4. Groundwater Development

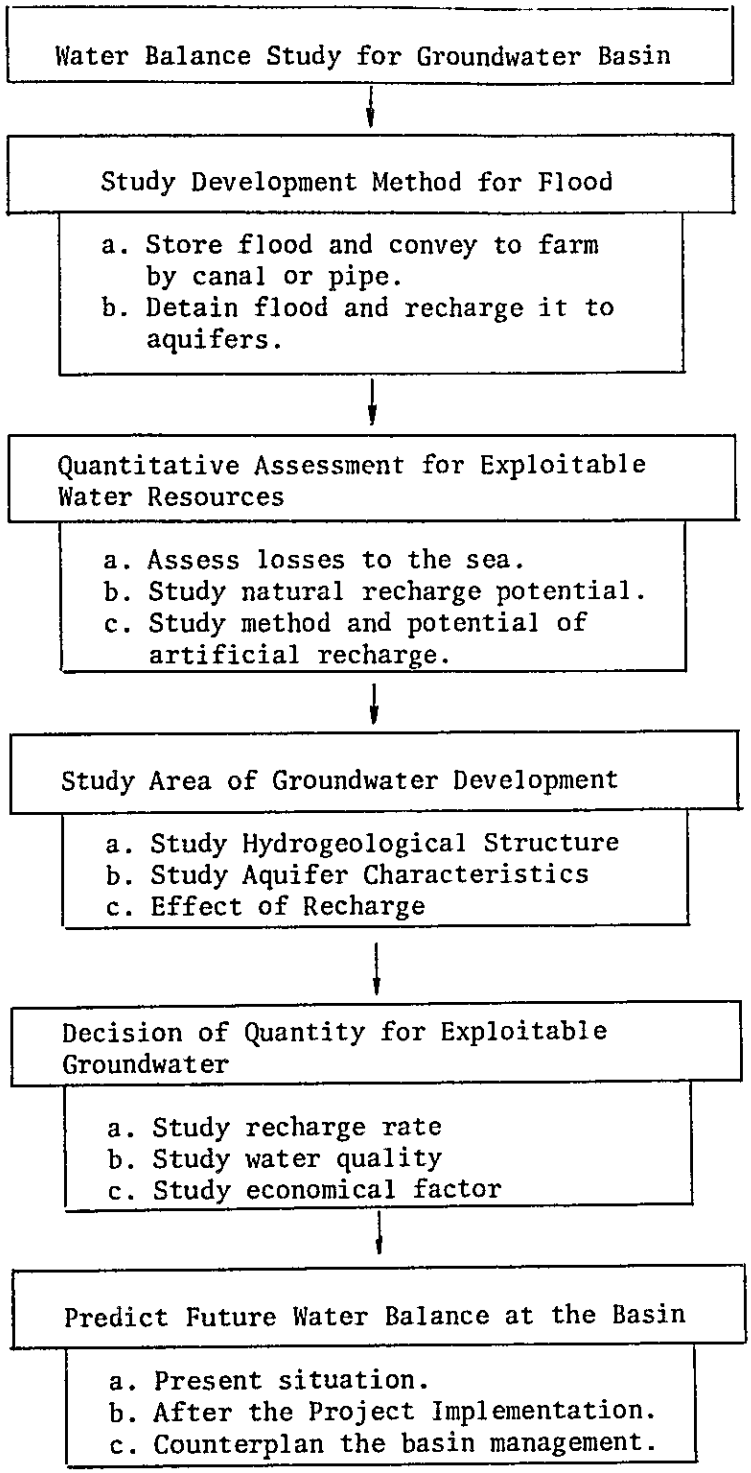
4.1 Basic Concept

Two kinds of water development method were studied for the Project.

a) Detain flood at dam ----- Convey to farm pond at plain by canal or pipe.

b) Detain flood at dam ----- Recharge to aquifer at plain in accordance with recharge potential. Extract by well

The latter was adopted for the Project judging from the hydrogeological and economical point of view. Following studies have been discussed for the adoption of final method for the development.


Water Balance Study for Groundwater Basin
Study Development Method for Flood
a. Store flood and convey to farm by canal or pipe.
b. Detain flood and recharge it to aquifers.
Quantitative Assessment for Exploitable Water Resources
a. Assess losses to the sea.
b. Study natural recharge potential.
c. Study method and potential of artificial recharge.
Study Area of Groundwater Development
a. Study Hydrogeological Structure
b. Study Aquifer Characteristics
c. Effect of Recharge
Decision of Quantity for Exploitable Groundwater
a. Study recharge rate
b. Study water quality
c. Study economical factor
Predict Future Water Balance at the Basin
a. Present situation.
b. After the Project Implementation.
c. Counterplan the basin management.

4. Groundwater Development

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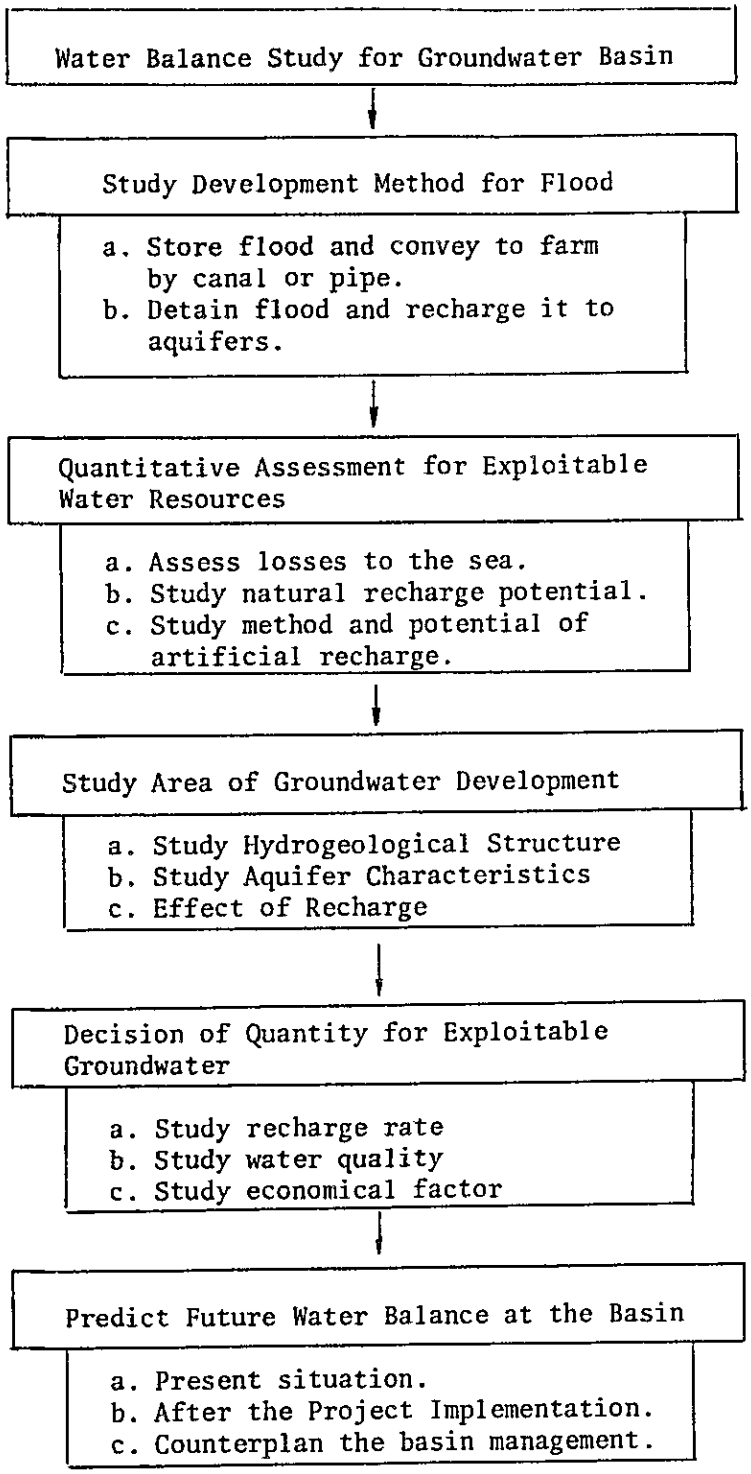
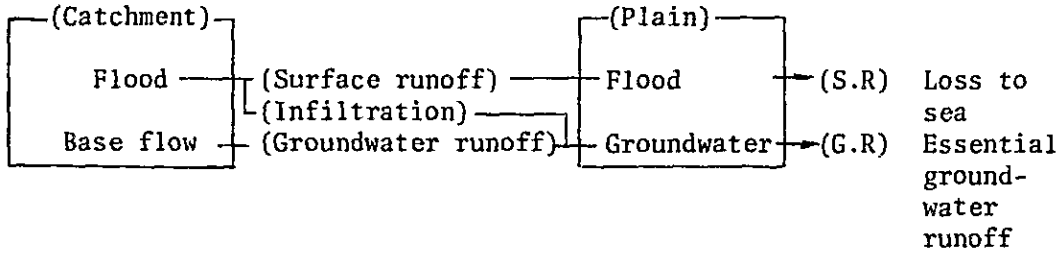


Basic concept of the method of water resources development are described as follows:

The rainfall, origin of water resource in the Project turn to various kinds of water resources in accordance with places.



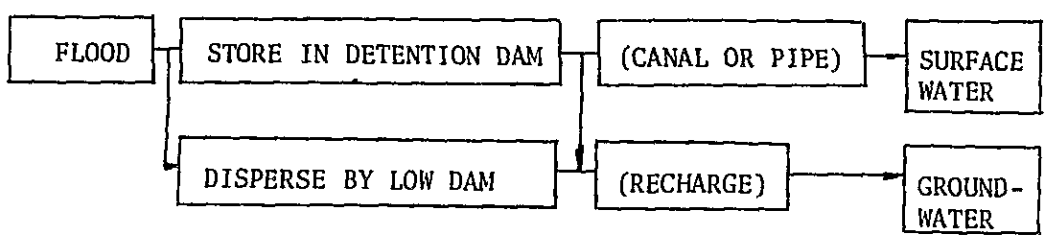
As is shown in the diagram, all the surface water resources which would contribute to groundwater recharge cannot expected as exploitable resources because of negative coastal groundwater balance.

Only the resource to be developed is losses to the sea. Floods occures sporadically, caused by heavy rainfall in short period. Estimated flood losses to the sea ranges from 2.5 to 3.6 MCM/ANN in an average of last eight years. Only the way to prevent it is detain the flood by means of dam.

Two kinds of functions for the dam are considered: they are storage or detention dam and dispersion dam. Stored flood can be conveyed to downwards for utilizations by means of canals or pipes and at the same time released to downstream for the recharge at groundwater.

Dispersed flood is subjected to recharge same as retarded flood for groundwater. The latter is called groundwater recharge method.

Following is summarised diagram for the method of development.



The plan for surface water development is not advisable because the volumes and the intervals of the floods is not stable from year to year.

The plan for groundwater development is adaptable to the Project because stored groundwater in the basin at the coastal plain can be sustained few seasons even if flood would not occurred. Groundwater storage in the basin is estimated more than ten times of annual groundwater recharge.

Furthermore, special differences between area of recharge and extraction which could be influenced to water levels is compensated shortly because of large storativity of aquifers and their unconfined condition. As a matter of course, water levels at the development area should be kept above mean sea level for prevention of sea water intrusion into the aquifers.

Groundwater recharge by means of dispersion is not advisable positively for the Project. It has some difficulties that increased velocity of the flood is to accelerate siltation on the wadi course.

4.2 Development Plan

As already mentioned before, recommendable development plan is groundwater recharge at the gravel plain under natural condition by means or released flood flow in accordance with recharge potential. Recharge potential at the gravel plain is estimated at 15 cu.m/sec. Dispersion dam to increase additional recharge potential is planned at 3.3 km down of the detention dam.

Dispersed flood take the wadi course which was filled up by old floods elevating slightly higher than the recent wadi platforms. Additional recharge caused by dispersion is estimated at 7 cu.m/sec in rate.

Quantitative assessments for the plan are conducted as follows.

a) Quantity of exploitable water resources

Quantitative assessment for present groundwater condition is essential to estimate exploitable groundwater resources because it is only one water resources for the people in the Area.

Present conditions can be assessed by means of well-hydrograph, water balance calculation, groundwater contour map and Iso-EC contour map.

Average changes of water levels during last eight years for the wells of AE-104, AE-142 and OA-2 are counted 12 mm in defect as mentioned before, it is equivalent to 0.19 MCM/ANN defect for covering areas of 317 sq.km at the coast. It is no wonder that groundwater in the basin is under defected condition of annual rainfalls be on an average.(Figure C-39)

On the other hands, zero mamsl groundwater contour line which is indicator of sea water intrusion, extends to the coastal plain in Sohar city with 1 km width and 5 km length at drought month. (refer to Figure C-29)

Iso-EC contour line 3,000 micro mho/cm which is equivalent to about 1,000 mg/lit of cloride content, is located on the same location of zero mamsl groundwater contour line indicating chemical contamination of groundwater with sea water.

The summary of assessment is shown in Table C-17. As described previously, flood discharge to the sea is only the exploitable water resources. It is estimated 2.5 and 3.6 MCM/ANN by means of hydrological analysis and groundwater balance calculation respectively. Actual possible extraction for the Project is estimated at about 3.5 MCM because developed water should compensate the defect of average

FIGURE C–39 RELATIONSHIP, CHANGE WATER LEVEL AND GROUNDWATER RUNOFF

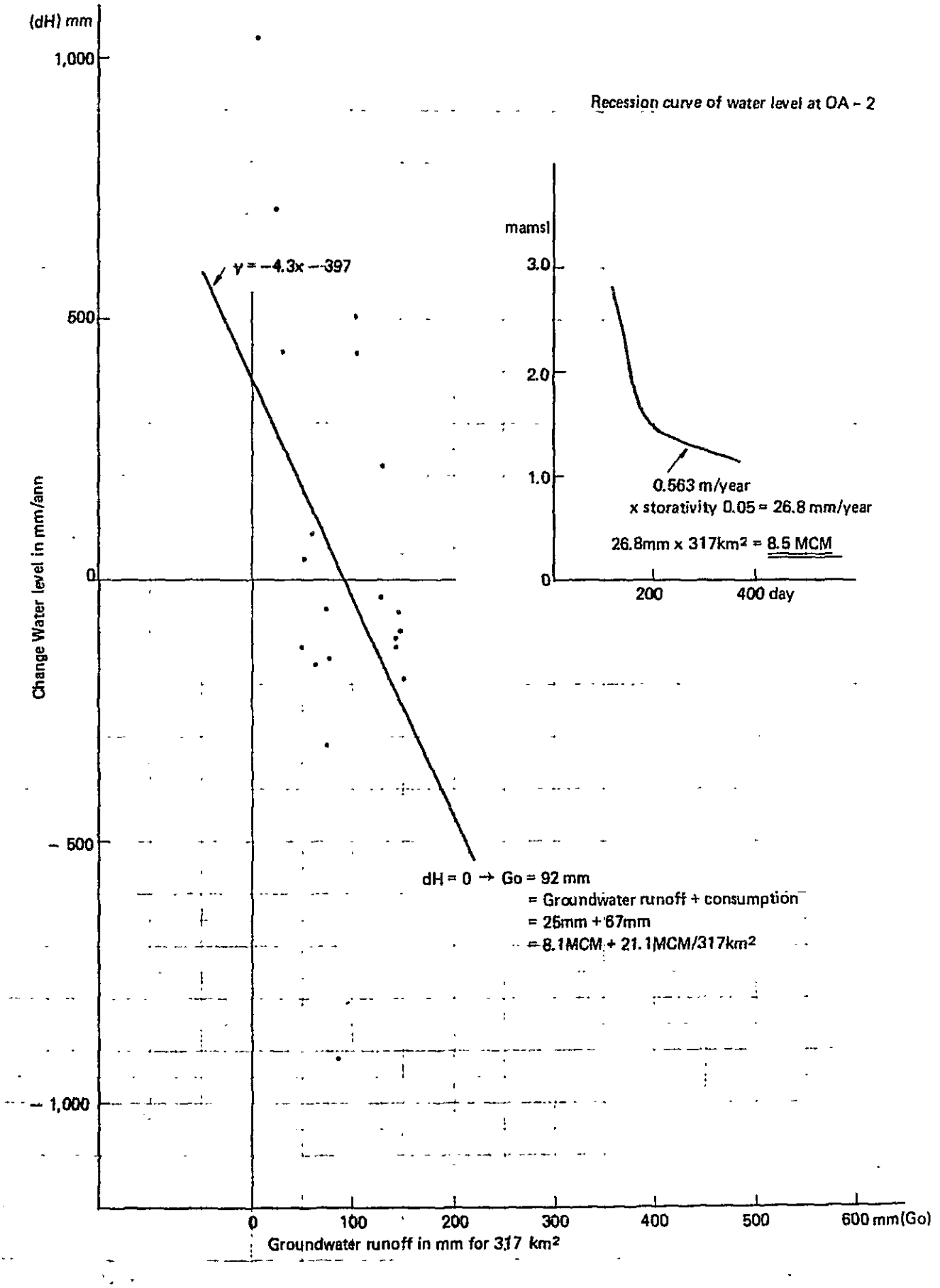


Table C - 17. Assessment of Water Balance in the Basin (Year Applied 1974 - 1981)

Method	Applied Parameter	Assessed Parameter	Results, Assessed
Well-Hydrograph	Water table	Storage	- 0.6 mm in basin - 0.19 MCM for 317 km^2 in storage
Water Level Map	Water table	Area of sea water intrusion	Area enclosed by Zero mamsl water table line is extending near Sohar with 1 km width and 5 km length.
Iso - EC Map	EC	Contamination of groundwater	Area enclosed by more than 3,000 µmho/cm/25°C (equivalent more than 1,000 mg/ℓ chloride content) is extending same area of Zero mamsl water table line.

0.1 MCM in the coastal area. On the other hand, estimated consumption for Mining and Sohar city supplies up to 1987 is 0.31 and 0.95 MCM/annum respectively. It must be subtracted from 3.5 and possible quantity for the Project is finally counted at about 2.24 MCM. (Table C-19)

b) Groundwater recharge potentials

Estimation of recharge potential at the downstream of the dam can get optimal recharge for the development plan.

Discharge measurement at Mulayyinah was carried out on February 15, 1982 by currentmeter for estimation of recharge potential at the gravel plain when flood discharge ceased in the mouth of Wadi Sallan.

Measured discharge and estimated potential recharge are shown in follows;

11.01 cu.m/sec ----- measured discharge at Mulayyinah.
11.01/654 sq.km (for Mulayyinah) x 812 sq.km (for dam site)
= 13.6 cu.m/sec ----- converted discharge at dam site.
11.01/654 sq.km x 893 sq.m (for outlet of catchment)
= 15.0 cu.m/sec ----- converted discharge at outlet of catchment.

Calculated figures are considered recharge potential at respective sites. Design volume of possible released flow is decided at 12.15 cu.m/sec including safety factors.

Estimation of release flows through spillway and conduit which may be counted into the losses are attempted in Table C-18. As is shown in table, floods occurred at 76/2 and 76/3 which discharged 6.98 and 8.00 MCM at dam site are excessed storage capacity of 5.4 MCM to 1.58 and 2.6 MCM respectively. However, reservoir can store them because duration of flood discharge took two and three days respectively.

Table C - 18 Calculation of Required Days of Detention

Occured Date	Days, Over 8mm Rain continued T_1 (day)	Discharge Damsite D_1 (MCM)	Discharge at Mouth: Analized D_2 (MCM)	Discharge at Mouth: Expected $D_3=D_1 \times \frac{1283}{812}$ (MCM)	Overflow Expected $R_1= D_3-D_2$ (MCM)	Overflow Exceeded: $D_1 \leq 5.4$ $R_2=R_1/1.3$	Overflow Exceeded: $D_1 > 5.4$ $R_3=R_1/1.9$	Days Required Detention $T_2=R_2/13, R_3/1.9$
74/2	1	1.91	1.46	3.02	1.56	0.26	-	0.2
75/2	2	4.14	1.74	6.54	4.80	3.50	-	2.7
76/1	1	1.06	0.30	1.67	1.37	0.05	-	0.04
76/2	} 5	2.72	} 2.81	4.30	} 4.76	3.46	-	2.7
76/2		2.07		3.27		0	-	0
76/2	2	6.98	2.67	11.03	8.36	-	4.4	2.3
76/3	1	0.85	} 0.15	1.34	} 4.90	3.6	-	2.8
76/3	2	2.35		3.71		0	-	0
76/3	3	8.00	4.16	12.64	8.48	-	4.5	2.7
76/4	4	3.25	1.59	5.14	3.55	2.29	-	1.7
77/1	1	0.61	0.66	0.96	0.3	0	-	0
77/2	1	0.89	0.56	1.41	0.85	0	-	0
77/4	2	2.68	1.41	4.23	2.82	1.52	-	1.2
77/5	3	2.07	0.79	3.27	2.48	1.18	-	0.9
78/2	2	2.35	1.16	3.71	2.55	1.25	-	1.0
79/1	1	0.24	0.04	0.38	0.34	0	-	0
79/12	1	0.16	0.27	0.25	- 0.02	0	-	0
80/3	2	0.73	0.14	1.15	1.01	0	-	0
81/5	1	0.53	0.14	0.84	0.7	0	-	0

Table C - 19 Future Water Balance at Coastal Plain

	Coastal Water Balance	
	Without Project	With Project
Expected Groundwater Recharge	0	+ 3.6
Present Coastal Balance	- 0.6	- 0.6
Increase Use upto 1987		
Copper Mine	- 0.31	- 0.31
Sohar Water Supply	- 0.95	- 0.95
Coastal Balance	- 1.86	+ 1.74
Agricultural Development (100 ha)	0	- 1.34
Total Balance at 1987	- 1.86	+ 0.40

Potential recharge at the recent wadi beds on the gravel plain is calculated as follows;

Potential recharge = Discharge at Mulayyinah when losses ceased
x Area of Plain / Area of Mulayyinah
= 11.01 x 893 / 654
= 15.03 cu.m/sec

Potential recharge in the recent wadi course comes to 1.3 MCM per day. I will be precisely discussed later that 7 cu.m/sec of incremented recharge by dispersion can be added to 1.3 MCM. Total potential recharge produced by two detention dam and dispersion facilities is counted at 1.9 MCM per day.

Simplified case calculation for estimation of losses to the sea is attempted as follows;

Name of flood	Discharge at dam	Day of rain	Design release	Possible losses per day	Loss rate for 1st day
76/2	6.98 MCM	2	1.9 MCM	6.98-1.9=5.08	5.08/6.98=0.73
76/3	8.00 MCM	3	1.9 MCM	8.00-1.9=6.10	6.10/8.00=0.76

As is shown in above table, possible loss of 5.08 MCM in the flood occurred on 76/2 can be controlled within dam capacity of 5.4 MCM, and 6.1 MCM in the flood on 76/3 also be controlled unless flood discharge at first day wouldn't exceed 76% of total discharge.

As a result of above assumption, construction of the detention dam and the dispersion facilities would not allow the flood losses to the sea on the condition that hydrological figures could not exceed an average of the past eight years.

