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MUQDISHO WATER SUPPLY EXPANSION

GROUNDWATER EXPLORATION
AND
MODELLING STUDIES

APPENDICES B TO J

MARCH 1980

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The Institute of Hydrology
Wallingford
England

APPENDIX B

DETERMINATION OF AQUIFER PROPERTIES FROM PUMPING TEST ANALYSIS

Six sites were constructed for pumping test investigations each comprising a production borehole supported by a single observation borehole. Constant rate testing for up to 10 days provided estimates of aquifer transmissivity and storage, while step drawdown tests of either 4 or 5 stages of 1 to 3 hours duration gave information on yield/drawdown characteristics and borehole efficiency.

In our exploration of the aquifer properties and pumping characteristics we adopted a fairly standard test design. Each test borehole comprised a 20 m length of 6 inch 0.5 mm slotted screen, gravel packed, and set below 8 inch casing. Upon completion of drilling test boreholes were developed by airlifting for between 24-30 hours and by pumping for up to 10 hours. Pumping was undertaken with a shaft-driven diesel turbine and discharge monitored using an orifice plate. Water was discharged at least 90 m from the test sites to avoid recirculation whilst water level measurements were made by electric tape in the observation boreholes and by air line in the test wells.

Each of the three main aquifer lithologies were tested. Construction details are summarised in Table B1 and Figure B1. At three sites (1T, 3T and 5T) the more extensive buff sand aquifer was explored, borehole 2T examined the red sands, borehole 4T the limestones, whilst at 6T the screen was set in both buff and red sands. This appendix firstly discusses the results of the constant rate tests to determine the nature of the aquifer and aquifer properties, the results of the step drawdown tests are then presented, and finally all of the water level data are given in simple tabular form.

B1 CONSTANT RATE TESTING

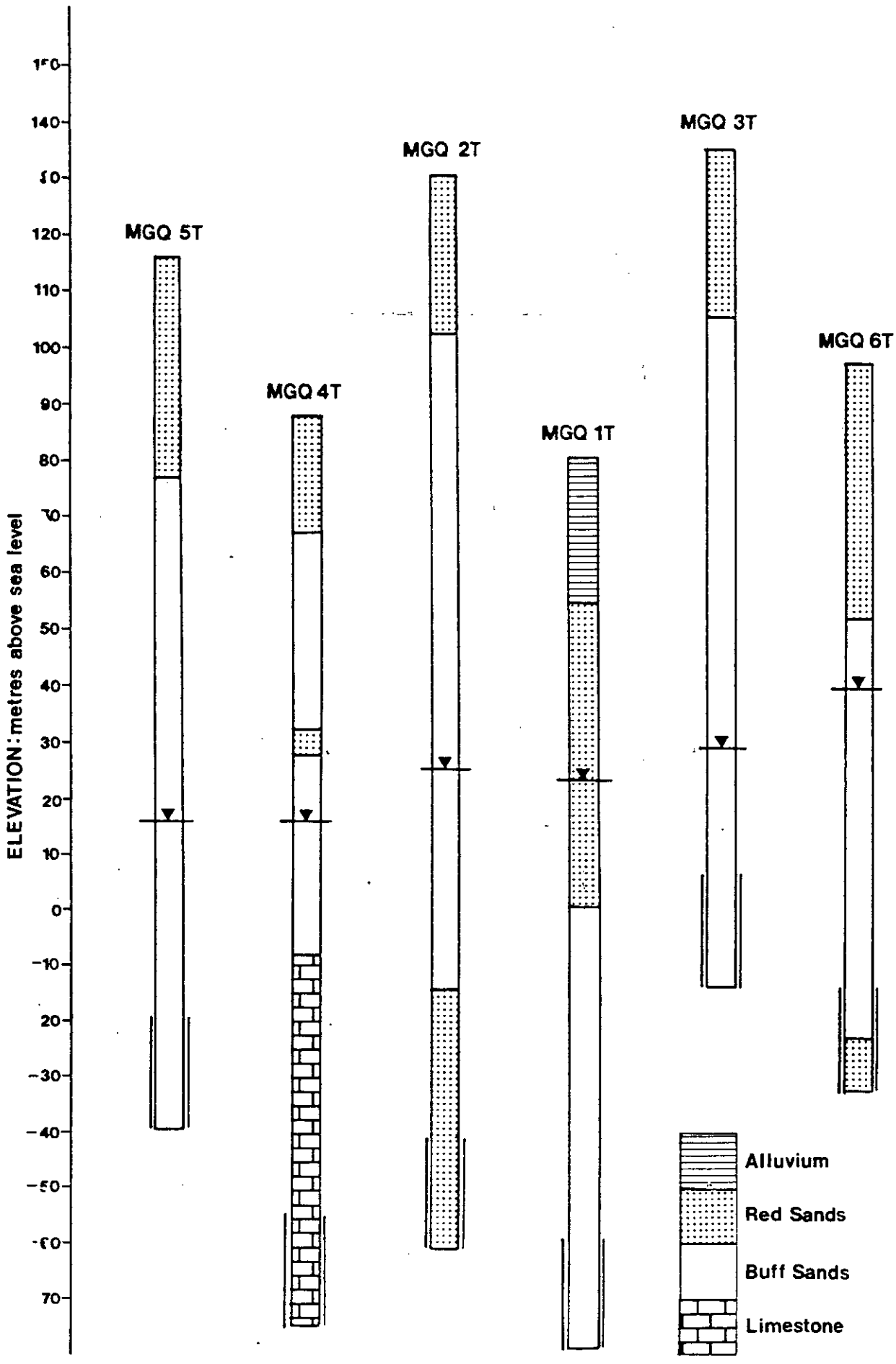
Our analysis and interpretation of these test results has been made from drawdown data in the observation boreholes. Water level information in the pumped boreholes had to be collected by air line and has proved to be less reliable for purposes of determining the nature of the aquifer.

TABLE B1

CONSTRUCTION DETAILS PUMPING TEST SITES

(metres)

PUMPED BOREHOLE			OBSERVATION BOREHOLE			DISTANCE OF OBS.B.H. FROM PUMPED B.H.
No.	Depth	Screen	No.	Depth	Screen	
1T	152	132-152	3P	253	132-144	30.5
2T(A)	187	172-184	6P(A)	182	170-182	19.9
3T	155	130-150	7P	277	134-146	27.2
4T	163	143-163	9P	163	151-163	24.0
5T	156	136-156	10P(A)	153	141-151	13.1 ?'
6T	130	111-130	12P	126	114-126	22.0



TEST WELLS: SCREEN SETTINGS, WATER LEVELS & SIMPLIFIED GEOLOGY

Figure B.1

The results from the five test sites in the sand aquifer have been submitted to analysis using unconfined solutions and the drawdown data match Boulton[1] delayed yield type curves. Delayed yield is an effect found in unconfined aquifers caused by the drawing down of the water level leaving pores containing significant water above the water table. At the start of abstraction the system behaves as an artesian aquifer; however, after a short initial period, the rate of drawdown decreases as water is released from storage in the de-watered sediment. This supply can be sufficient to decrease or even halt the expansion of the cone of depression. Delayed yield slowly becomes less important, the rate of drawdown increases, and once again, approaches that of an artesian aquifer.

Recognition of the condition involves matching water level data, plotted on log-log scale, against a series of type curves. Pumping test data are shown in Figures B.2 to B.7 with a full marked example being given in figure B.2 for the observation borehole at site T1.

The formulae used for deriving Transmissivity and Storage are as follows:-

$$T = \frac{Q\, w\,(u_A,\ u_y,\ r/B)}{r\ \pi\ s} \qquad \text{.... Eq.1}$$

$$S_y = \frac{4t\ u_y\ T}{r^2} \qquad \text{.... Eq.2}$$

where: T = transmissivity in m^2/day

S_y = storage coefficient (derived from late data)

Q = discharge in m^3/day

t = time in days

r = distance from observation well to pumped well in metres

s = drawdown in observation well in metres

$w(u_A, u_y, r/B)$ = Well Function. w_{u_A} used when early part of data is matched. w_{u_y} used when late data is matched. r/B value is given by the best fit curve.

[1] *Boulton N.S. 1963. Analysis of data from non-equilibrium pumping tests allowing for delayed yield from storage. Proc. Civl. Engrs. (London) v.26, No 6693*

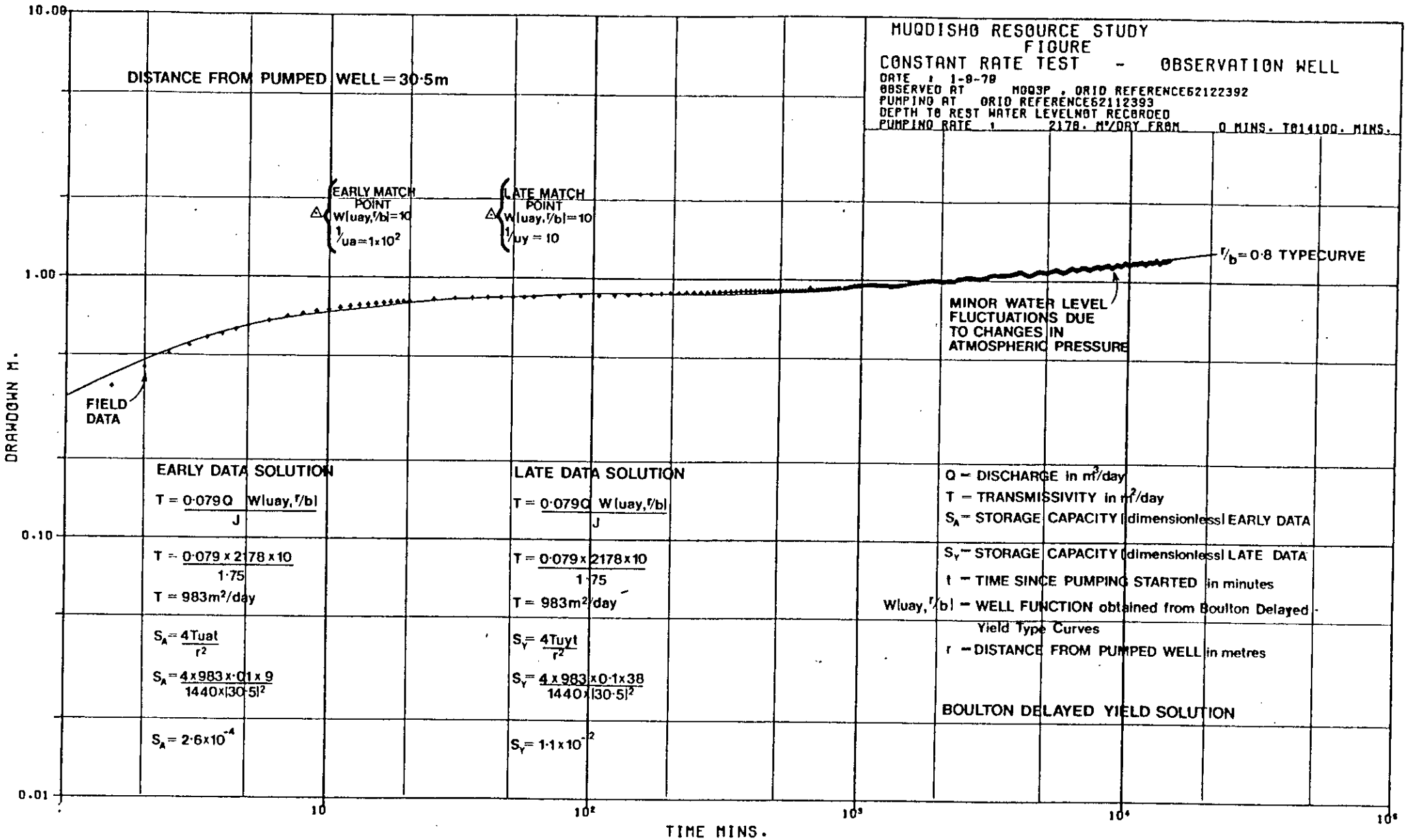

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 1-9-78
OBSERVED AT MOO3P , ORID REFERENCE62122392
PUMPING AT ORID REFERENCE62112393
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 2178. M³/DAY FROM 0 MINS. TO 14100. MINS.
DISTANCE FROM PUMPED WELL = 30·5m
EARLY MATCH POINT
W(uay,r/b)=10
1/ua=1x10²
LATE MATCH POINT
W(uay,r/b)=10
1/uy = 10
r/b= 0·8 TYPECURVE
MINOR WATER LEVEL FLUCTUATIONS DUE TO CHANGES IN ATMOSPHERIC PRESSURE
FIELD DATA
EARLY DATA SOLUTION
T = 0·079Q W(uay,r/b) / J
T = 0·079 x 2178 x 10 / 1·75
T = 983m²/day
SA = 4Tuat / r²
SA = 4x983x·01x9 / 1440x(30·5)²
SA = 2·6x10⁻⁴
LATE DATA SOLUTION
T = 0·079Q W(uay,r/b) / J
T = 0·079 x 2178 x 10 / 1·75
T = 983m²/day
SY = 4Tuyt / r²
SY = 4 x 983 x 0·1 x 38 / 1440 x (30·5)²
SY = 1·1 x 10⁻²
Q = DISCHARGE in m³/day
T = TRANSMISSIVITY in m²/day
SA = STORAGE CAPACITY (dimensionless) EARLY DATA
SY = STORAGE CAPACITY (dimensionless) LATE DATA
t = TIME SINCE PUMPING STARTED in minutes
W(uay,r/b) = WELL FUNCTION obtained from Boulton Delayed Yield Type Curves
r = DISTANCE FROM PUMPED WELL in metres
BOULTON DELAYED YIELD SOLUTION
DRAWDOWN M.
10.00
1.00
0.10
0.01
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.2

Results from early data show approximately the same transmissivity but a lower storage coefficient than those fitted to the late data. For example the solution of 3P gives an early storage coefficient of .026 per cent and a late one of 1.1 per cent. It is the storage coefficient derived using the late data taking gravity drainage into account that is important in long term movements of the water table.

Results of the pumping test solutions are shown in Table B.2. For the sand aquifers Boulton solutions show transmissivity varying between 646-1247 m^2/d and storage coefficients, taking delayed yield into account from 1 per cent to about 6 per cent.

The limestone tested at site 4T, does not display unconfined water-table characteristics. A semi-confined aquifer is indicated. Analysis of the early stage data using Boulton type curves gives a storage coefficient of 0.03 per cent reflecting the leaky artesian conditions and the lowest transmissivity value of 234 m^2/d.

Our main interpretation has been based upon use of the Boulton solution since recognition of the delayed yield effect is most important to our resources considerations. Pumping test data have also been analysed using the Jacob[1] modification of the Theis method. This involves plotting the drawdown data on a semi log plot, with time on the log scale, and using the slope and intercept of the resulting straight line to estimate transmissivity and storage using the following formulae

$$T = \frac{0.183Q}{\Delta s} \qquad \text{.... Eq.3}$$

$$S = \frac{2.25\,Tt_o}{r^2} \qquad \text{.... Eq.4}$$

where T = transmissivity in m^2/day
S = storage coefficient
Q = discharge in m^3/day
s = drawdown over one log, cycle of time, in metres
r = distance between observation and pumped well in metres
t_o = intercept of the straight line with the zero drawdown axis, in days

[1] *Jacob C.E. 1946. Drawdown test to determine effective radius of Artesian Well. Proc. Am. Soc. Civil Engineers v.72*

TABLE B.2

AQUIFER PROPERTIES

WELL NUMBER	TRANSMISSIVITY			PERMEABILITY*	STORAGE COEFFICIENT (DIMENSIONLESS)			SPECIFIC CAPACITY (1 DAY)	AQUIFER
	Jacob m^2/d	Boulton m^2/d	Partial Penetration Correction m^2/d	m/d	Jacob	Boulton		$m^3/d/m$	
						Early	Late		
MGQ-1T (TEST WELL)								155	Buff Sand
MGQ-3P (OBS. WELL)	972	983	2136	15.2	0.02	0.03	1.1		
MGQ-2T(A) (TEST WELL)								187	Red Sand
MGQ-6P(A) (OBS. WELL)	743	1247	2256	16.3	0.07	0.07	2.3		
MGQ-5T (TEST WELL)								188	Buff Sand
MGQ-7P (OBS. WELL)	1383	845	-	-	0.02	0.04	4.6		
MGQ-4T (TEST WELL)								49	Limestone
MGQ-9P (OBS. WELL)	245	254	-	-	0.03	0.03	-		
MGQ-8T (TEST WELL)								101	Buff Sand
MGQ-10P(A) (OBS. WELL)	493	705	4570	36.6	0.09	0.05	5.7		
MGQ-6T (TEST WELL)								116	Buff Sand
MGQ-12P (OBS. WELL)	317	646	1430	10.1	0.07	0.07	5.5		Red Sand

*Permeability has been determined by dividing the corrected transmissivity by the total saturated thickness.

A worked example of this method is shown for MGC-3P in Figure B.8, while semi-log plots for every test are presented in Figure B.8 to B.13.

This method is designed for the analysis of pumping tests of confined aquifers. If, however, only the early part of the data is used, thus avoiding the effects of delayed yield, the method can be used successfully to calculate transmissivity for water table conditions. Storage coefficients derived using this method are on the other hand analagous with those derived from early Boulton solutions and for the same reasons are unrepresentative.

Corrections for partial penetration

Because observation wells used for the six tests only penetrate the aquifer to between $\frac{1}{5}$ and $\frac{1}{7}$ of the total saturated thickness, the calculated transmissivities have to be corrected. The effect of a partially penetrating well is to increase the drawdown by causing an element of vertical flow around the pumped well, for a distance equivalent to $1\frac{1}{2}$ times the thickness of the aquifer. This causes calculated transmissivities to be underestimated. Corrections have been applied to the Boulton data using a type-curve fitting method developed by Hantush[1]. These are given in Table B.2, Figure B.14 gives a worked example for MGQ 3P.

The Hantush method solves the following equation:-

$$K = \frac{Q}{8\pi s(b-d)} E(u, \frac{b}{r}, \frac{d}{r}, \frac{z}{r}) \qquad \text{.....Eq. 5}$$

where

Q, s and r are as previously defined

b = distance in metres from water table to bottom of the screen

d = distance in metres from water table to top of screen

$z = \frac{b + d}{2}$ in metres

$$E(u, \frac{b}{r}, \frac{d}{r}, \frac{z}{r}) = M(u,\beta_1) + M(u,\beta_2) + M(u,\beta_3) - M(u,\beta_4)$$

[1] *Hantush M.S. 1962 Aquifer tests on partially penetrating wells. Am.Soc.Civ.Eng.Trans., Vol 127 part I : 284-308.*

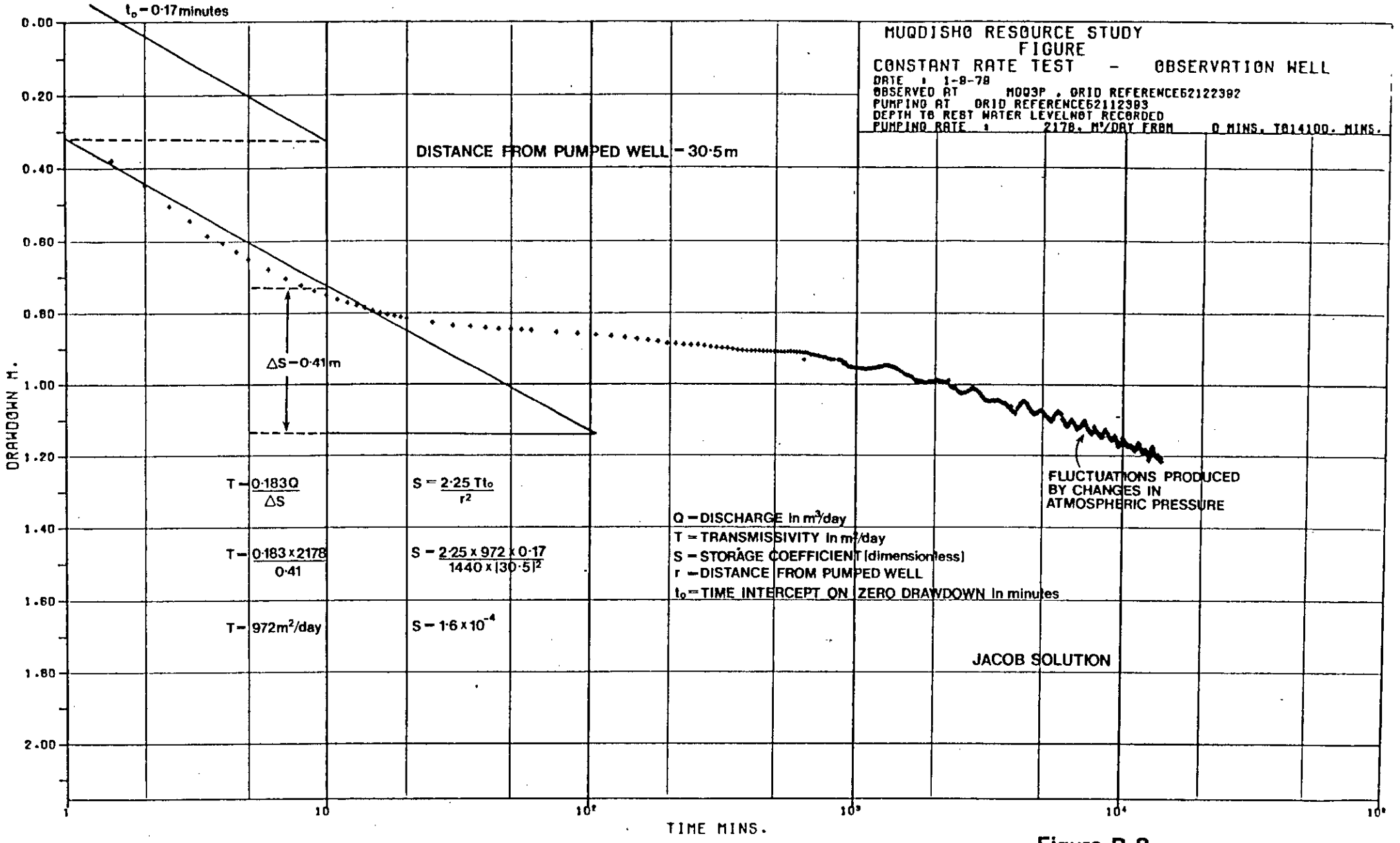

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 1-8-78
OBSERVED AT MOO3P , ORID REFERENCE62122382
PUMPING AT ORID REFERENCE62112383
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 2178. M³/DAY FROM 0 MINS. TO14100. MINS.
t_o = 0·17 minutes
DISTANCE FROM PUMPED WELL = 30·5m
ΔS = 0·41m
DRAWDOWN M.
TIME MINS.
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
1
10
10²
10³
10⁴
10⁵
$T = \frac{0·183Q}{\Delta S}$
$S = \frac{2·25Tt_o}{r^2}$
$T = \frac{0·183 \times 2178}{0·41}$
$S = \frac{2·25 \times 972 \times 0·17}{1440 \times (30·5)^2}$
$T = 972 m^2/day$
$S = 1·6 \times 10^{-4}$
Q = DISCHARGE In m³/day
T = TRANSMISSIVITY In m²/day
S = STORAGE COEFFICIENT (dimensionless)
r = DISTANCE FROM PUMPED WELL
t_o = TIME INTERCEPT ON ZERO DRAWDOWN In minutes
FLUCTUATIONS PRODUCED BY CHANGES IN ATMOSPHERIC PRESSURE
JACOB SOLUTION

Figure B.8

HANTUSH PARTIAL PENETRATION CORRECTION FOR OBSERVATION WELL MGQ 3P.(TEST WELL MGQ IT)

$$k = \frac{Q}{8\pi s(b-d)} E\left[u\ {}^{b}/_{r}\ {}^{d}/_{r}\ {}^{z}/_{r}\right]$$

$$k = \frac{2178}{8 \times \frac{22}{7} \times 0{\cdot}52(87-75)} \times 0{\cdot}59\left[0{\cdot}1 \times \frac{87}{30{\cdot}5} \times \frac{75}{30{\cdot}5} \times \frac{81}{30{\cdot}5}\right]$$

$k = 15{\cdot}2$ m/d

$T = kD$

$T = 15{\cdot}2 \times 140$

$T = 2136$ m²/day

$Q = 2178$ m³/day
$r = 30{\cdot}5$ metres
$b = 87$ metres
$d = 75$ metres
$z = 81$ metres
$D = 140$ metres

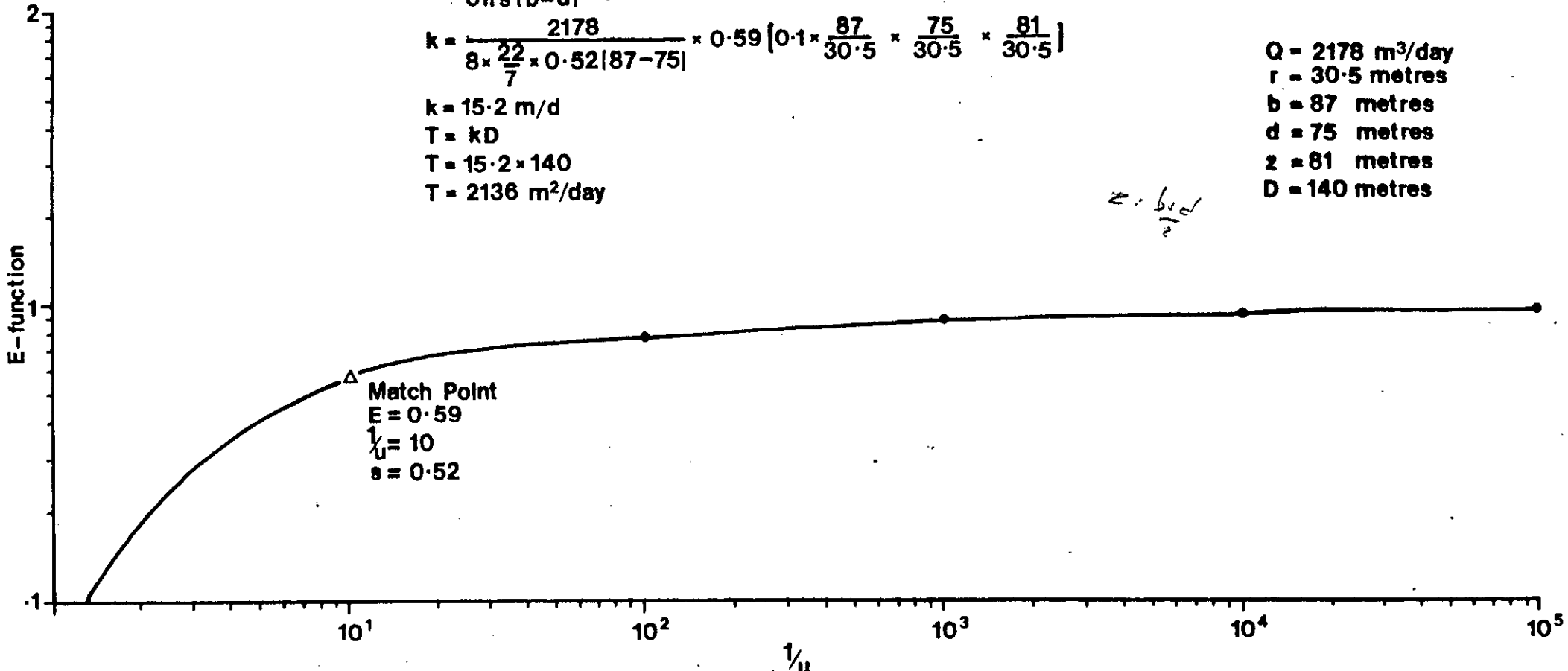


Figure B.14

$\beta_1 = (b+z)/r$

$\beta_2 = (d+z)/r$

$\beta_3 = (b-z)/r$

$\beta_4 = (d-z)/r$

$M(u,\beta)$ is a function for which numerical values are provided in published tables.

$$u = \frac{r^2 \ S/D}{4 \ kt} \qquad \text{.... Eq.6}$$

where D = thickness of aquifer in metres
S = Storage coefficient
t = time since pumping began in days.

B2 STEPDRAWDOWN TESTS

These were carried out to examine well design and efficiency and to determine yield/drawdown relationships.

With step test data it is possible to separate the components of total drawdown into that caused by the resistance of the aquifer to flow and that caused by the turbulent movement of water in and around the well. The first is termed aquifer loss and the second well loss. They are calculated using the following formula developed by Jacob[2].

$$sw = BQ + CQ^2 \qquad \text{.... Eq.7}$$

where sw = the theoretical drawdown in the pumped well
B = the formation constant
C = the well loss constant
Q = the discharge in m^3/day

and BQ and CQ^2 are the formation and well loss components respectively.

[2] *Jacob C.E. 1946. Drawdown test to determine effective radius of Artesian Well. Proc. Am. Soc. Civil Engineers. v.72.*

The well efficiency is derived when the aquifer loss is expressed as a percentage of total drawdown, the higher the percentage the more efficient the well. Efficiency will decrease with increasing pumping rate and will tend to increase slightly with time. An example of a test analysis is given in Figure B.15, for borehole MGQ-4T.

Of the six step tests three have been successfully interpreted and the results are listed below.

Well Number	Per cent Efficiency	Duration hours	Discharge m^3/day
MGQ-3T	98	3	1920
MGQ-1T	64	2	2160
MGQ-4T	83	1	1200

The tests of the three remaining wells 2T(A), 5T and 6T did not produce solutions because of well development problems. Figure B.16 shows that during these tests the specific drawdown decreased with increasing pumping rate instead of increasing as would normally be the case. The failure of the wells to become fully developed despite having been extensively airlifted and pumped for ten days is probably related to the fine grained nature of the aquifer. The problem of efficient well development in these slightly cemented sands is particularly difficult. This was anticipated in the drilling programme which used a degradable drilling fluid in preference to conventional mud. Mechanically produced skin effects on the borehole face obviously influence some well performances and particular care is needed in the construction of production wells to minimise such effects.

The results of the six step tests are summarised as yield/drawdown curves in Figure B.17. Borehole 4T in the limestone clearly exhibits the poorest yield/drawdown characteristics. The well efficiency of 83 per cent is good, and the poor yield reflects the less attractive aquifer property of the limestone as compared with the sands.

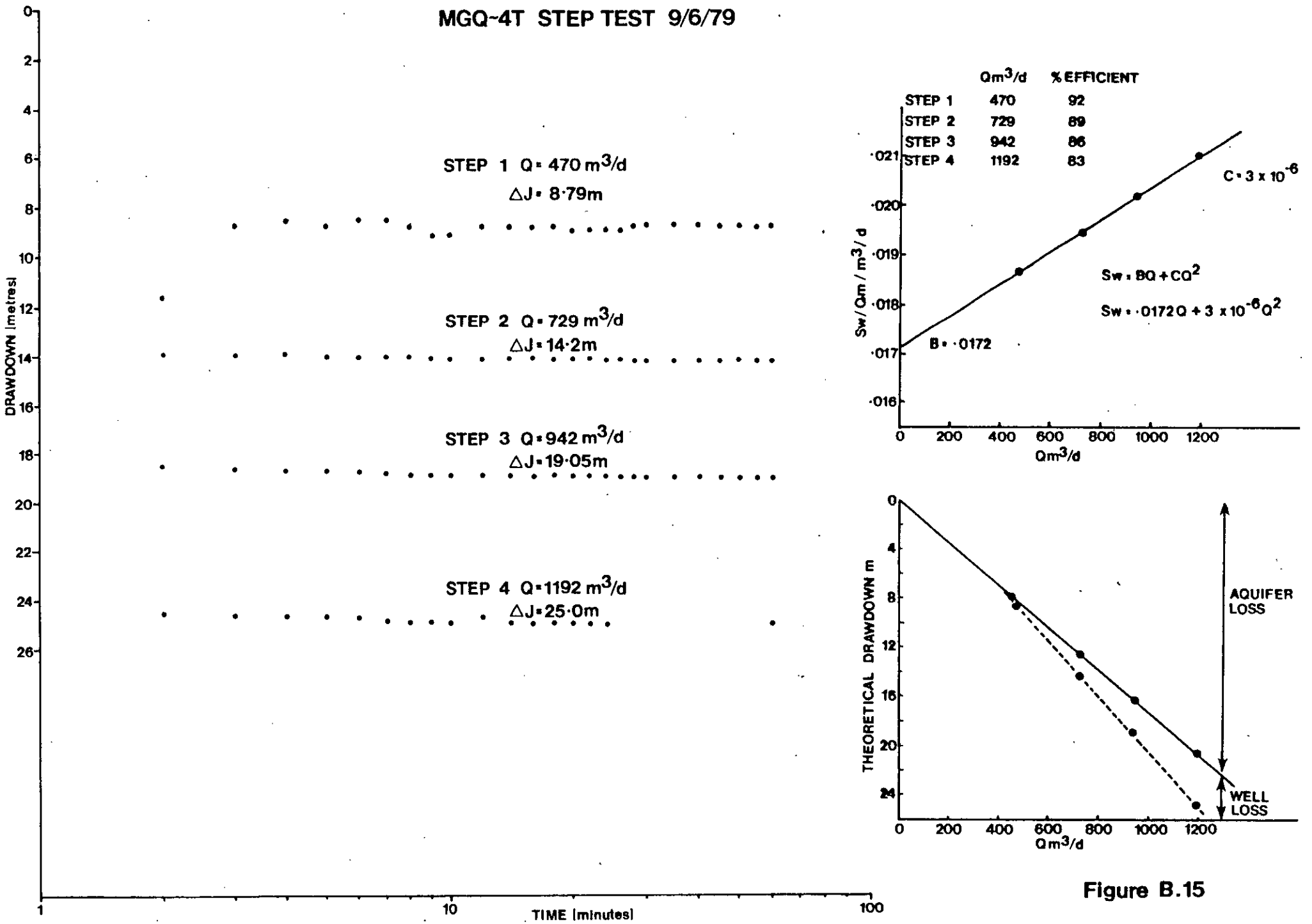
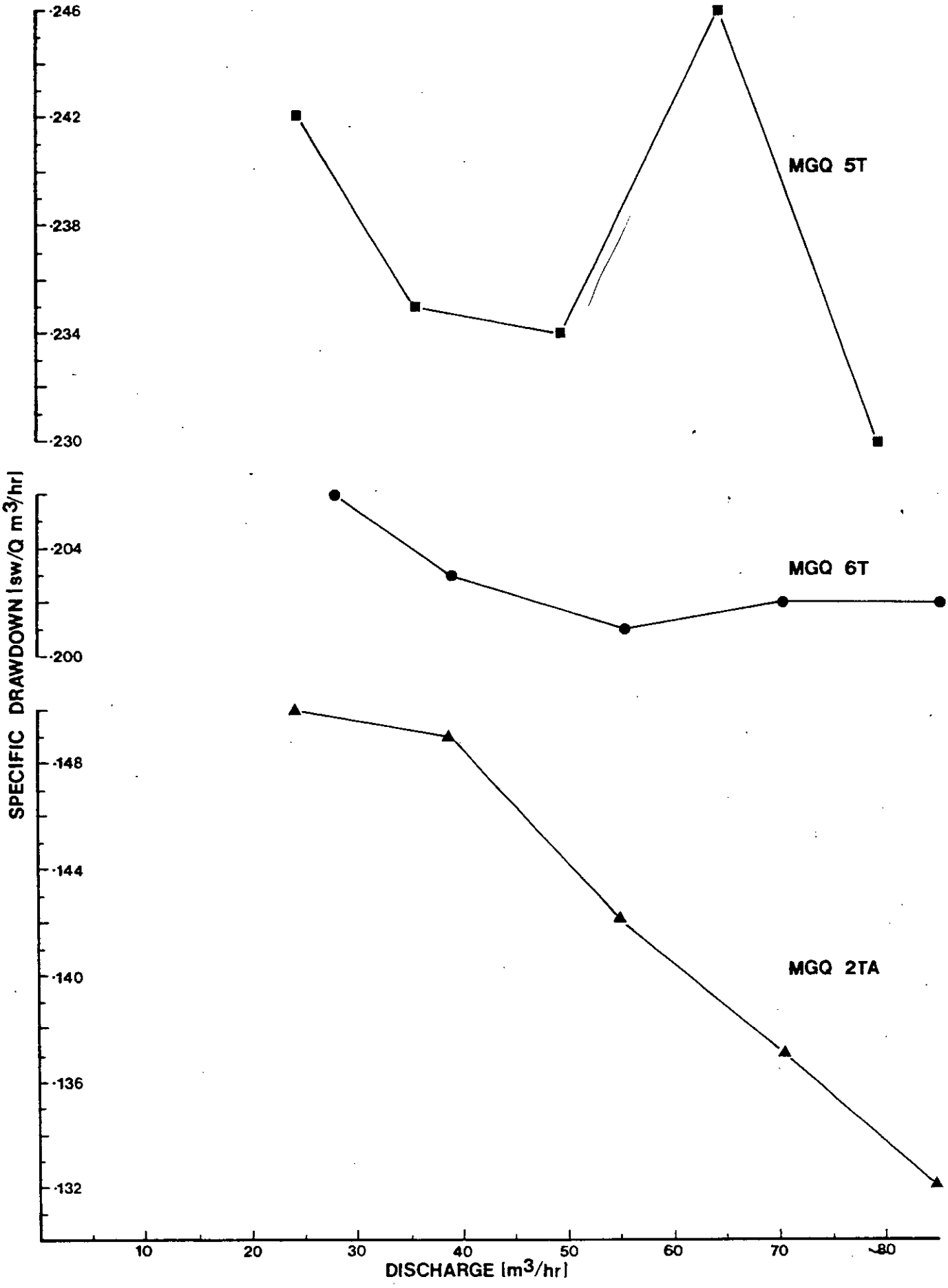
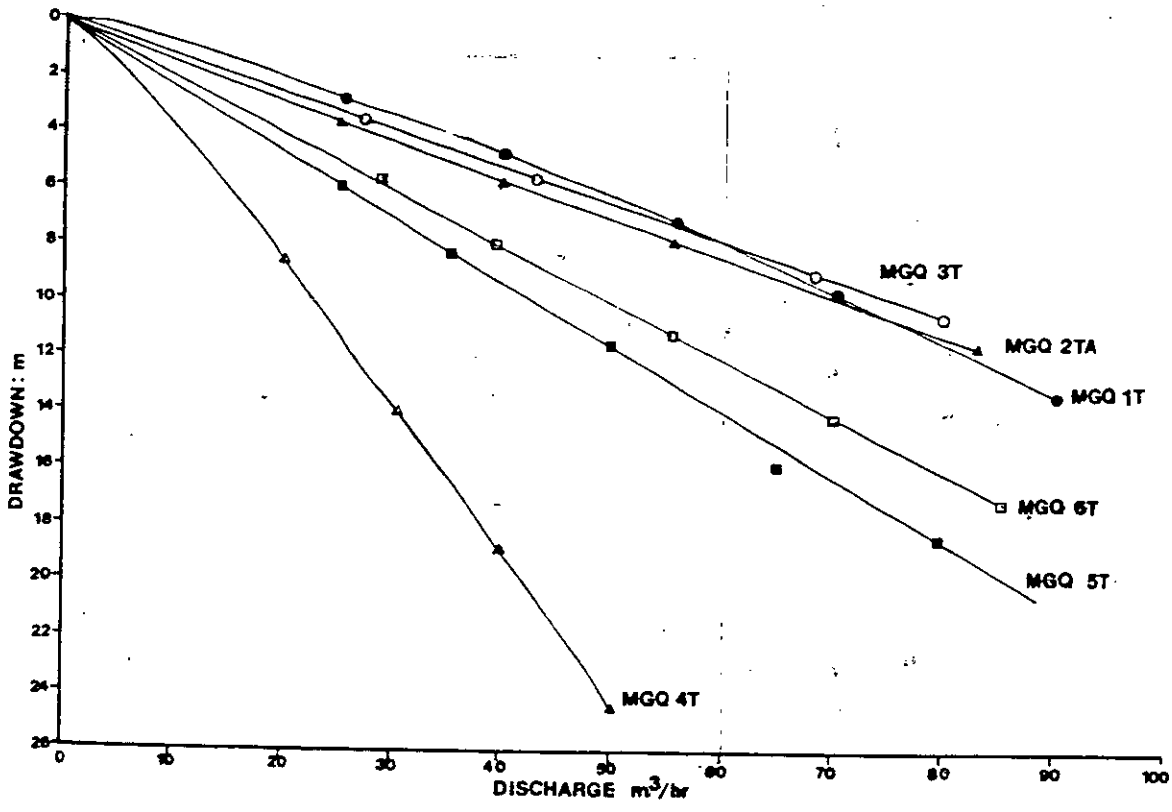

MGQ-4T STEP TEST 9/6/79
STEP 1 Q = 470 m3/d
ΔJ = 8·79m
STEP 2 Q = 729 m3/d
ΔJ = 14·2m
STEP 3 Q = 942 m3/d
ΔJ = 19·05m
STEP 4 Q = 1192 m3/d
ΔJ = 25·0m
DRAWDOWN (metres)
TIME (minutes)
Qm3/d
% EFFICIENT
STEP 1 470 92
STEP 2 729 89
STEP 3 942 86
STEP 4 1192 83
C = 3 x 10-6
Sw = BQ + CQ2
Sw = ·0172Q + 3 x 10-6Q2
B = ·0172
Sw/Qm / m3/d
THEORETICAL DRAWDOWN m
AQUIFER LOSS
WELL LOSS

Figure B.15



STEP TEST RESULTS DISPLAYING WELL DEVELOPMENT

Figure B.16



YIELD DRAWDOWN CURVES

Figure B.17

Generally a simple family of drawdown curves were obtained. Borehole 1T exhibits slight breakaway characteristics at the two highest rates of abstraction in keeping with the low well efficiency of 64 per cent. Boreholes 5T and 6T exhibit the poorest sand aquifer yield/drawdown characteristics and if these were production wells some significant improvement in yield characteristics would need to be sought.

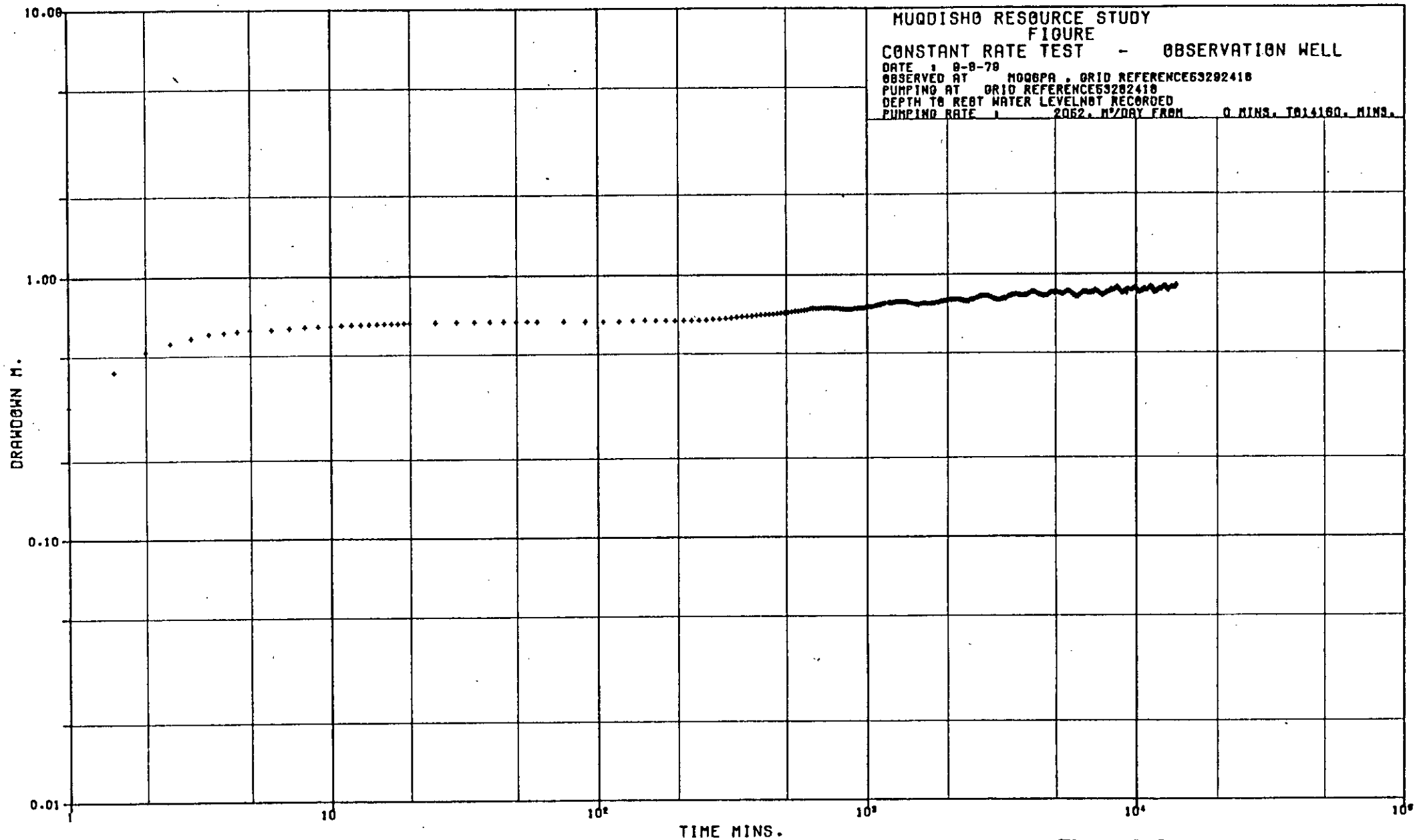

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 8-8-79
OBSERVED AT MOQBPA , GRID REFERENCE63292416
PUMPING AT GRID REFERENCE63292416
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 2062. M³/DAY FROM 0 MINS. TO14160. MINS.
10.00
1.00
0.10
0.01
DRAWDOWN M.
1
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.3

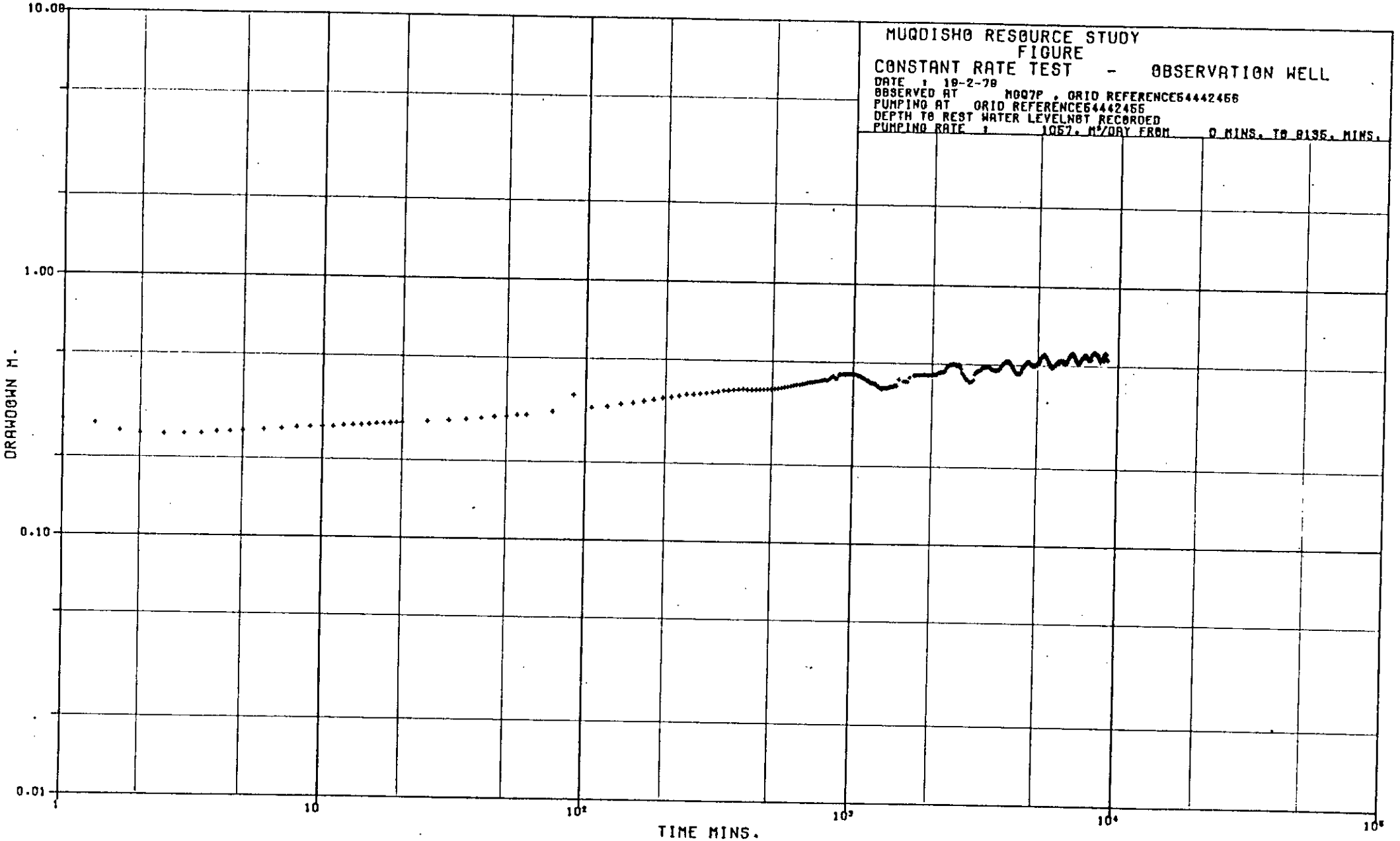

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 19-2-78
OBSERVED AT MOQ7P , GRID REFERENCE64442466
PUMPING AT GRID REFERENCE64442466
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 1057. M³/DAY FROM 0 MINS. TO 8136. MINS.
10.00
1.00
0.10
0.01
DRAWDOWN M.
1
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.4

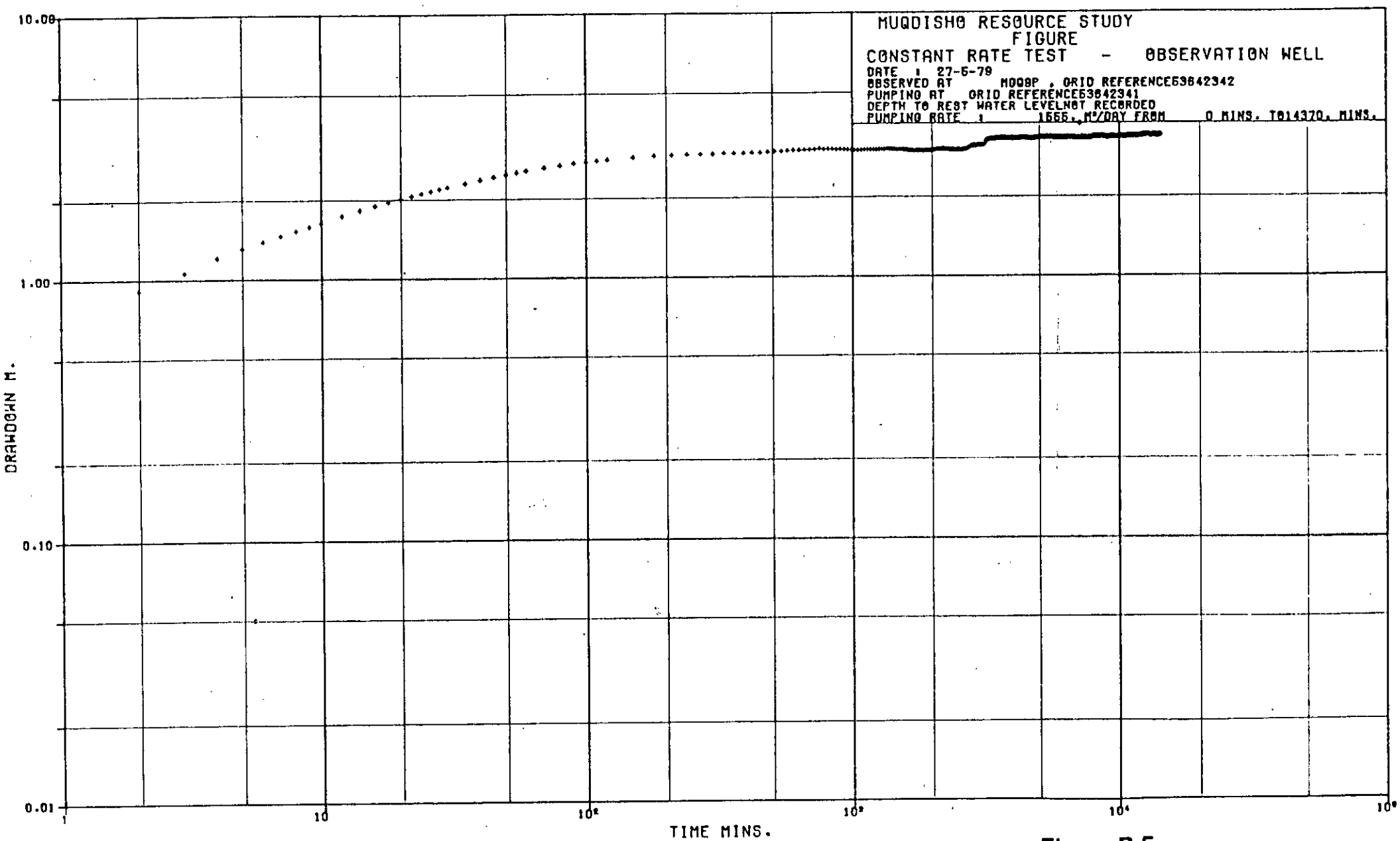

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 27-5-79
OBSERVED AT MOQSP , GRID REFERENCE63642342
PUMPING AT GRID REFERENCE63642341
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 1665. M³/DAY FROM 0 MINS. TO14370. MINS.
10.00
1.00
0.10
0.01
DRAWDOWN M.
1
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.5

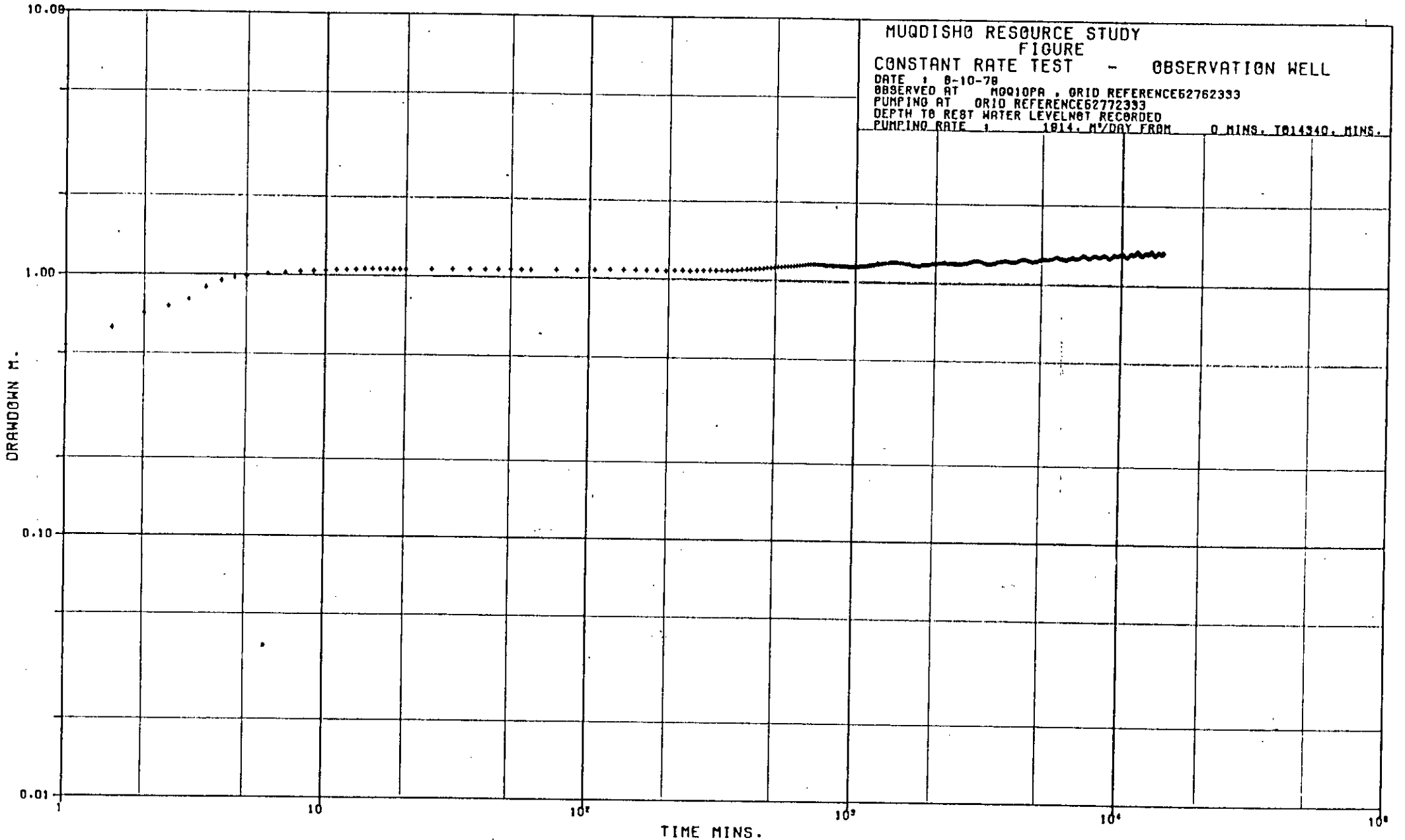

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 8-10-78
OBSERVED AT MOQ10PA , GRID REFERENCE62762333
PUMPING AT GRID REFERENCE62772333
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 1814. M³/DAY FROM 0 MINS. TO14340. MINS.
10.00
1.00
0.10
0.01
DRAWDOWN M.
1
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.6

