

Rept. Bk. No. 63/80

G.S. No. 3559

Hyd. No. 1824

6922 IV

R/B 63/80

**DEPARTMENT OF MINES
SOUTH AUSTRALIA**

GEOLOGICAL SURVEY

ENGINEERING DIVISION



REPORT ON PUMPING TEST RESULTS

BORE NO. 6. MILLICENT

Hd. Mt, Muirhead

- E. & W.S. Department -

6922

by

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SENIOR GEOLOGIST
HYDROGEOLOGY SECTION

D.M. 455/65

63/80

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GENERAL

Borehole No. 6 was drilled to a depth of 505ft.
and probably penetrated the full depth of the Gambier Limestone.

Two aquifers were penetrated:-

Upper aquifer from 10ft. to 300ft.

Lower aquifer from 300ft. to 505ft.

Marl beds occur in the upper aquifer which are probably
sufficiently impermeable to form a confining bed so that the
lower is a pressure water aquifer.

An observation bore drilled 100ft. east of the main
bore hole penetrated fully the upper aquifer but on pump testing
did not respond. It therefore cannot be used in the calculations
of characteristics of the lower aquifer. In addition it is not
possible to calculate the storage capacity of the aquifer.

PUMP TESTING PROCEDURE

The single stage pump test was started on 20th April,
1966, at 08.00 hours and was stopped on 27th April, 1966, at
08.20. Pumping was therefore carried out during 10.100 minutes
and the groundwater pumped discharged in a surface drain approxi-
mately 60ft. to the south.

Fluorescence was mixed with the water in this drain to
investigate the possible return to the aquifer of water discharged
on the surface. No indication of such return has been noticed
during the testing.

Slight fluctuations occurred in the pumping rate of 1.59 cusecs or 35,800 gallons per hour during the first 1,200 minutes thereafter it was increased to an average rate of 1.64 cusecs or 36,200 gallons per hour.

The fluctuations in the actual volumes of water discharged, are of little importance but they effected the draw-down of the water level considerably.

PUMPING TEST RESULTS

The drawdowns recorded in the borehole pumped and the recovery were plotted against the log of time and the plot (see graph no. 68-820/85) indicates that the aquifer tested is a leaky type aquifer. This means that either groundwater from the Knight aquifer below or groundwater from the water-table aquifer above is passing through the aquicludic and this seepage recharges the pressure aquifer.

As aquifer characteristics cannot be calculated by means of the semilog approach attempted, the log of the drawdown was plotted against the log of time as shown in graph 66-819.

The coefficient of transmissibility "T" being $4.9 \times 10^{-3} \text{ ft}^2/\text{sec.}$ was calculated with the use of this graph. However this value of "T" is very low if compared with values of "T" calculated for the same type of aquifer penetrated in the boreholes of Apotill Ltd. about three miles to the south-east. The average value of "T" for the Cambrian Limestone aquifer calculated by using the pump test data from the bores on that property is $1.1 \times 10^{-1} \text{ ft}^2/\text{sec.}$

The rather flat curve obtained in the bilogarithmic approach suggest a very small quantity of water seeping through the aquitard.

In order to arrive at a comparison the drawdown data of bore 8 of Apotill Ltd. has been plotted also on graph 66-819. The "T" calculated for this bore is $1.1 \times 10^{-2} \text{ ft}^2/\text{sec}$ being ten times lower than the average, but 50 times larger than the value calculated for Borehole 6.

It appears therefore that the aquifer at this site is considerably less permeable. Therefore it is not possible to use the coefficient of storage "S" derived at on Apella property. If it was used to design the cone of drawdown considerable errors may be introduced.

The largest drawdown measured during the pumping test was 146.39ft. at a pumping rate of 1.62 cusecs or 36,500 gallons per hour. This suggests that the specific capacity of the borehole is 1.1×10^{-2} cusec - or 250 gallons per foot of drawdown. The specific capacity would decrease with an increase in pumping time under artesian aquifer conditions. However in the case of a leaky aquifer the specific capacity is expected to remain constant provided that the seepage through the aquitard is equal to the discharge. If the borehole is pumped at a rate of 20,000 gallons per hour the drawdown therefore will remain constant at about 60ft. below the surface.