4.3 Recharge Method

The flood, dated February 14, 1982 was caused by total amount of 103 mm rainfall at Sohar which is estimated more than twenty years

return period. Losses to the sea analyzed by means of wadi gauge in the Wadi Sallan is calculated at 3.83 MCM in total. The size of flood is similar to the last 76/3 flood in terms of losses to the sea which was estimated 4.16 MCM. As already mentioned before, flood of 76/3 can be controlled by detention dam and dispersion facilities.

Total length of wadi course which is activating in recent floods, in counted at 200 km by means of air photos. (See Figure C-40)

Potential recharge rate for unit length is calculated as follows;

13.6 cu.m/sec / 200 km = 0.07 cu.m/sec/km
=0.10 cu.m/sec/km in approximate

Where; 13.6 cu.m/sec for discharge at dam site

Measured Wadi courses are usual courses of recent floods and they are composed of unconsolidated sand and gravel with thickness ranging from 5 to 40 m. The wadi courses expected for dispersion is composed of partially cemented sand and gravel on the platform of the terrace which were eroded during the transgression in post-glacial age. Permeability in the wadi courses is estimated less than recent wadi beds because of floods seldom occurred on them.

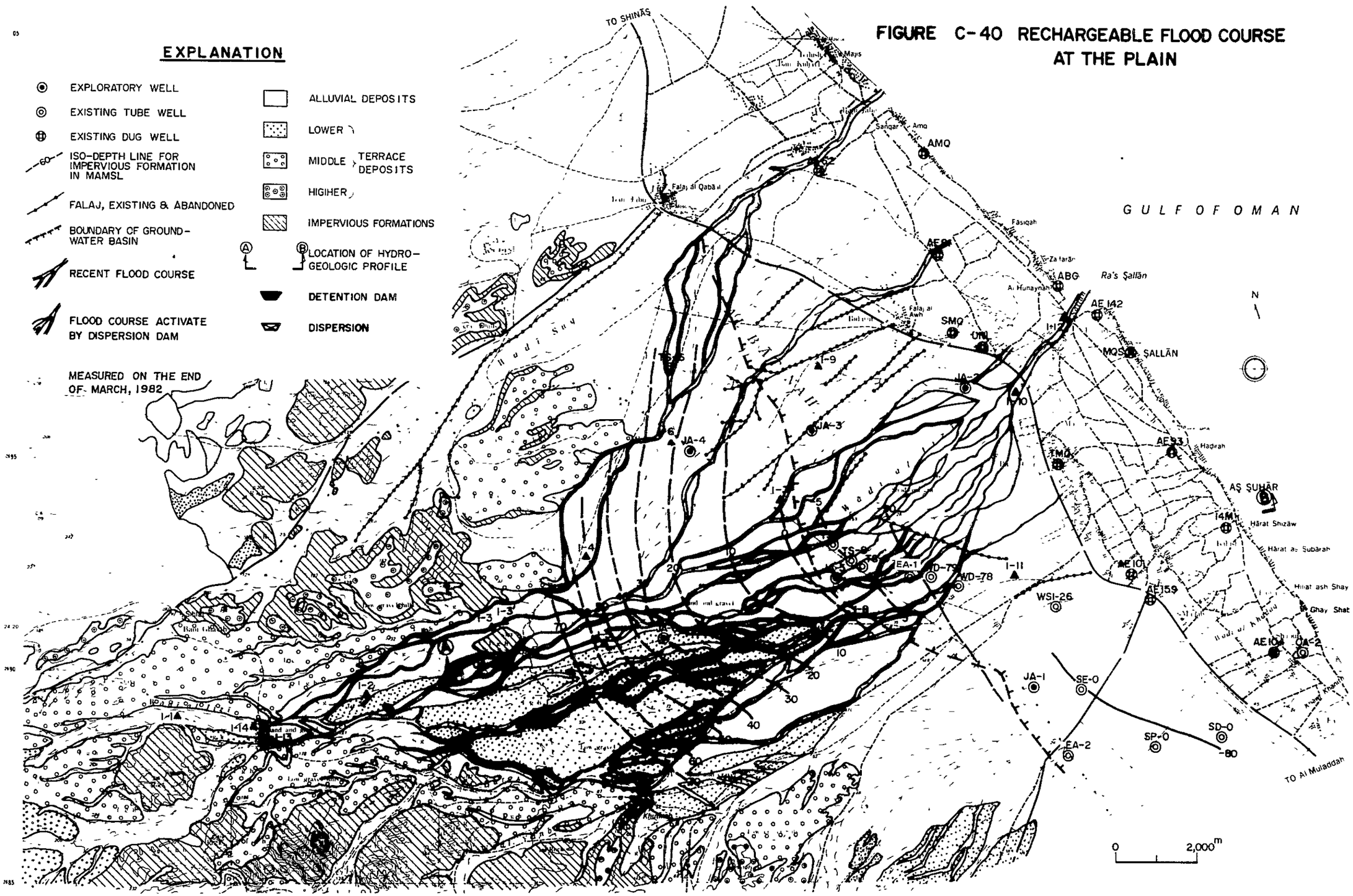
The rate of potential recharge in the recent courses and the terrace is assumed 3 mm/min and 2 mm/min respectively which is based on the results of infiltration test.

As a result of above assumption, increased recharge by means of the dispersion is estimated by following calculation.

Increased recharge by dispersion
= Increased length of wadi courses x
Potential recharge for unit length x 2/3
= 100 km x 0.1 cu.m/sec/km x 2/3
= 6.7 cu.m/sec
= 7.0 cu.m/sec approximately

Rejuvenated wadi courses by the dispersion facilities is shown in Figure C-40.

FIGURE C-40 RECHARGEABLE FLOOD COURSE AT THE PLAIN



5. Physical Plan for Groundwater Extraction

5.1 Alternative Plans of Groundwater Development Facilities

Many methods can be considered for collection of groundwater: selection of a method depends on the depth of groundwater, geologic conditions, the quality of water required and economic factor. Following methods can be considered for groundwater collecting facilities in the Project.

Falaj
Caisson well with radial collectors
Tube well

a) Falaj

Falaj, traditional water collecting facility in the Sultanate of Oman attract special interest. Aflaj which terminate at Qabail and Awhi are assumed active ones. As easily visualized in the Map, source of Aflaj are located on the places where the impervious formations upheave to near the surface ground. Aflaj are collecting groundwater on the impervious formations where stable quantity of groundwater can be obtained. Discharge patterns of Aflaj is very similar to that of base flows (See Figure C-41). Collecting capacity of unit length of the Falaj Qabail and Awhi is estimated at about 2.5 lit/sec/km on an average based on the total length of 12 km.

In case Falaj is adopted for the Project, the source will be at 4 km from the proposed farm site where the impervious formations are found near to the ground. Even if discharge of Falaj could sustain the water requirement, water table in the farm is expected more than 20 mbgs therefore, pumping facilities are required as well as the tube wells. It is considered that Falaj systems are not suitable for the Project because it cannot be operated without pumping.

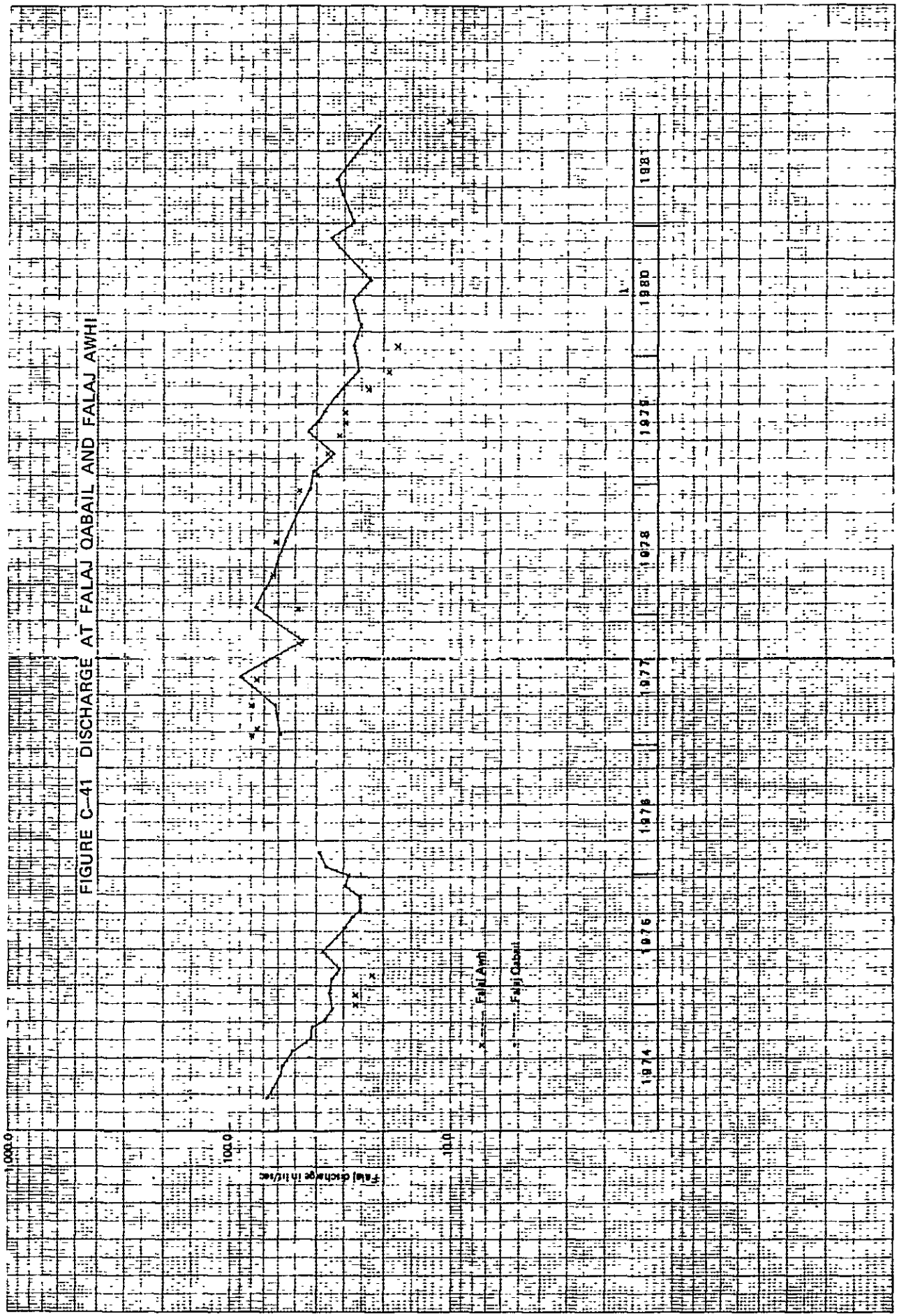


FIGURE C-41 DISCHARGE AT FALAJ QABAIL AND FALAJ AWHI

b) Caisson well with radial collectors

In general, caisson wells are adopted on the place where groundwater table comes to the surface with high permeability as well as under flow in the recent river beds. Large amount of water is expected to be extracted in spite of high costs of construction. Adoption of caisson wells for the Project is not advisable because estimated construction costs is much higher than tube wells.

c) Tube well

Adoption of tube well for the Project is more advisable than the others. Tube wells have following advantages in regard to groundwater extraction.

i) Tube wells can endure against heavy groundwater level fluctuations.

ii) Adequate aquifers can be easily selected prior to casing installation.

iii) Construction costs is cheaper than the others.

5.2 Location of Production Wells

The production wells should be located as close to the Project area as possible from the economical point of view, however groundwater movement by the recharge scheme and permissive drawdown against sea water intrusion into the aquifers should be taken into consideration. In the recharge scheme, it has been pointed out that flood turned by the dispersion facilities can be subject to recharge in a upright area of the new extension farm land. According to the hydraulic studies of dispersion facilities, about 50% of released flow can be diverted to the rejuvenated wadi courses when total volume of released flow exceed 10.5 cu.m/sec. Average 1.25 MCM per annum can be diverted based on the floods during from 1974 to 1981 and it covers 93% of annual water requirement for the Project.

As already mentioned in the previous chapter, it is no wonder that defects of 7% can be compensated by recharge at the Wadi Jizzi main courses without any hydrogeological problems.

Therefore, proposed location of production wells in western edge of the Area is consistent with recharge scheme.

In connecting with permissive drawdown, the concept of safe yield for the preservation of groundwater basin should be taken into consideration for the production pumping. IRI report proposed general guides for safe yield for the production pumping at Sohar Expansion Farm as follows:

a) Quantity keeps less than 50% of groundwater flow at the area.

b) Water level in the aquifers keeps more than one mamsl.

Proposed production rate under above concepts for production wells No.1, No.2 and No.3 were, 4,750, 2,500 and 5,000 cu.m/day respectively. Permissive drawdown in the Area has been considered based on safe yield point of view. Proposed water requirements for production wells SE-1, SE-2 and SE-3 are counted 2,523, 858 and 1,665 cu.m/day in peak requirements with 33 to 52% of proposed production rate of IRI.

Estimation of drawdown at production pumpings is calculated applying the nonequilibrium equation. Applied parameters for calculation are shown as follows:

Transmissivity	:	33,000 sq.m/day
Storativity	:	0.05
Pumpage, total	:	14,600,000 cu.m/year
Pumpage, wells	:	50% for SE-1, 17% for SE-2, 33% for SE-3
Pumping time	:	300 days
Well loss	:	75%

Calculated drawdown with accumulated interferences at each wells are:

SE-1 = 0.3 m. SE-2 = 0.1 m. SE-3 = 0.2 m.

The water levels in the drought month at the end of December, 1981 for SE-1, SE-2 and SE-3 are 2.4, 2.2 and 2.2 mamsl respectively. Therefore, water tables at the end of production pumping for SE-1, SE-2 and SE-3 are 2.1, 2.1 and 2.0 mamsl respectively. In consequence of production pumping, location of interface between fresh and sea water based on Ghyben-Herzberg assumption comes to about 80 mbmsl which locates more than 40 m below the bottom of the wells.

5.3 Design Yield of Production Wells

Water requirement for the Project is counted at 1.34 MCM. However, peak requirement can be applied for design of wells and pumps. Calculated peak requirement for the Project is 70.1 lit/sec at the month of July for 85 ha. On the other hand, well yields for Sohar Expansion Farm as well as described in the report of IRI, is estimated 45 cu.m/hr/m in an average specific capacity of four production wells.

Possible well yield can be calculated 90 cu.m/sec or 2,150 cu.m/day with two meters permissive drawdown in maximum.

Necessary numbers of production wells are calculated as following procedures:

Numbers of necessary wells = Peak requirement/Possible well yield
= 70.1 x 86.4/2,150
= 2.8
= 3 in approximately

In case of adoption for the production wells of Sohar Expansion Farm into the Project, the wells of No.1 No.2 and No.3 are adoptable in view of their location. Design yields for each wells can be assigned based on their well potentials in reference to minimige

differences of drawdown. As mentioned before, rates of shared yields for wells of, No.1, No.2 and No.3 are 50, 17 and 33% of total pumpage and they are 35.1, 11.9 and 23.1 lit/sec in peak requirements respectively.

It is recommendable that another aquifer tests at the production wells of Sohar Expansion Farm shall be conducted at the next stage because they have been abandoned since 1978 without any pumping.

In case of construction of new wells, design yield and estimated drawdown in the wells are 25 lit/sec and 1.4 m at peak requirement based on data of production well No.1 in Sohar Expansion Farm.

5.4 Specifications of Production Wells and Pumps

Specifications for drilling and completion of production well are summarized as follows:

Number of wells	:	3 wells
Location of wells	:	Upper limit of proposed farm with spacing, more than 600 m.
Depth of wells	:	55 m
Diameter, casing	:	250 mm
Diameter, hole	:	275 mm more
Material, casing	:	Steel, same as API or JIS quality
Screen	:	Wire wrapped, same as Johnson type
Aperture, screen	:	2 - 3 mm, equivalent to Slot No.100 - 120
Length, screen	:	10 m

Specifications for production pumps to be installed in the Production wells of No.1, No.2 and No.3 are summarized as follows:

Neme of Well	Q (cu.m/hr)	H (m)
No.1	132.5	30.0
No.2	46.5	23.0
No.3	90.0	22.0

Where Q is design well yield and H is total required head for the production pumps. Calculation for H is shown in Table C-20.

Recommendable type of production pump is the vertical turbine with electric motor pump which is better than the submersible pump by reasons of easier maintenance.

Table C - 20 Calculation for Required Pump Head (Ht)

Item	SE-1	SE-2	SE-3
Site Altitude, E (mamsl)	EL 20.0	EL 18.6	EL 18.4
Lowest Water Level, W. (mamsl)	EL 2.4	EL 2.2	EL 2.2
Peak Discharge, Q (cu.m/hr)	132.48	46.44	89.64
Specific Capacity, S.C. (cu.m/hr/m)	67	25	56
Drawdown, $S_1 = (Q)/(S.C)$ (m)	1.98	1.86	1.60
Interferenced Drawdown, I 1/ (m)	0.03	0.04	0.04
Interference with Well Losses, 2/ S_2 (m) $S_2 = (I)/0.75$	0.04	0.06	0.06
Total Drawdown, $S_3 = (S_1)+(S_2)$ (m)	2.02	1.92	1.66
Operating Water Level, $W_2 = (W_1)-(S_3)$ (mamsl)	EL 0.38	EL 0.28	EL 0.54
Actual Head, $H_1 = (E)-(W_2)$ (m)	19.62	18.32	17.86
Friction Loss in Conveyance Pipe, Lf (m)	8.3	2.6	2.2
Pump Loss, Lp (m)	2.0	2.0	2.0
Total Head, $\Sigma H = (H_1)+(Lf)+(Lp)$ (m)	29.92	22.92	22.06
Diameter of Well (I.D),(mm)	260	260	260
Screen Diameter (I.D), (mm)	254	254	254
Depth of Well (m)	56	50	55
Depth of Top of Screen (mbgs)	44	41	43
Depth to Pump Screen (mbgs)	25	24	23

Note: 1/ : Calculated by this formula, $T = 33{,}000\ m^2/day$, $S = 0.05$, $t = 10$ days.

2/ Based on IRI Report.

6. Bibliography

FAO: "Rainfall in the Muscal Area", Field Document No.1. 1976.

FAO: "Climate of the Batinah, 1973-1977", Field Document No.4. 1977.

FAO: "Runoff Measurements in Oman", Field Document No.7. 1979.

FAO: "Water Resources of the Batinah", Field Document No.10. 1979.

FAO: "Rainfall in Oman, 1974-1978", Field Document No.11.

FAO: "Groundwater resources for Agricultural Development in the Sohar-Saham District, Batinah Region" Field Document No.12.

FAO: "Development of the Water Resources of Oman for Agriculture" Field Document No.14. 1980.

FAO: "Groundwater Development in the Kamil/Wafi District, Sharqiya Region" Field Document No.15. 1980.

Barrett, Eric C. "The Assessment of Rainfall in North-Eastern Oman Through the Integration of Observations from Conventional and Satellite Sources" FAO, 1977.

The Secretariat of the Water R sources Council: "Flood Hydrology of Northern Oman" WRC-4, 1978.

Sir MacDonald and Partners Ltd: "Nizwa Town Water Supply Temporary Wellfield - Final Report" Ministry of Electricity and Water, Sultanate of Oman, 1981.

U.S. Army Corps of Engineers: "Report on Water Resources Study, Phase II, and Technical Proposal for Construction of Water Recharge Projects for the Government of Oman, Ministry of Agriculture & Fisheries" US AID, 1979.

Preece Cardew & Rider in Asso. Sir MacDonald & Partners Rendel, Palmer & Titton: "Power and Uban Water Supply Study, Phase 2, Water Supplies to Sohar Water Resources Evaluation, Preliminary Report" Ministry of Communications, Sultanate of Oman, 1987.

- : "Power and Uban Water Supply Study, Phase II, Water Development Programme, Town and Villages, Volume Two, Hydrology" Ministry of Electricity and Water, 1980.

ICACO: "Water Resources Development Project, Northern Oman, Final Report Annex A Meteorology and Surface Hydrology, Annex B Groundwater" Ministry of Agriculture & Fisheries, Sultanate of Oman, 1975.

IRI Research Institute, Inc. : "Sohar-Saham Groundwater Program, Final Report" Ministry of Agriculture, Fisheries, Petroleum Minerals 1978.

- : "Sohar-Saham Groundwater Program, Appendix to Final Report" Ministry of Agriculture, Fisheries, Petroleum & Minerals, 1978.

JICA : "Report on Feasibility Study for Agricultural Development Plan, Sultanate of Oman" in Japanese, JICA, 1980.

- : "Wadi Jizzi Agricultural Development Project, Sohar, North Batinah Interim Report No.1, Feasibility Study" JICA, 1981.

- : "Wadi Jizzi Agricultural Development Project, Interim Report No.2" JICA, 1982.

Al-Sayari, Saad S., and Josef G. Zotl : "Quaternary Period in Saudi Arabia" Springer-Verlag, Wien, 1978.

Glennie, K. W. et al " "Geology of the Oman Mountains" Martinus Nijhoff's Boekhandel en Uitgeversmij, Hugue, 1974.

Domenico, P. A. : "Concepts and Models in Groundwater Hydrology" McGraw-Hill, 1972.

FAO: "Salinity Seminar Baghdad" Irrigation and Drainage Paper, FAO, 1971.

