

After the step drawdown test, the well was allowed to fully recover and then subjected to a 72 hour constant discharge test with an average pumping rate (Q_{av}) of 4260 kl/day. Recovery wasmonitored for 36 hours after pump stoppage.

Table 2 presents data obtained from the test, Figure 3 shows the Time/Drawdown plot - semi log, Figure 4 Time/Drawdown plot - log log and Figure 5 the log log plot for Observation Well 8b (GAM 196).

TABLE 2

CONSTANT DISCHARGE TEST DATA

Q_{av} = 4260 m^3/day

(distance to observation well) = 8.85 m

Transmissivity (T) - Early Time = 239m^3/day/m (mean of 8 values)

Transmissivity (T) - Late Time = 117m^3/day/m (mean of 8 values)

$S = 1.8 \times 10^{-3}$ (semilog plot Fig. 7)

$S = 2.3 \times 10^{-3}$ (log log plot Fig. 9 - early time)

$S = 3.4 \times 10^{-2}$ (log log plot Fig. 9 - late time)

Boundary - discharge type after 500 minutes

Average $Q/\Delta s$ for step test - 1.24

$Q/\Delta s$ pre 500 minutes pumping, 72 hour test - 0.95

$Q/\Delta s$ post 500 minutes pumping, 72 hour test - 0.46

Analysis of the test data yielded a discharge boundary at about 500 minutes. The Predicted Drawdown vs Time Curves presented in Fig. 6 have been adjusted accordingly. The

method is outlined in Smith (1978).

No leakage is evident from the test, however the length of the test is too short to dismiss this possibility. Head difference in the unstressed state, between the unconfined and confined is about 22 m with the confined aquifer head the greater. At the completion of 72 hours pumping at 4260 m^3/day drawdown was 31.5 m. After accounting for well loss ($aQ + cQ^2$ = 16.7 m) the head difference between the confined and unconfined aquifers was still about + 7 m i.e. downward leakage would not occur. Under the reduced head difference however vertical leakage from the aquifer would be reduced in a slight net gain in water available to the well.

Screen Entrance Velocity

Using a moderate value of x 15 increase in permeability in the vicinity of the well screen Smith (op. cit), K (permeability) becomes $\frac{240 \times 15}{12.7}$ = 280 $m^3/day/m^2$ which leads to an optimum screen entrance velocity of about 0.06 m/sec.

From 12.7 m of 153 mm I.D. screen with a 0.9 mm slot width, an optimum discharge rate of >8540 kl/day is derived. (Surescreen data.) This figure is well in excess of the 7860 kl/day (1200 gpm) requested by the E. & W.S. Department. Thus screen corrosion or precipitation problems with long term use of the well should not occur at the desired pumping rate.

Optimum Discharge Rate

From screen entrance velocity considerations and the maximum drawdown available from the well, the discharge rate of 7860 m^3/day (1200 gpm) required by the E. & W.S. Department could be provided. However, it is stressed that the well be redeveloped slowly from the test rate of about

4260 m^3/day to that required. The method outlined in Smith (op cit) should be used.

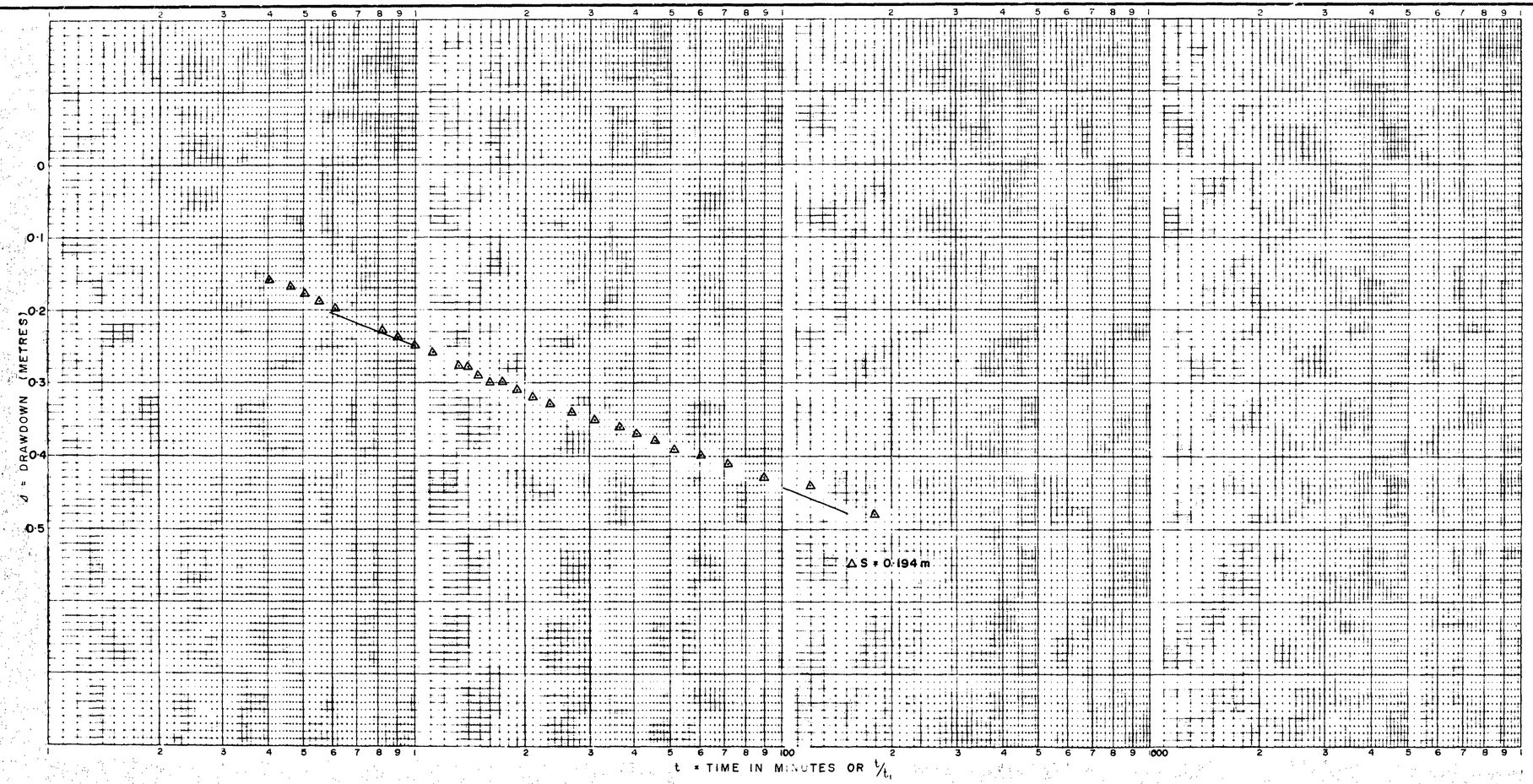
For the selection of optimum pump intake depth the curves presented in Fig. 6 should be consulted after well management guidelines have been established. Maximum available drawdown is about 71 m from a Standing Water Depth of 6 m and with the deep well turbine pump installed inside 273 mm tubing.

For example: in the event the well were to be pumped continuously for 24 hours at 7860 m^3/day, a suitable intake depth would be 70.5,

Made up of: 6 m - S.W.D.
57 m - from curve on Figure 6
1 m - seasonal fluctuation
6.5 m - 10% "safety" margin

It can be seen that the well is at maximum stress at this pumping rate and time. Thus consideration may have to be given to the selection of a lower yield pump if longer pumping periods are required. The above also neglects any possible interference from surrounding wells pumping from the confined aquifer.

The well loss component in the predicted drawdown value is 46 m, therefore only 11 m head loss is due to the aquifer i.e. residual head difference between confined and unconfined aquifers is = 11 m in proximity to the well - no leakage downwards is possible for this pumping rate and time.



BOREHOLE STATE/UNIT No. 7022330ϕW02675

REF. PT. .....(m) above ground

AQUIFER FROM 242·25 TO 244·25 (m)

HOLE DEPTH 244·25 (m)

TYPE OF PUMP AIRLIFT

LENGTH OF TEST 6 hrs

DEPTH WATER LEVEL AT TEST START (ℓ_2) 6·62 (m)

DEPTH PUMP INTAKE (ℓ_1) - (m)

* AVAILABLE DRAWDOWN - (m)

δ = RESIDUAL DRAWDOWN (METRES)

EQUATIONS

$$T = \frac{0.183 \times Q}{\Delta_\delta} \qquad S = \frac{2.25 \times T t_o}{r^2}$$

In which

T = Transmissivity (m^3/day/m)

Q = Pumping Rate (m^3/day)

Δ_δ = Drawdown per log cycle (m)

S = Storage Coefficient

t_o = Zero drawdown time (mins)

r = Distance to Observation Bore (m)

1 day = 8.64×10^4 secs.