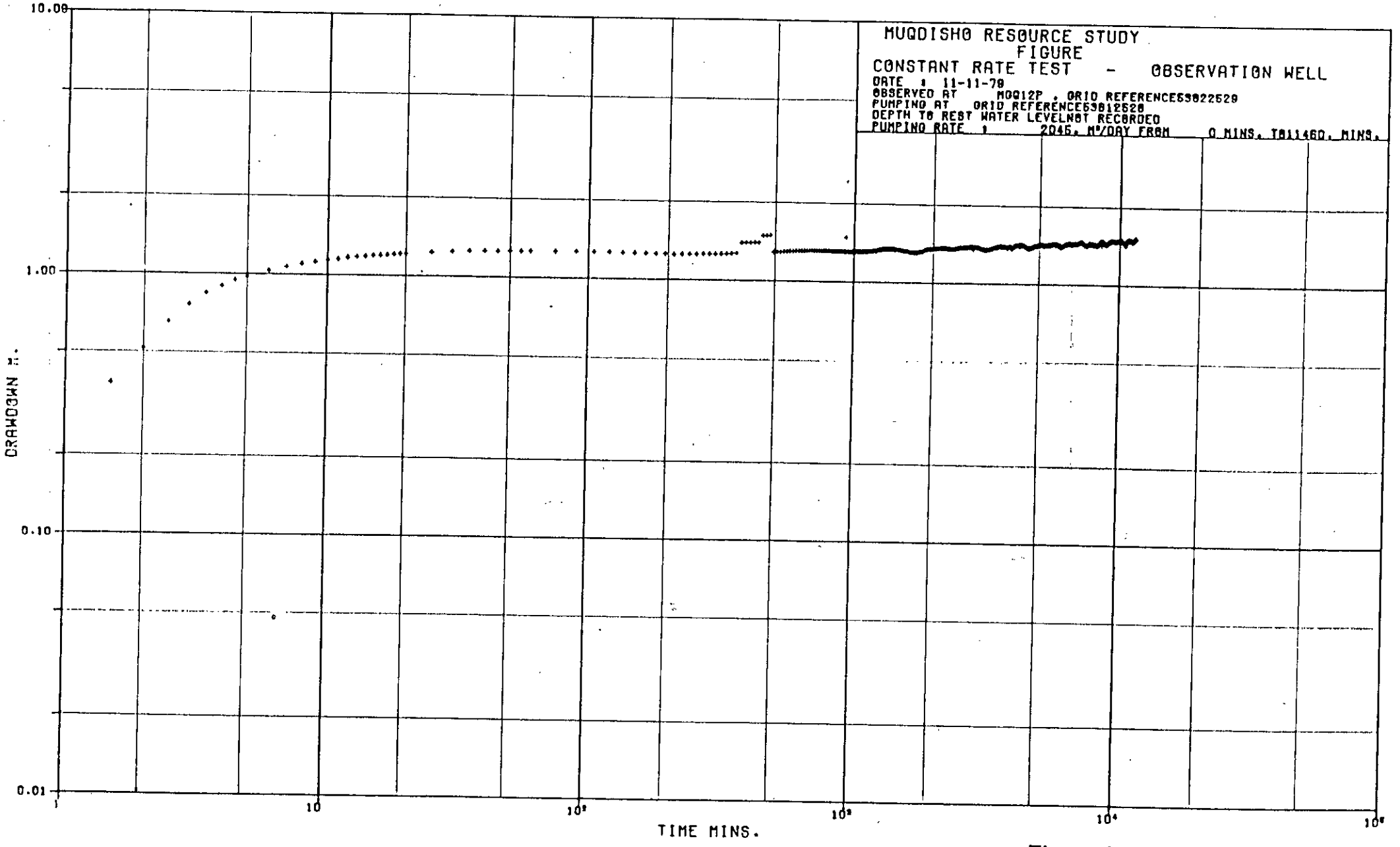

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 11-11-79
OBSERVED AT MOQ12P , GRID REFERENCE63822529
PUMPING AT GRID REFERENCE63812528
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE 1 2045. M³/DAY FROM 0 MINS. TO11460. MINS.
10.00
1.00
0.10
0.01
DRAWDOWN M.
1
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.7

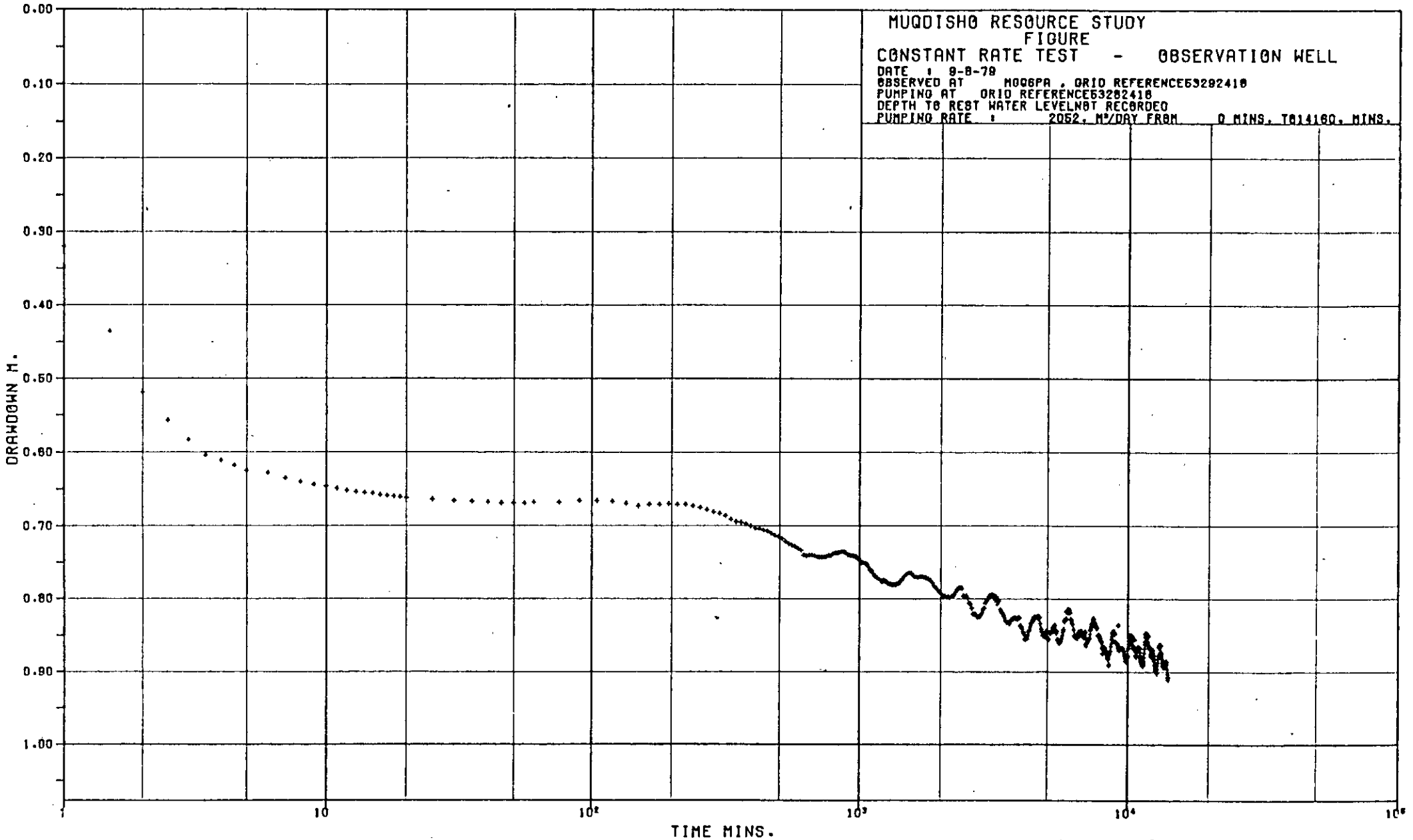

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 9-8-79
OBSERVED AT MOO6PA , ORIO REFERENCE63282418
PUMPING AT ORIO REFERENCE63282418
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 2052. M³/DAY FROM 0 MINS. TO14160. MINS.
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
DRAWDOWN M.
1
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.9

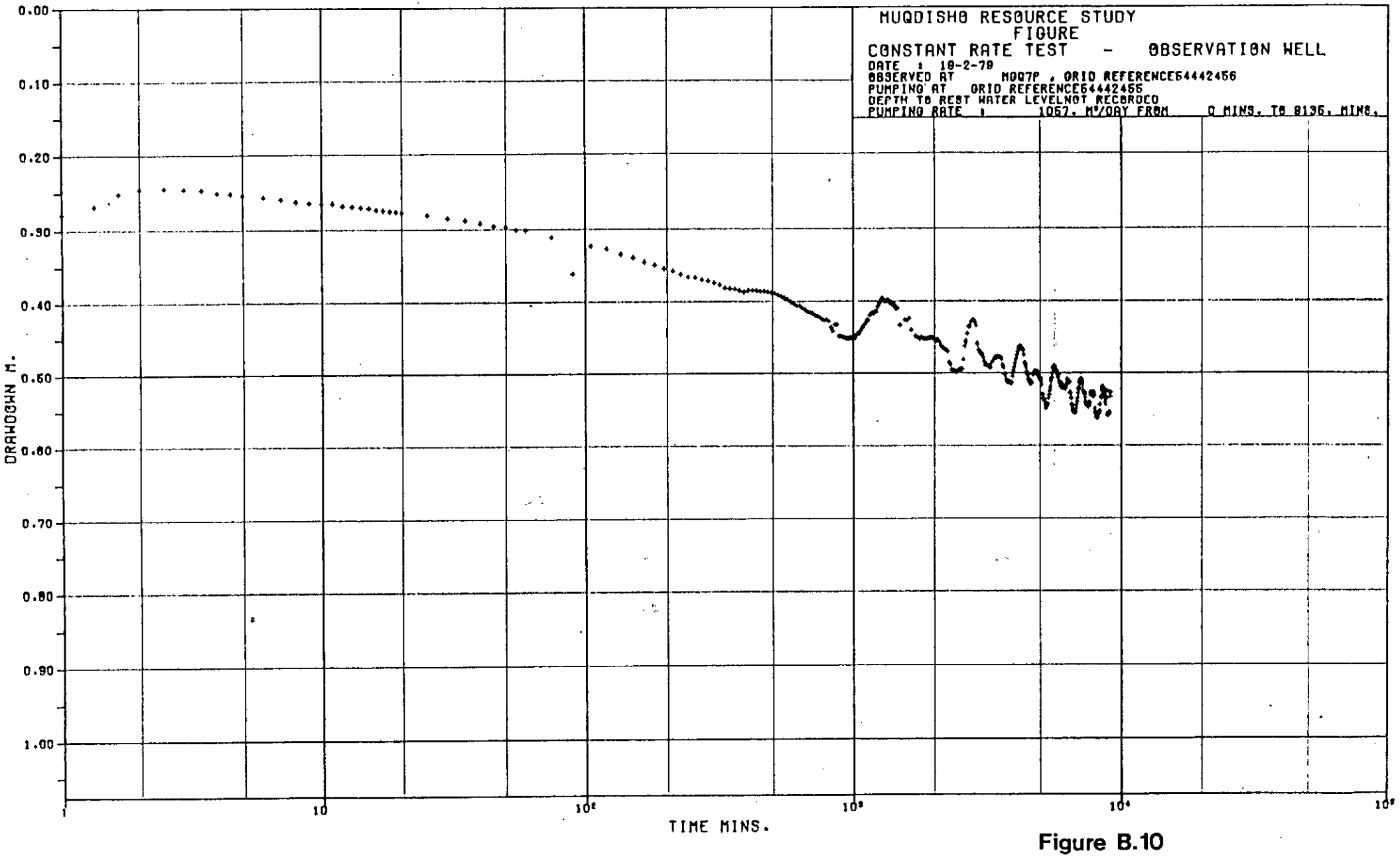

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 19-2-79
OBSERVED AT M007P , ORIO REFERENCE64442456
PUMPING AT ORIO REFERENCE64442456
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 1067. M³/DAY FROM 0 MINS. TO 8136. MINS.
DRAWDWN M.
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
1
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.10

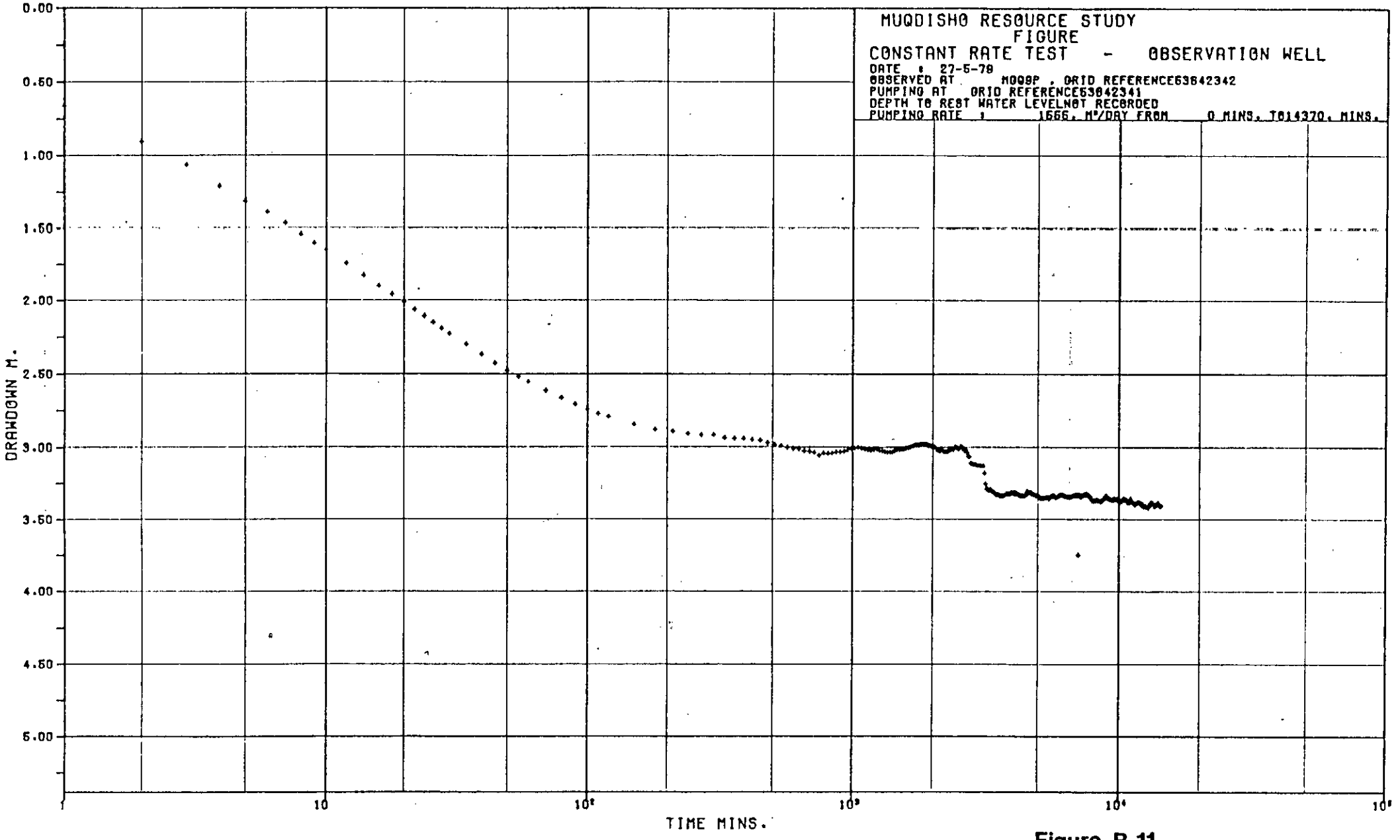

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 27-5-78
OBSERVED AT MOOSP . ORID REFERENCE63642342
PUMPING AT ORID REFERENCE63642341
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 1666. M³/DAY FROM 0 MINS. TO14370. MINS.
DRAWDOWN M.
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
1
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.11

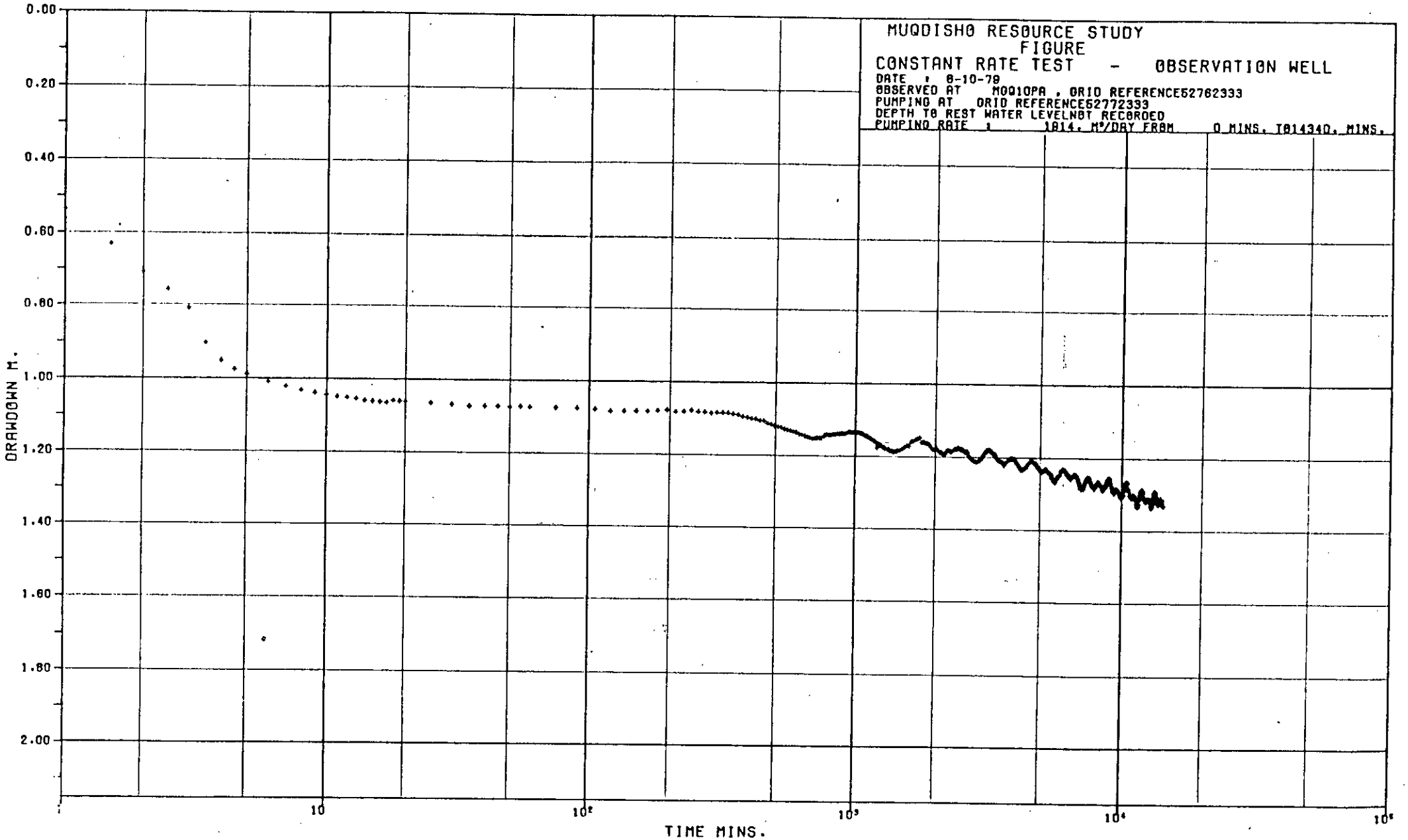

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 8-10-78
OBSERVED AT MOQ10PA , GRID REFERENCE52762333
PUMPING AT GRID REFERENCE52772333
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 1814. M³/DAY FROM 0 MINS. TO1434O. MINS.
DRAWDOWN M.
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.12

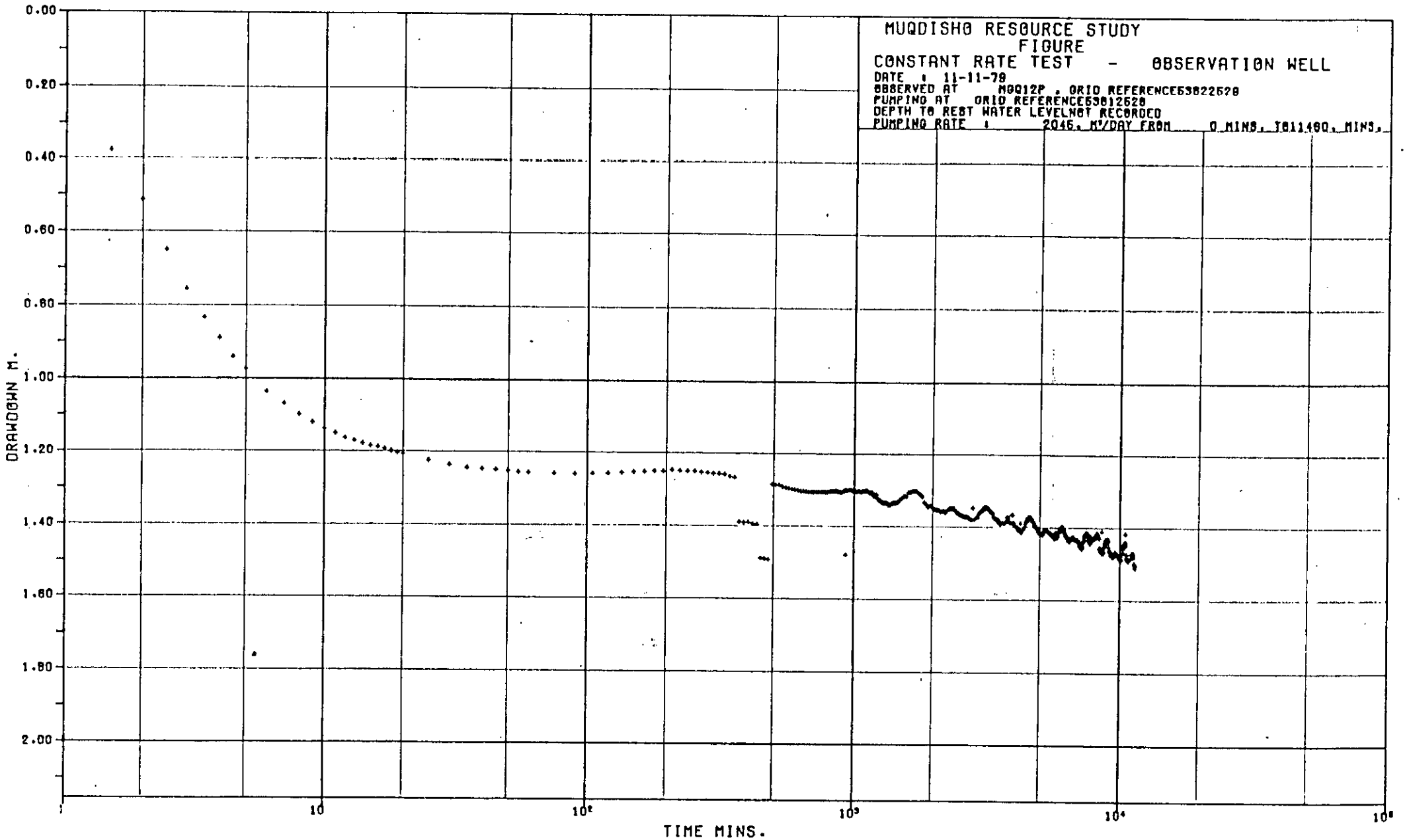

MUQDISHO RESOURCE STUDY
FIGURE
CONSTANT RATE TEST - OBSERVATION WELL
DATE : 11-11-79
OBSERVED AT MOQ12P , ORIO REFERENCE63822528
PUMPING AT ORIO REFERENCE63812528
DEPTH TO REST WATER LEVELNOT RECORDED
PUMPING RATE : 2046. M³/DAY FROM 0 MINS, TO11480. MINS.
DRAWDOWN M.
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00
1
10
10²
10³
10⁴
10⁵
TIME MINS.

Figure B.13

MOGDISHO RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT MGGIT GRID REF. 52112393

DATE OF TEST 13 9 79

PUMPING RATES (M**3/DAY) :

618.0 FROM	0.0 MINS TO	120.0 MINS
947.0 FROM	120.0 MINS TO	240.0 MINS
1337.0 FROM	240.0 MINS TO	360.0 MINS
1689.0 FROM	360.0 MINS TO	480.0 MINS
2176.0 FROM	480.0 MINS TO	600.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2.0	3.300	134.0	4.780
3.0	3.300	136.0	4.850
4.0	3.300	138.0	4.850
5.0	3.020	140.0	4.850
6.0	2.470	145.0	4.990
7.0	2.670	150.0	5.130
8.0	2.670	155.0	5.200
10.0	2.670	160.0	5.200
12.0	2.670	165.0	5.200
14.0	2.670	170.0	5.200
16.0	2.470	175.0	5.270
18.0	2.470	180.0	5.270
20.0	2.470	195.0	5.270
25.0	2.470	210.0	4.850
30.0	2.810	225.0	4.850
35.0	2.810	240.0	4.850
40.0	2.810	241.0	7.100
45.0	2.810	242.0	7.100
50.0	2.810	243.0	7.100
55.0	2.810	244.0	7.100
60.0	2.810	245.0	7.100
75.0	2.810	246.0	7.100
90.0	2.810	247.0	7.100
105.0	2.810	248.0	7.100
120.0	2.810	249.0	7.100
121.0	4.570	250.0	7.100
122.0	4.710	252.0	7.100
123.0	4.710	254.0	7.170
124.0	4.710	256.0	7.170
125.0	4.710	258.0	7.170
126.0	4.780	260.0	7.170
127.0	4.780	265.0	7.170
128.0	4.780	270.0	7.170
129.0	4.780	275.0	7.170
130.0	4.780	280.0	7.170
132.0	4.780	285.0	7.170

(CONTINUED)

[illegible]ISHO RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT [illegible] MG.IT GRID REF. 52112393

DATE OF TEST 13 9 79

TIME(MINS)	DRAWDOWN(M)
290.0	7.170
295.0	7.170
300.0	7.240
315.0	7.240
330.0	7.310
345.0	7.450
360.0	7.450
361.0	9.630
362.0	9.700
363.0	9.770
364.0	9.770
365.0	9.770
366.0	9.840
367.0	9.840
368.0	9.840
369.0	9.840
370.0	9.910
372.0	9.910
374.0	9.910
376.0	9.910
378.0	9.910
380.0	9.910
385.0	9.910
390.0	9.980
395.0	9.980
400.0	9.980
405.0	9.980
410.0	9.980
415.0	9.980
420.0	9.980
435.0	9.980
450.0	9.980
465.0	9.910
480.0	9.910
481.0	13.000
482.0	13.080
483.0	13.080
484.0	13.150
485.0	13.220
486.0	13.220
487.0	13.220
488.0	13.290
489.0	13.290
490.0	13.290
492.0	13.290
494.0	13.360
496.0	13.360
498.0	13.360
500.0	13.360
505.0	13.360
510.0	13.360
515.0	13.430
520.0	13.430
525.0	13.430
530.0	13.430
535.0	13.430
540.0	13.430
555.0	13.430
570.0	13.430
585.0	13.430
600.0	13.430

FOGOISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MOGIT GRID REF. 52112393

DATE OF TEST 1 9 75

PUMPING RATES (M**3/DAY) :
2178.0 FROM 0.0 MINS TO 14100.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	10.970	150.0	13.570
1.0	12.020	165.0	13.500
1.5	12.440	180.0	14.060
2.0	12.720	195.0	14.130
2.5	13.080	210.0	14.270
3.0	13.290	225.0	14.340
3.5	13.070	240.0	14.130
4.0	13.010	255.0	13.710
4.5	13.010	270.0	14.270
5.0	13.080	285.0	14.270
6.0	13.080	300.0	14.270
7.0	13.150	315.0	14.270
8.0	13.220	330.0	14.340
9.0	13.220	345.0	14.340
10.0	13.220	360.0	14.340
11.0	13.220	375.0	14.270
12.0	13.220	390.0	14.270
13.0	13.290	405.0	14.270
14.0	13.290	420.0	14.270
15.0	13.290	435.0	14.270
16.0	13.290	450.0	14.270
17.0	13.290	465.0	14.270
18.0	13.360	480.0	14.200
19.0	13.360	495.0	14.130
20.0	13.360	510.0	13.990
25.0	13.360	525.0	13.990
30.0	13.360	540.0	13.920
35.0	13.360	555.0	13.920
40.0	13.360	570.0	13.850
45.0	13.360	585.0	13.920
50.0	13.360	600.0	13.920
55.0	13.360	615.0	13.920
60.0	13.430	630.0	13.920
75.0	13.430	645.0	13.920
90.0	13.430	660.0	13.920
105.0	13.500	675.0	13.990
120.0	13.530	690.0	13.990
135.0	13.570	705.0	13.990

(CONTINUED)

[illegible]DISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
720.0	13.990	1350.0	14.060
735.0	13.990	1365.0	13.900
750.0	13.990	1380.0	13.990
765.0	14.060	1395.0	14.060
780.0	14.060	1410.0	14.060
795.0	14.060	1425.0	14.060
810.0	14.060	1440.0	14.060
825.0	14.060	1470.0	13.990
840.0	14.060	1500.0	13.990
855.0	14.060	1530.0	14.270
870.0	14.060	1560.0	14.200
885.0	14.060	1590.0	14.200
900.0	14.060	1620.0	14.200
915.0	14.060	1650.0	14.200
930.0	14.060	1680.0	14.270
945.0	14.060	1710.0	14.270
960.0	14.060	1740.0	14.200
975.0	14.060	1770.0	14.200
990.0	14.060	1800.0	14.200
1005.0	14.060	1830.0	14.270
1020.0	14.060	1860.0	14.270
1035.0	14.060	1890.0	14.270
1050.0	14.060	1920.0	14.270
1065.0	14.060	1950.0	14.130
1080.0	14.060	1980.0	14.130
1095.0	14.060	2010.0	14.130
1110.0	14.060	2040.0	14.130
1125.0	13.920	2070.0	14.130
1140.0	13.920	2100.0	14.130
1155.0	13.920	2130.0	14.130
1170.0	13.920	2160.0	14.130
1185.0	13.920	2190.0	14.130
1200.0	13.920	2220.0	14.130
1215.0	13.920	2250.0	14.130
1230.0	13.990	2280.0	14.130
1245.0	13.920	2310.0	14.130
1260.0	13.850	2340.0	14.130
1275.0	13.920	2370.0	14.130
1290.0	13.990	2400.0	14.200
1305.0	13.990	2430.0	14.200
1320.0	14.050	2460.0	14.200
1335.0	14.050	2490.0	14.270

(CONTINUED) TOURISM RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MOUNT GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2520.0	14.200	3780.0	14.760
2550.0	14.270	3810.0	14.760
2580.0	14.270	3840.0	14.760
2610.0	14.340	3870.0	14.270
2640.0	14.340	3900.0	14.130
2670.0	14.340	3930.0	14.130
2700.0	14.340	3960.0	14.130
2730.0	14.340	3990.0	14.130
2760.0	14.340	4020.0	14.130
2790.0	14.270	4050.0	14.130
2820.0	14.340	4080.0	14.130
2850.0	14.270	4110.0	14.130
2880.0	14.130	4140.0	14.200
2910.0	14.130	4170.0	14.270
2940.0	14.060	4200.0	14.270
2970.0	14.340	4230.0	14.200
3000.0	14.200	4260.0	14.130
3030.3	14.130	4290.0	14.130
3060.0	14.130	4320.0	14.130
3090.0	14.130	4350.0	14.060
3120.0	14.130	4380.0	14.130
3150.0	14.130	4410.0	14.130
3180.0	14.130	4440.0	14.130
3210.0	14.130	4470.0	14.200
3240.0	14.130	4500.0	14.200
3270.0	14.130	4530.0	14.130
3300.0	14.130	4560.0	14.130
3300.0	14.130	4590.0	14.130
3360.0	14.200	4620.0	14.130
3390.0	14.200	4650.0	14.130
3420.0	14.200	4680.0	14.200
3450.0	14.200	4710.0	14.200
3480.0	14.200	4740.0	14.200
3510.0	14.200	4770.0	14.200
3540.0	14.270	4800.0	14.200
3570.0	14.410	4830.0	14.270
3600.0	14.410	4860.0	14.200
3630.0	14.690	4890.0	14.200
3660.0	14.760	4920.0	14.130
3690.0	14.760	4950.0	14.130
3720.0	14.760	4980.0	14.130
3750.0	14.760	5010.0	14.130

(CONTINUED)

...ISH RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ... M3/H GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
5040.0	14.130	6300.0	14.200
5070.0	14.130	6330.0	14.200
5100.0	14.130	6360.0	14.200
5130.0	14.130	6390.0	14.200
5160.0	14.130	6420.0	14.200
5190.0	14.130	6450.0	14.200
5220.0	14.130	6480.0	14.200
5250.0	14.130	6510.0	14.200
5280.0	14.130	6540.0	14.200
5310.0	14.130	6570.0	14.200
5340.0	14.130	6600.0	14.200
5370.0	14.130	6630.0	14.200
5400.0	14.270	6660.0	14.200
5430.0	14.060	6690.0	14.200
5460.0	14.130	6720.0	14.200
5490.0	14.200	6750.0	14.200
5520.0	14.060	6780.0	14.200
5550.0	14.200	6810.0	14.200
5580.0	14.200	6840.0	14.200
5610.0	14.200	6870.0	14.200
5640.0	14.200	6900.0	14.200
5670.0	14.200	6930.0	14.200
5700.0	14.200	6960.0	14.200
5730.0	14.200	6990.0	14.200
5760.0	14.200	7020.0	14.200
5790.0	14.200	7050.0	14.200
5820.0	14.200	7080.0	14.200
5850.0	14.200	7110.0	14.200
5880.0	14.200	7140.0	14.200
5910.0	14.200	7170.0	14.340
5940.0	14.200	7200.0	14.340
5970.0	14.200	7230.0	14.270
6000.0	14.200	7260.0	14.270
6030.0	14.200	7290.0	14.200
6060.0	14.200	7320.0	14.200
6090.0	14.200	7350.0	14.200
6120.0	14.200	7380.0	14.200
6150.0	14.200	7410.0	14.200
6180.0	14.200	7440.0	14.200
6210.0	14.200	7470.0	14.200
6240.0	14.200	7500.0	14.200
6270.0	14.200	7530.0	14.200

(CONTINUED)

GEOTHERMAL RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ... MGWIT GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7560.0	14.200	8820.0	14.200
7590.0	14.200	8850.0	14.270
7620.0	14.200	8880.0	14.200
7650.0	14.200	8910.0	14.200
7680.0	14.200	8940.0	14.200
7710.0	14.200	8970.0	14.200
7740.0	14.200	9000.0	14.200
7770.0	14.200	9030.0	14.200
7800.0	14.200	9060.0	14.200
7830.0	14.200	9090.0	14.200
7860.0	14.200	9120.0	14.200
7890.0	14.200	9150.0	14.200
7920.0	14.200	9180.0	14.200
7950.0	14.200	9210.0	14.200
7980.0	14.200	9240.0	14.200
8010.0	14.200	9270.0	14.200
8040.0	14.200	9300.0	14.200
8070.0	14.200	9330.0	14.240
8100.0	14.270	9360.0	14.200
8130.0	14.270	9390.0	14.200
8160.0	14.270	9420.0	14.200
8190.0	14.270	9450.0	14.200
8220.0	14.200	9480.0	14.200
8250.0	14.200	9510.0	14.200
8280.0	14.200	9540.0	14.200
8310.0	14.340	9570.0	14.200
8340.0	14.270	9600.0	14.200
8370.0	14.270	9630.0	14.200
8400.0	14.270	9660.0	14.200
8430.0	14.270	9690.0	14.200
8460.0	14.200	9720.0	14.200
8490.0	14.270	9750.0	14.200
8520.0	14.270	9780.0	14.270
8550.0	14.270	9810.0	14.270
8580.0	14.340	9840.0	14.270
8610.0	14.200	9870.0	14.270
8640.0	14.200	9900.0	14.270
8670.0	14.200	9930.0	14.200
8700.0	14.200	9960.0	14.200
8730.0	14.200	9990.0	14.200
8760.0	14.200	10020.0	14.270
8790.0	14.200	10050.0	14.200

(CONTINUED)

...OSIS RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ...OSIT GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
10060.0	14.290	11370.0	14.130
10110.0	14.760	11400.0	14.130
10140.0	14.760	11430.0	14.130
10170.0	14.760	11460.0	13.990
10200.0	14.760	11490.0	13.990
10230.0	14.760	11520.0	13.990
10260.0	14.760	11550.0	13.990
10290.0	14.760	11580.0	13.990
10320.0	14.670	11610.0	13.990
10350.0	14.690	11640.0	13.990
10380.0	14.760	11670.0	13.990
10410.0	14.270	11700.0	13.990
10440.0	14.270	11730.0	13.990
10470.0	14.340	11760.0	13.990
10500.0	14.340	10790.0	13.990
10530.0	14.270	11820.0	13.990
10590.0	14.060	11850.0	13.990
10620.0	14.060	11880.0	13.990
10650.0	14.060	11910.0	13.990
10680.0	14.060	11940.0	13.990
10710.0	14.060	11970.0	13.990
10740.0	14.130	12000.0	13.990
10770.0	14.130	12030.0	13.990
10800.0	14.130	12060.0	13.990
10830.0	14.130	12090.0	13.990
10860.0	14.130	12120.0	13.990
10890.0	14.130	12150.0	13.990
10920.0	14.130	12180.0	14.060
10950.0	14.060	12210.0	14.060
10980.0	14.130	12240.0	14.060
11010.0	13.990	12270.0	13.990
11040.0	13.990	12300.0	13.990
11070.0	14.060	12330.0	13.990
11100.0	14.060	12360.0	13.990
11130.0	13.990	12390.0	13.990
11160.0	13.990	12420.0	14.060
11190.0	13.990	12450.0	14.060
11220.0	13.990	12480.0	14.060
11250.0	13.990	12510.0	14.060
11280.0	14.060	12540.0	14.060
11310.0	14.130	12570.0	14.060
11340.0	14.130	12600.0	13.990

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. S2112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
12630.0	13.990	13350.0	14.060
12660.0	13.990	13410.0	13.990
12690.0	13.990	13440.0	13.990
12720.0	13.990	13470.0	13.990
12750.0	13.990	13500.0	13.990
12780.0	13.990	13530.0	13.990
12810.0	14.060	13560.0	13.990
12840.0	14.060	13590.0	13.990
12870.0	13.990	13620.0	13.990
12900.0	13.990	13650.0	13.990
12930.0	13.990	13680.0	13.990
12960.0	14.060	13710.0	13.990
12990.0	14.130	13740.0	13.990
13020.0	14.060	13770.0	13.990
13050.0	14.060	13800.0	13.990
13080.0	13.990	13830.0	13.990
13110.0	13.990	13860.0	14.060
13140.0	13.990	13890.0	14.060
13170.0	13.990	13920.0	13.990
13200.0	13.990	13950.0	13.990
13230.0	13.990	13980.0	13.990
13260.0	14.060	14010.0	13.990
13290.0	14.060	14040.0	13.990
13320.0	13.990	14070.0	13.990
13350.0	14.060	14100.0	13.990

...BIOMED RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ...3E GRID REF. 52122392

PUMPING AT ...1T GRID REF. 52112393

DATE OF TEST 1 9 79

PUMPING RATES (M**3/DAY) :
2178.0 FROM 0.0 MINS TO 14100.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	.101	135.0	.869
1.0	.275	150.0	.873
1.5	.379	165.0	.876
2.0	.448	180.0	.880
2.5	.506	195.0	.885
3.0	.545	210.0	.886
3.5	.585	225.0	.889
4.0	.606	240.0	.890
4.5	.630	255.0	.890
5.0	.651	270.0	.892
6.0	.679	285.0	.895
7.0	.705	300.0	.897
8.0	.724	315.0	.898
9.0	.741	330.0	.899
10.0	.753	345.0	.901
11.0	.764	360.0	.904
12.0	.774	375.0	.905
13.0	.781	390.0	.907
14.0	.787	405.0	.907
15.0	.794	420.0	.907
16.0	.800	435.0	.907
17.0	.805	450.0	.908
18.0	.808	465.0	.908
19.0	.812	480.0	.909
20.0	.815	495.0	.909
25.0	.826	510.0	.909
30.0	.835	525.0	.909
35.0	.838	540.0	.910
40.0	.842	555.0	.910
45.0	.845	570.0	.909
50.0	.845	585.0	.909
55.0	.847	600.0	.910
60.0	.849	615.0	.910
75.0	.855	630.0	.911
90.0	.858	645.0	.912
105.0	.862	660.0	.913
120.0	.865	675.0	.917

(CONTINUED)

...UBLISHED RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MG63P GRID REF. 52122392

PUMPING AT MG.1T GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
690.0	.917	1305.0	.948
705.0	.919	1320.0	.948
720.0	.920	1335.0	.948
735.0	.922	1350.0	.950
750.0	.924	1365.0	.951
765.0	.924	1380.0	.952
780.0	.926	1395.0	.953
795.0	.929	1410.0	.955
810.0	.931	1425.0	.957
825.0	.931	1440.0	.958
840.0	.932	1470.0	.963
855.0	.932	1500.0	.967
870.0	.933	1530.0	.973
885.0	.934	1560.0	.975
900.0	.944	1590.0	.977
915.0	.941	1620.0	.980
930.0	.951	1650.0	.983
945.0	.952	1680.0	.990
960.0	.953	1710.0	.991
975.0	.955	1740.0	.992
990.0	.955	1770.0	.993
1005.0	.956	1800.0	.994
1020.0	.956	1830.0	.997
1035.0	.957	1860.0	.997
1050.0	.957	1890.0	.994
1065.0	.957	1920.0	.994
1080.0	.960	1950.0	.994
1095.0	.960	1980.0	.993
1110.0	.958	2010.0	.990
1125.0	.958	2040.0	.990
1140.0	.958	2070.0	.992
1155.0	.957	2100.0	.994
1170.0	.957	2130.0	.995
1185.0	.956	2160.0	.995
1200.0	.955	2190.0	.995
1215.0	.954	2220.0	.994
1230.0	.953	2250.0	.991
1245.0	.953	2280.0	1.007
1260.0	.951	2310.0	1.009
1275.0	.948	2340.0	1.011
1290.0	.948	2370.0	1.011

(CONTINUED)

...ISHU RESOURCE STUDY

ALL THE DATA

CONST... RATE TEST - OBSERVATION WELL

OBSERVED AT ... WELL GRID REF. 52122392

PUMPING AT ... WELL GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2400.0	1.013	3630.0	1.053
2430.0	1.019	3660.0	1.053
2460.0	1.022	3690.0	1.057
2490.0	1.024	3720.0	1.062
2520.0	1.026	3750.0	1.063
2550.0	1.025	3780.0	1.067
2580.0	1.024	3810.0	1.067
2610.0	1.024	3840.0	1.062
2640.0	1.020	3870.0	1.077
2670.0	1.021	3900.0	1.077
2700.0	1.016	3930.0	1.078
2730.0	1.014	3960.0	1.083
2760.0	1.013	3990.0	1.083
2790.0	1.013	4020.0	1.075
2820.0	1.015	4050.0	1.067
2850.0	1.016	4080.0	1.066
2880.0	1.019	4110.0	1.065
2910.0	1.023	4140.0	1.059
2940.0	1.024	4170.0	1.056
2970.0	1.030	4200.0	1.052
3000.0	1.035	4230.0	1.050
3030.0	1.038	4260.0	1.048
3060.0	1.044	4290.0	1.049
3090.0	1.045	4320.0	1.052
3120.0	1.046	4350.0	1.052
3150.0	1.047	4380.0	1.054
3180.0	1.049	4410.0	1.061
3210.0	1.048	4440.0	1.063
3240.0	1.047	4470.0	1.068
3270.0	1.046	4500.0	1.069
3300.0	1.046	4530.0	1.072
3330.0	1.047	4560.0	1.076
3360.0	1.047	4590.0	1.080
3390.0	1.047	4620.0	1.083
3420.0	1.044	4650.0	1.085
3450.0	1.046	4680.0	1.084
3480.0	1.049	4710.0	1.081
3510.0	1.049	4740.0	1.082
3540.0	1.050	4770.0	1.082
3570.0	1.053	4800.0	1.081
3600.0	1.054	4830.0	1.079

(CONTINUED)

...GADISHU RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ...4G.3F GRID REF. 52122392

PUMPING AT ...4G.1T GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
4860.0	1.077	6090.0	1.113
4890.0	1.075	6120.0	1.116
4920.0	1.074	6150.0	1.117
4950.0	1.075	6180.0	1.118
4980.0	1.075	6210.0	1.118
5010.0	1.077	6240.0	1.115
5040.0	1.080	6270.0	1.110
5070.0	1.080	6300.0	1.109
5100.0	1.085	6330.0	1.107
5130.0	1.087	6360.0	1.105
5160.0	1.090	6390.0	1.100
5190.0	1.092	6420.0	1.101
5220.0	1.092	6450.0	1.103
5250.0	1.093	6480.0	1.104
5280.0	1.097	6510.0	1.104
5310.0	1.099	6540.0	1.109
5340.0	1.101	6570.0	1.111
5370.0	1.103	6600.0	1.113
5400.0	1.104	6630.0	1.114
5430.0	1.103	6660.0	1.117
5460.0	1.100	6690.0	1.120
5490.0	1.099	6720.0	1.126
5520.0	1.090	6750.0	1.124
5550.0	1.089	6780.0	1.123
5580.0	1.087	6810.0	1.120
5610.0	1.084	6840.0	1.119
5640.0	1.081	6870.0	1.120
5670.0	1.080	6900.0	1.120
5700.0	1.077	6930.0	1.121
5730.0	1.078	6960.0	1.119
5760.0	1.082	6990.0	1.117
5790.0	1.081	7020.0	1.113
5820.0	1.082	7050.0	1.111
5850.0	1.083	7080.0	1.107
5880.0	1.083	7110.0	1.112
5910.0	1.097	7140.0	1.113
5940.0	1.097	7170.0	1.103
5970.0	1.097	7200.0	1.102
6000.0	1.103	7230.0	1.110
6030.0	1.104	7260.0	1.109
6060.0	1.107	7290.0	1.112

(CONTINUED)

...SSISTED RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ... GRID REF. 52122392

PUMPING AT ... GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7320.0	1.117	8550.0	1.129
7350.0	1.119	8580.0	1.127
7380.0	1.122	8610.0	1.127
7410.0	1.127	8640.0	1.131
7440.0	1.125	8670.0	1.133
7470.0	1.128	8700.0	1.134
7500.0	1.129	8730.0	1.135
7530.0	1.133	8760.0	1.133
7560.0	1.135	8790.0	1.137
7590.0	1.137	8820.0	1.141
7620.0	1.138	8850.0	1.143
7650.0	1.139	8880.0	1.144
7680.0	1.137	8910.0	1.149
7710.0	1.130	8910.0	1.149
7740.0	1.134	8940.0	1.150
7770.0	1.132	8970.0	1.150
7800.0	1.117	9000.0	1.154
7830.0	1.122	9030.0	1.155
7860.0	1.123	9060.0	1.157
7890.0	1.125	9090.0	1.157
7920.0	1.127	9120.0	1.155
7950.0	1.127	9150.0	1.155
7980.0	1.131	9180.0	1.153
8010.0	1.132	9210.0	1.147
8040.0	1.133	9240.0	1.146
8070.0	1.137	9270.0	1.145
8100.0	1.136	9300.0	1.144
8130.0	1.140	9330.0	1.143
8160.0	1.137	9360.0	1.144
8190.0	1.143	9390.0	1.152
8220.0	1.145	9420.0	1.150
8250.0	1.147	9450.0	1.153
8280.0	1.145	9480.0	1.154
8310.0	1.146	9510.0	1.159
8340.0	1.147	9540.0	1.163
8370.0	1.146	9570.0	1.169
8400.0	1.144	9600.0	1.175
8430.0	1.146	9630.0	1.174
8460.0	1.147	9660.0	1.174
8490.0	1.134	9690.0	1.168
8520.0	1.133	9720.0	1.173

(CONTINUED)

TOURISM RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MGW3P GRID REF. 52122392

PUMPING AT MGW11 GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
9750.0	1.173	11040.0	1.184
9780.0	1.169	11070.0	1.185
9810.0	1.169	11100.0	1.186
9840.0	1.165	11130.0	1.186
9870.0	1.162	11160.0	1.184
9900.0	1.160	11190.0	1.182
9930.0	1.159	11220.0	1.180
9960.0	1.148	11250.0	1.177
9990.0	1.152	11280.0	1.178
10020.0	1.153	11310.0	1.174
10050.0	1.153	11340.0	1.173
10080.0	1.151	11370.0	1.170
10110.0	1.158	11400.0	1.169
10140.0	1.155	11430.0	1.164
10170.0	1.158	11460.0	1.170
10200.0	1.160	11490.0	1.166
10230.0	1.163	11520.0	1.166
10260.0	1.167	11550.0	1.167
10290.0	1.172	11580.0	1.168
10320.0	1.173	11610.0	1.174
10350.0	1.173	11640.0	1.177
10380.0	1.174	11670.0	1.177
10410.0	1.172	11700.0	1.179
10440.0	1.169	11730.0	1.184
10470.0	1.167	11760.0	1.183
10500.0	1.169	11790.0	1.187
10530.0	1.174	11820.0	1.190
10620.0	1.175	11850.0	1.190
10650.0	1.173	11880.0	1.189
10680.0	1.173	11910.0	1.190
10710.0	1.170	11940.0	1.189
10740.0	1.170	11970.0	1.188
10770.0	1.172	12000.0	1.187
10800.0	1.175	12030.0	1.189
10830.0	1.176	12060.0	1.186
10860.0	1.174	12090.0	1.183
10890.0	1.180	12120.0	1.183
10920.0	1.180	12150.0	1.184
10950.0	1.176	12180.0	1.182
10980.0	1.179	12210.0	1.186
11010.0	1.183	12240.0	1.187

(CONTINUED)

...ISHED RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ... GRID REF. 52122392

PUMPING AT ... GRID REF. 52112393

DATE OF TEST 1 9 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
12270.0	1.187	13200.0	1.197
12300.0	1.189	13230.0	1.199
12330.0	1.192	13260.0	1.201
12360.0	1.193	13290.0	1.200
12390.0	1.194	13320.0	1.202
12420.0	1.193	13350.0	1.204
12450.0	1.199	13380.0	1.204
12480.0	1.201	13410.0	1.203
12510.0	1.211	13440.0	1.204
12540.0	1.213	13470.0	1.200
12570.0	1.210	13500.0	1.199
12600.0	1.205	13530.0	1.203
12630.0	1.205	13560.0	1.197
12660.0	1.203	13590.0	1.197
12690.0	1.196	13620.0	1.197
12720.0	1.193	13650.0	1.199
12750.0	1.190	13680.0	1.199
12780.0	1.186	13710.0	1.200
12810.0	1.180	13740.0	1.203
12840.0	1.181	13770.0	1.205
12870.0	1.177	13800.0	1.205
12900.0	1.176	13830.0	1.207
12930.0	1.177	13860.0	1.214
12960.0	1.175	13890.0	1.213
12990.0	1.178	13920.0	1.214
13020.0	1.180	13950.0	1.214
13050.0	1.183	13980.0	1.217
13080.0	1.187	14010.0	1.215
13110.0	1.188	14040.0	1.216
13140.0	1.193	14070.0	1.214
13170.0	1.197	14100.0	1.207

ROSBUISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT .. MONIOPA GRID REF. 52762333

PUMPING AT MOOSI GRID REF. 52772333

DATE OF TEST 8 10 79

PUMPING RATES (M**3/DAY) :
1914.0 FROM 0.0 MINS TO 1434.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	.298	135.0	1.083
1.0	.536	150.0	1.082
1.5	.629	165.0	1.082
2.0	.709	180.0	1.080
2.5	.755	195.0	1.078
3.0	.810	210.0	1.083
3.5	.903	225.0	1.082
4.0	.952	240.0	1.078
4.5	.975	255.0	1.082
5.0	.998	270.0	1.083
6.0	1.010	285.0	1.085
7.0	1.023	300.0	1.084
8.0	1.034	315.0	1.084
9.0	1.041	330.0	1.085
10.0	1.049	345.0	1.087
11.0	1.051	360.0	1.089
12.0	1.053	375.0	1.094
13.0	1.056	390.0	1.096
14.0	1.061	405.0	1.100
15.0	1.063	420.0	1.100
16.0	1.064	435.0	1.106
17.0	1.066	450.0	1.105
18.0	1.060	465.0	1.113
19.0	1.062	480.0	1.115
20.0	1.063	495.0	1.119
25.0	1.066	510.0	1.123
30.0	1.069	525.0	1.124
35.0	1.073	540.0	1.126
40.0	1.073	555.0	1.131
45.0	1.073	570.0	1.133
50.0	1.074	585.0	1.136
55.0	1.073	600.0	1.138
60.0	1.074	615.0	1.142
75.0	1.075	630.0	1.144
90.0	1.076	645.0	1.147
105.0	1.078	660.0	1.150
120.0	1.080	675.0	1.152

(CONTINUED)

...SHED RESOURCE STUDY

ALL THE DATA

CONSTA... RATE TEST - OBSERVATION WELL

OBSERVED AT ... GRID REF.. 52762333

PUMPING AT ... GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
690.0	1.155	1205.0	1.177
705.0	1.154	1320.0	1.181
720.0	1.153	1335.0	1.182
735.0	1.153	1350.0	1.185
750.0	1.153	1365.0	1.185
765.0	1.146	1380.0	1.187
780.0	1.143	1395.0	1.187
795.0	1.145	1410.0	1.187
810.0	1.144	1425.0	1.186
825.0	1.142	1440.0	1.184
840.0	1.142	1470.0	1.183
855.0	1.141	1500.0	1.180
870.0	1.141	1530.0	1.175
885.0	1.140	1560.0	1.171
900.0	1.140	1590.0	1.172
915.0	1.140	1620.0	1.161
930.0	1.138	1650.0	1.159
945.0	1.135	1680.0	1.154
960.0	1.136	1710.0	1.152
975.0	1.136	1740.0	1.149
990.0	1.135	1770.0	1.162
1005.0	1.137	1800.0	1.161
1020.0	1.136	1830.0	1.164
1035.0	1.137	1860.0	1.165
1050.0	1.139	1890.0	1.167
1065.0	1.139	1920.0	1.175
1080.0	1.144	1950.0	1.180
1095.0	1.145	1980.0	1.181
1110.0	1.147	2010.0	1.175
1125.0	1.151	2040.0	1.182
1140.0	1.153	2070.0	1.187
1155.0	1.156	2100.0	1.188
1170.0	1.156	2130.0	1.192
1185.0	1.161	2160.0	1.194
1200.0	1.165	2190.0	1.186
1215.0	1.167	2220.0	1.183
1230.0	1.169	2250.0	1.183
1245.0	1.171	2280.0	1.186
1260.0	1.174	2310.0	1.185
1275.0	1.176	2340.0	1.181
1290.0	1.176	2370.0	1.178

(CONTINUED)

MUGUISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT - MONIOPA GRID REF. 52762333