7. LIST OF ANNEX

DATA SHEET FOR AQUIFER TEST

No. 1

Name of Well: JA-1

Tested Date: March 14, 1982

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
Mar. 14 9.20 a.m	0		20.90	0	416.3	Step draw-down test
	0.5		20.95	0.05	"	
	1.0		20.95	0.05	"	
	1.5		21.05	0.15	"	
	2.0		21.10	0.20	"	
	2.5		21.20	0.30	"	
	3.0		21.20	0.30	"	
	3.5		21.21	0.31	"	
	4.0		21.21	0.31	"	
	4.5		21.22	0.32	"	
	5.0		21.22	0.32	"	
	6.0		21.22	0.32	"	
	7.0		21.23	0.33	"	
	8.0		21.23	0.33	"	
	9.0		21.24	0.34	"	
	10.0		21.24	0.34	"	
	11.0		21.25	0.35	"	
	12.0		21.25	0.351	"	
	13.0		21.26	0.36	"	
	14.0		21.26	0.36	"	
	15.0		21.26	0.36	"	
	20.0		21.27	0.37	"	
	25.0		21.27	0.37	"	
	30.0		21.28	0.38	"	
	40.0		21.28	0.38	"	
	50.0		21.28	0.38	"	
	60.0		21.28	0.38	"	
	70.0		21.28	0.38	"	
	80.0		21.28	0.38	26.5	
	90.0		21.28	0.38	"	
	100.0		21.28	0.38	"	
	110.0		21.28	0.38	"	
	120.0		21.28	0.38	"	
	130.0		21.28	0.38	"	
	140.0		21.28	0.38	"	

DATA SHEET FOR AQUIFER TEST

No. 2

Name of Well: JA-1 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	150.0		21.28	0.38	26.5	
	160.0		21.28	0.38	"	
	170.0		21.28	0.38	"	
	180.0		21.28	0.38	"	
	180.5		21.31	0.41	613.2	2nd step
	181.0		21.38	0.48	"	
	182.0		21.45	0.55	"	
	182.5		21.48	0.58	"	
	183.0		21.50	0.60	"	
	183.5		21.50	0.60	"	
	184.0		21.50	0.60	"	
	184.5		21.50	0.60	"	
	185.0		21.50	0.60	"	
	186.0		21.48	0.58	"	
	187.0		21.48	0.58	"	
	188.0		21.46	0.56	"	
	189.0		21.45	0.55	"	
	190.0		21.46	0.56	"	
	191.0		21.45	0.55	"	
	192.0		21.45	0.55	"	
	193.0		21.45	0.55	"	
	194.0		21.46	0.56	"	
	195.0		21.46	0.56	"	
	200.0		21.45	0.55	"	
	205.0		21.45	0.55	"	
	210.0		21.45	0.55	"	
	220.0		21.44	0.54	"	
	230.0		21.44	0.54	"	
	240.0		21.45	0.55	"	
	250.0		21.45	0.55	"	
	260.0		21.44	0.54	"	
	270.0		21.44	0.54	"	
	280.0		21.45	0.55	"	
	290.0		21.44	0.54	"	
	300.0		21.45	0.55	"	

DATA SHEET FOR AQUIFER TEST No. 3

Name of Well: JA-1 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	310.0		21.44	0.54	613.2	
	320.0		21.44	0.54	"	
	330.0		21.44	0.54	"	
	340.0		21.45	0.55	"	
	350.0		21.44	0.54	"	
	360.0		21.45	0.55	"	
	360.5		21.47	0.57	730.6	3rd step
	361.0		21.47	0.57	"	
	361.5		21.48	0.58	"	
	362.0		21.49	0.59	"	
	362.5		21.50	0.60	"	
	363.0		21.50	0.60	"	
	363.5		21.50	0.60	"	
	364.0		21.52	0.62	"	
	364.5		21.53	0.63	"	
	365.0		21.54	0.64	"	
	366.0		21.54	0.64	"	
	367.0		21.53	0.63	"	
	368.0		21.53	0.63	"	
	369.0		21.53	0.63	"	
	370.0		21.54	0.64	"	
	371.0		21.54	0.64	"	
	372.0		21.54	0.64	"	
	373.0		21.54	0.64	"	
	374.0		21.53	0.63	"	
	375.0		21.54	0.64	"	
	380.0		21.54	0.64	"	
	385.0		21.55	0.65	"	
	390.0		21.55	0.65	"	
	400.0		21.55	0.65	"	
	410.0		21.55	0.65	"	
	420.0		21.54	0.64	"	
	430.0		21.55	0.65	"	
	440.0		21.55	0.65	"	
	450.0		21.54	0.64	"	

DATA SHEET FOR AQUIFER TEST No. 4

Name of Well: JA-1 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	460.0		21.54	0.64	730.6	
	470.0		21.54	0.64	"	
	480.0		21.55	0.65	"	
	490.0		21.55	0.65	"	
	500.0		21.54	0.64	"	
	510.0		21.54	0.64	"	
	520.0		21.54	0.64	"	
	530.0		21.54	0.64	"	
	540.0		21.54	0.64	"	
	540.5		21.63	0.73	825.2	4th step
	541.0		21.64	0.74	"	
	541.5		21.64	0.74	"	
	542.0		21.64	0.74	"	
	542.5		21.64	0.74	"	
	543.0		21.64	0.74	"	
	543.5		21.63	0.73	"	
	544.0		21.64	0.74	"	
	544.5		21.64	0.74	"	
	545.0		21.64	0.74	"	
	546.0		21.64	0.74	"	
	547.0		21.64	0.74	"	
	548.0		21.65	0.75	"	
	549.0		21.65	0.75	"	
	550.0		21.65	0.75	"	
	551.0		21.64	0.74	"	
	552.0		21.64	0.74	"	
	553.0		21.64	0.74	"	
	554.0		21.65	0.75	"	
	555.0		21.65	0.75	"	
	560.0		21.65	0.75	"	
	565.0		21.65	0.75	"	
	570.0		21.64	0.74	"	
	580.0		21.64	0.74	"	
	590.0		21.65	0.75	"	
	600.0		21.65	0.75	"	

DATA SHEET FOR AQUIFER TEST No. 5

Name of Well: JA-1 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	610.0		21.65	0.75	825.2	
	620.0		21.65	0.75	"	
	630.0		21.65	0.75	"	
	640.0		21.65	0.75	"	
	650.0		21.65	0.75	"	
	660.0		21.65	0.75	"	
	670.0		21.64	0.64	"	
	680.0		21.64	0.64	"	
	690.0		21.64	0.64	"	
	700.0		21.65	0.64	"	
	710.0		21.65	0.65	"	
	720.0		21.65	0.65	"	

DATA SHEET FOR AQUIFER TEST No. 1

Name of Well: JA-1 Tested Date: March 14, 1982

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
Mar 14	0		20.90	0	825.2	Constant
9.35 p.m	0.5		21.53	0.63	"	discharge
	1.0		21.55	0.65	"	test
	1.5		21.60	0.70	"	
	2.0		21.60	0.70	"	
	2.5		21.62	0.72	"	
	3.0		21.63	0.73	"	
	3.5		21.63	0.73	"	
	4.0		21.63	0.73	"	
	4.5		21.63	0.73	"	
	5.0		21.63	0.73	"	
	6.0		21.63	0.73	"	
	7.0		21.63	0.73	"	
	8.0		21.63	0.73	"	
	9.0		21.63	0.73	"	
	10.0		21.64	0.74	"	
	11.0		21.64	0.74	"	
	12.0		21.63	0.73	"	
	13.0		21.63	0.73	"	
	14.0		21.63	0.73	"	
	15.0		21.63	0.73	"	
	20.0		21.64	0.74	"	
	30.0		21.63	0.73	"	
	40.0		21.63	0.73	"	
	50.0		21.63	0.73	"	
	60.0		21.64	0.74	"	
	70.0		21.65	0.75	"	
	80.0		21.65	0.75	"	
	90.0		21.65	0.75	"	
	100.0		21.65	0.75	"	
	110.0		21.65	0.75	"	
	120.0		21.64	0.74	"	
	135.0		21.65	0.75	"	
	150.0		21.65	0.75	"	
	165.0		21.65	0.75	"	

DATA SHEET FOR AQUIFER TEST No. 2

Name of Well: JA-1 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	180.0		21.65	0.75	825.2	
	210.0		21.64	0.74	"	
	240.0		21.64	0.74	"	
	270.0		21.64	0.74	"	
	300.0		21.65	0.75	"	
	330.0		21.65	0.75	"	
	360.0		21.65	0.75	"	
	390.0		21.64	0.74	"	
	420.0		21.64	0.74	"	
	450.0		21.65	0.75	"	
	480.0		21.65	0.75	"	
	510.0		21.65	0.75	"	
	540.0		21.65	0.75	"	
	570.0		21.65	0.75	"	
	600.0		21.64	0.74	"	
	630.0		21.65	0.75	"	
	660.0		21.64	0.74	"	
	690.0		21.64	0.74	"	
	720.0		21.65	0.75	"	
	780.0		21.65	0.75	"	
	840.0		21.64	0.74	"	
	900.0		21.64	0.74	"	
	960.0		21.65	0.75	"	
	1,020.0		21.65	0.75	"	
	1,080.0		21.65	0.75	"	
	1,140.0		21.65	0.75	"	
	1,200.0		21.64	0.64	"	
	1,260.0		21.40	0.50	"	
	1,285.0	0	21.40	0.50	"	pumping
	1,285.5	0.5	20.95	0.05		stopped
	1,286.0	1.0	20.95	0.05		
	1,286.5	1.5	20.95	0.05	"	
	1,287.0	2.0	20.94	0.04	"	
	1,287.5	2.5	20.94	0.04	"	
	1,288.0	3.0	20.94	0.04	"	

DATA SHEET FOR AQUIFER TEST No. 3

Name of Well: JA-1 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	1,288.5	3.5	20.94	0.04	825.2	
	1,289.0	4.0	20.94	0.04	"	
	1,289.5	4.5	20.94	0.04	"	
	1,290.0	5.0	20.94	0.04	"	
	1,291.0	6.0	20.94	0.04	"	
	1,292.0	7.0	20.94	0.04	"	
	1,293.0	8.0	20.94	0.04	"	
	1,294.0	9.0	20.94	0.04	"	
	1,295.0	10.0	20.94	0.04	"	
	1,300.0	15.0	20.94	0.04	"	
	1,305.0	20.0	20.94	0.04	"	
	1,310.0	25.0	20.94	0.04	"	
	1,315.0	30.0	20.94	0.04	"	
	1,325.0	40.0	20.94	0.04	"	
	1,335.0	50.0	20.94	0.04	"	
	1,345.0	60.0	20.94	0.04	"	
	1,375.0	90.0	20.94	0.04	"	
	1,405.0	120.0	20.94	0.04	"	
	1,465.0	180.0	20.94	0.04	"	
	1,525.0	240.0	20.94	0.04	"	
	1,585.0	300.0	20.94	0.04	"	
	1,645.0	360.0	20.94	0.04	"	
	1,705.0	420.0	20.93	0.03	"	
	1,765.0	480.0	20.93	0.03	"	
	1,825.0	540.0	20.93	0.03	"	
	1,885.0	600.0	20.92	0.02	"	
	1,945.0	660.0	20.92	0.02	"	
	2,000.0	720.0	20.92	0.02	"	
	2,065.0	780.0	20.92	0.02	"	
	2,125.0	840.0	20.92	0.02	"	
	2,185.0	900.0	20.92	0.02	"	

DATA SHEET FOR AQUIFER TEST No. 1

Name of Well: JA-2 Tested Date: March 17, 1982

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
March 17	0		7.07	0	386.1	Step draw-
0.15 p.m	0.5		7.32	0.25	"	down test
	1.0		7.34	0.27	"	
	1.5		7.35	0.28	"	
	2.0		7.45	0.38	"	
	2.5		7.50	0.43	"	
	3.0		7.55	0.48	"	
	3.5		7.55	0.48	"	
	4.0		7.56	0.49	"	
	4.5		7.58	0.51	"	
	5.0		7.60	0.53	"	
	6.0		7.60	0.53	"	
	7.0		7.61	0.54	"	
	8.0		7.62	0.55	"	
	9.0		7.62	0.55	"	
	10.0		7.62	0.55	"	
	11.0		7.63	0.56	"	
	12.0		7.63	0.56	"	
	13.0		7.63	0.56	"	
	14.0		7.64	0.57	"	
	15.0		7.64	0.57	"	
	20.0		7.66	0.59	"	
	25.0		7.67	0.60	"	
	30.0		7.67	0.60	"	
	40.0		7.67	0.60	"	
	50.0		7.67	0.60	"	
	60.0		7.68	0.61	"	
	70.0		7.68	0.61	"	
	80.0		7.70	0.63	"	
	90.0		7.69	0.62	"	
	100.0		7.69	0.62	"	
	110.0		7.70	0.63	"	
	120.0		7.70	0.63	"	
	130.0		7.70	0.63	"	
	140.0		7.70	0.63	"	

DATA SHEET FOR AQUIFER TEST No. 2

Name of Well: JA-2 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	150.0		7.70	0.63	386.1	
	160.0		7.70	0.63	"	
	170.0		7.70	0.63	"	
	180.0		7.70	0.63	499.7	2nd step
	180.5		7.80	0.73	"	
	181.0		7.85	0.78	"	
	181.5		7.90	0.83	"	
	182.0		7.90	0.83	"	
	182.5		7.90	0.83	"	
	183.0		7.90	0.83	"	
	183.5		7.90	0.83	"	
	184.0		7.90	0.83	"	
	184.5		7.91	0.84	"	
	185.0		7.91	0.84	"	
	186.0		7.91	0.84	"	
	187.0		7.92	0.85	"	
	188.0		7.92	0.85	"	
	189.0		7.92	0.85	"	
	190.0		7.92	0.85	"	
	191.0		7.92	0.85	"	
	192.0		7.92	0.85	"	
	193.0		7.92	0.85	"	
	194.0		7.92	0.85	"	
	195.0		7.92	0.85	"	
	200.0		7.92	0.85	"	
	205.0		7.92	0.85	"	
	210.0		7.92	0.85	"	
	220.0		7.92	0.85	"	
	230.0		7.92	0.85	"	
	240.0		7.92	0.85	"	
	250.0		7.92	0.85	"	
	260.0		7.92	0.85	"	
	270.0		7.92	0.85	"	
	280.0		7.92	0.85	"	
	290.0		7.92	0.85	"	

DATA SHEET FOR AQUIFER TEST No. 3

Name of Well: JA-2 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	300.0		7.92	0.85	499.7	
	310.0		7.92	0.85	"	
	320.0		7.92	0.85	"	
	330.0		7.92	0.85	"	
	340.0		7.92	0.85	"	
	350.0		7.92	0.85	"	
	360.0		7.92	0.85	711.7	3rd step
	360.5		8.10	1.03	"	
	361.0		8.15	1.08	"	
	361.5		8.17	1.10	"	
	362.0		8.17	1.10	"	
	362.5		8.17	1.10	"	
	363.0		8.18	1.11	"	
	363.5		8.18	1.11	"	
	364.0		8.18	1.11	"	
	364.5		8.18	1.11	"	
	365.0		8.18	1.11	"	
	365.5		8.18	1.11	"	
	366.0		8.18	1.11	"	
	367.0		8.18	1.11	"	
	368.0		8.18	1.11	"	
	369.0		8.18	1.11	"	
	370.0		8.18	1.11	"	
	371.0		8.18	1.11	"	
	372.0		8.18	1.11	"	
	373.0		8.18	1.11	"	
	374.0		8.18	1.11	"	
	375.0		8.18	1.11	"	
	380.0		8.20	1.13	"	
	385.0		8.20	1.13	"	
	390.0		8.22	1.15	"	
	400.0		8.23	1.16	"	
	410.0		8.24	1.17	"	
	420.0		8.24	1.17	"	
	430.0		8.25	1.18	"	

DATA SHEET FOR AQUIFER TEST

No. 4

Name of Well: JA-2

Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	440.0		8.26	1.19	711.7	
	450.0		8.27	1.20	"	
	460.0		8.27	1.20	"	
	470.0		8.27	1.20	"	
	480.0		8.28	1.21	"	
	490.0		8.28	1.21	"	
	500.0		8.28	1.21	"	
	510.0		8.28	1.21	"	
	520.0		8.28	1.21	"	
	530.0		8.28	1.21	"	
	540.0		8.28	1.21	"	Pumping stop

DATA SHEET FOR AQUIFER TEST No. 1

Name of Well: JA-2 Tested Date: March 18, 1982

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
Mar. 18	0.0		7.08	0	923.6	Constant
8.15 a.m	0.5		7.88	0.80	"	discharge
	1.0		8.50	1.42	"	test
	1.5		8.50	1.42	"	
	2.0		8.51	1.43	"	
	2.5		8.52	1.44	"	
	3.0		8.55	1.47	"	
	3.5		8.56	1.48	"	
	4.0		8.57	1.49	"	
	4.5		8.58	1.50	"	
	5.0		8.58	1.50	"	
	6.0		8.59	1.51	"	
	7.0		8.62	1.54	946.4	
	8.0		8.64	1.56	"	
	9.0		8.65	1.57	"	
	10.0		8.66	1.58	"	
	11.0		8.67	1.59	"	
	12.0		8.68	1.60	"	
	13.0		8.68	1.60	"	
	14.0		8.68	1.60	"	
	15.0		8.68	1.60	"	
	20.0		8.68	1.60	"	
	25.0		8.68	1.60	"	
	30.0		8.68	1.60	"	
	40.0		8.68	1.60	"	
	50.0		8.68	1.60	"	
	60.0		8.68	1.60	"	
	70.0		8.68	1.60	"	
	80.0		8.68	1.60	"	
	90.0		8.68	1.60	"	
	100.0		8.68	1.60	"	
	110.0		8.68	1.60	"	
	120.0		8.69	1.61	"	
	130.0		8.69	1.61	"	
	140.0		8.69	1.61	"	

DATA SHEET FOR AQUIFER TEST

No. 2

Name of Well: JA-2 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	150.0		8.69	1.61	946.4	
	160.0		8.69	1.61	"	
	170.0		8.69	1.61	"	
	180.0		8.69	1.61	"	
	210.0		8.69	1.61	"	
	240.0		8.69	1.61	953.9	
	270.0		8.70	1.62	"	
	300.0		8.70	1.62	"	
	330.0		8.70	1.62	"	
	360.0		8.70	1.62	953.9	
	420.0		8.70	1.62	"	
	480.0		8.70	1.62	"	
	540.0		8.70	1.62	"	
	600.0		8.71	1.63	"	
	660.0		8.71	1.63	"	
	720.0		8.72	1.64	957.7	
	780.0		8.72	1.64	"	
	840.0		8.73	1.65	"	
	900.0		8.73	1.65	"	
	960.0		8.73	1.65	"	
	1,020.0		8.74	1.66	957.7	
	1,080.0		8.74	1.66	"	
	1,140.0		8.74	1.66	"	
	1,200.0		8.74	1.66	"	
	1,260.0		8.75	1.67	"	
	1,320.0		8.75	1.67	"	
	1,380.0		8.75	1.67	"	
	1,440.0	0.0	8.75	1.67	953.9	Pumping
	1,440.5	0.5	8.00	0.92	"	stopped
	1,441.0	1.0	7.80	0.72	"	
	1,441.5	1.5	7.55	0.47	"	
	1,442.0	2.0	7.40	0.32	"	
	1,442.5	2.5	7.29	0.21	"	
	1,443.0	3.0	7.20	0.12	"	
	1,443.5	3.5	7.14	0.06	"	

DATA SHEET FOR AQUIFER TEST No. 3

Name of Well: JA-2 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	1,444.0	4.0	7.14	0.06	953.9	
	1,444.5	4.5	7.14	0.06	"	
	1,445.0	5.0	7.14	0.06	"	
	1,446.0	6.0	7.14	0.06	"	
	1,447.0	7.0	7.13	0.05	"	
	1,448.0	8.0	7.13	0.05	"	
	1,449.0	9.0	7.13	0.05	"	
	1,450.0	10.0	7.12	0.04	"	
	1,451.0	11.0	7.12	0.04	"	
	1,452.0	12.0	7.11	0.03	"	
	1,453.0	13.0	7.11	0.03	"	
	1,454.0	14.0	7.11	0.03	"	
	1,455.0	15.0	7.11	0.03	"	
	1,465.0	25.0	7.10	0.02	"	
	1,470.0	30.0	7.10	0.02	"	
	1,480.0	40.0	7.10	0.02	"	
	1,490.0	50.0	7.10	0.02	"	
	1,500.0	60.0	7.09	0.01	"	
	1,510.0	70.0	7.09	0.01	"	
	1,520.0	80.0	7.09	0.01	"	
	1,530.0	90.0	7.09	0.01	"	
	1,540.0	100.0	7.09	0.01	"	
	1,550.0	110.0	7.09	0.01	"	
	1,560.0	120.0	7.09	0.01	"	
	1,570.0	130.0	7.09	0.01	"	
	1,580.0	140.0	7.08	0.00	"	
	1,590.0	150.0	7.08	0.00	"	

DATA SHEET FOR AQUIFER TEST No. 1

Name of Well: JA-3 Tested Date: January 7, 1982

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
Jan. 7	0		25.46	0	138	Step draw-
11.48 a.m	0.5		27.30	1.84	"	down test
	1.0		27.65	2.19	"	
	1.5		27.80	2.34	"	
	2.0		27.90	2.44	"	
	2.5		28.00	2.54	"	
	3.0		28.10	2.64	"	
	3.5		28.10	2.64	"	
	4.0		28.15	2.69	"	
	4.5		28.20	2.74	"	
	5.0		28.25	2.79	"	
	6.0		28.35	2.89	"	
	7.0		28.38	2.92	"	
	8.0		28.38	2.92	"	
	9.0		28.58	3.12	"	
	10.0		28.58	3.12	"	
	11.0		28.54	3.08	"	
	12.0		28.54	3.08	"	
	13.0		28.52	3.06	"	
	14.0		28.50	3.04	"	
	15.0		28.50	3.04	"	
	20.0		28.55	3.09	"	
	25.0		28.54	3.08	"	
	30.0		28.35	2.89	"	
	40.0		28.34	2.88	"	
	50.0		28.33	2.87	"	
	60.0		28.32	2.86	"	
	70.0		28.17	2.71	"	
	80.0		28.20	2.74	"	
	90.0		28.15	2.69	"	
	100.0		28.18	2.72	"	
	110.0		28.32	2.86	"	
	120.0		28.28	2.82	"	
	130.0		28.25	2.79	"	
	140.0		28.44	2.98	"	

DATA SHEET FOR AQUIFER TEST No. 2

Name of Well: JA-3 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	150.0		28.45	2.99	138	
	160.0		28.38	2.92	"	
	170.0		28.30	2.84	"	
	180.0		28.62	3.16	168	2nd step
	180.5		29.00	3.54	"	
	181.0		29.10	3.64	"	
	181.5		29.12	3.66	"	
	182.0		29.20	3.74	"	
	182.5		29.25	3.79	"	
	183.0		29.30	3.84	"	
	183.5		29.30	3.84	"	
	184.0		29.30	3.84	"	
	184.5		29.30	2.84	"	
	185.0		29.31	3.85	"	
	186.0		29.38	3.92	"	
	187.0		29.40	3.94	"	
	188.0		29.40	3.94	"	
	189.0		29.42	3.96	"	
	190.0		29.40	3.94	"	
	191.0		29.40	3.94	"	
	192.0		29.39	3.93	"	
	193.0		29.39	3.93	"	
	194.0		29.39	3.93	"	
	195.0		29.39	3.93	"	
	200.0		29.39	3.93	"	
	205.0		29.42	3.96	"	
	210.0		29.60	4.14	"	
	220.0		29.64	4.18	"	
	230.0		29.60	4.14	"	
	240.0		29.53	4.07	"	
	250.0		29.40	3.94	"	
	260.0		29.72	4.26	"	
	270.0		29.50	4.04	"	
	280.0		29.50	4.04	"	
	290.0		29.50	4.04	"	

DATA SHEET FOR AQUIFER TEST No. 3

Name of Well: JA-3 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	300.0		29.50	4.04	168	
	310.0		29.65	4.19	"	
	320.0		29.70	4.24	"	
	330.0		29.70	4.24	"	
	340.0		29.65	4.19	"	
	350.0		29.60	4.14	"	
	360.0		29.59	4.13	251.4	3rd step
	360.5		30.50	5.04	"	
	361.0		30.80	5.34	"	
	361.5		31.10	5.64	"	
	362.0		31.40	5.94	"	
	362.5		31.60	6.14	"	
	363.0		31.80	6.34	"	
	363.5		32.00	6.54	"	
	364.0		32.00	6.54	"	
	364.5		32.10	6.64	"	
	365.0		32.15	6.69	"	
	366.0		32.16	6.70	"	
	367.0		33.10	7.64	"	
	368.0		31.60	6.14	"	
	369.0		30.55	5.09	"	
	370.0		30.35	4.89	"	
	371.0		30.32	4.86	"	
	372.0		30.32	4.86	"	
	373.0		30.35	4.89	"	
	374.0		30.28	4.82	"	
	375.0		30.26	4.80	"	
	380.0		30.30	4.84	"	
	385.0		30.30	4.84	"	
	390.0		30.25	4.79	"	
	400.0		30.33	4.87	"	
	410.0		30.50	5.04	"	
	420.0		30.60	5.14	"	
	430.0		30.73	5.27	"	
	440.0		32.30	6.84	"	