A second attempt was made to obtain drawdown measurements in the observation borehole. On 13th July the E. & W.S. Department started pumping at a rate of 20,000 gallons per hour. The head in the observation borehole remained constant for 1710 minutes and thereafter it has risen $\frac{1}{2}$ foot in the following 5280 minutes. The drawdown levels taken by means of a pressure gauge in the pumped borehole are too inaccurate to use for calculations of aquifer characteristics.

The slight rise in water level recorded in the observation bore may be due to local rain and a rise in the unconfined aquifer overlying the artesian aquifer.

Borehole No. 6 was drilled to a depth of 505ft. in order to assess whether better quality water would be obtained containing less Fe. The occurrence of excessive quantities of hydrated iron oxide in groundwater is partly due to the occurrence of free oxygen in the aquifer. A zone in which free oxygen would occur is expected not to extend below 200ft. hence it is considered that the difficulties experienced in the other boreholes in Millicent may not be encountered in borehole No. 6.

CONCLUSIONS

The pump test carried out on Borehole No. 6 is inconclusive because no drawdown was observed in the observation bore 100ft. to the east.

Calculations made suggest that the coefficient of transmissibility "T" is low and not comparable with values obtained some three miles to the southeast.

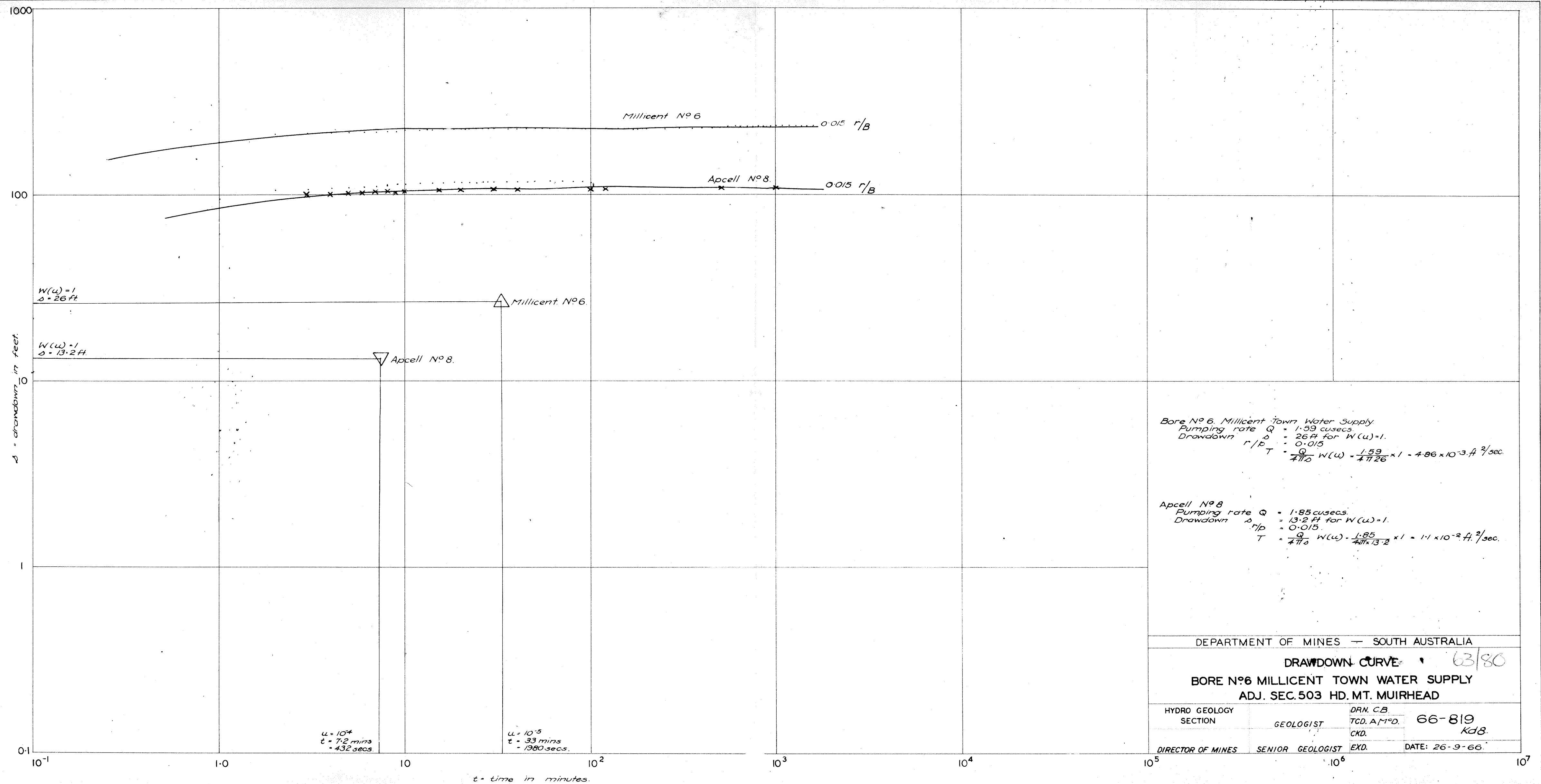
The Gambier Limestone is a leaky type aquifer and therefore a drawdown of 60ft. is expected if the borehole is pumped continuously at a rate of 0.9 cusecs of 20,000 gallons per hour.