DATA

Q (ave)	Δ_δ	t_o	r
2720 gph = 296·6 m^3/day	0·194 m	—	

CALCULATIONS

$$T = \frac{0.183 \times 296.6}{0.194} = 279.8 \text{ m}^3\text{/day/m}$$

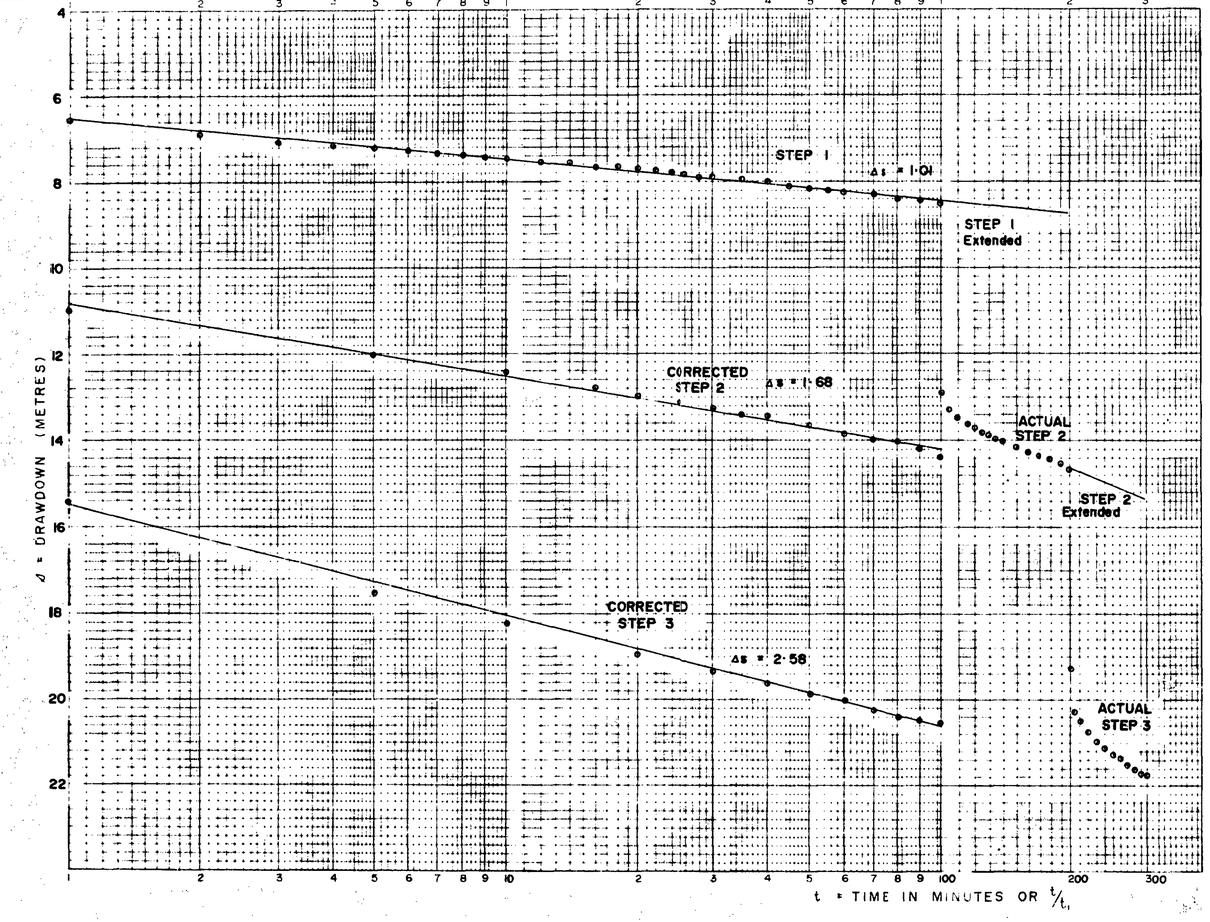
Note: Air line discharge approx. 40 m, ie. submergence ratio approx. 6:1

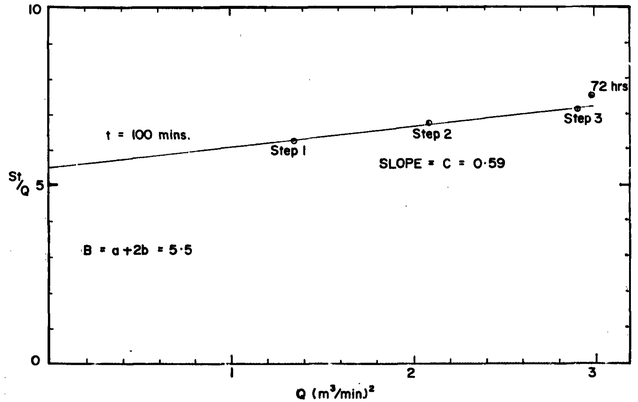
* Available drawdown = $\ell_1 - \ell_2$

APPENDIX C FIG. 1

ENGINEERING DIVISION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	D.M. 553/75
COMPILED P.C.S.	MT. GAMBIER T.W.S. STANDBY WELL No. 8	DATE APRIL '78
DRN M.R. KD	AIRLIFT RECOVERY TEST ON WELL No. 8b	PLAN NUMBER 78 - 350

P.F. No. 62–953 MH





Parameters for water well equation: $s = (aQ + cQ^2) + b.\log t.Q$ (well loss; aquifer loss)

s = drawdown in metres
t = time in minutes
Q = discharge rate in m^3/min

$B = a + 2b = 5·5$ (at $t = 100$ mins. ie. $\log t = 2$)
and $b = \Delta s/Q$

Step 1 b = 0·74
Step 2 b = 0·80
Step 3 b = 0·89

hence $b_{ave.} = 0·81$ therefore $a = B - 2b = 5·5 - 1·62 = 3·88$
and c = slope = 0·59

Thus water well equation:

$$s = (3·88Q + 0·59Q^2) + 0·81 \log t Q$$

BOREHOLE STATE/UNIT No. 7022330WW02676
REF. PT. 1·305 (m) above ground
AQUIFER FROM 237·3 TO 250 (m)
HOLE DEPTH 250 (m)

TYPE OF PUMP POMONA 5 stage 6" column
LENGTH OF TEST 3 x 100 mins
DEPTH WATER LEVEL AT TEST START (ℓ_2) 6·551 (m) T.O.C.
DEPTH PUMP INTAKE (ℓ_1) 49 (m)
* AVAILABLE DRAWDOWN 42 (m)

EQUATIONS

$$T = \frac{0·183 \times Q}{\Delta_d} \qquad S = \frac{2·25 \times T t_o}{r^2}$$

In which

T = Transmissivity (m^3/day/m)
Q = Pumping Rate (m^3/day)
Δ_d = Drawdown per log cycle (m)
S = Storage Coefficient
t_o = Zero drawdown time (mins)
r = Distance to Observation Bore (m)
1 day = $8·64 \times 10^4$ secs.

DATA

	Q (ave)	Δ_d	$\Delta s/Q$	Intercept	s^1/Q (t=100 mins)
STEP 1	17,900 gph 1·36 m^3/min.	1·01	0·74	6·40	6·24
STEP 2	27,600 " 2·10 "	1·68	0·80	10·78	6·76
STEP 3	38,300 " 2·91 "	2·58	0·89	15·58	7·11

CALCULATIONS

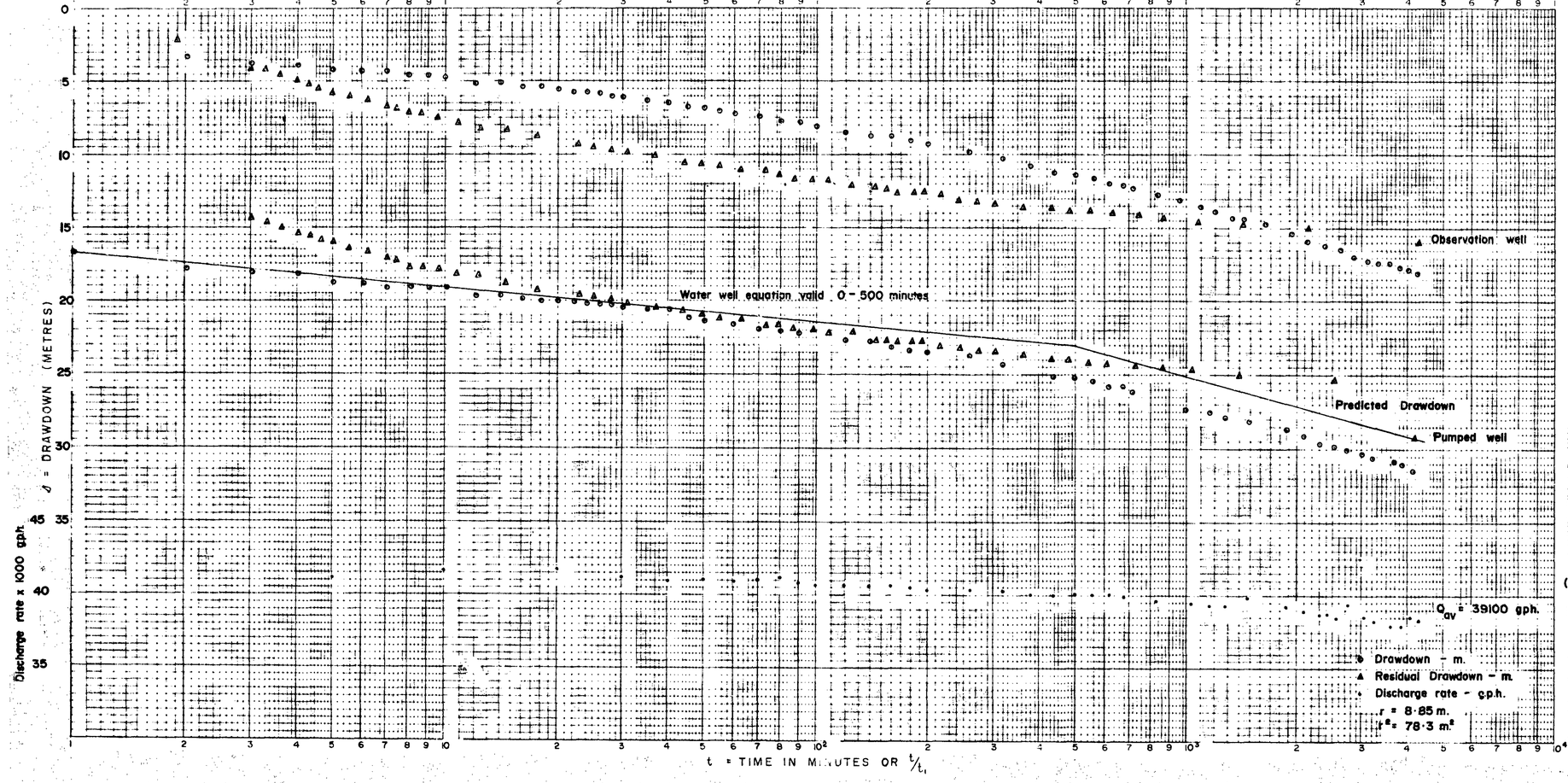
STEP 1 T = 355 m^3/day/m.
" 2 T = 329 "
" 3 T = 297 "