DATA SHEET FOR AQUIFER TEST No. 4

Name of Well: JA-3 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	450.0		32.56	7.10	251.4	
	460.0		32.70	7.24	"	
	470.0		32.50	7.04	"	
	480.0		32.76	7.30	"	
	490.0		32.78	7.32	"	
	500.0		32.88	7.42	"	
	510.0		32.70	7.24	"	
	520.0		32.70	7.24	"	
	530.0		32.90	7.44	"	
	540.0	0	32.92	7.46	"	pumping stopped
	540.5	0.5	30.80	5.34	"	
	541.0	1.0	29.45	3.99	"	
	541.5	1.5	28.25	2.79	"	
	542.0	2.0	27.30	1.84	"	
	542.5	2.5	26.85	1.39	"	
	543.0	3.0	26.44	0.98	"	
	543.5	3.5	26.00	0.54	"	
	544.0	4.0	25.88	0.42	"	
	544.5	4.5	25.68	0.22	"	
	545.0	5.0	25.60	0.14	"	
	546.0	6.0	25.55	0.09	"	
	547.0	7.0	25.50	0.04	"	
	548.0	8.0	25.49	0.03	"	
	549.0	9.0	25.48	0.02	"	
	550.0	10.0	25.47	0.01	"	
	551.0	11.0	25.47	0.01	"	
	552.0	12.0	25.46	0	"	
	553.0	13.0	25.46	0	"	
	554.0	14.0	25.46	0	"	
	555.0	15.0	25.46	0	"	

DATA SHEET FOR AQUIFER TEST No. 1

Name of Well: JA-3 Tested Date: January 8, 1982

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
Jan. 8	0		25.46	0	168	Constant
7.30 a.m	0.5		26.91	1.45	"	discharge
	1.0		26.55	1.09	"	test
	1.5		26.22	0.76	"	
	2.0		26.85	1.39	"	
	2.5		27.37	1.91	"	
	3.0		27.78	2.32	"	
	3.5		28.05	2.59	"	
	4.0		28.32	2.86	"	
	4.5		28.50	3.04	"	
	5.0		28.69	3.23	"	
	6.0		28.88	3.42	"	
	7.0		29.00	3.54	"	
	8.0		28.90	3.44	"	
	9.0		29.00	3.54	"	
	10.0		29.10	3.64	"	
	11.0		29.21	3.75	"	
	12.0		29.28	3.82	"	
	13.0		29.31	3.85	"	
	14.0		29.31	3.85	"	
	15.0		29.34	3.88	"	
	20.0		29.17	3.71	"	
	25.0		29.32	3.86	"	
	30.0		29.26	3.80	"	
	45.0		29.62	4.16	"	
	60.0		29.57	4.11	"	
	75.0		29.63	4.17	"	
	90.0		29.54	4.08	"	
	105.0		29.55	4.09	"	
	120.0		29.56	4.10	"	
	135.0		29.57	4.11	"	
	150.0		29.58	4.12	"	
	165.0		29.61	4.15	"	
	180.0		29.52	4.06	"	
	210.0		29.61	4.15	"	

DATA SHEET FOR AQUIFER TEST No. 2

Name of Well: JA-3 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	240.0		29.61	4.15	168	
	270.0		29.56	4.10	"	
	300.0		29.62	4.16	"	
	330.0		29.62	4.16	"	
	360.0		29.57	4.16	"	
	420.0		29.59	4.13	"	
	480.0		29.63	4.17	"	
	540.0		29.61	4.15	"	
	600.0		29.68	4.22	"	
	660.0		29.62	4.16	"	
	720.0		29.62	4.16	"	
	780.0		29.62	4.16	"	
	840.0		29.58	4.12	"	
	900.0		29.70	4.24	"	
	960.0		29.67	4.21	"	
	1,020.0		29.68	4.22	"	
	1,080.0		29.68	4.22	"	
	1,140.0		29.72	4.26	"	
	1,200.0		29.68	4.22	"	
	1,260.0		29.65	4.19	"	
	1,320.0		29.65	4.19	"	
	1,380.0		29.70	4.24	"	Pumping stopped

DATA SHEET FOR AQUIFER TEST No. 1

Name of Well: JA-3 Tested Date: January 9, 1982

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
Jan. 9	0		25.46	0	252	constant
	0.5		30.41	4.95	"	discharge
	1.0		31.01	5.55	"	test
	1.5		31.30	5.84	"	
	2.0		31.61	6.15	"	
	2.5		31.77	6.31	"	
	3.0		31.99	6.53	"	
	3.5		32.08	6.62	"	
	4.0		32.26	6.80	"	
	4.5		32.35	6.89	"	
	5.0		32.41	6.95	"	
	6.0		32.45	6.99	"	
	7.0		32.51	7.05	"	
	8.0		32.55	7.09	"	
	9.0		32.62	7.16	"	
	10.0		32.65	7.19	"	
	11.0		32.67	7.21	"	
	12.0		32.69	7.23	"	
	13.0		32.69	7.23	"	
	14.0		32.66	7.20	"	
	15.0		32.68	7.22	"	
	20.0		32.72	7.26	"	
	25.0		32.78	7.32	"	
	30.0		32.77	7.31	"	
	40.0		32.70	7.24	"	
	50.0		32.58	7.12	"	
	60.0		32.60	7.14	"	
	70.0		32.65	7.19	"	
	80.0		32.69	7.23	"	
	90.0		32.78	7.32	"	
	100.0		32.83	7.37	"	
	110.0		32.77	7.31	"	
	120.0	0	32.71	7.25	"	Pumping
	120.5	0.5	31.42	5.96	"	stopped
	121.0	1.0	29.91	4.45	"	

DATA SHEET FOR AQUIFER TEST

No. 2

Name of Well: JA-3 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	121.5	1.5	28.56	3.10	252	
	122.0	2.0	27.55	2.09	"	
	122.5	2.5	26.99	1.53	"	
	123.0	3.0	26.52	1.06	"	
	123.5	3.5	26.21	0.75	"	
	124.0	4.0	25.93	0.47	"	
	124.5	4.5	25.78	0.32	"	
	125.0	5.0	25.65	0.19	"	
	126.0	6.0	25.56	0.10	"	
	127.0	7.0	25.54	0.08	"	
	128.0	8.0	25.51	0.05	"	
	129.0	9.0	25.49	0.03	"	
	130.0	10.0	25.48	0.02	"	
	131.0	11.0	25.48	0.02	"	
	132.0	12.0	25.47	0.01	"	
	133.0	13.0	25.47	0.01	"	
	134.0	14.0	25.47	0.01	"	
	135.0	15.0	25.46	0	"	

DATA SHEET FOR AQUIFER TEST No. 1

Name of Well: JA-4 Tested Date: February 26, 1982

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
Feb.26	0		23.91	0	120	Step draw-
7.45 a.m	10.0		24.35	0.44	"	down test
	20.0		24.35	0.44	"	
	30.0		24.35	0.44	"	
	40.0		24.36	0.45	"	
	50.0		24.36	0.45	"	
	60.0		24.36	0.45	"	
	90.0		24.36	0.45	"	
	120.0		24.37	0.46	"	
	150.0		24.37	0.46	"	
	180.0		24.37	0.46	240	2nd step
	190.0		24.70	0.79	"	
	200.0		24.70	0.79	"	
	210.0		24.71	0.80	"	
	220.0		24.71	0.80	"	
	230.0		24.71	0.80	"	
	240.0		24.71	0.80	"	
	270.0		24.71	0.80	"	
	300.0		24.71	0.80	"	
	330.0		24.72	0.82	"	
	360.0		24.72	0.82	360	3rd step
	370.0		25.40	1.49	"	
	380.0		25.40	1.49	"	
	390.0		25.40	1.49	"	
	400.0		25.40	1.49	"	
	410.0		25.40	1.49	"	
	420.0		25.40	1.49	"	
	450.0		25.42	1.51	"	
	480.0		25.42	1.51	"	
	510.0		25.43	1.52	"	
	540.0		25.46	1.55	"	

DATA SHEET FOR AQUIFER TEST No. 1

Name of Well: JA-4 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	0		23.92	0	480	constant
	0.5		24.40	0.48	"	discharge
	1.0		24.56	0.64	"	test
	1.5		25.42	1.50	"	
	2.0		25.80	1.88	"	
	2.5		25.92	2.00	"	
	3.0		25.93	2.01	"	
	3.5		25.93	2.01	"	
	4.0		25.93	2.01	"	
	4.5		25.93	2.01	"	
	5.0		25.93	2.01	"	
	6.0		25.93	2.01	"	
	7.0		25.93	2.01	"	
	8.0		25.94	2.02	"	
	9.0		25.94	2.02	"	
	10.0		25.94	2.02	"	
	11.0		25.95	2.03	"	
	12.0		25.95	2.03	"	
	13.0		25.95	2.03	"	
	14.0		25.95	2.03	"	
	15.0		25.95	2.03	"	
	20.0		25.95	2.03	"	
	25.0		25.95	2.03	"	
	30.0		25.95	2.03	"	
	45.0		25.96	2.04	"	
	60.0		25.96	2.04	"	
	75.0		25.95	2.03	"	
	90.0		25.93	2.01	"	
	105.0		25.93	2.01	"	
	120.0		25.94	2.02	"	
	135.0		25.93	2.01	"	
	150.0		25.94	2.02	"	
	165.0		25.94	2.02	"	
	180.0		25.95	2.03	"	
	210.0		25.95	2.03	"	

DATA SHEET FOR AQUIFER TEST No. 2

Name of Well: JA-4 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	240.0		25.94	2.02	480	
	270.0		25.94	2.02	"	
	300.0		25.95	2.03	"	
	330.0		25.95	2.03	"	
	360.0		25.95	2.03	"	
	420.0		25.96	2.04	"	
	480.0		25.96	2.04	"	
	540.0		25.97	2.05	"	
	600.0		25.98	2.06	"	
	660.0		25.99	2.07	"	
	720.0		25.99	2.07		
	780.0		25.98	2.06	"	
	840.0		25.99	2.07	"	
	900.0		26.00	2.08	"	
	960.0		26.00	2.08	"	
	1,020.0		26.01	2.09	"	
	1,080.0		26.01	2.09	"	
	1,140.0		26.02	2.10	"	
	1,200.0		26.01	2.09	"	
	1,260.0		26.02	2.10	"	
	1,320.0		26.03	2.11	"	
	1,380.0		26.03	2.11	"	
	1,440.0	0	26.04	2.12	"	Pumping
	1,440.5	0.5	24.75	0.93	"	stopped
	1,441.0	1.0	24.40	0.48	"	
	1,441.5	1.5	24.00	0.08	"	
	1,442.0	2.0	24.00	0.08	"	
	1,442.5	2.5	23.98	0.06	"	
	1,443.0	3.0	23.98	0.06	"	
	1,443.5	3.5	23.98	0.06	"	
	1,444.0	4.0	23.98	0.06	"	
	1,444.5	4.5	23.97	0.05	"	
	1,445.0	5.0	23.97	0.05	"	
	1,446.0	6.0	23.97	0.05	"	
	1,447.0	7.0	13.96	0.04	"	

DATA SHEET FOR AQUIFER TEST No. 3

Name of Well: JA-4 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	1,448.0	8.0	23.96	0.04	480	
	1,449.0	9.0	23.96	0.04	"	
	1,450.0	10.0	23.96	0.04	"	
	1,451.0	11.0	23.96	0.04	"	
	1,452.0	12.0	23.96	0.04	"	
	1,453.0	13.0	23.96	0.04	"	
	1,454.0	14.0	23.96	0.04	"	
	1,455.0	15.0	23.96	0.04	"	
	1,460.0	20.0	23.96	0.04	"	
	1,465.0	25.0	23.96	0.04	"	
	1,470.0	30.0	23.96	0.04	"	
	1,485.0	45.0	23.96	0.04	"	
	1,500.0	60.0	23.96	0.04	"	
	1,515.0	75.0	23.96	0.04	"	
	1,530.0	90.0	23.96	0.04	"	
	1,545.0	105.0	23.96	0.04	"	
	1,560.0	120.0	23.96	0.04	"	
	1,575.0	135.0	23.96	0.04	"	
	1,590.0	150.0	23.96	0.04	"	
	1,605.0	165.0	23.96	0.04	"	
	1,620.0	180.0	23.96	0.04	"	
	1,650.0	210.0	23.96	0.04	"	
	1,680.0	240.0	23.95	0.03	"	
	1,710.0	270.0	23.95	0.03	"	
	1,740.0	300.0	23.95	0.03	"	
	1,770.0	330.0	23.95	0.03	"	
	1,800.0	360.0	23.94	0.02	"	
	1,860.0	420.0	23.94	0.02	"	

DATA SHEET FOR AQUIFER TEST No. 1

Name of Well: JA-5 Tested Date: March 10, 1982

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
Mar. 10	0		37.28	0	78	constant
5.00 p.m	0.5		38.00	0.72	"	discharge
	1.0		38.18	0.90	"	test
	1.5		38.38	1.10	"	
	2.0		38.54	1.26	"	
	2.5		38.54	1.26	"	
	3.0		38.55	1.27	"	
	3.5		38.57	1.29	"	
	4.0		38.59	1.31	"	
	4.5		38.59	1.31	"	
	5.0		38.59	1.31	"	
	6.0		38.59	1.31	"	
	7.0		39.00	1.72	"	
	8.0		39.00	1.72	"	
	9.0		39.00	1.72	"	
	10.0		39.00	1.72	"	
	11.0		39.00	1.72	"	
	12.0		39.00	1.72	"	
	13.0		39.00	1.72	"	
	15.0		39.05	1.77	"	
	20.0		39.06	1.78	"	
	25.0		39.07	1.79	"	
	30.0		39.07	1.79	"	
	40.0		39.07	1.79	"	
	50.0		39.08	1.80	"	
	60.0		39.08	1.80	"	
	70.0		39.00	1.72	"	
	80.0		39.10	1.82	"	
	90.0		39.00	1.72	"	
	100.0		39.05	1.77	"	
	110.0		39.00	1.72	"	
	120.0		39.00	1.72	"	
	130.0		39.00	1.72	"	
	140.0		39.05	1.77	"	
	150.0		39.05	1.77	"	

DATA SHEET FOR AQUIFER TEST No. 2

Name of Well: JA-5 Tested Date: _____

Date	Time after Pumping started (min)	Time after Pumping stopped (min)	Water Level (mbgs)	Drawdown (m)	Discharge (lit/min)	Remarks
	160.0		39.06	1.78	78	
	170.0		39.07	1.79	"	
	180.0		39.12	1.84	"	
	210.0		39.15	1.87	"	
	240.0		39.30	2.02	"	
	270.0		39.32	2.04	"	
	300.0		39.37	2.09	"	
	330.0		39.40	2.12	"	
	360.0		39.45	2.17	"	
	420.0		39.47	2.19	"	
	480.0		39.45	2.17	"	
	540.0		39.40	2.12	"	
	600.0		39.42	2.14	"	
	660.0		39.39	2.11	"	
	720.0		39.41	2.13	"	
	780.0		39.45	2.17	"	
	840.0		39.45	2.17	"	
	900.0		39.40	2.12	"	
	960.0		39.35	2.07	"	
	1,020.0		39.30	2.02	"	
	1,080.0		39.30	2.02	"	
	1,140.0		39.45	2.17	"	
	1,200.0		39.51	2.23	"	
	1,260.0		39.55	2.27	"	
	1,320.0		39.65	2.37	"	
	1,380.0		39.38	2.10	"	
	1,440.0		39.55	2.27	"	
	1,500.0	0	39.56	2.28	"	pumping
	1,500.5	0.5	38.50	1.22	"	stopped
	1,501.0	1.0	37.68	0.40	"	
	1,501.5	1.5	37.28	0	"	
	1,502.0	2.0	36.90	-0.38	"	
	1,502.5	2.5	36.88	-0.40	"	
	1,503.0	3.0	36.88	-0.40	"	

DATA SHEET FOR INFILTRATION TEST

Site No.: 1 Date: _____

Altitude of site: 190 (mamsl) Location: D-1 site wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	19.40				
0.5	19.00	8.0			
1.0	18.70	6.0			
1.5	18.50	4.0			
2.0	18.30	4.0			
3.0	17.85	4.5			
4.0	17.40	4.5			
5.0	17.00	4.0			
6.0	16.60	4.0			
7.0	16.15	4.5			
8.0	15.80	3.5			
9.0	15.60	2.0			
10.0	14.95	6.5			
12.0	14.15	4.0			
14.0	13.40	3.75			
16.0	12.70	3.5			
18.0	11.90	4.0			
20.0	11.25	3.25			
22.0	10.50	3.75			
24.0	9.80	3.5			
26.0	9.10	3.5			
28.0	8.50	3.0			
30.0	7.80	3.5			

DATA SHEET FOR INFILTRATION TEST

Site No.: 2 Date: _____

Altitude of site: 130 (mamsl) Location: Wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	19.20				
0.5	17.80	28.0			
1.0	17.00	16.0			
1.5	16.20	16.0			
2.0	15.35	17.0			
3.0	13.90	14.5			
4.0	12.35	15.5			
5.0	11.40	9.5			
6.0	10.00	14.0			
7.0	8.95	10.5			
8.0	7.90	10.5			
9.0	6.80	11.0			
10.0	5.95	8.5			
12.0	16.40	6.5			
14.0	13.70	13.5			
16.0	11.40	11.5			
18.0	9.10	11.5			
20.0	6.95	10.75			
22.0	5.10	9.25			
24.0	2.50	13.0			
26.0	1.80	3.5			
28.0	2.20	10.0			

DATA SHEET FOR INFILTRATION TEST

Site No.: 3 Date: _____

Altitude of site: 115 (mamsl) Location: Wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	19.75				
0.5	18.80	19.0			
1.0	18.25	11.0			
1.5	17.85	8.0			
2.0	17.50	7.0			
3.0	17.00	5.0			
4.0	16.55	4.5			
5.0	16.15	4.0			
6.0	15.70	4.5			
7.0	15.25	4.5			
8.0	14.90	3.5			
9.0	14.45	4.5			
10.0	14.05	4.0			
12.0	13.40	3.25			
14.0	12.70	3.5			
16.0	12.00	3.5			
18.0	11.30	3.5			
20.0	10.65	3.25			
22.0	9.70	4.75			
24.0	8.80	4.5			
26.0	7.80	5.0			
28.0	6.80	5.0			
30.0	5.95	4.25			

DATA SHEET FOR INFILTRATION TEST

Site No.: 3' Date: _____

Altitude of site: 103 (mamsl) Location: Wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	14.70				
0.5	13.70	20.0			
1.0	13.00	14.0			
1.5	12.20	16.0			
2.0	11.50	14.0			
3.0	10.00	15.0			
4.0	8.80	12.0			
5.0	7.45	13.5			
6.0	6.25	12.0			
7.0	5.10	11.5			
8.0	17.90	1.5			
9.0	16.40	15.0			
10.0	14.50	10.0			
12.0	12.90	8.0			
14.0	11.10	9.0			
16.0	8.30	14.0			
18.0	5.50	14.0			
20.0	9.30	12.0			
22.0	5.40	19.5			

DATA SHEET FOR INFILTRATION TEST

Site No.: 4 Date: _____

Altitude of site: 80 (mamsl) Location: Old Wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	21.25				
0.5	20.95	6.0			
1.0	20.80	3.0			
1.5	20.55	5.0			
2.0	20.40	3.0			
3.0	20.15	2.5			
4.0	19.90	2.5			
5.0	19.60	3.0			
6.0	19.35	2.5			
7.0	19.15	2.0			
8.0	18.95	2.0			
9.0	18.70	2.5			
10.0	18.50	2.0			
12.0	18.10	2.0			
14.0	17.70	2.0			
16.0	17.30	2.0			
18.0	16.90	2.0			
20.0	16.50	2.0			
22.0	16.10	2.0			
24.0	15.75	1.75			
26.0	15.40	1.75			
28.0	14.95	2.25			
30.0	14.60	1.75			
32.0	14.25	1.75			

DATA SHEET FOR INFILTRATION TEST

Site No.: 5 Date: _____

Altitude of site: 90 (mamsl) Location: Wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	22.40				
0.5	21.95	9.0			
1.0	21.70	5.0			
1.5	21.50	4.0			
2.0	21.40	2.0			
3.0	21.15	2.5			
4.0	20.80	3.5			
5.0	20.50	3.0			
6.0	20.30	2.0			
7.0	20.00	3.0			
8.0	19.70	3.0			
9.0	19.50	2.0			
10.0	19.20	3.0			
12.0	18.70	2.5			
14.0	18.15	2.75			
16.0	17.50	3.25			
18.0	16.80	3.5			
20.0	16.10	3.5			
22.0	15.20	4.5			
24.0	14.40	4.0			
26.0	13.50	4.5			
28.0	12.50	5.0			
30.0	11.50	5.0			
32.0	10.50	5.0			

DATA SHEET FOR INFILTRATION TEST

Site No.: 6 Date: _____

Altitude of site: 50 (mamsl) Location: Old wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	20.00				
0.5	19.45	11.0			
1.0	19.00	9.0			
1.5	18.55	9.0			
2.0	18.00	11.0			
3.0	17.20	8.0			
4.0	16.30	9.0			
5.0	15.40	9.0			
6.0	14.50	9.0			
7.0	13.75	7.5			
8.0	12.90	8.5			
9.0	12.20	7.0			
10.0	11.40	8.0			
12.0	9.50	9.5			
14.0	8.50	5.0			
16.0	7.15	6.75			
18.0	5.80	6.75			
20.0	4.55	6.25			
22.0	3.30	6.25			
24.0	17.60	6.5			
26.0	16.00	8.0			
28.0	14.40	8.0			
30.0	12.85	7.75			
32.0	11.30	7.75			
34.0	9.80	7.5			
36.0	8.35	7.25			

DATA SHEET FOR INFILTRATION TEST

Site No.: 7 Date: _____

Altitude of site: 40 (mamsl) Location: Alluvial terrace

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	1.40				
0.5	1.80	8.0			
1.0	1.90	2.0			
1.5	2.10	4.0			
2.0	2.30	4.0			
3.0	2.50	2.0			
4.0	2.90	4.0			
5.0	3.20	3.0			
6.0	3.65	4.5			
7.0	4.05	4.0			
8.0	4.40	3.5			
9.0	4.65	2.5			
10.0	4.80	1.5			
12.0	5.50	3.5			
14.0	6.05	2.75			
16.0	6.85	4.0			
18.0	7.40	2.75			
20.0	8.00	3.0			
22.0	8.50	2.5			
24.0	9.05	2.75			
26.0	9.50	2.25			
28.0	10.10	3.0			
30.0	10.55	2.25			
32.0	11.05	2.5			

DATA SHEET FOR INFILTRATION TEST

Site No.: 8 Date: _____

Altitude of site: 40 (mamsl) Location: Wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	13.3				
0.5	12.85	9.0			
1.0	12.5	7.0			
1.5	12.4	2.0			
2.0	12.25	3.0			
3.0	11.95	3.0			
4.0	11.65	3.0			
5.0	11.45	2.0			
6.0	11.25	2.0			
7.0	11.0	2.5			
8.0	10.8	2.0			
9.0	10.55	2.5			
10.0	10.3	2.5			
12.0	9.9	2.0			
14.0	9.5	2.0			
16.0	9.15	1.75			
18.0	8.8	1.75			
20.0	8.45	1.75			
22.0	8.05	2.0			
24.0	7.65	2.0			
26.0	7.3	1.75			
28.0	6.95	1.75			
30.0	6.6	1.75			
32.0	6.25	1.75			

