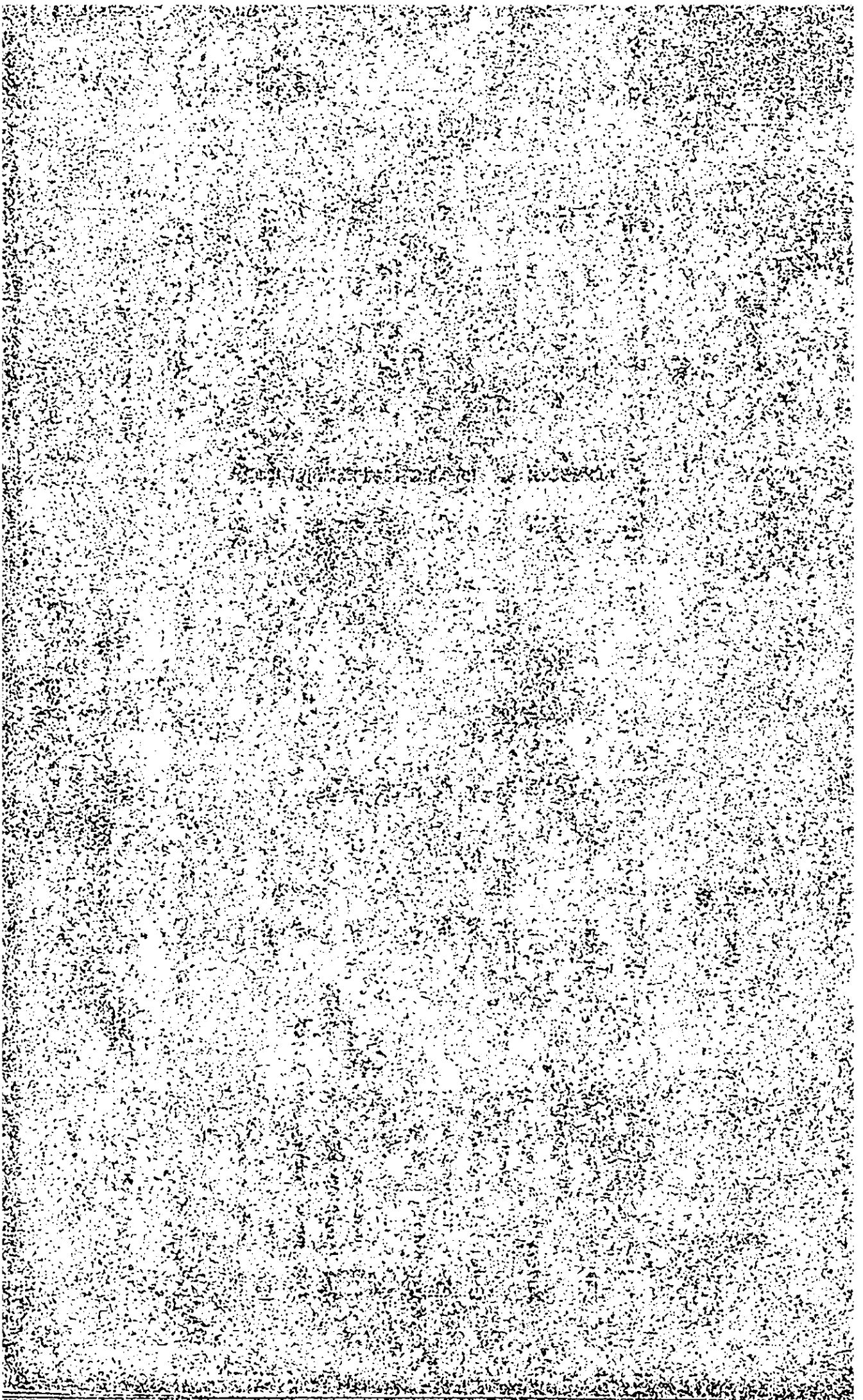


APPENDIX K. PROJECT IMPLEMENTATION



APPENDIX K. PROJECT IMPLEMENTATION

K-1. Construction Plan of Major Civil Works

K-2. Pre-engineering Works

K-3. Operation and Maintenance Cost

K-4. Term of Reference for the Consultant's Services

1. A work schedule of major civil works including the acquisition, construction, commissioning and maintenance of the works.

2. The construction schedule shall include the equipment and materials and the construction equipment to be used in the works.

3. Training of personnel.

4. The works shall be completed within the period of 24 months from the start of the works. The works shall be completed by the end of the year 2000.

5. In the case of any delay in the completion of the works, the contractor shall be liable for the delay. The contractor shall be liable for the delay in the completion of the works. The contractor shall be liable for the delay in the completion of the works. The contractor shall be liable for the delay in the completion of the works.

Construction Plan of Major Civil Works

The attached construction schedule itemized the construction works under the Wadi Jizzi Agricultural Development Project. The detail descriptions for the construction works of the detention dam are hereinafter made.

These representative schedule was enumerated based upon the following items.

