DEPARTMENT OF MINES & ENERGY
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

ROYAL ADELAIDE GOLF CLUB
PRODUCTION TEST OF WELL NO. 10

Client: Hosking, Fargher & Oborn

by

O.J.W. BOWERING

and

D. ARMSTRONG

Rept.Bk.No. 78/45
G.S. No. 6019
DM. No. 538/52

CONTENTS

	PAGE
ABSTRACT	1
INTRODUCTION	1
GEOPHYSICAL EXAMINATION	2
PRODUCTION TESTING	2
SALINITY	4

FIGURES

Fig. No.	Title	Plan No.
1	Locality Plan.	S13333
2	Four Stage Step Drawdown Test.	78-263

DEPARTMENT OF MINES & ENERGY
SOUTH AUSTRALIA

Rept.Bk.No. 78/45
G.S. No. 6019
DM. No. 538/52

ROYAL ADELAIDE GOLF CLUB
PRODUCTION TEST OF WELL NO. 10

ABSTRACT

Production testing of the Royal Adelaide Golf Club Well No. 10 has shown that it is capable of yielding 45 kilolitres (10 000 gallons) per hour for a drawdown of approximately 45 metres after continuous pumping for a week. The apparent decline in well performance is due to a deterioration in pump efficiency rather than the well itself.

The casing is corroded at 46 metres and at 78 metres, allowing the entry of saline water into the well, which will eventually have to be abandoned and redrilled.

INTRODUCTION

Royal Adelaide Golf Club production well No. 10 was reported as having declined in yield from a designed rate of 36 kilolitres (8 000 gallons) per hour to 14 kilolitres (3 168 gallons) per hour.

The production test described in this report was designed to determine the cause of the decline in yield and thereby enable suitable measures to be taken to rehabilitate the well.

Records show that the salinity of water from the well has increased and in 1957 its depth was increased from 136 to 183 metres to overcome the problem.

GEOPHYSICAL EXAMINATION

Prior to production testing of the well the existing pump was withdrawn and wireline geophysical logging equipment was run into the well to determine the condition of the casing. The density and gamma ray tools were used, the density to locate holes in the casing and the gamma ray to determine the presence of sandy strata likely to contain saline groundwater. The objective was to correlate the position of holes in the casing and the depths of saline aquifers.

The density log indicates that the casing is holed at 46 metres and at 78 metres.

A down hole T.V. camera was lowered into the well to examine the extent of casing corrosion. The water in the well down to a depth of 46 metres is clear. Below 46 metres the water is very murky owing to the presence of finely suspended clay entering the well through the casing. Because of the murkiness of the water no further visual examination of the casing was possible below 46 metres.

PRODUCTION TESTING

The production test was carried out in four consecutive stages with no recovery between stages. The details are summarised in Table 1 below:

TABLE I

Testing Details

Stage	Duration	Pumping Rate	Drawdown
1	40 mins	13.6 kl (3 000 gal)/hr	9.5 m
2	40 "	22.7 " (5 000 gal)/hr	18.5 m
3	40 "	31.8 " (7 000 gal)/hr	26.0 m
4	350 "	40.9 kl (9 000 gal)/hr	39.0

The graph of drawdown vs. the log of time is shown in Figure 2. The four stages of the production test provide four simultaneous equations, relating discharge rate to drawdown and duration of pumping, which are solved to determine three variables in the drawdown equation which has the form:

$$S_t = aQ + b\ Q \log_{10} t + cQ^2$$

where S_t = drawdown at any time t minutes after pumping commenced.

Q = discharge rate in m^3/day

a & b are constants related to the yield of water by the aquifer.

c is a constant related to well loss

The solution of the production test results gives the following drawdown equation:

$$S_t = 38.5Q + 2.5Q \log_{10} t + 15.2\ Q^2$$

= drawdown in the well after any time t minutes of pumping at any rate Q in 3/min.

To determine the actual level of water in the well below top of casing after any given period of pumping, to the value obtained in the above equation, there should be added the static water level prior to pumping (in this case 21 metres).

Some typical pumping levels derived from the above equation are tabulated below:

TABLE 2

Predicted pumping levels

Pumping rate (gph)	9 000	10 000	11 000
Pumping time (mins)			
100	57.57	62.84	67.57
1 000	59.59	64.74	69.65
10 000	60.97	66.64	71.73

The pump in the well was previously set at a depth of 62.8 metres below top of casing. As can be seen from the above table if the well is to be pumped at 45 kilolitres (10 000 gallons) per hour for 10 000 minutes continuous pumping (approximately one week) the pumping level will be 66.64 metres.

For this reason, it is recommended that the pump be reset to a depth of 70 metres as this will allow for pumping at rates of up to 10 000 gallons per hour for extended periods and will allow for a decline in static water level during years of below average rainfall.

SALINITY

Throughout the production test, water samples were taken at intervals of 100 minutes and analysed for approximate total dissolved salts. The analyses show that the water has a salinity of 880 mg/l. In view of the condition of the casing it is likely that the quality of the water produced from the well will show a further decline. This may necessitate its future abandonment and replacement by a new well.