DATA SHEET FOR INFILTRATION TEST

Site No.: 9 Date: _____

Altitude of site: 25 (mamsl) Location: Alluvial terrace

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	15.5				
0.5	15.25	5.0			
1.0	15.0	5.0			
1.5	14.7	6.0			
2.0	14.4	6.0			
3.0	14.0	4.0			
4.0	13.5	5.0			
5.0	12.95	5.5			
6.0	12.5	4.5			
7.0	12.05	4.5			
8.0	11.6	4.5			
9.0	11.2	4.0			
10.0	10.8	4.0			
12.0	10.0	4.0			
14.0	9.2	4.0			
16.0	8.5	3.5			
18.0	7.75	3.75			
20.0	7.0	3.75			
22.0	6.25	3.75			
24.0	5.5	3.75			
26.0	4.8	3.5			
28.0	4.15	3.25			
30.0	3.5	3.25			
32.0	2.85	3.25			
34.0	2.2	3.25			
36.0	1.55	3.25			

DATA SHEET FOR INFILTRATION TEST

Site No.: 10 Date: _____

Altitude of site: 8 (mamsl) Location: Wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	12.5		40.0	10.35	0.25
0.5	12.3	4.0	42.0	10.3	0.25
1.0	12.2	2.0			
1.5	12.1	2.0			
2.0	12.0	2.0			
3.0	11.95	0.5			
4.0	11.85	1.0			
5.0	11.8	0.5			
6.0	11.75	0.5			
7.0	11.7	0.5			
8.0	11.65	0.5			
9.0	11.6	0.5			
10.0	11.55	0.5			
12.0	11.45	0.5			
14.0	11.35	0.5			
16.0	11.25	0.5			
18.0	11.15	0.5			
20.0	11.05	0.5			
22.0	10.95	0.5			
24.0	10.85	0.5			
26.0	10.8	0.25			
28.0	10.75	0.25			
30.0	10.65	0.5			
32.0	10.55	0.5			
34.0	10.50	0.25			
36.0	10.45	0.25			
38.0	10.4	0.25			

DATA SHEET FOR INFILTRATION TEST

Site No.: 11 Date: _____

Altitude of site: 18 (mamsl) Location: Wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	10.0				
0.5	9.6	8.0			
1.0	9.4	4.0			
1.5	9.1	6.0			
2.0	8.8	6.0			
3.0	8.4	4.0			
4.0	8.0	4.0			
5.0	7.6	4.0			
6.0	7.25	3.5			
7.0	6.9	3.5			
8.0	6.6	3.0			
9.0	6.3	3.0			
10.0	6.0	3.0			
12.0	5.5	2.5			
14.0	5.0	2.5			
16.0	4.5	2.5			
18.0	4.0	2.5			
20.0	3.5	2.5			
22.0	3.05	2.25			
24.0	2.6	2.25			
26.0	2.2	2.0			
28.0	1.8	2.0			
30.0	1.4	2.0			
32.0	1.0	2.0			
34.0	0.6	2.0			
36.0	0.2	2.0			

DATA SHEET FOR INFILTRATION TEST

Site No.: 12 Date: _____

Altitude of site: 2 (mamsl) Location: Wadi bed

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	14.35				
0.5	13.35	20.0			
1.0	12.65	14.0			
1.5	12.0	13.0			
2.0	11.55	9.0			
3.0	10.75	8.0			
4.0	10.05	7.0			
5.0	9.35	7.0			
6.0	8.7	6.5			
7.0	8.05	6.5			
8.0	7.5	5.5			
9.0	6.95	5.5			
10.0	6.45	5.25			
12.0	5.4	5.0			
14.0	4.5	4.5			
16.0	3.6	4.5			
18.0	2.7	4.5			
20.0	7.8				
22.0	6.75	5.25			
24.0	5.7	5.25			
26.0	4.7	5.0			
28.0	3.75	4.75			
30.0	2.75	5.0			
32.0	1.8	4.75			
34.0	8.0	5.0			

DATA SHEET FOR INFILTRATION TEST

Site No.: 13 Date: _____

Altitude of site: 155 (mamsl) Location: D-2

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	23.5				
0.5	23.3	4.0			
1.0	22.7	12.0			
1.5	22.3	8.0			
2.0	21.6	14.0			
3.0	20.9	7.0			
3.4	20.0	9.0			
5.0	19.4	6.0			
6.0	18.3	11.0			
7.0	18.0	3.0			
8.0	17.4	6.0			
9.0	16.8	6.0			
10.0	16.2	6.0			
12.0	15.0	4.0			
14.0	13.9	5.5			
16.0	12.9	5.0			
18.0	11.9	5.0			
20.0	10.9	5.0			
22.0	10.0	4.5			
24.0	9.0	5.0			
26.0	8.2	4.0			
28.0	7.3	4.5			
30.0	6.5	4.0			

DATA SHEET FOR INFILTRATION TEST

Site No.: 14 Date: _____

Altitude of site: 155 (mamsl) Location: D-2

Diameter of infiltration tube: _____ (cm)

Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)	Time (min-sec)	Hook gauge reading (cm)	Drawdown Infiltration rate (mm/min)
0	21.5				
0.5	21.0	10.0			
1.0	20.4	12.0			
1.5	20.0	8.0			
2.0	19.3	14.0			
3.0	18.4	9.0			
4.0	17.4	10.0			
5.0	16.4	10.0			
6.0	15.5	9.0			
7.0	14.7	8.0			
8.0	13.8	9.0			
9.0	13.0	8.0			
10.0	12.3	7.0			
12.0	10.8	7.5			
14.0	9.5	6.5			
16.0	8.4	5.5			
18.0	7.4	5.0			
20.0	6.4	5.0			
22.0	5.4	5.0			
24.0	4.6	4.0			
26.0	3.7	4.5			
28.0	3.0	3.5			
30.0	2.4	3.0			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: JA-1 Location, UTM: 469550, 2689580

Altitude of Well Site: 24.04 (mamsl) Well Diameter: 250 (mm)

Height to Measurement Point: 1.60 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
82' 3-2	20.64	3.4			
3-11	20.58	3.46			
3-13	20.56	3.48			
3-14	20.55	3.49			
3-22	20.53	3.51			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: JA-2 Location, UTM: 467850, 2696740

Altitude of Well Site: 11 (mamsl) Well Diameter: 250 (mm)

Height to Measurement Point: 1.85 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
82' 2-21	6.97	4.03			
3-7	6.62	4.38			
3-11	6.71	4.29			
3-15	6.455	4.545			
3-19	6.51	4.49			
3-20	6.58	4.42			
3-22	6.46	4.54			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: JA-3 Location, UTM: 464050, 2695700

Altitude of Well Site: 30 (mamsl) Well Diameter: 250 (mm)

Height to Measurement Point: 1.48 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
82' 1-10	24.76	5.24	3-7	26.135	5.345
1-20	24.78	5.22	3-8	26.125	5.355
2-1	24.80	5.20	3-9	26.11	5.37
2-13	24.84	5.16	3-10	26.105	5.375
2-14	26.31	5.17	3-11	26.10	5.38
2-15	26.31	5.17	3-12	26.09	5.39
2-16	26.31	5.17	3-13	26.08	5.40
2-17	26.31	5.17	3-14	26.08	5.40
2-18	26.30	5.18	3-15	26.06	5.42
2-19	26.295	5.185	3-16	26.05	5.43
2-20	26.29	5.19	3-17	26.025	5.455
2-21	26.30	5.18	3-18	26.02	5.46
2-22	26.29	5.19	3-19	26.005	5.475
2-23	26.30	5.18	3-20	25.98	5.50
2-24	26.27	5.21	3-21	25.96	5.52
2-25	26.255	5.225	3-22	25.955	5.525
2-26	26.25	5.23	3-23	25.93	5.55
2-27	26.245	5.235	3-24	25.92	5.56
2-28	26.21	5.27			
3-1	26.19	5.29			
3-2	26.18	5.30			
3-3	26.17	5.31			
3-4	26.17	5.31			
3-5	26.16	5.32			
3-6	26.145	5.335			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: JA-4 Location, UTM: 461080, 2695200

Altitude of Well Site: 50 (mamsl) Well Diameter: 250 (mm)

Height to Measurement Point: 1.36 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
82' 2-1	23.91	26.09	3-21	25.505	25.855
2-13	23.95	26.05	3-22	25.50	25.86
2-14	23.95	26.05	3-23	25.50	25.86
2-15	23.84	26.16	3-24	25.50	25.86
2-21	23.83	26.17			
2-27	23.84	26.16			
3-2	24.15	25.85			
3-3	25.51	25.85			
3-4	25.515	25.845			
3-5	25.53	25.83			
3-6	25.535	25.825			
3-7	25.52	25.84			
3-8	25.53	25.83			
3-9	25.54	25.82			
3-10	25.545	25.815			
3-11	25.535	25.825			
3-12	25.52	25.84			
3-13	25.51	25.85			
3-14	25.505	25.855			
3-15	25.51	25.85			
3-16	25.515	25.845			
3-17	25.525	25.835			
3-18	25.528	25.832			
3-19	25.51	25.85			
3-20	25.51	25.85			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: JA-5 Location, UTM: 464660, 2692200

Altitude of Well Site: 42 (mamsl) Well Diameter: 250 (mm)

Height to Measurement Point: 1.82 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
82' 2-7	36.05	5.95			
2-13	37.63	4.37			
2-15	38.43	3.57			
2-17	38.43	3.57			
3-3	37.18	4.82			
3-7	36.78	5.22			
3-10	36.82	5.18			
3-11	36.82	5.18			
3-16	36.72	5.28			
3-21	36.15	5.85			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: AE-91 Location, UTM: _____

Altitude of Well Site: 10.53 (mamsl) Well Diameter: 800 (mm)

Height to Measurement Point: 0.15 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
75' 1-		1.95			
2-		2.08			
3-		2.63			
4-		1.92			
5-		1.91			
6-		1.63			
7-		1.48			
8-		1.80			
81' 12-20	8.63	1.90			
82' 1-10	9.22	1.31			
1-20	9.22	1.31			
2-1	9.24	1.29			
2-20	8.56	1.97			
3-1	8.10	2.43			
3-22	8.03	2.50			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: AE-93 Location, UTM: _____

Altitude of Well Site: 2.76 (mamsl) Well Diameter: 1,400 (mm)

Height to Measurement Point: 0.1 (m)

Screen Schedule: _____

	Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
75'	1-		0.87			
	2-		0.79			
	3-		0.90			
	4-		0.84			
	5-		0.74			
	6-		0.64			
	7-		0.66			
	8-		0.74			
82'	1-10	1.56	1.20			
	1-20	1.80	0.96			
	2-1	1.80	0.96			
	2-20	1.86	0.90			
	3-1	1.80	0.96			
	3-22	1.89	0.87			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: AE-101 Location, UTM: _____

Altitude of Well Site: 12.68 (mamsl) Well Diameter: 800 (mm)

Height to Measurement Point: 0.1 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
75' 1-		2.19 + 0.92			
2-		2.33 "			
3-		2.42 "			
4-		2.42 "			
5-		0.26 "			
6-		2.04 "			
7-		2.15 "			
8-		2.09 "			
81' 12-20	10.95	1.83			
82' 1-10	10.94	1.74			
1-20	10.7	1.96			
2-1	10.70	1.98			
2-20	9.56	3.12			
3-1	9.50	3.18			
3-20	10.13	2.55			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: Father Location, UTM: _____

Altitude of Well Site: 4 (mamsl) Well Diameter: 1,300(mm)

Height to Measurement Point: 0.2 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
81' 12-30	3.17				
82' 1-10	3.16				
1-20	3.24				
2-1	3.26				
2-20	2.86				
3-1	2.68				
3-20	2.74				

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: 14/M Location, UTM: _____

Altitude of Well Site: 4 (mamsl) Well Diameter: 800 (mm)

Height to Measurement Point: 0 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
81' 12-20	5.70				
82' 1-10	5.71				
1-20	5.70				
2-1	5.74				
2-20	5.10				
3-1	5.00				
3-22	2.38				

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: Sallan Location, UTM: _____

Altitude of Well Site: 4 (mamsl) Well Diameter: 800 (mm)

Height to Measurement Point: 0.3 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
81' 12-20	3.53				
82' 1-10	3.56				
1-20	3.55				
2-1	3.61				
2-20	3.54				
3-1	3.53				
3-22	3.52				

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: SP-0 Location, UTM: 472500, 2688150

Altitude of Well Site: 21 (mamsl) Well Diameter: 200 (mm)

Height to Measurement Point: 0.24 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
82' 2-1	18.90				
2-15	18.88				
3-5	18.64				
3-15	18.57				
3-23	18.595				

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: Territ Location, UTM: _____

Altitude of Well Site: 1049 (mamsl) Well Diameter: 850 (mm)

Height to Measurement Point: 0.09 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
82' 1-10	8.77	1.81			
1-20	8.76	1.82			
2-1	8.71	1.87			
2-20	8.16	2.42			
3-1	8.00	2.58			
3-20	7.80	2.78			

DATA SHEET FOR WATER LEVEL MEASUREMENT

Name of Well: Uncle Location, UTM: _____

Altitude of Well Site: 10.11 (mamsl) Well Diameter: 800 (mm)

Height to Measurement Point: 0.2 (m)

Screen Schedule: _____

Date	Water Level (m)	Water Level Altitude (mamsl)	Date	Water Level (m)	Water Level Altitude (mamsl)
81' 12-20	8.00	2.31			
82' 1-10	7.94	2.37			
1-20	7.90	2.41			
2-1	7.91	2.40			
2-20	7.90	2.41			
3-1	7.56	2.75			
3-20	7.19	3.12			

DATA SHEET FOR EC-LOGGING

Name of Well: JA-1 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity ( )25°	(µm/cm)	Depth (m)	Temperature (C)	Conducitity ( )25°	(µm/cm)
24	33.0	(918)	1,080	76	33.0	(905)	1,080
26	33.0	(901)	1,060	78	33.8	(905)	1,080
28	33.0	(901)	1,060	80	33.8	(905)	1,080
30	33.0	(893)	1,050	82	33.8	(913)	1,050
32	33.0	(884)	1,050				
34	33.0	(884)	1,040				
36	33.1	(883)	1,040				
38	33.2	(873)	1,030				
40	33.2	(873)	1,030				
42	33.4	(861)	1,020				
42	33.6	(925)	1,100				
46	33.6	(825)	1,100				
48	33.6	(917)	1,090				
50	33.6	(917)	1,090				
52	33.6	(917)	1,090				
54	33.6	(917)	1,090				
56	33.6	(917)	1,090				
58	33.6	(917)	1,090				
60	33.7	(915)	1,090				
62	33.7	(915)	1,090				
64	33.8	(913)	1,090				
66	33.8	(905)	1,080				
69	33.8	(905)	1,080				
70	33.8	(905)	1,080				
72	33.8	(905)	1,080				
74	33.8	(905)	1,080				

DATA SHEET FOR EC-LOGGING

Name of Well: JA-2 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
8	32.7	485	34	32.6	449
9	32.7	480	35	32.6	448
10	32.7	475	36	32.6	448
11	32.7	472	37	32.6	448
12	32.7	470	38	32.6	448
13	32.7	469	39	32.6	447
14	32.7	462	40	32.6	447
15	32.7	460			
16	32.7	458			
17	32.7	458			
18	32.7	455			
19	32.7	455			
20	32.7	455			
21	32.7	451			
22	32.7	451			
23	32.7	449			
24	32.7	449			
25	32.7	449			
26	32.7	449			
27	32.7	449			
28	32.7	449			
29	32.7	449			
30	32.7	449			
31	32.7	449			
32	32.7	448			
33	32.6	448			

DATA SHEET FOR EC-LOGGING

Name of Well: JA-3 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
27	33.1	530			
28	33.1	540			
30	33.1	540			
32	33.0	540			
34	33.0	540			
36	33.0	550			
38	33.0	550			
40	33.0	560			
42	33.0	575			
44	33.0	580			
46	33.0	555			

DATA SHEET FOR EC-LOGGING

Name of Well: JA-3 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
24	28.8				
25	29.2				
26	33.0	540			
27	33.1	550			
28	33.2	540			
29	33.2	540			
30	33.2	540			
31	33.2	540			
32	33.2	540			
33	33.2	545			
34	33.2	540			
35	33.2	550			
36	33.2	550			
37	33.0	555			
38	33.0	560			
29	33.0	560			
40	33.0	570			
41	33.0	580			
42	33.0	585			
43	33.0	585			
44	33.0	585			
45	33.0	500			

DATA SHEET FOR EC-LOGGING

Name of Well: JA-4 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
26	26.6	640	52		630
27	31.7	640	53		620
28	31.8	640	54		620
29	31.9	640	55		650
30	31.9	640			
31	32.0	640			
32	32.0	640			
33	32.0	640			
34	32.0	640			
35	32.0	630			
36	31.6 - 31.8	630			
37	31.6 - 31.8	630			
37	31.6 - 31.8	630			
38	31.6 - 31.8	630			
38	31.6 - 31.8	630			
39	31.6 - 31.8	630			
40	31.6 - 31.8	630			
41	31.6 - 31.8	630			
42	31.6 - 31.8	630			
43	31.6 - 31.8	630			
44	31.6 - 31.8	630			
45	31.6 - 31.8	630			
46	31.6 - 31.8	630			
47	31.6 - 31.8	630			
48	31.6 - 31.8	630			
49	31.6 - 31.8	630			
50	31.6 - 31.8	630			
51	31.6 - 31.8	630			

DATA SHEET FOR EC-LOGGING

Name of Well: JA-4 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
26	32.4	610			
28	32.4	640			
30	32.4	640			
32	32.3	640			
34	32.4	650			
36	32.4	650			
38	32.4	640			
40	32.4	640			
42	32.4	640			
44	32.4	640			
46	32.4	640			
48	32.4	640			
50	32.4	640			
52	32.4	640			
54	32.4	640			
56	32.4	640			

DATA SHEET FOR EC-LOGGING

Name of Well: JA-5 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 21, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
38	32.2	460			
40	33.0	45.5			
45	33.0	450			
50	33.0	450			
55	32.8	450			

DATA SHEET FOR EC-LOGGING

Name of Well: AE-62 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
10	29.2	590			
11	30.0	590			

DATA SHEET FOR EC-LOGGING

Name of Well: AE-101 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conductivity (µm/cm)
11	31.2	1,040			
12	31.1	1,040			

DATA SHEET FOR EC-LOGGING

Name of Well: AE-159 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
11	30.0	590			
12	30.4	1,030			

DATA SHEET FOR EC-LOGGING

Name of Well: Territ mosq Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
8	32.5	580			
9	32.3	580			

DATA SHEET FOR EC-LOGGING

Name of Well: Father garden Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
3	29.9	4,700			
4	29.9	4,700			
5	29.8	4,650			
6	29.8	4,630			
7	29.8	4,600			

DATA SHEET FOR EC-LOGGING

Name of Well: Uncle Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
7.3	31.8	800			
8	31.9	800			
9	31.9	800			

DATA SHEET FOR EC-LOGGING

Name of Well: Auh well mosq Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
11	29.7	1,080			

DATA SHEET FOR EC-LOGGING

Name of Well: H-1 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 21, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
3	30.9	540			
4	30.9	540			
7	31.2	540			
10	31.2	540			
15	31.2	550			
19	30.6	550			

DATA SHEET FOR EC-LOGGING

Name of Well: AE-49 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 21, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
4	31.7	930			
5	32.0	930			
6	32.0	920			
7	32.0	920			
8	32.0	920			
9	32.0	910			
10	32.0	910			
11	32.0	910			
12.4					

DATA SHEET FOR EC-LOGGING

Name of Well: M-14 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
3	27.0	4,550			
4	26.8	4,500			
5	26.8	4,500			

DATA SHEET FOR EC-LOGGING

Name of Well: AE-93 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
2	30.5	1,400			
3	30.6	1,410			
4	30.6	1,420			
5	30.6	1,430			
6	30.6	1,430			
7	30.6	1,430			
8	30.6	1,430			
9	30.6	1,430			

DATA SHEET FOR EC-LOGGING

Name of Well: Sallam mosq Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
3.5	28.8	2,820			
3.9	29.0	3,000			

DATA SHEET FOR EC-LOGGING

Name of Well: Amq Mosq Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
10	28.2	3,620			
11	28.2	3,600			

DATA SHEET FOR EC-LOGGING

Name of Well: AE-91 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
9	28.6	890			
10	28.5	910			

DATA SHEET FOR EC-LOGGING

Name of Well: AE-62 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
10	30.7	620			
11	30.7	620			

DATA SHEET FOR EC-LOGGING

Name of Well: SPO Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
19	33.3	720			
20	33.3	720			
22	33.1	720			
24	33.1	720			
26	33.1	720			
28	33.1	720			
30	33.1	720			

DATA SHEET FOR EC-LOGGING

Name of Well: SP-0 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
18	31.0		44	32.6	640
19	31.0	620	45	32.6	640
20	32.2	620	46	32.6	640
21	32.5	620	47	32.6	640
22	32.5	620	48	32.6	640
23	32.5	620	49	32.6	640
24	32.5	620	50	32.6	640
25	32.5	620			
26	32.5	620			
27	32.5	620			
28	32.5	620			
29	32.5	620			
30	32.5	620			
31	32.5	620			
32	32.5	620			
33	32.5	620			
34	32.5	620			
35	32.5	620			
36	32.6	620			
37	32.6	640			
38	32.6	640			
39	32.6	640			
40	32.6	640			
41	32.6	640			
42	32.6	640			
43	32.6	640			

DATA SHEET FOR EC-LOGGING

Name of Well: Sallan Mosque Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31,1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
4	28.9	2,600			

DATA SHEET FOR EC-LOGGING

Name of Well: AE-142 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
3	27.0	5,100			

DATA SHEET FOR EC-LOGGING

Name of Well: AE-142 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
3	28.7	3,800			
4	28.7	3,800			

DATA SHEET FOR EC-LOGGING

Name of Well: Father's Garden Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
3	21.0				
4	30,4	4,800			
5	30.5	4,800			
6	30.5	4,800			
7	30.5	4,800			
8	30.5	4,800			
9	30.5	4,800			

DATA SHEET FOR EC-LOGGING

Name of Well: Amq-Moseque Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
10	27.7	2,700			

DATA SHEET FOR EC-LOGGING

Name of Well: WST-26 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
12	33.0	660	38	33.0	655
13	33.0	670	39	33.0	655
14	32.9	660	40	33.0	655
15	33.0	660	41	33.0	655
16	33.0	660	42	33.0	655
17	33.0	660	43	33.0	655
18	33.0	660	44	33.0	655
19	33.0	660	45	33.0	655
20	33.0	660	46	33.0	655
21	33.0	660	47	33.0	655
22	33.0	660	48	33.0	655
23	33.0	660	49	33.0	655
24	33.0	660	50	-3.1	600
25	33.0	660	51		
26	33.0	655	52	33.1	680
27	33.0	655	53		
28	33.0	655	54	33.1	680
29	33.0	655	55		
30	33.0	655	56	33.1	680
31	33.0	655	57		
32	33.0	655	58	33.1	680
33	33.0	655	59		
34	33.0	655	60	33.1	680
35	33.0	655			
36	33.0	655			
37	33.0	655			

