DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

E. & W.S. Department

MOUNT GAMBIER TOWN WATER SUPPLY

STANDBY WELL NO. 7

by

P.C. SMITH

GEOLOGIST I

Rept.Bk.No. 78/9
D.M. No. ~~784~~/74 4801/77
G.S. No. 5983
Eng.Div.No. MG77-2D

CONTENTS

Tables

Appendices

PLANS

Fig. No.	Title	Plan No.
1	Locality Plan	S13271
2	Well Construction Sketch	S13272
3	Step Tests - Semi Log	78-165
4	72 hour Constant Discharge Test - Semi log	78-166
5	72 hour Constant Discharge Test - Log log	78-167

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E. & W.S. DEPARTMENT MOUNT GAMBIER TOWN WATER SUPPLY STANDBY WELL NO. 7

ABSTRACT

The first of a series of high yielding standby wells exploiting the confined aquifer was drilled to a total depth of 208 m using both rotary and cable tool methods.

Production interval for the well is from 184.6 to 205.3 m in an unconsolidated sand interval of the Dilwyn Formation (formerly Knight Group) confined aquifer.

The E. & W.S. Department's specified production rate of 7860 m^3/day (1200 gpm) should be obtained from a pump intake depth of about 60 m without undue screen abrasion or encrustation. As the well was tested at a maximum production rate of only 4400 m^3/day, it is essential that the specified rate be achieved slowly over a period of at least a week to avoid irreversible damage to the production interval.

From a preliminary analysis the water appears to be suitable for domestic purposes but is rather hard, as is the case for most groundwater in the South East.

The impact of this series of confined aquifer production wells on the groundwater regime in and around Mt. Gambier will be the subject of a separate report.

INTRODUCTION

Town Water Supply Well No. 7 is the first of a weries of emergency production wells to the confined aquifer planned to service Mt. Gambier in the event of cessation of supply via the Blue Lake pumping station.

Contamination of the lake water by accidental introduction of toxic material and damage to the pumping install-

ation itself from vehicular traffic around the rim of the lake together with the susceptibility of the unconfined Gambier Limestone aquifer to more widespread pollution are the prime sources for concern.

Thus, a series of wells which obtains groundwater from the less vulnerable, confined Dilwyn Formation aquifer was initiated in early 1976 by the E. & W.S. Dept.

The current procedure is for the Department of Mines to fund the drilling of small diameter exploration wells at sites agreeable to the E. & W.S. and considered hydrogeologically suitable by this Department. When a suitable production interval is found to provide yields of the order of 7500 m^3/day a contract price for the drilling of the large diameter production well is submitted to the E. & W.S. Department for approval. The well drilled by this Department is, where possible, used as an observation well during production and aquifer testing.

Although the programmed series of wells is intended at this time to be used only in emergency situations, the siting of wells should be such that mutual interference during long term semi-continuous pumping be kept within tolerable limits. If for instance pollution indicators rose above acceptable limits in the Blue Lake, this well field would be the prime source of the City's water requirements with resultant increased stress on the confined aquifer.

HYDROGEOLOGY

The following stratigraphic summary is taken from the detailed log presented in Appendix A. The stratigraphic terminology as proposed in Geology of Victoria (1976) and Harris (pers. comm.) is employed with previous nomenclature in parentheses.

Eocene-Dilwyn Formation (Knight Group) - a series of lenticularly bedded, carbonaceous, gravels, sands, silts and clays usually black to dark brown and characterised by rapid horizontal and vertical facies changes. Minor constituents usually evident are thin lignite beds, muscovite, pyrite and glauconite. Deposition occurred in a marginal marine, esturinal environment.

Oligocene - Narrawaturk Marl (Lacepede Formation) - a light brown, orange marl with bryozoal fragments, rounded quartz sand, calcite rhombs, ferruginous (limonite) grains and glauconite - well indurated with carbonate matrix in part. This unit represents the beginning of the marine transgression.

Olio-Miocene-Gambier Limestone - a white to grey marine fossiliferous calcarenite with calcisiltite and marly intervals - generally becoming less permeable toward its base. Richly fossiliferous with bryozoal and echinoid remains predominating.

Recent - Unnamed interdunal despoits - orange brown, non-calcareous clay with significant quartz sand proportion. A thin, dark brown, silty sand topsoil is developed.

The characteristics of hydrogeologically important units are summarised in Table 1 below.

Table 1

Hydrogeology Summary

Unit	Interval (m)	Water Cut (m)	S.W.D. (m)	Remarks
Gambier Limestone	4-125	(?)31	29	Water Table Aquifer -unconfined, good quality groundwater- 400 mg/1. Susceptible to contamination. Becomes marly toward base.
Narrawaturk Marl	125-125.5	-	-	Confining bed
Dilwyn Formation	125.5-135 (Burrungule Member)	-	-	Confining bed - black, carbonaceous clay with minor quartz sand and mica.
	135-208	135	11.9	Confined aquifer - interbedded clays, silts, sands and gravels - high carbonaceous content. Good quality groundwater - low pollution threat. T_3= 194 to 826 $m^3/day^{-1}m^{-1}$ S = 10^{-4}

WELL CONSTRUCTION

The well was commenced on 7th January, 1976 and completed on 25th January, 1977. Cable tool was used from surface to 175 m to handle potential cavities in the Gambier Limestone. To stabilise the confined aquifer sediments during drilling, mud circulation rotary was used from 175 to total depth of 208 m.

A suitable aquifer interval was obtained between 183 and 205 m within the Dilwyn Formation.

Subsequently, a 20.9 m x 170 mm Stainless Steel Sand-screen was installed from 184.6 to 205.3 m. Slot widths range from 0.7 to 0.8 mm. The screen was developed with a

cable tool rig by bailing and surging the face of the screen for 28 hours, followed later by pumping for 11 hours from 64 m using a line shaft turbine pump.

Effective depth to which the required pump can be lowered (inside 273 mm tubing) is just above 120 m i.e. top of seal from 152 mm liner and screen assembly to the 273 mm steel tubing. Maximum available drawdown is therefore about 108 m from a standing water depth of about 12 m.

A detailed construction report is presented in Appendix G and the construction sketch is shown on Fig. 2.

WELL DISCHARGE TESTS

Testing to determine aquifer properties and to predict well performance with time was carried out in January 1977 using a 5 stage, 203 mm line shaft turbine pump with an intake depth of 64 m. Available drawdown was about 52 m.

The test method was to fully develop the well to the capacity of the pump, followed by 3 x 100 minute step drawdown tests and completed with a 72 hour constant discharge test and 36 hour recovery.

The detailed test method, assumptions and calculations are presented in Appendix C.

Step Drawdown Tests

Step drawdown tests were used to determine the equation for the well relating drawdown to the variables of time and discharge rate. See Fig. 3.

The equation is of the form:

$s = (a + b \log t) Q + c Q^2$

where s = drawdown in metres

t = time in minutes

Q = discharge rate in m^3/min.

a and b are constants related to laminar flow

c is a constant related to turbulent flow (well loss)

For this well the equation is:

$$s = (2.79 + 0.35 \log t)\, Q + 0.42\, Q^2$$

Constant Discharge Test

The well was pumped for 72 hours at a constant discharge rate of 4377 m^3/day (3.04 m^3/min) followed by a 36 hour recovery test. Data were plotted both on semi log (Fig. 4) and log log (Fig. 5) graphs.

From the recovery plot on Fig. 4 a discharge boundary occurs at $\frac{t}{t_1} = 20$ i.e. t_1 (time since pump stopped) = 230 minutes. Thus any predicted drawdown values from the water well equation have to be "weighted" accordingly. For the time interval 0 - 230 minutes $\frac{Q}{\Delta s} = 3.1$ which is close to the mean value of 2.8 obtained from the step tests (Fig. 3), therefore the water well equation is adequate for the first 230 minutes of pumping. However, for the interval 230 - 4320 minutes, $\frac{Q}{\Delta s}$ decreases to 1.8 i.e. the values of Q used in Appendix D relating drawdown (s) to time (t) for various pumping rates (Q) are divided by 1.8 to obtain the corrected Δs. The curves present in Appendix D have been corrected to allow for increased drawdown associated with the discharge boundary intersected at 230 minutes.

Table 2

Summary of Aquifer Properties

Test	Q (m^3/day)	Δs (m)	Transmissivity (m^3/day/m)	Comments
Step 1	1476	0.36	750	See Fig. 3
Step 2	2477	0.59	768	See Fig. 3
Step 3	3512	0.90	714	See Fig. 3
72 hour	4377	1.44	556	See Fig. 4 Semi log-early time drawdown
72 hour	4377	2.72	295	See Fig. 4 Semi log-late time drawdown
72 hour	4377	0.97	826	See Fig. 4 Semi log-early time recovery
72 hour	4377	1.70	471	See Fig. 4 Semi log-late time recovery
72 hour	4377	-	633	See Fig. 5 Log log-early time
72 hour	4377	-	194	See Fig. 5 Log log-late time

Using a value of b (aquifer thickness) = 22 m, Storage coefficient $S = 6.6 \times 10^{-5}$ from the relationship $S = b \times 3 \times 10^{-6}$ (Hazel, 1973). A rounded value of $S = 10^{-4}$ could be used in calculations.

The values of Transmissivity (T) cited above demonstrate the inhomogeneity of the confined aquifer with early time values being significantly greater than those of later time - recovery T values, from Fig. 4 are the most reliable. This is attributed to:

the nature of the aquifer - discontinuous, lenticular sands and gravels of varying grain size interbedded with fine grained silts and clays i.e. rapid changes of T with pumping time are to be expected.

From the log-log plot of drawdown vs time from the 72 hour constant discharge test (see Fig. 5), no appreciable

leakage is apparent. However, the relatively short length of the test places a certain unreliability on this conclusion. The 17 m head difference between the confined and unconfined aquifers would however minimise downward leakage from unconfined to confined aquifers as maximum drawdown was only 19.8 m i.e. a resultant head difference of about only 3 m at the end of the test.

Screen Entrance Velocity

From Walton (1970) and practical experience it has been found that permeability (K) is proportional to the square of the 10% smallest grainsize. With normal screen development, 10% smallest grain size can be increased in the vicinity of the screen by a factor of 3 to 5; hence K adjacent to the screen can be increased from 9 to 25 fold.

Taking a moderate value of x15 increase in permeability in the vicinity of the well screen, K(permeability) becomes $\frac{300\ m^3/day/m \times 15}{22\ m}$ or approximately 200 $m^3/day/m^2$ which leads to an optimum screen entrance velocity of about 0.05 m/sec.

From 21 m of 6 5/8" screen with a 0.75 mm slot width, an optimum discharge rate of 12800 m^3/day is derived. ("Sure screen" data). This figure is well in excess of the 7860 m^3/day (1200 gallons per minute -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 the preceding it is recommended that the discharge rate required by the E. & W.S. Department be employed viz 7860 m^3/day (1200 gpm). This production rate is compatible with the pumping rate of the deep well pump planned to be

installed. However, it is stressed that the well must be redeveloped to the required rate as the test pump was capable of only 4400 m^3/day (about 670 gpm). Therefore, after installation of the production pump, initial discharge should be of the order of 4400 m^3/day which should be gradually increased to the desired rate of 7860 m^3/day over say a one week pumping period. If this recommendation is not observed, serious irreversible damage could be done to the aquifer interval adjacent to the well with resultant well failure or diminished yield.

For the selection of an optimum pump intake depth for the desired value of discharge, management practice for the well needs to be established. For example, if the well is to be used frequently for relatively short periods, a shallower intake depth can be used relative to that required for infrequent long term pumping. This assumes that full recovery takes place between pumping steps and that no interference is experienced from adjacent wells pumping from the confined aquifer. The curves presented in Appendix D should be consulted for intake depth selection bearing in mind a Standing Water Depth (S.W.D.) of about 12 m i.e. a maximum drawdown of about 108 m is available.