PUMPING AT MOUST GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2400.0	1.179	3630.0	1.223
2430.0	1.175	3660.0	1.218
2460.0	1.177	3690.0	1.214
2490.0	1.179	3720.0	1.213
2520.0	1.180	3750.0	1.210
2550.0	1.181	3780.0	1.207
2580.0	1.187	3810.0	1.204
2610.0	1.185	3840.0	1.205
2640.0	1.186	3870.0	1.201
2670.0	1.190	3900.0	1.204
2700.0	1.201	3930.0	1.205
2730.0	1.205	3960.0	1.202
2760.0	1.206	3990.0	1.204
2790.0	1.211	4020.0	1.210
2820.0	1.212	4050.0	1.215
2850.0	1.213	4080.0	1.218
2880.0	1.213	4110.0	1.221
2910.0	1.210	4140.0	1.227
2940.0	1.210	4170.0	1.228
2970.0	1.205	4200.0	1.235
3000.0	1.202	4230.0	1.236
3030.0	1.195	4260.0	1.236
3060.0	1.190	4290.0	1.233
3090.0	1.185	4320.0	1.233
3120.0	1.182	4350.0	1.230
3150.0	1.182	4380.0	1.230
3180.0	1.180	4410.0	1.226
3210.0	1.182	4440.0	1.224
3240.0	1.183	4470.0	1.221
3270.0	1.185	4500.0	1.216
3300.0	1.191	4530.0	1.215
3330.0	1.190	4560.0	1.212
3360.0	1.192	4590.0	1.210
3390.0	1.201	4620.0	1.208
3420.0	1.203	4650.0	1.208
3450.0	1.207	4680.0	1.211
3480.0	1.210	4710.0	1.215
3510.0	1.211	4740.0	1.216
3540.0	1.211	4770.0	1.214
3570.0	1.214	4800.0	1.215
3600.0	1.215	4830.0	1.220

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONST[illegible] RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 52762333

PUMPING AT [illegible] GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
4860.0	1.225	6690.0	1.233
4890.0	1.229	6120.0	1.233
4920.0	1.228	6150.0	1.234
4950.0	1.231	6180.0	1.236
4980.0	1.235	6210.0	1.236
5010.0	1.238	6240.0	1.241
5040.0	1.241	6270.0	1.243
5070.0	1.242	6300.0	1.245
5100.0	1.240	6330.0	1.246
5130.0	1.239	6360.0	1.248
5160.0	1.238	6390.0	1.249
5190.0	1.236	6420.0	1.249
5220.0	1.231	6450.0	1.255
5250.0	1.232	6480.0	1.258
5280.0	1.233	6510.0	1.260
5310.0	1.237	6540.0	1.258
5340.0	1.241	6570.0	1.257
5370.0	1.242	6600.0	1.253
5400.0	1.243	6630.0	1.252
5430.0	1.244	6660.0	1.248
5460.0	1.244	6690.0	1.247
5490.0	1.247	6720.0	1.247
5520.0	1.252	6750.0	1.248
5550.0	1.257	6780.0	1.249
5580.0	1.259	6810.0	1.248
5610.0	1.264	6840.0	1.250
5640.0	1.266	6870.0	1.255
5670.0	1.268	6900.0	1.258
5700.0	1.269	6930.0	1.261
5730.0	1.267	6960.0	1.266
5760.0	1.261	6990.0	1.269
5790.0	1.257	7020.0	1.275
5820.0	1.254	7050.0	1.278
5850.0	1.251	7080.0	1.284
5880.0	1.254	7110.0	1.287
5910.0	1.249	7140.0	1.287
5940.0	1.250	7170.0	1.286
5970.0	1.238	7200.0	1.284
6000.0	1.236	7230.0	1.282
6030.0	1.237	7260.0	1.287
6060.0	1.234	7290.0	1.280

(CONTINUED)

MOSOISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MGW10PA GRID REF. 52762333

PUMPING AT MGW5T GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7320.0	1.275	8550.0	1.292
7350.0	1.270	8580.0	1.290
7380.0	1.268	8610.0	1.287
7410.0	1.264	8640.0	1.283
7440.0	1.261	8670.0	1.282
7470.0	1.259	8700.0	1.284
7500.0	1.256	8730.0	1.280
7530.0	1.255	8760.0	1.276
7560.0	1.255	8790.0	1.273
7590.0	1.257	8820.0	1.269
7620.0	1.256	8850.0	1.266
7650.0	1.261	8880.0	1.263
7680.0	1.265	8910.0	1.260
7710.0	1.270	8940.0	1.258
7740.0	1.274	8970.0	1.257
7770.0	1.275	9000.0	1.257
7800.0	1.277	9030.0	1.257
7830.0	1.281	9060.0	1.260
7860.0	1.281	9090.0	1.266
7890.0	1.282	9120.0	1.271
7920.0	1.284	9150.0	1.276
7950.0	1.286	9180.0	1.278
7980.0	1.285	9210.0	1.283
8010.0	1.283	9240.0	1.285
8040.0	1.278	9270.0	1.288
8070.0	1.275	9300.0	1.292
8100.0	1.273	9330.0	1.295
8130.0	1.272	9360.0	1.297
8160.0	1.271	9390.0	1.296
8190.0	1.268	9420.0	1.296
8220.0	1.267	9450.0	1.292
8250.0	1.267	9480.0	1.285
8280.0	1.271	9510.0	1.287
8310.0	1.273	9540.0	1.285
8340.0	1.273	9570.0	1.286
8370.0	1.275	9600.0	1.287
8400.0	1.276	9630.0	1.291
8430.0	1.280	9660.0	1.292
8460.0	1.291	9690.0	1.292
8490.0	1.286	9720.0	1.293
8520.0	1.290	9750.0	1.294

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 52762333

PUMPING AT [illegible] GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
9780.0	1.294	11010.0	1.302
9810.0	1.301	11040.0	1.301
9840.0	1.303	11070.0	1.302
9870.0	1.304	11100.0	1.304
9900.0	1.307	11130.0	1.306
9930.0	1.308	11160.0	1.308
9960.0	1.310	11190.0	1.307
9990.0	1.308	11220.0	1.310
10020.0	1.309	11250.0	1.315
10050.0	1.307	11280.0	1.317
10080.0	1.306	11310.0	1.325
10110.0	1.304	11340.0	1.331
10140.0	1.303	11370.0	1.333
10170.0	1.299	11400.0	1.332
10200.0	1.292	11430.0	1.336
10230.0	1.287	11460.0	1.333
10260.0	1.281	11490.0	1.332
10290.0	1.277	11520.0	1.333
10320.0	1.273	11550.0	1.327
10350.0	1.271	11580.0	1.325
10380.0	1.268	11610.0	1.317
10410.0	1.268	11640.0	1.313
10440.0	1.270	11670.0	1.306
10470.0	1.272	11700.0	1.301
10500.0	1.268	11730.0	1.298
10530.0	1.284	11760.0	1.297
10560.0	1.285	11790.0	1.294
10590.0	1.285	11820.0	1.289
10620.0	1.291	11850.0	1.290
10650.0	1.293	11880.0	1.288
10680.0	1.301	11910.0	1.289
10710.0	1.303	11940.0	1.292
10740.0	1.305	11970.0	1.295
10770.0	1.306	12000.0	1.298
10800.0	1.306	12030.0	1.305
10830.0	1.306	12060.0	1.306
10860.0	1.310	12090.0	1.307
10890.0	1.305	12120.0	1.310
10920.0	1.305	12150.0	1.312
10950.0	1.303	12180.0	1.315
10980.0	1.302	12210.0	1.317

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MOU1UPA GRID REF. 52762333

PUMPING AT MOUST GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
12240.0	1.320	13320.0	1.294
12270.0	1.322	13350.0	1.295
12300.0	1.321	13380.0	1.298
12330.0	1.318	13410.0	1.297
12360.0	1.316	13440.0	1.303
12390.0	1.315	13470.0	1.305
12420.0	1.315	13500.0	1.312
12450.0	1.314	13530.0	1.316
12480.0	1.315	13560.0	1.316
12510.0	1.314	13590.0	1.323
12540.0	1.314	13620.0	1.326
12570.0	1.313	13650.0	1.330
12600.0	1.313	13680.0	1.330
12630.0	1.313	13710.0	1.328
12660.0	1.313	13740.0	1.322
12690.0	1.314	13770.0	1.322
12720.0	1.318	13800.0	1.321
12750.0	1.322	13830.0	1.316
12780.0	1.325	13860.0	1.315
12810.0	1.331	13890.0	1.316
12840.0	1.332	13920.0	1.314
12870.0	1.339	13950.0	1.312
12900.0	1.337	13980.0	1.311
12930.0	1.336	14010.0	1.312
12960.0	1.334	14040.0	1.314
12990.0	1.330	14070.0	1.314
13020.0	1.325	14100.0	1.315
13050.0	1.320	14130.0	1.316
13080.0	1.314	14160.0	1.321
13110.0	1.309	14190.0	1.326
13140.0	1.305	14220.0	1.328
13170.0	1.301	14250.0	1.331
13200.0	1.296	14280.0	1.332
13230.0	1.295	14310.0	1.332
13260.0	1.294	14340.0	1.332
13290.0	1.295		

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
720.0	18.700	1350.0	18.700
735.0	18.700	1365.0	18.700
750.0	18.700	1380.0	18.700
765.0	18.700	1395.0	18.700
780.0	18.700	1410.0	18.800
795.0	18.700	1425.0	18.800
810.0	18.700	1440.0	18.800
825.0	18.700	1470.0	18.800
840.0	18.700	1500.0	18.800
855.0	18.700	1530.0	18.800
870.0	18.700	1560.0	18.800
885.0	18.700	1590.0	18.800
900.0	18.700	1620.0	18.800
915.0	18.700	1650.0	18.800
930.0	18.700	1680.0	18.700
945.0	18.700	1710.0	18.800
960.0	18.700	1740.0	18.800
975.0	18.700	1770.0	18.800
990.0	18.700	1800.0	18.800
1005.0	18.700	1830.0	18.900
1020.0	18.700	1860.0	18.800
1035.0	18.700	1890.0	18.800
1050.0	18.700	1920.0	18.800
1065.0	18.700	1950.0	18.800
1080.0	18.700	1980.0	18.800
1095.0	18.700	2010.0	18.900
1110.0	18.700	2040.0	18.900
1125.0	18.700	2070.0	18.900
1140.0	18.700	2100.0	18.900
1155.0	18.700	2130.0	18.900
1170.0	18.700	2160.0	18.900
1185.0	18.700	2190.0	18.900
1200.0	18.700	2220.0	18.900
1215.0	18.700	2250.0	18.900
1230.0	18.700	2280.0	18.900
1245.0	18.700	2310.0	18.900
1260.0	18.700	2340.0	18.900
1275.0	18.700	2370.0	18.900
1290.0	18.700	2400.0	18.900
1305.0	18.700	2430.0	18.900
1320.0	18.700	2460.0	18.900
1335.0	18.700	2490.0	18.900

(CONTINUED)

...ISHU RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ... M3/H3 GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2520.0	18.900	3810.0	19.000
3550.0	18.900	3840.0	19.000
2580.0	18.900	3870.0	19.000
2610.0	18.900	3900.0	19.000
2640.0	18.900	3930.0	19.000
2700.0	18.900	3960.0	19.000
2730.0	18.900	3990.0	19.000
2760.0	18.900	4020.0	19.000
2790.0	18.900	4050.0	19.000
2820.0	18.900	4080.0	19.000
2850.0	19.000	4110.0	19.000
2880.0	18.900	4140.0	19.000
2910.0	18.900	4170.0	19.000
2940.0	18.900	4200.0	19.000
2970.0	18.900	4230.0	19.000
3000.0	18.900	4260.0	19.000
3030.0	18.900	4290.0	19.000
3060.0	18.900	4320.0	19.000
3090.0	18.900	4350.0	19.000
3120.0	18.900	4380.0	19.000
3150.0	18.900	4410.0	19.000
3180.0	18.900	4440.0	19.000
3210.0	18.900	4470.0	19.000
3240.0	18.900	4500.0	19.000
3270.0	18.900	4530.0	19.000
3300.0	18.900	4560.0	19.000
3330.0	18.900	4590.0	19.000
3360.0	18.900	4620.0	19.000
3390.0	18.900	4650.0	19.000
3420.0	18.900	4680.0	19.000
3450.0	19.000	4710.0	19.100
3480.0	19.000	4740.0	19.100
3510.0	19.000	4770.0	19.100
3540.0	19.000	4800.0	19.100
3570.0	19.000	4830.0	19.100
3600.0	19.000	4860.0	19.200
3630.0	19.000	4890.0	19.200
3660.0	19.000	4920.0	19.100
3690.0	19.000	4950.0	19.100
3720.0	19.000	4980.0	19.100
3750.0	19.000	5010.0	19.100
3780.0	19.000	5040.0	19.100

(CONTINUED)

MUSHISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MG/ST GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
5070.0	19.100	6330.0	19.200
5100.0	19.100	6360.0	19.200
5130.0	19.100	6390.0	19.200
5160.0	19.100	6420.0	19.200
5190.0	19.200	6450.0	19.200
5220.0	19.200	6480.0	19.200
5250.0	19.200	6510.0	19.200
5280.0	19.200	6540.0	19.200
5310.0	19.200	6570.0	19.200
5340.0	19.200	6600.0	19.200
5370.0	19.200	6630.0	19.200
5400.0	19.200	6660.0	19.200
5430.0	19.200	6690.0	19.200
5460.0	19.200	6720.0	19.200
5490.0	19.100	6750.0	19.200
5520.0	19.100	6780.0	19.200
5550.0	19.100	6810.0	19.200
5580.0	19.100	6840.0	19.200
5610.0	19.200	6870.0	19.200
5640.0	19.200	6900.0	19.200
5670.0	19.100	6930.0	19.200
5700.0	19.100	6960.0	19.200
5730.0	19.100	6990.0	19.200
5760.0	19.100	7020.0	19.200
5790.0	19.100	7050.0	19.200
5820.0	19.100	7080.0	19.200
5850.0	19.100	7110.0	19.200
5880.0	19.200	7140.0	19.200
5910.0	19.200	7170.0	19.200
5940.0	19.200	7200.0	19.200
5970.0	19.200	7230.0	19.200
6000.0	19.200	7260.0	19.200
6030.0	19.200	7290.0	19.200
6060.0	19.200	7320.0	19.200
6090.0	19.200	7350.0	19.200
6120.0	19.200	7380.0	19.200
6150.0	19.200	7410.0	19.200
6180.0	19.200	7440.0	19.200
6210.0	19.200	7470.0	19.200
6240.0	19.200	7500.0	19.200
6270.0	19.200	7530.0	19.200
6300.0	19.200	7560.0	19.200

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7590.0	19.200	8850.0	19.200
7620.0	19.200	8880.0	19.200
7650.0	19.200	8910.0	19.200
7680.0	19.200	8940.0	19.200
7710.0	19.200	8970.0	19.200
7740.0	19.200	9000.0	19.200
7770.0	19.200	9030.0	19.200
7800.0	19.200	9060.0	19.200
7830.0	19.200	9090.0	19.200
7860.0	19.200	9120.0	19.200
7890.0	19.200	9150.0	19.200
7920.0	19.200	9180.0	19.200
7950.0	19.200	9210.0	19.200
7980.0	19.200	9240.0	19.200
8010.0	19.200	9270.0	19.200
8040.0	19.200	9300.0	19.200
8070.0	19.200	9330.0	19.200
8100.0	19.200	9360.0	19.200
8130.0	19.200	9390.0	19.200
8160.0	19.200	9420.0	19.200
8190.0	19.200	9450.0	19.200
8220.0	19.200	9480.0	19.200
8250.0	19.200	9510.0	19.200
8280.0	19.200	9540.0	19.200
8310.0	19.200	9570.0	19.200
8340.0	19.200	9600.0	19.200
8370.0	19.200	9630.0	19.200
8400.0	19.200	9660.0	19.200
8430.0	19.200	9690.0	19.200
8460.0	19.200	9720.0	19.200
8490.0	19.200	9750.0	19.200
8520.0	19.200	9780.0	19.200
8550.0	19.200	9810.0	19.200
8580.0	19.200	9840.0	19.200
8610.0	19.200	9870.0	19.200
8640.0	19.200	9900.0	19.200
8670.0	19.200	9930.0	19.200
8700.0	19.200	9960.0	19.200
8730.0	19.200	9990.0	19.200
8760.0	19.200	10020.0	19.200
8790.0	19.200	10050.0	19.200
8820.0	19.200	10080.0	19.200

(CONTINUED)

...ISHU RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING WELL ROSS' GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
10110.0	19.200	11370.0	19.200
10140.0	19.200	11400.0	19.200
10170.0	19.200	11430.0	19.200
10200.0	19.200	11460.0	19.200
10230.0	19.200	11490.0	19.200
10260.0	19.200	11520.0	19.200
10290.0	19.200	11550.0	19.200
10320.0	19.200	11580.0	19.200
10350.0	19.200	11610.0	19.200
10380.0	19.200	11640.0	19.200
10410.0	19.200	11670.0	19.200
10440.0	19.200	11700.0	19.200
10470.0	19.200	11730.0	19.200
10500.0	19.200	11760.0	19.200
10530.0	19.200	11790.0	19.200
10560.0	19.200	11820.0	19.200
10590.0	19.200	11850.0	19.200
10620.0	19.200	11880.0	19.200
10650.0	19.200	11910.0	19.200
10680.0	19.200	11940.0	19.200
10710.0	19.200	11970.0	19.200
10740.0	19.200	12000.0	19.200
10770.0	19.200	12030.0	19.200
10800.0	19.200	12060.0	19.200
10830.0	19.200	12090.0	19.200
10860.0	19.200	12120.0	19.200
10890.0	19.200	12150.0	19.200
10920.0	19.200	12180.0	19.200
10950.0	19.200	12210.0	19.200
10980.0	19.200	12240.0	19.200
11010.0	19.200	12270.0	19.200
11040.0	19.200	12300.0	19.200
11070.0	19.200	12330.0	19.200
11100.0	19.200	12360.0	19.200
11130.0	19.200	12390.0	19.200
11160.0	19.200	12420.0	19.200
11190.0	19.200	12450.0	19.200
11220.0	19.200	12480.0	19.200
11250.0	19.200	12510.0	19.200
11280.0	19.200	12540.0	19.200
11310.0	19.200	12570.0	19.200
11340.0	19.200	12600.0	19.200

(CONTINUED) [illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 52772333

DATE OF TEST 8 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
12630.0	19.200	13500.0	19.200
12660.0	19.200	13530.0	19.200
12690.0	19.200	13560.0	19.200
12720.0	19.200	13590.0	19.200
12750.0	19.200	13620.0	19.200
12780.0	19.200	13650.0	19.200
12810.0	19.200	13680.0	19.200
12840.0	19.200	13710.0	19.200
12870.0	19.200	13740.0	19.200
12900.0	19.200	13770.0	19.200
12930.0	19.200	13800.0	19.200
12960.0	19.200	13830.0	19.200
12990.0	19.200	13860.0	19.200
13020.0	19.200	13890.0	19.200
13050.0	19.200	13920.0	19.200
13080.0	19.200	13950.0	19.200
13110.0	19.200	13980.0	19.200
13140.0	19.200	14010.0	19.200
13170.0	19.200	14040.0	19.200
13200.0	19.200	14070.0	19.200
13230.0	19.200	14100.0	19.200
13260.0	19.200	14130.0	19.200
13290.0	19.200	14160.0	19.200
13320.0	19.200	14190.0	19.200
13350.0	19.200	14220.0	19.200
13380.0	19.200	14250.0	19.200
13410.0	19.200	14280.0	19.200
13440.0	19.200	14310.0	19.200
13470.0	19.200	14340.0	19.200

GROUNDWATER RESOURCE STUDY

ALL TIME DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT MGGST GRID REF. 52772333

DATE OF TEST 20 10 79

PUMPING RATES (M**3/DAY) :

596.0 FROM	0.0 MINS TO	120.0 MINS
649.0 FROM	120.0 MINS TO	240.0 MINS
1193.0 FROM	240.0 MINS TO	360.0 MINS
1553.0 FROM	360.0 MINS TO	480.0 MINS
1912.0 FROM	480.0 MINS TO	600.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
1.0	8.500	130.0	8.400
2.0	8.400	132.0	8.400
3.0	8.100	134.0	8.400
4.0	8.100	136.0	8.400
5.0	8.100	138.0	8.400
6.0	8.100	140.0	8.400
7.0	8.500	145.0	8.400
8.5	8.300	150.0	8.400
9.0	8.000	155.0	8.400
10.0	8.100	160.0	8.400
12.0	8.200	165.0	8.300
14.0	8.300	170.0	8.300
16.0	8.100	175.0	8.300
18.0	8.900	180.0	8.300
20.0	8.900	195.0	8.300
25.0	8.900	210.0	8.300
30.0	8.900	225.0	8.300
35.0	8.900	240.0	8.300
40.0	8.900	241.0	11.500
45.0	8.900	242.0	11.600
50.0	8.000	243.0	11.600
55.0	8.000	244.0	11.600
60.0	8.000	245.0	11.500
75.0	8.000	246.0	11.600
90.0	8.000	247.0	11.600
105.0	8.000	248.0	11.600
120.0	8.000	249.0	11.600
121.0	8.200	250.0	11.500
122.0	8.300	252.0	11.600
123.0	8.400	254.0	11.600
124.0	8.400	256.0	11.500
125.0	8.400	258.0	11.600
126.0	8.400	260.0	11.600
127.0	8.400	265.0	11.600
128.0	8.400	270.0	11.600
129.0	8.400	275.0	11.600

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 52772333

DATE OF TEST 20 10 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
280.0	11.600	435.0	15.900
285.0	11.500	450.0	15.900
290.0	11.600	465.0	15.900
295.0	11.600	480.0	15.900
300.0	11.600	481.0	16.300
315.0	11.600	482.0	18.300
330.0	11.600	483.0	18.300
345.0	11.600	484.0	18.300
360.0	11.600	485.0	18.300
361.0	15.900	486.0	18.300
362.0	16.000	487.0	18.300
363.0	16.000	488.0	18.300
364.0	15.900	489.0	18.300
365.0	16.000	490.0	18.300
366.0	15.800	492.0	18.300
367.0	15.900	494.0	18.300
368.0	15.900	496.0	18.300
369.0	15.900	498.0	18.300
370.0	15.900	500.0	18.300
372.0	15.900	505.0	18.300
374.0	15.900	510.0	18.300
376.0	15.900	515.0	18.300
378.0	15.900	520.0	18.300
380.0	15.900	525.0	18.300
385.0	15.900	530.0	18.300
390.0	15.900	535.0	18.300
395.0	15.900	540.0	18.300
400.0	15.900	555.0	18.300
405.0	15.900	570.0	18.400
410.0	15.900	585.0	18.400
415.0	15.900	600.0	18.400
420.0	15.900		

[illegible]DISH RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT [illegible]GGETA GRID REF. 53262418

DATE OF TEST 7 8 79

PUMPING RATES (M**3/DAY) :

595.0 FROM	0.0 MINS TO	90.0 MINS
945.0 FROM	90.0 MINS TO	180.0 MINS
1338.0 FROM	180.0 MINS TO	270.0 MINS
1692.0 FROM	270.0 MINS TO	360.0 MINS
2052.0 FROM	360.0 MINS TO	450.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
1.0	4.780	104.0	5.550
3.0	3.730	106.0	5.550
4.0	3.660	108.0	5.550
5.0	3.590	110.0	5.620
6.0	3.590	115.0	5.620
7.0	3.590	120.0	5.690
8.0	3.590	125.0	5.690
9.0	3.590	130.0	5.690
10.0	3.660	135.0	5.690
12.0	3.660	140.0	5.760
14.0	3.660	145.0	5.830
16.0	3.660	150.0	5.830
18.0	3.660	160.0	5.830
20.0	3.730	170.0	5.900
25.0	3.730	180.0	5.900
30.0	3.730	181.0	7.730
35.0	3.730	182.0	7.800
40.0	3.730	183.0	7.800
45.0	3.730	184.0	7.800
50.0	3.730	185.0	7.800
55.0	3.730	186.0	7.870
60.0	3.730	187.0	7.870
70.0	3.730	188.0	7.870
80.0	3.730	189.0	7.870
90.0	3.730	190.0	7.940
91.0	5.480	192.0	7.940
92.0	5.480	194.0	7.940
93.0	5.410	196.0	7.940
94.0	5.410	198.0	7.940
95.0	5.410	200.0	7.940
96.0	5.410	205.0	7.940
97.0	5.480	210.0	7.870
98.0	5.480	215.0	7.940
99.0	5.480	220.0	7.940
100.0	5.480	225.0	7.940
102.0	5.480	230.0	7.940

(CONTINUED)

MUSHISHU RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT MG32TA GRID REF. 53282418

DATE OF TEST 7 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
235.0	7.940	350.0	9.700
240.0	7.940	360.0	9.700
250.0	7.940	361.0	11.320
260.0	7.940	362.0	11.180
270.0	7.940	363.0	11.110
271.0	9.140	364.0	11.110
272.0	9.140	365.0	11.110
273.0	9.070	366.0	11.110
274.0	9.140	367.0	11.110
275.0	9.140	368.0	11.110
276.0	9.140	369.0	11.110
277.0	9.350	370.0	11.110
278.0	9.420	372.0	11.110
279.0	9.420	374.0	11.110
280.0	9.490	376.0	11.110
282.0	9.560	378.0	11.110
284.0	9.620	380.0	11.110
286.0	9.620	385.0	11.180
288.0	9.620	390.0	11.180
290.0	9.620	395.0	11.180
295.0	9.560	400.0	11.180
300.0	9.560	405.0	11.250
305.0	9.560	410.0	11.250
310.0	9.560	415.0	11.250
315.0	9.620	420.0	11.250
320.0	9.620	430.0	11.320
325.0	9.620	440.0	11.320
330.0	9.620	450.0	11.320
340.0	9.700		

MONDISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MONZTA GRID REF. 53282418

DATE OF TEST 9 8 79

PUMPING RATES (M**3/DAY) :
2052.0 FROM 0.0 MINS TO 14130.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	6.220	150.0	10.970
1.0	7.730	165.0	10.820
1.5	10.470	180.0	10.820
2.0	10.690	195.0	10.820
2.5	10.970	210.0	10.820
3.0	11.180	225.0	10.820
3.5	11.180	240.0	10.820
4.0	11.180	255.0	10.820
4.5	11.180	270.0	10.900
5.0	11.110	285.0	10.900
6.0	11.040	300.0	10.900
7.0	10.970	315.0	10.900
8.0	10.970	330.0	10.900
9.0	10.970	345.0	10.900
10.0	10.970	360.0	10.900
11.0	10.970	375.0	10.900
12.0	10.970	390.0	10.900
13.0	10.970	405.0	10.900
14.0	11.040	420.0	10.970
15.0	11.110	435.0	11.110
16.0	11.110	450.0	11.110
17.0	11.180	465.0	11.110
18.0	11.180	480.0	11.110
19.0	11.250	495.0	11.110
20.0	11.250	510.0	11.180
25.0	11.250	525.0	11.460
30.0	11.250	540.0	11.390
35.0	11.320	555.0	11.530
40.0	11.320	570.0	11.600
45.0	11.390	585.0	11.600
50.0	11.390	600.0	11.600
55.0	11.390	615.0	11.600
60.0	11.390	630.0	11.600
75.0	11.320	645.0	11.600
90.0	11.320	660.0	11.600
105.0	10.970	675.0	11.040
120.0	10.970	690.0	11.040
135.0	10.970	705.0	11.040

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] AUGST GRID REF. 52772333

DATE OF TEST 8 10 79

PUMPING RATES (M**3/DAY) :
1914.0 FROM 0.0 MINS TO 14340.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	14.500	150.0	18.500
1.0	13.400	165.0	18.500
1.5	14.700	180.0	18.500
2.0	15.100	195.0	18.500
2.5	15.200	210.0	18.500
3.0	17.100	225.0	18.500
3.5	16.200	240.0	18.500
4.0	16.400	255.0	18.500
4.5	16.400	270.0	18.500
5.0	16.400	285.0	18.500
6.0	16.400	300.0	18.500
7.0	16.500	315.0	18.500
8.0	16.500	330.0	18.500
9.0	16.500	345.0	18.500
10.0	16.500	360.0	18.500
11.0	16.500	375.0	18.500
12.0	16.500	390.0	18.500
13.0	16.500	405.0	18.500
14.0	16.500	420.0	18.500
15.0	16.500	435.0	18.600
16.0	16.500	450.0	18.600
17.0	16.400	465.0	18.600
18.0	16.300	480.0	18.600
19.0	16.300	495.0	18.600
20.0	16.300	510.0	18.600
25.0	16.400	525.0	18.600
30.0	16.400	540.0	18.600
35.0	16.400	555.0	18.600
40.0	16.300	570.0	18.600
45.0	16.400	585.0	18.700
50.0	16.400	600.0	18.700
55.0	16.400	615.0	18.700
60.0	16.400	630.0	18.700
75.0	16.400	645.0	18.700
90.0	16.400	660.0	18.700
105.0	16.400	675.0	18.700
120.0	16.500	690.0	18.800
135.0	16.500	705.0	18.800

(CONTINUED)

...SBISMO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ...ETA GRID REF. 53202418

DATE OF TEST 9 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
720.0	11.040	1350.0	10.760
735.0	11.040	1365.0	10.760
750.0	11.040	1380.0	10.760
765.0	11.040	1395.0	10.970
780.0	11.040	1410.0	10.970
795.0	10.970	1425.0	10.970
810.0	10.760	1440.0	10.970
825.0	10.900	1470.0	10.970
840.0	10.970	1500.0	10.900
855.0	11.040	1530.0	10.900
870.0	11.040	1560.0	10.820
885.0	11.110	1590.0	10.900
900.0	11.110	1620.0	10.970
915.0	11.180	1650.0	11.040
930.0	11.180	1680.0	10.970
945.0	11.110	1710.0	11.040
960.0	11.180	1740.0	11.110
975.0	11.040	1770.0	11.110
990.0	11.110	1800.0	10.900
1005.0	10.970	1830.0	11.110
1020.0	11.390	1860.0	11.040
1035.0	11.530	1890.0	11.040
1050.0	11.670	1920.0	11.040
1065.0	11.670	1950.0	11.110
1080.0	11.670	1980.0	10.900
1095.0	11.670	2010.0	10.900
1110.0	11.670	2040.0	11.040
1125.0	11.670	2070.0	10.900
1140.0	11.670	2100.0	11.040
1155.0	11.530	2130.0	11.040
1170.0	11.530	2160.0	11.040
1185.0	11.600	2190.0	11.040
1200.0	11.530	2220.0	11.040
1215.0	11.530	2250.0	11.040
1230.0	11.460	2280.0	11.040
1245.0	11.530	2310.0	11.110
1260.0	11.530	2340.0	11.180
1275.0	11.460	2370.0	11.110
1290.0	11.390	2400.0	11.320
1305.0	11.460	2430.0	11.180
1320.0	11.460	2460.0	11.320
1335.0	11.040	2490.0	11.320

(CONTINUED)

MOGADISHU RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MOGZIA GRID REF. 53282418

DATE OF TEST 9 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2520.0	11.070	3780.0	11.040
2550.0	11.070	3810.0	11.040
2580.0	11.070	3840.0	11.040
2610.0	10.900	3870.0	10.970
2640.0	10.900	3900.0	11.040
2670.0	10.900	3930.0	11.040
2700.0	10.900	3960.0	11.040
2730.0	10.900	3990.0	11.110
2760.0	10.900	4020.0	11.040
2790.0	10.900	4050.0	11.040
2820.0	10.900	4080.0	11.040
2850.0	10.900	4110.0	11.180
2880.0	10.910	4140.0	11.180
2910.0	10.900	4170.0	10.760
2940.0	10.900	4200.0	10.760
2970.0	10.970	4230.0	10.900
3000.0	10.970	4260.0	10.970
3030.0	10.970	4290.0	10.970
3060.0	10.970	4320.0	10.970
3090.0	10.900	4350.0	10.900
3120.0	10.900	4380.0	10.900
3150.0	10.900	4410.0	10.900
3180.0	10.900	4440.0	10.900
3210.0	10.970	4470.0	10.970
3240.0	10.970	4500.0	10.900
3270.0	11.460	4530.0	10.970
3300.0	11.460	4560.0	10.970
3330.0	11.460	4590.0	10.970
3360.0	11.180	4620.0	10.970
3390.0	11.040	4650.0	10.970
3420.0	11.040	4680.0	10.970
3450.0	11.040	4710.0	10.970
3480.0	10.900	4740.0	10.900
3510.0	11.040	4770.0	10.900
3540.0	11.040	4800.0	10.900
3570.0	11.040	4830.0	10.900
3600.0	11.040	4860.0	10.900
3630.0	10.970	4890.0	10.900
3660.0	10.970	4920.0	10.900
3690.0	10.970	4950.0	10.900
3720.0	10.970	4980.0	10.900
3750.0	11.040	5010.0	10.900

(CONTINUED) [illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 53282418

DATE OF TEST 9 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
5040.0	10.900	6420.0	10.760
5070.0	10.900	6450.0	10.760
5100.0	11.110	6480.0	10.760
5130.0	11.040	6510.0	10.760
5160.0	11.110	6540.0	10.760
5190.0	11.040	6570.0	10.760
5220.0	11.110	6600.0	10.760
5250.0	11.110	6630.0	10.760
5280.0	11.320	6660.0	10.760
5310.0	11.180	6690.0	10.900
5340.0	11.320	6720.0	10.900
5370.0	11.600	6750.0	10.900
5400.0	11.670	6780.0	10.760
5430.0	10.670	6810.0	10.760
5460.0	10.470	6840.0	10.760
5490.0	10.970	6870.0	11.040
5520.0	10.540	6900.0	10.970
5550.0	10.760	6930.0	11.040
5580.0	10.760	6960.0	11.040
5610.0	10.540	6990.0	11.040
5760.0	11.250	7020.0	11.040
5790.0	11.110	7050.0	11.110
5820.0	11.040	7080.0	11.040
5850.0	11.040	7110.0	11.110
5880.0	11.110	7140.0	10.970
5910.0	11.110	7170.0	10.540
5940.0	11.110	7200.0	10.540
5970.0	11.110	7230.0	10.470
6000.0	11.110	7260.0	10.470
6030.0	11.320	7290.0	10.470
6060.0	11.390	7320.0	10.540
6090.0	11.180	7350.0	10.610
6120.0	11.390	7380.0	10.760
6150.0	10.540	7410.0	10.900
6180.0	10.400	7440.0	10.820
6210.0	10.470	7470.0	10.820
6240.0	10.530	7500.0	10.900
6270.0	10.690	7530.0	10.970
6300.0	10.690	7560.0	10.900
6330.0	10.690	7590.0	10.900
6360.0	10.690	7620.0	10.970
6390.0	10.760	7650.0	10.970

(CONTINUED)

GROUNDWATER RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 53282418

DATE OF TEST 9 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7680.0	11.110	8940.0	10.760
7710.0	11.110	8970.0	10.760
7740.0	11.320	9000.0	10.760
7770.0	11.320	9030.0	11.040
7800.0	11.600	9060.0	11.040
7830.0	11.600	9090.0	11.110
7860.0	11.390	9120.0	11.040
7890.0	11.600	9150.0	10.970
7920.0	11.600	9180.0	11.320
7950.0	11.670	9210.0	11.600
7980.0	11.600	9240.0	11.670
8010.0	11.740	9270.0	11.670
8040.0	11.740	9300.0	11.670
8070.0	11.670	9330.0	11.740
8100.0	11.600	9360.0	11.740
8130.0	11.600	9390.0	11.460
8160.0	11.600	9420.0	11.040
8190.0	11.460	9450.0	11.040
8220.0	11.040	9480.0	11.040
8250.0	10.970	9510.0	10.900
8280.0	10.970	9540.0	10.900
8310.0	11.040	9570.0	10.900
8340.0	10.970	9600.0	10.900
8370.0	10.970	9630.0	10.900
8400.0	11.040	9660.0	10.900
8430.0	11.040	9690.0	10.760
8460.0	10.970	9720.0	11.040
8490.0	11.390	9750.0	11.040
8520.0	11.320	9780.0	10.970
8550.0	11.110	9810.0	10.970
8580.0	11.320	9840.0	10.970
8610.0	11.110	9870.0	10.970
8640.0	11.110	9900.0	10.970
8670.0	10.690	9930.0	11.040
8700.0	10.690	9960.0	10.690
8730.0	10.900	9990.0	10.900
8760.0	10.760	10020.0	10.900
8790.0	10.820	10050.0	10.970
8820.0	10.820	10080.0	10.970
8850.0	10.820	10110.0	10.900
8880.0	10.820	10140.0	10.900
8910.0	10.760	10170.0	10.820

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 53282418

DATE OF TEST 9 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
10200.0	10.820	11460.0	11.390
10230.0	10.820	11490.0	11.530
10260.0	10.900	11520.0	10.900
10290.0	10.900	11550.0	10.900
10320.0	10.900	11580.0	10.900
10350.0	10.900	11610.0	10.900
10380.0	10.820	11640.0	10.820
10410.0	10.900	11670.0	10.820
10440.0	10.900	11700.0	10.820
10470.0	10.900	11730.0	10.900
10500.0	10.900	11760.0	10.970
10530.0	10.970	11790.0	10.970
10560.0	11.110	11820.0	10.970
10590.0	11.040	11850.0	11.040
10620.0	11.040	11880.0	10.970
10650.0	11.320	11910.0	11.040
10680.0	11.110	11940.0	11.040
10710.0	11.110	11970.0	11.600
10740.0	11.110	12000.0	11.670
10770.0	11.320	12030.0	11.670
10800.0	11.320	12060.0	11.670
10830.0	11.530	12090.0	11.600
10860.0	11.600	12120.0	11.740
10890.0	11.110	12150.0	11.740
10920.0	11.040	12180.0	11.670
10950.0	11.040	12210.0	11.670
10980.0	11.040	12240.0	11.040
11010.0	11.040	12270.0	11.740
11040.0	11.040	12300.0	11.600
11070.0	11.040	12330.0	11.740
11100.0	11.040	12360.0	11.740
11130.0	11.040	12390.0	11.530
11160.0	11.040	12420.0	11.530
11190.0	11.040	12450.0	11.460
11220.0	11.040	12480.0	11.390
11250.0	11.040	12510.0	11.460
11280.0	11.110	12540.0	11.460
11310.0	11.180	12570.0	11.390
11340.0	11.740	12600.0	11.390
11370.0	11.390	12630.0	11.320
11400.0	11.390	12660.0	11.110
11430.0	11.600	12690.0	11.040

(CONTINUED)

TOWNSHO RESOURCE STUDY

ALL TIME DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MONETA GRID REF. 53282418

DATE OF TEST 9 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
12720.0	11.040	13440.0	10.970
12750.0	11.110	13470.0	10.970
12780.0	11.320	13500.0	10.970
12810.0	11.390	13530.0	11.040
12840.0	11.390	13560.0	11.040
12870.0	11.530	13590.0	11.040
12900.0	11.600	13620.0	11.040
12930.0	10.970	13650.0	11.040
12960.0	10.900	13680.0	11.040
12990.0	10.900	13710.0	11.110
13020.0	10.970	13740.0	11.530
13050.0	11.040	13770.0	11.600
13080.0	10.970	13800.0	11.600
13110.0	10.970	13830.0	11.670
13140.0	10.900	13860.0	11.670
13170.0	10.970	13890.0	11.670
13200.0	10.900	13920.0	11.670
13230.0	10.900	13950.0	11.740
13260.0	10.900	13980.0	11.670
13290.0	10.970	14010.0	11.600
13320.0	10.970	14040.0	11.040
13350.0	10.970	14070.0	11.040
13380.0	10.970	14100.0	11.040
13410.0	10.970	14130.0	10.820

[illegible]ISH[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 53292418

PUMPING AT [illegible] GRID REF. 53282418

DATE OF TEST 28 7 79

PUMPING RATES (M**3/DAY) :
2052.0 FROM 0.0 MINS TO 9810.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.2	.005	150.0	.650
.3	.128	165.0	.651
1.0	.225	180.0	.651
1.5	.381	195.0	.652
2.0	.470	210.0	.652
2.5	.512	225.0	.653
3.0	.535	240.0	.653
3.5	.550	255.0	.654
4.0	.562	270.0	.655
4.5	.572	285.0	.656
5.0	.578	300.0	.657
7.0	.597	315.0	.660
8.0	.603	330.0	.660
9.0	.610	345.0	.662
10.0	.612	360.0	.664
11.0	.615	375.0	.665
12.0	.617	390.0	.665
13.0	.620	405.0	.667
14.0	.622	420.0	.670
15.0	.623	435.0	.673
16.0	.623	450.0	.673
17.0	.624	465.0	.676
18.0	.627	480.0	.677
19.0	.628	495.0	.678
20.0	.629	510.0	.680
25.0	.632	525.0	.681
30.0	.634	540.0	.683
35.0	.636	555.0	.684
40.0	.638	570.0	.686
45.0	.639	585.0	.688
50.0	.640	600.0	.689
55.0	.640	615.0	.691
60.0	.641	630.0	.693
75.0	.642	645.0	.696
105.0	.643	660.0	.696
120.0	.647	675.0	.697
135.0	.649	690.0	.699

(CONTINUED)

GROUNDWATER RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MOW6PA GRID REF. 53292418

PUMPING AT MOW2TA GRID REF. 53282418

DATE OF TEST 28 7 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
705.0	.698	1320.0	.744
720.0	.700	1335.0	.744
735.0	.700	1350.0	.747
750.0	.701	1365.0	.752
765.0	.702	1380.0	.752
780.0	.702	1395.0	.753
795.0	.702	1410.0	.752
810.0	.702	1425.0	.752
825.0	.702	1440.0	.752
840.0	.702	1470.0	.752
855.0	.699	1500.0	.750
870.0	.700	1530.0	.748
885.0	.702	1560.0	.746
900.0	.703	1590.0	.742
915.0	.703	1620.0	.740
930.0	.704	1650.0	.738
945.0	.702	1680.0	.735
960.0	.704	1710.0	.730
975.0	.705	1740.0	.730
990.0	.708	1770.0	.730
1005.0	.707	1800.0	.730
1020.0	.705	1830.0	.730
1035.0	.708	1860.0	.732
1050.0	.709	1890.0	.734
1065.0	.704	1920.0	.734
1080.0	.705	1950.0	.736
1095.0	.709	1980.0	.743
1110.0	.715	2010.0	.744
1125.0	.719	2040.0	.749
1140.0	.718	2070.0	.752
1155.0	.724	2100.0	.756
1170.0	.725	2130.0	.756
1185.0	.724	2160.0	.756
1200.0	.727	2190.0	.756
1215.0	.729	2220.0	.756
1230.0	.732	2250.0	.763
1245.0	.732	2280.0	.764
1260.0	.734	2310.0	.762
1275.0	.737	2340.0	.760
1290.0	.739	2370.0	.764
1305.0	.742	2400.0	.765

(CONTINUED)

...UISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ...GUETA GRID REF. 53292418

PUMPED AT ...GUETA GRID REF. 53282418

DATE OF TEST 28 7 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2430.0	.763	3750.0	.784
2460.0	.764	3780.0	.782
2490.0	.766	3810.0	.780
2520.0	.768	3840.0	.778
2550.0	.769	3870.0	.778
2580.0	.769	3900.0	.777
2700.0	.767	3930.0	.773
2730.0	.771	3960.0	.776
2760.0	.773	3990.0	.779
2790.0	.778	4020.0	.784
2820.0	.781	4050.0	.786
2850.0	.786	4080.0	.792
2880.0	.782	4110.0	.793
2910.0	.780	4140.0	.798
2940.0	.780	4170.0	.805
2970.0	.775	4200.0	.808
3000.0	.723	4230.0	.811
3030.0	.770	4260.0	.813
3060.0	.767	4290.0	.813
3090.0	.765	4320.0	.813
3120.0	.763	4350.0	.808
3150.0	.760	4380.0	.804
3180.0	.756	4410.0	.801
3210.0	.756	4440.0	.800
3240.0	.757	4470.0	.797
3270.0	.757	4500.0	.794
3300.0	.759	4530.0	.791
3330.0	.765	4560.0	.784
3360.0	.768	4590.0	.783
3390.0	.773	4620.0	.781
3420.0	.775	4650.0	.781
3450.0	.776	4680.0	.781
3480.0	.782	4710.0	.782
3510.0	.785	4740.0	.782
3540.0	.787	4770.0	.785
3570.0	.789	4800.0	.789
3600.0	.787	4830.0	.793
3630.0	.791	4860.0	.794
3660.0	.789	4890.0	.796
3690.0	.787	4920.0	.798
3720.0	.786	4950.0	.800

(CONTINUED)

GOODISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT SO96PA GRID REF. 53292418

PUMPING AT SO92TA GRID REF. 53282418

DATE OF TEST 28 7 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
4980.0	.806	6210.0	.817
5010.0	.808	6240.0	.818
5040.0	.812	6270.0	.824
5070.0	.813	6300.0	.825
5100.0	.813	6330.0	.828
5130.0	.812	7140.0	.842
5160.0	.809	7170.0	.844
5190.0	.802	7440.0	.821
5220.0	.808	7470.0	.820
5250.0	.806	7500.0	.817
5280.0	.807	7530.0	.817
5310.0	.807	7560.0	.818
5340.0	.803	7590.0	.818
5370.0	.804	7620.0	.820
5400.0	.805	7650.0	.824
5430.0	.807	7680.0	.830
5460.0	.810	7710.0	.831
5490.0	.811	7740.0	.831
5520.0	.815	7770.0	.833
5550.0	.817	7800.0	.840
5580.0	.819	7830.0	.841
5610.0	.816	7860.0	.844
5640.0	.822	7890.0	.845
5670.0	.825	7920.0	.845
5700.0	.826	7950.0	.846
5730.0	.827	7980.0	.848
5760.0	.823	8010.0	.850
5790.0	.823	8040.0	.848
5820.0	.822	8070.0	.849
5850.0	.820	8100.0	.847
5880.0	.818	8130.0	.847
5910.0	.817	8160.0	.846
5940.0	.815	8190.0	.844
5970.0	.802	8220.0	.843
6000.0	.805	8250.0	.842
6030.0	.802	8280.0	.840
6060.0	.803	8310.0	.843
6090.0	.800	8340.0	.842
6120.0	.818	8370.0	.846
6150.0	.816	8400.0	.847
6180.0	.817	8430.0	.845

(CONTINUED)

[illegible]ISHU RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 53292418

PUMPING AT [illegible] GRID REF. 53282418

DATE OF TEST 28 7 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
8460.0	.848	9330.0	.849
8490.0	.850	9360.0	.850
8520.0	.858	9390.0	.850
8550.0	.856	9420.0	.849
8940.0	.822	9450.0	.850
8970.0	.821	9480.0	.848
9000.0	.820	9510.0	.848
9030.0	.819	9540.0	.842
9030.0	.819	9570.0	.842
9060.0	.820	9600.0	.839
9090.0	.823	9630.0	.838
9120.0	.826	9660.0	.838
9150.0	.829	9690.0	.841
9180.0	.836	9720.0	.842
9210.0	.837	9750.0	.846
9240.0	.843	9780.0	.847
9270.0	.844	9810.0	.847
9300.0	.848		

GOOISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MOOOPA GRID REF. 53292418

PUMPING AT MOOZIA GRID REF. 53282418

DATE OF TEST 9 8 79

PUMPING RATES (M**3/DAY) :
2652.0 FROM 0.0 MINS TO 14160.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	.223	135.0	.670
1.0	.319	150.0	.673
1.5	.435	165.0	.671
2.0	.519	180.0	.671
2.5	.557	195.0	.670
3.0	.583	210.0	.671
3.5	.604	225.0	.671
4.0	.611	240.0	.673
4.5	.618	255.0	.675
5.0	.625	270.0	.678
6.0	.628	285.0	.681
7.0	.635	300.0	.683
8.0	.640	315.0	.686
9.0	.644	330.0	.691
10.0	.646	345.0	.694
11.0	.649	360.0	.695
12.0	.652	375.0	.697
13.0	.654	390.0	.700
14.0	.655	405.0	.703
15.0	.656	420.0	.704
16.0	.658	435.0	.706
17.0	.659	450.0	.707
18.0	.660	465.0	.710
19.0	.661	480.0	.713
20.0	.662	495.0	.715
25.0	.664	510.0	.717
30.0	.666	525.0	.721
35.0	.667	540.0	.724
40.0	.668	555.0	.726
45.0	.669	570.0	.728
50.0	.669	585.0	.731
55.0	.669	600.0	.733
60.0	.668	615.0	.740
75.0	.668	630.0	.741
90.0	.666	645.0	.740
105.0	.666	660.0	.740
120.0	.667	675.0	.741

(CONTINUED) [illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 53292416

PUMPING AT [illegible] GRID REF. 53282418

DATE OF TEST 9 6 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
690.0	.742	1320.0	.781
705.0	.743	1335.0	.781
720.0	.743	1350.0	.781
735.0	.743	1365.0	.781
750.0	.742	1380.0	.780
765.0	.741	1395.0	.780
780.0	.741	1410.0	.779
795.0	.738	1425.0	.776
810.0	.737	1440.0	.775
825.0	.737	1470.0	.770
840.0	.736	1500.0	.767
855.0	.735	1530.0	.765
870.0	.735	1560.0	.765
885.0	.736	1590.0	.769
900.0	.739	1620.0	.770
915.0	.740	1650.0	.771
930.0	.741	1680.0	.770
945.0	.741	1710.0	.770
960.0	.742	1740.0	.771
975.0	.742	1770.0	.772
990.0	.746	1800.0	.773
1005.0	.747	1830.0	.775
1020.0	.751	1860.0	.778
1035.0	.750	1890.0	.783
1050.0	.751	1920.0	.785
1065.0	.752	1950.0	.788
1080.0	.756	1980.0	.791
1095.0	.761	2010.0	.793
1110.0	.761	2040.0	.798
1125.0	.765	2070.0	.796
1140.0	.769	2100.0	.798
1155.0	.770	2130.0	.797
1170.0	.772	2160.0	.799
1200.0	.775	2190.0	.797
1215.0	.777	2220.0	.796
1230.0	.775	2250.0	.795
1245.0	.776	2280.0	.791
1260.0	.777	2310.0	.787
1275.0	.779	2340.0	.786
1290.0	.780	2370.0	.785
1305.0	.780	2400.0	.786

(CONTINUED)

MONDISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MONOPA GRID REF. 53292418

PUMPING AT MONZTA GRID REF. 53282418

DATE OF TEST 9 6 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2430.0	.796	3660.0	.829
2460.0	.796	3690.0	.828
2490.0	.796	3720.0	.828
2520.0	.799	3750.0	.826
2550.0	.806	3780.0	.826
2580.0	.807	3810.0	.827
2610.0	.813	3840.0	.828
2640.0	.821	3870.0	.829
2670.0	.821	3900.0	.826
2700.0	.822	3930.0	.826
2730.0	.825	3960.0	.837
2760.0	.825	3990.0	.838
2790.0	.825	4020.0	.841
2820.0	.823	4050.0	.845
2850.0	.820	4080.0	.848
2880.0	.815	4110.0	.855
2910.0	.813	4140.0	.856
2940.0	.806	4170.0	.855
2970.0	.803	4200.0	.855
3000.0	.801	4230.0	.850
3030.0	.797	4260.0	.845
3060.0	.796	4290.0	.843
3090.0	.795	4320.0	.838
3120.0	.795	4350.0	.834
3150.0	.796	4380.0	.833
3180.0	.802	4410.0	.831
3210.0	.797	4440.0	.828
3240.0	.808	4470.0	.825
3270.0	.802	4500.0	.826
3300.0	.803	4530.0	.825
3330.0	.815	4560.0	.826
3360.0	.818	4590.0	.825
3390.0	.820	4620.0	.824
3420.0	.823	4650.0	.827
3450.0	.825	4680.0	.825
3480.0	.831	4710.0	.834
3510.0	.832	4740.0	.841
3540.0	.833	4770.0	.845
3570.0	.833	4800.0	.850
3600.0	.835	4830.0	.850
3630.0	.832	4860.0	.851

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 53292418

PUMPING AT [illegible] GRID REF. 53282418

DATE OF TEST 9 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
4890.0	.852	6120.0	.828
4920.0	.852	6150.0	.830
4950.0	.844	6180.0	.833
4980.0	.855	6210.0	.835
5010.0	.855	9240.0	.836
5040.0	.854	6270.0	.842
5070.0	.856	6300.0	.850
5100.0	.846	6330.0	.851
5130.0	.847	6360.0	.853
5160.0	.848	6390.0	.853
5190.0	.845	6420.0	.853
5220.0	.845	6450.0	.854
5250.0	.839	6480.0	.854
5280.0	.840	6510.0	.848
5310.0	.838	6540.0	.848
5340.0	.836	6570.0	.845
5370.0	.845	6600.0	.847
5400.0	.847	6630.0	.846
5430.0	.844	6660.0	.845
5460.0	.855	6690.0	.845
5490.0	.857	6720.0	.845
5520.0	.860	6750.0	.852
5550.0	.861	6780.0	.847
5580.0	.860	6810.0	.851
5610.0	.859	6840.0	.853
5640.0	.856	6870.0	.850
5670.0	.854	6900.0	.847
5700.0	.850	6930.0	.845
5730.0	.845	6960.0	.862
5760.0	.842	6990.0	.865
5790.0	.830	7020.0	.860
5820.0	.831	7050.0	.855
5850.0	.829	7080.0	.856
5880.0	.827	7110.0	.858
5910.0	.818	7140.0	.855
5940.0	.817	7170.0	.855
5970.0	.819	7200.0	.853
6000.0	.815	7230.0	.848
6030.0	.820	7260.0	.843
6060.0	.816	7290.0	.841
6090.0	.819	7320.0	.838

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. S3292418

PUMPING AT [illegible] GRID REF. S3282418

DATE OF TEST 9 6 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7350.0	.835	8580.0	.875
7380.0	.833	8610.0	.872
7410.0	.828	8640.0	.871
7440.0	.827	8670.0	.865
7470.0	.831	8700.0	.861
7500.0	.833	8730.0	.855
7530.0	.834	8760.0	.851
7560.0	.836	8790.0	.847
7590.0	.837	8820.0	.845
7620.0	.839	8850.0	.845
7650.0	.841	8880.0	.845
7680.0	.839	8910.0	.845
7710.0	.850	8940.0	.848
7740.0	.851	8970.0	.848
7770.0	.849	9000.0	.858
7800.0	.850	9030.0	.859
7830.0	.851	9060.0	.860
7860.0	.852	9090.0	.861
7890.0	.855	9120.0	.860
7920.0	.858	9150.0	.862
7950.0	.857	9180.0	.862
7980.0	.859	9210.0	.867
8010.0	.868	9240.0	.865
8040.0	.875	9270.0	.870
8070.0	.865	9300.0	.871
8100.0	.866	9330.0	.871
8130.0	.866	9360.0	.870
8160.0	.867	9540.0	.868
8190.0	.868	9570.0	.867
8220.0	.868	9600.0	.870
8250.0	.871	9630.0	.871
8280.0	.873	9660.0	.871
8310.0	.873	9690.0	.871
8340.0	.877	9720.0	.877
8370.0	.876	9750.0	.876
8400.0	.881	9780.0	.875
8430.0	.882	9810.0	.882
8460.0	.882	9840.0	.885
8490.0	.881	9870.0	.886
8520.0	.890	9900.0	.885
8550.0	.877	9930.0	.882

(CONTINUED)

...ISH RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ...GRID REF. 53292418

PUMPING AT ...GRID REF. 53282418

DATE OF TEST 9 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
9960.0	.876	11190.0	.883
9990.0	.880	11220.0	.885
10020.0	.877	11250.0	.887
10050.0	.879	11280.0	.889
10080.0	.878	11310.0	.890
10110.0	.867	11340.0	.891
10140.0	.861	11370.0	.892
10170.0	.857	11400.0	.891
10200.0	.853	11430.0	.887
10230.0	.852	11460.0	.889
10260.0	.850	11490.0	.885
10290.0	.850	11520.0	.880
10320.0	.850	11550.0	.874
10350.0	.850	11580.0	.868
10380.0	.853	11610.0	.862
10410.0	.857	11640.0	.858
10440.0	.862	11670.0	.852
10470.0	.864	11700.0	.847
10500.0	.866	11730.0	.848
10530.0	.867	11760.0	.851
10560.0	.869	11790.0	.849
10590.0	.855	11820.0	.858
10620.0	.856	11910.0	.860
10650.0	.871	11940.0	.859
10680.0	.870	11970.0	.851
10710.0	.877	12000.0	.864
10740.0	.879	12030.0	.866
10770.0	.880	12060.0	.867
10800.0	.872	12090.0	.869
10830.0	.871	12120.0	.866
10860.0	.871	12150.0	.866
10890.0	.867	12180.0	.877
10920.0	.866	12210.0	.875
10950.0	.866	12240.0	.874
10980.0	.867	12270.0	.866
11010.0	.867	12300.0	.874
11040.0	.867	12330.0	.875
11070.0	.869	12360.0	.873
11100.0	.873	12390.0	.874
11130.0	.877	12420.0	.875
11160.0	.880	12450.0	.870