* Available drawdown = $\ell_1 - \ell_2$

APPENDIX C. FIG. 2

ENGINEERING DIVISION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	D.M. 480/77
COMPILED A.J.F./P.C.S.	MT. GAMBIER T.W.S. STANDBY WELL No. 8	DATE APRIL 1978
DRN M.R. CKD	STEP DRAWDOWN TEST – TIME / DRAWDOWN DATA	PLAN NUMBER 78-351

DF No. 69-953 MH



BOREHOLE STATE/UNIT No 7022330WW02676 No.8 LINE
7022330W02675 No.8b TYPE OF PUMP SHAFT TURBINE 5 Stage 6" Column

REF. PT. .....(m) above ground — LENGTH OF TEST .....72 hrs

AQUIFER FROM 237·3 TO 250 (m) — DEPTH WATER LEVEL AT TEST START (ℓ_2) 5·36 (m)

HOLE DEPTH 250 (m) — DEPTH PUMP INTAKE (ℓ_1) 49 (m)

* AVAILABLE DRAWDOWN 44 (m)

EQUATIONS

$$T = \frac{0{\cdot}183 \times Q}{\Delta_s} \qquad S = \frac{2{\cdot}25 \times T t_o}{r^2}$$

In which

T = Transmissivity (m^3/day/m) — S = Storage Coefficient

Q = Pumping Rate (m^3/day) — t_o = Zero drawdown time (mins)

Δ_s = Drawdown per log cycle (m) — r = Distance to Observation Bore (m)

1 day = $8{\cdot}64 \times 10^4$ secs.

DATA

	Q	Δ_s	T	t_o
PUMPED WELL				
Drawdown (0-500 mins)	4260 m^3/day 2·96 m^3/min	3·1	250 m^3/day/m	
" (500 - end)	"	6·5	120 "	
Recovery (t/t_1 4321-10)	"	3·2	240 "	
(Residual Drawdown) (t/t_1 10-1·9)	"	7·2	110 "	
OBSERVATION WELL				
Drawdown (0-500 mins)	"	3·2	240 "	$2{\cdot}6 \times 10^{-5}$
" (500 - end)	"	7·2	110 "	
Recovery (t/t_1 4321-10)	"	3·3	235 "	
(Residual Drawdown) " (t/t_1 10-1·9)	"	7·7	100 "	

$$S = \frac{2{\cdot}25 \times 240 \times 2{\cdot}6 \times 10^{-4}}{78{\cdot}3} = 1{\cdot}8 \times 10^{-5}$$ cf. theoretical value $3{\cdot}6 \times 10^{-5}$ obtained by relationship S = aqu. thickness x 3×10^{-6}

T (ave.) - early time 0 - approx. 500 mins = 240 m^3/day/m

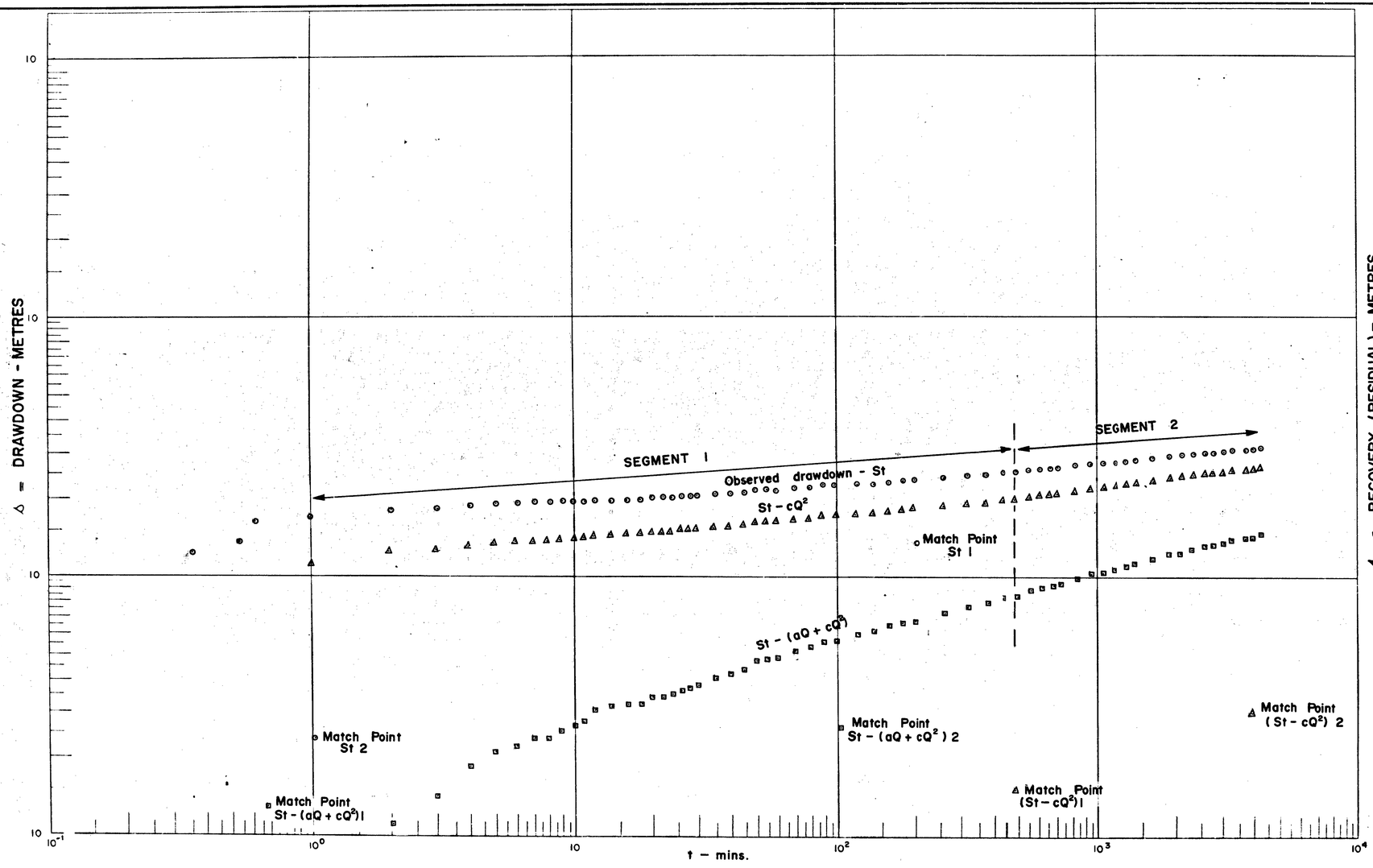
T (ave.) - late time 500 mins. to end of test = 110 "

* Available drawdown = [illegible]

APPENDIX C FIG. 3

ENGINEERING DIVISION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	D.M. 553/75 & 480/77
COMPILED PCS/AJF	MT. GAMBIER T.W.S. STANDBY WELL No.8	DATE APRIL 1978
DRN M.R. CKD	CONSTANT DISCHARGE TEST TIME/DRAWDOWN DATA	PLAN NUMBER 78-352

PF No. GE-953 MH



BOREHOLE STATE Nº 7022330WW02676
DEPTH TO WATER LEVEL
AT TEST START 5·816 m (L) *
PUMP INTAKE DEPTH 49 m (L)
AVAILABLE DRAWDOWN 43 m (L)

TYPE OF PUMP SHAFT LINE TURBINE 5 stage 6"column
DISCHARGE STARTED AT 0900 ON 16·9·77
" STOPPED AT 0900 ON 19·9·77
AQUIFER FROM 237·3 TO 250 m (L)
HOLE DEPTH 250 m (L)

BASIC EQUATIONS

$$T = \frac{Q}{4\pi\Delta} Wu \qquad S = \frac{4\,Tut}{r^2}$$

In which
T = Transmissivity $(L^3/t/L)$
Q = Pumping Rate (L^3/t)
Δ = Drawdown (L)
Wu = function of u
S = Storage Coefficient (dimensionless)
t = time (t)
r = Distance to observation hole (L)