For example; in the unlikely event that the well were to be pumped continuously at 7860 m^3/day for three days, a suitable intake depth would be 54 m.

Made up of: 12 m - S.W.D.
36 m - from Predicted Drawdown vs Time Curves
1 m - seasonal fluctuation
5 m - 10% safety margin

Table 3

Summary of Well Details

Depth: 206 m

Casing: 273 mm steel tubing to 129 m pressure cemented;
152 mm I.D. galv. pipe 120.4 - 184.6 m; 154 mm I.D. sandscreen
184.6 - 205.3 m, blank with backoff assembly 205.3 - 205.9 m.

Standing water depth: 12.1 m (before testing)

Interval tested: 184.6 - 205.2 m

Recommended discharge rate: 7860 m^3/day (1200 gpm)

Recommended pump intake depth: 60 m - depending on well management

Pumping water level: approx. 48 m after 3 days at 7860 m^3/day

Water Salinity: approx. 600 mg/1

Aquifer: unconsolidated coarse sand - Dilwyn Formation

WATER QUALITY

Water samples were taken at regular intervals during production testing. Analysis results are tabulated in Appendix E.

Groundwater quality did not change appreciably from a T.D.S. of about 600 mg/1 during the constant discharge test of 72 hours. All ions/parameters are within the accepted tolerances for human consumption as recommended by the World Health Organisation (W.H.O.) and Hart (1974).

However, it is recommended that the well be sampled and "well head" analyses made for iron as there is some doubt concerning the validity of previous analyses. Results obtained are dependent upon sampling method (airlift, bailer,

mechanical, pumped, etc.), period between sample collection and analysis, amount of suspended solids in sample and analysis technique.

SUMMARY AND CONCLUSIONS

1. The well was drilled between January, 1976 and January, 1977, using a combination of cable tool and rotary mud circulation drilling methods to a total depth of 208 m. The screened production interval within the confined aquifer is from 184.6 to 205.3 m. Standing water level is about 12 m.

2. Maximum available drawdown is about 108 m with a maximum pump intake depth of 120 m.

3. Predicted drawdown vs time curves for various pumping rates (Appendix D) should be consulted for pump intake depth selection when well management is known. Advice can be obtained from this Department when required.

4. Water quality is suitable for all domestic purposes if subsequent bacteriological sampling and analysis prove pollution indicators to be absent. Monitoring of water quality when the well is in use is strongly recommended.

5. The desired discharge rate of 7860 m^3/day (1200 gpm) is probably obtainable provided the well is re-developed gradually from the test rate to the required value. Screen abrasion or encrustation should not occur.

6. As this is the first large yield standby well for the town, extreme care is necessary to ensure controlled management of the confined aquifer. Factors such as spacing of further wells, interference with present industrial confined aquifer production wells, induced leakage of potentially contaminated unconfined aquifer groundwater because of reduced confined aquifer head should all be considered before large scale development takes place.

This is to be the subject of a subsequent report together with the possible effect of deep unconfined aquifer storm-water etc. drainage wells on the potentially "stressed" confined aquifer i.e. potential downward leakage of contaminants through the confining bed.

P.C. Smith

REFERENCES

Douglas, J.G. and Ferguson, J.A., (1976). Geology of Victoria. Geol. Soc. Aust. Special Pub. No. 5 Melbourne pp. 528.

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

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

Johnson, Edward E., Inc., (1966). Groundwater and Wells. Edward E. Johnson, Inc. St. Paul, Minnesota pp.440.

Walton, W.C., (1970). Groundwater Resource Evaluation McGraw Hill, New York, pp.664.

GLOSSARY

Available Drawdown - the difference between pump intake depth and Standing Water Depth (q.v.) in metres.

Confined Aquifer - an aquifer where the contained groundwater is under pressure considerably greater than atmospheric. Its upper limit is the base of a bed of distinctly lower hydraulic conductivity than that of the material in which the confined water occurs.

Facies - lateral and vertical subdivisions of a stratigraphic unit.

Interference - two or more wells are said to interfere when one or more of their respective cones of depression overlap during the pumping of one or more of the wells.

Marl - a weakly consolidated carbonate rock made up of 75% lime carbonate and 25% clay.

Permeability (Hydraulic) - is a measure of the relative ease with which a porous medium can transmit a fluid under a potential gradient.

Standing Water Depth (S.W.D.) - is the depth in metres to water in a well below some known reference point - generally ground level.

Step Drawdown Tests - a series (in this case 3) of well discharge tests if successively larger discharge rates (Q) the analysis of which leads to the Water Well Equation and hence predictions of well performance with time.

Storage Coefficient - volume of water stored or released from a column of aquifer with unit cross section under unit pressure decline.

Transmissivity - is the rate at which water is transmitted through one metre of vertical saturated thickness of an aquifer under a unit hydraulic gradient - measured in m^3/day/m.

Unconfined Aquifer - an aquifer which has a water table i.e. groundwater is at atmospheric pressure.

APPENDIX A

Hydrogeological Log

PROJECT: MT. GAMBIER T.W.S.
STANDBY WELLS. E. & W.S.

LOCATION OR COORDS:

SEC. 263 HD. BLANCHE

EL Surface approx. 50 m
EL Ref. Point m Datum M.S.L. (1)

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: TWS No. 7
UNIT / STATE NO 7022330WW02927
DM 784/74

	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	Analysis No:
AQUIFER	31	29	-	-				412	W— 656/76
SUMMARY:	134.8	11.9	184.6	205.3	4400	72	Turbine Pump	594	719/77

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE
0	4		Soil and Clay	Quartz Sand with 40 -50% brown silt overlying orange/brown, stiff clay.	Unnamed/ Recent
4	125		Fossiliferous Calcarenite/ Marl	Predominantly Fossiliferous Calcarenite to 104m, then marl to 125m. Traces of glauconite, frequent, flint and calcite rhombs.	Gambier Limestone/ Oligo-Miocene
125	125.5		Marl	Fawn, 5-10% bryozoal fragments, quartz ferruginous, glauconite-cemented with calcareous matrix.	Narrawaturk Marl/ Oligo-cene
125.5	135		Clay	Plastic dark brown/black carbonaceous, micaceous with 10-20% rounded quartz.	Burrungle Member (Dilwyn Form'n)/ Eocene
135	208		Clayey Sands	Interbedded sands, gravels, clays and silts pyritic, micaceous, minor wood fragments.	Dilwyn Form'n/ Eocene

DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
	273	0	129
152 ID.		120.4	184.6
154 ID. Screen		184.6	205.3

REMARKS: Mount Gambier Standby water Supply Well No. 7

* NOTE: 110 kl / day = 1000gals / hr.

DRILL TYPE: Cable/T to 175m Rotary to 208m
CIRCULATION: Rotary(fluid)
SHEET 1 OF 1

COMPLETED: 25/1/77
LOGGED BY: S.R.Barnett
DATE: Feb. '78

APPENDIX B

COMPOSITE WELL LOG

DEPARTMENT OF MINES - SOUTH AUSTRALIA
ENGINEERING DIVISION

COMPOSITE WELL LOG – GROUNDWATER

HOLE No.	7
UNIT/STATE No.	7022330WW02927
SERIAL No.	28/76
FOLDER No.	056428
ORG. No.	78-168
SHEET	1 OF 1

CONSTRUCTION DETAILS

CABLE TOOL 0–175m
DRILLING TECHNIQUE ROTARY 175–208m
CIRCULATION WATER BASED MUD
START 7-11-76
FINISH 25-1-77
TOTAL DEPTH 208m

	Inches	m/m	From m	To m
HOLE DIAMETER		375 305 216	0 20 120	20 125.5 208
	Note: Diam of interval 125.5 to 129m not clear from drilling records			
CASING DIAMETER		378 steel 273 "	0 0	187 129
CASING DIAMETER		152 I.D. galv. pipe	170 205.34	184.57 205.94
SCREEN DETAILS	"Suroscreen" Mk II Std S.S. wire wound, OD 170mm, ID. 154mm See Fig. 2 for aperture details	170 O.D.	184.57	205.34

PROJECT MT GAMBIER STANDBY TOWN WATER SUPPLY
E & W S DEPARTMENT
LOCATION APPROX 0.65km NORTH OF JUNCTION OF WEHL ST NORTH & WIRELESS RD WEST
SECTION 265 HUNDRED BLANCHE
CO-ORDINATES
REFERENCE ELEV.
SURFACE ELEV.
DATUM

LOGGED BY S.R. BARNETT
DATE DURING DRILLING
TRACED BY
DATE

TYPE OF LOG	64 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)						177	177	
LAST READING (m)						20	0	
INTERVAL MEASURED (m)						157	177	
CASING LOGGER (m)						not stated	not stated	
CASING DRILLER (m)						"	"	
DEPTH REACHED (m)						177	177	
BOTTOM DRILLER (m)								
MUD TYPE						water base	water base	
MUD RESISTIVITY								
RECORDED BY						A.W. Young	A.W. Young	

WELL SYMBOLS

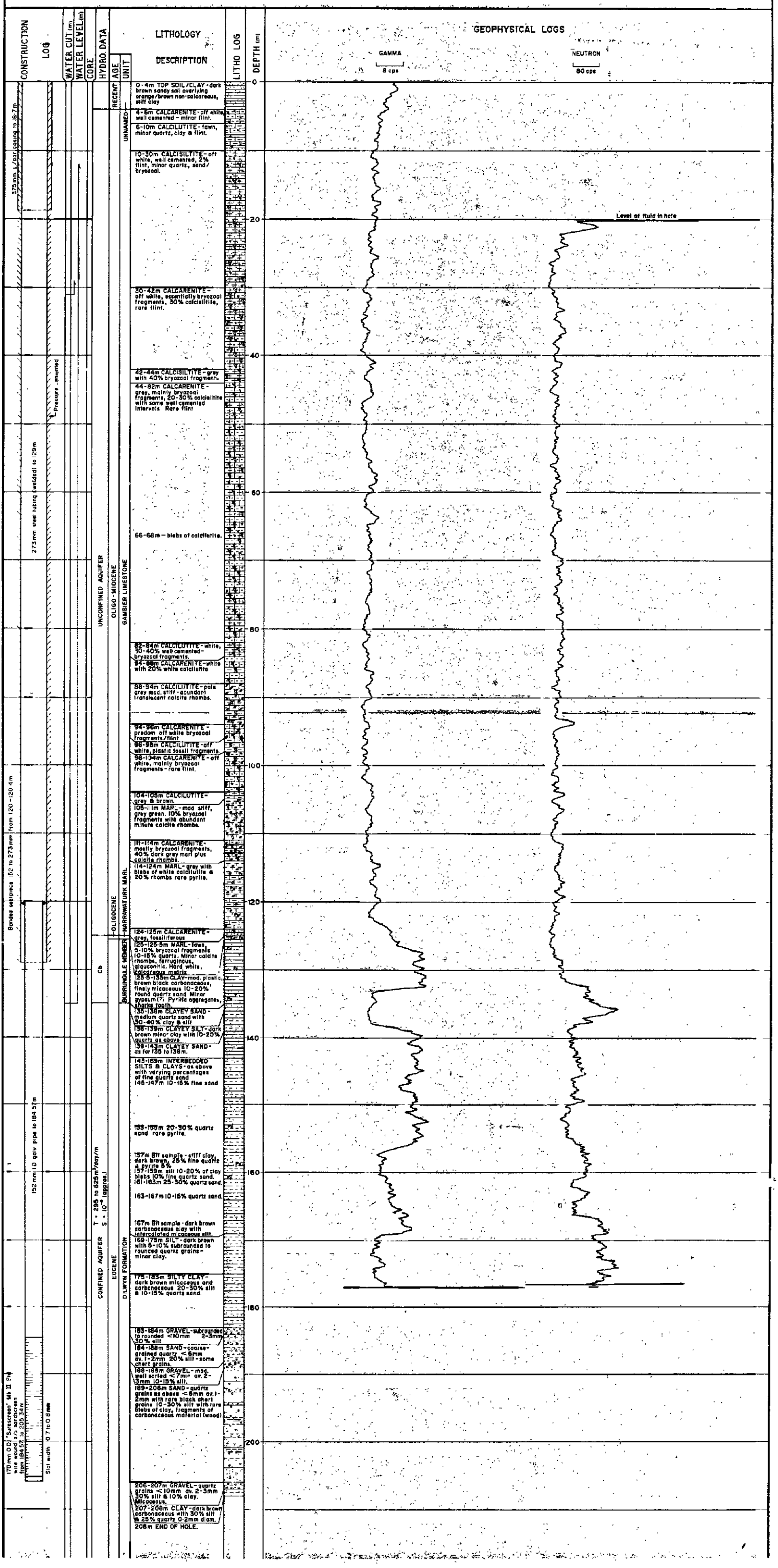
CONSTRUCTION LOG
- Casing shoe
- Wire wound screen
- Slotted casing
- Cemented interval
- Gravel packed interval

HYDROGEOLOGICAL LOG
- Aq Aquifer
- Cb Confining bed
- T Transmissivity m²/day
- 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
31	29	—	—	412	656/76 *
134-8	119	See report		594	719/77 *

N.B. * Denotes ANGEL Pott Analysis

REMARKS Permit B482 Drillers A. Anderson (Cable Tool), R. Feeby (Rotary).