(CONTINUED)

GROUNDWATER RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT BOREHOLE GRID REF. 5329241N

PUMPING AT BOREHOLE GRID REF. 5328241N

DATE OF TEST 9 8 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
12480.0	.878	13350.0	.875
12510.0	.881	13380.0	.878
12540.0	.883	13410.0	.881
12570.0	.886	13440.0	.883
12600.0	.890	13470.0	.887
12630.0	.891	13500.0	.890
12660.0	.890	13530.0	.893
12690.0	.894	13560.0	.893
12720.0	.896	13590.0	.893
12750.0	.898	13620.0	.893
12780.0	.900	13650.0	.893
12810.0	.901	13680.0	.891
12840.0	.901	13710.0	.888
12870.0	.902	13740.0	.889
12900.0	.896	13770.0	.890
12930.0	.891	13800.0	.890
12960.0	.887	13830.0	.891
12990.0	.882	13860.0	.888
13020.0	.877	13890.0	.886
13050.0	.878	13920.0	.886
13080.0	.886	13950.0	.885
13110.0	.896	13980.0	.889
13140.0	.886	14010.0	.890
13170.0	.884	14040.0	.896
13200.0	.883	14070.0	.903
13230.0	.883	14100.0	.907
13260.0	.885	14130.0	.911
13290.0	.873	14160.0	.907
13320.0	.873		

TOURISM RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT 46/-4T GRID REF. 53642341

DATE OF TEST 27 5 79

PUMPING RATES (M**3/DAY) :
1550.0 FROM 0.0 MINS TO 14370.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
1.0	27.700	330.0	31.420
2.0	28.650	360.0	31.350
3.0	28.820	390.0	31.280
4.0	29.040	420.0	31.350
5.0	29.590	450.0	31.210
6.0	29.590	480.0	31.350
7.0	29.730	510.0	31.350
8.0	29.810	540.0	31.280
9.0	29.870	570.0	31.280
10.0	29.950	600.0	31.350
12.0	30.090	630.0	31.280
14.0	30.090	660.0	31.280
16.0	30.230	690.0	31.490
18.0	30.300	720.0	31.490
20.0	30.370	750.0	31.490
22.0	30.440	780.0	31.570
24.0	30.440	810.0	31.570
26.0	30.510	840.0	31.570
28.0	30.510	870.0	31.630
30.0	30.510	900.0	31.630
35.0	30.580	930.0	31.630
40.0	30.650	960.0	31.630
45.0	30.650	990.0	31.570
50.0	30.650	1020.0	31.570
55.0	30.720	1050.0	31.630
60.0	30.720	1080.0	31.630
70.0	30.790	1110.0	31.630
80.0	30.860	1140.0	31.710
90.0	30.790	1170.0	31.900
100.0	30.860	1200.0	31.900
110.0	30.860	1230.0	31.840
120.0	30.930	1260.0	31.900
150.0	31.070	1290.0	31.900
180.0	31.070	1320.0	31.840
210.0	31.140	1350.0	31.840
240.0	31.140	1380.0	31.840
270.0	31.280	1410.0	31.770
300.0	31.210	1440.0	31.840

(CONTINUED)

MOGDISHU RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MOG-41 GRID REF. 53542341

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
1470.0	31.770	2730.0	31.900
1500.0	31.840	2760.0	31.840
1530.0	31.840	2790.0	31.840
1560.0	31.840	2820.0	31.840
1590.0	31.900	2850.0	31.840
1620.0	31.900	2880.0	31.840
1650.0	31.900	2910.0	31.840
1680.0	31.900	2940.0	31.840
1710.0	31.980	2970.0	31.840
1740.0	31.980	3000.0	31.840
1770.0	31.980	3030.0	31.770
1800.0	31.900	3060.0	31.770
1830.0	31.900	3090.0	31.770
1860.0	31.900	3120.0	31.770
1890.0	31.900	3150.0	31.770
1920.0	31.900	3180.0	30.580
1950.0	32.060	3210.0	30.580
1980.0	31.900	3240.0	30.510
2010.0	31.900	3270.0	30.510
2040.0	31.900	3300.0	30.510
2070.0	32.130	3330.0	30.580
2100.0	31.900	3360.0	30.510
2130.0	31.900	3390.0	30.510
2160.0	31.900	3420.0	30.510
2190.0	31.900	3450.0	30.510
2220.0	32.060	3480.0	30.510
2250.0	32.130	3510.0	30.440
2280.0	32.060	3540.0	30.440
2310.0	32.060	3570.0	30.510
2340.0	32.130	3600.0	30.510
2370.0	32.130	3630.0	30.510
2400.0	31.980	3660.0	30.510
2430.0	32.060	3690.0	30.510
2460.0	32.060	3720.0	30.510
2490.0	32.060	3750.0	30.510
2520.0	31.980	3780.0	30.510
2550.0	31.980	3810.0	30.510
2580.0	31.980	3840.0	30.510
2610.0	31.900	3870.0	30.510
2640.0	31.900	3900.0	30.440
2670.0	31.900	3930.0	30.510
2700.0	31.900	3960.0	30.510

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPED AT [illegible] GRID REF. 53042341

DATE OF TEST 27 5 76

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
3990.0	30.510	5250.0	30.510
4020.0	30.510	5280.0	30.510
4050.0	30.510	5310.0	30.510
4080.0	30.510	5340.0	30.510
4110.0	30.510	5370.0	30.510
4140.0	30.510	5400.0	30.510
4170.0	30.510	5430.0	30.510
4200.0	30.440	5460.0	30.510
4230.0	30.510	5490.0	30.510
4260.0	30.510	5520.0	30.510
4290.0	30.510	5550.0	30.580
4320.0	30.510	5580.0	30.580
4350.0	30.510	5610.0	30.510
4380.0	30.510	5640.0	30.510
4410.0	30.510	5670.0	30.510
4440.0	30.510	5700.0	30.510
4470.0	30.810	5730.0	30.510
4500.0	30.510	5760.0	30.510
4530.0	30.510	5790.0	30.510
4560.0	30.370	5820.0	30.580
4590.0	30.510	5850.0	30.650
4620.0	30.510	5880.0	30.580
4650.0	30.510	5910.0	30.580
4680.0	30.510	5940.0	30.650
4710.0	30.510	5970.0	30.580
4740.0	30.510	6000.0	30.580
4770.0	30.510	6030.0	30.650
4800.0	30.510	6060.0	30.580
4830.0	30.510	6090.0	30.580
4860.0	30.510	6120.0	30.580
4890.0	30.510	6150.0	30.580
4920.0	30.510	6180.0	30.580
4950.0	30.580	6210.0	30.580
4980.0	30.510	6240.0	30.580
5010.0	30.510	6270.0	30.510
5040.0	30.510	[illegible]	30.510
5070.0	30.510	[illegible]	30.510
5100.0	30.510	[illegible]	30.650
5130.0	30.510	[illegible]	30.510
5160.0	30.510	[illegible]	30.580
5190.0	30.510	[illegible]	30.510
5220.0	30.510	[illegible]	30.510

(CONTINUED) MOGGISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MOG-4T GRID REF. 53642341

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
6510.0	30.580	7800.0	30.580
6540.0	30.510	7830.0	30.650
6570.0	30.650	7860.0	30.650
6600.0	30.650	7890.0	31.210
6630.0	30.650	7920.0	31.210
6660.0	30.650	7950.0	31.210
6690.0	30.580	7980.0	31.210
6720.0	30.580	8010.0	31.070
6750.0	30.580	8040.0	31.070
6780.0	30.580	8070.0	31.210
6810.0	30.580	8100.0	31.210
6840.0	30.580	8130.0	31.000
6870.0	30.580	8160.0	31.070
6900.0	30.580	8190.0	31.140
6930.0	30.580	8220.0	31.210
6960.0	30.580	8250.0	31.210
6990.0	30.580	8280.0	31.210
7020.0	30.580	8310.0	31.210
7050.0	30.510	8340.0	31.210
7080.0	30.510	8370.0	31.210
7110.0	30.510	8400.0	31.210
7140.0	30.510	8430.0	31.210
7170.0	30.510	8460.0	31.210
7200.0	30.510	8490.0	31.210
7230.0	30.510	8520.0	31.210
7260.0	30.510	8550.0	31.210
7290.0	30.510	8580.0	31.210
7320.0	30.510	8610.0	31.210
7350.0	30.510	8640.0	31.210
7380.0	30.510	8670.0	31.070
7410.0	30.510	8700.0	31.210
7440.0	30.510	8730.0	31.210
7470.0	30.510	8760.0	31.210
7500.0	30.510	8790.0	31.210
7530.0	30.510	8820.0	31.210
7560.0	30.510	8850.0	31.210
7620.0	30.510	8880.0	31.210
7650.0	30.510	8910.0	31.210
7680.0	30.510	8940.0	31.210
7710.0	30.510	8970.0	31.210
7740.0	30.510	9000.0	31.210
7770.0	30.510	9030.0	31.210

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 5364234

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
9060.0	31.210	10320.0	31.350
9090.0	31.210	10350.0	31.350
9120.0	31.210	10380.0	31.350
9150.0	31.210	10410.0	31.280
9180.0	31.210	10440.0	31.280
9210.0	31.210	10470.0	31.280
9240.0	31.210	10500.0	31.280
9270.0	31.210	10530.0	31.280
9300.0	31.210	10560.0	31.280
9330.0	31.210	10590.0	31.280
9360.0	31.210	10620.0	31.280
9390.0	31.210	10650.0	31.210
9420.0	31.210	10680.0	31.210
9450.0	31.210	10710.0	31.210
9480.0	31.210	10740.0	31.210
9510.0	31.210	10770.0	31.210
9540.0	31.210	10800.0	31.210
9570.0	31.210	10830.0	31.210
9600.0	31.210	10860.0	31.210
9630.0	31.210	10890.0	31.210
9660.0	31.210	10920.0	31.210
9690.0	31.210	10950.0	31.210
9720.0	31.210	10980.0	31.210
9750.0	31.210	11010.0	31.210
9780.0	31.210	11040.0	31.210
9810.0	31.210	11070.0	31.210
9840.0	31.210	11100.0	31.210
9870.0	31.210	11130.0	31.210
9900.0	31.210	11160.0	31.210
9930.0	31.210	11190.0	31.210
9960.0	31.420	11220.0	31.210
9990.0	31.420	11250.0	31.210
10020.0	31.420	11280.0	31.210
10050.0	31.210	11310.0	31.210
10080.0	31.210	11340.0	31.210
10110.0	31.350	11370.0	31.210
10140.0	31.280	11400.0	31.210
10170.0	31.280	11430.0	31.070
10200.0	31.280	11460.0	31.210
10230.0	31.350	11490.0	31.350
10260.0	31.350	11520.0	31.210
10290.0	31.350	11550.0	31.250

(CONTINUED)

...DISAD RESOURCE STUDY

ALL TIME DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT 40M³/H GRID REF. 53642341

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)
11550.0	31.250
11610.0	31.250
11640.0	31.250
11670.0	31.250
11700.0	30.860
11730.0	31.070
11760.0	31.070
11790.0	31.070
11820.0	31.420
11850.0	31.280
11880.0	31.210
11910.0	31.210
11940.0	31.280
11970.0	31.280
12000.0	31.210
12030.0	31.280
12060.0	31.250
12090.0	31.210
12120.0	31.210
12150.0	31.280
12180.0	31.280
12210.0	31.280
12240.0	31.350
12270.0	31.350
12300.0	31.350
12330.0	31.350
12360.0	31.350
12390.0	31.280
12420.0	31.350
12450.0	31.420
12480.0	31.350
12510.0	31.350
12540.0	31.280
12570.0	31.280
12600.0	31.350
12630.0	31.420
12660.0	31.350
12690.0	31.770
12720.0	31.770
12750.0	31.770
12780.0	31.140
12810.0	31.420

TIME(MINS)	DRAWDOWN(M)
12840.0	31.350
12870.0	31.350
12900.0	31.490
12930.0	31.210
12960.0	31.070
12990.0	31.210
13020.0	31.570
13050.0	31.570
13080.0	31.570
13110.0	31.770
13140.0	31.000
13170.0	31.070
13200.0	30.650
13230.0	31.350
13260.0	31.570
13290.0	31.140
13320.0	31.210
13350.0	31.570
13380.0	31.630
13410.0	31.570
13440.0	31.630
13470.0	31.570
13500.0	31.570
13530.0	31.570
13560.0	31.570
13590.0	31.570
13620.0	31.630
13650.0	31.900
13680.0	31.900
13710.0	31.900
13740.0	31.900
13770.0	31.900
13800.0	31.900
13830.0	31.900
13860.0	31.900
13890.0	31.770
13920.0	31.770
13950.0	31.770
13980.0	31.900
14010.0	31.900
14040.0	31.900
14070.0	31.770

(CONTINUED)

[illegible] RESOURCE STUDY

ALL TME DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 53042341

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
14100.0	31.770	14250.0	31.030
14130.0	31.770	14280.0	31.280
14160.0	31.770	14310.0	31.210
14190.0	31.770	14340.0	30.930
14220.0	31.770	14370.0	31.000

[illegible] RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT [illegible]-41 GRID REF. 53642341

DATE OF TEST 9 6 79

PUMPING RATES (M**3/DAY) :

470.4 FROM	0.0 MINS TO	60.0 MINS
729.6 FROM	60.0 MINS TO	120.0 MINS
942.7 FROM	120.0 MINS TO	180.0 MINS
1192.5 FROM	180.0 MINS TO	204.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2.0	11.600	74.0	14.060
3.0	8.650	76.0	14.060
4.0	8.580	78.0	14.060
5.0	8.790	80.0	14.060
6.0	8.510	82.0	14.060
7.0	8.510	84.0	14.130
8.0	8.790	86.0	14.130
9.0	9.070	88.0	14.200
10.0	9.070	90.0	14.200
12.0	8.790	95.0	14.200
14.0	8.790	100.0	14.200
16.0	8.790	105.0	14.200
18.0	8.790	110.0	14.200
20.0	8.860	115.0	14.200
22.0	8.860	120.0	14.200
24.0	8.860	121.0	18.300
26.0	8.860	122.0	18.560
28.0	8.790	123.0	18.630
30.0	8.790	124.0	18.630
35.0	8.790	125.0	18.700
40.0	8.790	126.0	18.770
45.0	8.790	127.0	18.840
50.0	8.790	128.0	18.910
55.0	8.790	129.0	18.910
60.0	8.790	130.0	18.910
61.0	13.640	132.0	18.910
62.0	13.920	134.0	18.910
63.0	13.990	136.0	18.910
64.0	13.990	138.0	18.910
65.0	14.060	140.0	18.910
66.0	14.060	142.0	18.910
67.0	14.060	144.0	18.910
68.0	14.060	146.0	18.980
69.0	14.060	148.0	14.980
70.0	14.060	150.0	18.980
72.0	14.060	155.0	18.980

(CONTINUED)

...SOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT ... GRID REF. 5304234

DATE OF TEST 9 6 7

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
160.0	18.980	187.0	24.810
165.0	19.050	188.0	24.890
170.0	19.050	189.0	24.890
175.0	19.050	190.0	24.890
180.0	19.050	192.0	24.870
181.0	24.180	194.0	24.890
182.0	24.460	196.0	24.890
183.0	24.500	198.0	24.890
184.0	24.600	200.0	24.890
185.0	24.670	202.0	24.890
186.0	24.750	204.0	24.890

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 53642342

PUMPING AT [illegible] GRID REF. 53642341

DATE OF TEST 27 5 79

PUMPING RATES (M**3/DAY) :
1555.0 FROM 0.0 MINS TO 14370.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
1.0	.062	300.0	2.922
2.0	.907	330.0	2.941
3.0	1.067	360.0	2.944
4.0	1.212	390.0	2.947
5.0	1.312	420.0	2.952
6.0	1.392	450.0	2.957
7.0	1.468	480.0	2.972
8.0	1.540	510.0	2.984
9.0	1.597	540.0	2.992
10.0	1.647	570.0	3.002
12.0	1.744	600.0	3.012
14.0	1.824	630.0	3.012
16.0	1.895	660.0	3.024
18.0	1.957	690.0	3.027
20.0	2.014	720.0	3.035
22.0	2.064	750.0	3.055
24.0	2.107	780.0	3.040
26.0	2.150	810.0	3.042
28.0	2.190	840.0	3.040
30.0	2.227	870.0	3.032
35.0	2.302	900.0	3.032
40.0	2.370	930.0	3.028
45.0	2.428	960.0	3.017
50.0	2.477	990.0	3.012
55.0	2.520	1020.0	3.007
60.0	2.557	1050.0	3.002
70.0	2.618	1080.0	3.008
80.0	2.668	1110.0	3.012
90.0	2.710	1140.0	3.017
100.0	2.742	1170.0	3.022
110.0	2.771	1200.0	3.017
120.0	2.792	1230.0	3.012
130.0	2.815	1260.0	3.022
140.0	2.832	1290.0	3.022
150.0	2.845	1320.0	3.028
160.0	2.862	1350.0	3.034
170.0	2.922	1380.0	3.032

(CONTINUED)

...ISMO RESOURCE STUDY

ALL TIME DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ... GRID REF. 53642342

PUMPED AT ... GRID REF. 53642341

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
1410.0	3.032	2640.0	3.024
1440.0	3.025	2670.0	3.014
1470.0	3.016	2700.0	3.032
1500.0	3.016	2730.0	3.062
1530.0	3.014	2760.0	3.062
1560.0	3.014	2790.0	3.108
1590.0	3.009	2820.0	3.112
1620.0	3.005	2850.0	3.118
1650.0	2.999	2880.0	3.117
1680.0	2.994	2910.0	3.118
1710.0	2.987	2940.0	3.125
1740.0	2.985	2970.0	3.127
1770.0	2.985	3000.0	3.128
1800.0	2.981	3030.0	3.126
1830.0	2.982	3060.0	3.131
1860.0	2.984	3090.0	3.132
1890.0	2.984	3120.0	3.127
1920.0	2.990	3150.0	3.182
1950.0	2.991	3180.0	3.257
1980.0	2.996	3210.0	3.290
2010.0	2.999	3240.0	3.295
2040.0	3.000	3270.0	3.301
2070.0	3.014	3300.0	3.294
2100.0	3.021	3330.0	3.297
2130.0	3.026	3360.0	3.302
2160.0	3.014	3390.0	3.311
2190.0	3.030	3420.0	3.312
2220.0	3.030	3450.0	3.321
2250.0	3.030	3480.0	3.329
2280.0	3.026	3510.0	3.322
2310.0	3.022	3540.0	3.325
2340.0	3.014	3570.0	3.328
2370.0	3.011	3600.0	3.333
2400.0	3.014	3630.0	3.334
2430.0	3.001	3660.0	3.334
2460.0	3.002	3690.0	3.334
2490.0	3.005	3720.0	3.333
2520.0	3.011	3750.0	3.332
2550.0	2.997	3780.0	3.325
2580.0	3.000	3810.0	3.322
2610.0	3.007	3840.0	3.317

(CONTINUED)

GROUNDWATER RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT NGGSP GRID REF. 53642342

PUMPING AT NGW-41 GRID REF. 53642341

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
3870.0	3.322	5100.0	3.347
3900.0	3.322	5130.0	3.350
3930.0	3.321	5160.0	3.352
3960.0	3.316	5190.0	3.350
3990.0	3.312	5220.0	3.352
4020.0	3.316	5250.0	3.351
4050.0	3.316	5280.0	3.350
4080.0	3.320	5320.0	3.350
4110.0	3.314	5340.0	3.351
4140.0	3.320	5370.0	3.350
4170.0	3.320	5400.0	3.342
4200.0	3.324	5430.0	3.345
4230.0	3.326	5460.0	3.347
4260.0	3.331	5490.0	3.357
4290.0	3.331	5520.0	3.352
4320.0	3.334	5550.0	3.343
4350.0	3.335	5580.0	3.351
4380.0	3.337	5610.0	3.340
4410.0	3.333	5640.0	3.338
4440.0	3.333	5670.0	3.335
4470.0	3.335	5700.0	3.332
4500.0	3.328	5730.0	3.336
4530.0	3.328	5760.0	3.334
4560.0	3.304	5790.0	3.337
4590.0	3.316	5820.0	3.346
4620.0	3.312	5850.0	3.347
4650.0	3.314	5880.0	3.344
4680.0	3.312	5910.0	3.343
4710.0	3.314	5940.0	3.342
4740.0	3.315	5970.0	3.340
4740.0	3.318	6000.0	3.336
4800.0	3.325	6030.0	3.333
4830.0	3.327	6060.0	3.332
4860.0	3.327	6090.0	3.330
4890.0	3.330	6120.0	3.329
4920.0	3.336	6150.0	3.331
4950.0	3.332	6180.0	3.324
4980.0	3.331	6210.0	3.332
5010.0	3.331	6240.0	3.332
5040.0	3.335	6270.0	3.335
5070.0	3.345	6300.0	3.336

(CONTINUED)

...IS 19 RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ...SP GRID REF. 53642342

PUMPED AT ...SP GRID REF. 53642341

...TE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
6330.0	3.337	7560.0	3.322
6360.0	3.341	7590.0	3.332
6390.0	3.342	7620.0	3.325
6420.0	3.340	7650.0	3.327
6450.0	3.340	7680.0	3.327
6480.0	3.340	7710.0	3.327
6510.0	3.339	7740.0	3.330
6540.0	3.342	7770.0	3.332
6570.0	3.345	7800.0	3.332
6600.0	3.345	7830.0	3.342
6630.0	3.342	7860.0	3.349
6660.0	3.341	7890.0	3.350
6690.0	3.340	7920.0	3.357
6720.0	3.339	7950.0	3.367
6750.0	3.337	7980.0	3.369
6780.0	3.334	8010.0	3.371
6810.0	3.332	8040.0	3.368
6840.0	3.332	8070.0	3.367
6870.0	3.331	8100.0	3.368
6900.0	3.330	8130.0	3.369
6930.0	3.329	8160.0	3.371
6960.0	3.332	8190.0	3.365
6990.0	3.332	8220.0	3.366
7020.0	3.329	8250.0	3.365
7050.0	3.326	8280.0	3.367
7080.0	3.752	8310.0	3.364
7110.0	3.752	8340.0	3.362
7140.0	3.330	8370.0	3.365
7170.0	3.330	8400.0	3.368
7200.0	3.334	8430.0	3.366
7230.0	3.345	8460.0	3.369
7260.0	3.345	8490.0	3.372
7290.0	3.337	8520.0	3.372
7320.0	3.332	8550.0	3.379
7350.0	3.332	8580.0	3.376
7380.0	3.332	8610.0	3.371
7410.0	3.331	8640.0	3.369
7440.0	3.331	8670.0	3.369
7470.0	3.327	8700.0	3.366
7500.0	3.330	8730.0	3.364
7530.0	3.329	8760.0	3.364

(CONTINUED)

MUNDISHU RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MUW5P GRID REF. 53642342

PUMPING AT MUW-4T GRID REF. 53642341

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
8790.0	3.352	10020.0	3.372
8820.0	3.354	10050.0	3.372
8850.0	3.352	10080.0	3.368
8880.0	3.350	10110.0	3.380
8910.0	3.342	10140.0	3.373
8940.0	3.342	10170.0	3.372
8970.0	3.336	10200.0	3.373
9000.0	3.339	10230.0	3.373
9030.0	3.346	10260.0	3.366
9060.0	3.347	10290.0	3.373
9090.0	3.354	10320.0	3.362
9120.0	3.352	10350.0	3.356
9150.0	3.352	10380.0	3.354
9180.0	3.354	10410.0	3.355
9210.0	3.357	10440.0	3.354
9240.0	3.357	10470.0	3.356
9270.0	3.360	10500.0	3.361
9300.0	3.357	10530.0	3.360
9330.0	3.360	10560.0	3.364
9360.0	3.362	10590.0	3.362
9390.0	3.362	10620.0	3.362
9420.0	3.362	10650.0	3.360
9450.0	3.362	10680.0	3.364
9480.0	3.360	10710.0	3.377
9510.0	3.360	10740.0	3.382
9540.0	3.360	10770.0	3.382
9570.0	3.361	10800.0	3.382
9600.0	3.352	10830.0	3.382
9630.0	3.360	10860.0	3.382
9660.0	3.357	10890.0	3.382
9690.0	3.360	10920.0	3.382
9720.0	3.360	10950.0	3.362
9750.0	3.357	10980.0	3.382
9780.0	3.358	11010.0	3.382
9810.0	3.358	11040.0	3.352
9840.0	3.357	11070.0	3.377
9870.0	3.357	11100.0	3.377
9900.0	3.354	11130.0	3.377
9930.0	3.362	11160.0	3.378
9960.0	3.373	11190.0	3.362
9990.0	3.372	11220.0	3.382

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 53642342

PUMPING AT [illegible] GRID REF. 53642341

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
11250.0	3.382	12480.0	3.406
11280.0	3.382	12510.0	3.405
11310.0	3.382	12540.0	3.406
11340.0	3.382	12570.0	3.410
11370.0	3.394	12600.0	3.409
11400.0	3.394	12630.0	3.412
11430.0	3.394	12660.0	3.414
11460.0	3.395	12690.0	3.413
11490.0	3.399	12720.0	3.417
11520.0	3.396	12750.0	3.422
11550.0	3.392	12780.0	3.420
11580.0	3.390	12810.0	3.415
11610.0	3.390	12840.0	3.414
11640.0	3.384	12870.0	3.420
11670.0	3.382	12900.0	3.419
11700.0	3.382	12930.0	3.414
11730.0	3.382	12960.0	3.407
11760.0	3.377	12990.0	3.406
11790.0	3.380	13020.0	3.405
11820.0	3.380	13050.0	3.399
11850.0	3.382	13080.0	3.399
11880.0	3.382	13110.0	3.394
11910.0	3.384	13140.0	3.382
11940.0	3.380	13170.0	3.382
11970.0	3.386	13200.0	3.382
12000.0	3.386	13230.0	3.382
12030.0	3.386	13260.0	3.389
12060.0	3.387	13290.0	3.388
12090.0	3.392	13320.0	3.382
12120.0	3.390	13350.0	3.390
12150.0	3.391	13380.0	3.397
12180.0	3.390	13410.0	3.401
12210.0	3.390	13440.0	3.404
12240.0	3.405	13470.0	3.409
12270.0	3.406	[illegible]	3.407
12300.0	3.406	13530.0	3.407
12330.0	3.414	[illegible]	[illegible]
12360.0	3.410	13590.0	3.410
12390.0	3.406	13620.0	3.410
12420.0	3.409	[illegible]	3.405
12450.0	3.409	13710.0	3.408

(CONTINUED)

GROUNDWATER RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT 4033P GRID REF. 53642342

PUMPING AT 4034T GRID REF. 53642341

DATE OF TEST 27 5 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
13740.0	3.402	14070.0	3.396
13770.0	3.397	14100.0	3.402
13800.0	3.394	14130.0	3.406
13830.0	3.392	14160.0	3.407
13860.0	3.390	14190.0	3.407
13890.0	3.392	14220.0	3.410
13920.0	3.392	14250.0	3.411
13950.0	3.380	14280.0	3.407
13980.0	3.392	14310.0	3.410
14010.0	3.392	14340.0	3.405
14040.0	3.394	14370.0	3.401

...ISTO RESOURCE STUDY

ALL TIME DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ... GRID REF. 53812528

DATE OF TEST 11 11 74

PUMPING RATES (M**3/DAY) :
2045.0 FROM 0.0 MINS TO 11460.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	13.800	150.0	17.400
1.0	16.300	165.0	17.400
1.5	17.000	180.0	17.400
2.0	17.100	195.0	17.400
2.5	17.200	210.0	17.400
3.0	17.200	225.0	17.400
3.5	17.200	240.0	17.400
4.0	17.200	255.0	17.400
4.5	17.300	270.0	17.400
5.0	17.300	285.0	17.400
6.0	17.300	300.0	17.500
7.0	17.300	315.0	17.400
8.0	17.300	330.0	17.400
9.0	17.300	345.0	17.500
10.0	17.300	360.0	17.500
11.0	17.300	375.0	17.500
12.0	17.300	390.0	17.500
13.0	17.300	405.0	17.500
14.0	17.400	420.0	17.500
15.0	17.200	435.0	17.500
16.0	17.300	450.0	17.500
17.0	17.300	465.0	17.500
18.0	17.300	480.0	17.500
19.0	17.300	495.0	17.500
20.0	17.300	510.0	17.500
25.0	17.300	525.0	17.500
30.0	17.400	540.0	17.500
35.0	17.400	555.0	17.500
40.0	17.400	570.0	17.500
45.0	17.400	585.0	17.500
50.0	17.400	[illegible]	17.500
55.0	17.400	[illegible]	17.500
60.0	17.400	[illegible]	17.500
75.0	17.400	[illegible]	17.500
90.0	17.400	[illegible]	17.500
105.0	17.400	[illegible]	17.500
120.0	17.400	[illegible]	17.500
135.0	17.400	[illegible]	17.500

(CONTINUED)

...WOOLSHED RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ... MODEL GRID REF. 53N12528

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
720.0	17.500	1350.0	17.500
735.0	17.500	1365.0	17.500
750.0	17.500	1380.0	17.600
765.0	17.500	1395.0	17.600
780.0	17.500	1410.0	17.500
795.0	17.500	1425.0	17.500
810.0	17.500	1440.0	17.600
825.0	17.500	1470.0	17.500
840.0	17.500	1500.0	17.600
855.0	17.500	1530.0	17.500
870.0	17.500	1560.0	17.500
885.0	17.500	1590.0	17.500
900.0	17.500	1620.0	17.500
915.0	17.500	1650.0	17.500
930.0	17.500	1680.0	17.500
945.0	17.500	1710.0	17.500
960.0	17.500	1740.0	17.500
975.0	17.500	1770.0	17.500
990.0	17.500	1800.0	17.500
1005.0	17.500	1830.0	17.500
1020.0	17.500	1860.0	17.600
1035.0	17.500	1890.0	17.700
1050.0	17.500	1920.0	17.500
1065.0	17.500	1950.0	17.500
1080.0	17.500	1980.0	17.500
1095.0	17.500	2010.0	17.500
1110.0	17.500	2040.0	17.500
1125.0	17.500	2070.0	17.500
1140.0	17.500	2100.0	17.500
1155.0	17.500	2130.0	17.500
1170.0	17.500	2160.0	17.500
1185.0	17.500	2190.0	17.500
1200.0	17.500	2220.0	17.500
1215.0	17.500	2250.0	17.500
1230.0	17.500	2280.0	17.500
1245.0	17.500	2310.0	17.500
1260.0	17.500	2340.0	17.700
1275.0	17.500	2370.0	17.700
1290.0	17.500	2400.0	17.600
1305.0	17.500	2430.0	17.700
1320.0	17.500	2460.0	17.700
1335.0	17.500	2490.0	17.700

(CONTINUED)

...SHU RESOURCE STUDY

...LL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ... GRID REF. 53812528

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2520.0	17.700	3780.0	17.800
2550.0	17.700	3810.0	17.700
2580.0	17.700	3840.0	17.700
2610.0	17.800	3870.0	17.700
2640.0	17.700	3900.0	17.700
2670.0	17.700	3930.0	17.700
2700.0	17.800	3960.0	17.800
2730.0	17.800	3990.0	17.800
2760.0	17.800	4020.0	17.700
2790.0	17.800	4050.0	17.700
2820.0	17.900	4080.0	17.800
2850.0	17.800	4110.0	17.800
2880.0	17.800	4140.0	17.800
2910.0	17.800	4170.0	17.800
2940.0	17.800	4200.0	17.800
2970.0	17.800	4230.0	17.900
3000.0	17.800	4260.0	17.800
3030.0	17.700	4290.0	17.900
3060.0	17.700	4320.0	17.900
3090.0	17.700	4350.0	17.900
3120.0	17.700	4380.0	17.900
3150.0	17.700	4410.0	17.900
3180.0	17.700	4440.0	17.900
3210.0	17.700	4470.0	17.800
3240.0	17.700	4500.0	17.800
3270.0	17.700	4530.0	17.800
3300.0	17.700	4560.0	17.700
3330.0	17.900	4590.0	17.700
3360.0	17.700	4620.0	17.700
3390.0	17.700	4650.0	17.700
3420.0	17.700	4680.0	17.800
3450.0	17.700	4710.0	17.800
3480.0	17.700	4740.0	17.900
3510.0	17.700	4770.0	17.900
3540.0	17.700	4800.0	17.800
3570.0	17.700	4830.0	17.800
3600.0	17.700	4860.0	17.800
3630.0	17.700	4890.0	17.800
3660.0	17.700	4920.0	17.800
3690.0	17.700	4950.0	17.800
3720.0	17.700	4980.0	17.800
3750.0	17.800	5010.0	17.800

(CONTINUED)

ADVISORY RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 53812529

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
5160.0	17.900	6420.0	17.900
5190.0	17.800	6450.0	17.900
5220.0	17.800	6480.0	17.900
5250.0	17.800	6510.0	18.000
5280.0	17.800	6540.0	18.000
5310.0	17.800	6570.0	18.000
5340.0	17.800	6600.0	17.900
5370.0	17.800	6630.0	17.900
5400.0	17.800	6660.0	18.000
5430.0	17.800	6690.0	18.000
5460.0	17.800	6720.0	18.000
5490.0	17.800	6750.0	18.000
5520.0	17.800	6780.0	18.000
5550.0	17.800	6810.0	18.000
5580.0	17.900	6840.0	18.000
5610.0	17.900	6870.0	18.000
5640.0	17.900	6900.0	18.000
5670.0	17.900	6930.0	18.000
5700.0	17.900	6960.0	18.000
5730.0	18.000	6990.0	18.000
5760.0	18.000	7020.0	18.000
5790.0	17.900	7050.0	18.000
5820.0	17.900	7080.0	18.000
5850.0	17.900	7110.0	18.100
5880.0	17.900	7140.0	18.100
5910.0	17.900	7170.0	18.100
5940.0	17.900	7200.0	18.100
5970.0	17.900	7230.0	18.100
6000.0	17.900	7260.0	18.100
6030.0	17.900	7290.0	18.100
6060.0	17.900	7320.0	18.000
6090.0	17.900	7350.0	18.000
6120.0	17.900	7380.0	18.000
6150.0	18.000	7410.0	18.000
6180.0	18.000	7440.0	18.000
6210.0	18.000	7470.0	18.000
6240.0	18.000	7500.0	18.000
6270.0	17.900	7530.0	18.000
6300.0	17.900	7560.0	18.000
6330.0	17.900	7590.0	18.000
6360.0	17.900	7620.0	18.200
6390.0	17.900	7650.0	18.000

(CONTINUED)

...SRO RESOURCE STUDY

ALL TME DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ... ROOT GRID REF. 53612528

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7660.0	18.000	9240.0	18.100
7710.0	18.200	9270.0	18.100
7740.0	18.200	9300.0	18.200
7770.0	18.200	9330.0	18.200
7800.0	18.200	9360.0	18.200
7830.0	18.200	9390.0	18.200
7860.0	18.200	9420.0	18.200
7890.0	18.200	9450.0	18.200
7920.0	18.200	9480.0	18.200
7950.0	18.200	9510.0	18.200
7980.0	18.200	9540.0	18.200
8010.0	18.200	9570.0	18.200
8040.0	18.200	9600.0	18.200
8070.0	18.000	9630.0	18.200
8100.0	18.000	9660.0	18.200
8130.0	18.000	9690.0	18.200
8160.0	18.000	9720.0	18.200
8190.0	18.000	9750.0	18.200
8220.0	18.000	9780.0	18.200
8250.0	18.000	9810.0	18.200
8280.0	18.000	9840.0	18.200
8310.0	18.000	9870.0	18.200
8340.0	18.000	9900.0	18.200
8370.0	18.000	9930.0	18.200
8400.0	18.000	9960.0	18.200
8430.0	18.100	9990.0	18.200
8460.0	18.100	10020.0	18.200
8490.0	18.100	10050.0	18.200
8520.0	18.100	10080.0	18.200
8550.0	18.100	10110.0	18.200
8580.0	18.100	10140.0	18.200
8610.0	18.200	10170.0	18.200
8640.0	18.200	10200.0	18.200
8670.0	18.200	10230.0	18.200
8700.0	18.200	10260.0	18.200
8730.0	18.200	10290.0	18.200
8760.0	18.200	10320.0	18.200
8790.0	18.100	10350.0	18.200
8820.0	18.100	10380.0	18.200
8850.0	18.100	10410.0	18.200
8880.0	18.100	10440.0	18.200
8910.0	18.100	10470.0	18.200

(CONTINUED)

FUNDISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MODEL GRID REF. 53812526

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)
10260.0	18.200
10290.0	18.200
10320.0	18.200
10350.0	18.200
10380.0	18.200
10410.0	18.200
10440.0	18.200
10470.0	18.200
10500.0	18.200
10530.0	18.200
10560.0	18.200
10590.0	18.200
10620.0	18.200
10650.0	18.200
10680.0	18.200
10710.0	18.200
10740.0	18.200
10770.0	18.200
10800.0	18.200
10830.0	18.200

TIME(MINS)	DRAWDOWN(M)
10860.0	18.200
10890.0	18.200
10920.0	18.200
10950.0	18.200
10980.0	18.200
11010.0	18.200
11040.0	18.200
11070.0	18.200
11100.0	18.200
11130.0	18.200
11160.0	18.200
11190.0	18.200
11220.0	18.200
11250.0	18.200
11280.0	18.200
11310.0	18.200
11340.0	18.200
11370.0	18.200
11400.0	18.200
11430.0	18.200
11460.0	18.200

[illegible] RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 5381252[illegible]

DATE OF TEST 2 12 79

PUMPING RATES (M**3/DAY) :

667.0	FROM	0.0 MINS	TO	90.0 MINS
943.0	FROM	90.0 MINS	TO	180.0 MINS
1334.0	FROM	180.0 MINS	TO	270.0 MINS
1687.0	FROM	270.0 MINS	TO	360.0 MINS
2045.0	FROM	360.0 MINS	TO	450.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
1.0	5.200	104.0	8.000
2.0	7.100	106.0	8.000
3.0	7.500	108.0	8.000
4.0	7.500	110.0	8.000
5.0	7.700	115.0	8.000
6.0	7.800	120.0	8.000
7.0	7.500	125.0	8.000
8.0	7.900	130.0	8.000
9.0	5.800	135.0	7.900
10.0	5.800	140.0	7.900
12.0	5.700	145.0	8.000
14.0	5.700	150.0	8.000
16.0	5.700	155.0	8.000
18.0	5.700	160.0	7.900
20.0	5.700	182.0	11.000
25.0	5.700	183.0	11.100
30.0	5.700	184.0	11.200
35.0	5.700	185.0	11.200
40.0	5.700	186.0	11.000
45.0	5.700	187.0	11.200
50.0	5.700	188.0	11.200
55.0	5.800	189.0	11.200
60.0	5.700	190.0	11.300
75.0	5.700	192.0	11.200
90.0	5.700	194.0	11.200
91.0	7.400	196.0	11.200
92.0	7.900	198.0	11.100
93.0	7.900	200.0	11.200
94.0	7.900	205.0	11.200
95.0	7.900	210.0	11.200
96.0	7.900	215.0	11.200
97.0	7.900	220.0	11.200
98.0	8.100	225.0	11.200
99.0	8.100	230.0	11.200
100.0	8.100	235.0	11.200
102.0	[illegible]	240.0	11.200

(CONTINUED)

FOGGITSHU RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT MG261 GRID REF. 53812528

DATE OF TEST 2 12 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
255.0	14.300	360.0	14.200
270.0	14.200	361.0	17.200
271.0	14.100	362.0	17.300
272.0	14.200	363.0	17.300
273.0	14.200	364.0	17.300
274.0	14.200	365.0	17.400
275.0	14.200	366.0	17.300
276.0	14.400	367.0	17.300
277.0	14.200	368.0	17.300
278.0	14.200	369.0	17.300
279.0	14.200	370.0	17.300
280.0	14.200	372.0	17.300
282.0	14.200	374.0	17.400
284.0	14.200	376.0	17.400
286.0	14.200	378.0	17.400
288.0	14.200	380.0	17.300
290.0	14.200	385.0	17.400
295.0	14.200	390.0	17.400
300.0	14.200	395.0	17.300
305.0	14.200	400.0	17.300
310.0	14.300	405.0	17.300
315.0	14.200	410.0	17.200
320.0	14.300	415.0	17.300
325.0	14.200	420.0	17.300
330.0	14.200	435.0	17.300
345.0	14.200	450.0	17.200

[illegible] PROBABLE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. S3822529

PUMPING AT [illegible] GRID REF. S3812528

DATE OF TEST 11 11 79

PUMPING RATES (M**3/DAY) :
2045.0 FROM 0.0 MINS TO 11460.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	.042	135.0	1.254
1.0	.199	150.0	1.252
1.5	.378	165.0	1.251
2.0	.514	180.0	1.249
2.5	.649	195.0	1.249
3.0	.757	210.0	1.248
3.5	.835	225.0	1.248
4.0	.890	240.0	1.249
4.5	.942	255.0	1.249
5.0	.975	270.0	1.252
6.0	1.035	285.0	1.253
7.0	1.070	300.0	1.255
8.0	1.099	315.0	1.256
9.0	1.119	330.0	1.258
10.0	1.136	345.0	1.263
11.0	1.146	360.0	1.265
12.0	1.162	375.0	1.388
13.0	1.170	390.0	1.390
14.0	1.176	405.0	1.389
15.0	1.185	420.0	1.393
16.0	1.186	435.0	1.395
17.0	1.193	450.0	1.488
18.0	1.199	465.0	1.489
19.0	1.204	480.0	1.491
20.0	1.207	495.0	1.286
25.0	1.224	510.0	1.286
30.0	1.235	525.0	1.288
35.0	1.243	540.0	1.294
40.0	1.248	555.0	1.299
45.0	1.249	570.0	1.299
50.0	1.251	585.0	1.300
55.0	1.254	600.0	1.301
60.0	1.255	615.0	1.303
75.0	1.257	630.0	1.306
90.0	1.258	645.0	1.306
105.0	1.257	660.0	1.306
120.0	1.255	675.0	1.308

(CONTINUED)

...BISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT Model GRID REF. 53822529

PUMPING AT Model GRID REF. 53812528

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
690.0	1.305	1305.0	1.336
705.0	1.306	1320.0	1.336
720.0	1.306	1335.0	1.337
735.0	1.306	1350.0	1.340
750.0	1.308	1365.0	1.340
765.0	1.306	1380.0	1.339
780.0	1.308	1395.0	1.338
795.0	1.308	1410.0	1.337
810.0	1.306	1425.0	1.336
825.0	1.306	1440.0	1.336
840.0	1.306	1470.0	1.335
855.0	1.305	1500.0	1.328
870.0	1.306	1530.0	1.323
885.0	1.306	1560.0	1.318
900.0	1.308	1590.0	1.319
915.0	1.304	1620.0	1.308
930.0	1.302	1650.0	1.307
945.0	1.303	1680.0	1.305
960.0	1.301	1710.0	1.304
975.0	1.302	1740.0	1.304
990.0	1.304	1770.0	1.310
1005.0	1.304	1800.0	1.314
1020.0	1.307	1830.0	1.318
1035.0	1.306	1860.0	1.334
1050.0	1.306	1890.0	1.338
1065.0	1.307	1920.0	1.346
1080.0	1.305	1950.0	1.342
1095.0	1.305	1980.0	1.344
1110.0	1.304	2010.0	1.350
1125.0	1.304	2040.0	1.351
1140.0	1.309	2070.0	1.353
1155.0	1.308	2100.0	1.353
1170.0	1.308	2130.0	1.356
1185.0	1.310	2160.0	1.357
1200.0	1.310	2190.0	1.356
1215.0	1.314	2220.0	1.359
1230.0	1.320	2250.0	1.358
1245.0	1.324	2280.0	1.353
1260.0	1.331	2310.0	1.350
1275.0	1.334	2340.0	1.349
1290.0	1.335	2370.0	1.349

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST, - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 53822529

PUMPING AT [illegible] GRID REF. 53812528

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2400.0	1.349	3630.0	1.388
2430.0	1.355	3660.0	1.389
2460.0	1.359	3690.0	1.389
2490.0	1.360	3720.0	1.385
2520.0	1.365	3750.0	1.384
2550.0	1.366	3780.0	1.371
2580.0	1.368	3810.0	1.375
2610.0	1.369	3840.0	1.387
2640.0	1.370	3870.0	1.388
2670.0	1.370	3900.0	1.387
2700.0	1.371	3930.0	1.385
2730.0	1.375	3960.0	1.385
2760.0	1.378	3990.0	1.386
2790.0	1.380	4020.0	1.395
2820.0	1.347	4050.0	1.397
2850.0	1.379	4080.0	1.400
2880.0	1.376	4110.0	1.399
2910.0	1.373	4140.0	1.404
2940.0	1.373	4170.0	1.408
2970.0	1.364	4200.0	1.413
3000.0	1.358	4230.0	1.389
3030.0	1.355	4260.0	1.415
3060.0	1.354	4290.0	1.412
3090.0	1.352	4320.0	1.407
3120.0	1.344	4350.0	1.406
3150.0	1.346	4380.0	1.399
3180.0	1.346	4410.0	1.398
3210.0	1.349	4440.0	1.388
3240.0	1.351	4470.0	1.384
3270.0	1.355	4500.0	1.377
3300.0	1.358	4530.0	1.372
3330.0	1.362	4560.0	1.371
3360.0	1.371	4590.0	1.371
3390.0	1.375	4620.0	1.375
3420.0	1.375	4650.0	1.375
3450.0	1.381	4680.0	1.381
3480.0	1.376	4710.0	1.384
3510.0	1.387	4740.0	1.385
3540.0	1.390	4770.0	1.394
3570.0	1.390	4800.0	1.397
3600.0	1.386	4830.0	1.401

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 53822529

PUMPING AT [illegible] GRID REF. 53812528

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
4800.0	1.402	6090.0	1.401
4830.0	1.402	6120.0	1.405
4920.0	1.404	6150.0	1.407
4950.0	1.414	6180.0	1.413
4980.0	1.417	6210.0	1.417
5010.0	1.418	6240.0	1.424
5040.0	1.418	6270.0	1.425
5070.0	1.419	6300.0	1.425
5100.0	1.420	6330.0	1.429
5130.0	1.421	6360.0	1.428
5160.0	1.414	6390.0	1.434
5190.0	1.406	6420.0	1.438
5220.0	1.406	6450.0	1.436
5250.0	1.408	6480.0	1.437
5280.0	1.406	6510.0	1.433
5310.0	1.410	6540.0	1.431
5340.0	1.411	6570.0	1.432
5370.0	1.414	6600.0	1.428
5400.0	1.415	6630.0	1.426
5430.0	1.415	6660.0	1.427
5460.0	1.416	6690.0	1.430
5490.0	1.418	6720.0	1.432
5520.0	1.419	6750.0	1.432
5550.0	1.422	6780.0	1.433
5580.0	1.424	6810.0	1.434
5610.0	1.425	6840.0	1.434
5640.0	1.429	6870.0	1.434
5670.0	1.431	6900.0	1.433
5700.0	1.431	6930.0	1.436
5730.0	1.414	6960.0	1.437
5760.0	1.428	6990.0	1.438
5790.0	1.428	7020.0	1.443
5820.0	1.424	7050.0	1.448
5850.0	1.425	7080.0	1.451
5880.0	1.411	7110.0	1.453
5910.0	1.414	7140.0	1.452
5940.0	1.413	7170.0	1.455
5970.0	1.402	7200.0	1.455
6000.0	1.403	7230.0	1.449
6030.0	1.399	7260.0	1.442
6060.0	1.398	7290.0	1.438

(CONTINUED)

...SIDE RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ...SIDE GRID REF. 53822529

PUMPING AT ...SIDE GRID REF. 53812528

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7320.0	1.434	8550.0	1.411
7350.0	1.426	8580.0	1.470
7380.0	1.421	8640.0	1.466
7410.0	1.419	8670.0	1.464
7440.0	1.417	8700.0	1.454
7470.0	1.416	8730.0	1.451
7500.0	1.416	8760.0	1.448
7530.0	1.417	8790.0	1.442
7560.0	1.418	8820.0	1.436
7590.0	1.422	8850.0	1.434
7620.0	1.432	8880.0	1.434
7650.0	1.436	8910.0	1.434
7680.0	1.441	8940.0	1.434
7710.0	1.444	8970.0	1.432
7740.0	1.424	9000.0	1.433
7770.0	1.426	9030.0	1.438
7800.0	1.429	9060.0	1.452
7830.0	1.431	9090.0	1.463
7860.0	1.436	9120.0	1.461
7890.0	1.435	9150.0	1.464
7920.0	1.434	9180.0	1.465
7950.0	1.432	9210.0	1.471
7980.0	1.431	9240.0	1.473
8010.0	1.426	9270.0	1.475
8040.0	1.427	9300.0	1.475
8070.0	1.426	9330.0	1.479
8100.0	1.427	9360.0	1.478
8130.0	1.421	9390.0	1.478
8160.0	1.418	9420.0	1.481
8190.0	1.416	9450.0	1.471
8220.0	1.419	9480.0	1.470
8250.0	1.421	9510.0	1.470
8280.0	1.425	9540.0	1.466
8310.0	1.426	9570.0	1.467
8340.0	1.430	9600.0	1.467
8370.0	1.454	9630.0	1.465
8400.0	1.457	9660.0	1.470
8430.0	1.459	9690.0	1.469
8460.0	1.463	9720.0	1.471
8490.0	1.465	9750.0	1.471
8520.0	1.466	9780.0	1.473

(CONTINUED)

PUBLISHED RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. S3822529

PUMPING AT [illegible] GRID REF. S3812528

DATE OF TEST 11 11 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
9810.0	1.476	10650.0	1.486
9840.0	1.478	10680.0	1.491
9870.0	1.479	10710.0	1.493
9900.0	1.481	10740.0	1.493
9930.0	1.483	10770.0	1.487
9960.0	1.488	10800.0	1.490
9990.0	1.489	10830.0	1.489
10020.0	1.488	10860.0	1.489
10050.0	1.488	10890.0	1.489
10080.0	1.486	10920.0	1.488
10110.0	1.486	10950.0	1.484
10140.0	1.488	10980.0	1.485
10170.0	1.469	11010.0	1.483
10200.0	1.471	11040.0	1.471
10230.0	1.465	11070.0	1.472
10260.0	1.456	11100.0	1.470
10290.0	1.452	11130.0	1.470
10320.0	1.453	11160.0	1.469
10350.0	1.445	11190.0	1.468
10380.0	1.444	11220.0	1.473
10410.0	1.442	11250.0	1.474
10440.0	1.445	11280.0	1.481
10470.0	1.449	11310.0	1.497
10500.0	1.417	11340.0	1.500
10530.0	1.441	11370.0	1.506
10560.0	1.471	11400.0	1.513
10590.0	1.480	11430.0	1.504
10620.0	1.485	11460.0	1.503

[illegible] RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT [illegible] O.S. GRID REF. 54442455

DATE OF TEST 15 2 79

PUMPING RATES (M**3/DAY) :

648.7 FROM	0.0 MINS TO	180.0 MINS
1045.0 FROM	180.0 MINS TO	300.0 MINS
1652.0 FROM	300.0 MINS TO	540.0 MINS
1932.0 FROM	540.0 MINS TO	720.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	3.000	182.0	5.690
1.0	3.270	182.5	5.690
1.5	3.450	183.0	5.760
2.0	3.760	183.5	5.690
2.5	3.760	184.0	5.690
3.0	3.760	184.5	5.760
3.5	3.760	185.0	5.760
4.0	3.760	186.0	5.760
4.5	3.660	187.0	5.760
5.0	3.760	188.0	5.760
6.0	3.760	189.0	5.760
7.0	3.760	190.0	5.760
8.0	3.760	195.0	5.690
9.0	3.760	200.0	5.690
10.0	3.760	205.0	5.760
15.0	3.660	210.0	5.690
20.0	3.660	215.0	5.760
25.0	3.660	220.0	5.760
30.0	3.660	225.0	5.760
35.0	3.660	230.0	5.760
40.0	3.660	235.0	5.760
45.0	3.660	240.0	5.760
50.0	3.940	255.0	5.760
55.0	3.940	270.0	5.760
60.0	3.760	285.0	5.760
75.0	3.760	300.0	5.760
90.0	3.660	315.0	5.760
105.0	3.760	330.0	5.760
120.0	3.760	345.0	5.760
135.0	3.760	360.0	5.760
150.0	3.760	375.5	4.070
165.0	3.760	381.0	4.140
180.0	3.720	381.5	4.140
180.5	4.570	382.0	4.210
181.0	5.620	382.5	4.210
181.5	5.690	383.0	4.210

(CONTINUED)

MIDDLESBRO RESOURCE STUDY

ALL THE DATA

STEP DRAWDOWN TEST - PUMPED WELL

PUMPING AT MOW31 GRID REF. 54442455

DATE OF TEST 15 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
363.5	9.210	542.0	10.610
364.0	9.210	542.5	10.610
364.5	9.210	543.0	10.610
365.0	9.210	543.5	10.610
366.0	9.210	544.0	10.610
367.0	9.210	544.5	10.610
368.0	9.210	545.0	10.610
369.0	9.210	546.0	10.610
370.0	9.210	547.0	10.610
375.0	9.140	548.0	10.610
380.0	9.140	549.0	10.610
385.0	9.140	550.0	10.540
390.0	9.140	222.0	10.610
395.0	9.140	560.0	10.610
400.0	9.140	565.0	10.610
405.0	9.140	570.0	10.610
410.0	9.210	575.0	10.610
415.0	9.140	580.0	10.610
420.0	9.140	585.0	10.690
435.0	9.140	590.0	10.690
450.0	9.140	595.0	10.690
465.0	9.140	600.0	10.690
480.0	9.140	615.0	10.690
495.0	9.140	630.0	10.690
510.0	9.140	645.0	10.690
525.0	9.140	660.0	10.690
540.0	9.140	675.0	10.760
540.5	10.540	690.0	10.610
541.0	10.610	705.0	10.610
541.5	10.610	720.0	10.610

...ISM RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING WI ...3.31 GRID REF. 54442455

DATE OF TEST 19 2 79

PUMPING RATES (M**3/DAY) :
1057.0 FROM 0.0 MINS TO 9135.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	9.260	150.0	5.410
1.0	5.470	165.0	5.410
1.5	5.200	180.0	5.410
2.0	5.130	195.0	5.410
2.5	5.130	210.0	5.410
3.0	5.200	225.0	5.410
3.5	5.200	240.0	5.410
4.0	5.200	255.0	5.410
4.5	5.200	270.0	5.410
5.0	5.200	285.0	5.410
6.0	5.200	300.0	5.480
7.0	5.200	315.0	5.480
8.0	5.200	330.0	5.480
9.0	5.200	345.0	5.480
10.0	5.200	360.0	5.480
11.0	5.200	375.0	5.480
12.0	5.200	390.0	5.480
13.0	5.200	405.0	5.480
14.0	5.200	420.0	5.480
15.0	5.200	435.0	5.550
16.0	5.200	450.0	5.550
17.0	5.200	465.0	5.550
18.0	5.200	480.0	5.550
19.0	5.200	495.0	5.550
20.0	5.270	510.0	5.550
25.0	5.270	525.0	5.550
30.0	5.270	540.0	5.550
35.0	5.270	555.0	5.550
40.0	5.270	570.0	5.550
45.0	5.270	585.0	5.550
50.0	5.340	600.0	5.550
55.0	5.340	615.0	5.550
60.0	5.340	630.0	5.550
75.0	5.340	645.0	5.550
90.0	5.340	660.0	5.550
105.0	5.340	675.0	5.550
120.0	5.340	690.0	5.550
135.0	5.340	705.0	5.550

(CONTINUED)

...ISTON RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT ...W.S.T GRID REF. 54442455