DATA

Match Pt.	Q (m³/day)	Δ (m)	t (mins)	Wu	u	T m³/day/m
St 1	4260	13·5	205	10	10^{-8}	250
St 2	"	2·35		1	10^{-2}	145
(St - cQ²) 1	"	1·5	500	1	10^{-6}	225
" 2	"	3·0	4050	1	10^{-4}	115
St - (aQ + cQ²) 1	"	1·3	0·7	1	1	260
" 2	"	2·6	104	1	10^{-1}	130

Ave early time T (0 to approx. 500 mins.) - 245 m³/day/m
" late " T (500 mins to end of test) - 130 "

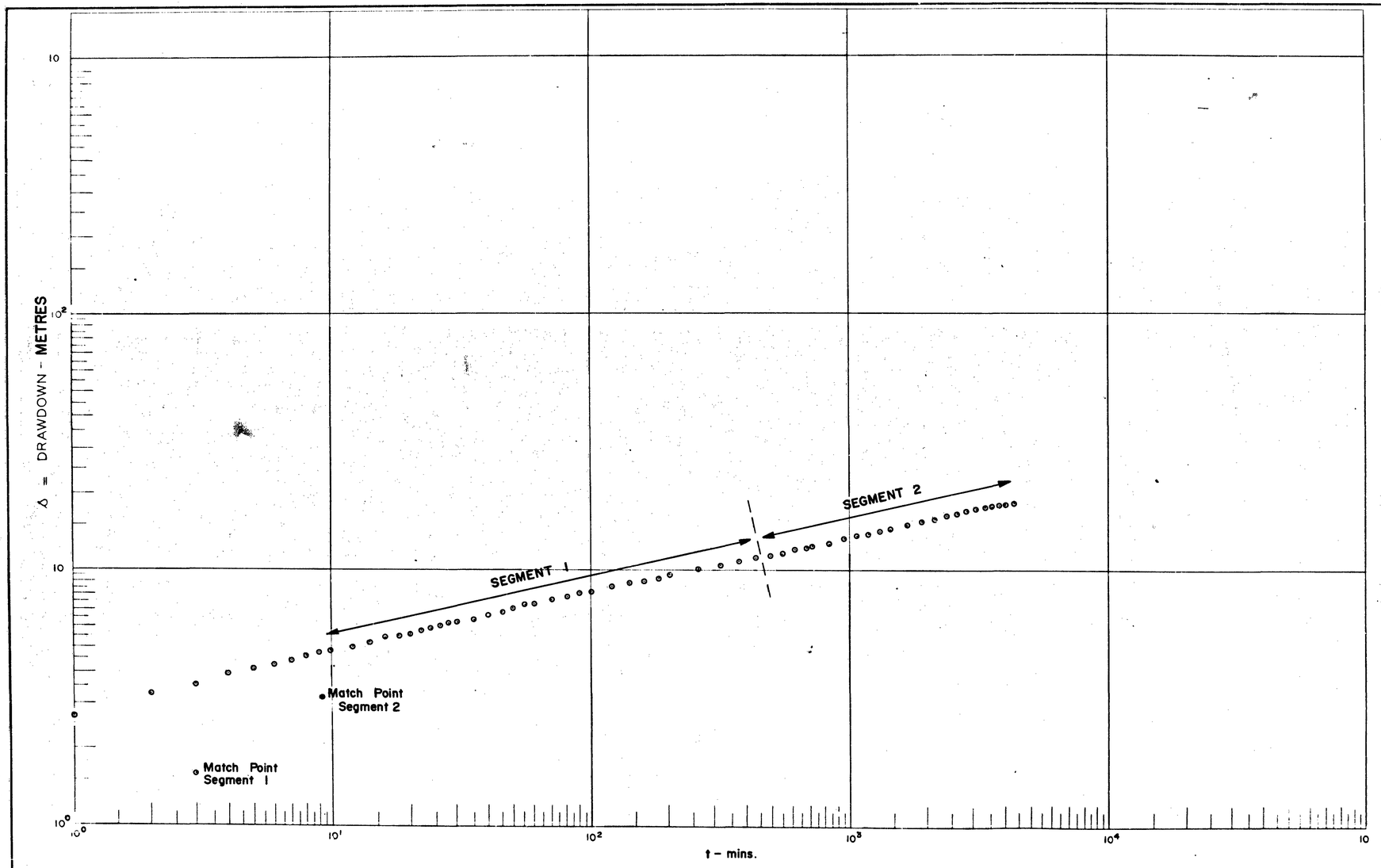
Note: cQ = 5·17 m
aQ + cQ² = 16·65 m
r = 8·85 m

* L = unit of Length
t = time unit

o Observed drawdown - St
Δ St - cQ²
□ St - (aQ + cQ²)

APPENDIX C FIG. 4

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM 480 · 77
COMPILED P.C.S.	MT. GAMBIER T.W.S. STANDBY WELL No. 8	DATE APRIL 1978
DRN M R CHD	CONSTANT DISCHARGE TEST LOG - LOG PLOT	DRG NO 78-353



Δ = RECOVERY (RESIDUAL) - METRES

BOREHOLE STATE N° 70223300W02675
DEPTH TO WATER LEVEL
AT TEST START 5·356 m (L) *
PUMP INTAKE DEPTH - (L)
AVAILABLE DRAWDOWN - (L)

TYPE OF PUMP SHAFT LINE TURBINE 5 stage 6" column
DISCHARGE STARTED AT 0900 ON 16·9·77
" STOPPED AT 0900 ON 19·9·77
AQUIFER FROM 237·3 m TO 250 m (L)
HOLE DEPTH 244 m (L)

BASIC EQUATIONS

$$T = \frac{Q}{4\pi\Delta} Wu \qquad S = \frac{4Tut}{r^2}$$

In which
T = Transmissivity $(L^3/t/L)$
Q = Pumping Rate (L^3/t)
Δ = Drawdown (L)
Wu = function of u
S = Storage Coefficient (dimensionless)
t = time (t)
r = Distance to observation hole (L)

DATA

	Q (ave)	Δ (m)	t (days)	Wu	u	T m³/day/m
Segment 1	4260 m³/day	1·6	$2·7 \times 10^{-3}$	1	10^{-1}	210
" 2	"	3·3	$6·4 \times 10^{-3}$	1	1	105

CALCULATIONS

* Storage coefficient

Segment 1 $S = \frac{4 \times 210 \times 10^{-1} \times 2·1 \times 10^{-3}}{78·3} = 2·3 \times 10^{-3}$

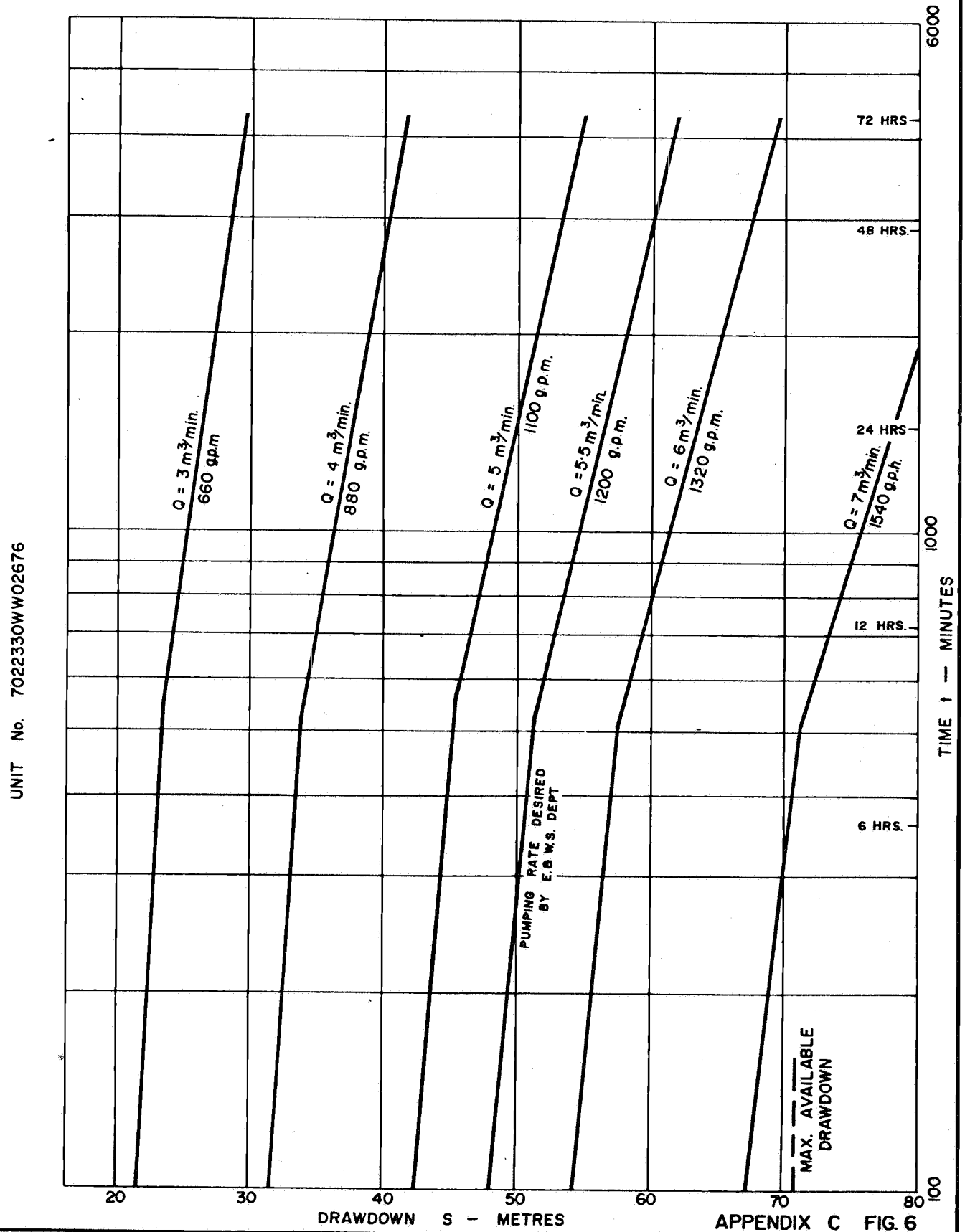
" 2 $S = \frac{4 \times 105 \times 1 \times 6·4 \times 10^{-3}}{78·3} = 3·4 \times 10^{-2}$

* Non unique match points make the computed values of S doubtful.