APPENDIX C

Discharge Test Parameters, Calculations and Assumptions

Assumptions

The following assumptions have been used in the interpretation of aquifer and production test data:

1. the aquifer is of infinite areal extent.
2. prior to pumping, the potentiometric surface is horizontal over the area influenced by the discharge test.
3. the aquifer is pumped at a constant discharge rate.
4. the pumped well penetrates the entire aquifer and thus receives water flow from the entire thickness of aquifer by horizontal flow.
5. flow to the well is in a non-steady state.
6. the well is fully developed prior to testing.

Testing Method

Water Level Measurement:

Water level measurements were taken using an electric water level probe.

Frequency (Drawdown and Recovery):

0	- 10 minutes	-	every 1 minute
10	- 30 minutes	-	every 2 minutes
30	- 60 minutes	-	every 5 minutes
60	- 100 minutes	-	every 10 minutes
100	- 200 minutes	-	every 20 minutes
200	- 720 minutes	-	every 60 minutes (1 hour)
720	-1440 minutes	-	every 120 minutes (2 hours)
1440	- completion	-	every 240 minutes (4 hours)

Discharge Rate Measurement:

Discharge rate was determined by an in line water meter.

Frequency:			
0	- 10 minutes	-	every 5 minutes
10	-100 minutes	-	every 10 minutes
100	- completion	-	same frequency as water level measurements

Water Sampling:

Samples for full analysis + NO_3, PO_4, B, F and Fe were taken just after the commencement of the 72 hour constant discharge test and every 12 hrs. during the test and at completion.
Samples for A.T.S. analysis were taken every 4 hrs.
Samples were also taken at intervals during the step tests.

Step Drawdown Tests:

A three x 100 minute step drawdown test was carried out at the following rates:

	$Q(m^3/day)$	$\Delta s(m)$	$Q/\Delta s$
Step 1	1476	0.36	4.1×10^3
Step 2	2477	0.59	4.2×10^3
Step 3	3512	0.90	3.9×10^3

No recovery occurred between steps and data were reduced by the method outlined by Hazel (1973) pVII-26.

The Well Equation was obtained from the following data:

Step 1 Q_{ave} = 1.03 m^3/min
1476 m^3/day

Δs = 0.36

intercept on ordinate 3.27

bQ = 0.36
b = 0.35
a + cQ = intercept/Q
a + 1.03c = 3.17

Step 2 Q_{ave} = 1.72 m^3/min
2477 m^3/day

Δs = 0.59

intercepts on ordinate 6.21

bQ = 0.59
b = 0.34
a + 1.72c = 6.21

Step 3 Q_{ave} = 2.44 m^3/min
3512 m^3/day

Δs = 0.90

intercept on ordinate 9.20

bQ = 0.90
b = 0.37
a + 2.44c = 9.20

Thus b_{ave} = 0.35

Step 1 a + 1.03c = 3.17
Step 2 a + 1.72c = 3.61
Step 3 a + 2.44c = 3.77

Solving for c:

Steps 1 and 2 0.69c = 0.44
c = 0.63
Steps 1 and 3 1.41c = 0.60
c = 0.42
Steps 2 and 3 0.72c = 0.16
c = 0.22

c_{ave} = 042

Solving for a:

Step 1 $a = 2.74$
Step 2 $a = 2.89$
Step 3 $a = 2.75$ $\qquad a_{ave} = 2.79$

Hence the Well Equation becomes:

$$s = (2.79 + 0.35 \log t)\, Q + 0.42Q^2$$

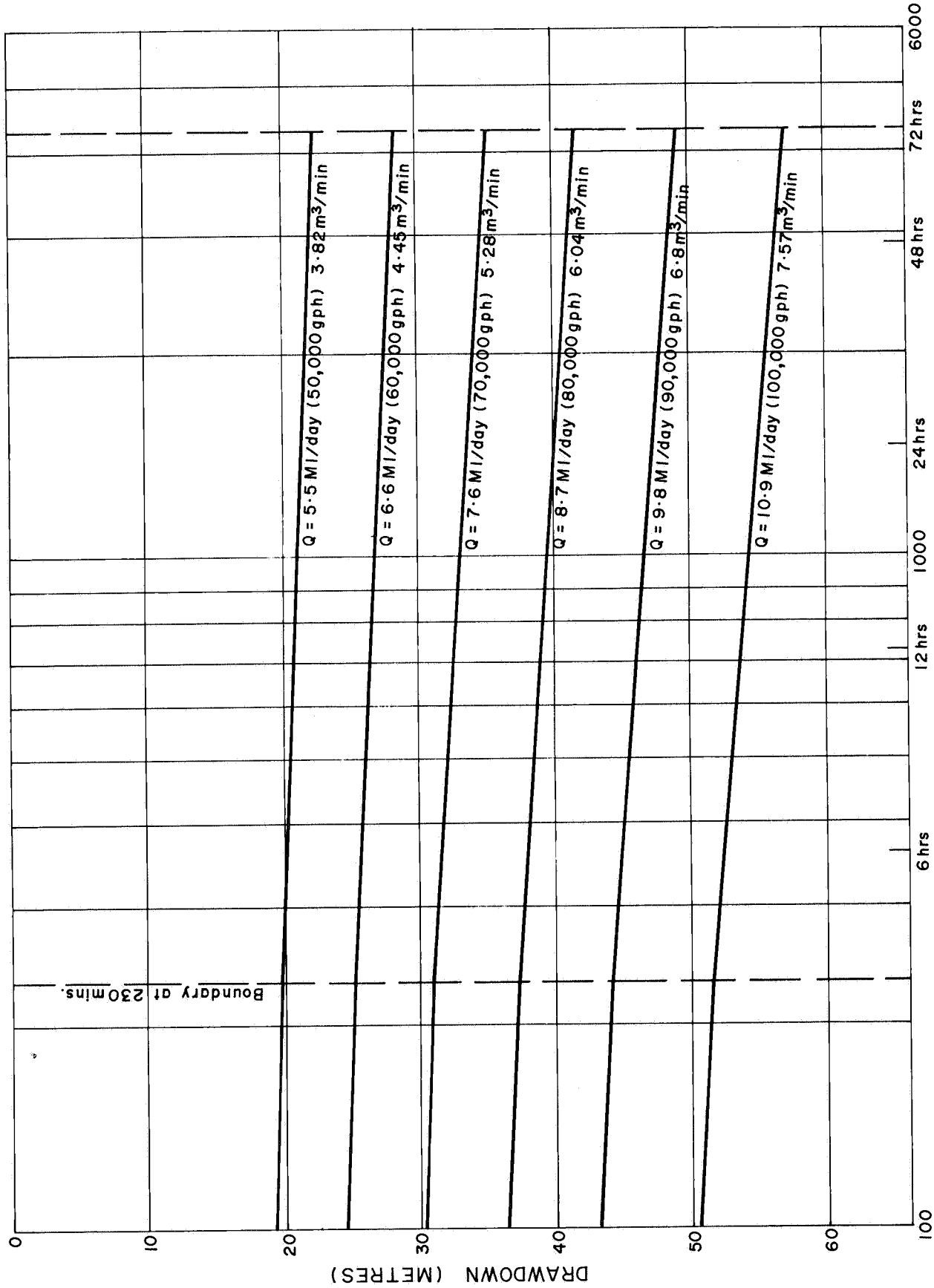
where s in metres
t in minutes
Q in m^3/min

Constant Discharge Test:

This test was used to determine the presence or absence of boundary conditions with long term pumping. The duration of the test was 72 hours followed by 36 hour recovery. Measurement frequency as cited above. Data are presented graphically in Figs. 4 and 5.

APPENDIX D

PREDICTED DRAWDOWN VS. TIME CURVES



	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE:
COMPILED: P.C. Smith	E. & W.S. DEPT.	DATE: JAN. 78
DRN: M.W. CKD.	MT. GAMBIER T.W.S. STANDBY WELL No.7	PLAN NUMBER:
	PREDICTED DRAWDOWN vs TIME CURVES	S13273

APPENDIX E

Summary of water analyses

and Full 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)	pH	Analysis W No.	Remarks
		Samples Taken during Drilling				
Approx. 31	31	Approx. 29	375	7.5	655/76	Sample taken at water cut - unconfined aquifer
"	31	"	412	7.4	656/76*	As above
		Samples Taken during Test Pumping				
			599	7.2	723/77*	6mins from start of Step1
			595	7.3	724/77	3mins from end of Step 1
			590	7.3	725/77	2mins from end of Step 2
			601	7.1	726/77*	End of Step 3
			574	7.1	704/77*	Start of 72hr constant
			620	7.4	701/77	discharge test 240 minutes
			620	7.4	702/77	480 minutes
			603	7.3	703/77*	720 minutes
			605	7.4	705/77	1040 minutes
			610	7.4	706/77	1280 minutes
			596	7.2	707/77*	1555 minutes
			590	7.4	708/77	1760 minutes
			605	7.4	709/77	2000 minutes
			599	7.3	710/77*	2240 minutes
			580	7.4	711/77	2480 minutes
			580	7.4	712/77	2720 minutes
			598	7.3	713/77*	2960 minutes
			580	7.4	714/77	3200 minutes
			590	7.5	715/77	3440 minutes
			599	7.3	716/77*	3680 minutes
			590	7.4	717/77	3920 minutes
			590	7.4	718/77	4160 minutes
			594	7.5	719/77*	4300 minutes

Note: * indicates AMDEL analysis

Borehole State No. 7022330WW02927

Drn: PCS | Sheet 2 of 2

Date: Sept. 1977 | Bore Folder No.

PF Nº S10538 MH

WATER ANALYSIS REPORT

SAMPLE No. W656/76 JOB No. 2414-76

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	70	3.5
MAGNESIUM	(Mg)	14	1.2
SODIUM	(Na)	63	2.7
POTASSIUM	(K)	6	.2
IRON	(Fe)	.04	.0
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	285	4.7
SULPHATE	(SO_4)	11	.2
CHLORIDE	(Cl)	75	2.1
FLUORIDE	(F)	0.15	.0
NITRATE	(NO_3)	33	.5
PHOSPHATE	(PO_4)	.10	.0

TOTALS AND BALANCE			
CATIONS	(me/ℓ)	7.5	DIFF = .0
ANIONS	(me/ℓ)	7.6	SUM = 15.1

DIFF 100 / SUM = .1%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 730.