DATE OF TEST 19 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
720.0	5.550	1350.0	5.550
735.0	5.550	1365.0	5.620
750.0	5.550	1380.0	5.620
765.0	5.550	1395.0	5.620
780.0	5.620	1410.0	5.620
795.0	5.620	1425.0	5.620
810.0	5.620	1440.0	5.620
825.0	5.620	1455.0	5.620
840.0	5.620	1485.0	5.620
855.0	5.550	1515.0	5.620
870.0	5.690	1545.0	5.690
885.0	5.620	1575.0	5.760
900.0	5.620	1605.0	5.760
915.0	5.620	1635.0	5.760
930.0	5.760	1665.0	5.760
945.0	5.620	1695.0	5.760
960.0	5.620	1725.0	5.760
975.0	5.620	1755.0	5.760
990.0	5.550	1785.0	5.760
1005.0	5.550	1815.0	5.760
1020.0	5.260	1845.0	5.760
1035.0	5.260	1875.0	5.760
1050.0	5.260	1905.0	5.830
1065.0	5.260	1935.0	5.830
1080.0	5.550	1965.0	5.760
1095.0	5.260	1995.0	5.760
1110.0	5.550	2025.0	5.760
1125.0	5.480	2055.0	5.760
1140.0	5.480	2085.0	5.830
1155.0	5.480	2115.0	5.830
1170.0	5.480	2145.0	5.760
1185.0	5.480	2175.0	5.760
1200.0	5.550	2205.0	5.760
1215.0	5.550	2235.0	5.830
1230.0	5.550	2265.0	5.900
1245.0	5.550	2295.0	5.900
1260.0	5.550	2325.0	5.830
1275.0	5.550	2355.0	5.830
1290.0	5.550	2385.0	5.830
1305.0	5.620	2415.0	5.830
1320.0	5.550	2445.0	5.830
1335.0	5.550	2475.0	5.760

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 5444 2455

DATE OF TEST 19 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2505.0	5.630	4095.0	5.690
2535.0	5.900	4125.0	5.690
2895.0	5.620	4155.0	5.690
2925.0	5.620	4185.0	5.690
2955.0	5.620	4215.0	5.690
2985.0	5.620	4245.0	5.690
3015.0	5.620	4275.0	5.760
3045.0	5.620	4305.0	5.760
3075.0	5.550	4335.0	5.760
3105.0	5.760	4365.0	5.760
3135.0	5.760	4395.0	5.760
3165.0	5.760	4425.0	5.760
3195.0	5.620	4455.0	5.760
3225.0	5.750	4485.0	5.760
3255.0	5.760	4515.0	5.760
3285.0	5.760	4545.0	5.760
3315.0	5.760	4575.0	5.760
3345.0	5.760	4605.0	5.760
3375.0	5.750	4635.0	5.760
3405.0	5.760	4665.0	5.760
3435.0	5.620	4695.0	5.630
3465.0	5.620	4725.0	5.630
3495.0	5.750	4755.0	5.760
3525.0	5.750	4785.0	5.760
3555.0	5.760	4815.0	5.760
3585.0	5.760	4845.0	5.760
3615.0	5.760	4875.0	5.760
3645.0	5.760	4905.0	5.760
3675.0	5.760	4935.0	5.760
3705.0	5.760	4965.0	5.630
3735.0	5.620	4995.0	5.630
3765.0	5.760	5025.0	5.630
3795.0	5.760	5055.0	5.760
3825.0	5.760	5085.0	5.760
3855.0	5.750	5115.0	5.630
3885.0	5.620	5145.0	5.630
3915.0	5.690	5175.0	5.630
3945.0	5.690	5205.0	5.900
3975.0	5.690	5235.0	5.900
4005.0	5.690	5265.0	5.630
4035.0	5.690	5295.0	5.900
4065.0	5.690	5325.0	5.900

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 54442455

DATE OF TEST 19 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
5355.0	5.830	6615.0	5.830
5385.0	5.760	6645.0	5.900
5415.0	5.970	6675.0	5.900
5445.0	5.830	6705.0	5.900
5475.0	5.830	6735.0	5.900
5505.0	5.760	6765.0	5.900
5535.0	5.830	6795.0	5.900
5565.0	5.830	6825.0	5.900
5595.0	5.830	6855.0	5.900
5625.0	5.830	6885.0	5.900
5655.0	5.900	6915.0	5.760
5685.0	5.830	6945.0	5.760
5715.0	5.830	6975.0	5.760
5745.0	5.760	7005.0	5.760
5775.0	5.760	7035.0	5.830
5805.0	5.830	7065.0	5.760
5835.0	5.900	7095.0	5.760
5865.0	5.900	7125.0	5.760
5895.0	5.830	7155.0	5.760
5925.0	5.760	7185.0	5.830
5955.0	5.900	7215.0	5.830
5985.0	5.760	7245.0	5.830
6015.0	5.760	7275.0	5.830
6045.0	5.760	7305.0	5.830
6075.0	5.760	7335.0	5.760
6105.0	5.830	7365.0	5.760
6135.0	5.760	7395.0	5.760
6165.0	5.760	7425.0	5.760
6195.0	5.830	7455.0	5.760
6225.0	5.900	7485.0	5.760
6255.0	5.900	7515.0	5.830
6285.0	5.830	7545.0	5.900
6315.0	5.830	7575.0	5.760
6345.0	5.830	7605.0	5.760
6375.0	5.830	7635.0	5.760
6405.0	5.830	7665.0	5.760
6435.0	5.900	7695.0	5.830
6465.0	5.830	7725.0	5.830
6495.0	5.830	7755.0	5.830
6525.0	5.900	7785.0	5.760
6555.0	5.900	7815.0	5.760
6585.0	5.900	7845.0	5.760

(CONTINUED) [illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 54442455

DATE OF TEST 19 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7875.0	5.760	8535.0	5.900
7905.0	5.830	8565.0	5.830
7935.0	5.830	8595.0	5.900
7965.0	5.830	8625.0	5.900
7995.0	5.900	8655.0	5.900
8025.0	5.830	8685.0	5.900
8055.0	5.900	8715.0	5.900
8085.0	5.760	8745.0	5.830
8115.0	5.760	8775.0	5.760
8145.0	5.760	8805.0	5.760
8175.0	5.760	8835.0	5.760
8205.0	5.830	8865.0	5.760
8235.0	5.830	8895.0	5.830
8265.0	5.900	8925.0	5.760
8295.0	5.900	8955.0	5.760
8325.0	5.900	8985.0	5.760
8355.0	5.830	9015.0	5.760
8385.0	5.900	9045.0	5.760
8415.0	5.900	9075.0	5.760
8445.0	5.900	9105.0	5.760
8475.0	5.830	9135.0	5.760
8505.0	5.900		

ROBOTSHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 54442455

DATE OF TEST 27 2 79

PUMPING RATES (M**3/DAY) :
1050.0 FROM 0.0 MINS TO 1470.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	9.490	150.0	5.690
1.0	6.040	165.0	5.690
1.5	5.620	180.0	5.690
2.0	5.620	195.0	5.690
2.5	5.620	210.0	5.690
3.0	5.620	225.0	5.690
3.5	5.620	240.0	5.690
4.0	5.620	255.0	5.760
4.5	5.690	270.0	5.760
5.0	5.690	285.0	5.690
6.0	5.690	300.0	5.690
7.0	5.690	315.0	5.690
8.0	5.760	330.0	5.620
9.0	5.760	345.0	5.690
10.0	5.760	360.0	5.690
11.0	5.690	375.0	5.690
12.0	5.690	390.0	5.690
13.0	5.690	405.0	5.690
14.0	5.760	420.0	5.690
15.0	5.760	435.0	5.690
16.0	5.760	450.0	5.760
17.0	5.760	465.0	5.760
18.0	5.760	480.0	5.760
19.0	5.760	495.0	5.760
20.0	5.760	510.0	5.760
25.0	5.690	525.0	5.760
30.0	5.690	540.0	5.760
35.0	5.690	555.0	5.760
40.0	5.690	570.0	5.760
45.0	5.690	585.0	5.760
50.0	5.690	600.0	5.760
55.0	5.690	615.0	5.760
60.0	5.690	630.0	5.760
75.0	5.690	645.0	5.760
90.0	5.690	660.0	5.760
105.0	5.690	675.0	5.760
120.0	5.690	690.0	5.760
135.0	5.690	705.0	5.760

(CONTINUED)

[illegible] RESOURCE STUDY

ALL TIME DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 54442455

DATE OF TEST 27 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
720.0	5.830	1110.0	5.760
735.0	5.760	1125.0	5.760
750.0	5.760	1140.0	5.760
765.0	5.760	1155.0	5.760
780.0	5.760	1170.0	5.830
795.0	5.760	1185.0	5.760
810.0	5.760	1200.0	5.760
825.0	5.760	1215.0	5.830
840.0	5.760	1230.0	5.760
855.0	5.760	1245.0	5.760
870.0	5.760	1260.0	5.760
885.0	5.760	1275.0	5.760
900.0	5.760	1290.0	5.760
915.0	5.760	1305.0	5.760
930.0	5.760	1320.0	5.760
945.1	5.760	1335.0	5.760
960.0	5.760	1350.0	5.760
975.0	5.760	1365.0	5.760
990.0	5.760	1380.0	5.760
1005.0	5.760	1395.0	5.830
1020.0	5.830	1410.0	5.900
1035.0	5.830	1425.0	5.900
1050.0	5.830	1440.0	5.200
1065.0	5.760	1455.0	5.760
1080.0	5.760	1470.0	5.760
1095.0	5.760		

MOGDISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT MOG31 GRID REF. 54442455

DATE OF TEST 7 12 79

PUMPING RATES (M**3/DAY) :
1440.0 FROM 0.0 MINS TO 2490.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	8.800	225.0	8.900
1.0	8.700	240.0	8.900
1.5	8.000	255.0	8.900
2.0	8.400	270.0	8.900
2.5	8.500	285.0	8.900
3.0	7.900	300.0	8.900
3.5	8.200	315.0	8.900
4.0	8.600	330.0	8.900
4.5	8.800	345.0	8.900
5.0	8.600	360.0	8.900
6.0	8.700	375.0	8.900
7.0	8.700	390.0	8.900
8.0	8.700	405.0	8.900
9.0	8.700	420.0	8.900
10.0	8.700	435.0	8.900
12.0	8.700	450.0	8.900
14.0	8.700	465.0	8.900
16.0	8.700	480.0	9.000
18.0	8.700	495.0	9.000
20.0	8.700	510.0	9.000
25.0	8.700	525.0	9.000
30.0	8.800	540.0	9.000
35.0	8.800	555.0	9.000
40.0	8.800	570.0	9.000
45.0	8.800	585.0	9.000
50.0	8.800	600.0	9.000
55.0	8.800	615.0	9.000
60.0	8.800	630.0	9.000
75.0	8.800	645.0	9.000
90.0	8.800	660.0	9.000
105.0	8.800	675.0	9.000
120.0	8.800	690.0	9.000
135.0	8.800	705.0	9.000
150.0	8.800	720.0	9.000
165.0	8.800	735.0	9.000
180.0	8.900	750.0	9.000
195.0	8.900	765.0	9.000
210.0	8.900	780.0	9.000

(CONTINUED)

TOURISM RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - PUMPED WELL

PUMPING AT [illegible] GRID REF. 54442455

DATE OF TEST 7 12 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
795.0	9.000	1395.0	9.100
810.0	9.000	1410.0	9.100
825.0	9.000	1425.0	9.100
840.0	9.000	1440.0	9.000
855.0	9.000	1470.0	9.100
870.0	9.000	1500.0	9.000
885.0	9.000	1530.0	9.000
900.0	9.000	1560.0	9.100
915.0	9.000	1590.0	9.100
930.0	9.000	1620.0	9.000
945.0	9.000	1650.0	9.100
960.0	9.000	1680.0	9.100
975.0	9.000	1710.0	9.100
990.0	9.000	1740.0	9.100
1005.0	9.000	1770.0	9.100
1020.0	9.000	1800.0	9.100
1035.0	9.000	1830.0	9.100
1050.0	9.000	1860.0	9.100
1065.0	9.000	1890.0	9.100
1080.0	9.000	1920.0	9.100
1095.0	9.000	1950.0	9.100
1110.0	9.000	1980.0	9.100
1125.0	9.000	2010.0	9.100
1140.0	9.000	2040.0	9.100
1155.0	9.000	2070.0	9.100
1170.0	9.000	2100.0	9.100
1185.0	9.000	2130.0	9.100
1200.0	9.000	2160.0	9.100
1215.0	9.000	2190.0	9.100
1230.0	9.000	2220.0	9.100
1245.0	9.000	2250.0	9.100
1260.0	9.000	2280.0	9.100
1275.0	9.000	2310.0	9.100
1290.0	9.000	2340.0	9.100
1305.0	9.000	2370.0	9.100
1320.0	9.000	2400.0	9.100
1335.0	9.000	2430.0	9.100
1350.0	9.000	2460.0	9.100
1365.0	9.100	2490.0	9.100
1380.0	9.100		

GOODISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MG47P GRID REF. 54442456

PUMPING AT MG47T GRID REF. 54442455

DATE OF TEST 19 2 79

PUMPING RATES (M**3/DAY) :
1057.0 FROM 0.0 MINS TO 9135.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.2	.019	90.0	.361
.3	.099	105.0	.324
.7	.223	120.0	.328
1.0	.279	135.0	.335
1.3	.269	150.0	.339
1.7	.252	165.0	.345
2.0	.246	180.0	.349
2.5	.245	195.0	.354
3.0	.246	210.0	.357
3.5	.247	225.0	.362
4.0	.251	240.0	.366
4.5	.252	255.0	.367
5.0	.254	270.0	.370
6.0	.257	285.0	.372
7.0	.260	300.0	.375
8.0	.263	315.0	.378
9.0	.265	330.0	.382
10.0	.266	345.0	.383
11.0	.266	360.0	.384
12.0	.269	375.0	.386
13.0	.270	390.0	.388
14.0	.271	405.0	.386
15.0	.272	420.0	.386
16.0	.274	435.0	.386
17.0	.275	450.0	.387
18.0	.276	465.0	.387
19.0	.277	480.0	.388
20.0	.278	495.0	.389
25.0	.281	510.0	.390
30.0	.285	525.0	.392
35.0	.288	540.0	.394
40.0	.292	555.0	.396
45.0	.296	570.0	.398
50.0	.297	585.0	.401
55.0	.301	600.0	.403
60.0	.302	615.0	.406
75.0	.312	630.0	.406

(CONTINUED)

...ISH RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ...M/F GRID REF. 54442455

PUMPING AT ...M/F GRID REF. 54442455

ATE OF TEST 19 2.79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
645.0	.409	1260.0	.399
660.0	.411	1275.0	.397
675.0	.414	1290.0	.399
690.0	.415	1305.0	.400
705.0	.416	1320.0	.400
720.0	.419	1335.0	.399
735.0	.420	1350.0	.400
750.0	.422	1365.0	.402
765.0	.425	1380.0	.404
780.0	.427	1395.0	.404
795.0	.426	1410.0	.404
810.0	.428	1425.0	.409
825.0	.437	1440.0	.409
840.0	.442	1455.0	.409
855.0	.433	1485.0	.434
870.0	.433	1545.0	.426
885.0	.449	1575.0	.427
900.0	.449	1605.0	.424
915.0	.450	1635.0	.441
930.0	.451	1695.0	.449
945.0	.452	1725.0	.451
960.0	.452	1755.0	.453
975.0	.451	1785.0	.451
990.0	.452	1815.0	.453
1005.0	.450	1845.0	.453
1020.0	.452	1875.0	.453
1035.0	.446	1905.0	.452
1050.0	.446	1935.0	.451
1065.0	.442	1965.0	.452
1080.0	.438	1995.0	.454
1095.0	.434	2025.0	.455
1110.0	.432	2055.0	.454
1125.0	.426	2085.0	.457
1140.0	.427	2115.0	.462
1155.0	.419	2145.0	.464
1170.0	.416	2175.0	.466
1185.0	.417	2205.0	.467
1200.0	.414	2235.0	.469
1215.0	.414	2265.0	.468
1230.0	.407	2295.0	.468
1245.0	.403	2325.0	.496

(CONTINUED)

MUSKISHO RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MGW/P GRID REF. 54442456

PUMPING AT MGW3T GRID REF. 54442455

DATE OF TEST 19 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
2355.0	.457	3585.0	.480
2385.0	.498	3615.0	.489
2415.0	.499	3645.0	.493
2445.0	.497	3675.0	.502
2475.0	.496	3705.0	.502
2505.0	.496	3735.0	.509
2535.0	.495	3765.0	.512
2565.0	.481	3795.0	.513
2595.0	.462	3825.0	.513
2625.0	.456	3855.0	.513
2655.0	.446	3885.0	.514
2685.0	.436	3915.0	.514
2715.0	.430	3945.0	.505
2745.0	.429	3975.0	.497
2775.0	.426	4005.0	.492
2805.0	.427	4035.0	.486
2835.0	.430	4065.0	.480
2865.0	.435	4095.0	.474
2895.0	.459	4125.0	.469
2925.0	.467	4155.0	.465
2955.0	.472	4185.0	.463
2985.0	.472	4215.0	.464
3015.0	.473	4245.0	.464
3045.0	.477	4275.0	.466
3075.0	.484	4305.0	.468
3105.0	.490	4335.0	.474
3135.0	.489	4365.0	.486
3165.0	.490	4395.0	.487
3195.0	.491	4425.0	.492
3225.0	.492	4455.0	.499
3255.0	.493	4485.0	.503
3285.0	.486	4515.0	.509
3315.0	.483	4545.0	.509
3345.0	.482	4575.0	.514
3375.0	.478	4605.0	.514
3405.0	.477	4635.0	.514
3435.0	.478	4665.0	.513
3465.0	.476	4695.0	.503
3495.0	.477	4725.0	.502
3525.0	.478	4755.0	.500
3555.0	.478	4785.0	.498

(CONTINUED)

...ISHD RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ...GATE GRID REF. 54442455

PUMPING AT ...GATE GRID REF. 54442455

DATE OF TEST 19 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
4815.0	.501	6045.0	.519
4845.0	.501	6075.0	.521
4875.0	.499	6105.0	.521
4905.0	.500	6135.0	.519
4935.0	.503	6165.0	.519
4965.0	.506	6195.0	.520
4995.0	.509	6225.0	.522
5025.0	.508	6255.0	.516
5055.0	.510	6285.0	.516
5085.0	.516	6315.0	.509
5115.0	.529	6345.0	.513
5145.0	.534	6375.0	.514
5175.0	.536	6405.0	.511
5205.0	.539	6435.0	.513
5235.0	.544	6465.0	.526
5265.0	.549	6495.0	.527
5295.0	.544	6525.0	.534
5325.0	.546	6555.0	.543
5355.0	.542	6585.0	.544
5385.0	.534	6615.0	.549
5415.0	.529	6645.0	.552
5445.0	.524	6675.0	.554
5475.0	.519	6705.0	.554
5505.0	.511	6735.0	.556
5535.0	.507	6765.0	.553
5565.0	.501	6795.0	.549
5595.0	.494	6825.0	.544
5625.0	.491	6855.0	.539
5655.0	.491	6885.0	.534
5685.0	.496	6915.0	.527
5715.0	.496	6945.0	.522
5745.0	.497	6975.0	.520
5775.0	.501	7005.0	.514
5805.0	.502	7035.0	.512
5835.0	.507	7065.0	.509
5865.0	.508	7095.0	.509
5895.0	.513	7125.0	.512
5925.0	.514	7155.0	.512
5955.0	.519	7185.0	.516
5985.0	.514	7215.0	.524
6015.0	.519	7245.0	.525

(CONTINUED)

...SHU RESOURCE STUDY

ALL TME DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT MG.7P GRID REF. 54442456

PUMPING AT MG.3 GRID REF. 54442455

DATE OF TEST 19 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
7275.0	.527	8235.0	.555
7305.0	.529	8265.0	.557
7335.0	.533	8295.0	.553
7365.0	.539	8325.0	.544
7395.0	.541	8355.0	.543
7425.0	.544	8382.0	.553
7455.0	.544	8415.0	.532
7485.0	.546	8445.0	.534
7515.0	.546	8475.0	.533
7545.0	.547	8505.0	.524
7575.0	.544	8535.0	.519
7605.0	.539	8565.0	.522
7635.0	.542	8595.0	.524
7665.0	.526	8625.0	.529
7695.0	.529	8655.0	.532
7725.0	.530	8685.0	.534
7755.0	.528	8715.0	.540
7785.0	.529	8745.0	.544
7815.0	.526	8775.0	.534
7845.0	.532	8805.0	.524
7875.0	.532	8835.0	.524
7905.0	.526	8865.0	.534
7935.0	.530	8895.0	.559
7965.0	.549	8925.0	.558
7995.0	.554	8955.0	.557
8025.0	.556	8985.0	.557
8055.0	.557	9015.0	.554
8085.0	.561	9045.0	.554
8115.0	.562	9075.0	.526
8145.0	.559	9105.0	.532
8175.0	.562	9135.0	.526
8205.0	.556		

[illegible] RESOURCE STUDY

ALL TME DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 54442456

PUMPING AT [illegible] GRID REF. 54442455

DATE OF TEST 27 2 79

PUMPING RATES (M**3/DAY) :
1056.0 FROM 0.0 MINS TO 1470.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.2	.027	90.0	.286
.3	.120	105.0	.287
.7	.221	120.0	.289
1.0	.274	135.0	.289
1.3	.267	150.0	.290
1.7	.251	165.0	.290
2.0	.244	180.0	.290
2.5	.244	195.0	.290
3.0	.246	210.0	.288
3.5	.249	225.0	.288
4.0	.251	240.0	.287
4.5	.252	255.0	.288
5.0	.255	270.0	.288
6.0	.258	285.0	.289
7.0	.260	300.0	.287
8.0	.262	315.0	.289
9.0	.265	330.0	.294
10.0	.266	345.0	.295
11.0	.267	360.0	.296
12.0	.268	375.0	.298
13.0	.268	390.0	.299
14.0	.269	405.0	.300
15.0	.270	420.0	.304
16.0	.270	435.0	.308
17.0	.271	450.0	.312
18.0	.271	465.0	.315
19.0	.271	480.0	.319
20.0	.272	495.0	.321
25.0	.272	510.0	.321
30.0	.275	525.0	.322
35.0	.277	540.0	.326
40.0	.278	555.0	.327
45.0	.279	570.0	.324
50.0	.280	585.0	.321
55.0	.281	600.0	.325
60.0	.281	615.0	.330
75.0	.283	630.0	.332

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 54442456

PUMPING AT [illegible] GRID REF. 54442455

DATE OF TEST 27 2 79

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
545.0	.340	1060.0	.376
560.0	.342	1080.0	.375
575.0	.346	1095.0	.376
590.0	.347	1110.0	.378
705.0	.348	1125.0	.377
720.0	.354	1140.0	.384
735.0	.359	1155.0	.382
750.0	.359	1170.0	.383
765.0	.363	1185.0	.381
780.0	.364	1200.0	.380
795.0	.363	1215.0	.387
810.0	.367	1230.0	.388
825.0	.367	1245.0	.394
840.0	.371	1260.0	.397
855.0	.371	1275.0	.399
870.0	.372	1290.0	.404
885.0	.369	1305.0	.405
900.0	.371	1320.0	.408
915.0	.370	1335.0	.409
930.0	.369	1350.0	.413
945.0	.371	1365.0	.414
960.0	.369	1380.0	.414
975.0	.371	1395.0	.417
990.0	.370	1410.0	.416
1005.0	.375	1425.0	.417
1020.0	.373	1440.0	.416
1030.0	.372	1455.0	.416
1050.0	.371	1470.0	.416

...SHU RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT ...7 GRID REF. 54442456

PUMPING AT ...31 GRID REF. 54442455

DATE OF TEST 7 12 74

PUMPING RATES (M**3/DAY) :
1440.0 FROM 0.0 MINS TO 2490.0 MINS

REST WATER LEVEL NOT RECORDED

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
.5	.144	210.0	.493
1.0	.218	225.0	.497
1.5	.214	240.0	.499
2.0	.237	255.0	.505
2.5	.302	270.0	.506
3.0	.337	285.0	.510
3.5	.347	300.0	.516
4.0	.366	315.0	.523
4.5	.376	330.0	.526
5.0	.387	345.0	.529
6.0	.398	360.0	.535
7.0	.406	375.0	.542
8.0	.409	390.0	.535
9.0	.414	405.0	.544
10.0	.416	420.0	.553
12.0	.421	435.0	.556
14.0	.425	450.0	.563
16.0	.428	465.0	.566
18.0	.430	480.0	.571
20.0	.434	495.0	.576
25.0	.436	510.0	.579
30.0	.439	525.0	.584
35.0	.443	540.0	.586
40.0	.445	555.0	.588
45.0	.447	570.0	.592
50.0	.448	585.0	.594
55.0	.449	600.0	.596
60.0	.452	615.0	.597
75.0	.456	630.0	.601
90.0	.465	645.0	.605
105.0	.470	660.0	.606
120.0	.475	675.0	.606
135.0	.478	690.0	.608
150.0	.480	705.0	.609
165.0	.485	720.0	.608
180.0	.487	735.0	.611
195.0	.490	750.0	.610

(CONTINUED)

[illegible] RESOURCE STUDY

ALL THE DATA

CONSTANT RATE TEST - OBSERVATION WELL

OBSERVED AT [illegible] GRID REF. 54442456

PUMPING AT [illegible] GRID REF. 54442455

DATE OF TEST 7 12 74

TIME(MINS)	DRAWDOWN(M)	TIME(MINS)	DRAWDOWN(M)
765.0	.610	1350.0	.677
780.0	.609	1365.0	.679
795.0	.606	1410.0	.676
810.0	.606	1425.0	.676
825.0	.606	1440.0	.676
840.0	.606	1470.0	.670
855.0	.606	1500.0	.669
870.0	.606	1530.0	.668
885.0	.609	1560.0	.664
900.0	.609	1590.0	.663
915.0	.609	1620.0	.661
930.0	.611	1650.0	.659
945.0	.611	1680.0	.660
960.0	.618	1710.0	.663
975.0	.621	1740.0	.665
990.0	.623	1770.0	.672
1005.0	.624	1800.0	.678
1020.0	.626	1830.0	.684
1035.0	.627	1860.0	.690
1050.0	.627	1890.0	.697
1065.0	.634	1920.0	.704
1080.0	.635	1950.0	.708
1095.0	.638	1980.0	.710
1110.0	.640	2010.0	.713
1125.0	.643	2040.0	.714
1140.0	.646	2070.0	.715
1155.0	.647	2100.0	.719
1170.0	.649	2130.0	.716
1185.0	.653	2160.0	.721
1200.0	.654	2190.0	.718
1215.0	.659	2220.0	.719
1230.0	.661	2250.0	.717
1245.0	.664	2280.0	.717
1260.0	.666	2310.0	.716
1275.0	.668	2340.0	.711
1290.0	.670	2370.0	.710
1305.0	.669	2400.0	.706
1320.0	.673	2430.0	.705
1335.0	.674	2460.0	.701
1350.0	.674	2490.0	.689
1365.0	.680		

APPENDIX C

WATER CHEMISTRY

The results of the chemical analysis of 49 water samples are listed. These represent samples taken from 41 separate sites, the locations and reference numbers of which are shown on Figure C.1.

C.1 SAMPLING PROCEDURE AND CHEMICAL ANALYSIS

Samples were collected in tightly stoppered polythene bottles from which all air was expelled. Where possible samples were taken directly from the discharge pipe at the well head; in some cases, however, samples had to be taken from storage tanks or as was the case for all observation wells drilled during the investigation from airlift samples.

Water analyses were undertaken by International Consultancy and Laboratory Services Ltd. (formerly Thresh, Bede and Suckling Ltd.) in England. Full chemical and mineralanalyses were carried out and report in both milligrams and milliequivalents per litre.

C.2 DESCRIPTION OF THE TABLES

The chemical results are arranged in columns with five samples to the page. At the head of the column the grid reference is followed by the well reference number which in turn is followed by the sample number and the date of collection.

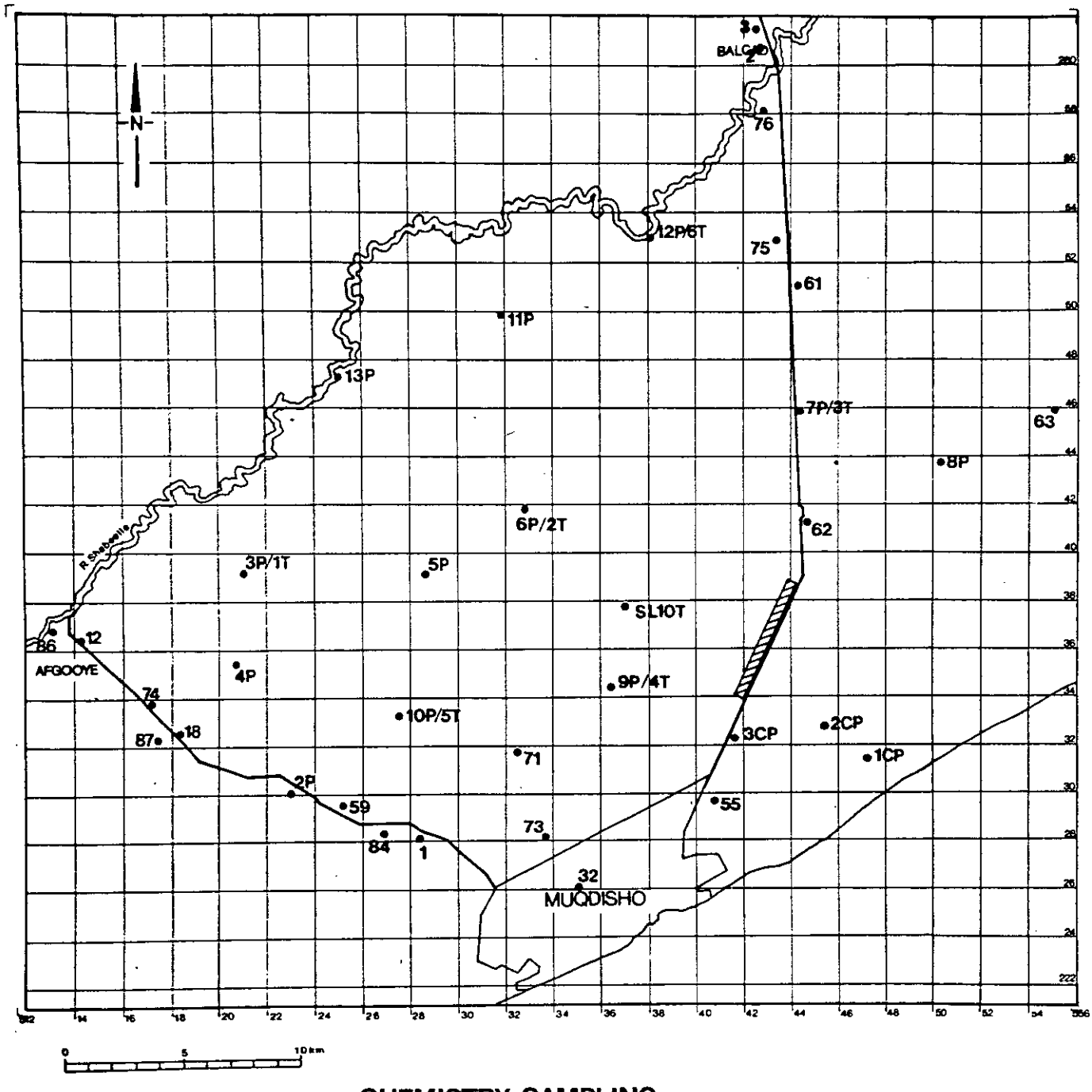
Major ion concentrations are quoted in milliequivalents per litre, total dissolved solids, hardness and trace elements in milligrams per litre. The electrical conductivity is presented as micromhos per centimetre at $20^{o}C$.

Most of the abbreviations used are self explanatory but the coding classification used for Basin, Aquifer and Source requires explanation.

The Basin Code refers to the groundwater basin from which the sample was collected; in this instance there is only one basin.

1. Shabeelle River Basin

The Aquifer code defines the geological origin of the sample as follows:



CHEMISTRY SAMPLING POINTS

Figure C.1

1. Limestone
2. Red and Buff sands
3. Alluvial sediments
4. Limestone and sands.

The Source code defines the physical origin as follows.

1. Drilled borehole
2. Hand dug well.

The water class indicates an overall assessment of water quality in terms of domestic and agricultural suitability. These are generated automatically within the computer data base system of the Institute. Although agricultural suitability has not formed any part of our study the results are included in this appendix from the point of view of general information. Domestic suitability has been established using criteria laid down in the WHO International Standards for drinking-water. The waters are shown as being of Class 1, 2 or 3 on the basis of the following limiting conditions:-

Class 1 waters have all constituents below the WHO highest desirable level

Class 2 waters have one or more constituents between the highest desirable level and the maximum permissible level

Class 3 waters have one or more constituents exceeding the maximum permissible level.

The constituent or constituents responsible for placing the water in classes 2 and 3 defined above have been indicated by the use of asterisks whereby:-

* indicates a concentration which exceeds WHO highest desirable level, and

** indicates a concentration which exceeds WHO maximum permissible level.

The limiting concentrations of the chemical substances used in the classification are shown in Table C.1. Discretion is needed in interpreting the classification. Class 1 waters are suitable for use as public supplies to large communities, class 2 waters are suitable for supplies to smaller communities. Concentrations of chemicals in excess of the criteria for class 3 frequently impair the palatability of the water but are not

TABLE C.1

DOMESTIC SUITABILITY - LIMITING CONCENTRATIONS OF CHEMICAL SUBSTANCES

Substance	Class 1	Class 2	Class 3
pH	6.5 - 8.5	8.5 - 9.2	> 9.2
Total dissolved solids (mg/l)	< 500	500 - 1 500	>1 500
Total hardness	< 100	100 - 500	> 500
Calcium (me/l)	< 3.7	3.7 - 10.0	> 10.0
Magnesium if			
sulphate < 250	< 4.1	4.1 - 12.3	> 12.3
sulphate > 250	< 2.5	2.5 - 12.3	> 12.3
Sulphate	< 4.2	4.2 - 8.3	> 8.3
Chloride	< 5.6	5.6 - 16.9	> 16.9
Nitrate	< 0.7	0.7	> 0.7
Manganese (mg/l)	< 0.05	0.05 - 0.5	> 0.5
Iron	< 0.1	0.1 - 1.0	> 1.0
Copper	< 0.05	0.05 - 1.5	> 1.5
Zinc	< 5	5 - 15	> 15

[1] *WHO International Standards for Drinking Water, 3rd Edition, Geneva 1971.*

necessarily harmful. However, certain substances in concentrations above those used as the criteria for class 3 can be injurious to health. For example, water containing nitrates in excess of 0.7 me/l (45 mg/l as NO_3) can give rise to infantile methaemoglobinaemia. Alternative sources of water should be found if a high nitrate concentration is present in a supply used for infant feeding. The nitrate content of 1 sample exceeded the limit, Well No.86, sample 33. Here a nitrate concentration of 0.96 me/l (60 mg/l) was recorded at the Villia Somalia rest house at Afgooye; local contamination is suspected.

In general the Total Dissolved Solids content of the majority of samples are over the highest desirable levels but below the maximum permitted levels. A similar pattern is followed by the concentration of the individual major elements. Those waters having over the maximum permitted levels of Total Dissolved Solids are the saline coastal waters such as MGQ-1CP and 2CP and the occasional inland water such as MGQ-1OP where sulphate minerals are present in usually large amounts. Overall, therefore, the quality of groundwater in terms of the concentration of major elements is of a satisfactory standard for drinking, whilst not being of outstanding purity. Concentration of the trace elements Iron, Zinc, Copper, Lead and Manganese for most waters fall within maximum permissible levels, with a few very minor exceptions.

Agricultural Suitability has been based on the U.S. Salinity Laboratory system[2] using the Sodium-Adsorption Ratio (SAR) and electrical conductivity (EC). The method of classification was adapted into the form of a set of constraints which determine the class of water by the salinity hazard and the sodium (alkali) hazard, given the EC at 20°C and the SAR as follows:-

1 The reported EC at 20°C is corrected to the U.S. standard at 25°C (ECL) by:-

$$ECL = \log_{10} (EC + 0.1\ EC)$$

then the salinity hazard classes are defined by:-

2 *U.S. Salinity Laboratory Staff 1954, Diagnosis and improvement of saline and alkali soils: U.S. Dept. of Agriculture Handbook No. 60.*

Range of ECL	Class
ECL < 2.398	C1
2.398 ≤ ECL < 2.875	C2
2.875 ≤ ECL < 3.352	C3
3.352 ≤ ECL < 3.699	C4
3.699 ≤ ECL	C5

2 The SAR is determined by:-

$$SAR = \frac{Na}{\sqrt{\frac{Ca + Mg}{2}}}$$

where the concentrations of Na, Ca and Mg are in me/l(milli-equivalent per litre). The sodium (alkali) hazard classes are then defined by:-

Range of SAR	Class
SAR < (-4.414 x ECL + 18.828)	S1
(-4.414 x ECL + 18.828) ≤ SAR < (-6.769 x ECL + 31.538)	S2
(-6.769 x ECL + 31.538) ≤ SAR < (-8.829 x ECL + 43.658)	S3
(-8.829 x ECL + 43.658) ≤ SAR ≤ 31	S4
31 ≤ SAR	S5

Finally reference may be made to water quality as it affects the choice of screen material for production wells. It is the chemistry of the groundwater and more particularly its degree of equilibrium with respect to Ca Co_3 that will determine whether screens become corroded, encrusted or left unaffected. With this in mind an index of the corrosive-incrustive nature of groundwater has been calculated using a formula developed by

J W Ryznar[3] and used subsequently by other workers[4]. The Index is calculated from the following formula.

$$pHs = \frac{\log Ks}{K2} - \log Ca^{++} - \log Alk + 9.3 + \frac{2.5\sqrt{u}}{1 + 5.3\sqrt{u+5.5}}$$

Where
- pHs = Calculated pH
- Ks = Activity product of $CaCo_3$
- K2 = 2nd dissociation constant of HGO
- Ca = Concentration of Ca in mg/l
- Alk = Alkalinity expressed as Ca CO_3 (mg/l)
- μ = Ionic strength of the water

The last term in the equation is very small and unless the Total Dissolved Solids content is well over 1000 mg/l it can be approximated by, T.D.S. mg/l x 2.5 x 10^{-5}. Once the pHs has been calculated the Stability Index is derived thus:

$$S.I = 2\ pHs - pH$$

where Qh is the measured pH of the water.

The answer will always be positive and lie between 3 and 13. In general water with an index below 6 are progressively encrusting whilst those over 8 are increasingly corrosive. Between 6 and 8 only mild corrosion or encrustation is likely to take place, with 6.6 being the approximate value at which theoretically no corrosion or encrustation takes place. To calculate this figure accurately requires that the pH of the groundwater be measured in the field immediately after sampling. This was done for 5 of the 6 pumped wells tested during the investigation; the results are as follows:

[3] *RYZNAR, J.W. Journal of American Waterworks Association, 1944 April pp 472-86.*

[4] *Mugg, J.L. Groundwater 1972 V.10 No.2 pp 6-11.*

TABLE B

Well Number	Calculated pHs	Measured Field pH	Stability Index
MGQ - 1T	7.10	7.3	6.9
MGQ - 2T	6.65	7.0	6.3
MGQ - 3T	7.35	7.1	7.6
MGQ - 4T	7.01	7.2	6.8
MGQ - 5T	6.61	6.9	6.3

These figures fall on either side of the 6.6 neutral point and it would seem that neither severe encrustation or corrosion is likely to be a problem with any of the groundwaters.

MUQDISHO RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF	51342372	51432365	51742340	51782325	51862330
WELL NUMBER	86.	12	74	87	18
SAMPLE	33	17	23	36	35.
DATE	12 APR 79	23 FEB 79	11 FEB 79	12 APR 79	12 APR 79
BASIN	1	1	1	1	1
AQUIFER	3	2	2	2	2
SOURCE	1	1	1	1	1
TOTAL SOLIDS	950.*	1200.*	1000.*	1672.**	1720.**
ELEC. COND.	1250.	1320.	1300.	2300.	2100.
PH	7.90	8.30	7.80	7.80	7.70
HARDNESS:TOT	420.00*	720.00**	480.00*	700.00**	740.00**
NON-CO3	180.00	500.00	280.00	330.00	440.00
ALK AS CACO3	240.00	220.00	200.00	370.00	300.00
FREE CO2	5.00		6.00	10.00	10.00
CATIONS (MEQ/L) CA	4.02*	8.66*	4.68*	7.40*	9.43*
MG	4.38*	5.74*	4.92*	6.60*	5.37*
NA	6.30	4.92	4.60	12.78	11.68
K	.05	.21	.31	.12	.20
ANIONS (MEQ/L) HCO3	4.80	4.40	4.00	7.40	6.00
SO4	7.08*	8.33*	7.92*	14.14**	16.14**
CL	1.91	6.74*	2.59	5.35	4.51
NO3	.96**	.06		.01	.03
MINORS (MG/L) FE	.28*	.05	.84*	.05	.09
ZN	.04	.03	.11	1.08	.21
CU	<.03000	<.03000	<.03000	<.03000	<.03000
PB	<.03000	<.03000	<.03000	<.03000	<.03000
MN	<.03000	<.03000	.28*	<.03000	<.03000
DOMES. CLASS	3	3	2	3	3
AGRIC. CLASS	C3S1	C3S1	C3S1	C4S2	C4S2

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL

** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

MUQDISHO RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF		52092356	52112393	52122392	52322302	52512470
WELL NUMBER		MGQ4P	MGQ1T	MGQ3P	MGQ2P	MGQ13P
SAMPLE		4	9358	3	2	9360
DATE		16 DEC 78	10 AUG 79	15 DEC 78	14 DEC 78	11 AUG 79
BASIN		1	1	1	1	1
AQUIFER		3	2	2	2	2
SOURCE		1	1	1	1	1
TOTAL SOLIDS		750.*	600.*	610.*	1080.*	890.*
ELEC. COND.		840.	690.	720.	1280.	1000.
PH		8.60*	7.50	8.30	8.10	7.70
HARDNESS:TOT		375.00*	340.00*	365.00*	760.00**	470.00*
NON-CO3		155.00	280.00	210.00	580.00	250.00
ALK AS CACO3		220.00	160.00	155.00	180.00	220.00
FREE CO2			10.00		2.50	8.00
CATIONS (MEQ/L)	CA	5.90*	3.89*	4.43*	7.54*	4.07*
	MG	1.60	2.91	2.87	7.62*	5.33*
	NA	4.02	2.39	2.14	1.90	4.89
	K	.18	.15	.10	.19	.09
ANIONS (MEQ/L)	HCO3	4.40	3.20	3.10	3.60	4.40
	SO4	5.99*	4.59*	4.83*	10.83**	7.73*
	CL	1.18	1.24	1.24	2.77	2.25
	NO3	.13	.31	.37	.05	
MINORS (MG/L)	FE	.60*	.06	.12*	.16*	2.70**
	ZN	.10	<.03000	.05	.05	<.03000
	CU	<.03000	<.03000	<.03000	<.03000	<.03000
	PB	<.03000	<.03000	<.03000	<.03000	<.03000
	MN	.78**	<.03000	.18*	.64**	.06*
DOMES. CLASS		3	2	2	3	3
AGRIC. CLASS		C3S1	C3S1	C3S1	C3S1	C3S1

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL
** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

MUQDISHO RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF	52582299	52672285	52772332	52772333	52862283
WELL NUMBER	59	84	MGQ10P	MGQ5T	MGQ1P
SAMPLE	30	34	8	11515	1
DATE	9 SEP 78	12 APR 79	10 JAN 79	18 OCT 79	13 DEC 78
BASIN	1	1	1	1	1
AQUIFER	2	2	2	2	2
SOURCE	1	1	1	1	1
TOTAL SOLIDS	1200.*	870.*	1515.**	1560.**	1340.*
ELEC. COND.	1600.	1050.	1670.	1600.	1580.
PH	7.70	7.90	8.00	7.80	8.20
HARDNESS:TOT	690.00**	530.00**	660.00**	680.00**	600.00**
NON-CO3	550.00	290.00	320.00	380.00	320.00
ALK AS CACO3	140.00	240.00	340.00	300.00	280.00
FREE CO2	5.00	6.00	5.00	7.00	3.00
CATIONS (MEQ/L) CA	6.10*	6.26*	7.87*	6.30*	6.02*
MG	7.70*	4.34*	5.33*	7.30*	5.98*
NA	5.65	3.26	10.43	10.87	9.40
K	.23	.09	.17	.26	.17
ANIONS (MEQ/L) HCO3	2.80	4.80	6.80	6.00	5.60
SO4	10.71**	7.08*	13.90**	15.01**	10.42**
CL	6.08*	2.03	3.10	3.66	5.49
NO3	.09	.04		.06	.06
MINORS (MG/L) FE	.56*	.03	.11*	<.03000	.38*
ZN	1.27	.51	.17	<.03000	.06
CU	.03	<.03000	<.03000	<.03000	<.03000
PB	<.03000	<.03000	<.03000	<.03000	<.03000
MN	<.03000	<.03000	<.03000	<.03000	.21*
DOMES. CLASS	3	3	3	3	3
AGRIC. CLASS	C3S1	C3S1	C3S1	C3S1	C3S1

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL

** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

MUQDISHO RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF		52862283	52872391	53202498	53202498	53222328
WELL NUMBER		MGQ1P	MGQ5P	MGQ11P	MGQ11P	70
SAMPLE		31	5	9	11516	20
DATE		25 SEP 78	18 DEC 78	24 JAN 79	17 SEP 79	11 FEB 79
BASIN		1	1	1	1	1
AQUIFER		2	2	2	2	2
SOURCE		1	1	1	1	1
TOTAL SOLIDS		1550.**	1445.*	3165.**	3230.**	660.*
ELEC. COND.		2200.	1350.	3300.	3600.	970.
PH		6.75*	8.30	7.80	7.90	8.00
HARDNESS:TOT		830.00**	868.00**	1680.00**	1750.00**	320.00*
NON-CO3		430.00	798.00	1540.00	1530.00	120.00
ALK AS CACO3		400.00	70.00	140.00	220.00	200.00
FREE CO2		120.00		3.50	4.50	4.00
CATIONS (MEQ/L)	CA	10.21**	12.20**	16.39**	15.33**	2.88
	MG	6.39*	5.16*	17.21**	19.67**	3.52
	NA	9.78	3.70	17.20	17.39	2.83
	K	.26	.29	.20	.26	.28
ANIONS (MEQ/L)	HCO3	8.00	1.40	2.80	4.40	4.00
	SO4	8.64**	18.54**	29.50**	29.70**	4.01
	CL	9.94*	1.18	18.59**	18.45**	1.49
	NO3	.06	.23	.11	.10	.01
MINORS (MG/L)	FE	1.93**	.12*	.06	<.03000	.26*
	ZN	1.15	.05	.07	<.03000	.04
	CU	.04	<.03000	<.03000	<.03000	<.03000
	PB	.10	<.03000	<.03000	<.03000	<.03000
	MN	.57**	.14*	<.03000	<.03000	<.03000
DOMES. CLASS		3	3	3	3	2
AGRIC. CLASS		C4S1	C3S1	C4S2	C4S2	C3S1

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL
** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

MUQDISHO RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF	53282419	53282419	53292418	53332285	53482246
WELL NUMBER	MGQ2T	MGQ2T	MGQ6PA	73	RAIN
SAMPLE	25	9359	32	24	8543
DATE	1 DEC 78	18 AUG 79	3 MAR 79	11 FEB 79	8 JUL 79
BASIN	1	1	1	1	
AQUIFER	2	2	2	2	
SOURCE	1	1	1	1	
TOTAL SOLIDS	1000.*	940.*	1020.*	650.*	55.
ELEC. COND.	1280.	1060.	1340.	920.	85.
PH	7.80	7.60	7.70	7.85	7.00
HARDNESS:TOT	360.00*	670.00**	750.00**	390.00*	31.00
NON-CO3	130.00	420.00	490.00	190.00	1.00
ALK AS CACO3	230.00	250.00	260.00	200.00	30.00
FREE CO2	7.00	12.00	10.00	5.00	6.00
CATIONS (MEQ/L) CA		6.88*	9.47*	3.54	.55
MG		6.52*	5.53*	4.26*	.07
NA		2.50	1.74	2.17	.21
K		.10	.12	.36	.02
ANIONS (MEQ/L) HCO3		5.00	5.20	4.00	.60
SO4		6.61*	7.14*	4.39*	.10
CL		4.39	4.51	1.92	.15
NO3			.01	.02	
MINORS (MG/L) FE	1.32**	.04	.06	.30*	<.03000
ZN	.11	<.03000	.26	.08	<.03000
CU	<.03000	<.03000	<.03000	<.03000	<.03000
PB	<.03000	<.03000	<.03000	<.03000	<.03000
MN	.42*	<.03000	<.03000	<.03000	<.03000
DOMES. CLASS	3	3	3	2	1
AGRIC. CLASS	C3	C3S1	C3S1	C3S1	C1S1

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL
** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

MUQDISHU RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF	53492262	53642341	53642341	53642342	53672379
WELL NUMBER	32	MGQ-4T	MGQ-4T	MGQ9P	SL10T
SAMPLE	18	29	8545	7	22
DATE	23 FEB 79	29 DEC 78	6 JUN 79	20 DEC 78	20 FEB 79
BASIN	1	1	1	1	1
AQUIFER	2	1	1	1	2
SOURCE	2	1	1	1	1
TOTAL SOLIDS	2210.**	770.*	760.*	920.*	620.*
ELEC. COND.	2720.	900.	1050.	1000.	920.
PH	8.00	8.60*	7.90	8.60*	8.00
HARDNESS:TOT	660.00**	340.00*	350.00*	400.00*	420.00*
NON-CO3	580.00	120.00	90.00	150.00	260.00
ALK AS CACO3	80.00	220.00	260.00	250.00	160.00
FREE CO2	1.30		6.00		3.00
CATIONS (MEQ/L) CA	5.00*	3.52	3.68	4.43*	3.15
MG	8.20*	3.28	3.32	3.57	5.25*
NA	22.61	5.37	5.57	6.52	2.26
K	.17	.17	.16	.18	.36
ANIONS (MEQ/L) HCO3	1.60	4.40	5.20	5.00	3.20
SO4	11.55**	4.90*	4.96*	6.31*	3.54
CL	22.67**	3.04	2.54	3.37	4.28
NO3	.16		.03	.02	
MINORS (MG/L) FE	.08	.19*	.04	.21*	.32*
ZN	.11	.04	<.03000	.17	.16
CU	<.03000	<.03000	<.03000	<.03000	<.03000
PB	<.03000	<.03000	<.03000	.04	<.03000
MN	<.03000	.04	<.03000	<.03000	<.03000
DOMES. CLASS	3	2	2	2	2
AGRIC. CLASS	C4S3	C3S1	C3S1	C3S1	C3S1

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL
** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

MUQDISHO RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF		53812528	53812528	53822529	54062300	54152322
WELL NUMBER		MGQ6T	MGQ6T	MGQ12P	55	MGQ3CP
SAMPLE		5131	11517	10	26	13
DATE		10 FEB 79	18 NOV 79	1 FEB 79	28 SEP 78	12 DEC 78
BASIN		1	1	1	1	1
AQUIFER		2	2	2	1	4
SOURCE		1	1	1	1	1
TOTAL SOLIDS		595.*	780.*	680.*	1350.*	1125.*
ELEC. COND.		815.	1000.	785.	1950.	1300.
PH		7.50	7.50	8.30	7.70	8.20
HARDNESS:TOT			490.00*	390.00*	385.00*	410.00*
NON-CO3			350.00	260.00	175.00	250.00
ALK AS CACO3			140.00	130.00	210.00	160.00
FREE CO2			7.00	1.10	7.00	1.60
CATIONS (MEQ/L)	CA	5.92*	8.06*	6.37*	4.18*	3.77*
	MG	1.48	1.74	1.43	3.52	4.43*
	NA	1.99	2.17	2.72	14.48	9.57
	K	.14	.21	.14	.19	.18
ANIONS (MEQ/L)	HCO3	3.00	2.80	2.60	4.20	3.20
	SO4	4.27*	8.00*	6.23*	7.31*	7.42*
	CL	2.25	1.38	1.80	10.76*	7.32*
	NO3	.01		.03	.10	.01
MINORS (MG/L)	FE		<.03000	.14*	.97*	.32*
	ZN		<.03000	.17	.04	.11
	CU		<.03000	<.03000	.05	<.03000
	PB		<.03000	<.03000	<.03000	<.03000
	MN		<.03000	<.03000	.03	.25*
DOMES. CLASS		2	2	2	2	2
AGRIC. CLASS		C3S1	C3S1	C3S1	C3S2	C3S1

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL
** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

MUQDISHO RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF		54302577	54302605	54342521	54342595	54352598
WELL NUMBER		76	2	75	4	RIVER
SAMPLE		27	38	19	5139	39
DATE		14 FEB 79	21 JUN 79	14 FEB 79	3 MAY 79	26 SEP 78
BASIN		1	1	1	1	
AQUIFER		2	2	2	2	
SOURCE		1	1	1	1	
TOTAL SOLIDS		620.*	745.*	550.*	730.*	300.
ELEC. COND.		900.	950.	780.	990.	470.
PH		7.90	7.70	7.80	7.60	7.40
HARDNESS:TOT		410.00*	480.00*	280.00*		210.00*
NON-CO3		290.00	350.00	120.00		90.00
ALK AS CACO3		120.00	130.00	160.00		120.00
FREE CO2		3.00	5.00	5.00		10.00
CATIONS (MEQ/L)	CA	6.07*	6.49*	2.81	7.43*	3.18
	MG	2.13	3.11	2.79	1.97	1.02
	NA	1.65	1.97	2.13	1.96	.86
	K	.38	.11	.46	.11	.09
ANIONS (MEQ/L)	HCO3	2.40	2.60	3.20	3.20	2.40
	SO4	6.36*	7.08*	3.98	6.46*	2.04
	CL	1.46	1.97	1.01	1.74	.62
	NO3	.01	.01		.07	.09
MINORS (MG/L)	FE	.40*	<.03000	.10		5.70**
	ZN	.32	.04	.12		1.08
	CU	<.03000	<.03000	<.03000		.13*
	PB	<.03000	<.03000	<.03000		<.03000
	MN	<.03000	<.03000	<.03000		3.25**
DOMES. CLASS		2	2	2	2	3
AGRIC. CLASS		C3S1	C3S1	C3S1	C3S1	C2S1

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL
** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

MUQDISHO RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF	54352598	54412508	54442455	54442455	54462413
WELL NUMBER	RIVER	61	MGQ3T	MGQ3T	NO 62
SAMPLE	8544	15	14	21	28
DATE	3 JUN 79	23 FEB 79	28 NOV 78	24 FEB 79	9 OCT 78
BASIN		1	1	1	1
AQUIFER		2	2	2	2
SOURCE		1	1	1	1
TOTAL SOLIDS	468.	520.*	650.*	660.*	620.*
ELEC. COND.	700.	550.	780.	940.	900.
PH	7.30	8.40	8.50	7.70	7.80
HARDNESS:TOT	330.00*	210.00*	400.00*	300.00*	100.00
NON-CO3	200.00	85.00	160.00	40.00	
ALK AS CACO3	130.00	125.00	240.00	260.00	120.00
FREE CO2	14.00			10.00	3.00
CATIONS (MEQ/L) CA	5.49*	1.37	3.90*	1.41	5.21*
MG	1.11	2.83	4.10	4.59*	2.79
NA	.65	3.38	2.54	3.56	2.17
K	.13	.13	.15	.44	.33
ANIONS (MEQ/L) HCO3	2.60	2.50	4.80	5.20	2.40
SO4	4.41*	4.00	3.91	2.08	3.71
CL	.33	1.13	1.92	2.70	4.39
NO3	.04	.08	.06	.02	
MINORS (MG/L) FE	34.00**	.12*	.26*	.11*	1.76**
ZN	.12	.03	.07	.13	.12
CU	.14*	<.03000	<.03000	<.03000	.94**
PB	<.03000	<.03000	.12**	<.03000	<.03000
MN	4.74**	<.03000	.23*	<.03000	.08*
DOMES. CLASS	3	2	3	2	3
AGRIC. CLASS	C3S1	C2S1	C3S1	C3S1	C3S1

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL
** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

MUQDISHU RESOURCE STUDY

ALL THE DATA

CHEMISTRY SUMMARY

GRID REF	54462413	54552327	54712315	55022437	55512457
WELL NUMBER	NO 62	MGQ2CP	MGQ1CP	MGQ8P	63
SAMPLE	37	12	11	6	16
DATE	3 MAY 79	8 JAN 79	23 FEB 79	12 DEC 78	23 FEB 79
BASIN	1	1	1	1	1
AQUIFER	2	1	1	4	2
SOURCE	1	1	1	1	1
TOTAL SOLIDS	975.*	2485.**	30500.**	970.*	1290.*
ELEC. COND.	1340.	2860.	42000.	1180.	1620.
PH	7.80	8.00	7.60	8.70*	8.80*
HARDNESS:TOT	450.00*	820.00**	7720.00**	440.00*	160.00*
NON-CO3	145.00	560.00	7580.00	180.00	
ALK AS CACO3	305.00	260.00	140.00	260.00	390.00
FREE CO2	8.00	4.00			
CATIONS (MEQ/L) CA	6.21*	8.55*	92.10**	5.11*	1.89
MG	2.79	7.87*	62.30**	3.69	1.31
NA	6.74	23.13	343.60	6.76	17.39
K	.11	.32	6.80	.15	.12
ANIONS (MEQ/L) HCO3	6.10	5.20	2.80	5.20	7.80
SO4	3.44	18.75**	51.30**	5.71*	5.52*
CL	6.20*	15.88*	450.70**	4.80	7.35*
NO3	.11	.04			.04
MINORS (MG/L) FE	.03	.18*	.17*	.07	.24*
ZN	.25	.30	.25	.08	.09
CU	<.03000	<.03000	.05	<.03000	.03
PB	<.03000	<.03000	<.03000	<.03000	<.03000
MN	<.03000	<.03000	<.03000	<.03000	<.03000
DOMES. CLASS	2	3	3	2	2
AGRIC. CLASS	C3S1	C4S3	C5S5	C3S1	C3S3

* CONCENTRATION EXCEEDS W.H.O. HIGHEST DESIRABLE LEVEL
** CONCENTRATION EXCEEDS W.H.O. MAXIMUM PERMISSIBLE LEVEL

APPENDIX D

REGIONAL CONDUCTIVITY SURVEY

The conductivity of pumped groundwater samples was measured. This was possible with the boreholes drilled during the investigation and all other boreholes equiped with pumps. These data are presented together with all available historical data.