* L = unit of Length $r = 8·85$ m
t = time unit $r^2 = 78·3$ m²

APPENDIX C FIG 5

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM 553 75
COMPILED P.C.S.	MT. GAMBIER T.W.S. STANDBY WELL No. 8	DATE APRIL 1978
DRN M.R. CHD	OBSERVATION WELL No. 8b LOG - LOG PLOT	DRG NO 78-354



APPENDIX C FIG. 6

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE:
COMPILED: P. C. S.	MT. GAMBIER T.W.S. STANDBY WELL No. 8	DATE: APRIL 1978
DRN: M.R. CKD:	PREDICTED DRAWDOWN vs. TIME	PLAN NUMBER S 13376

APPENDIX D

Water Analyses by AMDEL

DEPARTMENT OF MINES — SOUTH AUSTRALIA

SUMMARY OF WATER ANALYSES

Progressive depth of bore (m)	Sampling depth (m)	Water level (m)	Total dissolved solids (Milligrammes/litre)	Analysis W No.	Remarks
			WELL 8b		
	Samples taken during cable tool drilling				
33.5	33.5	–	384	1640/77	Gambier Limestone aquifer
33.5	33.5	–	443*	1634/77	"
50	50	–	388	1641/77	"
70	70	–	399	1642/77	"
90	90	–	399	1643/77	"
100	100	–	411	1644/77	"
140	140	–	396	1645/77	"
155.5	155.5	–	435	1646/77	(?)Mepunga Form'n aquifer
155.5	155.5	–	507*	1647/77	"
			WELL 8		
	Samples taken during production testing - confined aquifer.				
250.5	237.3–250	–	591*	5838/77	Step drawdown – Step 1
"	"	–	604*	5839/77	" – Step 3
"	"	–	606*	5951/77	STart 72hr. constant discharge
"	"	–	575	5952/77	After 4hrs. pumping
"	"	–	570	5953/77	" 8hrs "
"	"	–	608*	5954/77	" 12hrs. "
"	"	–	570	5955/77	" 16hrs. "
"	"	–	575	5956/77	" 20hrs. "
"	"	–	613*	5957/77	" 24hrs. "
"	"	–	585	5958/77	" 28hrs. "
"	"	–	585	5959/77	" 32hrs. "
"	"	–	610*	5960/77	" 36hrs. "
"	"	–	580	5961/77	" 40hrs. "
"	"	–	580	5962/77	" 44hrs. "
"	"	–	612*	5963/77	" 48hrs. "
"	"	–	575	5964/77	" 52hrs. "
"	"	–	580	5965/77	" 56hrs. "
"	"	–	612*	5966/77	" 60hrs. "
"	"	–	580	5967/77	" 64hrs "
"	"	–	585	5968/77	" 68hrs. "
"	"	–	612*	5969/77	" 72hrs. "

pH varied between 7.2 and 7.5 during the test.

Note : * denotes ANDEL full analysis.

Borehole No. Unit Well 8 6 7022330 ϕw 02675 WW 2676

Drn : | Sheet 1 of 1

Date : | Bore Folder No.

PF Nº S10538 MH

WATER ANALYSIS REPORT

SAMPLE No. W1639/77 JOB No. 2968-77

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	60	3.0
MAGNESIUM	(Mg)	35	2.9
SODIUM	(Na)	50	2.2
POTASSIUM	(K)	7	.2
IRON	(Fe)	< 0.02	
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	293	4.8
SULPHATE	(SO_4)	18	.4
CHLORIDE	(Cl)	72	2.0
FLUORIDE	(F)	.35	.0
NITRATE	(NO_3)	57	.9
PHOSPHATE	(PO_4)	.34	.0

TOTALS AND BALANCE				
CATIONS	(me/ℓ)	8.2	DIFF =	.1
ANIONS	(me/ℓ)	8.2	SUM =	16.4

DIFF 100 / SUM = .4 %

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C	830
	MILLIGRAMS PER LITRE mg/ℓ
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	443
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS $CaCO_3$	294.
CARBONATE HARDNESS AS $CaCO_3$	240.
NON-CARBONATE HARDNESS AS $CaCO_3$	53.
TOTAL ALKALINITY AS $CaCO_3$	240
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	< .05
	UNITS
REACTION - pH	7.6
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	26.4 %

Sample depth 33.5m Water Table - Gambier Limestone

NAME - E. & W.S. Dept.
ADDRESS Mount Gambier
DATE COLLECTED 14/1/77
SAMPLE COLLECTED BY: W. Kahl

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm

OBS. No. GAM 196
HOLE No. T.W.S. 8b
D.M. No.

WATER ANALYSIS REPORT

SAMPLE No. W1647/77 JOB No. 2968-77

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	36	1.8
MAGNESIUM	(Mg)	38	3.1
SODIUM	(Na)	90	3.9
POTASSIUM	(K)	28	.7
IRON	(Fe)	2.90	.1
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	344	5.6
SULPHATE	(SO_4)	16	.3
CHLORIDE	(Cl)	118	3.3
FLUORIDE	(F)	.55	.0
NITRATE	(NO_3)	8	.1
PHOSPHATE	(PO_4)	.32	.0

TOTALS AND BALANCE				
CATIONS	(me/ℓ)	9.7	DIFF =	.2
ANIONS	(me/ℓ)	9.5	SUM =	19.1

DIFF 100 / SUM = 1.0 %

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 943.

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	507.
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	251.
CARBONATE HARDNESS AS $CaCO_3$	251.
NON-CARBONATE HARDNESS AS $CaCO_3$	<1.
TOTAL ALKALINITY AS $CaCO_3$	282.
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	0.95

	UNITS
REACTION - pH	7.9
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ) 40.5 %

Sample Depth 155.5m - Mepunga Formation

NAME - E. & W.S. Dept.
ADDRESS Mount Gambier
DATE COLLECTED 17/2/77
SAMPLE COLLECTED BY: W. Kahl

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm

OBS. No. GAM 196
HOLE No. T.W.S. 8b
D.M. No.

WATER ANALYSIS REPORT

SAMPLE No. W5969/77 JOB No. 1069-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	71	3.5
MAGNESIUM	(Mg)	30	2.5
SODIUM	(Na)	115	5.0
POTASSIUM	(K)	9	.2
IRON	(Fe)	.02	.0
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	383	6.3
SULPHATE	(SO_4)	21	.4
CHLORIDE	(Cl)	170	4.8
FLUORIDE	(F)	.45	.0
NITRATE	(NO_3)	6	.1
PHOSPHATE	(PO_4)	.18	.0

TOTALS AND BALANCE

CATIONS	(me/ℓ)	11.2	DIFF =	.4
ANIONS	(me/ℓ)	11.6	SUM =	22.9

DIFF 100 / SUM = 1.8 %

DERIVED AND OTHER DATA

		MILLIGRAMS PER LITRE mg/ℓ
CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C	1224.	
TOTAL DISSOLVED SOLIDS		
A. BASED ON E.C.		
B. CALCULATED (HCO_3=CO_3)		612
C. RESIDUE ON EVAP. AT 180 DEG.C		
TOTAL HARDNESS AS $CaCO_3$		301.
CARBONATE HARDNESS AS $CaCO_3$		301.
NON-CARBONATE HARDNESS AS $CaCO_3$		<1.
TOTAL ALKALINITY AS $CaCO_3$		314.
FREE CARBON DIOXIDE (CO_2)		
SUSPENDED SOLIDS		
SILICA (SiO_2)		
BORON (B)		0.10

	UNITS
REACTION - pH	7.2
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	44.5 %

End of 72hr. Constant Discharge Test - Dilwyn Formation

NAME - E. & W.S. Dept.
ADDRESS Mount Gambier
DATE COLLECTED
SAMPLE COLLECTED BY: B. Chaplin

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm

OBS. No. - -
HOLE No. T.W.S. 8
D.M. No.