Since the borehole is cased to 300ft. it is unlikely that free oxygen would be mixed with the groundwater and therefore reduce the danger of precipitation of hydrated iron oxide.

CB:EMA
7.10.1966



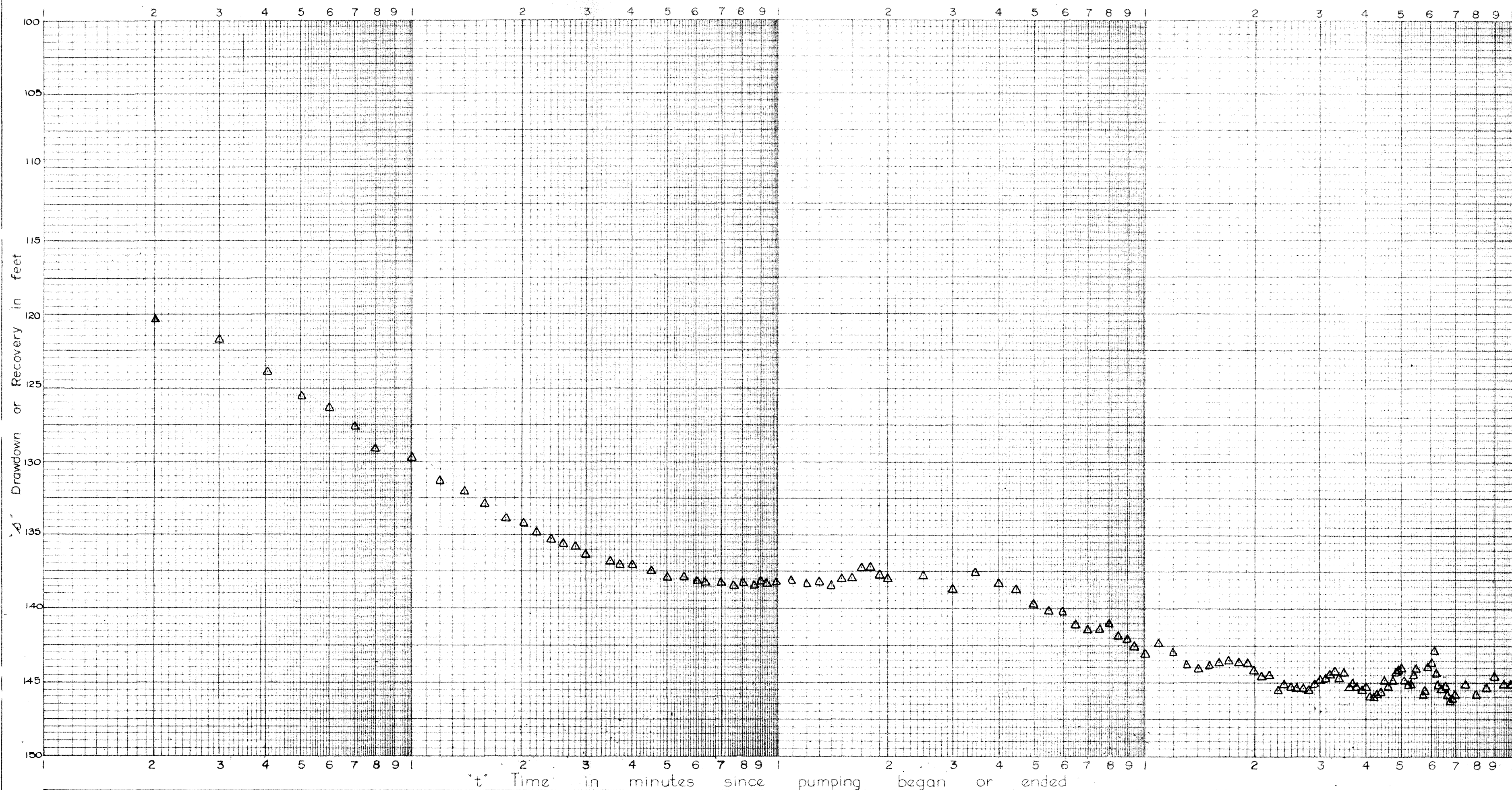
C. Blays
Senior Geologist
HYDROGEOLOGY SECTION