DATA SHEET FOR EC-LOGGING

Name of Well: WSI-26 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
11	27.0		37	33.0	640 - 660
12	32.4	640 - 660	38	33.0	640 - 660
13	32.9	640 - 660	39	33.0	640 - 660
14	33.0	640 - 660	40	33.0	640 - 660
15	33.0	640 - 660			
16	33.0	640 - 660			
17	33.0	640 - 660			
18	33.0	640 - 660			
19	33.0	640 - 660			
20	33.0	640 - 660			
21	33.0	640 - 660			
22	33.0	640 - 660			
23	33.0	640 - 660			
24	33.0	640 - 660			
25	33.0	640 - 660			
26	33.0	640 - 660			
27	33.0	640 - 660			
28	33.0	640 - 660			
29	33.0	640 - 660			
30	33.0	640 - 660			
31	33.0	640 - 660			
32	33.0	640 - 660			
33	33.0	640 - 660			
34	33.0	640 - 660			
35	33.0	640 - 660			
36	33.0	640 - 660			

DATA SHEET FOR EC-LOGGING

Name of Well: OA-1 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 21, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
12	31.4	530			
14	31.4	530			
16	31.2	530			
18	31.2	530			
20	31.3	530			
22.5	21.4	530			

DATA SHEET FOR EC-LOGGING

Name of Well: OA-2 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
7	32.4	890	33	33.0	4,900
8	32.4	890	34	33.0	5,200
9	32.4	890	35	33.0	5,300
10	32.4	890	36	33.0	5,500
11	32.4	890	37	33.0	5,500
12	32.4	890	38	33.0	5,500
13	32.4	890	39	33.0	5,500
14	32.4	890	40	33.0	5,600
15	32.4	890	41	33.0	5,800
16	32.4	900	42	33.0	6,200
17	32.4	900	43	33.0	6,500
18	32.4	900	44	33.2	7,000
19	32.4	900	45	33.2	8,000
20	32.4	910	46	33.2	9,500
21	32.4	930	47	33.2	11,200
22	32.4	950	48	33.2	14,000
23	32.4	990	49	33.2	17,000
24	32.4	1,180	50	33.2	19,500
25	32.4	1,580			
26	32.6	2,100			
27	32.6	2,500			
28	32.6	2,800			
29	32.6	3,200			
30	33.0	3,600			
31	33.0	4,000			
32	33.0	4,500			

DATA SHEET FOR EC-LOGGING

Name of Well: OA-2 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 23, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)		Depth (m)	Temperature (C)	Conducitity (µm/cm)
7	32.5		970	46	33.2	9,200
8	32.4		970	48	33.2	14,300
9	32.4		945	50	33.2	21,200
10	32.4	(955)	945	52	33.2	32,000
11	32.4		940	54	33.2	37,500
12	32.4		940	56	33.2	43,500
13	32.4		930	58	33.2	46,000
14	32.4		930	60	33.2	49,000
15	32.4	(970)	930	62	33.2	50,000
16	32.4		930	64	33.2	52,000
17	32.3		925			
18	32.3		920			
19	32.3		920			
20	32.3	(980)	920			
22	32.6		980			
24	32.6		980			
26	32.6	(1,220)	980			
28	32.6		2,020			
30	33.0		3,000			
32	33.0		3,900			
34	33.0		4,400			
36	33.1		4,850			
38	33.1		5,200			
40	33.2		5,400			
42	33.2		5,700			
44	33.2		6,800			

DATA SHEET FOR EC-LOGGING

Name of Well: EA-1 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
25	33.5	438	76	33.2	510
26	33.5	460	78	33.2	510
28	33.4	490			
30	33.4	490			
32	33.3	490			
34	33.3	488			
36	33.2	488			
38	33.2	488			
40	33.2	488			
42	33.3	488			
44	33.3	488			
46	33.3	488			
48	33.3	450			
50	33.3	500			
52	33.3	530			
54	33.3	530			
56	33.3	540			
58	33.2	540			
60	33.2	540			
62	33.2	530			
64	33.2	520			
66	33.2	510			
68	33.2	510			
70	33.2	510			
72	33.2	520			
74	33.2	520			

DATA SHEET FOR EC-LOGGING

Name of Well: EA-1 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
26	30.0				
27	33.3 - 33.4	465			
28	33.3 - 33.4	465			
29	33.3 - 33.4	465			
30	33.3 - 33.4	465			
31	33.3 - 33.4	465			
32	33.3 - 33.4	465			
33	33.3 - 33.4	465			
34	33.3 - 33.4	465			
35	33.3 - 33.4	465			
36	33.3 - 33.4	465			
37	33.3 - 33.4	465			
38	33.3 - 33.4	465			
39	33.3 - 33.4	465			
40	33.3 - 33.4	465			
41	33.3 - 33.4	465			
42	33.3 - 33.4	465			
43	33.3 - 33.4	465			
44	33.3 - 33.4	470			
45	33.3 - 33.4	460			
46	33.3 - 33.4	460			
47	33.3 - 33.4	460			
48	33.3 - 33.4	460			
49	33.3 - 33.4	460			
50	33.3 - 33.4	470			
51	33.3 - 33.4	470			

DATA SHEET FOR EC-LOGGING

Name of Well: EA-2 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: January 30 - 31, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
23	28.3				
24	32.9	620			
25	33.0	620			
26	33.0	620			
27	33.2	620			
28	33.2	620			
29	33.2	620			
30	33.2	620			
31	33.2	620			
32	33.2	620			
33	33.2	620			
34	33.2	625			
35	33.2	625			
36	33.2	625			
37	33.2	625			

DATA SHEET FOR EC-LOGGING

Name of Well: EA-2 Altitude of Well Site: _____(mamsl)

Location, UTM: _____ Depth Drilled: _____(m)

Casing diameter: _____(mm) Screen schedule: _____

Date: March 22, 1982

Depth (m)	Temperature (C)	Conductivity (µm/cm)	Depth (m)	Temperature (C)	Conducitity (µm/cm)
22	33.0	610			
24	33.0	610			
26	33.0	600			
28	33.0	600			
30	33.0	595			
32	33.0	595			
34	33.0	590			
36	33.0	590			
38	33.0	590			

Calculation for Water Balance, Well EA-1

Annex 14

WELL NAME=EA-1
E-SITE AREA(KM**2)= 893
RECHARGE AREA(KM**2)= 56.6
SURFACE RUNOFF/PLAIN=(P-13)*0.04
LOSS OF RAIN= 13
DIACHARGE RATIO,BASE FLOW= 0.057- 0.02
RECHARGE RATIO= 0.76
DISCHARGE RATIO,FLOOD=(P-29)*0.26(P>50,(P-8)*0.19(P<50)
SPECIFIC YIELD= 0.05
Go=P+Gi-Et-Sg-ds (Unit:mm)

Yr Mn	P	Fo	Gib	Gif	Rg	Et	Sg	dS	Go
74 6	0	0	7.3	0	0	0	0	0	7.3
74 7	0	0	1.7	0	0	0	0	-20	21.7
74 8	0	0	1.1	0	0	0	0	15	-13.9
74 9	0	1.1	2.2	3.4	0	0	0	0	5.6
74 10	0	0	2.2	0	0	0	0	25	-22.8
74 11	2.2	0	2.2	0	0	2.2	0	-40	42.2
74 12	2.6	0	3	0	0	2.6	0	-5	8
75 1	44.5	28.5	11.9	90.1	0	42.8	1.7	2.5	99.5
75 2	0	0	11.7	0	0	0	0	-2.5	14.2
75 3	0	0	10.3	0	0	0	0	-20	30.3
75 4	0	0	10.6	0	0	0	0	-15	25.6
75 5	0	0	10.8	0	0	0	0	-15	25.8
Total	49.3	29.6	75	93.5	0	47.6	1.7	-75	243.5
75 6	0	0	9.9	0	0	0	0	45	-35.1
75 7	6.2	2.7	2.8	8.4	0	6.2	0	40	-28.9
75 8	0	0	3.1	0	0	0	0	35	-31.9
75 9	0	0	3.1	0	0	0	0	45	-41.9
75 10	0	0	2.8	0	0	0	0	25	-22.2
75 11	0	0	2.6	0	0	0	0	20	-17.4
75 12	2.5	11.4	6.3	36	0	2.5	0	20	22.3
76 1	118	108.9	24.6	344.8	0	112.5	5.5	25	344.4
76 2	51.9	106.4	45	337	0	49.9	2	130	252
76 3	55.2	25.1	53.2	79.5	0	53	2.2	30	102.7
76 4	0	0	53.2	0	0	0	0	45	8.2
76 5	0	0	53.4	0	0	0	0	40	13.4
Total	233.8	254.5	260	805.7	0	224.1	9.7	500	565.7

74 9	0	1.1	2.2	0	0	0	0	25	-22.8
74 10	0	0	2.2	0	0	0	0	25	-22.8
74 11	2.2	0	2.2	0	0	2.2	0	-40	42.2
74 12	2.6	0	3	0	0	2.6	0	-5	8
75 1	44.5	28.5	11.9	90.1	0	42.8	1.7	2.5	99.5
75 2	0	0	11.7	0	0	0	0	-2.5	14.2
75 3	0	0	10.3	0	0	0	0	-20	30.3
75 4	0	0	10.6	0	0	0	0	-15	25.6
75 5	0	0	10.8	0	0	0	0	-15	25.8
Total	49.3	29.6	75	93.5	0	47.6	1.7	-75	243.5
75 6	0	0	9.9	0	0	0	0	45	-35.1
75 7	6.2	2.7	2.8	8.4	0	6.2	0	40	-28.8
75 8	0	0	3.1	0	0	0	0	35	-31.9
75 9	0	0	3.1	0	0	0	0	45	-41.9
75 10	0	0	2.8	0	0	0	0	25	-22.2
75 11	0	0	2.6	0	0	0	0	20	-17.4
75 12	2.5	11.4	6.3	36	0	2.5	0	20	22.3
76 1	118	108.9	24.6	344.8	0	112.5	5.5	25	344.4
76 2	51.9	106.4	45	337	0	49.9	2	130	252
76 3	55.2	25.1	53.2	79.5	0	53	2.2	30	102.7
76 4	0	0	53.2	0	0	0	0	45	8.2
76 5	0	0	53.4	0	0	0	0	40	13.4
Total	233.8	254.5	260	805.7	0	224.1	9.7	500	565.7
76 6	0	0	50.1	0	0	0	0	35	15.1
76 7	0	12	33.9	38.1	0	0	0	45	27
76 8	0	0	13.2	0	0	0	0	30	-16.8
76 9	8.2	0	5.6	0	0	8.2	0	0	5.6
76 10	0	3.9	7.6	12.3	0	0	0	-10	29.9
76 11	17.3	0	8.3	0	0.2	16.9	0.2	-15	23.5
76 12	68.1	12.3	11.3	39	0	65.2	2.9	-150	200.3
77 1	26.3	10.8	10.8	34.2	0	25.6	0.7	-70	115
77 2	2.6	0	10.8	0	0	2.6	0	-85	95.8
77 3	38.7	22.7	16.3	71.7	0	37.3	1.4	-30	118
77 4	10.9	18.5	19.3	58.5	0	10.9	0	165	-87.2
77 5	0	9.4	21.8	29.6	0	0	0	265	-213.6
Total	172.1	89.6	209	283.4	0.2	166.7	5.2	180	312.6
77 6	0	0	18.1	0	0	0	0	0	18.1
77 7	0	0	14.2	0	0	0	0	-190	204.2
77 8	0	0	14.1	0	0	0	0	-265	279.1
77 9	0	0	8.7	0	0	0	0	10	-1.3
77 10	17.6	1.2	5.1	3.6	0	17.6	0.2	15	-6.5
77 11	0.2	0	1.7	0	0	0.2	0	10	-8.3
77 12	0	0	1.7	0	0	0	0	5	-3.3
78 1	34.2	20.5	7.7	64.9	0	33.1	1.1	-15	87.6
78 2	6.5	0	8.4	0	0	6.5	0	-15	23.4
78 3	2	0	8.3	0	0	2	0	-15	23.3
78 4	0	0	6.8	0	0	0	0	-15	21.8
78 5	0	0	7.1	0	0	0	0	-15	22.1
Total	60.5	21.7	101.9	68.5	0	59.4	1.3	-490	660.2
78 6	3.6	0	9.4	0	0	3.6	0	-20	29.4
78 7	0	4	7.9	12.5	0	0	0	35	-14.6
78 8	0	0	7.5	0	0	0	0	-40	47.5
78 9	0	0	7.1	0	0	0	0	0	7.1
78 10	0	0	7.1	0	0	0	0	-25	32.1
78 11	0.3	0	6.8	0	0	0.3	0	-10	16.8
78 12	21.4	3.3	7.7	10.5	0	21	0.4	-5	23.2
79 1	0	0	3.3	0	0	0	0	30	-26.7
79 2	1.5	0	3.2	0	0	1.5	0	60	-56.8
79 3	2.3	0	3.9	0	0	2.3	0	10	-6.1
79 4	0	0	4	0	0	0	0	-125	129
79 5	0	0	4.6	0	0	0	0	-10	14.6
Total	29.1	7.3	72.5	23	0	28.7	0.4	-100	195.5
79 6	0	0	2.2	0	0	0	0	5	-2.8
79 7	0	0	2.1	0	0	0	0	-15	17.1
79 8	0	0	2.4	0	0	0	0	-5	7.4
79 9	36.6	0	2.7	0	0	35.4	1.2	-5	7.7
79 10	0.7	0	2.9	0	0	0.7	0	-5	7.9
79 11	58.4	8.8	5.4	27.8	0	56	2.4	0	33.2
79 12	1.7	0	5.4	0	0	1.7	0	10	-4.6
80 1	2.2	2.2	8.4	6.8	0	2.2	0	40	-24.8
80 2	3.9	4.2	11	13.5	0	3.9	0	55	-30.5
80 3	1.2	0	10	0	0	1.2	0	10	0
80 4	0	0	9.8	0	0	0	0	0	9.8
80 5	0	0	6.7	0	0	0	0	0	6.7
Total	104.7	15.2	69	48.1	0	101.1	3.6	90	27.1
80 6	0	0	7.4	0	0	0	0	0	7.4
80 7	0	0	4.5	0	0	0	0	0	4.5
80 8	0	0	1.3	0	0	0	0	0	1.3
80 9	0	0	1.3	0	0	0	0	0	1.3
80 10	0.8	0	1.2	0	0	0.8	0	0	1.2
80 11	0	0	2.7	0	0	0	0	0	2.7
80 12	4.8	0	1.8	0	0	4.8	0	5	-3.2
81 1	0	0	1.8	0	0	0	0	5	-3.2
81 2	1.5	0	1.9	0	0	1.5	0	-15	16.9
81 3	18.2	0	3.4	0	0.2	17.7	0.3	-20	23.6
81 4	12.6	6.8	5.6	21.4	0	12.6	0	-20	47
81 5	0	0	4.5	0	0	0	0	-25	29.5
Total	37.9	6.8	37.4	21.4	0.2	37.4	0.3	-70	129

Annex 15

WELL NAME=AE-104
E-SITE AREA(KM**2)= 893
RECHARGE AREA(KM**2)= 317
SURFACE RUNOFF/PLAIN=(P-13)*0.04
LOSS OF RAIN= 13
DIACHARGE RATIO,BASE FLOW= 0.057- 0.02
RECHARGE RATIO= 0.76
DISCHARGE RATIO,FLOOD=(P-29)*0.26(P>50,(P-8)*0.19(P<50)
SPECIFIC YIELD= 0.05
Go=P+Gi-Et-Sg-ds (Unit:mm)

Yr Mn	P	Fo	Gi	Rg	Et	Sg	dS	Lo	Go
74 6	0	0	1.4	0	0	0	0	0	1.4
74 7	0	0	3.9	0	0	0	0	0	3.9
74 8	0	0	-2.4	0	0	0	0	0	-2.4
74 9	0	0.2	1.1	0	0	0	-3	0	4.1
74 10	0	0	-4	0	0	0	3	0	-7
74 11	2.2	0	7.6	0	2.2	0	9.5	0	-1.9
74 12	2.6	0	1.5	0	2.6	0	0	0	1.5
75 1	44.5	5.4	17.8	0	42.8	1.7	-12	13.8	29.8
75 2	0	0	2.6	0	0	0	-4	0	6.6
75 3	0	0	5.4	0	0	0	-1	0	6.4
75 4	0	0	4.6	0	0	0	-2.5	0	7.1
75 5	0	0	4.7	0	0	0	2.5	0	2.2
Total	49.3	5.6	44.2	0	47.6	1.7	-7.5	13.8	51.7
75 6	0	0	-6.2	0	0	0	-1	0	-5.2
75 7	6.2	0.5	-5.1	0	6.2	0	-8	6.2	2.9
75 8	0	0	-5.6	0	0	0	-5.5	0	-0.1
75 9	0	0	-7.4	0	0	0	4.5	0	-11.9
75 10	0	0	-3.9	0	0	0	3.5	0	-7.4
75 11	0	0	-3.1	0	0	0	5.5	0	-8.6
75 12	2.5	2	4	0	2.5	0	8.5	2.5	-4.5
76 1	118	20.4	61.5	0	112.5	5.5	5	44.2	56.5
76 2	51.9	19.4	45	0	49.9	2	-8.5	47.1	53.5
76 3	55.2	4.9	18.4	0	53	2.2	7.5	29.4	10.9
76 4	0	0	1.5	0	0	0	7	0	-5.5
76 5	0	0	2.4	0	0	0	7	0	-4.6
Total	233.8	47.2	101.5	0	224.1	9.7	25.5	129.4	76
76 6	0	0	2.7	0	0	0	-23	0	25.7
76 7	0	2.1	4.9	0	0	0	-3	0	7.9
76 8	0	0	-2.9	0	0	0	1	0	-3.9
76 9	8.2	0	1	0	8.2	0	-5.5	0	6.5
76 10	0	0.7	5.4	0	0	0	-2.5	0	7.9
76 11	17.3	0	4.2	0.2	16.9	0.2	5	0	-0.6
76 12	68.1	2.7	35.8	0	65.2	2.9	9	29.8	26.8
77 1	26.3	2.1	20.6	0	25.6	0.7	4.5	11.1	16.1
77 2	2.6	0	17.2	0	2.6	0	14	0	3.2
77 3	38.7	4.3	21.1	0	37.3	1.4	5	16.8	16.1
77 4	10.9	3.3	-15.5	0	10.9	0	-9	10.9	-6.5
77 5	0	1.7	-38.1	0	0	0	-2	0	-36.1
Total	172.1	16.9	56.4	0.2	166.7	5.2	-6.5	68.6	63.1
77 6	0	0	3.3	0	0	0	-2	0	5.3
77 7	0	0	36.5	0	0	0	-2	0	38.5
77 8	0	0	49.9	0	0	0	-2	0	51.9
77 9	0	0	-0.2	0	0	0	2	0	-2.2
77 10	17.6	0.2	-1.1	0	17.6	0.2	2.5	17.6	-3.8
77 11	0.2	0	-1.4	0	0.2	0	-0.5	0	-0.9
77 12	0	0	-0.5	0	0	0	-1	0	0.5
78 1	34.2	3.9	15.7	0	33.1	1.1	-3	8.3	18.7
78 2	6.5	0	4.2	0	6.5	0	-2	0	6.2
78 3	2	0	4.2	0	2	0	-3	0	7.2
78 4	0	0	3.9	0	0	0	2	0	1.9
78 5	0	0	4	0	0	0	6	0	-2
Total	60.5	4.1	118.5	0	59.4	1.3	-3	25.9	121.3
78 6	3.6	0	5.3	0	3.6	0	-8	0	13.3
78 7	0	0.7	-2.6	0	0	0	-0.5	0	-2.1
78 8	0	0	8.5	0	0	0	6.5	0	2
78 9	0	0	1.3	0	0	0	0	0	1.3
78 10	0	0	5.8	0	0	0	0.5	0	5.3
78 11	0.3	0	3	0	0.3	0	0.5	0	2.5
78 12	21.4	0.7	4.2	0	21	0.4	0	3	4.2
79 1	0	0	-4.7	0	0	0	-1	0	-3.7
79 2	1.5	0	-10.1	0	1.5	0	-7.5	0	-2.6
79 3	2.3	0	-1	0	2.3	0	-8	0	7
79 4	0	0	23.1	0	0	0	2	0	21.1
79 5	0	0	2.7	0	0	0	7.5	0	-4.8
Total	29.1	1.4	35.5	0	28.7	0.4	-8	3	43.5
79 6	0	0	-0.4	0	0	0	4.5	0	-4.9
79 7	0	0	3.1	0	0	0	0	0	3.1
79 8	0	0	1.4	0	0	0	-0.5	0	1.9
79 9	36.6	0.2	1.4	0	35.4	1.2	-1	11.7	2.4
79 10	0.7	0	1.5	0	0.7	0	-1	0	2.5
79 11	58.4	2	6	0	56	2.4	2.5	41	3.5
79 12	1.7	0	-0.8	0	1.7	0	0	0	-0.8
80 1	2.2	0.4	-4.4	0	2.2	0	7.5	2.2	-11.9
80 2	3.9	0.7	-5.4	0	3.9	0	11.5	3.9	-16.9
80 3	1.2	0	0.1	0	1.2	0	6	0	-5.9
80 4	0	0	1.8	0	0	0	5	0	-3.2