Field conductivities were taken to provide a rapid method of estimating water quality throughout the area without full chemical analyses. This was useful when large numbers of samples are taken, the results being used to assess any deterioration of quality particularly under Muqdisho.

The field conductivities given were corrected to the standard temperature of 25°C whereas thise determined in the full chemical analysis, Appendix C, are corrected to 20°C. The field conductivity measurements can be adjusted to 20°C by multiplying by 0.89. It is also possible to use the conductivity value to estimate the total dissolved solids concentration in milligrams per litre by reference to figure D.1. Here, using data drawn from Appendix C, electrical conductivity at 20°C is plotted against total dissolved solids concentration and establishes the relationship:

$$\text{TDS in mg/l} = 0.8 \times \text{E.C. at } 20^{\circ}\text{C}$$

As the Shabeelle River is the major source of recharge the conductivity was monitored at frequent intervals. The sampling period was between September 1978 and September 1979 with the samples being taken at the old road bridge at Balcad.

The results are summarised in figure D.2 together with the river stage. During the sampling period conductivities ranged between 400 and 1400 micromhos with an approximate mean of 700 micromhos.

RELATIONSHIP BETWEEN TDS & E.C.

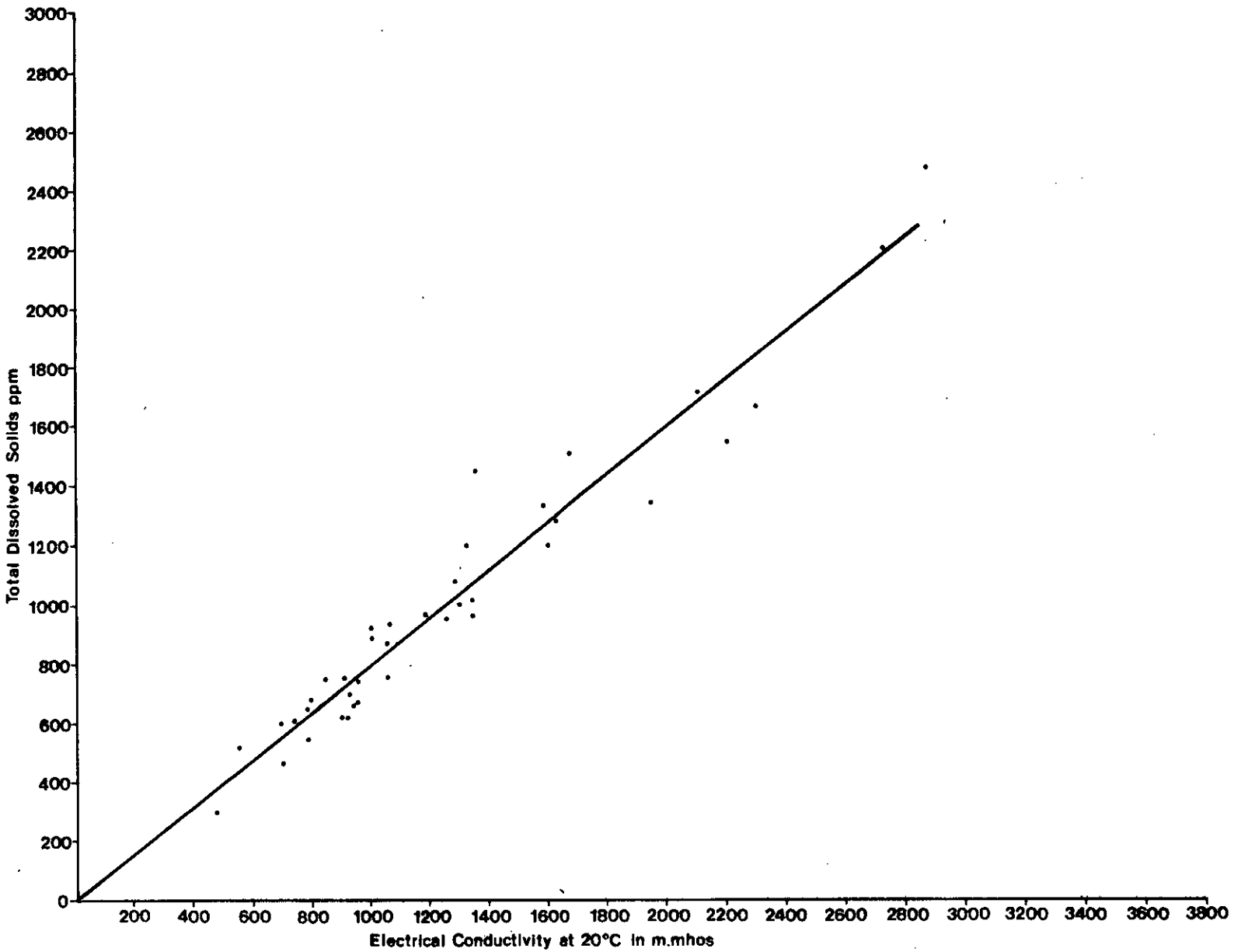


Figure D.1

SHABEELLE : CONDUCTIVITY / STAGE

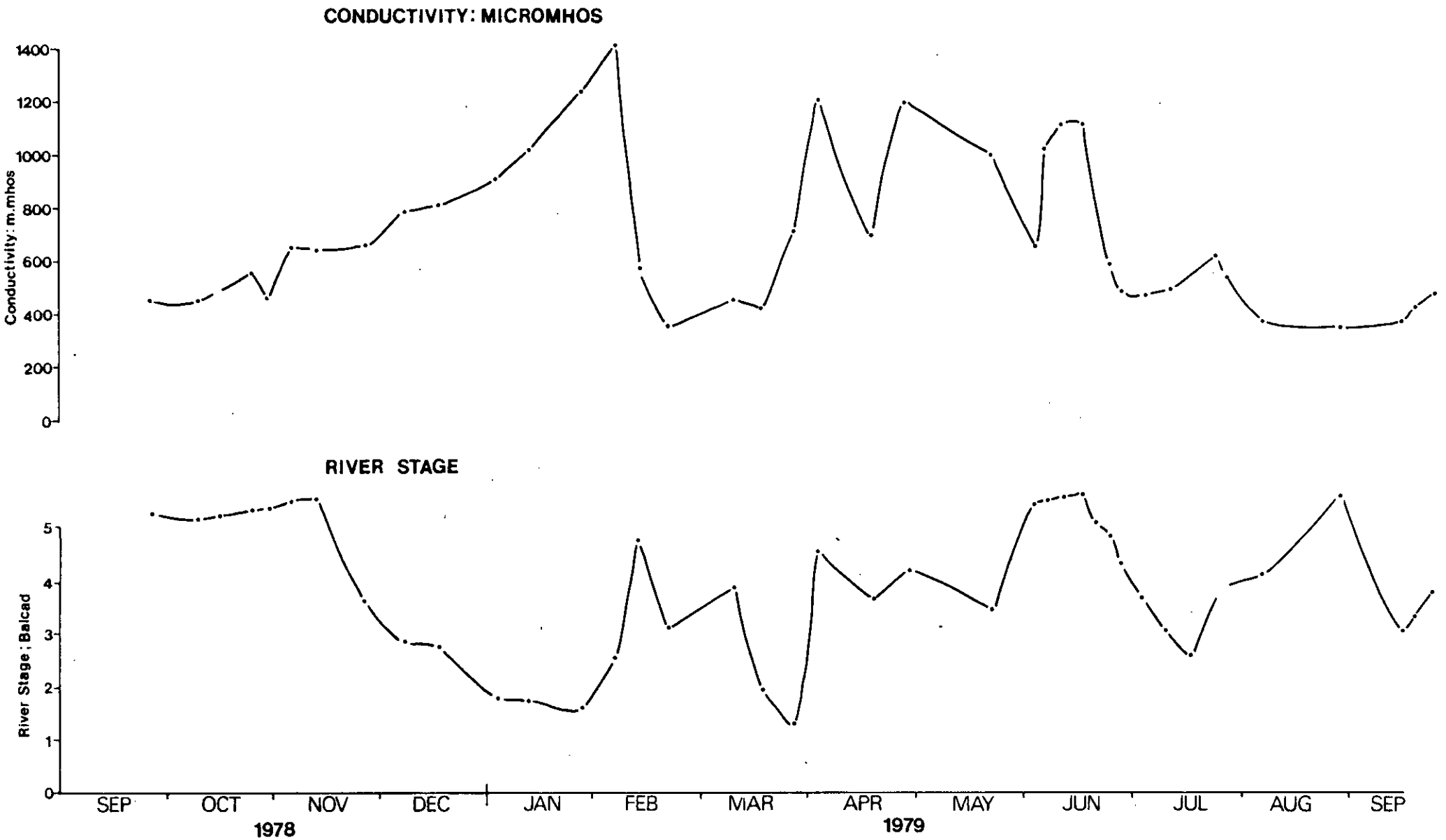


Figure D.2

MOGDISHU RESOURCE STUDY
CONDUCTIVITY SUMMARY
ALL THE DATA

GRID REF	SITE NO	DATE	CONDUCTIVITY (MICROMHOS/CM).
51282428	57	12 FEB 69	2060.0 ✓
51342372	86	15 APR 79	1330.0 ✓
51422365	14	10 OCT 78	4490.0 ✓
51422400	56	7 FEB 69	2010.0 ✓
51432361	58	2 FEB 69	1480.0 ✓
51432365	12	14 JAN 78	1275.0 ✓
		4 JAN 79	1670.0 ✓
51452368	60	10 OCT 78	1900.0 ✓
51742340	74	11 FEB 79	1475.0 ✓
51782325	87	5 FEB 77	2450.0 ✓
		15 APR 79	2355.0 ✓
51862330	18	1 AUG 69	1700.0 ✓
		5 FEB 77	2250.0 ✓
		14 JAN 78	2100.0 ✓
		21 APR 79	2175.0 ✓
52092356	MGQ4P	17 DEC 78	995.0 ✓
52112393	MGQ1T	26 OCT 78	905.0
		9 AUG 79	830.0 ✓
52122392	MGQ3P	15 DEC 78	865.0 ✓
52322302	MGQ2P	14 DEC 78	1600.0 ✓
52512470	MGQ13P	9 SEP 79	1300.0 ✓
52552284	11	9 OCT 78	1650.0 ✓
52582299	59	9 SEP 78	2050.0 ✓

MUGDISHU RESOURCE STUDY
CONDUCTIVITY SUMMARY
ALL THE DATA

GRID REF	SITE NO	DATE	CONDUCTIVITY (MICROMHOS/CM)
52672285	84	5 FEB 77	1200.0
		18 DEC 77	1200.0
		15 APR 79	1190.0
52702290	A13T	1 JUL 69	1150.0
52772332	MGQ10P	10 JAN 79	2400.0
52772333	MGQ5T	17 OCT 79	2050.0
52862283	MGQ1P	13 DEC 78	1880.0
52872391	MGQ5P	10 NOV 78	1910.0
		18 DEC 78	1910.0
53092266	40	21 JAN 78	1500.0
53202283	19	15 JAN 78	1200.0
53202498	MGQ11P	2 JAN 79	4130.0
53222320	71	11 DEC 79	975.0
53222328	70	11 DEC 79	952.0
53252295	72	11 DEC 79	972.0
53282253	24	17 JAN 78	2400.0
53282255	42	26 JAN 78	1190.0
53282418	MGQ2TA	17 AUG 79	1395.0
53282419	MGQ2T	3 DEC 78	1480.0
53292418	MGQ6PA	3 MAR 79	1435.0
53332285	73	11 FEB 79	1040.0
53342244		1 AUG 69	1180.0
53352250	43	26 JAN 78	1700.0

MOGDISHO RESOURCE STUDY
CONDUCTIVITY SUMMARY
ALL THE DATA

GRID REF	SITE NO	DATE	CONDUCTIVITY (MICROMHOS/CM).
53352270	65	11 DEC 78	1210.0 /
53362273	69	11 DEC 79	1200.0 /
53372249	A6T	1 JUL 69	1000.0 /
53402258	23	29 DEC 77	1130.0 /
53442269	21	29 DEC 77	1070.0 /
53452274	66	11 DEC 78	1150.0 /
53462278	68	11 DEC 78	1210.0 /
53472254	A4T	1 JUN 69	1200.0 /
53472261	33	18 JAN 78	2050.0 /
53472272	92	8 JUL 79	1160.0 /
53482276	67	11 DEC 78	1410.0 /
53482279	46	11 DEC 78	1040.0 /
53492262	32	18 JAN 78	2450.0 /
		5 NOV 78	3640.0 /
53512281	20	15 JAN 78	1210.0 /
53542276	39	19 JAN 78	1180.0 /
53572257	31	18 JAN 78	4250.0 /
53612286	48	26 JAN 78	1330.0 /
53642342	MGQSP	20 DEC 78	1330.0 /
53672379	SL10T	1 OCT 69	800.0 /
		7 FEB 77	1000.0 /
		22 JAN 78	975.0 /
		8 NOV 78	1040.0 /
		20 FEB 79	1060.0 /

MUDDISMO RESOURCE STUDY
CONDUCTIVITY SUMMARY
ALL THE DATA

GRID REF	SITE NO	DATE	CONDUCTIVITY (MICROMHOS/CM)
53692275	37	19 JAN 78	1390.0
53712288	64	22 SEP 78	1480.0
53722292	49	26 JAN 78	1600.0
53742279	38	24 JAN 78	1730.0
53812256	53	28 JAN 78	4100.0
53812287	29	17 JAN 78	2180.0
53812528	MGQ6T	10 FEB 79	812.0
53822529	MGQ12P	1 FEB 79	935.0
53882263	41	24 JAN 78	4750.0
53972289	27	26 JAN 78	1430.0
54002296	35	26 JAN 78	1800.0
54022302	26	8 DEC 76 12 FEB 77	2200.0 2100.0
54032304	85.5Tm	1 APR 69	1300.0
54062300	55	28 SEP 78	2310.0
54112264	5A	13 JAN 79	7200.0
54152322	MGQ3CP	12 DEC 78 19 SEP 79	1840.0 2880.0
54182276	4A	19 DEC 77	5750.0
54202340	10A	3 FEB 70	760.0
54202342	10AAA	11 AUG 79	923.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY SUMMARY
ALL THE DATA

GRID REF	SITE NO	DATE	CONDUCTIVITY (MICROMHOS/CM)
54202352	11B	31 JAN 77	1000.0
		16 JAN 78	975.0
		19 DEC 78	967.0
54222343	B10fw	1 OCT 69	800.0
54232356	11.5B	31 JAN 77	1050.0
		16 JAN 78	1000.0
54252350	11A	22 MAR 70	790.0
		31 JAN 77	1000.0
		9 FEB 77	1000.0
		30 JUN 77	970.0
		21 SEP 77	970.0
		16 JAN 78	980.0
		19 DEC 78	990.0
54262614	3	13 JAN 78	1300.0
54272355	11.5A	12 AUG 70	700.0
		31 JAN 77	1080.0
		16 JAN 78	1050.0
		19 DEC 78	1050.0
54282366	12.5B	28 APR 70	875.0
		6 DEC 76	1090.0
		31 JAN 77	1080.0
		16 JAN 78	1020.0
		19 DEC 78	1010.0
54292371	13B	26 MAY 70	720.0
		31 JAN 77	950.0
		16 JAN 78	950.0
		19 DEC 78	950.0
54302359	12A	10 JUL 70	760.0
		31 JAN 77	1100.0
		16 JAN 78	1075.0
		19 DEC 78	1060.0
54302577	76	14 FEB 79	1070.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY SUMMARY
ALL THE DATA

GRID REF	SITE NO	DATE	CONDUCTIVITY (MICROMHOS/CM)
54302605	2	13 JAN 78	1100.0
		3 MAY 79	1040.0
54312281	3A	19 DEC 77	5900.0
54322364	12.5A	6 MAY 70	810.0
		31 JAN 77	1150.0
		16 JAN 78	1100.0
		19 DEC 78	1120.0
54322375	13.5B	26 MAY 70	720.0
		31 JAN 77	950.0
		16 JAN 78	975.0
		19 DEC 78	967.0
54322594	7	13 JAN 78	1045.0
		3 MAY 79	1045.0
54342369	13A	12 MAY 70	720.0
		31 JAN 77	1000.0
		30 JUN 77	940.0
		21 SEP 77	940.0
		19 DEC 78	970.0
54342379	14B	30 JUN 77	920.0
		21 SEP 77	920.0
		16 JAN 78	945.0
		19 DEC 78	950.0
54342521	7S	14 FEB 79	782.0
54352366	13H	1 NOV 69	720.0
54362373	13.5A	2 JUN 70	740.0
		31 JAN 77	1000.0
		16 JAN 78	975.0
		19 DEC 78	970.0

MUGDISHU RESOURCE STUDY
CONDUCTIVITY SUMMARY
ALL THE DATA

GRID REF	SITE NO	DATE	CONDUCTIVITY (MICROMHOS/CM)
54362384	14.5B	29 JUN 70	920.0
		7 DEC 76	920.0
		31 JAN 77	1100.0
		16 JAN 78	1050.0
		19 DEC 78	1350.0
54372375	B14TW	1 AUG 69	1100.0
54382378	14A	14 JUN 70	710.0
		7 DEC 76	1150.0
		21 JAN 77	1080.0
		16 JAN 78	1120.0
		19 DEC 78	1120.0
54382389	15B	11 APR 70	650.0
		7 DEC 76	1050.0
		31 JAN 77	1200.0
		16 JAN 78	1200.0
		19 DEC 78	1230.0
54402382	14.5A	23 JUN 70	890.0
		31 JAN 77	1150.0
		16 JAN 78	1120.0
54412508	61	9 OCT 78	920.0
54432387	15A	19 MAY 70	980.0
		31 JAN 77	1350.0
		30 JUN 77	1170.0
		21 SEP 77	1170.0
		16 JAN 78	1275.0
		19 DEC 78	1285.0
54442449		29 NOV 78	1040.0
54442455	MGQ3T	18 NOV 78	1250.0
		29 NOV 78	1040.0
		23 FEB 79	1040.0
54442456	MGQ7P	18 NOV 78	1250.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY SUMMARY
ALL THE DATA

GRID REF	SITE NO	DATE	CONDUCTIVITY (MICROMHOS/CM)
54462413	NO 62	1 NOV 69	1900.0
		3 DEC 69	1500.0
		7 DEC 69	1500.0
		2 FEB 77	1600.0
		19 DEC 77	1540.0
		9 OCT 78	1500.0
		3 MAY 79	1440.0
54552327	MGQ2CP	19 SEP 79	6660.0
54712315	MGQ1CP	19 SEP 79	48700.0
55022437	MGQ8P	12 NOV 78	1540.0
		12 DEC 78	1540.0
55162328	1A	19 DEC 77	6500.0
55512457	63	25 OCT 78	2290.0

APPENDIX E

BOREHOLE FLUID CONDUCTIVITY AND TEMPERATURE LOGS

Fluid conductivity and temperature logs were run on all the observation boreholes drilled during the investigation except MGQ 13P. In addition logs were performed on test boreholes 3T and 4T and borehole number 1. Spot readings were taken at 5 metre intervals except at interfaces when 1 metre intervals were adopted. These logs are presented in the following pages.

The results have been used to establish the position and extent of the saline wedge near the coast and to supplement the regional conductivity survey and provide a temperature distribution.

E.L CONDUCTIVITY LOGGING

Because of the limited screen lengths of between 10 and 20 metres the inland boreholes exhibit little variation and serve to confirm the conductivity values obtained from pumped samples.

The coastal observation boreholes, with screen lengths between 76 and 86 metres, were drilled to locate and monitor the saline interface. In these boreholes, MGQ 1CP to 3CP, the top of the screen was positioned to be at, or below, the screen settings of the Balcad Road Wellfield. Logs were run in these boreholes every 2 or 3 months to determine whether there was movement of the saline wedge and in the period of observation no movement was detected.

Figure E.1 shows a set of typical logs from the coastal observation boreholes. The saline interface was detected only in MGQ 1CP where the conductivity rose rapidily from brackish water of 8000 micromhos to sea water (48000 micromhos). Above the saline interface is a broad transition zone of brackish water as can be seen in MGQ 2CP with a conductivity of 6000 to 8000 micromhos The log of MGQ 3CP shows good quality water overlying the top of the brackish zone with the conductivity increasing from 1000 to 2500 micromhos.

E.2 TEMPERATURE LOGGING

The temperatures recorded within the screened position of the boreholes have been used, in conjunction with pumped samples, to establish the regional groundwater variations. The results of this work, shown in Figure E.2, demonstrate the existence of a significant temperature gradient away from the Shabeelle. The temperature logs recorded during our survey are presented together with the conductivity data in this appendix.

CONDUCTIVITY AND TEMPERATURE PROFILES

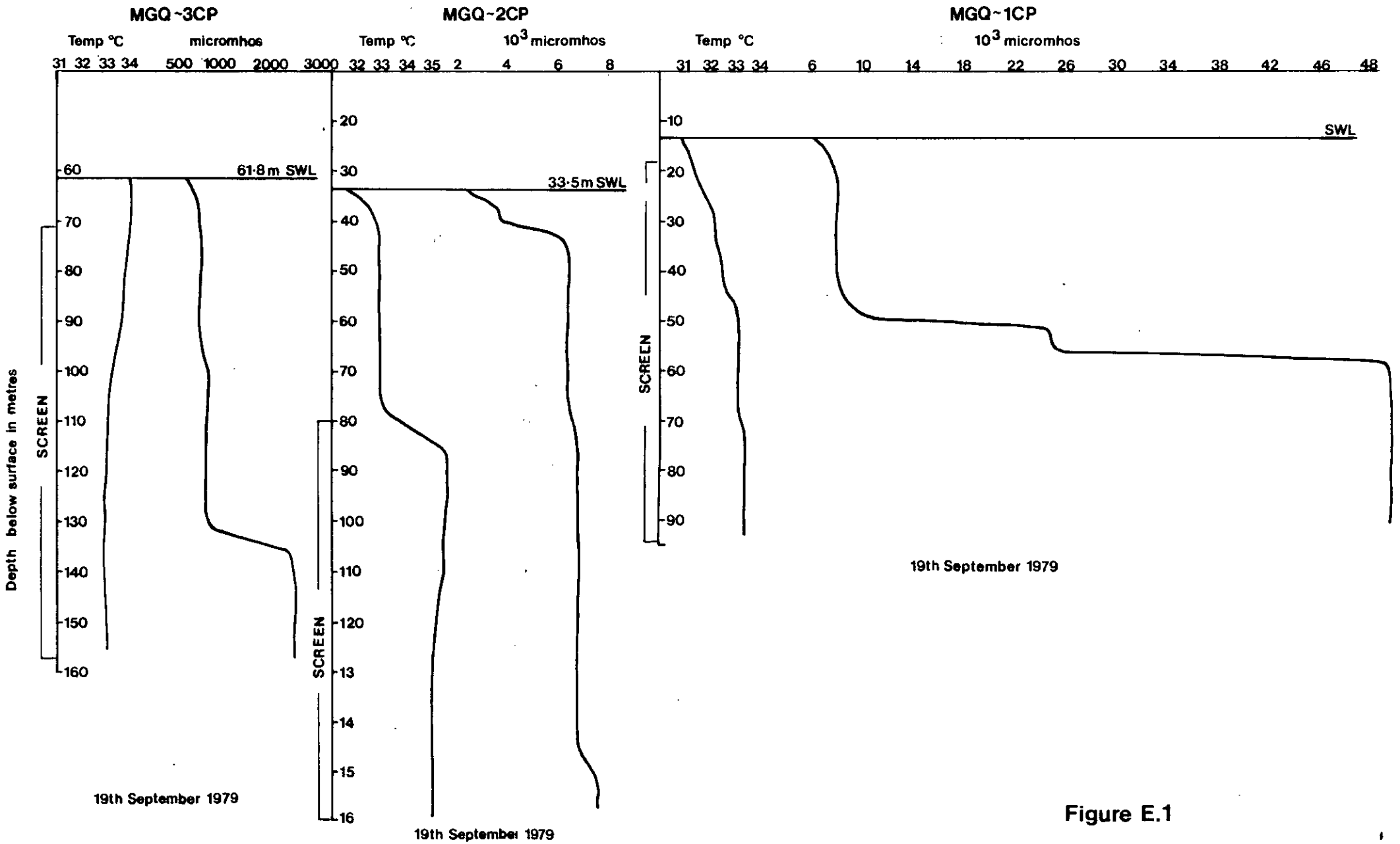
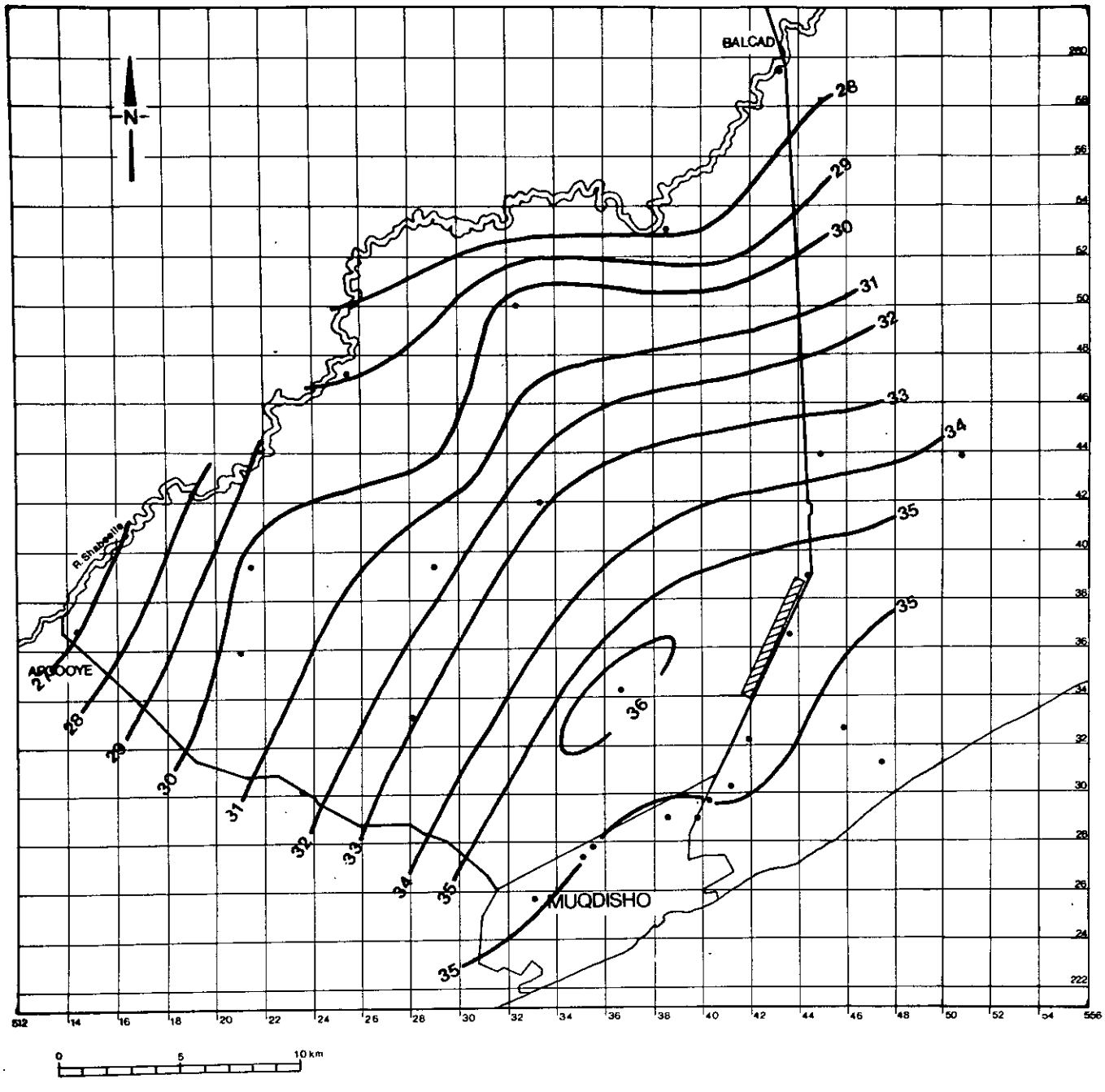


Figure E.1



—30— Temperature in °C

GROUNDWATER TEMPERATURE

Figure E.2

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 52092356
SITE NAME MGQ4P
9 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
59.10	930.0
60.00	930.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 52122392
SITE NAME MGQ3P
19 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
57.20	700.0	115.00	690.0
60.00	700.0	120.00	690.0
65.00	700.0	125.00	690.0
70.00	700.0	130.00	690.0
75.00	700.0	132.00	690.0
80.00	700.0	134.00	700.0
85.00	700.0	136.00	700.0
90.00	700.0	138.00	700.0
95.00	700.0	140.00	700.0
100.00	700.0	142.00	710.0
105.00	700.0	144.00	720.0
110.00	690.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 52322302
SITE NAME MGQ2P
12 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
128.10	1370.0	150.00	1560.0
130.00	1440.0	155.00	1560.0
131.00	1500.0	176.00	1550.0
132.00	1550.0	178.00	1550.0
133.00	1560.0	180.00	1550.0
134.00	1570.0	182.00	1550.0
135.00	1570.0	184.00	1570.0
140.00	1570.0	186.00	1570.0
145.00	1570.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 52862283
SITE NAME MGQ1P
5 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
78.87	1620.0	137.00	1890.0
80.00	1810.0	138.00	1890.0
85.00	1820.0	139.00	1900.0
90.00	1820.0	140.00	1900.0
95.00	1820.0	141.00	1910.0
100.00	1820.0	142.00	1900.0
105.00	1830.0	144.00	1910.0
110.00	1840.0	145.00	1890.0
115.00	1850.0	146.00	1890.0
120.00	1870.0	147.00	1930.0
125.00	1870.0	148.00	2000.0
130.00	1880.0	149.00	2000.0
135.00	1880.0	150.00	2090.0
136.00	1880.0	151.00	2170.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 52872391
SITE NAME MGQ5P
12 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
80.10	1860.0	110.00	1840.0
81.00	1850.0	112.00	1840.0
85.00	1850.0	114.00	1850.0
90.00	1840.0	116.00	1850.0
95.00	1840.0	118.00	1850.0
100.00	1840.0	120.00	1910.0
105.00	1840.0	121.00	1920.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 53202498
SITE NAME MGQ11P
16 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
60.00	1850.0	108.00	2980.0
65.00	1840.0	110.00	3000.0
70.00	1830.0	115.00	3170.0
75.00	1810.0	120.00	3330.0
80.00	1820.0	125.00	3500.0
82.00	1890.0	130.00	3580.0
84.00	1970.0	135.00	3670.0
86.00	2080.0	140.00	3780.0
88.00	2200.0	145.00	3910.0
90.00	2280.0	150.00	4100.0
92.00	2380.0	152.00	4190.0
94.00	2510.0	154.00	4200.0
96.00	2610.0	156.00	4220.0
98.00	2700.0	158.00	4240.0
100.00	2760.0	160.00	4220.0
102.00	2870.0	162.00	4230.0
104.00	2920.0	163.00	4250.0
106.00	2970.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 53642341
SITE NAME MGQ-4T
2 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
72.40	670.0	130.00	1260.0
73.00	1000.0	135.00	1260.0
74.00	1220.0	140.00	1260.0
75.00	1220.0	143.00	1260.0
80.00	1230.0	144.00	1260.0
85.00	1230.0	145.00	1270.0
90.00	1230.0	146.00	1270.0
95.00	1230.0	147.00	1270.0
100.00	1230.0	148.00	1270.0
105.00	1230.0	149.00	1270.0
110.00	1230.0	150.00	1270.0
115.00	1240.0	154.00	1280.0
120.00	1240.0	155.00	1280.0
125.00	1250.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 53822529
SITE NAME MGQ12P
16 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
58.00	500.0	105.00	670.0
60.00	590.0	110.00	700.0
65.00	620.0	112.00	700.0
70.00	620.0	114.00	700.0
75.00	620.0	116.00	700.0
80.00	620.0	118.00	700.0
85.00	620.0	120.00	700.0
90.00	620.0	122.00	700.0
95.00	620.0	124.00	700.0
100.00	620.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54152322
SITE NAME MGQ3CP
17 DEC 78

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
62.00	2120.0	120.00	2090.0
65.00	2100.0	125.00	2020.0
70.00	1980.0	130.00	2040.0
76.00	1860.0	135.00	2030.0
80.00	1840.0	138.00	2040.0
85.00	1920.0	139.00	2040.0
90.00	1950.0	140.00	2750.0
93.00	1790.0	141.00	3710.0
94.00	1750.0	142.00	3720.0
95.00	1740.0	143.00	3730.0
96.00	1650.0	144.00	3720.0
97.00	1680.0	145.00	3760.0
98.00	1690.0	146.00	3810.0
99.00	1790.0	147.00	3810.0
100.00	1850.0	148.00	3850.0
101.00	1800.0	149.00	3810.0
102.00	1900.0	150.00	3810.0
103.00	1820.0	151.00	3790.0
104.00	1890.0	153.00	3810.0
110.00	2000.0	155.00	3820.0
115.00	2060.0	156.00	3850.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54152322
SITE NAME MGQ3CP
24 APR 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
61.80	690.0	95.00	860.0
65.00	680.0	100.00	970.0
70.00	680.0	104.00	1060.0
72.00	700.0	105.00	1000.0
73.00	790.0	110.00	1090.0
74.00	830.0	115.00	1090.0
75.00	840.0	120.00	1020.0
76.00	850.0	125.00	1020.0
77.00	860.0	130.00	1020.0
77.00	880.0	131.00	1180.0
79.00	850.0	132.00	1890.0
80.00	810.0	133.00	2630.0
81.00	820.0	134.00	2640.0
82.00	810.0	135.00	2630.0
85.00	800.0	140.00	2640.0
87.00	830.0	145.00	2680.0
88.00	870.0	150.00	2690.0
89.00	1030.0	155.00	2680.0
90.00	970.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54152322
SITE NAME MGQ3CP
21 JUN 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
61.80	700.0	110.00	1100.0
63.00	700.0	115.00	1010.0
64.00	700.0	120.00	1010.0
65.00	700.0	125.00	1010.0
66.00	700.0	130.00	1010.0
67.00	700.0	135.00	1010.0
68.00	700.0	140.00	1040.0
69.00	700.0	142.00	1060.0
70.00	700.0	143.00	1910.0
72.00	720.0	144.00	2570.0
73.00	820.0	145.00	2610.0
74.00	860.0	146.00	2650.0
75.00	850.0	147.00	2680.0
80.00	840.0	148.00	2690.0
85.00	830.0	149.00	2700.0
90.00	870.0	150.00	2700.0
95.00	870.0	155.00	2710.0
100.00	1040.0	156.60	2710.0
105.00	1140.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54152322
SITE NAME MGQ3CP
19 SEP 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
61.84	680.0	120.00	1070.0
65.00	780.0	125.00	1080.0
70.00	780.0	130.00	1080.0
73.00	890.0	134.00	1180.0
74.00	900.0	135.00	2120.0
75.00	900.0	136.00	2780.0
80.00	890.0	137.00	2810.0
85.00	890.0	138.00	2810.0
90.00	870.0	139.00	2820.0
95.00	910.0	140.00	2830.0
98.00	1000.0	145.00	2850.0
100.00	1110.0	150.00	2880.0
105.00	1120.0	155.00	2880.0
110.00	1070.0	156.80	2880.0
115.00	1070.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54152322
SITE NAME MGQ3CP
26 NOV 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
62.00	420.0	125.00	1490.0
70.00	430.0	126.00	3760.0
75.00	810.0	127.00	3870.0
80.00	840.0	128.00	3880.0
85.00	890.0	129.00	3890.0
90.00	940.0	130.00	3900.0
95.00	1020.0	135.00	3900.0
100.00	1240.0	140.00	3890.0
105.00	1370.0	145.00	3790.0
110.00	1390.0	150.00	3730.0
115.00	1420.0	155.00	3490.0
120.00	1460.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54322590
SITE NAME 1
16 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
49.10	462.0	70.00	452.0
50.00	448.0	75.00	461.0
55.00	458.0	80.00	455.0
60.00	454.0	85.00	460.0
65.00	470.0	90.00	467.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54442455
SITE NAME MGQ3T
3 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
107.30	1020.0	141.00	1000.0
110.00	1020.0	142.00	1000.0
115.00	1020.0	143.00	1000.0
120.00	1020.0	144.00	1020.0
125.00	1020.0	145.00	1000.0
130.00	1020.0	146.00	1000.0
135.00	1010.0	148.00	1000.0
140.00	1000.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54442456
SITE NAME MGQ7P
3 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
107.60	91.0	135.00	910.0
109.00	910.0	136.00	910.0
110.00	910.0	137.00	910.0
115.00	910.0	138.00	910.0
120.00	900.0	139.00	910.0
125.00	900.0	140.00	910.0
130.00	910.0	142.00	910.0
134.00	910.0	144.00	920.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGQ2CP
11 JAN 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
33.70	3590.0	80.00	6240.0
40.00	3550.0	81.00	6360.0
45.00	3450.0	85.00	6420.0
50.00	3380.0	90.00	6420.0
55.00	3310.0	95.00	6420.0
60.00	3240.0	100.00	6420.0
65.00	3220.0	110.00	6420.0
70.00	3310.0	115.00	6420.0
71.00	3560.0	120.00	6400.0
72.00	3680.0	125.00	6400.0
73.00	3760.0	130.00	6400.0
74.00	3950.0	135.00	6380.0
75.00	4120.0	140.00	6420.0
76.00	4410.0	145.00	6400.0
77.00	4680.0	150.00	7080.0
78.00	4950.0	155.00	7160.0
79.00	6200.0	160.00	7200.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGQ2CP
24 APR 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
33.70	3300.0	85.00	6080.0
35.00	3280.0	90.00	6080.0
40.00	3280.0	95.00	6080.0
45.00	3270.0	100.00	6020.0
50.00	3260.0	105.00	6020.0
52.00	3270.0	110.00	6000.0
53.00	3420.0	115.00	6010.0
54.00	4000.0	120.00	6010.0
55.00	5040.0	125.00	6000.0
56.00	5700.0	130.00	6010.0
57.00	5800.0	135.00	6000.0
58.00	5800.0	140.00	6010.0
59.00	5800.0	145.00	6020.0
60.00	5800.0	147.00	6020.0
65.00	5800.0	148.00	6620.0
70.00	5800.0	150.00	6680.0
75.00	5800.0	155.00	6740.0
80.00	5980.0	160.00	6760.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGQ2CP
21 JUN 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
33.70	960.0	85.00	6300.0
34.00	1720.0	90.00	6280.0
35.00	3190.0	95.00	6280.0
36.00	3290.0	100.00	6280.0
37.00	3280.0	105.00	6280.0
38.00	3290.0	110.00	6280.0
39.00	3290.0	115.00	6280.0
40.00	3290.0	120.00	6240.0
45.00	3300.0	125.00	6240.0
50.00	3310.0	130.00	6240.0
51.00	3610.0	135.00	6240.0
52.00	4770.0	140.00	6240.0
53.00	5880.0	145.00	6220.0
54.00	5940.0	146.00	6280.0
55.00	5940.0	147.00	6300.0
60.00	5960.0	148.00	6600.0
65.00	5980.0	149.00	6940.0
70.00	6000.0	150.00	6940.0
75.00	6020.0	155.00	7000.0
80.00	6200.0	160.00	7040.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGQ2CP
19 SEP 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
33.55	2640.0	100.00	6680.0
35.00	3120.0	105.00	6680.0
37.00	3540.0	110.00	6680.0
40.00	3540.0	115.00	6680.0
42.00	4600.0	120.00	6660.0
43.00	6100.0	125.00	6660.0
45.00	6340.0	130.00	6660.0
50.00	6360.0	135.00	6660.0
55.00	6360.0	140.00	6660.0
60.00	6360.0	145.00	6660.0
65.00	6400.0	146.00	6700.0
70.00	6400.0	148.00	7100.0
75.00	6420.0	150.00	7400.0
80.00	6560.0	155.00	7440.0
85.00	6700.0	160.00	7520.0
90.00	6700.0	161.70	7520.0
95.00	6700.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGQ2CP
26 NOV 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
35.00	3310.0	105.00	6760.0
40.00	6340.0	110.00	6680.0
45.00	6440.0	115.00	6660.0
50.00	6440.0	120.00	6640.0
55.00	6400.0	125.00	6640.0
60.00	6400.0	130.00	6640.0
65.00	6420.0	135.00	6620.0
70.00	6440.0	140.00	6600.0
75.00	6480.0	145.00	6620.0
80.00	6660.0	148.00	7040.0
85.00	6720.0	149.00	7320.0
90.00	6700.0	150.00	7320.0
95.00	6660.0	155.00	7360.0
100.00	6680.0	160.00	7440.0

MUQUISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGQ1CP
1 JAN 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
13.90	8000.0	57.00	24600.0
20.00	8000.0	58.00	24500.0
25.00	8900.0	60.00	24900.0
30.00	8900.0	61.00	25100.0
35.00	8950.0	62.00	25600.0
40.00	9000.0	63.00	26900.0
45.00	9100.0	64.00	30500.0
48.00	10100.0	65.00	48100.0
50.00	11900.0	66.00	48800.0
51.00	18100.0	70.00	49200.0
52.00	23000.0	75.00	49100.0
53.00	23600.0	80.00	49100.0
54.00	23700.0	85.00	49100.0
56.00	24100.0	90.00	49200.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGQ1CP
24 APR 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
13.80	6920.0	59.00	24300.0
15.00	7100.0	60.00	24300.0
20.00	7100.0	61.00	24700.0
25.00	7200.0	62.00	24900.0
30.00	7300.0	63.00	25600.0
35.00	7100.0	64.00	28000.0
40.00	7600.0	65.00	36200.0
45.00	8440.0	66.00	40000.0
47.00	10000.0	67.00	44700.0
48.00	12200.0	68.00	46500.0
49.00	15300.0	69.00	46500.0
50.00	16300.0	70.00	46700.0
51.00	17200.0	71.00	46800.0
52.00	23700.0	72.00	46800.0
53.00	24300.0	75.00	46800.0
54.00	24300.0	80.00	46800.0
55.00	24300.0	85.00	46900.0
56.00	24300.0	90.00	46900.0
57.00	24400.0	93.00	46900.0
58.00	24400.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGQ1CP
21 JUN 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
13.80	6500.0	53.00	25100.0
14.00	7200.0	54.00	25100.0
15.00	7340.0	55.00	25100.0
16.00	7340.0	60.00	25200.0
17.00	7340.0	61.00	25500.0
18.00	7340.0	62.00	25900.0
19.00	7360.0	63.00	24600.0
20.00	7360.0	64.00	28900.0
25.00	7340.0	65.00	37500.0
30.00	7340.0	66.00	41500.0
35.00	7340.0	67.00	47300.0
40.00	7800.0	68.00	48200.0
45.00	9000.0	69.00	48200.0
46.00	9500.0	70.00	48300.0
47.00	10200.0	75.00	48600.0
48.00	12900.0	80.00	48700.0
49.00	16400.0	85.00	48800.0
50.00	16900.0	90.00	48800.0
51.00	17900.0	94.50	48800.0
52.00	24600.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGQ1CP
19 SEP 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
13.80	6100.0	53.00	25300.0
14.00	7000.0	55.00	25300.0
15.00	7220.0	57.00	25400.0
20.00	7900.0	59.00	25300.0
25.00	7900.0	60.00	25400.0
30.00	7900.0	62.00	26000.0
35.00	7920.0	63.00	26900.0
40.00	8180.0	64.00	28900.0
41.00	8400.0	65.00	37400.0
42.00	8550.0	66.00	41600.0
44.00	8740.0	67.00	48700.0
45.00	9200.0	68.00	49100.0
47.00	10000.0	70.00	49300.0
48.00	10220.0	75.00	49300.0
49.00	16600.0	80.00	49600.0
50.00	17200.0	85.00	49600.0
51.00	18000.0	90.00	49600.0
52.00	24800.0	94.30	49600.0

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGQ1CP
26 NOV 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
14.00	7080.0	50.00	17500.0
15.00	7380.0	51.00	19200.0
20.00	7880.0	52.00	24900.0
25.00	7920.0	53.00	25600.0
30.00	7920.0	54.00	25600.0
35.00	7920.0	55.00	25600.0
39.00	8040.0	60.00	25500.0
40.00	8340.0	64.00	29400.0
41.00	8560.0	65.00	38800.0
42.00	8680.0	66.00	42200.0
43.00	8760.0	67.00	49200.0
44.00	8820.0	70.00	49700.0
45.00	9440.0	75.00	49900.0
46.00	9300.0	80.00	50000.0
47.00	10600.0	85.00	49900.0
48.00	13800.0	90.00	49900.0
49.00	16800.0		

MUQDISHO RESOURCE STUDY
CONDUCTIVITY LOG
ALL THE DATA
GRID REF. 55022437
SITE NAME MGQ8P
14 JUL 79

DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)	DEPTH (METRES)	CONDUCTIVITY (MICRO-MHOS)
63.80	1620.0	105.00	1610.0
65.00	1620.0	110.00	1610.0
70.00	1610.0	112.00	1610.0
75.00	1610.0	114.00	1610.0
80.00	1610.0	116.00	1610.0
85.00	1610.0	118.00	1610.0
90.00	1610.0	120.00	1610.0
95.00	1610.0	122.00	1620.0
100.00	1610.0		

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 52092356
SITE NAME MGQ4P
9 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)
59.10	30.1
60.00	30.5

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 52122392
SITE NAME MGQ3P
19 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
57.20	29.8	115.00	30.7
60.00	30.1	120.00	30.8
65.00	30.1	125.00	30.9
70.00	30.2	130.00	31.0
75.00	30.3	132.00	31.0
80.00	30.3	134.00	31.1
85.00	30.4	136.00	31.1
90.00	30.5	138.00	31.2
95.00	30.0	140.00	31.2
100.00	30.6	142.00	31.2
105.00	30.6	144.00	31.2
110.00	30.7		

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 52322302
SITE NAME MGQ2P
12 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
128.81	30.6	160.00	31.3
130.00	30.9	165.00	31.3
131.00	31.1	170.00	31.3
132.00	31.1	174.00	31.3
133.00	31.1	176.00	31.3
134.00	31.1	178.00	31.3
135.00	31.1	180.00	31.4
140.00	31.2	182.00	31.4
145.00	31.2	184.00	31.5
150.00	31.3	186.00	31.5
155.00	31.3		

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 52662283
SITE NAME MGQ1P
5 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
78.87	30.4	137.00	34.1
80.00	32.7	138.00	34.0
85.00	32.8	139.00	33.8
90.00	33.1	140.00	33.8
95.00	33.2	141.00	33.8
100.00	33.3	142.00	33.8
105.00	33.4	144.00	33.8
110.00	33.5	145.00	33.6
115.00	33.6	146.00	33.5
12.00	34.0	147.00	33.4
125.00	34.1	148.00	33.2
130.00	34.3	149.00	33.2
135.00	34.3	150.00	33.2
136.00	34.3	151.00	33.2

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 52872391
SITE NAME MGQSP
12 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
80.10	29.7	110.00	30.7
81.00	30.1	112.00	30.8
85.00	30.5	114.00	30.9
90.00	30.6	116.00	30.9
95.00	30.6	118.00	30.9
100.00	30.6	120.00	31.0
105.00	30.7	121.00	31.0

MOGDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 53202498
SITE NAME MGG11P
16 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
60.00	29.1	108.00	30.8
65.00	29.7	110.00	30.8
70.00	30.1	115.00	31.0
75.00	30.2	120.00	31.1
80.00	30.2	125.00	31.2
82.00	30.3	130.00	31.2
84.00	30.4	135.00	31.2
86.00	30.5	140.00	31.2
88.00	30.5	145.00	31.2
90.00	30.6	150.00	31.2
92.00	30.6	152.00	31.2
94.00	30.6	154.00	31.2
96.00	30.6	156.00	31.2
98.00	30.6	158.00	31.1
100.00	30.7	160.00	31.1
102.00	30.7	162.00	31.0
104.00	30.7	163.00	30.8
106.00	30.8		

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 53642341
SITE NAME MGQ-41
2 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
72.40	31.8	130.00	36.0
73.00	32.8	135.00	36.2
74.00	33.2	140.00	36.3
75.00	33.2	143.00	36.4
80.00	33.6	144.00	36.5
85.00	34.0	145.00	36.6
90.00	34.2	146.00	36.6
95.00	34.4	147.00	36.6
100.00	34.6	148.00	36.7
105.00	34.8	149.00	36.9
110.00	35.0	150.00	36.9
115.00	35.3	154.00	37.0
120.00	35.5	155.00	37.0
125.00	35.9		

MUDDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 53822529
SITE NAME MGW12P
16 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
58.00	26.7	105.00	27.1
60.00	26.8	110.00	27.1
65.00	26.8	112.00	27.1
70.00	26.9	114.00	27.1
75.00	27.0	116.00	27.1
80.00	27.0	118.00	27.1
85.00	27.0	120.00	27.1
90.00	27.0	122.00	27.1
95.00	27.0	124.00	27.1
100.00	27.0		

MOGDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54152322
SITE NAME MGQ3CP
17 DEC 78

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
61.80	33.2	115.00	36.0
62.00	33.2	120.00	36.0
65.00	34.0	125.00	36.3
70.00	34.4	130.00	36.2
76.00	35.1	135.00	36.2
50.00	35.1	138.00	36.3
85.00	35.1	139.00	36.2
90.00	35.3	140.00	36.7
93.00	35.5	141.00	37.1
94.00	35.5	142.00	37.5
95.00	35.5	143.00	37.5
96.00	35.5	144.00	37.5
97.00	35.5	145.00	37.5
98.00	35.5	146.00	37.5
99.00	35.5	147.00	37.7
100.00	35.5	148.00	37.7
101.00	36.0	149.00	37.7
102.00	36.0	150.00	37.7
103.00	36.0	153.00	37.7
104.00	36.0	155.00	37.8
110.00	36.0	156.00	37.8

MOGDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54152322
SITE NAME MGQ3CP
24 APR 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
61.80	34.4	100.00	34.7
65.00	34.7	104.00	34.7
70.00	34.9	105.00	34.7
75.00	35.0	110.00	34.7
76.00	35.0	115.00	34.7
77.00	35.0	120.00	34.5
78.00	35.0	125.00	34.4
79.00	35.0	130.00	34.4
80.00	35.0	131.00	34.5
81.00	35.0	132.00	34.5
82.00	35.0	133.00	34.7
85.00	34.9	134.00	34.7
87.00	34.8	135.00	34.7
88.00	34.8	140.00	35.0
89.00	34.7	145.00	35.0
90.00	34.7	150.00	35.0
95.00	34.7	155.00	35.0

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54152322
SITE NAME MGQ3CP
21 JUN 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
61.80	32.6	110.00	31.3
63.00	33.0	115.00	31.4
64.00	33.0	120.00	31.3
65.00	32.7	125.00	31.3
66.00	32.5	130.00	31.3
67.00	32.4	135.00	31.3
68.00	32.4	140.00	31.6
69.30	32.4	142.00	31.5
70.00	32.2	143.00	31.5
72.00	32.0	144.00	31.4
73.00	32.0	145.00	31.5
74.00	32.0	146.00	31.4
75.00	31.8	147.00	31.4
80.00	31.8	148.00	31.3
85.00	31.7	149.00	31.3
90.00	31.7	150.00	31.3
95.00	31.7	155.00	31.3
100.00	31.3	156.00	31.0
105.00	31.5		

MOGDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54152322
SITE.NAME MGQ3CP
19 SEP 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
61.80	34.0	115.00	33.2
65.00	34.0	120.00	33.2
70.00	34.0	125.00	33.1
73.00	33.9	130.00	33.1
74.00	33.9	134.00	33.1
75.00	33.9	135.00	33.1
80.00	33.8	136.00	33.1
85.00	33.8	137.00	33.1
90.00	33.6	138.00	33.1
95.00	33.5	139.00	33.2
98.00	33.5	140.00	33.2
100.00	33.4	145.00	33.2
105.00	33.4	150.00	33.2
110.00	33.2	155.00	33.1

MUQUISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54322590
SITE NAME 1
16 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
49.10	28.2	70.00	27.5
50.00	28.1	75.00	27.5
55.00	28.0	80.00	27.5
60.00	27.8	85.00	27.4
65.00	27.7	90.00	27.4

MOGDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54442455
SITE NAME MGQ3T
3 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
107.30	31.8	141.00	32.9
110.00	32.0	142.00	33.0
115.00	32.1	143.00	33.0
120.00	32.2	144.00	33.1
125.00	32.4	145.00	33.1
130.00	32.6	146.00	33.1
135.00	32.7	148.00	33.1
140.00	32.8		

MUDDISHU RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54442456
SITE NAME MGQ7P
3 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
107.60	31.3	135.00	32.4
109.00	31.7	136.00	32.4
110.00	31.8	137.00	32.4
115.00	31.9	138.00	32.5
120.00	32.0	139.00	32.7
125.00	32.1	140.00	32.8
130.00	32.2	142.00	32.8
134.00	32.3	144.00	32.8

MUGDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGQ2CP
11 JAN 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
33.70	32.0	80.00	35.5
40.00	32.0	81.00	36.0
45.00	33.1	85.00	36.7
50.00	33.2	90.00	37.1
55.00	33.6	95.00	37.1
60.00	33.6	100.00	37.1
65.00	34.0	110.00	37.5
70.00	34.0	115.00	37.6
71.00	34.0	120.00	37.6
72.00	34.2	125.00	37.6
73.00	34.2	130.00	37.8
74.00	34.4	135.00	37.8
75.00	34.4	140.00	37.8
76.00	34.5	145.00	37.8
77.00	34.5	150.00	38.3
78.00	34.5	155.00	38.3
79.00	35.1	160.00	38.3

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGQ2CP
24 APR 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
33.70	34.0	85.00	36.3
35.00	34.1	90.00	36.3
40.00	34.2	95.00	36.3
45.00	34.5	100.00	36.3
50.00	34.5	105.00	36.3
52.00	34.5	110.00	36.3
53.00	34.6	115.00	36.2
54.00	34.6	120.00	36.2
55.00	34.6	125.00	36.2
56.00	34.8	130.00	36.2
57.00	34.8	135.00	36.2
58.00	34.8	140.00	36.0
59.00	34.8	145.00	36.0
60.00	34.9	142.00	36.0
65.00	34.9	148.00	36.1
70.00	35.1	150.00	36.1
75.00	35.4	155.00	36.1
80.00	35.5	160.00	36.1

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGQ2CP
21 JUN 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
33.70	31.7	85.00	34.0
34.00	31.9	90.00	33.8
32.40	35.0	95.00	33.6
36.00	32.5	100.00	33.6
37.00	32.5	105.00	33.5
38.00	32.5	110.00	33.5
39.00	32.3	115.00	33.5
40.00	32.3	120.00	33.2
45.00	32.3	125.00	33.2
50.00	32.3	130.00	33.2
51.00	32.0	135.00	33.2
52.00	31.8	140.00	33.2
53.00	31.8	145.00	33.2
54.00	31.8	146.00	33.2
55.00	31.8	147.00	33.0
60.00	31.8	148.00	33.1
65.00	31.8	149.00	33.1
70.00	31.8	150.00	33.2
75.00	32.3	155.00	33.2
80.00	33.2	160.00	33.2

MOGDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGG2CP
19 SEP 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
33.70	32.0	95.00	35.2
35.00	32.6	100.00	35.2
37.00	32.6	105.00	35.2
40.00	32.8	110.00	35.2
42.00	33.1	115.00	35.0
43.00	33.1	120.00	34.9
45.00	32.9	125.00	34.9
50.00	32.9	130.00	34.8
55.00	32.9	135.00	34.7
60.00	33.1	140.00	34.7
65.00	33.1	145.00	34.7
70.00	33.2	146.00	34.7
75.00	33.2	148.00	34.7
80.00	33.9	150.00	34.7
85.00	35.2	155.00	34.7
90.00	35.2	160.00	34.7

MOGDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54552327
SITE NAME MGQ2CP
26 NOV 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
35.00	32.6	105.00	36.3
40.00	31.7	110.00	35.9
45.00	33.2	115.00	35.9
50.00	33.2	120.00	35.5
55.00	33.2	125.00	35.5
60.00	33.2	130.00	35.5
65.00	33.2	135.00	35.1
70.00	33.2	140.00	34.8
75.00	33.6	145.00	34.9
80.00	34.8	148.00	34.8
85.00	34.8	149.00	34.8
90.00	35.1	150.00	34.8
95.00	35.1	155.00	34.8
100.00	35.1	160.00	34.8

MUDDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGD1CP
1 JAN 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
13.90	30.1	58.00	33.2
20.00	31.7	61.00	33.4
25.00	31.8	62.00	33.4
30.00	32.0	63.00	33.4
32.40	32.0	64.00	33.4
40.00	32.0	65.00	33.4
45.00	35.0	66.00	33.4
48.00	32.6	70.00	34.4
50.00	32.6	75.00	34.4
51.00	32.6	80.00	34.4
52.00	32.8	85.00	34.5
53.00	33.0	90.00	34.7
56.00	33.2		

MOGDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGQ1CP
24 APR 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
13.90	32.0	58.00	33.3
15.00	32.0	59.00	33.4
20.00	32.0	60.00	33.4
25.00	32.5	61.00	33.4
30.00	32.5	62.00	33.5
32.50	32.6	63.00	33.6
40.00	32.8	64.00	33.7
45.00	32.8	65.00	33.7
47.00	33.0	66.00	33.7
48.00	33.0	67.00	33.7
49.00	33.1	68.00	33.8
50.00	33.1	69.00	33.8
51.00	33.2	70.00	34.0
52.00	33.2	71.00	34.0
53.00	33.2	72.00	34.0
54.00	33.2	75.00	34.1
55.00	33.2	80.00	34.1
56.00	33.2	85.00	34.1
57.00	33.3	90.00	34.1

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGQ1CP
21 JUN 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
13.90	30.7	55.00	32.9
15.00	30.8	56.00	33.0
16.00	30.8	57.00	33.0
17.00	31.1	58.00	33.0
18.00	31.1	59.00	33.0
19.00	31.2	60.00	33.0
20.00	31.3	61.00	33.0
20.00	31.3	62.00	33.0
25.00	31.6	63.00	33.0
30.00	31.6	64.00	33.0
35.00	31.8	65.00	33.0
40.00	32.0	66.00	33.0
45.00	32.0	67.00	33.1
46.00	32.4	68.00	33.1
47.00	32.5	69.00	33.1
48.00	32.5	70.00	33.2
49.00	32.6	75.00	33.2
50.00	32.6	80.00	33.2
51.00	32.7	85.00	33.2
52.00	32.7	90.00	33.2
53.00	32.8	94.50	33.2
54.00	32.9		

MOGDISHU RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGQ1CP
19 SEP 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
13.90	28.2	53.00	32.6
14.00	30.9	55.00	32.6
15.00	31.0	57.00	32.6
20.00	31.3	59.00	32.7
25.00	31.7	60.00	32.7
30.00	31.7	62.00	32.7
35.00	31.8	63.00	32.7
40.00	31.7	64.00	32.7
41.00	31.7	65.00	32.7
42.00	31.7	66.00	32.7
44.00	32.3	67.00	32.8
45.00	32.5	68.00	32.8
47.00	32.6	70.00	32.8
48.00	32.6	75.00	32.9
49.00	32.6	80.00	32.8
50.00	32.6	85.00	32.8
51.00	32.6	90.00	32.8
52.00	32.6	94.00	32.8

MUQDISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 54712315
SITE NAME MGQ1CP
26 NOV 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
14.00	32.5	50.00	32.5
15.00	32.5	51.00	32.5
20.00	32.6	52.00	32.5
25.00	32.5	53.00	32.5
30.00	32.5	54.00	32.5
35.00	32.5	55.00	32.5
39.00	33.2	60.00	32.5
40.00	33.2	64.00	32.5
41.00	33.2	65.00	32.5
42.00	32.5	66.00	32.5
43.00	32.5	67.00	32.5
44.00	32.5	70.00	32.6
45.00	32.5	75.00	32.6
46.00	32.5	80.00	32.6
47.00	32.6	85.00	32.5
48.00	32.5	90.00	32.5
49.00	32.5		

MUGUISHO RESOURCE STUDY
TEMPERATURE LOG
ALL THE DATA
GRID REF. 55022437
SITE NAME MGQ8P
14 JUL 79

DEPTH (METRES)	TEMPERATURE (DEGREES C)	DEPTH (METRES)	TEMPERATURE (DEGREES C)
63.80	33.6	105.00	35.8
65.00	34.3	110.00	35.9
70.00	34.3	112.00	36.1
75.00	34.8	114.00	36.1
80.00	34.8	116.00	36.2
85.00	35.1	118.00	36.2
90.00	35.2	120.00	36.3
95.00	35.4	122.00	36.3
100.00	35.7		

APPENDIX F

GRAIN SIZE ANALYSIS

During the investigation a total of 15 samples from observation boreholes MGQ 1P to 8P and 10P and from test wells MGQ 1T to 3T were taken. Except for boreholes MGQ 1P and 8P all the samples were taken from the depths which were to be screened. These samples were sieved to determine the grain size distribution and the results are presented in a tabular form, expressed in terms of cumulative percent by weight retained.