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	412.
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	232.
CARBONATE HARDNESS AS $CaCO_3$	232.
NON-CARBONATE HARDNESS AS $CaCO_3$	.
TOTAL ALKALINITY AS $CaCO_3$	234.
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	0.17

	UNITS
REACTION - pH	7.4
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ) 36.3%

NAME - E.W.S. DEPT.
ADDRESS MT. GAMBIER
DATE COLLECTED 16/1/76
SAMPLE COLLECTED BY: A. ANDERSON

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

OBS. No.
HOLE No.
D.M. No.

WATER ANALYSIS REPORT

SAMPLE No. W704/77 JOB No. 2473-77

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	76	3.8
MAGNESIUM	(Mg)	21	1.7
SODIUM	(Na)	112	4.9
POTASSIUM	(K)	5	.1
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	374	6.1
SULPHATE	(SO_4)	16	.3
CHLORIDE	(Cl)	159	4.5
FLUORIDE	(F)		
NITRATE	(NO_3)	1	.0
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE				
CATIONS	(me/ℓ)	10.5	DIFF =	.4
ANIONS	(me/ℓ)	11.0	SUM =	21.5

$\frac{\text{DIFF } 100}{\text{SUM}}$ = 2.1%

DERIVED AND OTHER DATA

	MILLIGRAMS PER LITRE mg/ℓ
CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C	1074.
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	574.
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS $CaCO_3$	276.
CARBONATE HARDNESS AS $CaCO_3$	276.
NON-CARBONATE HARDNESS AS $CaCO_3$	<1.
TOTAL ALKALINITY AS $CaCO_3$	307.
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.1
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ) 46.3%

NAME -E.W.S.
ADDRESS MT.GAMBIER
DATE COLLECTED 17/1/77
SAMPLE COLLECTED BY: A.ANDERSON

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

OBS. No.
HOLE No. 7
D.M. No.

WATER ANALYSIS REPORT

SAMPLE No. W719/77 JOB No. 2473-77

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	84	4.2
MAGNESIUM	(Mg)	22	1.8
SODIUM	(Na)	111	4.8
POTASSIUM	(K)	5	.1
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	411	6.7
SULPHATE	(SO_4)	14	.3
CHLORIDE	(Cl)	156	4.4
FLUORIDE	(F)		
NITRATE	(NO_3)	<1	.0
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE			
CATIONS	(me/ℓ)	11.0	DIFF = .5
ANIONS	(me/ℓ)	11.4	SUM = 22.4

DIFF 100 / SUM = 2.0%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 1043.

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	594.
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	300.
CARBONATE HARDNESS AS $CaCO_3$	300.
NON-CARBONATE HARDNESS AS $CaCO_3$	<1.
TOTAL ALKALINITY AS $CaCO_3$	337.
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.5
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ) 44.1%

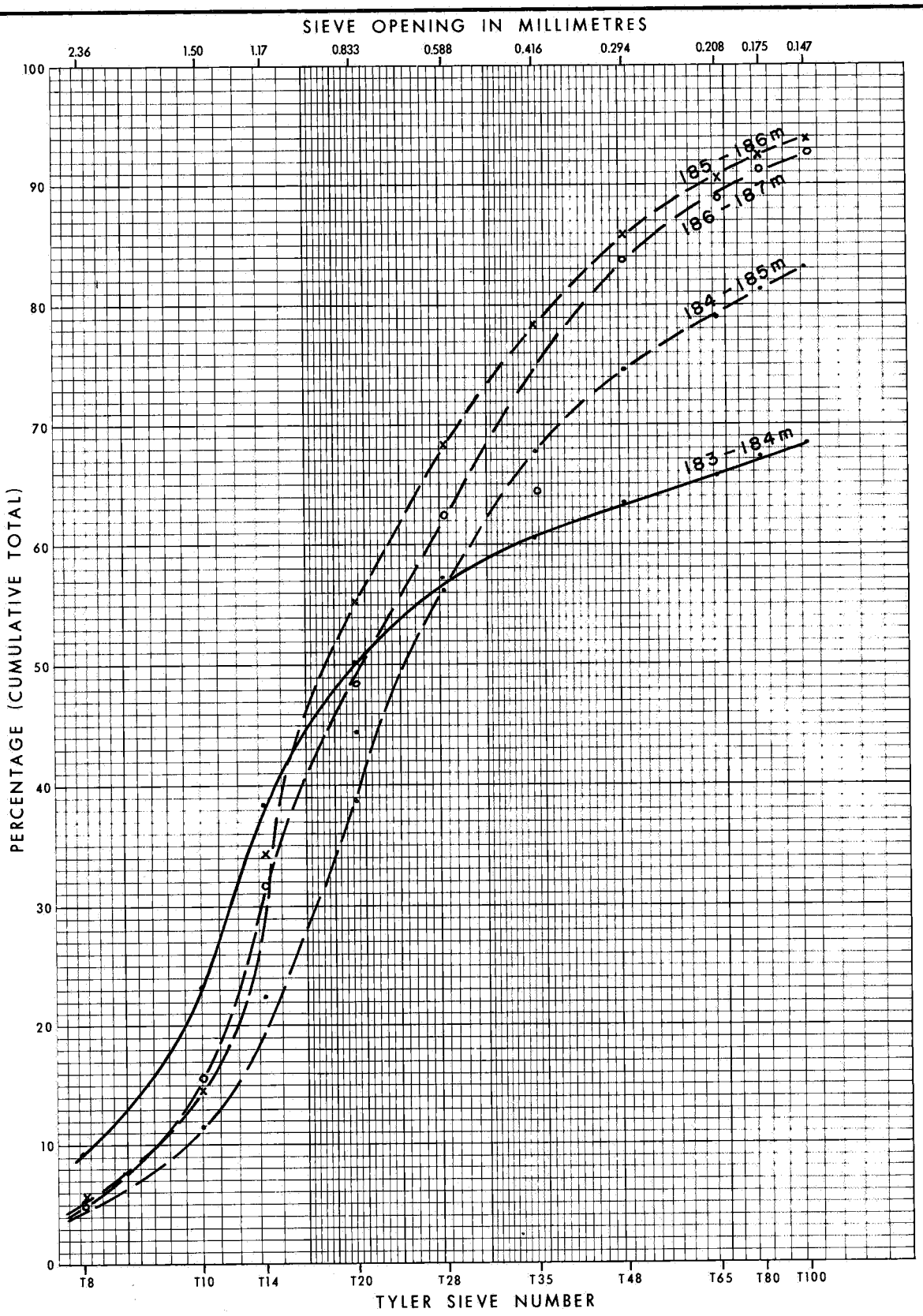
NAME -E.W.S.
ADDRESS MT.GAMBIER
DATE COLLECTED 20/1/77
SAMPLE COLLECTED BY: A.ANDERSON

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

OBS. No.
HOLE No. 7
D.M. No.

APPENDIX F

SCREEN SIZE ANALYSES



INTERVAL 183 m TO 187 m

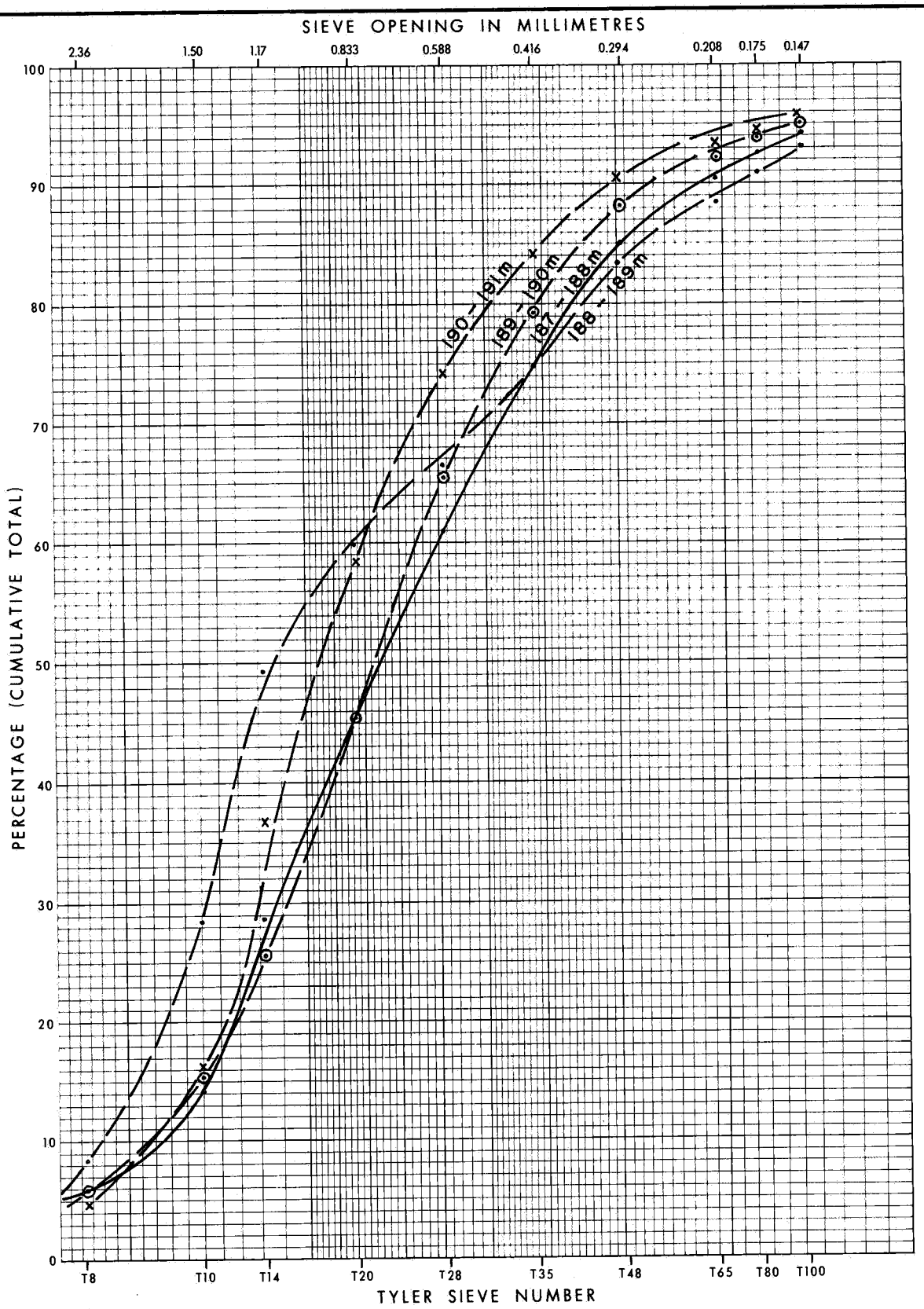
SCREEN RECOMMENDED .....