74 11	2.2	0	7.8	0	2.2	0	0	0	7.8
74 12	2.6	0	1.5	0	2.6	0	0	0	1.5
75 1	44.5	5.4	17.8	0	42.8	1.7	-12	13.8	29.8
75 2	0	0	2.6	0	0	0	-4	0	6.6
75 3	0	0	5.4	0	0	0	-1	0	6.4
75 4	0	0	4.6	0	0	0	-2.5	0	7.1
75 5	0	0	4.7	0	0	0	2.5	0	2.2
Total	49.3	5.6	44.2	0	47.6	1.7	-7.5	13.8	51.7
75 6	0	0	-6.2	0	0	0	-1	0	-5.2
75 7	6.2	0.5	-5.1	0	6.2	0	-8	6.2	2.9
75 8	0	0	-5.6	0	0	0	-5.5	0	-0.1
75 9	0	0	-7.4	0	0	0	4.5	0	-11.9
75 10	0	0	-3.9	0	0	0	3.5	0	-7.4
75 11	0	0	-3.1	0	0	0	5.5	0	-8.6
75 12	2.5	2	4	0	2.5	0	8.5	2.5	-4.5
76 1	118	20.4	61.5	0	112.5	5.5	5	44.2	56.5
76 2	51.9	19.4	45	0	49.9	2	-8.5	47.1	53.5
76 3	55.2	4.9	18.4	0	53	2.2	7.5	29.4	10.9
76 4	0	0	1.5	0	0	0	7	0	-5.5
76 5	0	0	2.4	0	0	0	7	0	-4.6
Total	233.8	47.2	101.5	0	224.1	9.7	25.5	129.4	76
76 6	0	0	2.7	0	0	0	-23	0	25.7
76 7	0	2.1	4.9	0	0	0	-3	0	7.9
76 8	0	0	-2.9	0	0	0	1	0	-3.9
76 9	8.2	0	1	0	8.2	0	-5.5	0	6.5
76 10	0	0.7	5.4	0	0	0	-2.5	0	7.9
76 11	17.3	0	4.2	0.2	16.9	0.2	5	0	-0.6
76 12	68.1	2.7	35.8	0	65.2	2.9	9	29.8	26.8
77 1	26.3	2.1	20.6	0	25.6	0.7	4.5	11.1	16.1
77 2	2.6	0	17.2	0	2.6	0	14	0	3.2
77 3	38.7	4.3	21.1	0	37.3	1.4	5	16.8	16.1
77 4	10.9	3.3	-15.5	0	10.9	0	-9	10.9	-6.5
77 5	0	1.7	-38.1	0	0	0	-2	0	-36.1
Total	172.1	16.9	56.4	0.2	166.7	5.2	-6.5	68.6	63.1
77 6	0	0	3.3	0	0	0	-2	0	5.3
77 7	0	0	36.5	0	0	0	-2	0	38.5
77 8	0	0	49.9	0	0	0	-2	0	51.9
77 9	0	0	-0.2	0	0	0	2	0	-2.2
77 10	17.6	0.2	-1.1	0	17.6	0.2	2.5	17.6	-3.8
77 11	0.2	0	-1.4	0	0.2	0	-0.5	0	-0.9
77 12	0	0	-0.5	0	0	0	-1	0	0.5
78 1	34.2	3.9	15.7	0	33.1	1.1	-3	8.3	18.7
78 2	6.5	0	4.2	0	6.5	0	-2	0	6.2
78 3	2	0	4.2	0	2	0	-3	0	7.2
78 4	0	0	3.9	0	0	0	2	0	1.9
78 5	0	0	4	0	0	0	6	0	-2
Total	60.5	4.1	118.5	0	59.4	1.3	-3	25.9	121.3
78 6	3.6	0	5.3	0	3.6	0	-8	0	13.3
78 7	0	0.7	-2.6	0	0	0	-0.5	0	-2.1
78 8	0	0	8.5	0	0	0	6.5	0	2
78 9	0	0	1.3	0	0	0	0	0	1.3
78 10	0	0	5.8	0	0	0	0.5	0	5.3
78 11	0.3	0	3	0	0.3	0	0.5	0	2.5
78 12	21.4	0.7	4.2	0	21	0.4	0	3	4.2
79 1	0	0	-4.7	0	0	0	-1	0	-3.7
79 2	1.5	0	-10.1	0	1.5	0	-7.5	0	-2.6
79 3	2.3	0	-1	0	2.3	0	-8	0	7
79 4	0	0	23.1	0	0	0	2	0	21.1
79 5	0	0	2.7	0	0	0	7.5	0	-4.8
Total	29.1	1.4	35.5	0	28.7	0.4	-8	3	43.5
79 6	0	0	-0.4	0	0	0	4.5	0	-4.9
79 7	0	0	3.1	0	0	0	0	0	3.1
79 8	0	0	1.4	0	0	0	-0.5	0	1.9
79 9	36.6	0.2	1.4	0	35.4	1.2	-1	11.7	2.4
79 10	0.7	0	1.5	0	0.7	0	-1	0	2.5
79 11	58.4	2	6	0	56	2.4	2.5	41	3.5
79 12	1.7	0	-0.8	0	1.7	0	0	0	-0.8
80 1	2.2	0.4	-4.4	0	2.2	0	7.5	2.2	-11.9
80 2	3.9	0.7	-5.4	0	3.9	0	11.5	3.9	-16.9
80 3	1.2	0	0.1	0	1.2	0	6	0	-5.9
80 4	0	0	1.8	0	0	0	5	0	-3.2
80 5	0	0	1.2	0	0	0	1	0	0.2
Total	104.7	3.3	5.5	0	101.1	3.6	35.5	58.8	-30
80 6	0	0	1.4	0	0	0	-0.5	0	1.9
80 7	0	0	0.8	0	0	0	-0.5	0	1.3
80 8	0	0	0.3	0	0	0	0	0	0.3
80 9	0	0	0.3	0	0	0	-43.5	0	43.8
80 10	0.8	0	0.3	0	0.8	0	-64	0	64.3
80 11	0	0	0.5	0	0	0	-37.5	0	38
80 12	4.8	0	-0.5	0	4.8	0	36.5	0	-37
81 1	0	0	-0.5	0	0	0	46	0	-46.5
81 2	1.5	0	3.1	0	1.5	0	21	0	-17.9
81 3	18.2	0.1	4.3	0.2	17.7	0.3	-18.5	0	23
81 4	12.6	1.2	8.4	0	12.6	0	6	12.6	2.4
81 5	0	0	5.3	0	0	0	9	0	-3.7
Total	37.9	1.3	23.7	0.2	37.4	0.3	-46	12.6	69.9

Calculation for Water Balance, Well AE-142

Annex 16

WELL NAME=AE-142
E-SITE AREA(KM**2)= 893
RECHARGE AREA(KM**2)= 317
SURFACE RUNOFF/PLAIN=(P-13)*0.04
LOSS OF RAIN= 13
DIACHARGE RATIO,BASE FLOW= 0.057- 0.02
RECHARGE RATIO= 0.76
DISCHARGE RATIO,FLOOD=(P-29)*0.26(P>50,(P-8)*0.19(P<50)
SPECIFIC YIELD= 0.05
Go=P+Gi-Et-Sg-dS (Unit:mm)

Yr Mn	P	Fo	Gi	Rg	Et	Sg	dS	Lo	Go
74 6	0	0	1.4	0	0	0	0	0	1.4
74 7	0	0	3.9	0	0	0	0	0	3.9
74 8	0	0	-2.4	0	0	0	0	0	-2.4
74 9	0	0.2	1.1	0	0	0	0	0	1.1
74 10	0	0	-4	0	0	0	2.5	0	-6.5
74 11	2.2	0	7.6	0	2.2	0	5	0	2.6
74 12	2.6	0	1.5	0	2.6	0	2.5	0	-1
75 1	44.5	5.4	17.8	0	42.8	1.7	1	13.8	16.8
75 2	0	0	2.6	0	0	0	-1	0	3.6
75 3	0	0	5.4	0	0	0	-4.5	0	9.9
75 4	0	0	4.6	0	0	0	-0.5	0	5.1
75 5	0	0	4.7	0	0	0	-0.5	0	5.2
Total	49.3	5.6	44.2	0	47.6	1.7	4.5	13.8	39.7
75 6	0	0	-6.2	0	0	0	-10.5	0	4.3
75 7	6.2	0.5	-5.1	0	6.2	0	-1.5	6.2	-5.6
75 8	0	0	-5.6	0	0	0	8	0	-13.6
75 9	0	0	-7.4	0	0	0	7	0	-14.4
75 10	0	0	-3.9	0	0	0	-7.5	0	3.6
75 11	0	0	-3.1	0	0	0	17	0	-20.1
75 12	2.5	2	4	0	2.5	0	18	2.5	-14
76 1	118	20.4	61.5	0	112.5	5.5	-21	44.2	82.5
76 2	51.9	19.4	45	0	49.9	2	8.5	47.1	36.5
76 3	55.2	4.9	18.4	0	53	2.2	3	29.4	15.4
76 4	0	0	1.5	0	0	0	2	0	-0.5
76 5	0	0	2.4	0	0	0	-0.7	0	3.1
Total	233.8	47.2	101.5	0	224.1	9.7	22.3	129.4	79.2
76 6	0	0	2.7	0	0	0	-3.5	0	6.2
76 7	0	2.1	4.9	0	0	0	0	0	4.9
76 8	0	0	-2.9	0	0	0	-1	0	-1.9
76 9	8.2	0	1	0	8.2	0	-1	0	2
76 10	0	0.7	5.4	0	0	0	-1.5	0	6.9
76 11	17.3	0	4.2	0.2	16.9	0.2	-1	0	5.4
76 12	68.1	2.7	35.8	0	65.2	2.9	5	29.8	30.8
77 1	26.3	2.1	20.6	0	25.6	0.7	1	11.1	19.6
77 2	2.6	0	17.2	0	2.6	0	5.5	0	11.7
77 3	38.7	4.3	21.1	0	37.3	1.4	6	16.8	15.1
77 4	10.9	3.3	-15.5	0	10.9	0	-12.5	10.9	-3
77 5	0	1.7	-38.1	0	0	0	-2.5	0	-35.6
Total	172.1	16.9	56.4	0.2	166.7	5.2	-5.5	68.6	62.1
77 6	0	0	3.3	0	0	0	-2	0	5.3
77 7	0	0	36.5	0	0	0	0	0	36.5
77 8	0	0	49.9	0	0	0	2.5	0	47.4
77 9	0	0	-0.2	0	0	0	-1	0	0.8
77 10	17.6	0.2	-1.1	0	17.6	0.2	-3	17.6	1.7
77 11	0.2	0	-1.4	0	0.2	0	-0.5	0	-0.9
77 12	0	0	-0.5	0	0	0	1	0	-1.5
78 1	34.2	3.9	15.7	0	33.1	1.1	1	8.3	14.7
78 2	6.5	0	4.2	0	6.5	0	0.5	0	3.7
78 3	2	0	4.2	0	2	0	0.5	0	3.7
78 4	0	0	3.9	0	0	0	-1	0	4.9
78 5	0	0	4	0	0	0	-3	0	7
Total	60.5	4.1	118.5	0	59.4	1.3	-5	25.9	123.3
78 6	3.6	0	5.3	0	3.6	0	-13	0	18.3
78 7	0	0.7	-2.6	0	0	0	-2.5	0	-0.1
78 8	0	0	8.5	0	0	0	3.5	0	5
78 9	0	0	1.3	0	0	0	4	0	-2.7
78 10	0	0	5.8	0	0	0	3.5	0	2.3
78 11	0.3	0	3	0	0.3	0	6.5	0	-3.5
78 12	21.4	0.7	4.2	0	21	0.4	2.5	3	1.7
79 1	0	0	-4.7	0	0	0	-2.5	0	-2.2
79 2	1.5	0	-10.1	0	1.5	0	-3	0	-7.1
79 3	2.3	0	-1	0	2.3	0	3	0	-4
79 4	0	0	23.1	0	0	0	-7.5	0	30.6
79 5	0	0	2.7	0	0	0	7.5	0	-4.8
Total	29.1	1.4	35.5	0	28.7	0.4	2	3	33.5
79 6	0	0	-0.4	0	0	0	-0.5	0	0.1
79 7	0	0	3.1	0	0	0	-2	0	5.1
79 8	0	0	1.4	0	0	0	1	0	0.4
79 9	36.6	0.2	1.4	0	35.4	1.2	1	11.7	0.4
79 10	0.7	0	1.5	0	0.7	0	0.5	0	1
79 11	58.4	2	6	0	56	2.4	4	41	2
79 12	1.7	0	-0.8	0	1.7	0	-4	0	3.2

74 10	0	0	-4	0	0	0	-2.5	0	-8.5
74 11	2.2	0	7.6	0	2.2	0	5	0	2.6
74 12	2.6	0	1.5	0	2.6	0	2.5	0	-1
75 1	44.5	5.4	17.8	0	42.8	1.7	1	13.8	16.8
75 2	0	0	2.6	0	0	0	-1	0	3.6
75 3	0	0	5.4	0	0	0	-4.5	0	9.9
75 4	0	0	4.6	0	0	0	-0.5	0	5.1
75 5	0	0	4.7	0	0	0	-0.5	0	5.2
Total	49.3	5.6	44.2	0	47.6	1.7	4.5	13.8	39.7
75 6	0	0	-6.2	0	0	0	-10.5	0	4.3
75 7	6.2	0.5	-5.1	0	6.2	0	-1.5	6.2	-3.6
75 8	0	0	-5.6	0	0	0	8	0	-13.6
75 9	0	0	-7.4	0	0	0	7	0	-14.4
75 10	0	0	-3.9	0	0	0	-7.5	0	3.6
75 11	0	0	-3.1	0	0	0	17	0	-20.1
75 12	2.5	2	4	0	2.5	0	18	2.5	-14
76 1	118	20.4	61.5	0	112.5	5.5	-21	44.2	82.5
76 2	51.9	19.4	45	0	49.9	2	8.5	47.1	36.5
76 3	55.2	4.9	18.4	0	53	2.2	3	29.4	15.4
76 4	0	0	1.5	0	0	0	2	0	-0.5
76 5	0	0	2.4	0	0	0	-0.7	0	3.1
Total	233.8	47.2	101.5	0	224.1	9.7	22.3	129.4	79.2
76 6	0	0	2.7	0	0	0	-3.5	0	6.2
76 7	0	2.1	4.9	0	0	0	0	0	4.9
76 8	0	0	-2.9	0	0	0	-1	0	-1.9
76 9	8.2	0	1	0	8.2	0	-1	0	2
76 10	0	0.7	5.4	0	0	0	-1.5	0	6.9
76 11	17.3	0	4.2	0.2	16.9	0.2	-1	0	5.4
76 12	68.1	2.7	35.8	0	65.2	2.9	5	29.8	30.8
77 1	26.3	2.1	20.6	0	25.6	0.7	1	11.1	19.6
77 2	2.6	0	17.2	0	2.6	0	5.5	0	11.7
77 3	38.7	4.3	21.1	0	37.3	1.4	6	16.8	15.1
77 4	10.9	3.3	-15.5	0	10.9	0	-12.5	10.9	-3
77 5	0	1.7	-38.1	0	0	0	-2.5	0	-35.6
Total	172.1	16.9	56.4	0.2	166.7	5.2	-5.5	68.6	62.1
77 6	0	0	3.3	0	0	0	-2	0	5.3
77 7	0	0	36.5	0	0	0	0	0	36.5
77 8	0	0	49.9	0	0	0	2.5	0	47.4
77 9	0	0	-0.2	0	0	0	-1	0	0.8
77 10	17.6	0.2	-1.1	0	17.6	0.2	-3	17.6	1.7
77 11	0.2	0	-1.4	0	0.2	0	-0.5	0	-0.9
77 12	0	0	-0.5	0	0	0	1	0	-1.5
78 1	34.2	3.9	15.7	0	33.1	1.1	1	8.3	14.7
78 2	6.5	0	4.2	0	6.5	0	0.5	0	3.7
78 3	2	0	4.2	0	2	0	0.5	0	3.7
78 4	0	0	3.9	0	0	0	-1	0	4.9
78 5	0	0	4	0	0	0	-3	0	7
Total	60.5	4.1	118.5	0	59.4	1.3	-5	25.9	123.3
78 6	3.6	0	5.3	0	3.6	0	-13	0	18.3
78 7	0	0.7	-2.6	0	0	0	-2.5	0	-0.1
78 8	0	0	8.5	0	0	0	3.5	0	5
78 9	0	0	1.3	0	0	0	4	0	-2.7
78 10	0	0	5.8	0	0	0	3.5	0	2.3
78 11	0.3	0	3	0	0.3	0	6.5	0	-3.5
78 12	21.4	0.7	4.2	0	21	0.4	2.5	3	1.7
79 1	0	0	-4.7	0	0	0	-2.5	0	-2.2
79 2	1.5	0	-10.1	0	1.5	0	-3	0	-7.1
79 3	2.3	0	-1	0	2.3	0	3	0	-4
79 4	0	0	23.1	0	0	0	-7.5	0	30.6
79 5	0	0	2.7	0	0	0	7.5	0	-4.8
Total	29.1	1.4	35.5	0	28.7	0.4	2	3	33.5
79 6	0	0	-0.4	0	0	0	-0.5	0	0.1
79 7	0	0	3.1	0	0	0	-2	0	5.1
79 8	0	0	1.4	0	0	0	1	0	0.4
79 9	36.6	0.2	1.4	0	35.4	1.2	1	11.7	0.4
79 10	0.7	0	1.5	0	0.7	0	0.5	0	1
79 11	58.4	2	6	0	56	2.4	4	41	2
79 12	1.7	0	-0.8	0	1.7	0	-4	0	3.2
80 1	2.2	0.4	-4.4	0	2.2	0	-0.5	2.2	-3.9
80 2	3.9	0.7	-5.4	0	3.9	0	13.5	3.9	-18.9
80 3	1.2	0	0.1	0	1.2	0	17	0	-16.9
80 4	0	0	1.8	0	0	0	17.5	0	-15.7
80 5	0	0	1.2	0	0	0	4.5	0	-3.3
Total	104.7	3.3	5.5	0	101.1	3.6	52	58.8	-46.5
80 6	0	0	1.4	0	0	0	0	0	1.4
80 7	0	0	0.8	0	0	0	0	0	0.8
80 8	0	0	0.3	0	0	0	0	0	0.3
80 9	0	0	0.3	0	0	0	-19.5	0	19.8
80 10	0.8	0	0.3	0	0.8	0	-24.5	0	24.8
80 11	0	0	0.5	0	0	0	-4	0	4.5
80 12	4.8	0	-0.5	0	4.8	0	20.5	0	-21
81 1	0	0	-0.5	0	0	0	28	0	-28.5
81 2	1.5	0	3.1	0	1.5	0	-23.5	0	26.6
81 3	18.2	0.1	4.3	0.2	17.7	0.3	-33	0	37.5
81 4	12.6	1.2	8.4	0	12.6	0	1.5	12.6	6.9
81 5	0	0	5.3	0	0	0	-6.5	0	11.8
Total	37.9	1.3	23.7	0.2	37.4	0.3	-61	12.6	84.9

Calculation for Water Balance, Well OA-2

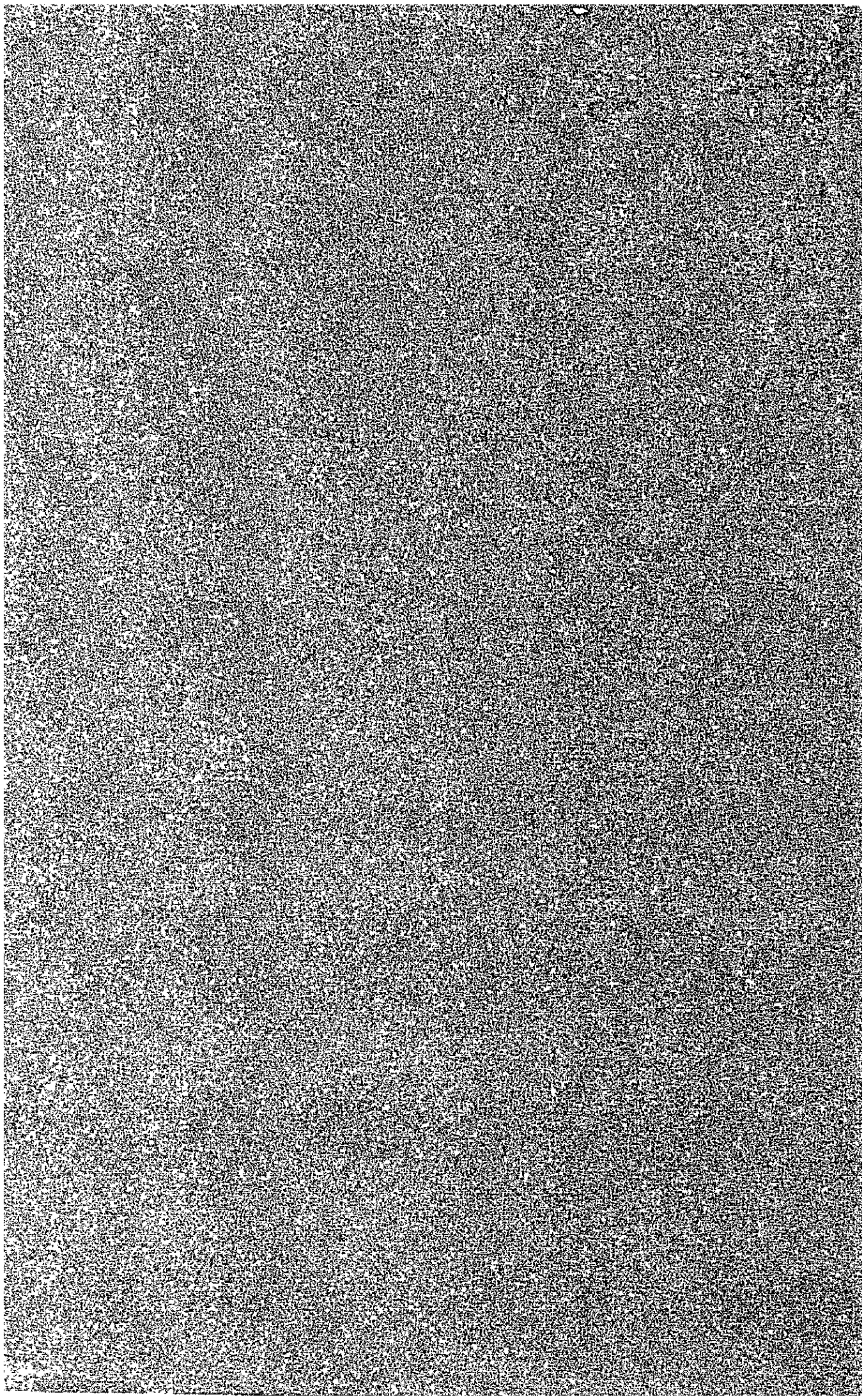
Annex 17

WELL NAME=OA-2
E-SITE AREA(KM**2)= 893
RECHARGE AREA(KM**2)= 317
SURFACE RUNOFF/PLAIN=(P-13)*0.04
LOSS OF RAIN= 13
DIACHARGE RATIO,BASE FLOW= 0.057- 0.02
RECHARGE RATIO= 0.76
DISCHARGE RATIO,FLOOD=(P-29)*0.26(P>50,(P-8)*0.19(P<50)
SPECIFIC YIELD= 0.05
Go=P+Gi-Et-Sg-ds (Unit:mm)