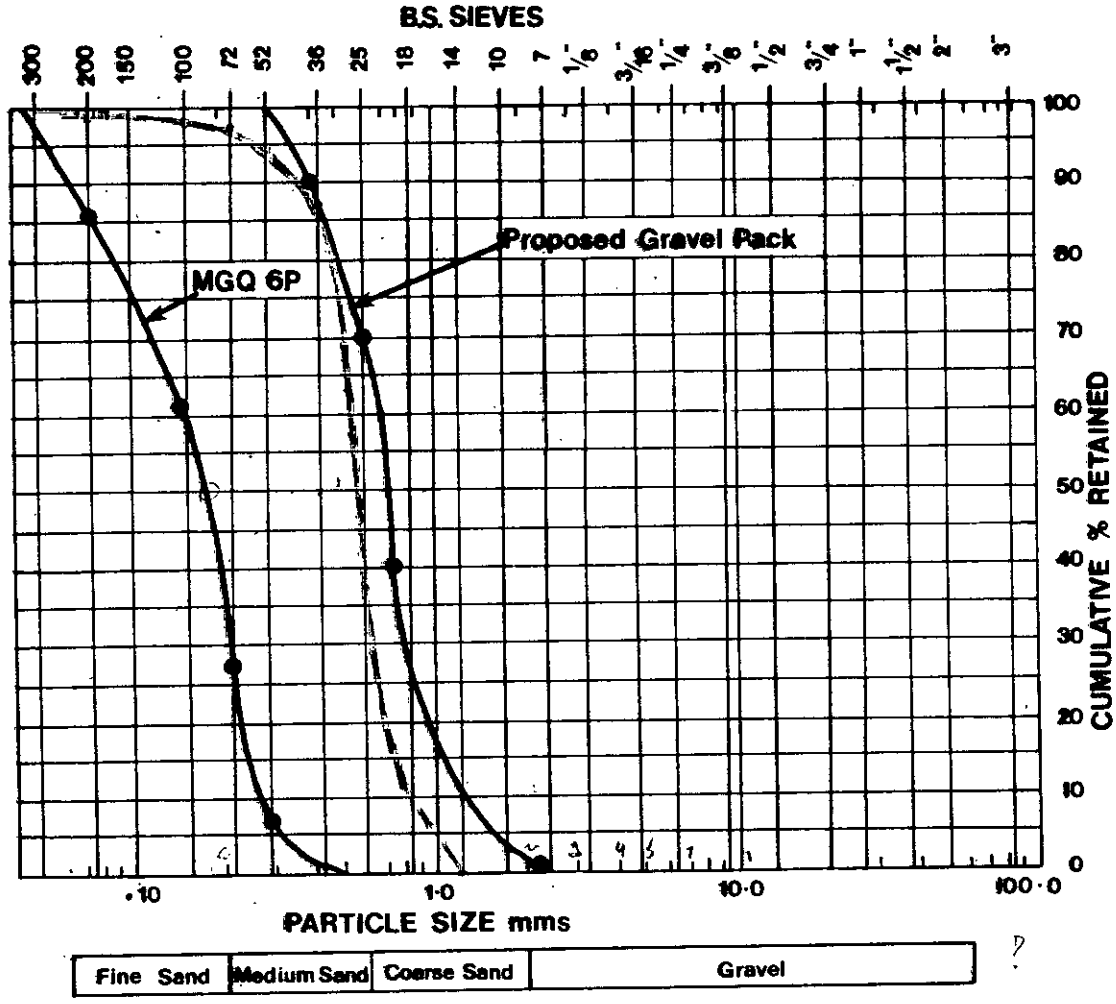
Unfortunately the samples analysed possessed a degree of secondary cementation sufficient to give rise to misleading results. Only one sample, from MGQ 6P, gave sufficiently good results that could be used, Figure F.1.

Grain size analysis curves are used to provide the basis for the selection of the gravel pack, which in turn determines the slot size of the screen. Figure F.1 also shows the gravel pack grain size distribution chosen for the production boreholes in the stage I, IIA and IIB well fields.

MGQ 6P ~ Uniformity Coefficient = 3.0

Gravel Pack ~ Uniformity Coefficient = 1.8

1,25 ·



PARTICLE SIZE DISTRIBUTION (MGQ 6P)

Figure F.1

AQUIFER GRAIN SIZE ANALYSES

WELL MGQ 1P
DEPTH OF SAMPLE 120 m.
WEIGHT OF SAMPLE 300 g.

B.S. Sieve size	Opening in mms	Weight Retained grammes	% Retained	Cumulative % Retained
3/16 in.	4.8	4	1.33	1.33
1/8 in.	3.1	14	4.67	6.0
No 7	2.3	12	4.00	10.0
No 14	1.3	19	6.33	16.3
No 25	0.59	5	1.67	18.0
No 36	0.41	3	1.00	19.0
No 52	0.18	5	1.67	20.7
No 72	0.11	24	8.00	28.7
No 100	0.106	72	24.00	52.7
No 200	0.073	42	14.00	66.7
Passing No 200		100	33.33	99.7

WELL MGQ - 1P
DEPTH OF SAMPLE 148-151 m.
WEIGHT OF SAMPLE 500 g

1/4 in	6.3	19	3.80	3.8
3/16 in	4.8	24	4.80	8.60
1/8 in	3.1	65	13.00	21.6
No 7	2.3	33	6.60	28.2
No 14	1.3	40	8.00	36.2
No 25	0.59	17	3.40	39.6
No 36	0.41	12	2.40	42.0
No 52	0.18	16	3.20	45.2
No 72	0.11	31	6.20	51.4
No 100	0.106	33	6.60	58.0
No 200	0.073	45	9.00	67.0
Passing 200		165	33.00	100

WELL MGQ 2P

DEPTH OF SAMPLE 175 - 187 m

WEIGHT OF SAMPLE 700 g

B.S. Sieve size	Opening in mms	Weight Retained grammes	% Retained	Cumulative % Retained
$\frac{1}{8}$ in	3.1	2	0.29	0.29
No 7	2.3	2	0.29	0.58
No 14	1.3	6	0.85	1.43
No 25	0.59	35	5.00	6.43
No 36	0.41	165	23.57	30.0
No 52	0.18	133	19.00	49.0
No 72	0.11	148	21.14	70.14
No 100	0.106	91	13.00	83.14
No 200	0.073	30	4.29	87.43
Passing 200		88	12.57	100

WELL MGQ 3P

DEPTH OF SAMPLE 132-142 m

WEIGHT OF SAMPLE 700 g

$\frac{1}{4}$ in	6.3	19	2.71	2.71
$^{3}/_{16}$ in	4.8	36	5.15	7.86
$\frac{1}{8}$ in	3.1	39	5.57	13.43
No 7	2.3	5	0.71	14.14
No 14	1.3	4	0.57	14.71
No 25	0.59	1	0.14	14.85
No 36	0.41	5	0.71	15.56
No 52	0.18	55	7.86	23.42
No 72	0.11	159	22.72	46.14
No 100	0.106	179	25.57	71.71
No 200	0.073	69	9.86	81.57
Passing 200		129	18.43	100

WELL MGQ 1T
DEPTH OF SAMPLE 140 m
WEIGHT OF SAMPLE 1000 g

B.S. Sieve size	Opening in mms	Weight Retained grammes	% Retained	Cumulative % Retained
¼ in	6.3	18	1.8	1.8
3/16 in	4.8	58	5.8	7.6
⅛ in	3.1	125	12.50	20.1
No 7	2.3	38	3.80	23.9
No 14	1.3	27	2.70	26.6
No 25	0.59	5	0.50	27.1
No 36	0.41	14	1.40	28.5
No 52	0.18	72	7.20	35.7
No 72	0.11	230	23.00	58.7
No 100	0.106	145	14.50	73.2
No 200	0.073	52	5.20	78.4
Passing 200		216	21.60	100

WELL MGQ 4P
DEPTH OF SAMPLE 115-127 m
WEIGHT OF SAMPLE 1000 g

3/16 in	4.8	20	2.0	2
⅛ in	3.1	58	5.80	7.80
No 7	2.3	24	2.40	10.2
No 14	1.3	24	2.40	12.6
No 25	0.59	6	0.60	13.2
No 36	0.41	20	2.00	15.2
No 52	0.18	75	7.50	22.7
No 72	0.11	337	33.70	56.4
No 100	0.106	183	18.30	74.7
No 200	0.073	60	6.00	80.7
Passing 200		193	19.30	100

WELL MGQ 5P

DEPTH OF SAMPLE 112-124 m

WEIGHT OF SAMPLE 1000 g

B.S. Sieve Size	Opening in mms	Weight Retained Grammes	% Retained	Cumulative % Retained
No 7	2.3	5	0.5	0.5
No 14	1.3	3	0.3	0.8
No 25	0.59	2	0.2	1.0
No 36	0.41	7	0.7	1.7
No 52	0.18	44	4.4	6.1
No 72	0.11	200	20.00	26.1
No 100	0.106	387	38.70	64.8
No 200	0.073	112	11.20	76.0
Passing 200		240	24.00	100

WELL MGQ 6P

DEPTH OF SAMPLE 170 - 182 m

WEIGHT OF SAMPLE 1000 g

No 36	0.41	16	1.6	1.6
No 52	0.18	44	4.40	6.0
No 72	0.11	214	21.40	27.4
No 100	0.106	347	34.70	62.1
No 200	0.073	239	23.90	86.0
Passing 200		140	14.00	100

WELL MGQ 2T

DEPTH OF SAMPLE 175 m

WEIGHT OF SAMPLE 1000 g

B.S. Sieve Size	Opening in mms	Weight Retained Grammes	% Retained	Cumulative % Retained
No 14	1.3	2	0.20	.20
No 25	0.59	7	0.70	.90
No 36	0.41	37	3.70	4.60
No 52	0.18	87	8.70	13.3
No 72	0.11	290	29.0	42.3
No 100	0.106	144	14.40	56.7
No 200	0.075	99	9.50	66.6
Passing 200		334	33.40	100

WELL MGQ 7P

DEPTH OF SAMPLE 138-144 m

WEIGHT OF SAMPLE 500 g

$\frac{1}{8}$ in	3.1	4	0.80	0.80
No 7	2.3	2	0.40	1.20
No 14	1.3	2	0.40	1.60
No 25	0.59	15	3.00	4.60
No 36	0.41	37	7.40	12.0
No 52	0.18	52	10.40	22.4
No 72	0.11	91	18.20	40.6
No 100	0.106	110	22.00	62.6
No 200	0.075	59	11.80	74.4
Passing 200		128	25.6	100

WELL MGQ 3T

DEPTH OF SAMPLE 140 m

WEIGHT OF SAMPLE 1000 g

B.S.Sieve Size	Opening in mms	Weight Retained Grammes	% Retained	Cumilative % Retained
No 14	1.3	2	0.20	0.20
No 25	0.59	4	0.40	0.60
No 36	0.41	18	1.80	2.40
No 52	0.18	68	6.80	9.20
No 72	0.11	225	22.50	31.7
No 100	0.106	266	26.60	58.3
No 200	0.073	164	16.40	74.7
Passing 200		253	25.30	100

WELL MGQ 8P

DEPTH OF SAMPLE 18.5 m

WEIGHT OF SAMPLE 300 g

$\frac{1}{8}$ in	3.1	7	2.33	2.33
No 7	2.3	3	1.00	3.33
No 14	1.3	7	2.33	5.66
No 25	0.59	81	27.00	32.66
No 36	0.41	64	21.34	54.00
No 52	0.18	30	10.00	64.00
No 72	0.11	30	10.00	74.00
No 100	0.106	15	5.00	79.00
No 200	0.073	20	6.67	85.67
Passing 200		43	14.33	100

WELL MGQ 10P

DEPTH OF SAMPLE 144-147 m

WEIGHT OF SAMPLE 1000 g

B.S. Sieve Size	Opening in mms	Weight Retained Grammes	% Retained	Cumulative % Retained
$\frac{1}{8}$ in	3.1	3	0.30	0.30
No 7	2.3	3	0.30	0.60
No 14	1.3	4	0.40	1.00
No 25	0.59	5	0.50	1.50
No 36	0.41	40	4.00	5.50
No 52	0.18	134	13.4	18.9
No 72	0.11	272	27.2	46.1
No 100	0.106	221	22.1	68.2
No 200	0.075	76	7.60	75.8
Passing 200		242	24.2	100

APPENDIX G

MATHEMATICAL BASIS FOR THE COMPUTER MODELS

In Chapters 3 and 4 of the main report extensive use was made of digital groundwater modelling techniques. In this appendix we describe briefly some of the underlying mathematics.

G.1 THE GOVERNING EQUATION

The model has inputs of recharge/abstraction and the parameters of transmissivity and storage coefficient with, as output, the water levels. The transmissivity parameter describes the resistance of the aquifer to water flowing through it and the storage coefficient the capacity of the aquifer to store water. The relation between the inputs and output is a partial differential equation, describing unconfined groundwater flow, with suitable boundary conditions.

$$\underline{\nabla}.\ (T\underline{\nabla}\phi) \ = \ -\ q + S\frac{\partial\phi}{\partial t} \qquad (1)$$

where $\underline{\nabla} = (\frac{\partial}{\partial x}\ ,\ \frac{\partial}{\partial y})$ is the differential operator

$T(x,y)$ is the spatial distribution of transmissivity (m^2/day),

$\phi(x,y,t)$ is the water-level (m)

$q(x,y,t)$ is the recharge or abstraction (m^3/day)

$S(x,y)$ is the spatial distribution of storage coefficient

and t is the time base (days)

The equation (1)has been simplified by making certain assumptions about the nature of the flow in the aquifer:

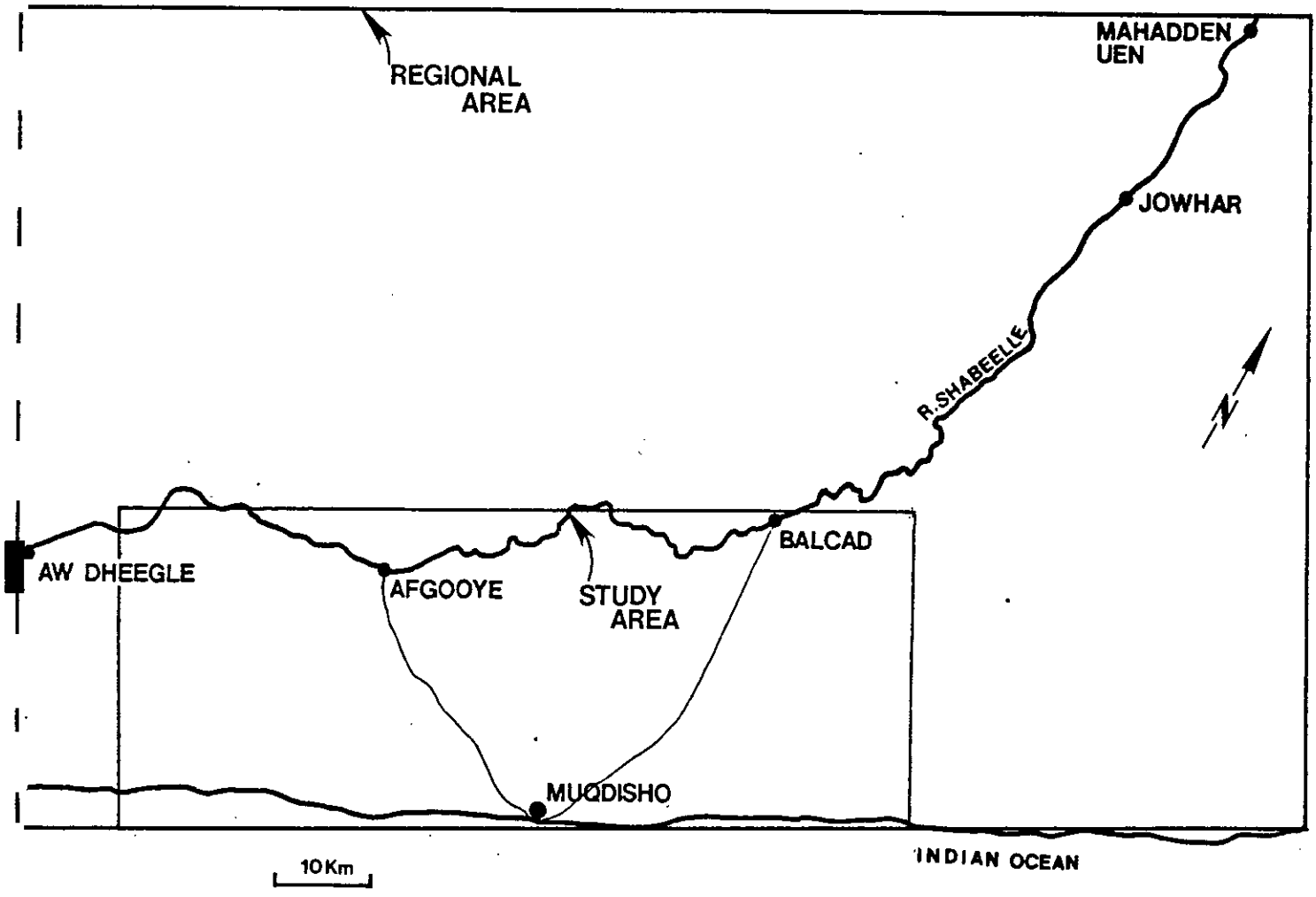
(a) That vertical flow in the aquifer is negligible compared to the horizontal components. This is a reasonable assumption except in the vicinity of the salt water wedge at the coast since the maximum saturated thickness is about 140 m compared to the horizontal dimensions are 30-80 km. This has allowed the model to have just two spatial dimensions {i.e. $\underline{\nabla}$ can be defined as $(\partial/\partial x,\ \partial/\partial y)$}

(b) In unconfined aquifers, such as the Muqdisho aquifer, the parameter of transmissivity should strictly be considered as the vertical integral of permeability with saturated thickness. However since the observed groundwater fluctuations are rarely greater than one or two metres and the decline in pumping water levels in the area of the Balcad road wellfield ranges between 5 and 10 m in the 7 years (less than 7% of the saturated thickness) transmissivity can be considered independent of the saturated thickness.

Figure G.1 shows the extent of the regions included in the groundwater modelling studies with the position of the model boundaries relative to the major towns and roads, the river Shabeelle and the Indian Ocean. The smaller area (P' Q' R' S'), which has been used for both the estimation of transmissivity (Chapter 3) and in the predictions of the likely response of the aquifer to further large scale abstractions in the vicinity of Muqdisho (Chapter 4) is referred to as the study area. Whereas the larger area (PQRS), which has been used to investigate both the mechanism of river recharge and the other boundaries in the modelling of the study area, is referred to as the regional area. Equation (1) is subject to boundary conditions around both these areas. The boundaries PQ, QS and RS of the regional area model and P'Q', Q'S' and R'S' of the study area model (for calibration and management) are impermeable; expressed mathematically as $\left|\frac{\partial \phi}{\partial \underline{n}} = 0\right|$, where $\underline{n}$ is a direction vector normal to the boundary. Flow passing over those boundaries is represented by an input or output of water in areas adjacent to the boundaries. The common boundary (P P' S' S) is aligned parallel to the coast and has been represented in both models as a constant (zero) head boundary because the available hydrogeological field evidence suggests that aquifer is in excellent hydraulic contact with the sea; expressed mathematically as $|\phi = 0|$.

G.2 STEADY-STATE PROBLEM

To reduce the number of parameters requiring calibration a steady-state description of the flow in the Muqdisho aquifer was used. This description has no time dependency and can be thought of as given an equilibrium or average response to time independent recharge. As long as care if taken in verifying that the water-levels are not varying quickly, the steady-state solution can be used to investigate the spatial distribution of both recharge and transmissivity.



GROUNDWATER MODEL AREAS

Figure G.1

In mathematical terms (1) becomes

$$\underline{\nabla}.\ (T\underline{\nabla}\phi) \ = \ - \ q \qquad (2)$$

with $\phi = \phi(x,y)$ and $q = q(x,y)$; the other terms being as in (1)

G.3 THE NUMERICAL APPROXIMATION

Invariably equations (1) and (2) cannot be solved by exact analytical means and so an approximate solution is found over discrete areas and time intervals is found. Taking the simple equation (2) the approximate finite difference equations are

$$\frac{\Delta x}{\Delta y} T_{ij+\frac{1}{2}} (\phi_{ij+1} - \phi_{ij}) + \frac{\Delta x}{\Delta y} T_{ij-\frac{1}{2}} (\phi_{ij} - \phi_{ij-1})$$

$$+ \frac{\Delta y}{\Delta x} T_{i+\frac{1}{2}j} (\phi_{i+1j} - \phi_{ij}) + \frac{\Delta y}{\Delta x} T_{i-\frac{1}{2}j} (\phi_{ij} - \phi_{i-1j}) - \Delta x \Delta y\ q_{ij} \qquad (3)$$

for an area Δx by Δy labelled (i,j). ϕ_{ij} is the water level and ϕ_{ij+1}, ϕ_{ij-1}, etc are the neighbouring levels. $T_{ij+\frac{1}{2}}$, $T_{ij-\frac{1}{2}}$, etc are the inter-nodal transmissivities (using the harmonic mean of the neighbouring nodal values) and q_{ij} is the recharge. For the different stages in the model development the sizes of the discrete areas were varied to mirror the uncertainty of the data and the requirements of the results. Thus, in the regional model the area Δx Δy was 10 km by 10 km, for the estimation of transmissivity it was 10 km by 5 km and in the management model it was 5 km by 5 km. Equation (3) describes the contribution, from neighbouring areas, of the flow into and out of a general area (i,j). Therefore there will be as many equations (3) as areas covering the model area.

These equations, have been solved in all cases by the numerical method of successive over-relaxation (SOR). The method requires an initial estimate of the water levels which is then iteratively refined until the required numerical accuracy is obtained (Smith[1]; 1965). The relaxation refers to a factor, determined in the first few iterations with a value, between 1 and 2, which improves the convergence of the method.

[1] *Smith, G.D., 1965. Numerical Solution of Partial Differential Equations, Oxford University Press, Oxford.*

G.4 CALIBRATION METHODS

For estimating recharge

The steady state model, defined over the regional area, Figure G.2, estimates the water levels given inputs or transmissivities and recharge. The optimization routine compares these model predicted water levels with those observed (from field data) and calculates suitable changes in the recharge subject to the constraints on its distribution whilst leaving the transmissivities unchanged. In mathematical terms this comparison can be expressed in terms of an error function which requires minimization,

$$J(\underline{q}^{(m)}) = \sum \{\tilde{\phi}_{ij}\ (g^{(m)};\ T) - w_{ij}\}^2 \qquad (4)$$

where the summation is taken over all the nodes,

$\underline{q}^{(m)}$ is the m^{th} iterate of the vector of recharges,

T is the constant transmissivity value,

$\tilde{\phi}_{ij}$ is the model predicted water level at (ij)

and w_{ij} is the observed water level.

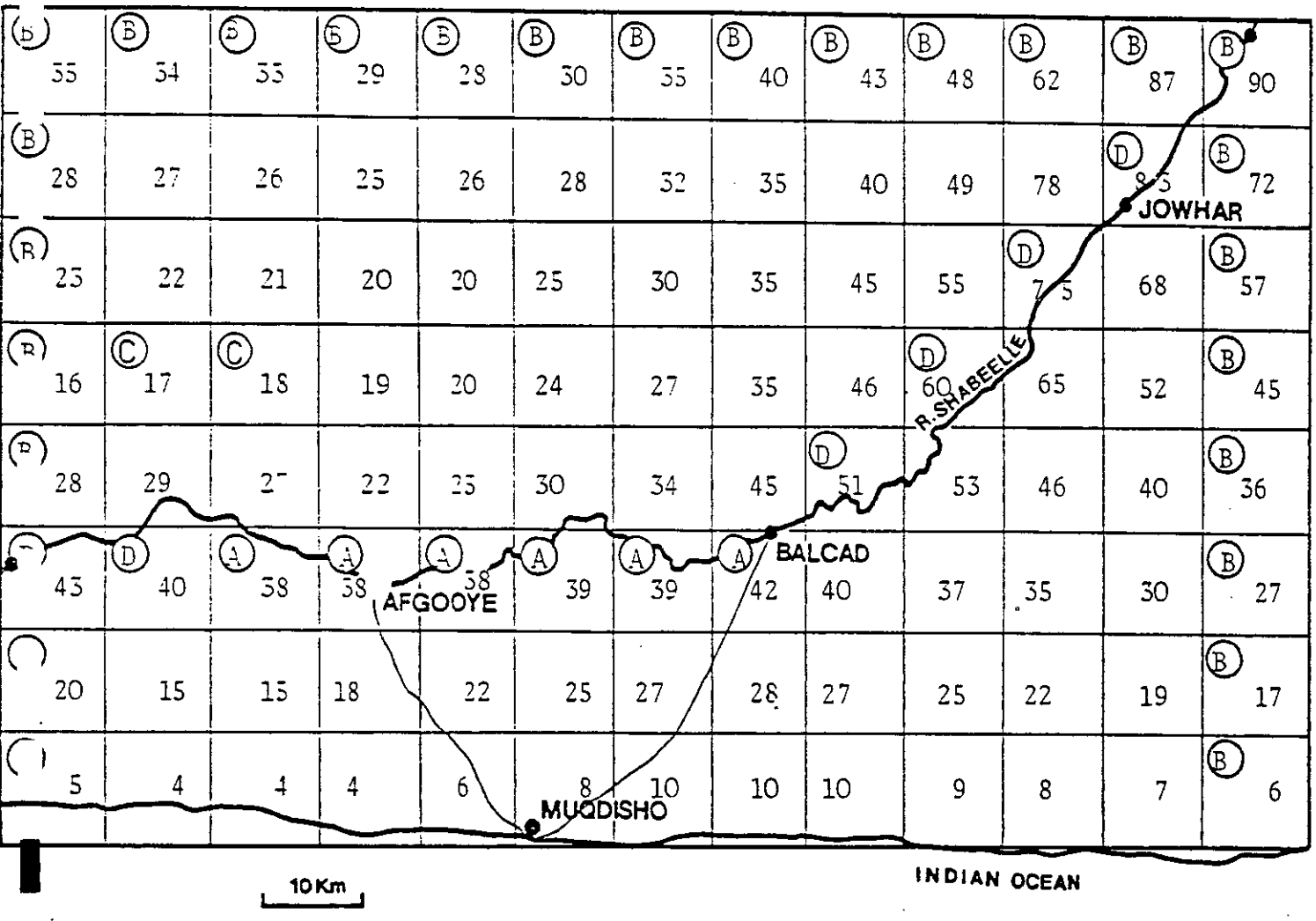
In fact, equation (4) defines a least squares error function which leads to good unbiassed estimates of the recharges, $\underline{q}^{(m)}$ when $J(\underline{q}^{(m)})$ is minimized.

The optimization routine uses a modification of Newton's method:

$$\underline{q}^{(m+1)} = \underline{q}^{(m)} + G^{(m)}\ \underline{v}^{(m)}$$

where $G^{(m)}$ is the matrix of second derivatives of J with respect to $\underline{q}$ (the Hessian) evaluated at $\underline{q}^{(m)}$ and $\underline{v}^{(m)}$ the vector of first derivatives. Newton's method can be derived directly from a Taylor expansion around the solution ignoring third and higher derivatives and thus it implicitly assumes that the error surface is quadratic around the optimum. Unfortunately Newton's method does not always converge to a solution and is invariably plagued with problems concerning the initial values.

Indeed, if at any iteration G is not positive definite ($\underline{x}'\ G\ \underline{x} > 0$, where $\underline{x}$ is an arbitrary vector) the method can actually make the solution worse by increasing the value of J. Consequently for this problem a modified Newton method has been used where the matrix G is replaced for some of the



REGIONAL GROUNDWATER MODEL

NOTE

1. Water levels within nodes are given as elevations in m.
2. Positions of river recharge nodes are marked (A) and (D)
3. Positions of boundary groundwater flows are marked (B)
4. Positions of direct evaporation from groundwater are marked (C)

Figure G.2

iterations by another matrix which is positive definite even when G is not.

The quality of fitting can be compared by expressing the overall difference as the root mean square error, corrected for the number of estimated recharge parameters. Thus if $\underline{q}^*$ is the optimum $\underline{q}^{(m)}$ with, say, p values then the r.m.s. error is

$$ER = \sqrt{\frac{J(q^*)}{n - p}} = \sqrt{\frac{\Sigma \{\tilde{\phi}_{ij}(\underline{q}^* - T) - w_{ij}\}^2}{n - p}} \qquad (5)$$

where n is the number of nodes (i,j).

For estimating transmissivity

The steady state model defined over the study area, Figure G.3, is used for the estimation of transmissivities. The optimization routine compares the model predicted water levels with those observed and calculates suitable changes in the transmissivity whilst leaving the recharge unchanged. The error function required for minimization is

$$J(\underline{T}^{(m)}) = \sum \{\tilde{\phi}_{ij}\ (\underline{T}^{(m)}; \underline{q}) - u_{ij}\}^2 \qquad (6)$$

where the summation is taken over all the nodes of the study area model,

$\underline{T}^{(m)}$ is the m^{th} iterate of the vector of transmissivities in the optimization routine,

$\underline{q}$ is the relevant part of the $\underline{q}^*$ estimated above (giving the river recharge and boundary flows),

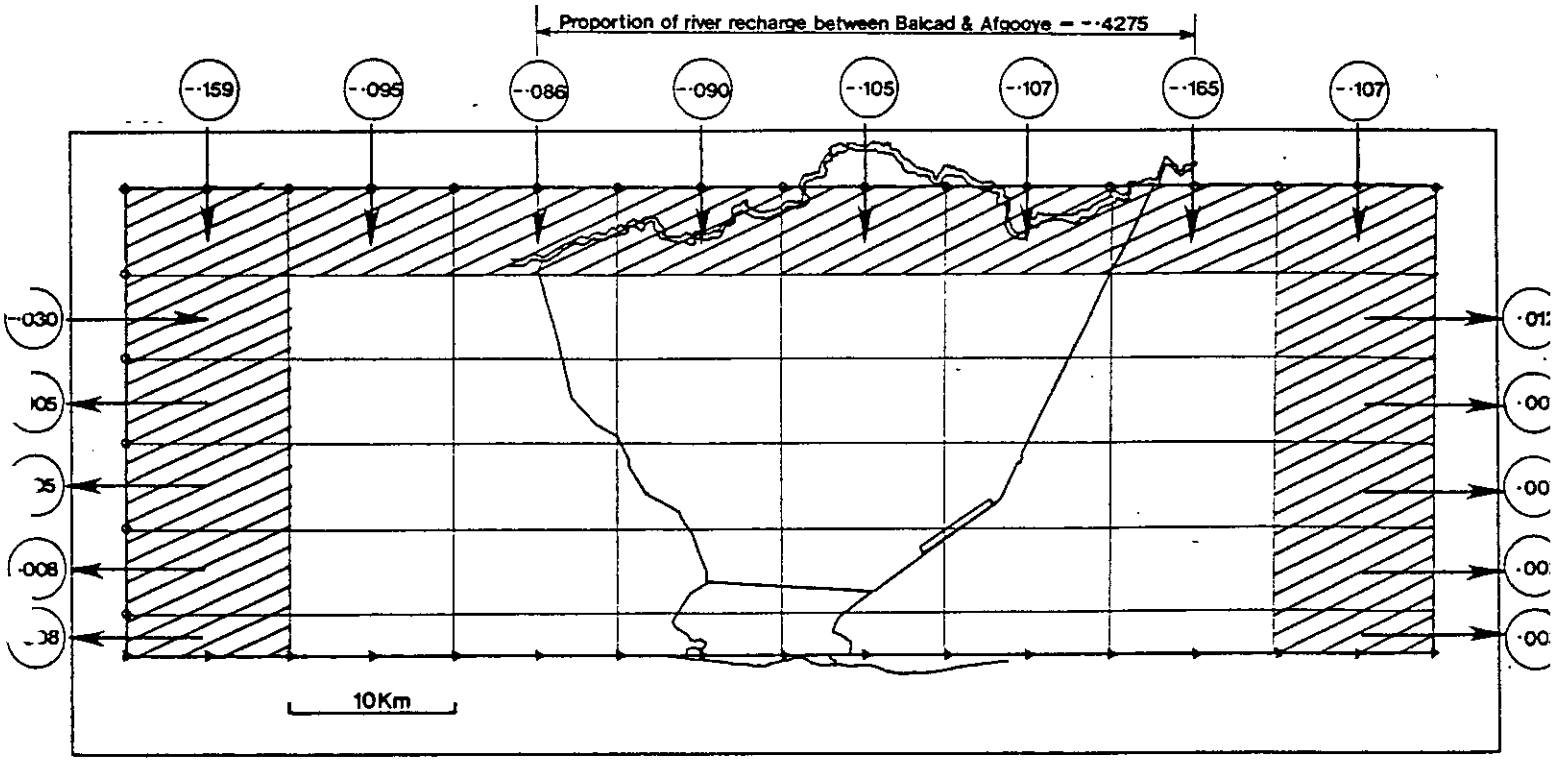
$\hat{\phi}_{ij}$ is the model predicted water level in the study area,

and u_{ij} is the observed level at (ij) in the study area

The same numerical optimization routine was used for the estimation of the transmissivities as described above. The quality of the fit of the optimum transmissivities $\underline{T}^*$ can be gauged by using the root mean square error, ie

$$ET = \sqrt{\frac{J(\underline{T}^*)}{\nu}} = \sqrt{\frac{\Sigma\{\hat{\phi}_{ij}\ (\underline{T}^*; \underline{q}) - u_{ij}\}^2}{\nu}} \qquad (7)$$

where ν are the number of areas in the study area.



THE COMPONENTS OF RECHARGE & GROUNDWATER FLOW INTO THE STUDY AREA

Figure G.3

APPENDIX H

USE OF MODELS AS A HYDROGEOLOGICAL TOOL

There are difficulties associated with measuring many of the hydrogeological parameters required for the aquifer management model. This has necessitated the extensive use of mathematical methods to estimate parameters from those data that can be measured- principally water level observations. These methods are collectively described as model calibration. The calibration of Muqdisho aquifer model has been divided into two stages: estimating recharge and estimating transmissivity.

The remaining hydrogeological parameter, namely the storage coefficient, has been estimated purely from pumping test results (Appendix B).

Calculating the distribution of river Shabeelle recharge into the aquifer has required particular attention since this recharge effects the estimation of the groundwater resource and thus how that resource is best managed. Consequently we have examined the groundwater flow in a larger regional setting; since in this way different interpretations of the recharge mechanism can be interrogated and the amounts of recharge estimated. For the estimation of transmissivity a more detailed model covering only the study area was used. Thus two calibration models, dealing with different but embedded areas, have been discussed in Chapter 3 and are shown in Figure H.1.

In this appendix we are concerned with the hydrogeological interpretation of the calibration results; the underlying mathematics has been described in Appendix G.

H.1 RECHARGE ESTIMATION

The water level map, Figure H.2, from the Hunting's report (1969) formed the basis for this regional verification of the river Shabeelle recharge and boundary flows. Figure H.3 shows the grid outline, divided into discrete elements, for the model of the regional area. The grid consists of (13 x 8) 10 km squares aligned parallel to the Indian Ocean. The marked nodes, in Figure H.3 show where values of recharge were estimated. The nodes marked A are those on the river which are adjacent to the study area, whereas those nodes marked D are the rest of the river. The boundary of the regional model, excluding the sea boundary, are marked B. Those marked C are the sites of possible evaporation losses. Different combinations of these marked nodes were used to test

alternative hydrogeological interpretations of the Muqdisho aquifer in several optimization runs. These runs can be compared on the basis of the quality of fit between observed and model predicted water-levels (equation 5; appendix G) together with a qualitative hydrogeological assessment.

The only other inputs at this stage are the transmissivities; these have been taken to have a constant value of 500 m^2/day since the spatial distribution of transmissivity within the model is as yet unknown. The exact value of transmissivity used will not excessively effect the proportional distribution of recharge in the study area.

Two alternative hydrogeological explanations of the regional water table were investigated:

(i) Some geological evidence suggested that the major recharge source was not the stretch of the river Shabeelle adjacent to the study area but rather a groundwater flow, captured higher up between Jowhar and Mahadden Uen. It was hypothesised that this flow entered the study area at the corner around Balcad with a possible additional source of recharge west of Aw Dheegle. Further support comes from an examination of the water table contours in the Hunting's report, Figure H.2. To test this hypothesis, recharge was estimated for the nodes marked A, B and D (with river recharge) against the alternative of only the nodes marked B and D (no river recharge in the study area). The spatial distribution of error between model predicted and observed water level is shown for these two cases in Figures H.4 and H.5. The solution which includes recharge at the nodes A is superior as demonstrated by the root mean square (r.m.s) error (equation (5); Appendix G), which in the case of nodes B and D has a value of 6.71, whereas with the additional nodes A the value is 5.57. These error estimates have been corrected for the different number of nodes in their calculation. Therefore, from the modelling studies the river seems to be confirmed as the major source of recharge between Balcad and Afgooye. This view is substantially corroborated by field measurements presented in Chapter 2 .

(ii) It has also been suggested that there is direct groundwater evaporation in the sink north west of Afgooye. This has been tested by inclusion of the two nodes marked C and the spatial distribution

of error in water level is shown in Figure H.6. Although the inclusion of nodes C does improve the fit (a r.m.s. of 4.84 as opposed to 5.57 for A, B and D only) the distribution of the evaporation losses is hydrologically implausible and the inclusion of the nodes C has been rejected in further modelling. In fact the inclusion of these evaporation nodes has little effect on the river recharge solution in the Afgooye to Balcad stretch.

It is worth comparing the model solution, with nodes A, B and D, for river recharge with that given in the Hunting's report (1969). Figure H.7 shows a graph of the cumulative totals different reaches using the Hunting's data and the model predicted values scaled to the same total river recharge. The graph shows a different proportioning of recharge in the three reaches, the model predicts greater recharge in the Mahadden Uen - Balcad and Afgooye - Aw Dheegle reach but less in the Balcad-Afgooye reach.

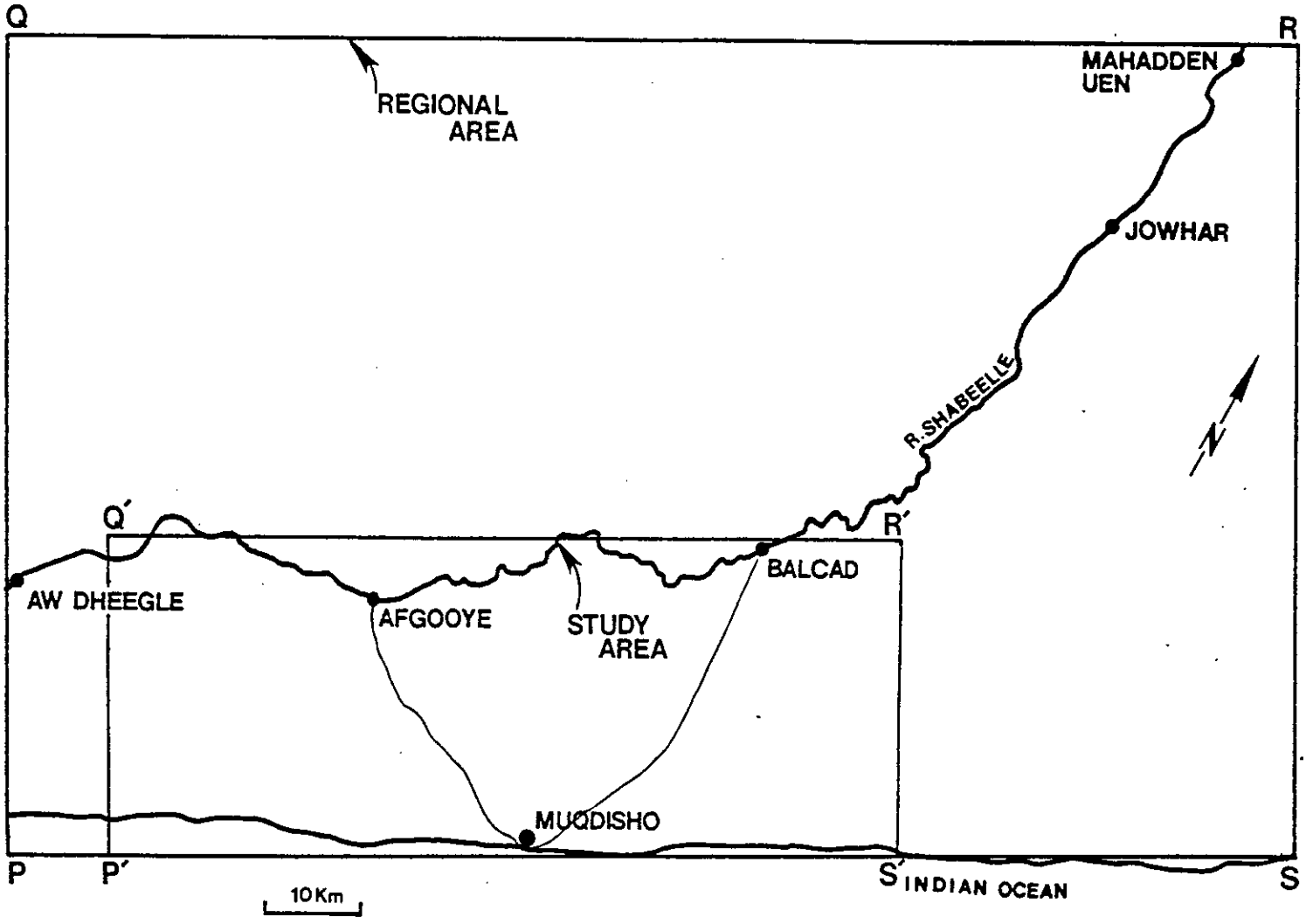
The internodal flows resulting from the regional estimation of recharge form the basis for the computation of river recharge and boundary flow into the study area. The absolute values of the study area boundary flows have been summed and this total used to calculate the proportional contributions of river recharge, boundary inflow and outflow, as shown in Figure H.8. The negative signs indicate recharge into the area and positive boundary outflow. The proportions attributed to river recharge show a fairly uniform pattern of roughly 10 per cent per 10 km of river reach; the larger proportions in the area of Balcad and west of Afgooye is because of the tendency, already discussed, of the Hunting's water table map to attribute flow to the up and down stream river reaches neighbouring the study area.

H.2 TRANSMISSIVITY ESTIMATION

Figure H.8 shows the grid consisting of rectangles 10 km x 5 km aligned on the grid used in Section H.1 shown in Figure H.3 so that each pair of rectangles correspond to one square divided parallel to the coast. This grid represents a transition between the 10 km squares used in the regional area model and the 5 km squares used in the management model (Chapter 4). Since the majority of flow in the study area is towards the sea, the subdivision shown in Figure H.8 gives a better numerical approximation; it is not possible to use 5 km squares because of the limitation in computer space. The shaded nodes represent positions where the river recharge and boundary flow was estimated; the proportions are shown alongside the appropriate nodes. Figure H.9 shows the

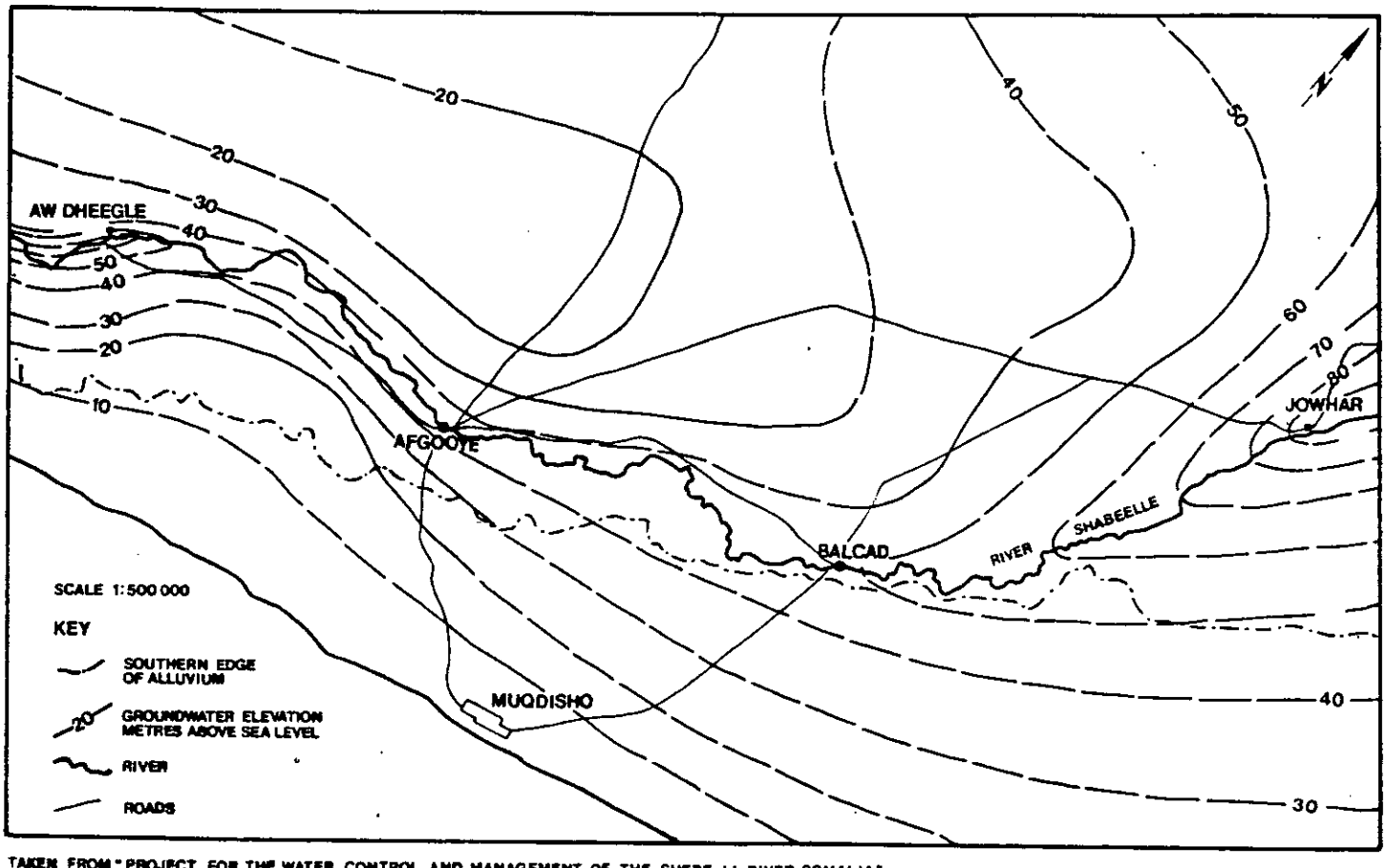
positions and amounts of the major abstractions. The water levels at the centre of each rectangle, estimated from the data collected during this study using the Hunting's data for those nodes outside the water-level observation well round, are shown in Figure H.10. Several optimization runs were made with a wide range of different values of total recharge. The resulting estimated transmissivity distributions were examined for the quality of fit between observed and model predicted water levels (Appendix G) and also that they mirrored the transmissivity values derived from known geological conditions and pumping test results which are shown in Figure H.16. Transmissivity distributions were estimated for different recharge and boundary flows into study area models (23.4, 46.8, 70.2, 93.6, 117, 140.4, 163.8 million m^3/year). The amount of recharge from the river in Balcad - Afgooye reach is 42.75% of the total recharge and boundary flow and so these seven totals represent river recharge of 10, 20, 30, 40, 50, 60, 70 million m^3/year. The root mean square errors defined by equation 7 (Appendix G) and plotted against the different Balcad - Afgooye river recharges in Figure H.11 are lowest between 40 and 60; increasing for both higher and lower recharges. Also plotted on Figure H.11 are the average transmissivities using the optimization method which increase almost linearly with increasing river recharge and have values ranging between about 450 and 3800 m^2/day. This behaviour can be simply explained by considering the partial differential equation describing steady-state groundwater flow (equation (2); Appendix G); where it will be seen that changing q (river recharge) by a constant factor will result in a corresponding change in T (transmissivity) if ϕ (the water level) is to remain unchanged.

A value of 40 million m^2/year was chosen as the design river recharge; this gives an average transmissivity of about 2000 m^2/day which agrees with the hydrogeological transmissivity Figure H.11. Moreover this recharge value is conservative in the sense that it is the smallest of recharges which have a good least squares fit. In order to smooth local irregularities in transmissivities the distribution which we used was a weighted average of the values from 30, 40 and 50 million m^3/year recharges. These distributions are shown on Figure H.12, H.13 and H.14 and the weighted average distribution as a contour map Figure H.15. The principle has been to weight different distributions inversely to the value of the r.m.s. error thus most note is taken of those distributions with the lowest errors.