BOREHOLE STATE No. 7022330WW02927

BOREHOLE IDENTIFYING No. Mt. Gambier T.W.S. No.7

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 784/74
Compiled: P.C. Smith	SCREEN SIZE ANALYSIS	Date: JAN. 78
Drn: M.S.W.	E. & W.S. DEPT. – MT. GAMBIER T.W.S. No.7	Drg.No:
Ckd:	INTERVAL 183 – 187m	S13274

P.F. No. 6255 MH



INTERVAL..187..m TO..191..m

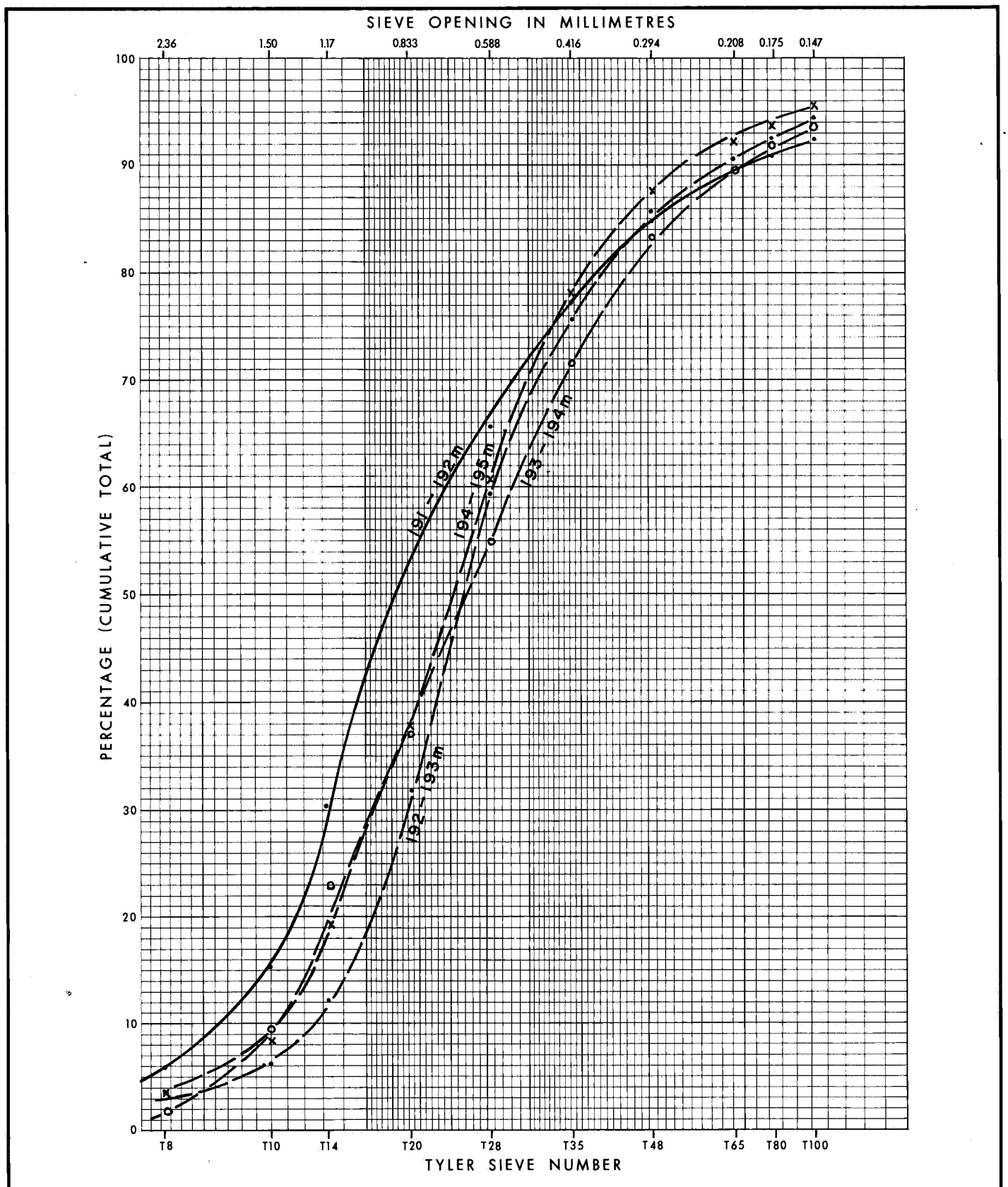
SCREEN RECOMMENDED.....

BOREHOLE STATE No. 7022330WW02927

BOREHOLE IDENTIFYING No. Mt. Gambier T.W.S. No.7

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 784/74
Compiled: P.C. Smith	SCREEN SIZE ANALYSIS	Date: JAN. 78
Drn: M.S.W.	E. & W.S. DEPT. – MT. GAMBIER T.W.S. No.7	Drg.No:
Ckd:	INTERVAL 187 – 191m	S13275

P.F. No. 6255 MH



INTERVAL..191..m TO..195..m

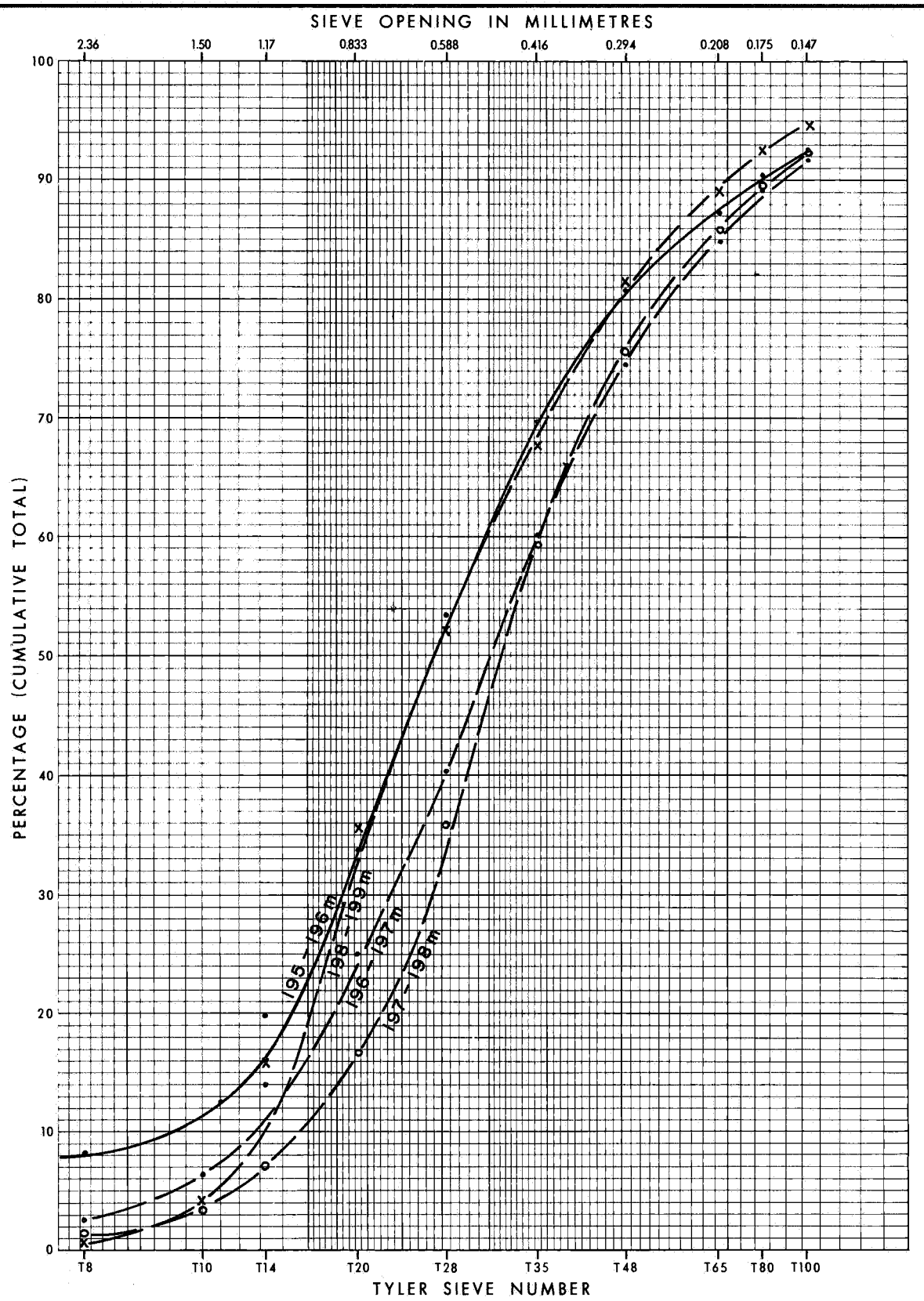
BOREHOLE STATE No.7022330WW02927

SCREEN RECOMMENDED.....

BOREHOLE IDENTIFYING No.Mt. Gambier T.W.S. No.7

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 784/74
Compiled: P.C. Smith	SCREEN SIZE ANALYSIS	Date: JAN. 78
Drn: M.S.W.	E. & W.S. DEPT. – MT. GAMBIER T.W.S. No.7	Drg.No:
Ckd:	INTERVAL 191 – 195m	S13276

P.F. No. 6255 MH



INTERVAL..195..m TO..199..m

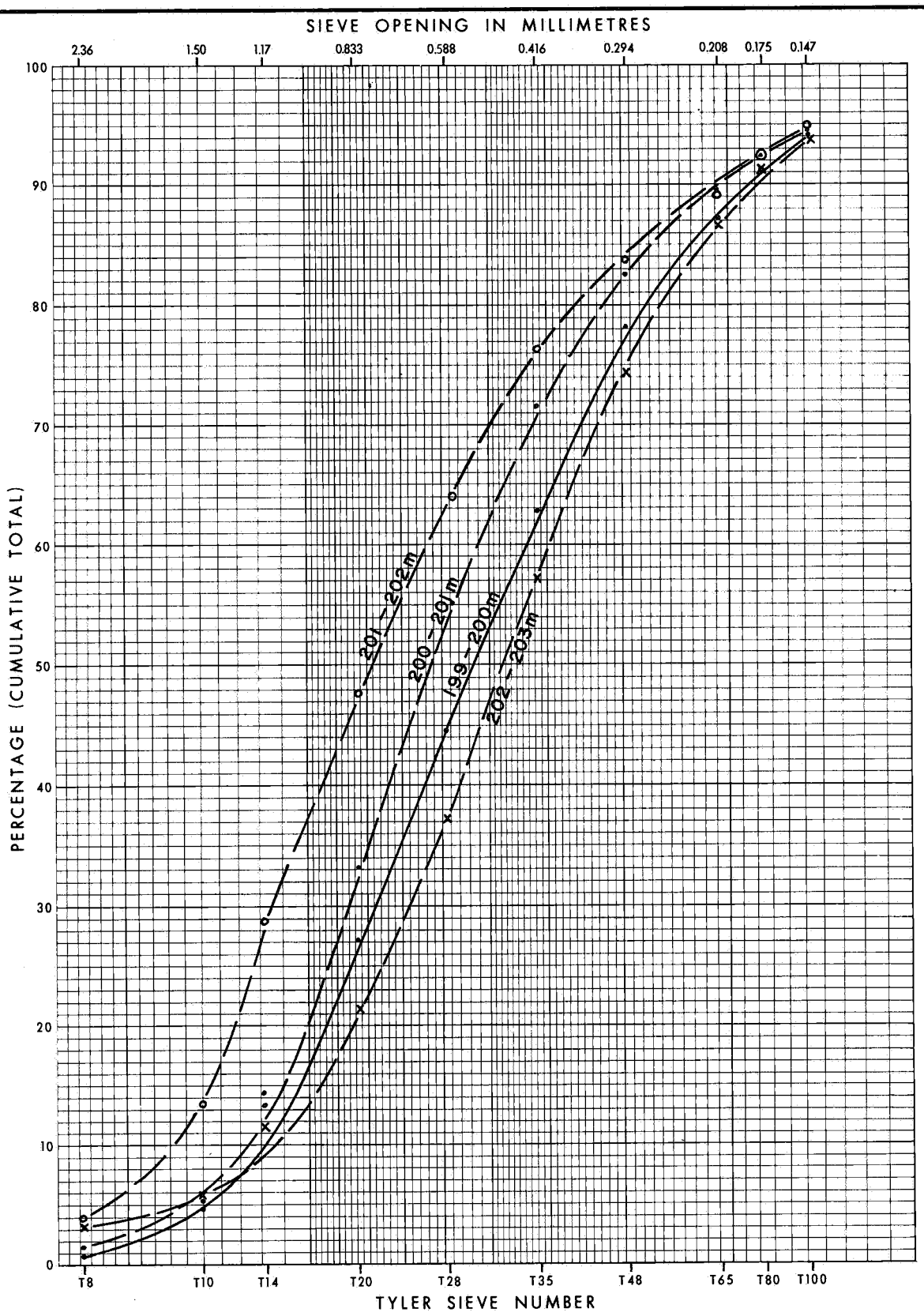
BOREHOLE STATE No. 7022330WW02927

SCREEN RECOMMENDED.....