WATER ANALYSIS REPORT

SAMPLE No. W5969/77 JOB No. 1069-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	71	3.5
MAGNESIUM	(Mg)	30	2.5
SODIUM	(Na)	115	5.0
POTASSIUM	(K)	9	.2
IRON	(Fe)	.02	.0
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	383	6.3
SULPHATE	(SO_4)	21	.4
CHLORIDE	(Cl)	170	4.8
FLUORIDE	(F)	.45	.0
NITRATE	(NO_3)	6	.1
PHOSPHATE	(PO_4)	.18	.0

TOTALS AND BALANCE

CATIONS	(me/ℓ)	11.2	DIFF =	.4
ANIONS	(me/ℓ)	11.6	SUM =	22.9

DIFF 100 / SUM = 1.8 %

DERIVED AND OTHER DATA

		MILLIGRAMS PER LITRE mg/ℓ
CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C	1224.	
TOTAL DISSOLVED SOLIDS		
A. BASED ON E.C.		
B. CALCULATED (HCO_3=CO_3)		612
C. RESIDUE ON EVAP. AT 180 DEG.C		
TOTAL HARDNESS AS $CaCO_3$		301.
CARBONATE HARDNESS AS $CaCO_3$		301.
NON-CARBONATE HARDNESS AS $CaCO_3$		<1.
TOTAL ALKALINITY AS $CaCO_3$		314.
FREE CARBON DIOXIDE (CO_2)		
SUSPENDED SOLIDS		
SILICA (SiO_2)		
BORON (B)		0.10

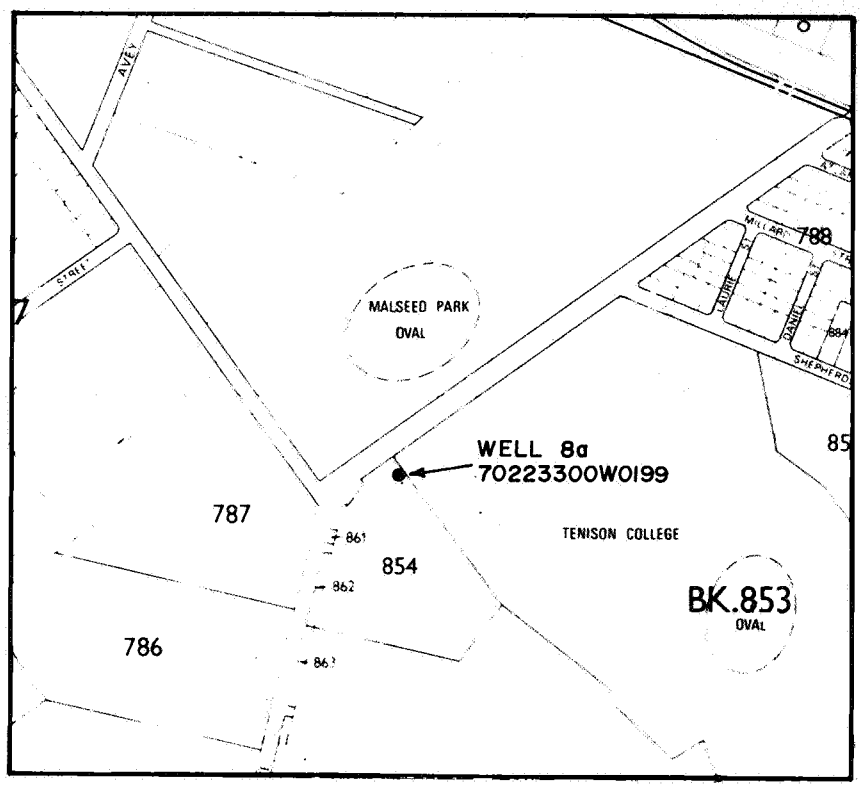
	UNITS
REACTION - pH	7.2
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	44.5 %

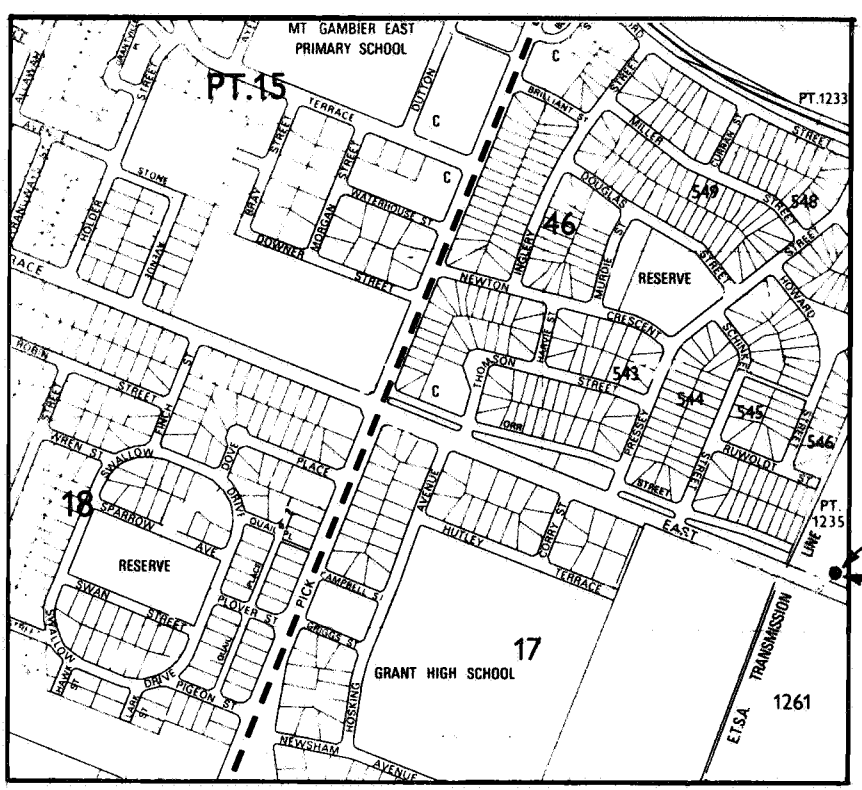
End of 72hr. Constant Discharge Test - Dilwyn Formation

NAME - E. & W.S. Dept.
ADDRESS Mount Gambier
DATE COLLECTED
SAMPLE COLLECTED BY: B. Chaplin

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm

OBS. No. - -
HOLE No. T.W.S. 8
D.M. No.





SCALE 1:10,000

0 200 400 METRES

FIG. 1

ENGINEERING DIVISION	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE 1:10,000
DRAWN P.C.S.	MT. GAMBIER T.W.S. STANDBY WELL No. 8	DATE APRIL 1978
TRACED M.R.	LOCALITY PLAN	PLAN NUMBER S 13375

DEPARTMENT OF MINES & ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

HOLE No.	8a
UNIT/STATE No.	7022330ØW01999
SERIAL No.	923/77
FOLDER No.	—
DRG. No.	78-356
SHEET	1 OF 1

PROJECT MOUNT GAMBIER T.W.S. STANDBY WELL No. 8

LOCATION on S.E. side of White Ave. approx. 2·5 kms W. of Mt.Gambier P.O.
SECTION 864 HUNDRED BLANCHE
CO-ORDINATES

REFERENCE ELEV.
SURFACE ELEV. approx 40m.
DATUM

LOGGED BY P.C.Smith/J.S.Lawson
DATE Dec 1977
TRACED BY M.R.
DATE APRIL 1978

CONSTRUCTION DETAILS

DRILLING TECHNIQUE Rotary
CIRCULATION Mud- water based
START 20.10.76
FINISH 12.11.76
TOTAL DEPTH 280m

	Inches	mm	From(m)	To(m)
HOLE DIAMETER	7·62 4·75	194 121	0 185	185 280
CASING DIAMETER (cemented)	50 sacks of cement pumped into well at 180m. to isolate Gambier Limestone and Dilwyn Formation aquifers.			
CASING DIAMETER (uncemented)				
SCREEN DETAILS Make / Model Dimensions	2·5" s.s. screen planned to be installed between 200 & 203 m. - lost in hole with 180 m. of 55mm. P.V.C. pipe.			

TYPE OF LOG	16 IN NORMAL	64 IN NORMAL	6FT LATERAL	S.P.	POINT RESISTIVITY	NEUTRON	GAMMA RAY	TEMPERATURE
DATE OF RUN						10.11.76	10.11.76	
FIRST READING (m)						279·2	279·2	
LAST READING (m)						24·8	0	
INTERVAL MEASURED (m)						254·4	279·2	
CASING LOGGER (m)						—	—	
CASING DRILLER (m)						185	185	
DEPTH REACHED (m)						279·2	279·2	
BOTTOM DRILLER (m)						280	280	
MUD TYPE						water base	water base	
MUD RESISTIVITY						—	—	
RECORDED BY						Bert Young	Bert Young	

WELL SYMBOLS

CONSTRUCTION LOG
- Casing seal
- Casing shoe
- Wire wound screen
- Slotted casing
- Cemented interval
- Gravel packed interval

HYDROGEOLOGICAL LOG
- Core interval
- Aq Aquifer
- Cb Confining bed
- T Transmissivity m²/day/m
- S Storage Coefficient/Specific Yield
- θ Porosity
- K Hydraulic conductivity m/day

DEPTH TO WATER (m)	DEPTH TO S.W.L. (m)	YIELD m³/day	YIELD Method of Test	TOTAL DISSOLVED SOLIDS mg/litre	TOTAL DISSOLVED SOLIDS Analysis No.
	No data obtained - rotary drilled (mud circulation)				

REMARKS. Drilled by R. Fabey. Scout well for T.W.S. No suitable production interval obtained. Abandoned after attempt to complete as a observation well within confined aquifer failed.