Bore No 6, Millicent Town Water Supply
Pumping rate $Q = 1.59$ cusecs.
Drawdown $s = 26$ ft for $W(u)=1$.
 $r/p = 0.015$
 $T = \frac{Q}{4\pi s} W(u) = \frac{1.59}{4\pi \times 26} \times 1 = 4.86 \times 10^{-3} \text{ ft}^2/\text{sec.}$

Apcell No 8
Pumping rate $Q = 1.85$ cusecs.
Drawdown $s = 13.2$ ft for $W(u)=1$.
 $r/p = 0.015$
 $T = \frac{Q}{4\pi s} W(u) = \frac{1.85}{4\pi \times 13.2} \times 1 = 1.1 \times 10^{-2} \text{ ft}^2/\text{sec.}$

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
DRAWDOWN CURVE 63/80			
BORE N°6 MILLICENT TOWN WATER SUPPLY			
ADJ. SEC.503 HD. MT. MUIRHEAD			
HYDRO GEOLOGY SECTION	GEOLOGIST	DRN. C.B. TCD. A.M.D. CKD.	66-819 Kd8.
DIRECTOR OF MINES	SENIOR GEOLOGIST	EXD.	DATE: 26-9-66.



OWNER E.W.S. Dept. FILE No. 455/65.
 DATE OF TEST 20 April 66
 TYPE OF PUMP Line shaft
 STATIC WATER LEVEL 8.13 ft
 PUMP INTAKE SETTING 230 ft
 AVAILABLE DRAWDOWNS 210 ft
 ANALYSIS BY C. Bleya

PUMPING RATE Q in Cu. Secs. Stage 1 1.58 Stage 2 Stage 3 Stage 4
 ADOPTED RATE OF DRAWDOWN FT/LOG CYCLE AT Cu. Secs.
 REMARKS Leaky type aquifer

S.A. DEPT. OF MINES
 HYDROLOGY SECTION 63/80
 PUMP TEST ANALYSIS
 Bore No 6 Millicent Adj Sec 503 Hd. Mt. Muirhead.
 SERIAL No 200466