BOREHOLE IDENTIFYING No. Mt. Gambier T.W.S. No.7

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 784/74
Compiled: P.C. Smith	SCREEN SIZE ANALYSIS	Date: JAN. 78
Drn: M.S.W.	E. & W.S. DEPT. – MT. GAMBIER T.W.S. No.7	Drg.No:
Ckd:	INTERVAL 195 – 199m	S13277

P.F. No. 6255 MH



INTERVAL..199..m TO..203..m

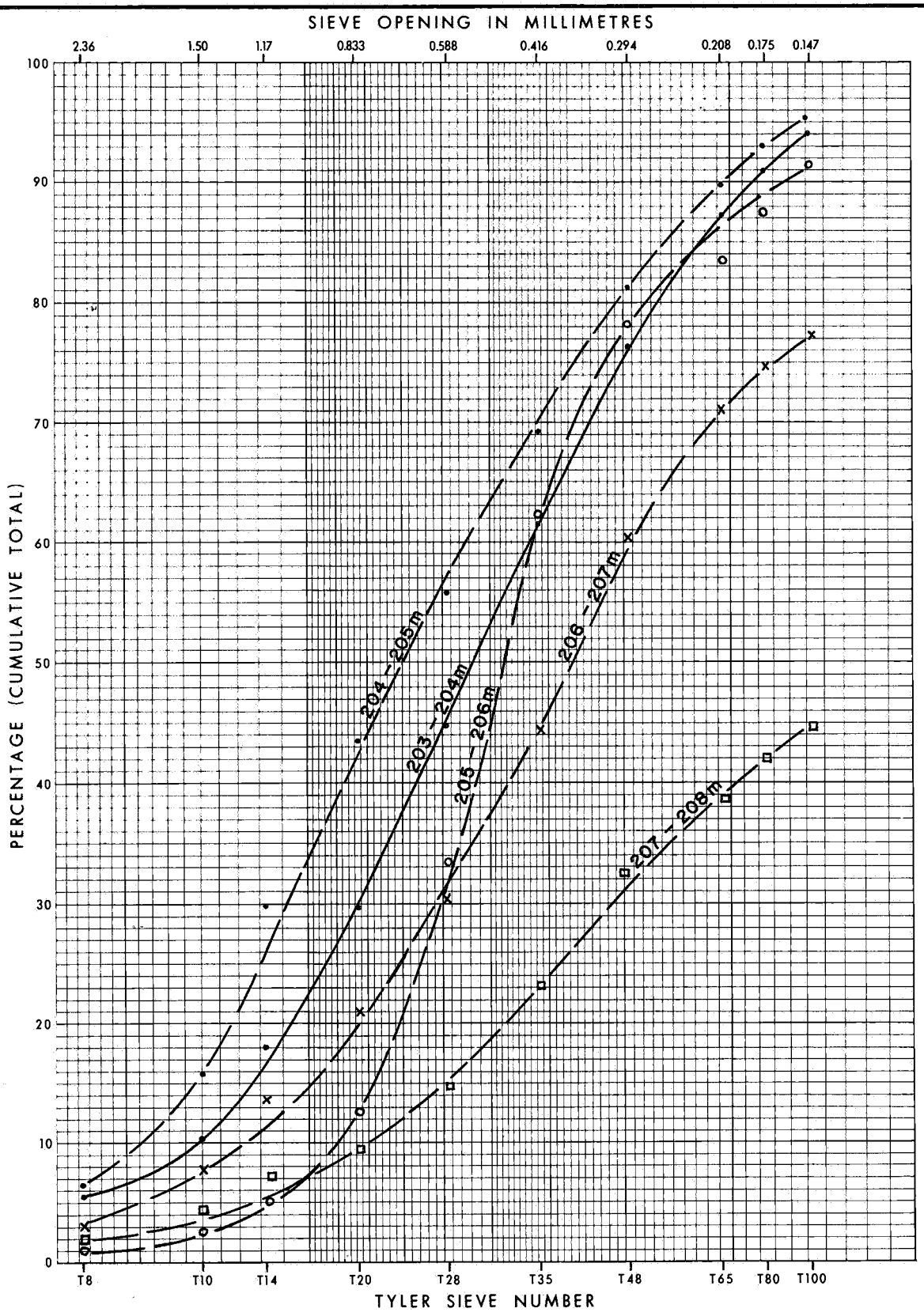
SCREEN RECOMMENDED.....

BOREHOLE STATE No. 7022330WW02927

BOREHOLE IDENTIFYING No. Mt. Gambier T.W.S. No. 7

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 784/74
Compiled: P.C. Smith	SCREEN SIZE ANALYSIS	Date: JAN. 78
Drn: M.S.W.	E. & W.S. DEPT. - MT. GAMBIER T.W.S. No. 7	Drg.No:
Ckd:	INTERVAL 199 - 203m	S13278

P.F. No. 6255 MH



INTERVAL 203 m TO 208 m

SCREEN RECOMMENDED.....

BOREHOLE STATE No. 7022330WW02927

BOREHOLE IDENTIFYING No. Mt. Gambier T.W.S. No.7

HYDROGEOLOGY SECTION	**DEPARTMENT OF MINES - SOUTH AUSTRALIA**	DM. 784/74
Compiled: P.C. Smith	SCREEN SIZE ANALYSIS	Date: JAN. 78
Drn: M.S.W.	E. & W.S. DEPT. MT. GAMBIER T.W.S. No.7	Drg.No:
Ckd:	INTERVAL 203 – 208m	S13279

P.F. No. 6255 MH

APPENDIX G

CONSTRUCTION REPORT

DM 784/74

TO THE CHIEF DRILLING & MECHANICAL ENGINEER

Through the Drilling Engineer

Completion of drilling
E. & W.S. Department

T.W.S. Well No. 7
Mount Gambier
Permit No. B482

A 375 mm diameter hole was drilled to 20 m and lined with 375 mm lockbar casing to 18.70 m, then a 305 mm open hole was drilled into the confining clay, cut at 125.50 m.

273 mm steel tubing was installed to 129 m and pressure cemented to surface, 1,310 gallons of gout was used - 5-1 mix. The formation was bulk sampled at 1 m intervals for sieve analyses from 134 m to 175 m. Initially drilling mud was used to contain the open hole whilst sampling, but as depth increased it became necessary to use steel casing, 203 mm diameter to 169 m then 152 mm diameter to 175 m.

The formation to this depth was unsuitable for screening, being only clayey silts.

It was not anticipated that it would be necessary to penetrate so far into the Dilwyn Formation, and the drilling mud not only failed to contain the hole but also compacted the formation making progress difficult.

Finally progress became so slow that, after discussions with the Drilling Engineer, a mud engineer and the E. & W.S. Department, it was decided to remove the cable tool plant and use a rotary drill to explore the formation to approximately 300 m. The original estimate was exhausted trying to locate a suitable aquifer and further approval was necessary for the rotary drilling.

The rotary drill commenced operation on 24.9.76 and a suitable sand bed was encountered from 183 m to 205 m.

The cable tool plant was then replaced over the well and the 152 mm and 203 mm casings were removed.

On 7.12.76 the rotary drill was returned and the hole was enlarged to 216 mm from 129 m to 205 m.

A 20.93 m x 170 mm Stainless steel sandscreen was installed from 184.57 m to 205.34 m, with 152 mm I.D. Galvanized pipe from 120.40 m to the top of the screen. A rubber banded seal piece to the 273 mm casing is attached to the top of the 152 mm pipe from 120 m.

The screen was developed with a cable tool rig by bailing and surging the face of the screen for 48 hours.

The 189 mm test pump was installed to 64 m and the bore was pumped for 11 hours to complete development and establish flow rates.

3 x 100 minute step drawdown tests were conducted with a 300 minute recovery period, followed by a 4,320 minute continuous test with a 2,160 minute recovery period.

Details of the bore and pump test are tabulated below:-

Commenced	7.1.76
Completed	25.1.77
Depth drilled	208 m
Depth on completion (Bottom of screen assembly)	205.94 m
375 mm lockbar casing	Surface - 18.70 m
273 mm steel tubing - Pressure cemented	Surface - 129 m
Rubber banded sealpiece - 152 mm to 273 mm	120 m - 120.40 m
152 mm I.D. Galvanized pipe	120.40 m - 184.57 m
170 mm O.D. Sandscreen	184.57 m - 205.34 m
Blank with ball and backoff assembly	205.34 m - 205.94 m
Water Cut	31 m and 134.80 m
Standing Water Depths	29 m (11.90 m)
Screen development	48 hours
Development with pump	11 hours

Details of Sandscreen and assembly

Sealpiece, screwed to 152 mm I.D. Galv. pipe with rubber Seals to 273 mm tubing)	length 0.43m
152 mm I.D. pipe (10 lengths)	" 64.58m
170 mm Stainless steel screen (4 sections)	" 20.93m
Bottom blank with ball and back off connection	" 0.60m
length overall-	86.54m
" effective-	85.94m

Sandscreen

Type - "Surescreen" Stainless Steel. Wire wound.
O.D. 170 mm (6 5/8")
I.D. 154 mm (6 1/16")

	Length	Aperatures
Top section	5.31m	.7mm (.028")
2nd section	5.23m	.8mm (.032")
3rd section	5.19m	.8mm (.032")
Bottom section	5.20m	.7mm (.028")

Length overall-20.93m
" effective-20.77m

Details of pump testing

Inside 203 mm 5 stage Test pump set at 64 m
Development 11 hours

3 x 100 minute Step drawdown tests
Static level 12.25m

	RPM	Pumping rate	Pumping level	Drawdown (at end of each step)
Step 1.	1,500	13,530 GPH	16.63m after 100 mins	4.38m
Step 2.	2,000	22,734 GPH	20.32m after 200 mins	8.06m
Step 3.	2,500	32,200 GPH	24.39m after 300 mins	12.14m

4,320 minute continuous Test

Average pumping rate	-	40,100 GPH
Maximum Pumping level	-	29.05m
" Drawdown	-	16.80m
R.P.M. at pump head	-	2,850

A Sketch of the bore and Screen is attached.