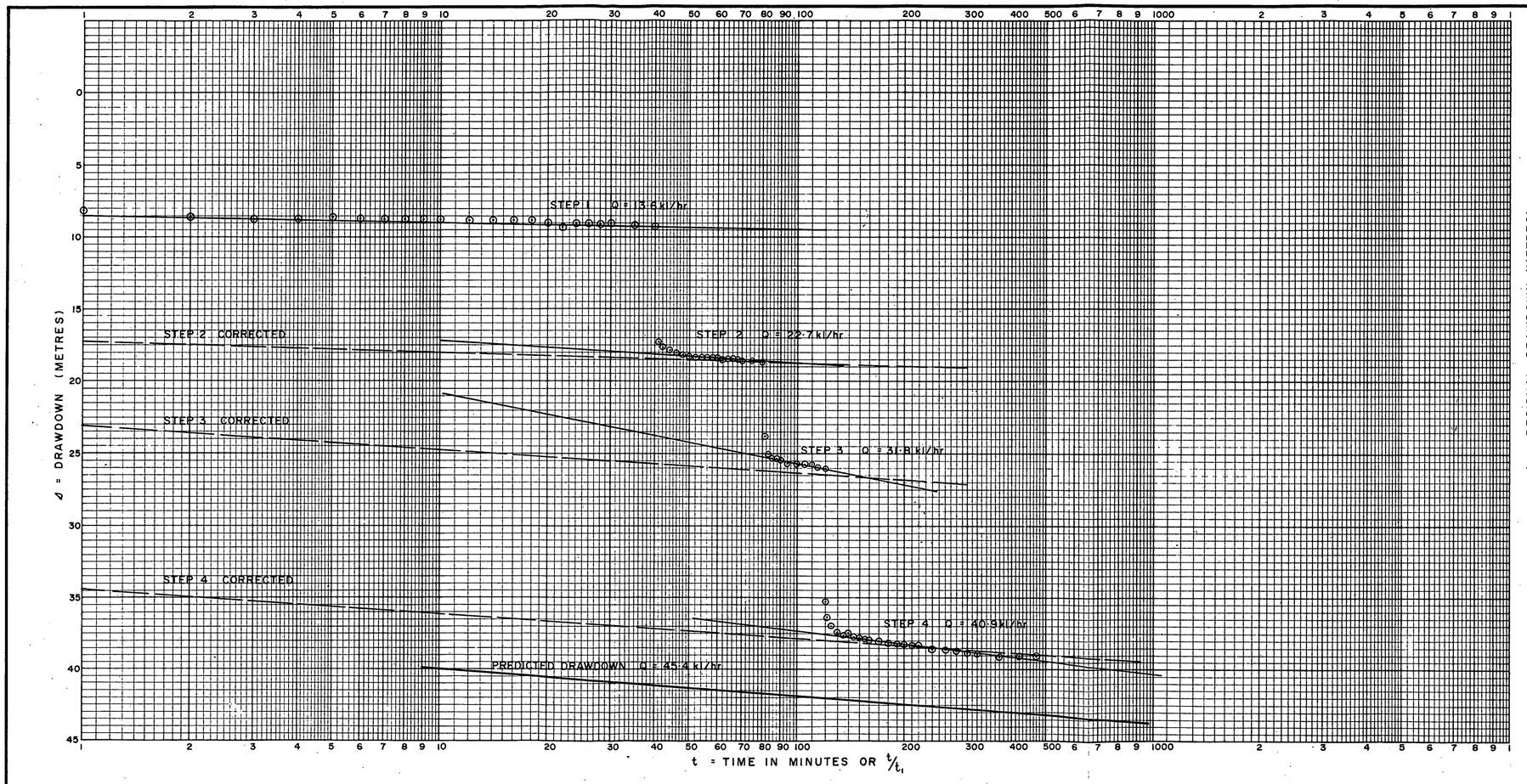
OJWB:DA:FdeA
19/4/78

O.J.W. BOWERING

D. ARMSTRONG

FIG. 1

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE: 1:50000
COMPILED: J. Bowering	ROYAL ADELAIDE GOLF CLUB PRODUCTION WELL No. 10 LOCALITY PLAN	DATE: Mar. 78
DRN: M.W. CKD:		PLAN NUMBER S13333



BOREHOLE STATE/UNIT No. 7557280 86

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

AQUIFER FROM ..... TO ..... (m)

HOLE DEPTH 183·5 ... (m)

TYPE OF PUMP ... POMONA

LENGTH OF TEST ... 470 mins

DEPTH WATER LEVEL AT TEST START (ℓ_2) ... 21 ... (m)

DEPTH PUMP INTAKE (ℓ_1) ... 63 ... (m)

* AVAILABLE DRAWDOWN ... 41 ... (m)

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	Δ_δ	t_o	r
STEP 1	13·6 kl/hr			
" 2	22·7 "			
" 3	31·8 "			
" 4	40·9 "			

CALCULATIONS

$$S_t = 38.5Q + 2.5 \log_{10} Q + 15.2Q^2$$

* Available drawdown = $\ell_1 - \ell_2$

FIG. 2

ENGINEERING DIVISION	DEPARTMENT OF MINES – SOUTH AUSTRALIA	D.M.
COMPILED: D. A.	ROYAL ADELAIDE GOLF CLUB PRODUCTION WELL No. 10 FOUR STAGE STEP DRAWDOWN TEST	DATE: Mar. 78
DRN: M.W. CKD.		PLAN NUMBER: 78-263

P.F. No. 69–953 MH