CONSTRUCTION LOG | WATER CUT (m) | WATER LEVEL (m) | CORE | HYDRO. DATA | AGE | UNIT | LITHOLOGY DESCRIPTION | LITHO LOG | DEPTH (m)

Construction log notes: Cement plug at surface (to unknown depth). 7·62" Hole. approx. position of P.V.C. pipe lost in hole. Cement plug (approx position). 4·75" Hole. 55mm. PVC. 63·5 mm. unrecovered sand.

Age: PLEIS. - RECENT; OLIGO - MIOCENE; EOCENE

Unit: BRIDGEWATER FM. VOLCANICS; GAMBIER LIMESTONE; MEPUNGA FORMATION; BURRUNGULE MBR.

LITHOLOGY DESCRIPTION

0-7m AEOLIANITE / VOLCANICS - interpreted as quartz sand cemented with calc matrix / volcanic ash

No returns to 80m.

7 - 80 m - FOSSILIFEROUS LIMESTONE - probably white/grey bryozoal limestone - varying induration with flint, dolomite, marl interbeds. Calcite rhombs frequent (interpreted).

80 - 128 m. FOSSILIFEROUS LIMESTONE. -

80 - 92 m. white, poorly cemented calcarenite with large proportion calcite rhombs, 5% flint and trace glauconite.

92 - 96 m. similar to above with larger proportion calcite rhombs.

96 - 100m. fossiliferous calcarenite, 40% calcite rhombs, minor calcilutite.

100 - 128 m. up to 60% clear, colourless calcite rhombs with fossiliferous calcarenite, calcilutite, flint and glauconite.

128 - 165 m. FOSSILIFEROUS LIMESTONE - (no returns to 186 m.)

141 - 155 m. well indurated interval - drillers time sheet. Possibly dolomite.

155 - 159 m. no returns.

159 - 165 m. dolomite and solution features (?) - drillers time sheet.

165 - 182·6 m. FERRUGINOUS SAND. - brown to black ironstone laminae with up to 10% clear to frosted, angular to sub angular qtz. iron stained. Dolomitic, glauconitic with some fossiliferous calcarenite - contamination? Poorly cemented.

182·6 - 185·2 m. well indurated ferruginous sand (interpreted).

185·2 - 196·6 m. CLAY - black, carbonaceous clay with silt and fine sand interbeds. Micaceous, pyritic. Interpreted from wireline logs.

196·6 - 204·2 m. CLAYEY SAND - black clay matrix with 10 - 15% silt. Quartz sand, colourless, iron stained, angular to rounded, grain size 0·1 - 5 mm., ave. 3mm. Traces glauconite.

204·2 - 216·3 m. CLAY - similar to 185·2 - 196·6 m. interval with lower sand content. (Interpreted). Some well indurated intervals (driller's time sheets).

216·3 - 217·6 m. CLAYEY SAND.

217·6 - 218·6 m. SANDY CLAY.

218·6 - 221·4 m. CLAYEY SAND - clear to frosted, sub ang. to sub rounded 0·2 - 3 mm. Minor pyrite.

221·4 - 234·4 m. SANDY CLAY - black plastic, carbonaceous clay with up to 40% quartz sand as above. Minor pyrite.

234·4 - 236·4 m. as above - well indurated.

236·4 - 244·2 m. SANDY CLAY - as for 221·4 - 234·4 m. interval.

244·2 - 260 m. SAND - quartz sand g.s. 0·1 - 5 mm., with up to 35% black, carbonaceous clay matrix and interbeds. Quartz, clear to frosted, sub ang. to sub rounded. Significant muscovite and minor pyrite.

260 - 268·8 m. CLAY - light to dark brown clay, with sand, silt interbeds and within clay matrix.

265·5 - 268·8 m. well indurated interval.

268·8 - 273·8 m. SAND - as for 244·2 - 260 m. interval.

273·8 - 280 m. CLAYEY SAND - clear sub angular to rounded quartz, 0·1 - 5 mm., ave 0·2 mm., with 40% mottled brown, black clay

END OF HOLE 280 m.

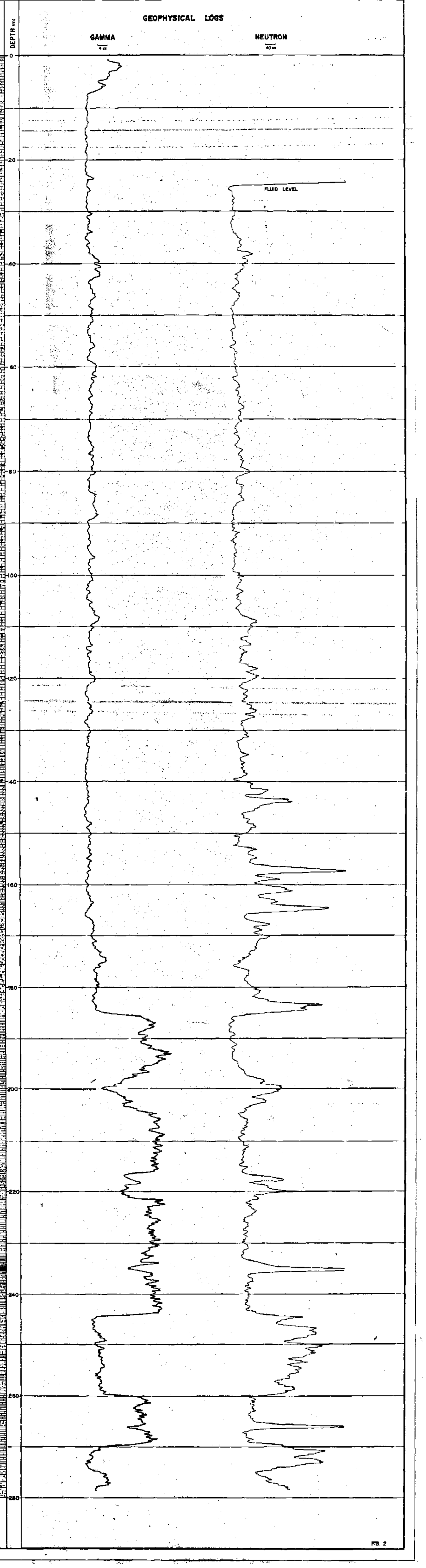


FIG. 2

DEPARTMENT OF MINES & ENERGY - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG - GROUNDWATER

HOLE No.	8 & 8b
UNIT/STATE No.	7022330WW02676
SERIAL No.	43/77 (CT) 909/78 (Rot.)
FOLDER No.	–
DRG. No.	78 - 355
SHEET	1 OF 1

CONSTRUCTION DETAILS

DRILLING TECHNIQUE: Cable tool 0 – 139 m; Rotary 139 - 250 m
CIRCULATION: Rotary - fluid
START: 26. 4. 77
FINISH: 21. 9. 77
TOTAL DEPTH: 250 m

	Inches	mm	From(m)	To(m)
HOLE DIAMETER — Cable tool		324	0	20
		305	20	121
		273	121	139
Rotary		250	139	250
CASING DIAMETER (Cemented)	Grouted	260 ID	0	139
	Pressure cemented	130	77	226
CASING DIAMETER (Uncemented)		305 I.D	2	20
		152 I.D.	205	237
SCREEN DETAILS Make / Model Dimensions	Surescreen s.s wirewound 0.9 aperture	153 ID 166 OD	237	250

PROJECT MT. GAMBIER T.W.S. STANDBY WELL No. 8

LOCATION on N side of Lake Tce. East approx 2.7 km S.E. of Post Office

SECTION Pt 1235 HUNDRED Gambier

CO-ORDINATES

LOGGED BY P.C. Smith / J.S. Lawson

REFERENCE ELEV. Well 8b 43.062 m (TOC) DATE Nov 1977 and on site

SURFACE ELEV. TRACED BY M.R.

DATUM M.S.L. (?) DATE APRIL 1978

TYPE OF LOG	16 IN NORMAL	64 IN NORMAL	6FT LATERAL	S.P.	POINT RESISTIVITY	NEUTRON	GAMMA RAY	TEMPERATURE	DENSITY
DATE OF RUN	8.3.77	Not run – faulty		8.3.77	8.3.77	13.8.77	13.8.77	8.3.77	13.8.77
FIRST READING (m)	288	probe		287.6	287.88	250	250	288	250.4
LAST READING (m)	143			143	143	178	0	0	0
INTERVAL MEASURED (m)	145			144.6	144.8	132.2	250	288	250.4
CASING LOGGER (m)	143			143	143	226	226	143	226
CASING DRILLER (m)	144.3			144.3	144.3			144.3	
DEPTH REACHED (m)	288			287.6	287.8	250	250	288	250.4
BOTTOM DRILLER (m)	287.3			287.3	287.3	"	"	287.3	250
MUD TYPE	C.M.C. / Rotrol			C.M.C. /Rotrol	C.M.C. /Rotrol	C.M.C.	C.M.C.	C.M.C./Rotrol	C.M.C.
MUD RESISTIVITY	0.2 Ωm			0.2 Ωm	0.2 Ωm	–	–	0.2 Ωm	–
RECORDED BY	A.W. Young			A.W. Young	A.W. Young	B.P. Taylor	B.P. Taylor	A.W. Young	B.P. Taylor

NOTE 16" N, SP, PR & Temp run on Scout Well 8b located 8.55 m on bearing 280° from production well. Gamma, Neutron & density run on production well prior to screen installation

WELL SYMBOLS

CONSTRUCTION LOG
- Casing seal
- Casing shoe
- Wire wound screen
- Slotted casing
- Cemented interval
- Gravel packed interval

HYDROGEOLOGICAL LOG
- ■ Core interval
- Aq Aquifer
- Cb Confining bed
- T Transmissivity m³/day m⁻¹
- S Storage Coefficient/Specific Yield
- θ Porosity
- K Hydraulic conductivity m/day

DEPTH TO WATER (m)	DEPTH TO S.W.L. (m)	YIELD m³/day	YIELD Method of Test	TOTAL DISSOLVED SOLIDS mg / litre	TOTAL DISSOLVED SOLIDS Analysis W No
34.5 (unconf)	28.8	–	–	443	1639/77
237.3 (conf.)	5.9	See completion report		612	5969/77

REMARKS: NOTE:- This is a composite log using data from Scout Well No. 8b & standby well No. 8. Permit No. 1003.
Drillers: A. Wilson, B. Chaplin, R. Blatchford.