Yr Mn	P	Fo	Gi	Rg	Et	Sg	dS	Lo	Go
74 6	0	0	1.4	0	0	0	-4	0	5.4
74 7	0	0	3.9	0	0	0	0	0	3.9
74 8	0	0	-2.4	0	0	0	3.5	0	-5.9
74 9	0	0.2	1.1	0	0	0	-1.5	0	2.6
74 10	0	0	-4	0	0	0	-3	0	-1
74 11	2.2	0	7.6	0	2.2	0	9	0	-1.4
74 12	2.6	0	1.5	0	2.6	0	1	0	0.5
75 1	44.5	5.4	17.8	0	42.8	1.7	-0.5	13.8	18.3
75 2	0	0	2.6	0	0	0	-5	0	7.6
75 3	0	0	5.4	0	0	0	-2.5	0	7.9
75 4	0	0	4.6	0	0	0	-3	0	7.6
75 5	0	0	4.7	0	0	0	3	0	1.7
Total	49.3	5.6	44.2	0	47.6	1.7	-3	13.8	47.2
75 6	0	0	-6.2	0	0	0	0	0	-6.2
75 7	6.2	0.5	-5.1	0	6.2	0	16	6.2	-21.1
75 8	0	0	-5.6	0	0	0	7.5	0	-13.1
75 9	0	0	-7.4	0	0	0	-23	0	15.6
75 10	0	0	-3.9	0	0	0	-3	0	-0.9
75 11	0	0	-3.1	0	0	0	-5	0	1.9
75 12	2.5	2	4	0	2.5	0	5.5	2.5	-1.5
76 1	118	20.4	61.5	0	112.5	5.5	13	44.2	48.5
76 2	51.9	19.4	45	0	49.9	2	6.5	47.1	38.5
76 3	55.2	4.9	18.4	0	53	2.2	9.5	29.4	8.9
76 4	0	0	1.5	0	0	0	-26.5	0	28
76 5	0	0	2.4	0	0	0	-2	0	4.4
Total	233.8	47.2	101.5	0	224.1	9.7	-1.5	129.4	103
76 6	0	0	2.7	0	0	0	-0.5	0	3.2
76 7	0	2.1	4.9	0	0	0	4	0	0.9
76 8	0	0	-2.9	0	0	0	6	0	-8.9
76 9	8.2	0	1	0	8.2	0	-5	0	6
76 10	0	0.7	5.4	0	0	0	-3	0	8.4
76 11	17.3	0	4.2	0.2	16.9	0.2	3	0	1.4
76 12	68.1	2.7	35.8	0	65.2	2.9	5	29.8	30.8
77 1	26.3	2.1	20.6	0	25.6	0.7	2	11.1	18.6
77 2	2.6	0	17.2	0	2.6	0	2	0	15.2
77 3	38.7	4.3	21.1	0	37.3	1.4	-0.5	16.8	21.6
77 4	10.9	3.3	-15.5	0	10.9	0	-1.5	10.9	-14
77 5	0	1.7	-38.1	0	0	0	-0.5	0	-37.6
Total	172.1	16.9	56.4	0.2	166.7	5.2	11	68.6	45.6
77 6	0	0	3.3	0	0	0	-5	0	8.3
77 7	0	0	36.5	0	0	0	-4	0	40.5
77 8	0	0	49.9	0	0	0	3.5	0	46.4
77 9	0	0	-0.2	0	0	0	3.5	0	-3.7
77 10	17.6	0.2	-1.1	0	17.6	0.2	4.5	17.6	-5.8
77 11	0.2	0	-1.4	0	0.2	0	29	0	-30.4
77 12	0	0	-0.5	0	0	0	26	0	-26.5
78 1	34.2	3.9	15.7	0	33.1	1.1	6	8.3	9.7
78 2	6.5	0	4.2	0	6.5	0	-41	0	45.2
78 3	2	0	4.2	0	2	0	-30	0	34.2
78 4	0	0	3.9	0	0	0	-0.5	0	4.4
78 5	0	0	4	0	0	0	-1.5	0	5.5
Total	60.5	4.1	118.5	0	59.4	1.3	-9.5	25.9	127.8
78 6	3.6	0	5.3	0	3.6	0	2	0	3.3
78 7	0	0.7	-2.6	0	0	0	2.5	0	-5.1
78 8	0	0	8.5	0	0	0	2	0	6.5
78 9	0	0	1.3	0	0	0	0.5	0	0.8
78 10	0	0	5.8	0	0	0	-5	0	10.8
78 11	0.3	0	3	0	0.3	0	-22.5	0	25.5
78 12	21.4	0.7	4.2	0	21	0.4	-22	3	26.2
79 1	0	0	-4.7	0	0	0	36.5	0	-41.2
79 2	1.5	0	-10.1	0	1.5	0	44.5	0	-54.6
79 3	2.3	0	-1	0	2.3	0	-16.5	0	15.5
79 4	0	0	23.1	0	0	0	-11	0	34.1
79 5	0	0	2.7	0	0	0	11	0	-8.3
Total	29.1	1.4	35.5	0	28.7	0.4	22	3	13.5
79 6	0	0	-0.4	0	0	0	-17.5	0	17.1
79 7	0	0	3.1	0	0	0	-15	0	18.1
79 8	0	0	1.4	0	0	0	0	0	1.4
79 9	36.6	0.2	1.4	0	35.4	1.2	6	11.7	-4.6
79 10	0.7	0	1.5	0	0.7	0	6.5	0	-5
79 11	58.4	2	6	0	56	2.4	4	41	2
79 12	1.7	0	-0.8	0	1.7	0	2	0	-2.8
80 1	2.2	0.4	-4.4	0	2.2	0	4	2.2	-8.4
80 2	3.9	0.7	-5.4	0	3.9	0	0.5	3.9	-5.9
80 3	1.2	0	0.1	0	1.2	0	-4.5	0	4.6
80 4	0	0	1.8	0	0	0	-1.5	0	3.3

75 2	0	0	2.6	0	0	0	-5	0	7.6
75 3	0	0	5.4	0	0	0	-2.5	0	7.9
75 4	0	0	4.6	0	0	0	-3	0	7.6
75 5	0	0	4.7	0	0	0	3	0	1.7
Total	49.3	5.6	44.2	0	47.6	1.7	-3	13.8	47.2
75 6	0	0	-6.2	0	0	0	0	0	-6.2
75 7	6.2	0.5	-5.1	0	6.2	0	16	6.2	-21.1
75 8	0	0	-5.6	0	0	0	7.5	0	-13.1
75 9	0	0	-7.4	0	0	0	-23	0	15.6
75 10	0	0	-3.9	0	0	0	-3	0	-0.9
75 11	0	0	-3.1	0	0	0	-5	0	1.9
75 12	2.5	2	4	0	2.5	0	5.5	2.5	-1.5
76 1	118	20.4	61.5	0	112.5	5.5	13	44.2	48.5
76 2	51.9	19.4	45	0	49.9	2	6.5	47.1	38.5
76 3	55.2	4.9	18.4	0	53	2.2	9.5	29.4	8.9
76 4	0	0	1.5	0	0	0	-26.5	0	28
76 5	0	0	2.4	0	0	0	-2	0	4.4
Total	233.8	47.2	101.5	0	224.1	9.7	-1.5	129.4	103
76 6	0	0	2.7	0	0	0	-0.5	0	3.2
76 7	0	2.1	4.9	0	0	0	4	0	0.9
76 8	0	0	-2.9	0	0	0	6	0	-8.9
76 9	8.2	0	1	0	8.2	0	-5	0	6
76 10	0	0.7	5.4	0	0	0	-3	0	8.4
76 11	17.3	0	4.2	0.2	16.9	0.2	3	0	1.4
76 12	68.1	2.7	35.8	0	65.2	2.9	5	29.8	30.8
77 1	26.3	2.1	20.6	0	25.6	0.7	2	11.1	18.6
77 2	2.6	0	17.2	0	2.6	0	2	0	15.2
77 3	38.7	4.3	21.1	0	37.3	1.4	-0.5	16.8	21.6
77 4	10.9	3.3	-15.5	0	10.9	0	-1.5	10.9	-14
77 5	0	1.7	-38.1	0	0	0	-0.5	0	-37.6
Total	172.1	16.9	56.4	0.2	166.7	5.2	11	68.6	45.6
77 6	0	0	3.3	0	0	0	-5	0	8.3
77 7	0	0	36.5	0	0	0	-4	0	40.5
77 8	0	0	49.9	0	0	0	3.5	0	46.4
77 9	0	0	-0.2	0	0	0	3.5	0	-3.7
77 10	17.6	0.2	-1.1	0	17.6	0.2	4.5	17.6	-5.8
77 11	0.2	0	-1.4	0	0.2	0	29	0	-30.4
77 12	0	0	-0.5	0	0	0	26	0	-26.5
78 1	34.2	3.9	15.7	0	33.1	1.1	6	8.3	9.7
78 2	6.5	0	4.2	0	6.5	0	-41	0	45.2
78 3	2	0	4.2	0	2	0	-30	0	34.2
78 4	0	0	3.9	0	0	0	-0.5	0	4.4
78 5	0	0	4	0	0	0	-1.5	0	5.5
Total	60.5	4.1	118.5	0	59.4	1.3	-9.5	25.9	127.8
78 6	3.6	0	5.3	0	3.6	0	2	0	3.3
78 7	0	0.7	-2.6	0	0	0	2.5	0	-5.1
78 8	0	0	8.5	0	0	0	2	0	6.5
78 9	0	0	1.3	0	0	0	0.5	0	0.8
78 10	0	0	5.8	0	0	0	-5	0	10.8
78 11	0.3	0	3	0	0.3	0	-22.5	0	25.5
78 12	21.4	0.7	4.2	0	21	0.4	-22	3	26.2
79 1	0	0	-4.7	0	0	0	36.5	0	-41.2
79 2	1.5	0	-10.1	0	1.5	0	44.5	0	-54.6
79 3	2.3	0	-1	0	2.3	0	-16.5	0	15.5
79 4	0	0	23.1	0	0	0	-11	0	34.1
79 5	0	0	2.7	0	0	0	11	0	-8.3
Total	29.1	1.4	35.5	0	28.7	0.4	22	3	13.5
79 6	0	0	-0.4	0	0	0	-17.5	0	17.1
79 7	0	0	3.1	0	0	0	-15	0	18.1
79 8	0	0	1.4	0	0	0	0	0	1.4
79 9	36.6	0.2	1.4	0	35.4	1.2	6	11.7	-4.6
79 10	0.7	0	1.5	0	0.7	0	6.5	0	-5
79 11	58.4	2	6	0	56	2.4	4	41	2
79 12	1.7	0	-0.8	0	1.7	0	2	0	-2.8
80 1	2.2	0.4	-4.4	0	2.2	0	4	2.2	-8.4
80 2	3.9	0.7	-5.4	0	3.9	0	0.5	3.9	-5.9
80 3	1.2	0	0.1	0	1.2	0	-4.5	0	4.6
80 4	0	0	1.8	0	0	0	-1.5	0	3.3
80 5	0	0	1.2	0	0	0	-0.5	0	1.7
Total	104.7	3.3	5.5	0	101.1	3.6	-16	58.8	21.5
80 6	0	0	1.4	0	0	0	0	0	1.4
80 7	0	0	0.8	0	0	0	0	0	0.8
80 8	0	0	0.3	0	0	0	0	0	0.3
80 9	0	0	0.3	0	0	0	0	0	0.3
80 10	0.8	0	0.3	0	0.8	0	0	0	0.3
80 11	0	0	0.5	0	0	0	1	0	-0.5
80 12	4.8	0	-0.5	0	4.8	0	4	0	-4.5
81 1	0	0	-0.5	0	0	0	0	0	-0.5
81 2	1.5	0	3.1	0	1.5	0	-16	0	19.1
81 3	18.2	0.1	4.3	0.2	17.7	0.3	-11	0	15.5
81 4	12.6	1.2	8.4	0	12.6	0	8	12.6	0.4
81 5	0	0	5.3	0	0	0	7.5	0	-2.2
Total	37.9	1.3	23.7	0.2	37.4	0.3	-6.5	12.6	30.4

APPENDIX D. GEOLOGY



APPENDIX D GEOLOGY

1. Progress of the Field Survey

The progress of the field survey which was carried out during the period from December 1981 to March 1982 is briefly summarized in this paragraph. Descriptions and considerations are mentioned in succeeding chapters.

1.1 Geological Survey

Geological Survey was performed in the purposes (i) to clarify geology and geological structure of the Wadi Jizzi River basin, (ii) to determine the dam site and (iii) to investigate detailed geology around the dam site.

Areal geological survey was almost assisted by analyzing aerial photographs and by reviewing existing reports. Most of survey works was focussed on the purposes (ii) and (iii).

Taking into considerations the commanded catchment area, topography and geology of river bed and both abutments and also construction cost of the dam, the location of the dam site was determined from five potential sites to the point D_2 where the Wadi Jizzi encounters with the Wadi Awhin, altitude of which is about 160 m above sea level. Detailed geological survey, drilling and permeability test were carried out at around this site. The results are illustrated in the Figure D-1, D-2 and Drawing D-1002 (Main Report).

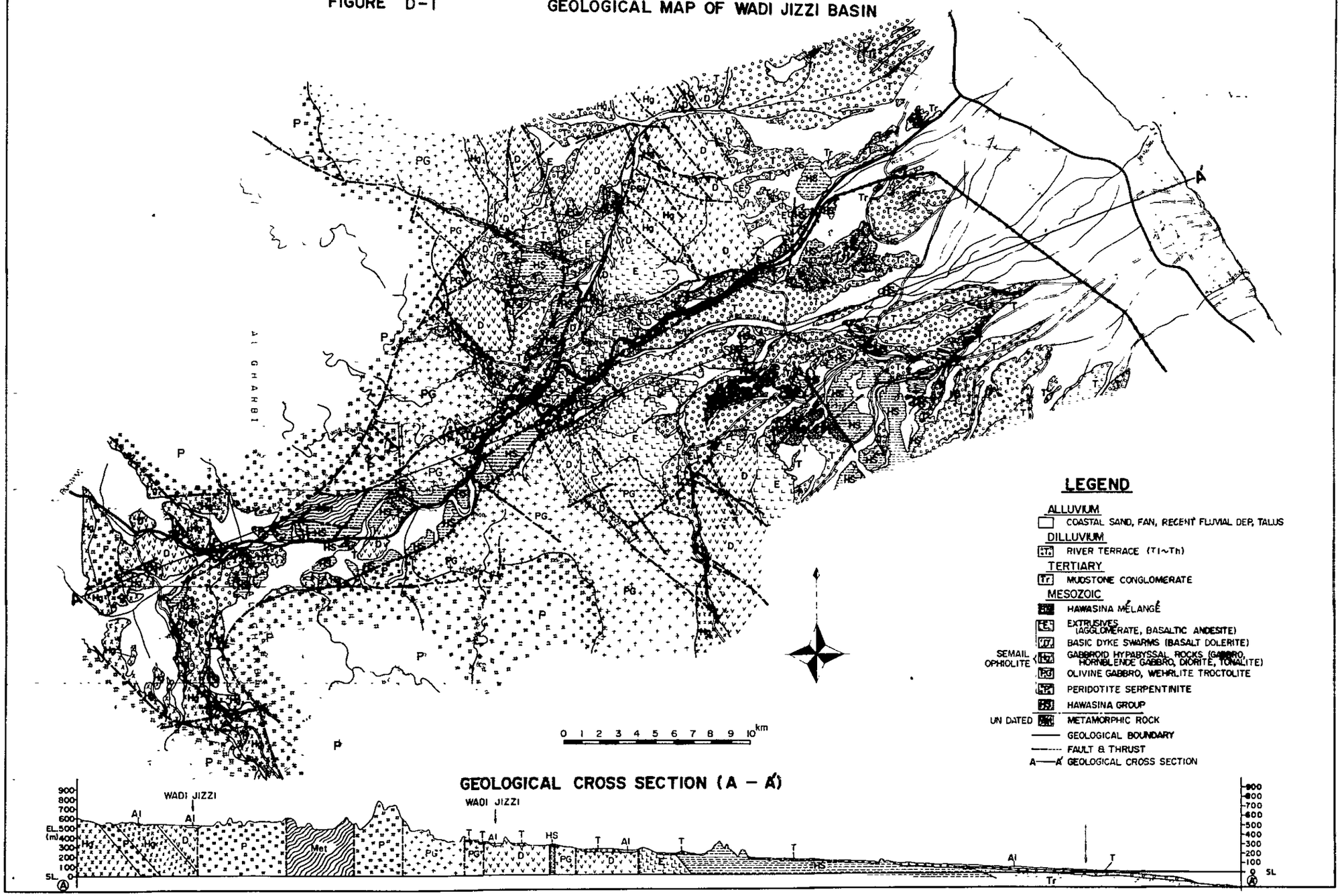
1.2 Drilling and permeability test

Eight holes were drilled at along the dam axis in order to know the permeability of dam foundation. Location and depth of drilling are indicated in Drawing D-1002.

Descriptions of drilling method:

Drilling machine: D-40K (U.S.), DR-1500 (India)
Drilling method: Rotary drilling

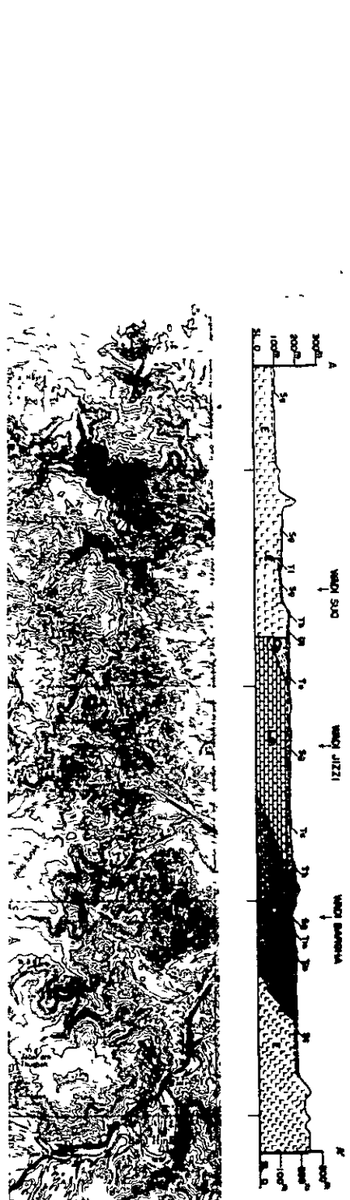
FIGURE D-1 GEOLOGICAL MAP OF WADI JIZZI BASIN



GEOLOGICAL CROSS SECTION (A – A')

FIGURE D-2 GEOLOGICAL MAP OF THE WADI JIZZI BASIN

(MIDDLE & LOWER STREAM AREA)



Bit:	Tricone bit
Diameter of bit:	20cm and 15cm

After drilling to the expected depth, a steel casing was inserted up to the bottom and then, the hole was thoroughly cleaned by circulating water. Then, permeability test was performed by the water injection method. Permeability coefficient can be obtained from the following equation;

$$k = \frac{2.30 r_0}{4t} \log_{10}(S_0/S_t)$$

where, r_0 = diameter of bore hole, S_0 = water level of initial state, S = water level after t hours and t = time in hours after stopping injection.

Descriptions of drill logs and results of permeability test are shown in Figures D-3 to D-10 and Table D-1.

2. Geology of the Wadi Jizzi Basin

2.1 Topography

The surveyed area is classified into three landforms from a topographical view point, that is, mountainland, hill and lowland. Mountainlands are situated in the upper reaches of the Wadi Jizzi basin and composed mainly of peridotite of the Semail Ophiolite Complex. The middle stream area of the basin presents a landform of hills composed of effusive and basic dyke rocks of the ophiolite complex, and of sedimentary rocks and terrace deposits. The lower stream area forms a lowland including fan, talus and dune deposits.

In the mountainland, ridges of more than 900 m height above sea level, among which that of 1,438 m is the highest, are surrounding the upper stream area, constituting watershed. Mountains take a steep and rigid appearance reflecting the nature of composing rocks and valleys are deeply eroded downward taking a form of V-valley. Drainage system shows a trellis pattern in general, but is often

modified into complicated patterns being affected by lithofacies and faults.

The hill land is composed of mountain hills and monadnocks of 100 to 500 m height above sea level. Drainage texture of the mountain hill area is of dendritic pattern, while, that of monadnocks and river terrace area is of parallel one. Rivers have a gentle gradient compared to those of mountainland and river bed appears flat in general. In the hill land area, there develop many river terraces which are classified into four steps according to their relative altitude, continuity and grade of dissection. The highest river terrace "Th" is strongly dissected and has a relative altitude of more than 25 m above river bed. It is considered that the terrace might be the oldest one brought by the Wadi Jizzi. The upper terrace deposits "Tu" of a relative altitude of about 20 m show the most wide distribution among four terraces and develop especially at around the dam site. The middle terrace deposits "Tm" are situated at the middle stream area and its extent of distribution is next to that of the upper terrace. The terrace has a relative altitude of 5 to 15 m and keeps well a form of terrace without much dissection. The lower terrace "Tl" is distributed at the boundary area with the lowland and, consequently, its lowest end is covered by fan deposits. It has a relative altitude of 0 to 3 m above present river bed and surface plane of fan deposits. In this mountain hill area, a landform of talus is often found at the piedmont of mountain hills and monadnocks.

The lowland mainly composed of a landform of fan has an altitude of 0 to 100 m above sea level. Generally speaking, drainage system in the fan area is of parallel pattern, but it always varies from place to place. Deltaic fan found at the end of fan deposits has a very gentle gradient so as to cause a deposition of clay and silt by a stagnant flood water. Dune of 50 to 500 m in width is found on the sea coast.

2.2 Outline of geological history

Geology of the Wadi Jizzi basin is consist of sedimentary rocks of the Hawasina Group, basic rocks of the Semail Ophiolite Complex, mudstone and conglomerate of the Neogene Tertiary Formation and Quaternary sediments. Geological map of the investigated area is shown in Figure D-1, D-2 and stratigraphic succession in Table D-2.

The geological history of the area is briefly summarized as follows. In the Jurassic to Cretaceous age, flysch-type sediments (Hawasina Group) were formed in the geosynclinal sea of the marginal zone of Arabian plateau. This sedimentation was followed by violent activities of oceanic crust resulting an enormous amount of effusive and intrusive basic rocks (Semail Ophiolite Complex). This activity caused at the same time the formation of a mixture of flysch with ophiolite (Hawasina Melange). In the late Cretaceous to Paleogene age, geosyncline transformed into geanticline and the upheaval movement gave rise to extensive folding and thrusting of these formation. The Oman mountain range was formed by later block movement which at the same time caused a graben structure of the Wadi Jizzi basin. In the Tertiary, most of the area was exposed on the surface ground except a narrow marginal belt of the mountain range where a little amount of flysch-type sediments were brought (Neogene Tertiary Formation). Quaternary glacial eustasy gave rise to the four steps of terrace deposits along the drainage system of the Wadi Jizzi. The Present landform was constructed through recent sedimentation along the Wadi Jizzi as fan, talus and fluvial deposits.

Geological structure of this area is characterized by the zonal arrangement of basic rocks elongated in the N-S direction and by the E-W trending faults along the Wadi Jizzi. These faults brought the area a graben structure where distributes the Hawasina Group.

Table D-2 Stratigraphic Succession of the Wadi Jizzi Basin

Age		Formation	Rock Facies	Remarks
Quaternary	Alluvium	Dune deposits	silt, sand	along the sea coast.
		Fan deposits	silt, sand, gravel	vast distribution in the lower stream area.
		Fluvial deposits	silt, sand, gravel	on the recent river floor.
		Talus deposits	silt, clay, gravel	at the piedmont.
	Diluvium	Lower terrace	sand, gravel	in the lower stream area, 0 to 3 m high.
		Middle terrace	sand, gravel	in the lower stream area, 5 to 10 m high.
		Upper terrace	sand, gravel	most wide distribution, 20 m high.
		Higher terrace	sand, gravel	much dissected, more than 25 m.
Ter-tiary		Neogene Tertiary Formation	mudstone, conglo-merate	in the lower stream, small in scale.
Mesozoic		Hawasina Mélange	limestone, chert basalt	in the middle stream.
		Semail Ophiolite Complex	basalt lava, pillow lava, agglomerate, dolerite, gabbro, dunite, peridotite, serpentinite	wide distribution, takes nappe structure, Peridotite of the upper reaches forms strong-relief moun-tains.
		Hawasina Group	limestone, chert	in the upper and middle stream areas, forms low-relief hills and monadnocks, basement of the dam site
un-dated		Metamorphic Rock	amphibolite	in the upper stream, near Al Wasit.