WDW:JRH
25.1.77

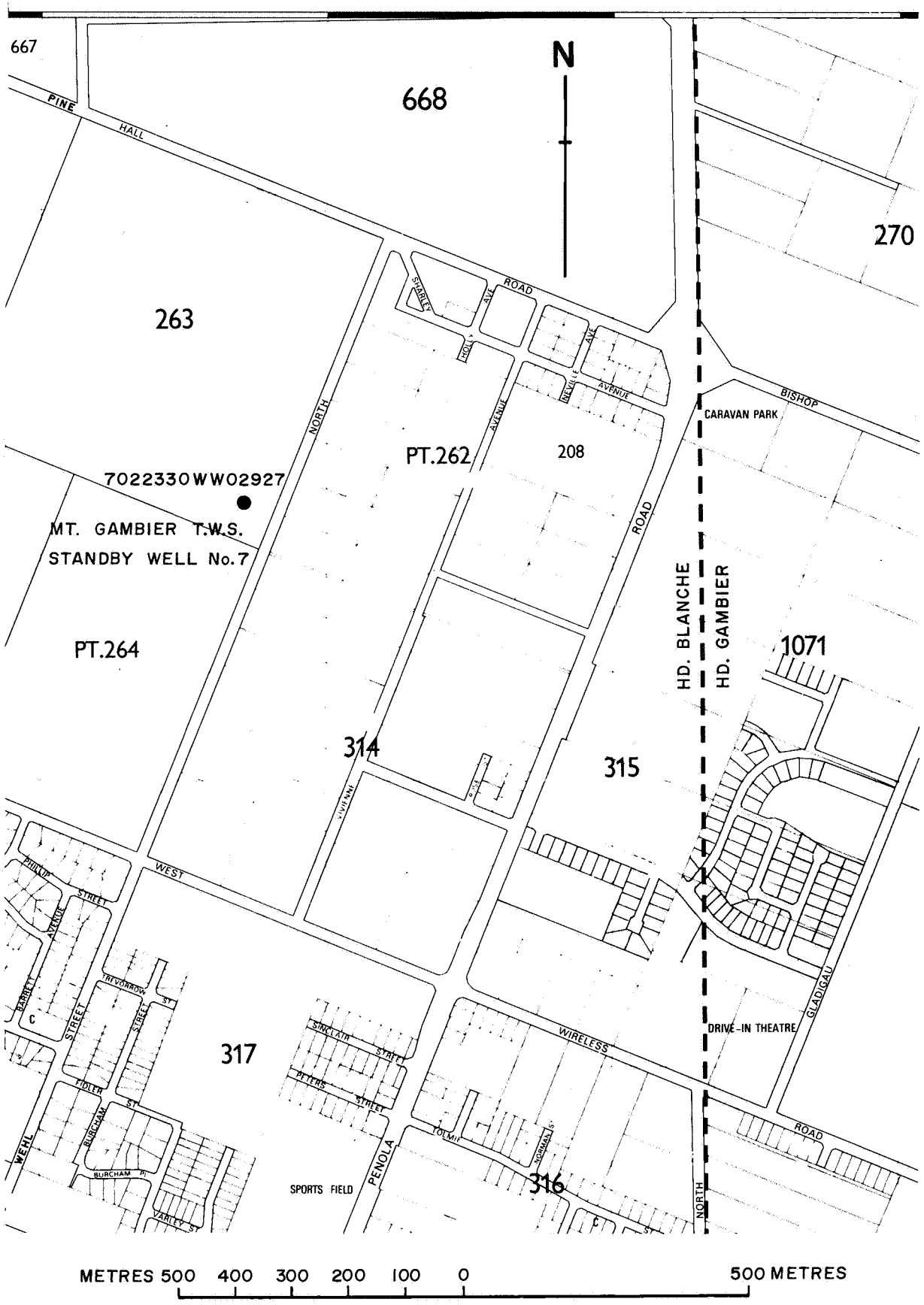
J. PERRY
DRILLING SUPERINTENDENT

TO THE DIRECTOR OF MINES:

Forwarding the above completion report submitted by the Cable Tool Superintendent.

25.1.77

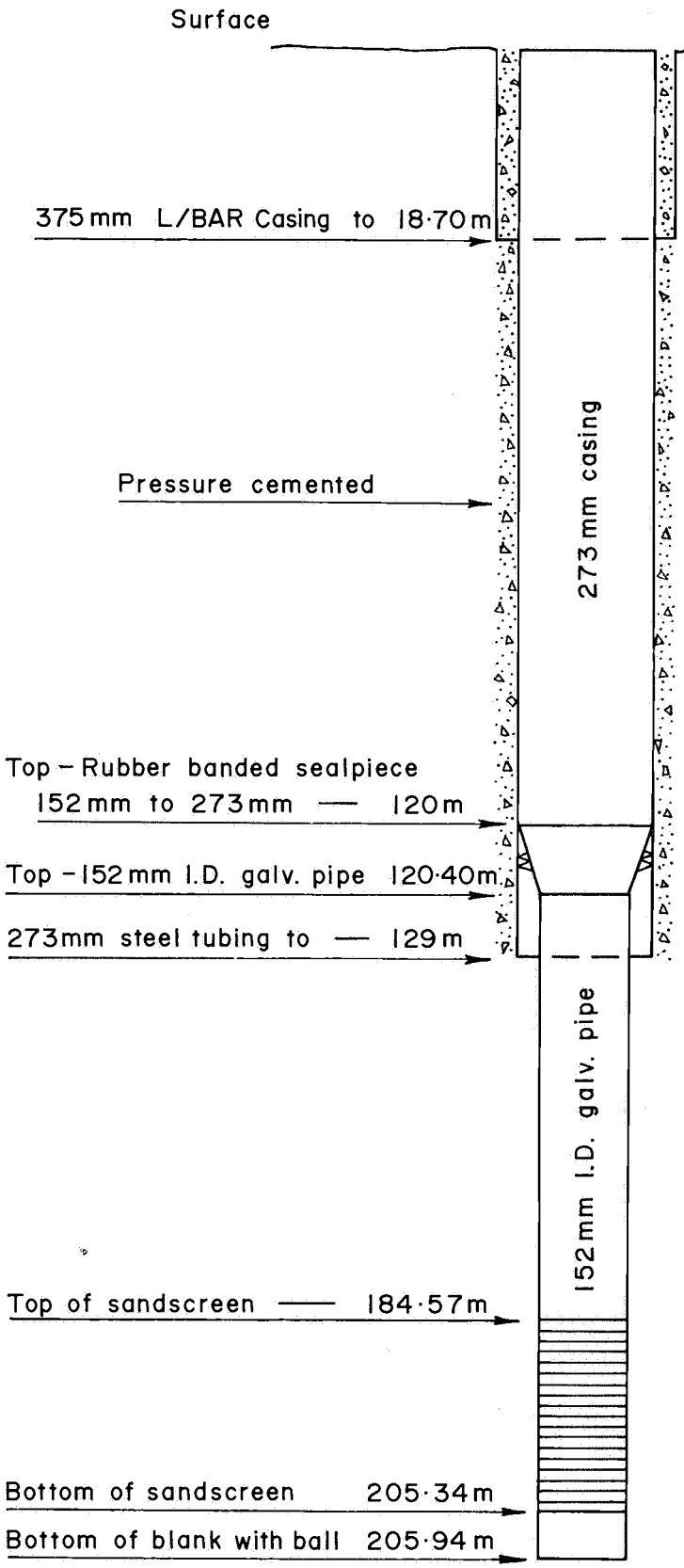
R.R. HANCOCK
CHIEF DRILLING & MECHANICAL ENGINEER



METRES 500 400 300 200 100 0 500 METRES

FIG. 1

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE 1:10,000
COMPILED . P.C. Smith	E. & W.S. DEPARTMENT	DATE FEB. 78
DRN . M.W. | CKD .	MT. GAMBIER T.W.S. STANDBY WELL No.7	PLAN NUMBER
	LOCALITY PLAN	S 13271



SEALPIECE

Rubber banded
152 mm to 273 m
Screwed to 152 mm galv. pipe
Length .....0·43 m overall

SCREEN & LINER ASSEMBLY

Rubber banded sealpiece Length	0·43 m
152 mm I.D. galv. pipe (10 lengths)	64·58 m
170 mm O.D. sandscreen	20·93 m
Bottom blank with spring loaded ball	0·60 m
Overall length	86·54 m
Effective length	85·94 m

SANDSCREEN

Type – "SURESCREEN" stainless steel, wire wound
O.D. 170 mm (6 5/8")
I.D. 154 mm (6 1/16")

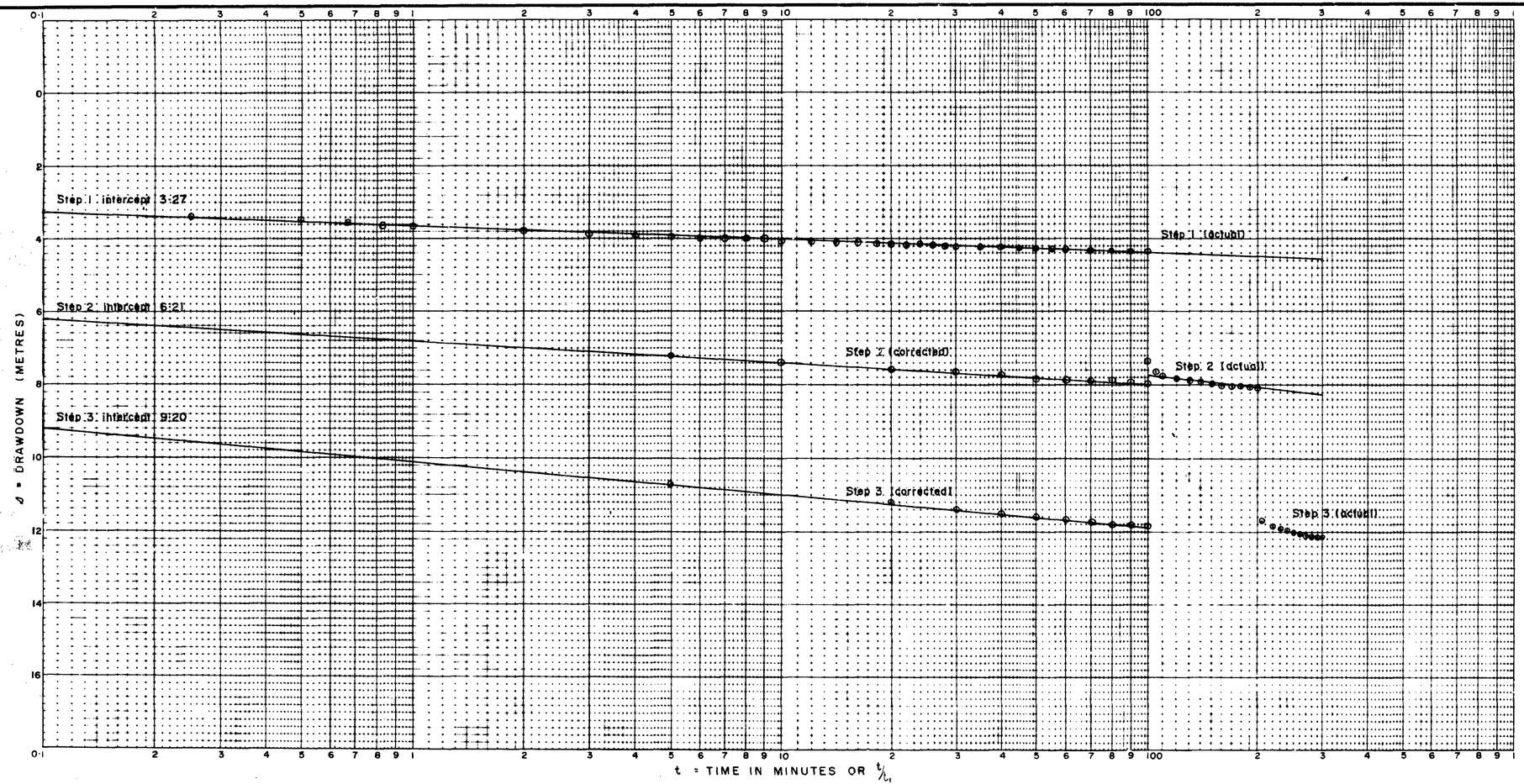
4 sections:

	Length	Apertures
Top section	5·31 m	0·7 mm (0·028")
2nd "	5·23 m	0·8 mm (0·032")
3rd "	5·19 m	0·8 mm (0·032")
Bottom "	5·20 m	0·7 mm (0·028")

Overall length..... 20·93 m
Effective length..... 20·77 m

FIG. 2

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE:
COMPILED:	E. & W.S. DEPARTMENT	DATE: FEB. 78
DRN: M.W. CKD.	MT. GAMBIER T.W.S. STANDBY WELL No.7	PLAN NUMBER:
	CONSTRUCTION SKETCH	S 13272



s = RESIDUAL DRAWDOWN (METRES)

BOREHOLE STATE/UNIT No.7022330WW02927 — TYPE OF PUMP POMONA 6" column 5 stage

REF. PT. .....(m) above ground — LENGTH OF TEST ....5 hrs .....