GROUNDWATER MODEL AREAS

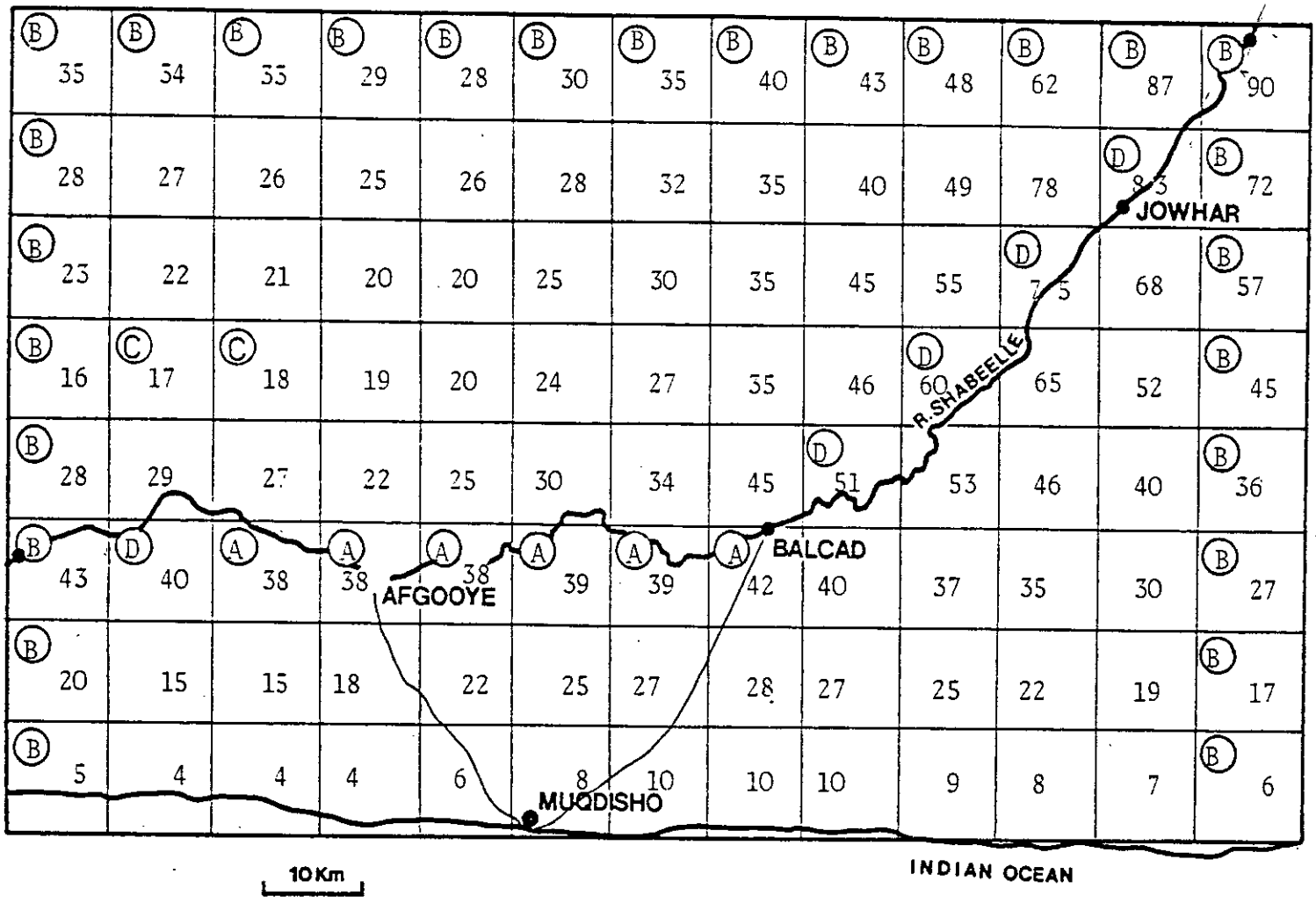
Figure H.1



TAKEN FROM "PROJECT FOR THE WATER CONTROL AND MANAGEMENT OF THE SHEBELLI RIVER, SOMALIA." VOLUME IV. HUNTING TECHNICAL SERVICES AND SIR M.MACDONALD AND PARTNERS. NOVEMBER 1969

REGIONAL GROUND WATER LEVELS

Figure H.2

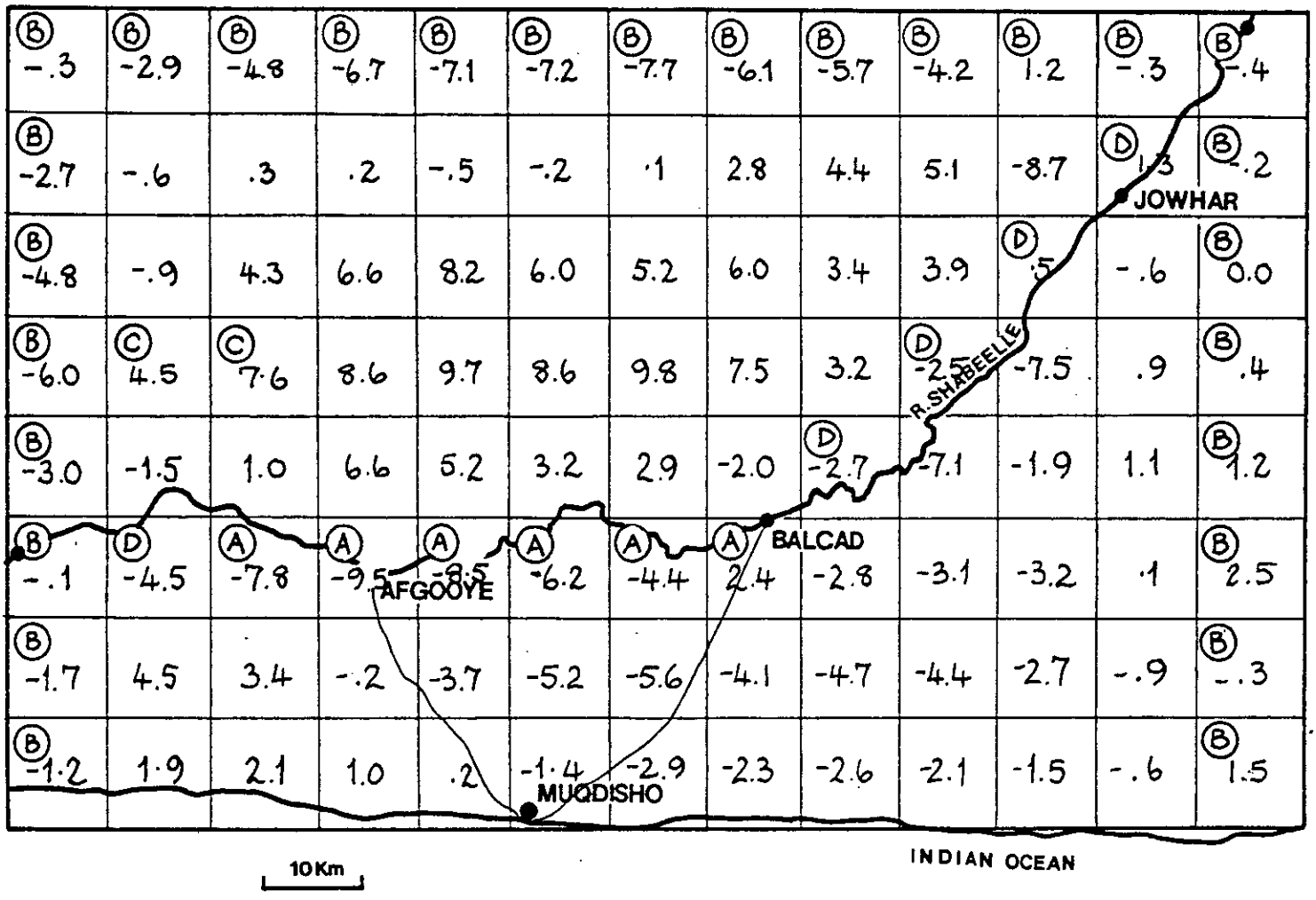


REGIONAL GROUNDWATER MODEL

NOTE

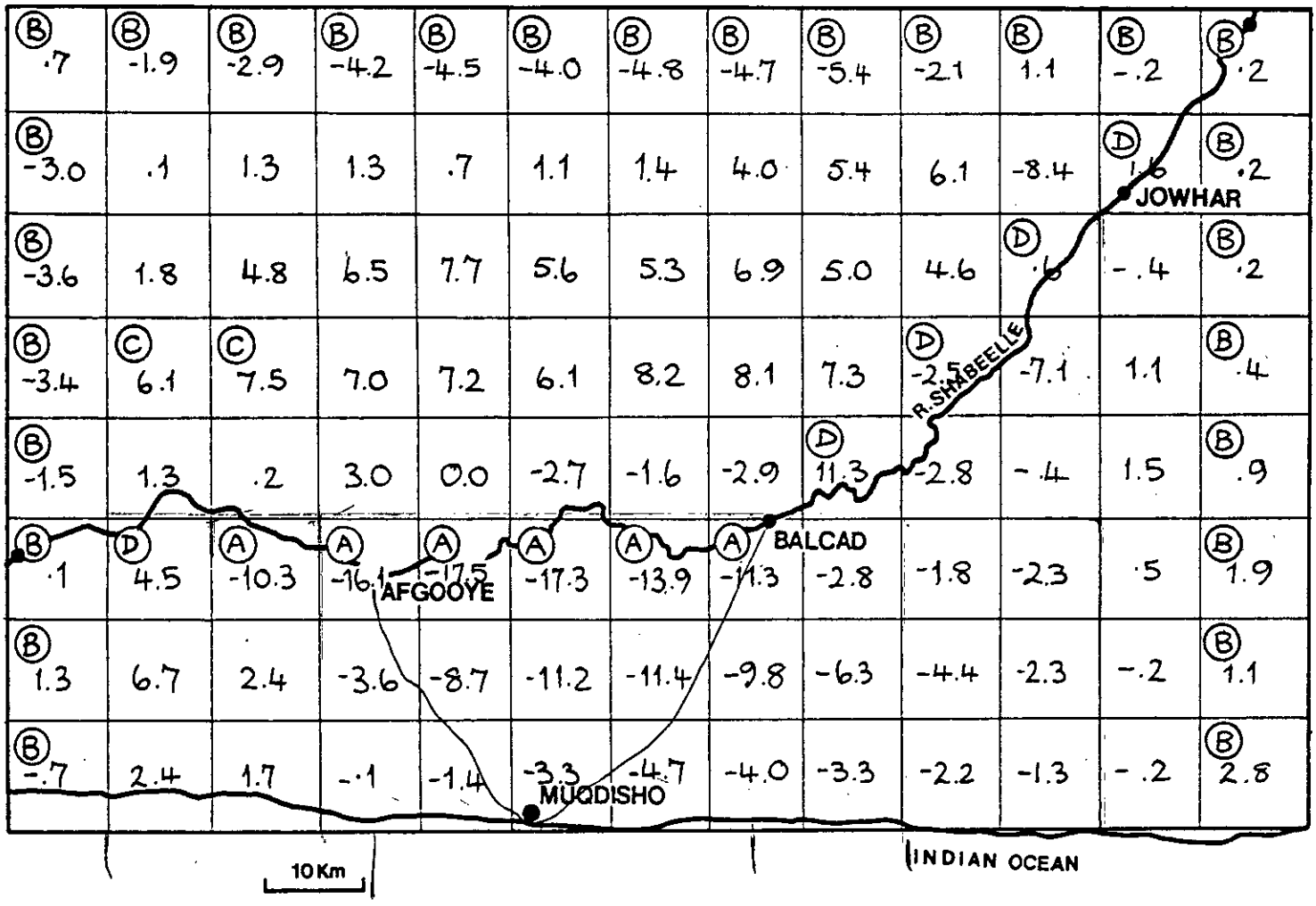
1. Water levels within nodes are given as elevations in m.
2. Positions of river recharge nodes are marked (A) and (D)
3. Positions of boundary groundwater flows are marked (B)
4. Positions of direct evaporation from groundwater are marked (C)

Figure H.3



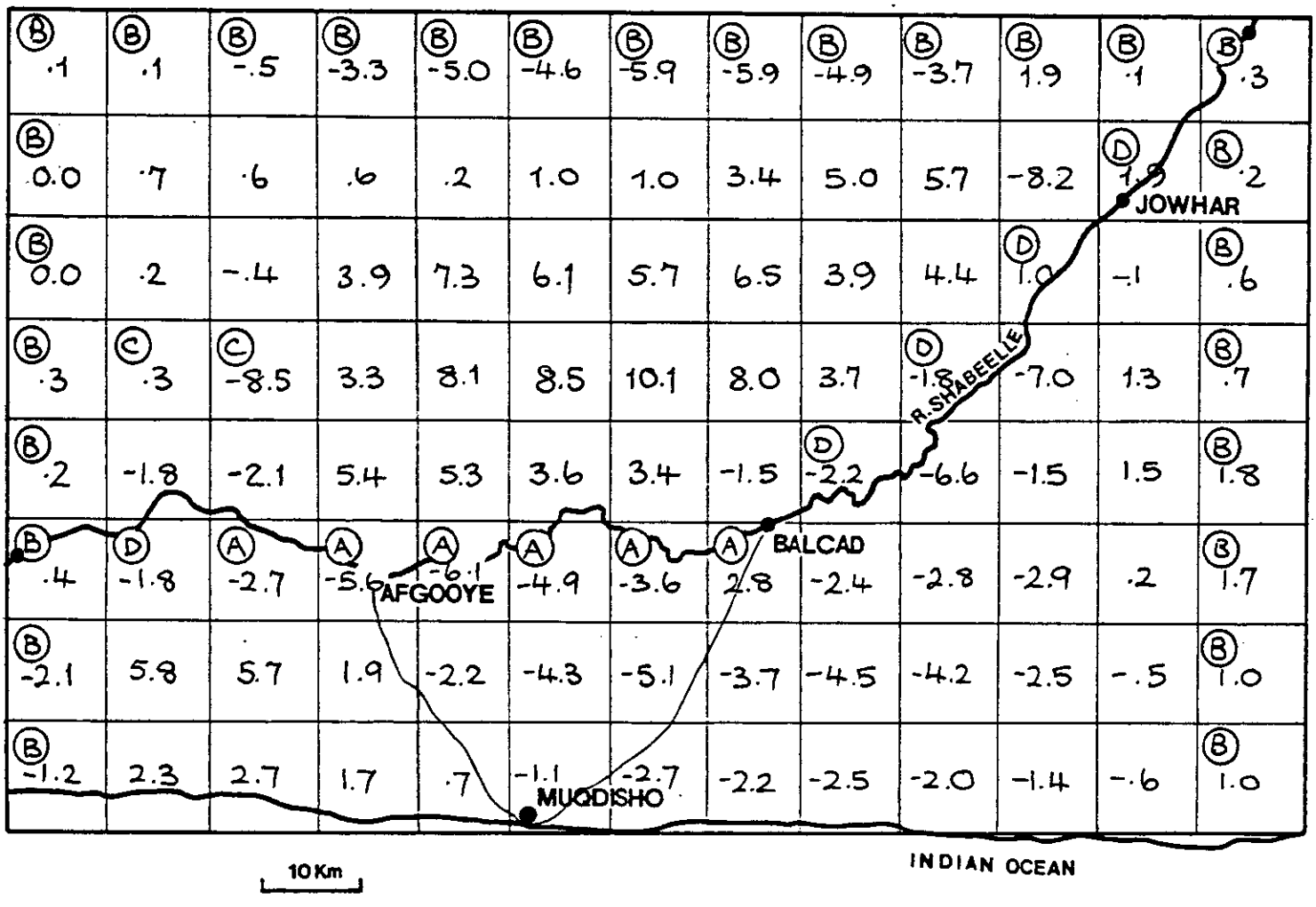
DISTRIBUTION OF ERRORS BETWEEN MODEL PREDICTED AND OBSERVED WATER LEVELS [m] WITH A, B AND D

Figure H.4



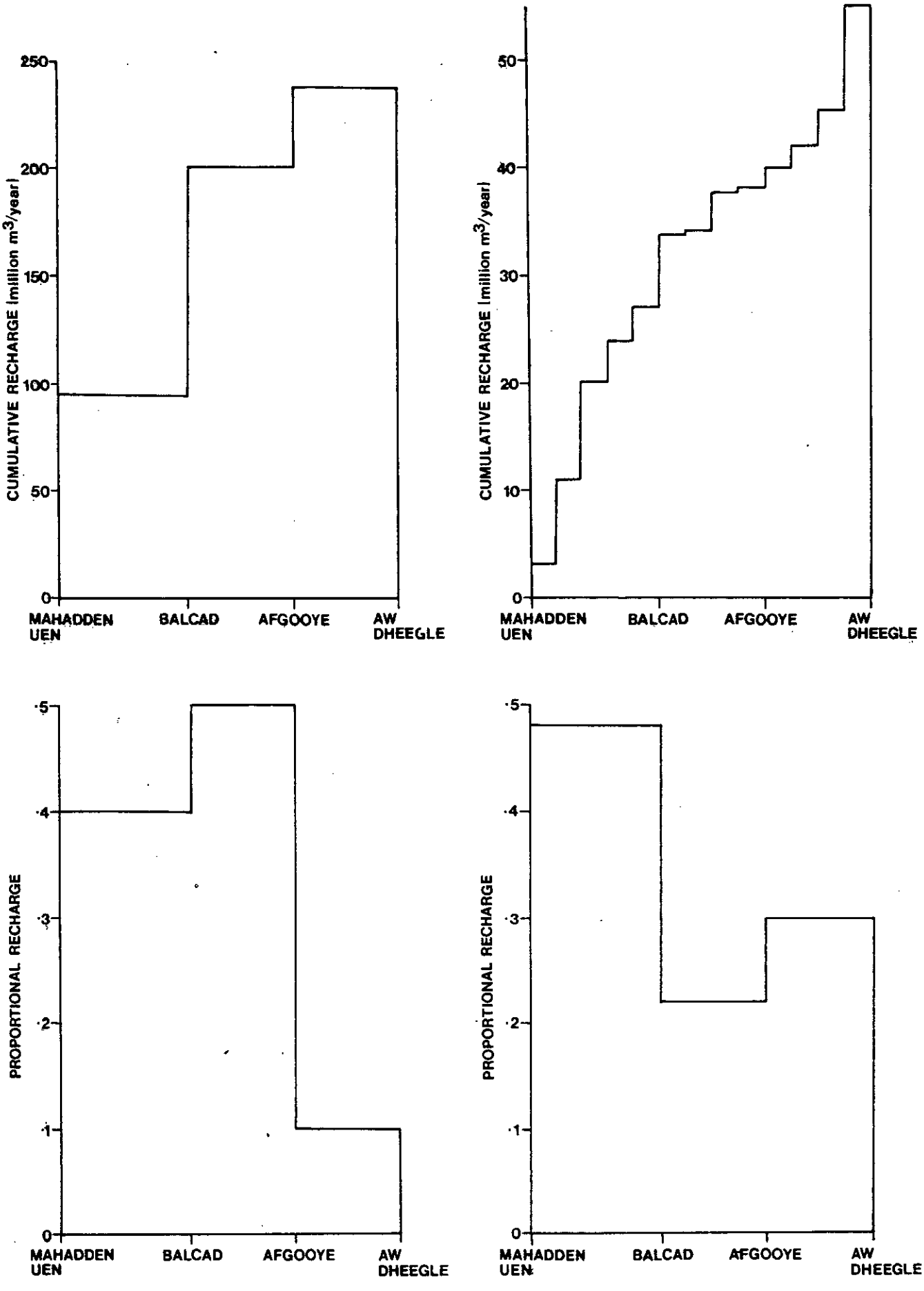
DISTRIBUTION OF ERRORS BETWEEN MODEL PREDICTED AND OBSERVED WATER LEVELS (m) WITH B AND D

Figure H.5



DISTRIBUTION OF ERRORS BETWEEN MODEL PREDICTED AND OBSERVED WATER LEVELS [m] WITH A, B, C AND D

Figure H.6

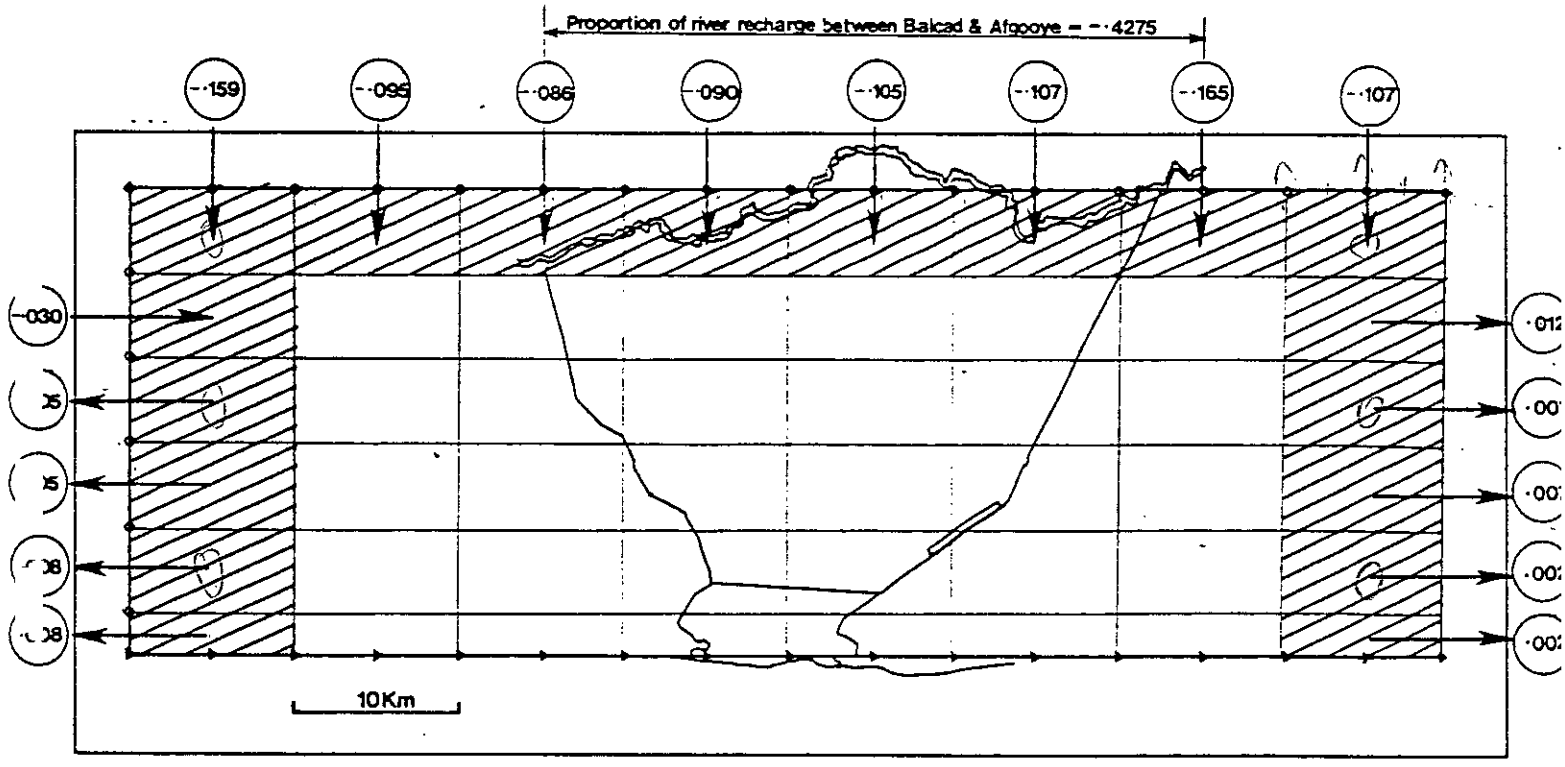


(a) HUNTING'S DATA (1969)

(b) MODEL PREDICTIONS

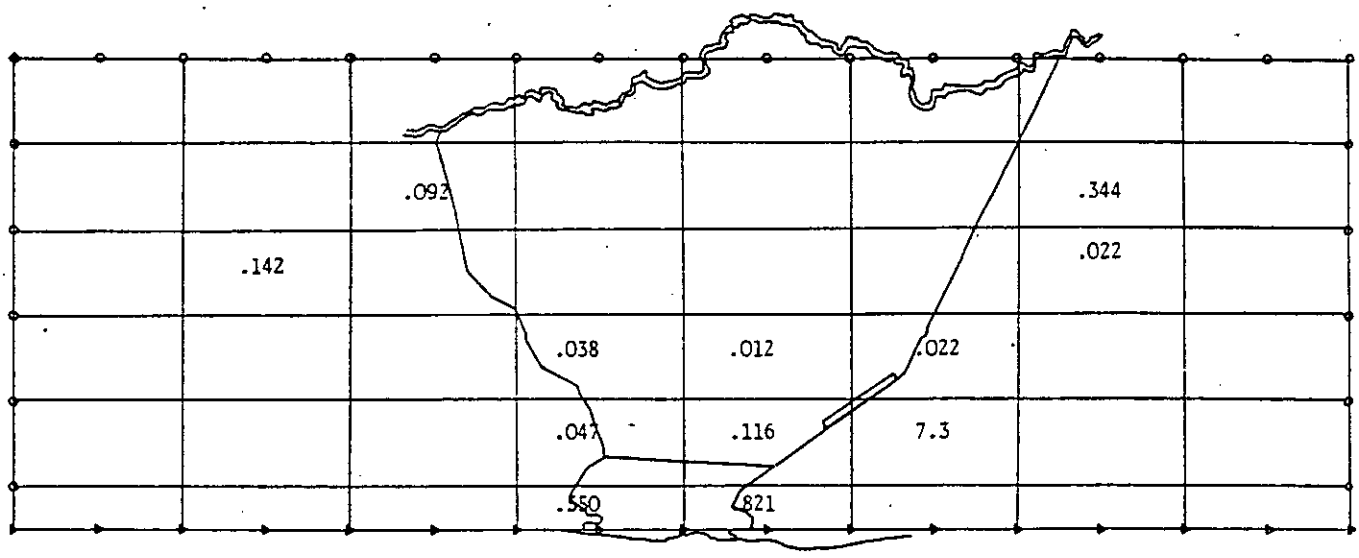
CUMULATIVE & PROPORTIONAL RECHARGES FOR HUNTING'S DATA & MODEL PREDICTIONS

Figure H.7



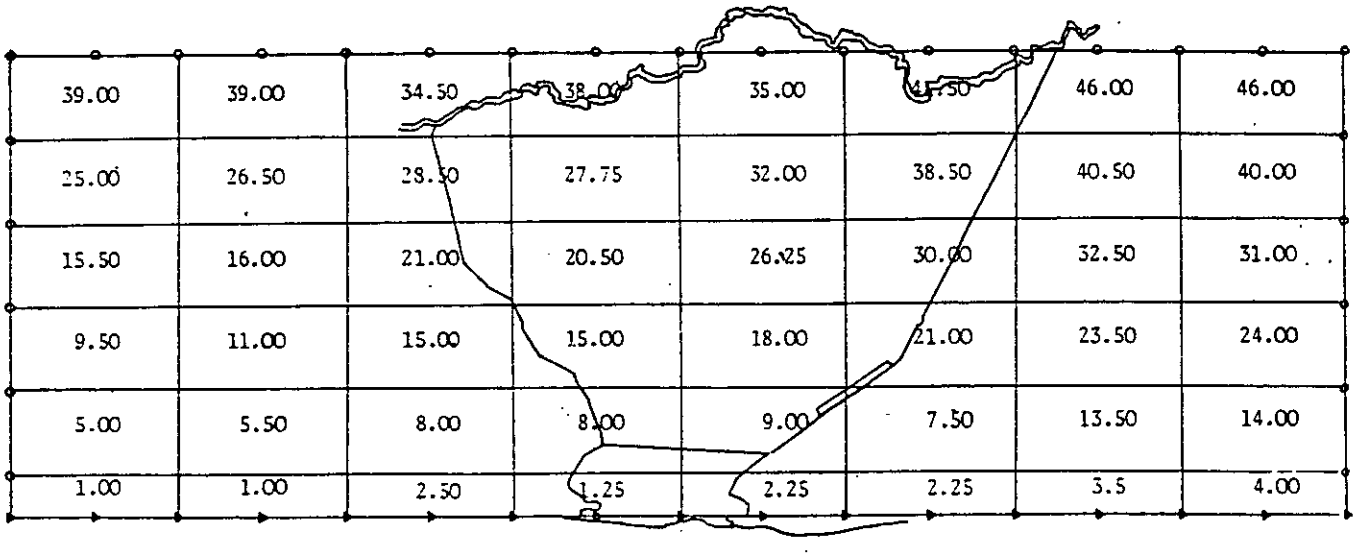
THE COMPONENTS OF RECHARGE & GROUNDWATER FLOW INTO THE STUDY AREA

Figure H.8



CURRENT GROUNDWATER ABSTRACTION
(million m^3/year)

Figure H.9



WATER LEVEL ELEVATION FOR STUDY AREA MODEL (m.)

Figure H.10

CALIBRATION RESULTS OF THE STUDY AREA MODEL

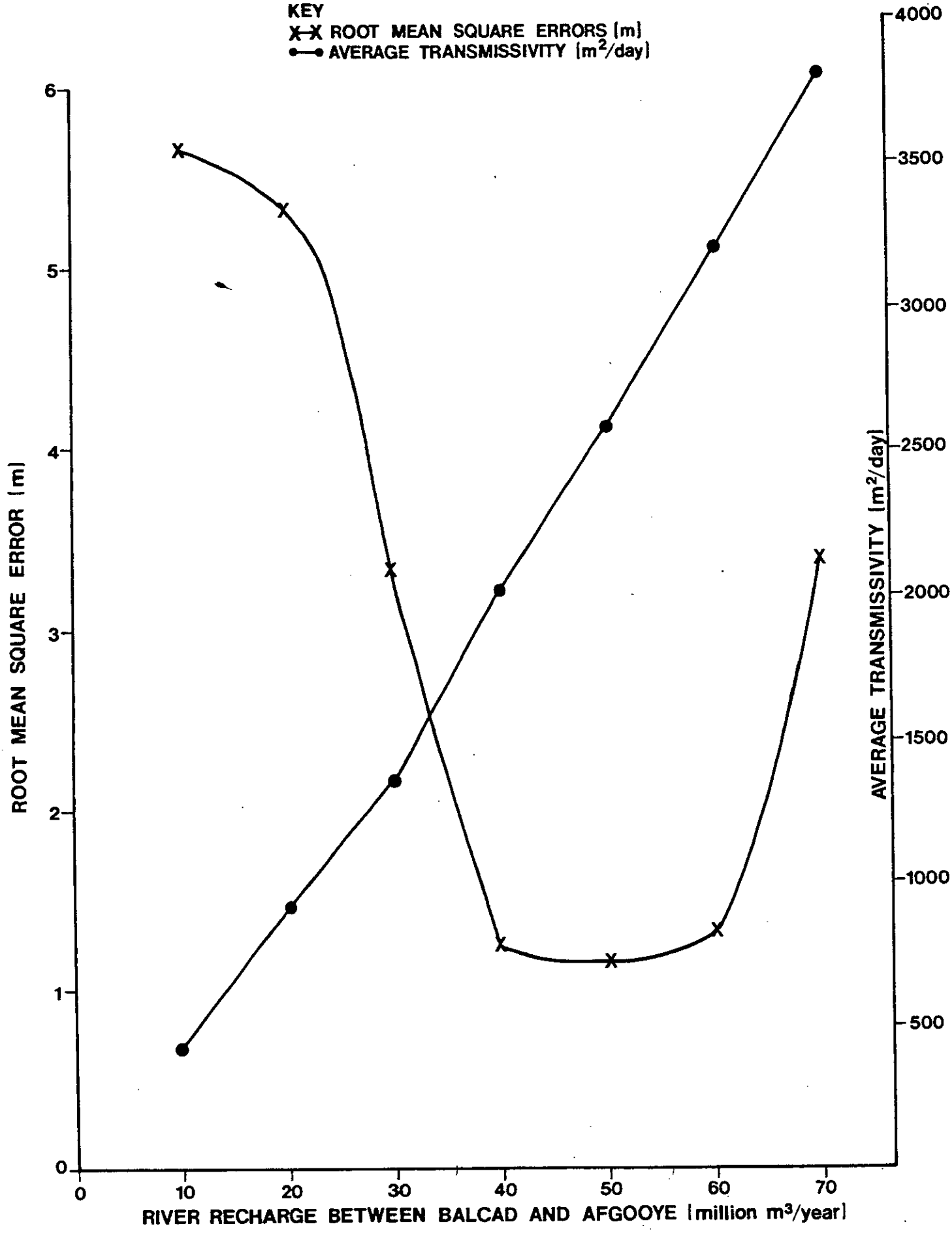


Figure H.11

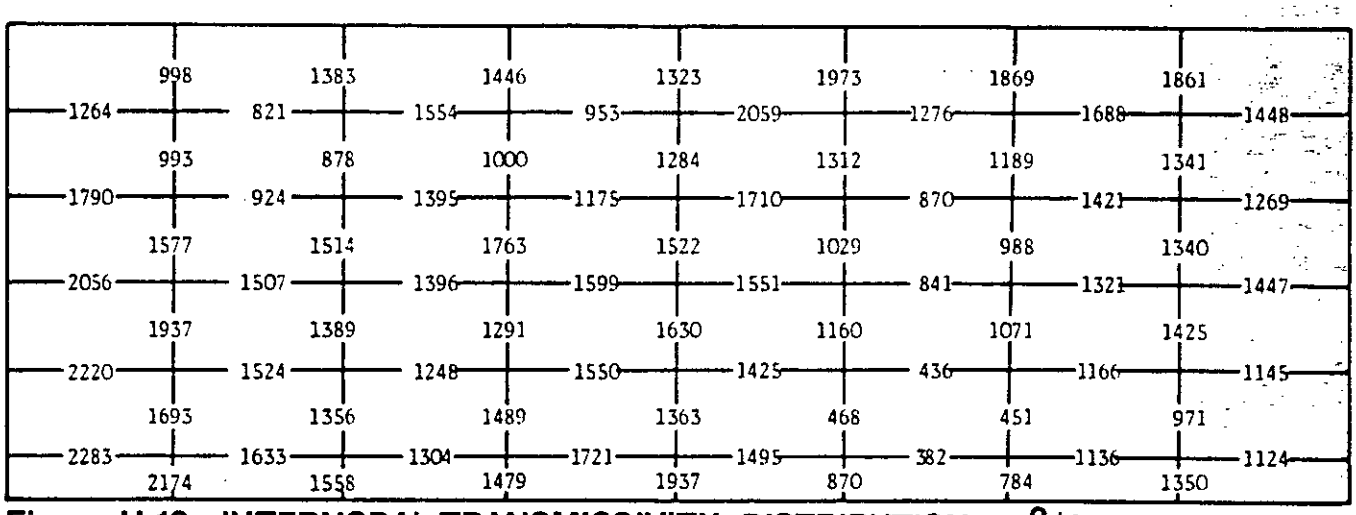


Figure H.12 INTERNODAL TRANSMISSIVITY DISTRIBUTION m^2/day WITH 30 million m^3/year RECHARGE BETWEEN BALCAD & AFGOOYE

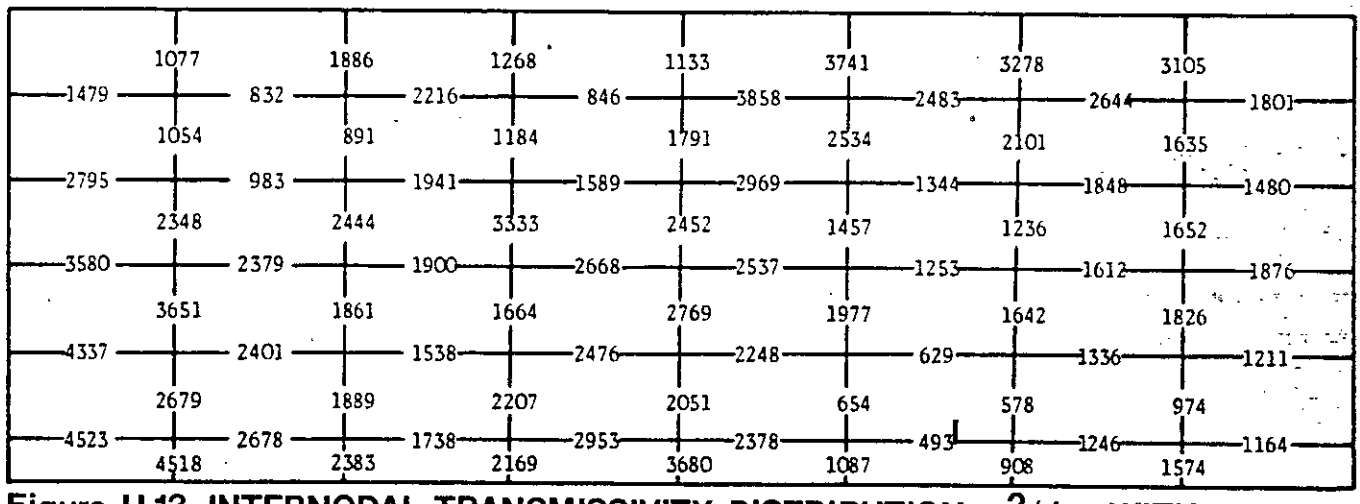


Figure H.13 INTERNODAL TRANSMISSIVITY DISTRIBUTION m^2/day WITH 40 million m^3/year RECHARGE BETWEEN BALCAD & AFGOOYE

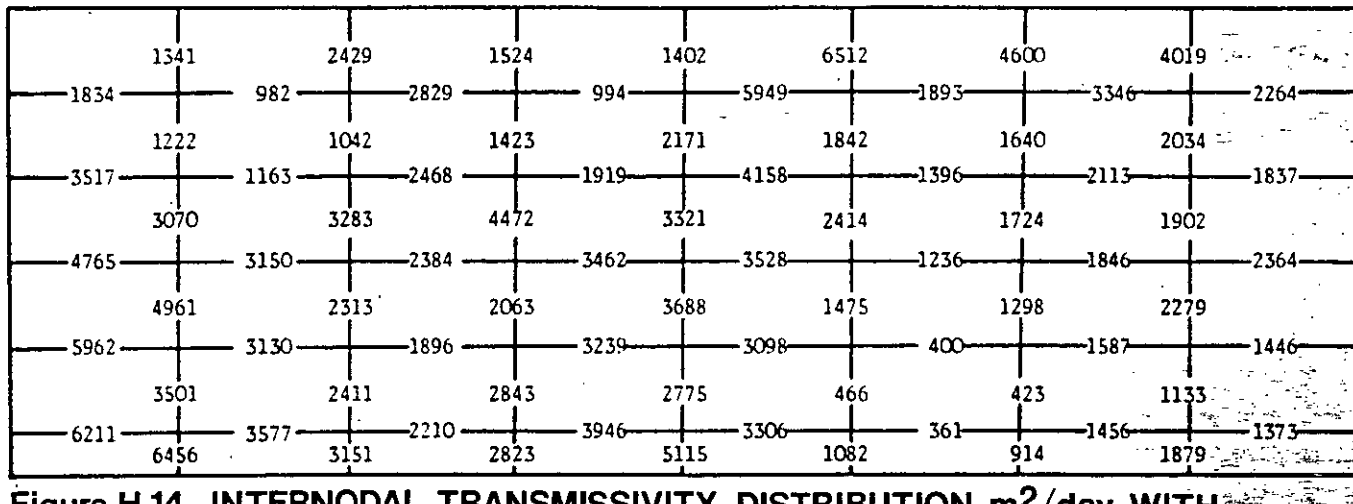
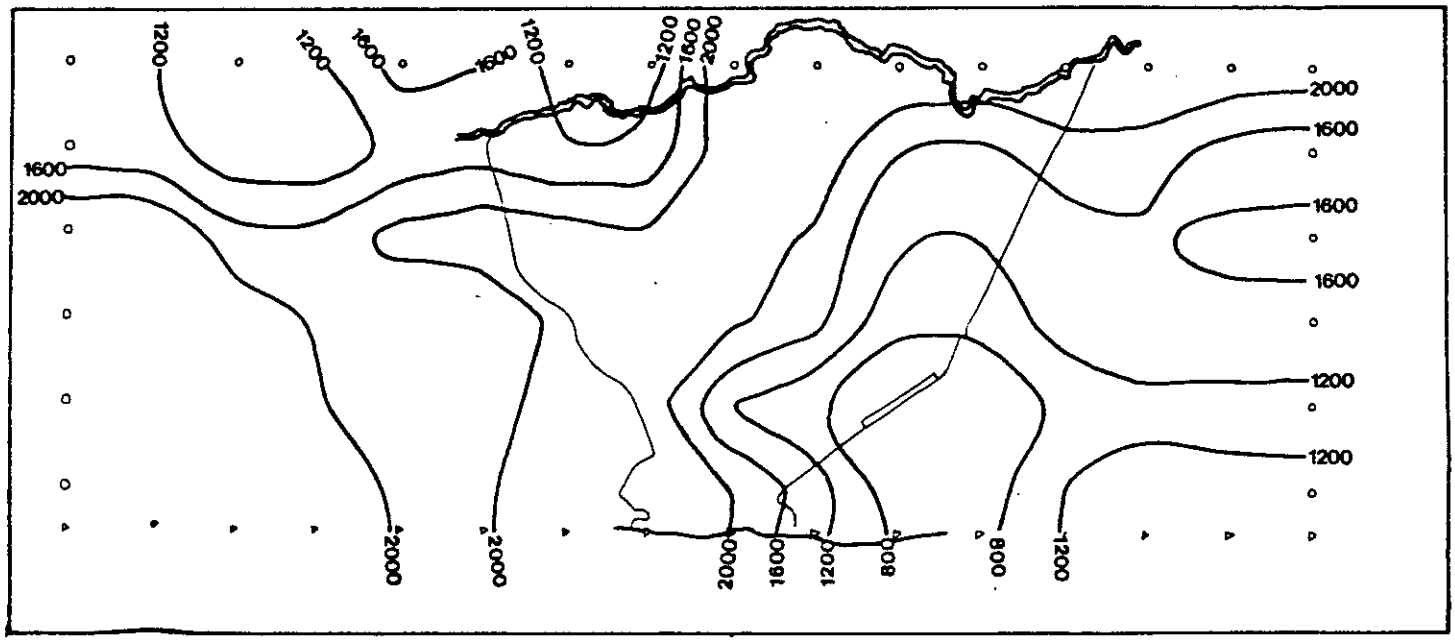
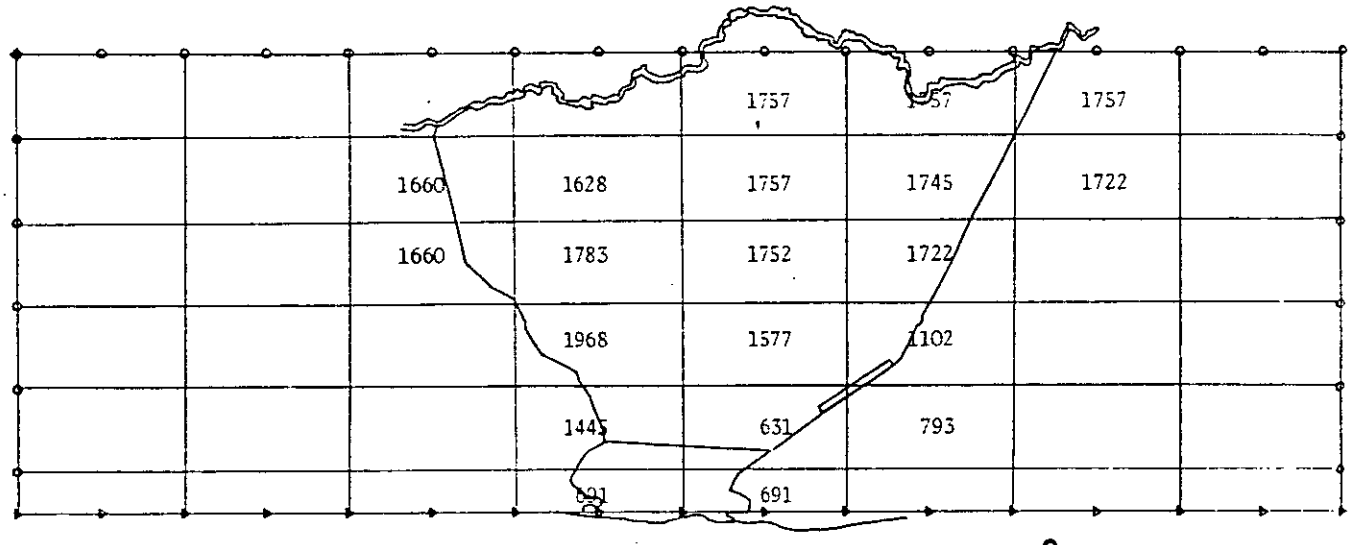


Figure H.14 INTERNODAL TRANSMISSIVITY DISTRIBUTION m^2/day WITH 50 million m^3/year RECHARGE BETWEEN BALCAD & AFGOOYE



CONTOUR MAP OF MODEL TRANSMISSIVITY (m^2/d)

Figure H.15



HYDROGEOLOGICAL TRANSMISSIVITY (m^2/d)

Figure H.16

Note Compiled from saturated thickness and the following aquifer permeabilities:

Limestone 3 m/day
Buff sand 12 m/day
Red sand 14 m/day

APPENDIX I

USE OF THE MODEL AS A MANAGEMENT TOOL

In this study the objective has been to determine the distribution and rates of abstraction which maximise the safe yield of the aquifer, subject to constraints on the water quality and on the wellfield locations.

I.1 THE CONSTRAINT CONCERNING SEAWATER INTRUSION

Because of the differing densities of fresh and sea water, a saline wedge will exist at the coast. The degree of saline intrusion is controlled by the volume of fresh water flow in the aquifer; a lowering of water levels (e.g. due to abstraction) will cause a reduction in this flow, leading to an inland migration of the salt water until a new equilibrium is established.

The ratio between the depth to the saline water (h_s) and the fresh water (h_f), both measured relative to sea level can be approximated using the Ghyben-Herzberg relation

$$\frac{h_s}{h_f} = \frac{\rho_f}{\rho_s - \rho_f} = 40$$

where ρ_f, the density of fresh water is 1.000 and ρ_s, the density of salt water is 1.025.

However, field measurements from the two wells closest to the coast, MG1CP and MG2CP, give values of h_s/h_f = 112.5 and h_s/h_f 71.1 respectively (see Table I.1). In our analysis we have therefore used a conservative value, based on the field data, of h_s/h_f = 80. At the toe of the wedge, h_s is equal to the saturated thickness of the aquifer (taken to be 140 m). Thus at this point the fresh water head is

$$h_f = \frac{h_s}{80} = 1.75$$

In the model, groundwater heads are calculated at a distance 2.5 km from the coast. The minimum head required at this point to limit the saline intrusion to 2.5 km is therefore 1.75 m. A head of 1 m, 2.5 km from the coast, will limit the intrusion to a distance of 4.4 km.

The constraints concerning poor quality groundwater and concerning the location of the wellfields have been discussed in Chapter 4.

TABLE I.1

Well number	Distance from coast	Depth to saline water, h_s	Fresh water head, h_f	$\frac{h_s}{h_f}$
MG1CP	1.25 km	45 m	0.4 m	112.5
MG2CP	3.5 km	> 128 m	1.8 m	> 71.1

1.2 WELLFIELD DESIGN - THE INTERFERENCE MODEL

A simple model of wellfield interference has been used to help design the proposed Stage I, IIA and IIB wellfields. The basis of this interference model is that the drawdown, s, due to the pumping of a single fully penetrating well in an infinite homogeneous aquifer is given by the Theis equation

$$s = \frac{Q}{4\pi T} \int_u^\infty \frac{e^{-y}}{y}\, dy$$

where $u = \frac{r^2 S}{4Tt}$

and
- r is the distance from the pumped well (m)
- Q is the rate of pumping (m^3/day)
- t is the time since pumping started (days)
- T is the transmissivity (m^2/day)
- S is the storage coefficient (dimensionless)

When there is more than one pumped well, the total drawdown at any point is given approximately by the sum of the drawdowns due to each of the pumped wells,

$$S_{tot} = \sum \frac{Q}{4\pi T} \int_u^\infty \frac{e^{-y}}{y}\, dy$$

where the summation is over all the pumped wells.

Each of the wellfield areas was assigned a representative transmissivity derived from the groundwater model predictions : 2000 m^3/day for Stages 1 and IIA and 1400 m^3/day for Stage IIB. An estimate of 2% for the storage coefficient was derived from the pumping test data (Appendix B).

The model takes no account of possible recharge to the area, so the drawdowns predicted represent the worst possible case of long term pumping with no recharge.

A correction has been made for partially penetrating wells, and drawdowns have been given both for the fully penetrating case and after correction.

APPENDIX J

SHABEELLE FLOW RECORDS

The gauging stations of direct relevance to this study are located at Balcad and Afgooye; although records are available from 1951 to date, there are some large gaps in the records. Moreover there are extensive periods when the quality of the data is particularly suspect.

In 1968 Hunting Technical Services[1] investigated the hydrology of the Shabeelle in some detail, and undertook a rehabilitation programme of the existing gauging stations. At Balcad and Afgooye the gauges were located on or near the existing road bridges, and neither site was considered to be very satisfactory for discharge observations because they both have bridge piers obstructing the flow. However the gaugings carried out at that time broadly confirmed the rating curves and five day mean discharges were calculated for the period of record. These are summarised as mean monthly discharges in Tables J.1 and J.2.

After 1968 flow data have been published for Afgooye[2] but not for Balcad; these cover the period up to 1974 and are summarised in Table J.3. Measurements of Shabeelle river stage were taken at Balcad road bridge as part of the routine water level observations taken during the course of this study; these are included at the end of this Appendix.

Since 1968, a new road bridge has been completed at each site a short distance downstream. Although Huntings recommended that, once construction had finished, new rating curves should be established by using boats or overhead cableways, there is no evidence that this has been done.

[1] *Project for the Water Control and Management of the Shabeelle River, Somalia, Vol. IV, Water Resources and Engineering, Hunting Technical Services Ltd. and Sir M. MacDonald and Partners, Nov. 1969.*

[2] *Pilot Project for Irrigated Agricultural Development on the Shabeele River, Somalia; UNDP/FAO, Rome, 1975.*

Our field survey of January 1979 revealed that at Balcad the gauge board and automatic water level recorder were still in their original positions, just upstream of the old bridge. The recorder had obviously been out of order for some time and the state of the bridge, from which the previous rating had been established, was too dangerous to allow further discharge measurements to be made.

At Afgooye, the gauge board is located on an upstream pier of the old bridge. It was impossible to read directly because the trash accumulated from recent floods obscured the markings on the gauge. It was impossible to make any discharge measurements from this bridge because of these obstructions.

It is clear that there are considerable shortcomings in the observation and analysis of the streamflow data. In view of the importance of the Shabeelle as the source of irrigation water, and its possible future role as an additional supply to the Mugdisho water supply, it is vital that all the components of the existing hydrometric network are thoroughly reviewed and updated.

TABLE J.1

BALCAD: MEAN MONTHLY DISCHARGE 1951/68

(m^3/sec)

YEAR	J	F	M	A	M	J	J	A	S	O	N	D	MEAN
1951	-	-	-	91.1	92.5	79.1	20.8	45.6	67.5	44.5	92.5	73.6	-
1952	8.5	4.5	4.5	4.5	66.9	20.9	7.3	18.5	83.3	65.9	36.6	-	-
1953						NO RECORDS							-
1954	8.4	8.4	8.4	52.8	51.4	21.8	4.1	52.9	92.5	92.5	55.7	32.4	40.1
1955	5.2	3.6	5.8	6.4	33.0	10.8	3.4	16.4	76.6	92.5	34.0	5.8	24.5
1956	4.8	4.0	7.3	14.9	88.4	23.6	19.0	82.1	92.4	90.5	88.5	25.1	45.1
1957	9.9	5.2	5.9	46.5	92.5	81.9	39.3	82.3	90.0	42.6	45.0	33.9	47.9
1958	6.9	14.8	36.6	14.3	56.1	8.6	10.4	79.7	92.5	92.5	56.4	15.8	40.4
1959	7.0	5.8	4.7	4.5	58.0	19.1	10.7	61.5	86.3	89.9	78.8	19.0	37.1
1960	54.8	19.4	8.3	16.4	51.6	31.2	14.2	31.4	70.6	-	-	-	-
1961	8.5	8.7	4.7	6.8	38.7	13.8	33.1	88.1	92.5	92.5	92.5	92.5	47.7
1962	12.9	3.6	4.0	9.9	43.1	13.7	6.3	22.4	59.2	67.8	92.2	60.4	33.0
1963	5.7	3.5	3.4	32.6	90.2	69.8	42.9	80.6	92.2	80.9	40.5	78.2	51.7
1964	33.3	12.8	3.6	18.9	31.0	14.6	22.8	70.9	91.2	90.8	73.3	24.1	40.6
1965	44.5	11.4	2.9	2.8	41.9	8.9	2.0	11.4	59.4	68.7	88.1	46.3	32.4
1966	7.5	3.6	28.8	50.2	83.0	42.2	31.7	46.4	59.7	79.6	66.7	26.7	43.8
1967	5.3	0.9	0	24.9	70.1	67.2	23.6	67.3	101.8	93.7	90.9	89.7	53.0
1968	31.6	13.6	63.8	63.0	102.2	90.0	69.9	85.4	99.7	95.7	65.5	66.7	70.6

Note: abstracted from Hunting (1969)

TABLE J.2

AFGOOYE: MEAN MONTHLY DISCHARGE 1951/68

(m^3/sec)

YEAR	J	F	M	A	M	J	J	A	S	O	N	O	MEAN
1951	-	-	-	91.1	92.8	80.9	19.5	47.9	72.5	42.5	92.8	76.1	-
1952	5.3	1.2	1.2	1.2	70.7	15.1	3.8	17.7	84.5	70.8	37.6	1.7	25.9
1953	NO RECORDS												
1954	5.0	5.0	5.0	50.2	61.8	21.2	1.4	54.1	92.8	92.8	60.3	29.1	39.9
1955	2.0	1.0	2.3	2.8	34.3	8.1	1.0	15.2	80.1	92.8	34.7	2.7	23.1
1956	1.4	1.1	4.0	13.0	89.0	23.2	17.9	86.1	92.8	91.8	89.5	26.3	44.7
1957	7.0	1.8	10.0	47.0	91.7	84.0	41.4	84.1	92.6	45.0	48.1	35.9	49.1
1958	3.4	12.9	38.0	11.5	58.3	5.2	7.3	81.8	79.5	92.8	61.0	13.6	38.8
1959	3.5	2.3	1.3	1.2	60.8	16.8	7.7	65.8	87.7	91.4	79.8	17.4	36.3
1960	58.2	17.6	5.0	14.2	55.3	33.8	11.8	32.0	75.1	-	-	-	-
1961	5.2	5.3	2.0	3.6	40.9	15.1	35.1	89.7	92.8	92.8	92.8	92.8	47.3
1962	10.5	1.0	1.1	7.4	42.3	12.5	2.9	20.6	65.2	74.1	92.7	64.8	32.9
1963	3.1	1.0	1.0	31.5	92.4	76.6	47.6	81.1	94.1	84.3	45.8	78.1	53.1
1964	38.2	14.7	3.3	15.1	33.4	16.4	23.0	70.2	91.8	91.3	78.7	29.3	42.1
1965	46.7	14.1	2.7	2.7	48.1	9.2	1.4	8.2	52.7	64.7	84.9	50.0	32.1
1966	8.5	0.8	22.7	23.9	69.4	36.5	32.2	48.3	80.1	74.8	67.6	13.7	39.9
1967	1.0	0.1	0	28.9	78.9	70.9	27.2	81.4	96.3	93.1	91.4	90.0	54.9
1968	29.5	9.7	53.0	54.5	91.8	86.5	70.8	83.7	91.5	89.0	61.8	64.2	65.5

Note: abstracted from Hunting (1969)

TABLE J.3

AFGOOYE: MEAN MONTHLY DISCHARGE 1969/74
(m^3/sec)

YEAR	J	F	M	A	M	J	J	A	S	O	N	D	MEAN
1969	24.7	18.5	72.1	94.9	88.1	62.8	45.9	83.1	95.1	85.6	52.0	16.8	61.6
1970	4.9	1.8	30.9	87.5	96.9	49.9	18.8	78.6	97.8	97.0	86.2	26.3	56.4
1971	10.3	2.4	0	23.6	74.6	52.3	70.5	87.5	97.8	88.0	69.0	45.9	51.8
1972	9.8	6.2	19.9	17.6	92.3	74.8	58.3	97.9	93.9	89.0	75.7	30.8	55.5
1973	3.0	0.2	0	0	36.7	35.2	11.1	63.1	88.4	83.5	45.7	4.2	30.9
1974	0.2	0	0	43.9	42.5	59.6	56.6	83.1	90.7	75.7	24.9	3.7	40.1

Note: abstracted from UNDP/FAO (1975)

MUQDISHO RESOURCE STUDY
RIVER STAGE SUMMARY
ALL THE DATA
GRID REF. 54352598
SITE NAME

DATE	RIVER STAGE (METRES)	DATE	RIVER STAGE (METRES)
26 SEP 78	5.270	18 APR 79	3.620
9 OCT 78	5.190	28 APR 79	4.200
14 OCT 78	5.270	20 MAY 79	3.400
24 OCT 78	5.330	3 JUN 79	5.460
28 OCT 78	5.340	6 JUN 79	5.490
5 NOV 78	5.500	11 JUN 79	5.520
12 NOV 78	5.520	16 JUN 79	5.520
18 NOV 78	5.130	20 JUN 79	5.020
26 NOV 78	3.600	24 JUN 79	4.860
7 DEC 78	2.870	28 JUN 79	4.300
16 DEC 78	2.740	3 JUL 79	3.630
23 DEC 78	2.350	10 JUL 79	3.030
3 JAN 79	1.800	16 JUL 79	2.540
12 JAN 79	1.720	24 JUL 79	3.790
5 FEB 79	2.570	26 JUL 79	3.880
13 FEB 79	4.750	6 AUG 79	4.100
10 MAR 79	3.880	28 AUG 79	5.520
17 MAR 79	1.900	15 SEP 79	3.000
26 MAR 79	1.290	17 SEP 79	3.290
3 APR 79	4.550	23 SEP 79	3.750

DATE	RIVER STAGE (METRES)	DATE	RIVER STAGE (METRES)
29 SEP 79	3.190	10 NOV 79	5.600
3 OCT 79	3.460	12 NOV 79	4.500
11 OCT 79	3.490	17 NOV 79	3.750
15 OCT 79	3.660	23 NOV 79	2.900
27 OCT 79	5.490		