CONSTRUCTION LOG
WATER CUT (m)
WATER LEVEL (m)
CORE
HYDRO DATA
AGE
UNIT
LITHOLOGY DESCRIPTION
LITHO LOG
DEPTH (m)
GEOPHYSICAL LOGS
SELF POTENTIAL 12.5 mV
POINT RESISTIVITY 5 Ωm
GAMMA 12.5 cps
NEUTRON 50 cps
DENSITY 500 cps
Unsaturated zone
Unconfined / semiconfined aquifer - 28.8 to 155 m
Confined aquifer 155 - 156.6 m
Confining bed
PLEISTOCENE - RECENT
BRIDGEWATER FMN. VOLCANICS
OLIGO - MIOCENE
GAMBIER LIMESTONE
EOCENE - OLIGOCENE
NARRAWATURK MARL
MEPUNGA FMN
BURRUNGULE MEMBER
EOCENE
DILWYN FORMATION
0-1.4 m Topsoil gry brown illsorted, silty sand 0.1 to 1 mm ave. 0.3 mm sub-ang. / sub rounded clear, milky qtz., minor calcrete (?)
1.4 - 6.8 m. Sandy Limestone / Volcanics approx. 50% yellow/white to orange limestone fragments with 40% sub-ang to angular clean qtz. 0.1 to 0.2 mm. Significant volcanic ash - plag. grains etc. Fe. staining and reworked bryozoal fragments
6.8 - 12 m. Sandy limestone - 20% clear qtz. grains as above. Remainder qtz. grains in yellow, off white, orange carbonate matrix. Numerous reworked forams, bryozoa. Indurated to friable. Trace volcanics - contaminated. (?)
12 - 32 m. Calcarenite - white to off white calcarenite - numerous bryozoal fragments 0.2 to 0.5 mm. Some recrystallisation - mod. well indurated. Frequent forams.
14 - 16 m. 70% clear to milky calcite rhombs with remainder recrystallised orange / yellow limestone. Very minor bryozoa, trace qtz. sand
26 - 28 m. as above with trace of glauconite.
28 - 32 m. similar to above, calcite rhombs, 40 - 50 %.
32 - 34 m. Mainly calcarenite - 0 - 10 % pale grey marl with 40% calcite rhombs with bry. frags, minor forams and trace glauconite.
34 - 42 m. Fossiliferous marl - light gry. marl with 40 - 50 % bryozoa frags. and 10% light brown translucent flint.
36 - 40 m. as above 15 - 20% flint
40 - 42 m. 80 % bryozoa fragments echinoid spines, forams with 2% black flint.
42 - 58 m. Calcarenite - predom. bry., foram. and echinoid frags. with minor grey marl, frequent glauconite grains and Fe. staining (oxidised py. ?) up to 5% nodular flint frags. Friable 0.5 to 1.0 m.m. grains of calcarenite.
48 - 50 m. as above with v. fine clear qtz. common < 0.1 m.m.
52 - 54 m. - increased light gry / brown marl / calcilutite prop'n frequent glauconite.
56 - 58 m. - dark grey - higher %age calcilutite. Flint more frequent - calcite rhombs.
58 - 78 m. Marly calcarenite - white, off white fossil frags. as above, frequ. glauconite, brown translucent flint, calcite rhombs - light grey marl fraction to 15 %.
62 - 64 m. frequ. glauconite / translucent flint.
68 - 70 m. 5 - 10% brown flint, glauconite, calcite fragments.
78 - 96 m. Calcarenite - pale grey, white, fossiliferous calcarenite with minor marl <5% flint (trans. brown) 5 - 10% calcite rhombs - no glauconite.
90 - 92 m. white fossil fragments 2% flint. Light grey friable frags. Calcite rhombs. 5 - 10 %
94 - 96 m. uncemented off white, rounded carbonate grains, minor Fe. staining & calcite rhombs. Well sorted 0.2 to 0.5 m.m.
96 - 102 m. Marly calcarenite - calcarenite as above with 5 - 10 % yellow / orange translucent grains of dolomite ? Trace translucent flint. Glauconitic g.s. < 0.1 to 0.5 m.m. 10 - 15 % light grey, yellow marl.
102 - 131 m. ?Dolomitic sand / dolomite
102 - 113 m. - rhombs of orange yellow translucent dolomite grains cemented with white carbonate - friable to indurated - 80 %. Remainder calcarenite as above with trace flint, minor fossil frags. Minor laminar ironstone fragments. Frequent iron staining. Grain size generally 0.1 to 0.5 m.m.
113 - 119 m. 60% dolomite sand as above with 40% orange yellow very well indurated fragments of recrystallised carbonate - angular fragments to 20 m.m.
119 - 125 m. similar to above weakly cemented pink carbonate grains with red nuclei, clear and angular grains with fragments of orange / yellow v. well indurated limestone / dolomite. Large rounded pods of cemented carbonate grains.
125 - 129 m. approx. equiv. propn's uncemented carbonate grains with pink, yellow & purple indurated fragments - frequ. iron staining.
129 - 131 m. as for 121.5 to 123 m.
131 - 137 m. Fossiliferous calcarenite - off white bryozoal fragments & calcarenite grains < 0.5 m.m. Frequ. iron staining with clear, white & yellow carbonate rhombs with yellow fine sand. Poorly cemented.
137 - 139 m. Marly calcarenite - as above with 20 - 30 % yellow / grey marl - some indurated pods.
139 - 154.8 m. Marl - yellow, grey marl with minor bryozoal and foram. fragments.
154.8 - 156.6 m. Ferruginous sand - equal propn's of limestone grains (rounded to angular), and clear iron stained qtz. - subangular 0.5 to 1 mm. up to 3mm. 20% fossil calcarenite
156.6 - 167.6 m. Clay - sticky black, carbonaceous clay with varying propn's clear qtz. sand 1 - 3 m.m. rounded. Minor py., muscovite and silt. Frequ. iron staining (contamin. from Mepunga Fmn. ?) becoming more sandy towards it's base.
167.6 - 171 m Clayey sand - 70 % sand, rounded qtz. 0.3 to 3.5 mm with frequ. pyrite, minor muscovite. 30 % black carbonaceous clay.
171 - 172.6 m. Clay - black carbonaceous clay as above, minor silt and sand.
172.6 to 189 m. Sandy clay / clayey sand - varying propn's of sand and clay interbedded. Up to 90 % qtz. sand g.s. 0.2 to 5.5 m.m. commonly 0.5 to 3.0 m.m. Well rounded clear, milky and grey translucent grains. Frequent iron staining with minor well indurated silt / muscovite frags. Black clay to 50 % in some intervals.
189 - 193.5 m. Sand - 70 - 80 % rounded, clear, milky, minor rose qtz. 1 - 2 m.m. with 15 - 20 % g.s. <0.1 m.m. Remainder black clay with frequ. py., trace mica & silt.
193.5 - 210.2 m. Sandy clay - no samples from 192 to 212 m. From geophysical logs similar to interval 172.6 to 189 m.
210.2 - 222 m. Clayey sand - with interbeds of sandy / gravelly clay. 60 - 70 % qtz. sand < 0.2 to 7mm., predom. 1 - 2 mm. Remainder black organic clay with minor py., mica & silt. Interbeds of up to 80% black clay with sand, silt fraction as above.
222 - 237.3 m Sandy clay - predom. sticky black clay with sig. silt content and interbeds of well rounded, clear, white and grey qtz 0.1 - 2.5 mm. predom. 1 - 1.5 mm. minor py. and muscovite.
237.3 - 250 m. Sand - see grain size analyses Appendix. Predom. well rounded, clear, white and grey translucent qtz. with high sphericity 0.1 to 6 mm. predom. 1 - 2 mm. < 5 - 10 % carbonaceous clay. Trace muscovite. Minor pyrite in indurated siltstone interbeds. Some opaque inclusions in qtz. grains.
Note: From 250 m - log taken from Scout Well 8b.
250 - 264 m. Sandy clay - qtz sand as above < 0.1 to 3mm predom 0.5 to 1 mm in varying propn's. Remainder sticky black clay with silt, mica and pyrite.
264 - 287 m. Clayey sand - 80 - 90 % rounded to subangular (fine grains) qtz. g.s. < 0.1 to 5 mm. predom. 0.2 to 3 mm. with 10 % 2 - 5 mm. well rounded - finer subangular. Trace muscovite, frequ. py. aggregates - remainder black clay with silt.
End of hole (8b) - 287 m.
BASE OF 205 mm C.O. CASING
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280

FIG. 3