AQUIFER FROM 184·6 TO 205·3 (m) — DEPTH WATER LEVEL AT TEST START (ℓ_2) 12·26 (m)

HOLE DEPTH 205·9 (m) — DEPTH PUMP INTAKE (ℓ_1) 64·33 (m)

* AVAILABLE DRAWDOWN 52·07 (m)

EQUATIONS

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

In which

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

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

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

1 day = 8.64×10^4 secs.

DATA

	Q m^3/min	Q m^3/day	Δs	$\frac{Q}{\Delta s}$	r
STEP 1	1·03	1476	0·36	2·86	
STEP 2	1·72	2477	0·59	2·92	
STEP 3	2·44	3512	0·90	2·71	

CALCULATIONS

STEP 1 $T = \frac{0.183 \times 1476}{0.36} = 750.3\ m^3/day/m$

STEP 2 $T = \frac{0.183 \times 2477}{0.59} = 768.3\ m^3/day/m$

STEP 3 $T = \frac{0.183 \times 3512}{0.90} = 714.1\ m^3/day/m$

$T_{ave} = 744.2\ m^3/day/m$

WATER WELL EQUATION:

$s = (2.79 + 0.35 \log t)Q + 0.42Q^2$

s in metres

t in minutes

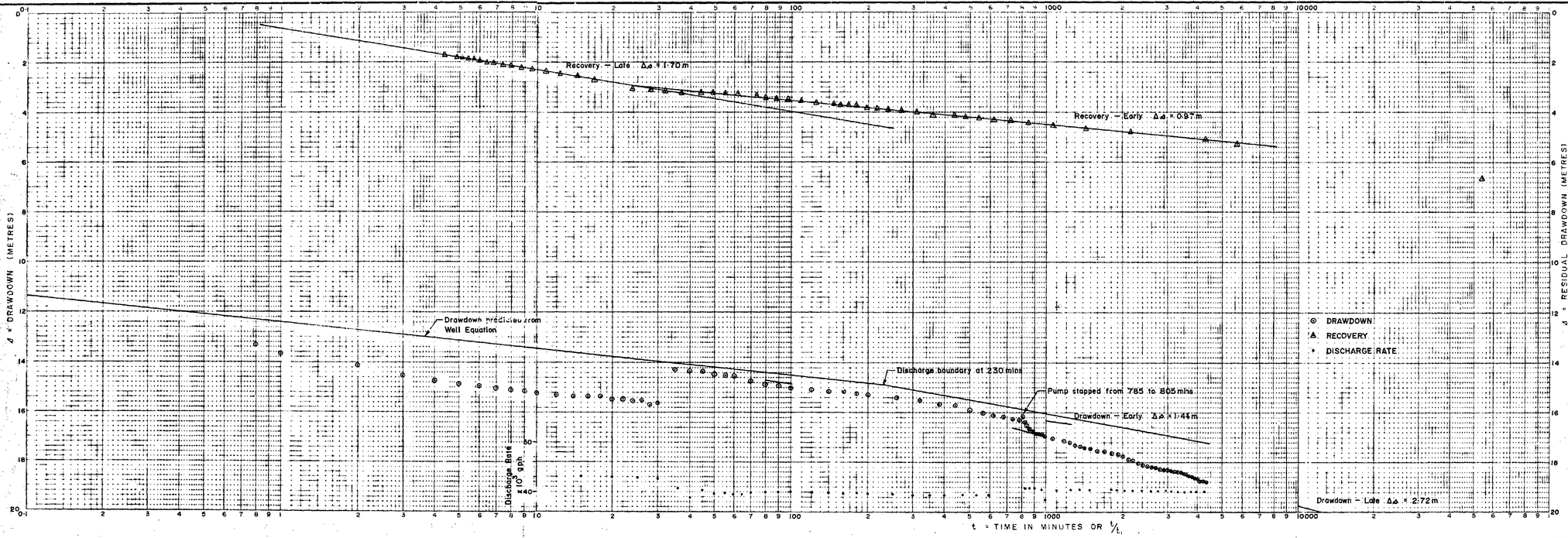
Q in m^3/min

* Available drawdown = $\ell_1 - \ell_2$

FIG. 3

ENGINEERING DIVISION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	D.M. 784/74
COMPILED P.C. Smith	E. & W.S. DEPARTMENT	DATE JAN. 78
DRN M.W. CKD	MT. GAMBIER T.W.S. STANDBY WELL No.7	PLAN NUMBER 78-165
	STEP TESTS – SEMI-LOG	

P.F. No. 69-953 MM



BOREHOLE STATE/UNIT No 7022330WW02927
REF PT .....(m) above ground
AQUIFER FROM 184·6 TO 205·3 (m)
HOLE DEPTH 205·9 (m)

TYPE OF PUMP POMONA, 6" column 5 stage
LENGTH OF TEST 72 hrs .....
DEPTH WATER LEVEL AT TEST START (ℓ_1) 12·10 (m)
DEPTH PUMP INTAKE (ℓ_1) 64·33 (m)
* AVAILABLE DRAWDOWN 52·23 (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 x 10^4 secs.

DATA

Q_{ave}	Δ_d	t_o	r
3·04 m³/min			

CALCULATIONS

	T (m^3/day/m)	$\frac{Q}{\Delta d}$
DRAWDOWN — EARLY	856	
LATE	894	
RECOVERY — EARLY	826	3·1
LATE	471	1·8

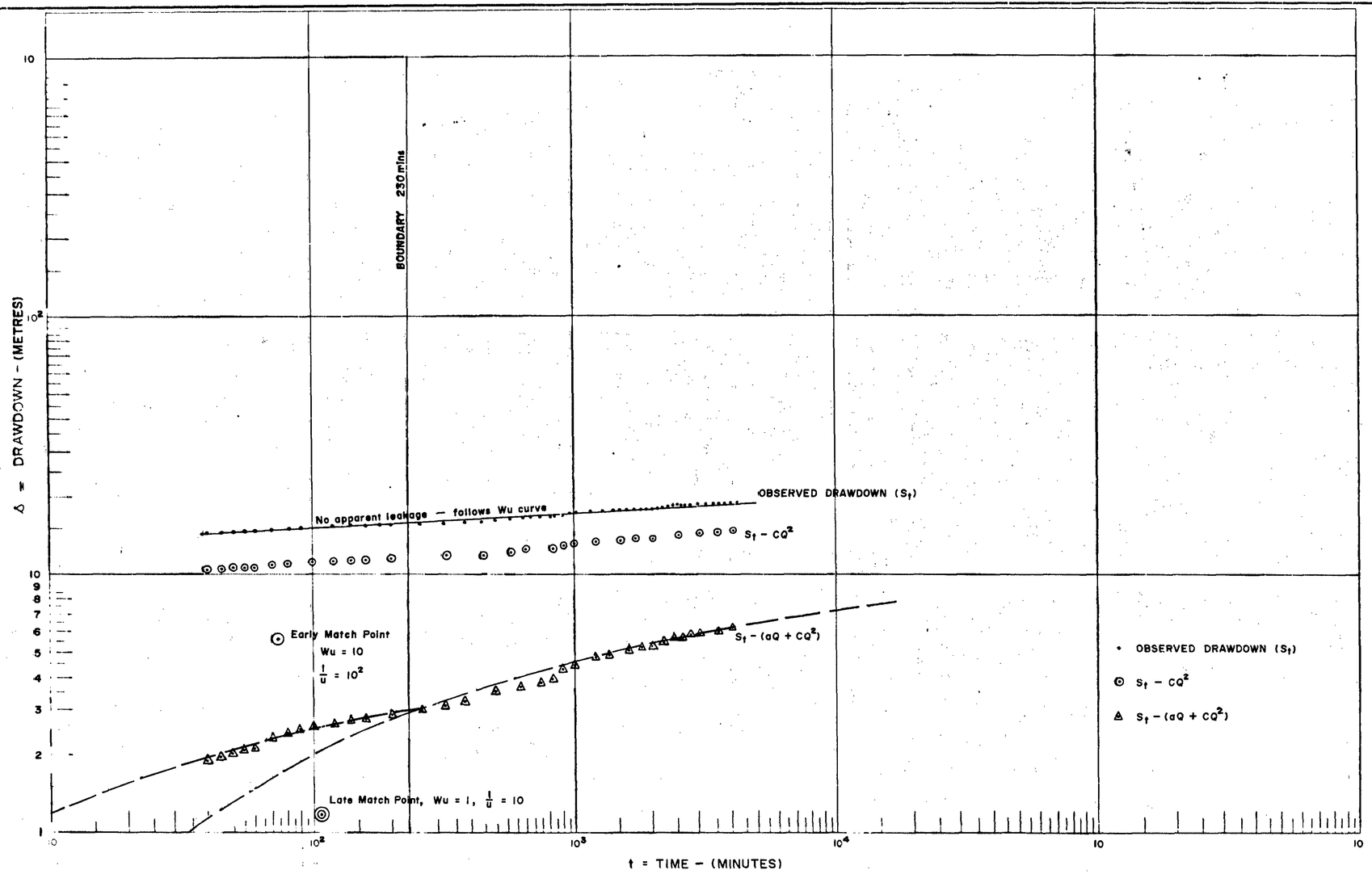
Note: Recovery values of T the more valid

* Available drawdown = $\ell_1 - \ell_2$

FIG. 4

ENGINEERING DIVISION	DEPARTMENT OF MINES — SOUTH AUSTRALIA	D.M. 784/74
DRAWN P.C. Smith	E. & W.S. DEPARTMENT	DATE FEB. 78
TRACED M.W.	MT. GAMBIER T.W.S. STANDBY WELL No.7	PLAN NUMBER
	72 hr CONSTANT DISCHARGE TEST — SEMI-LOG	78-166

PF No. 62—953 MH



Method: Hantush & Jacob (1955)

BOREHOLE STATE N° 7022330WW02927 TYPE OF PUMP Pomona, 5 stage, 6" column
DEPTH TO WATER LEVEL ..... DISCHARGE STARTED AT 0945 ON17·1·77
AT TEST START 12·10m ..(L) * " STOPPED AT 0945 ON20·1·77
PUMP INTAKE DEPTH 64·33m ..(L) AQUIFER FROM 184·6 TO 205·3m (L)
AVAILABLE DRAWDOWN 52·23m (L) HOLE DEPTH 205·9m (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	t	Wu	u	1 day
4380 m^3/day					$8{\cdot}64 \times 10^4$ SEC

CALCULATIONS

From Water Well Equation:

$CQ^2 = 3{\cdot}9$ and $aQ + CQ^2 = 12{\cdot}4$

Using the derived $S_t - (aQ + CQ^2)$ plot and boundary at 230 mins

Early: $T = \frac{Q}{4\pi\Delta} Wu$ $Q = 4380\ m^3/day$, $\Delta = 5{\cdot}5\ m$, $Wu = 10$

$$\therefore T = \frac{4380 \times 10}{4\pi \times 5{\cdot}5} = 633\ m^3/day/m$$

Late: $\Delta = 1{\cdot}8\ m$, $Wu = 1$

$$\therefore T = \frac{4380 \times 1}{4\pi \times 1{\cdot}8} = 194\ m^3/day/m$$

* L. unit of Length
t. time unit

FIG. 5

HYDROGEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	DM 784 74
COMPILED P.C. Smith	E. & W.S. DEPARTMENT	DATE FEB. 78
DRN M.W. CHD	MT. GAMBIER T.W.S. STANDBY WELL No.7	DRG NO 78-167
	72 hr CONSTANT DISCHARGE TEST – LOG-LOG	