- i) A working system of seven hours a day was employed for equipment operation, excluding the check time for equipment before operation,
- ii) The construction schedule was planned based upon the output of equipment, and required construction equipment are tabulated in Table J-3.

1. Staging of Detention Dam Construction

Since the river bed is almost dry throughout the year except the winter season in November to March and is fair wide about 650 m, construction of the detention dam in two stage by using the multi-staged diversion system will be introduced.

In the first stage, while the existing water course near the right bank will be utilized as temporary open water way with about 500 m length diversion canal which consists of cut and bank cross-section having a capacity of 5-year probability flood discharge of about 600 cu.m/sec, the construction of the left of the dam body including the outlet conduit would be commenced in September, 1984 and completed by April, 1985. During the above period for the construction of the dam body, construction of the spillway would also be made. The remaining construction works of dam body would be carried out during the months of May to November just after the winter season and completed by the end of November 1985.

2. Excavation Works

The river bed and both abutments contain objectionable materials in their surface layer such as top-soil, loose rocks, debris, mud, plants and roots, therefore, the surface layer of about 0.5 m deep on an average should be removed before placing embankment materials.

For the trench along the dam axis, the excavation shall be performed not to create extremely irregular surface and very steep slope, and the excavation depth is assumed to reach 2 m on an average. These excavation works will be executed by in a conventional way to combine tractor-shovels, bulldozers and dump trucks, and those excavated materials will be hauled to the spoil areas located immediately downstream of the dam body.

Excavation works along the conduit will be commenced in following those for the dam foundation by combination of backhoes, bulldozers and dump trucks.

No special measurements such as coffering and dewatering will be required in excavation works for the dam foundation and conduit works.

Since there is no rock foundation around the spillway site, excavation works for the spillway will be mostly composed of sand and gravel excavation. The major equipment will be tractor-shoves, bulldozers and dump trucks for borrowing and hauling excavated materials. These excavation works should be performed in accordance with the embankment schedule of the dam body.

3. Embankment Works

The detention dam is designed mainly to have two zones, that is, central sand and gravel zone and rock zone taking into consideration the embankment materials available around the dam site and their mechanical characteristics.

Central sand and gravel zone is located in the central part of the dam body. For this zone semi-pervious materials with the permeability coefficient less than 1×10^{-4} cm/sec will be obtained from the terrace deposits around the spillway site. The borrowing and embankment works will be made by construction equipment such as tractor-shovels, bulldozers, dump trucks and vibrating roller, etc.

Rock zone will be located on the both sides of central sand and gravel zone as the outer shells of the dam body and will be constructed rock materials to be obtained at the quarry site.

In embankment of the central sand and gravel zone, the materials should be compacted by the vibrating roller with watering, for each banking layer of about 30 cm.

The spreaded rock materials should also be compacted by the vibrating roller.

4. Concrete Works

Concrete to be used for the concrete works of the Project will be specified into two as follows:

<u>Kind of Concrete</u>	<u>Standard of Proportion</u>	
	<u>Weight of cement</u> (kg/m ³)	<u>Max-size of aggregate</u> (mm)
Reinforced concrete (Class A)	350	40
Plain concrete (Class B)	250	40

As regards cement, the portland cement will be used since it can be obtained in the market of the Oman. Aggregate materials will be collected from river deposits around the dam site. In order to remove the silty materials including in the river deposits and to obtain appropriate size of aggregate, river deposits will be washed and screened at an aggregate plant to be provided at the site.

Concrete will be mixed by portable mixer with a capacity of 0,5 cu.m/batch at site, and mixed concrete there will be hauled by agitator truck to respective job sites, and placed by chuting gutter or centipede conveyer.

5. Plants and Equipment for Construction Works

Combination of tractor-shovels, backhoes and bulldozers with rippers or rakes may be the major working force in excavation and dump trucks might be used for hauling, while the vibrating rollers for compaction of the embankment.

Rocks for dam embankment will be produced at the upstream quarry site without using of explosive.

Filter materials and aggregate for concrete will be produced to screen the river bed materials at the screening plant to be provided.

A 0.5 cu.m/batch mixing plant will be erected on the left bank near the emergency outlet. Concrete mixed here will be delivered to the respective placing sites by a 3.0 cu.m agitator trucks. A chutting gutter or centipede conveyer will be employed to place concretete.

The construction plant and equipment for the Project are listed in Table J-3.

6. Construction Schedule

The detention dam is expected to be completed by November, 1985 in order to store temporary flood discharges from the rainy season. The construction period of about 15 months has been scheduled in consideration of the present river flood conditions as well as construction methods. Under the situations, the construction of detention dam should be started in Spetember, 1984.

It is economical and safe to execute the construction works of the dam by using the multiple-stage diversion system. The construction plan schedules to start the works of the left bank in September, 1984, while keeping space of the right bank for flood way during the rainy season, whereas the right bank construction works of the dam will be commenced immediately after the rainy season of 1985, and completed by November of the same year.

The excavation works of the spillway may be commenced concurrently the embankment works of the dam body in consideration of the direct haul of materials excavated at the spillway site to the embankment place. The excavation period of the spillway will be about eight months as shown in the attached construction schedule.

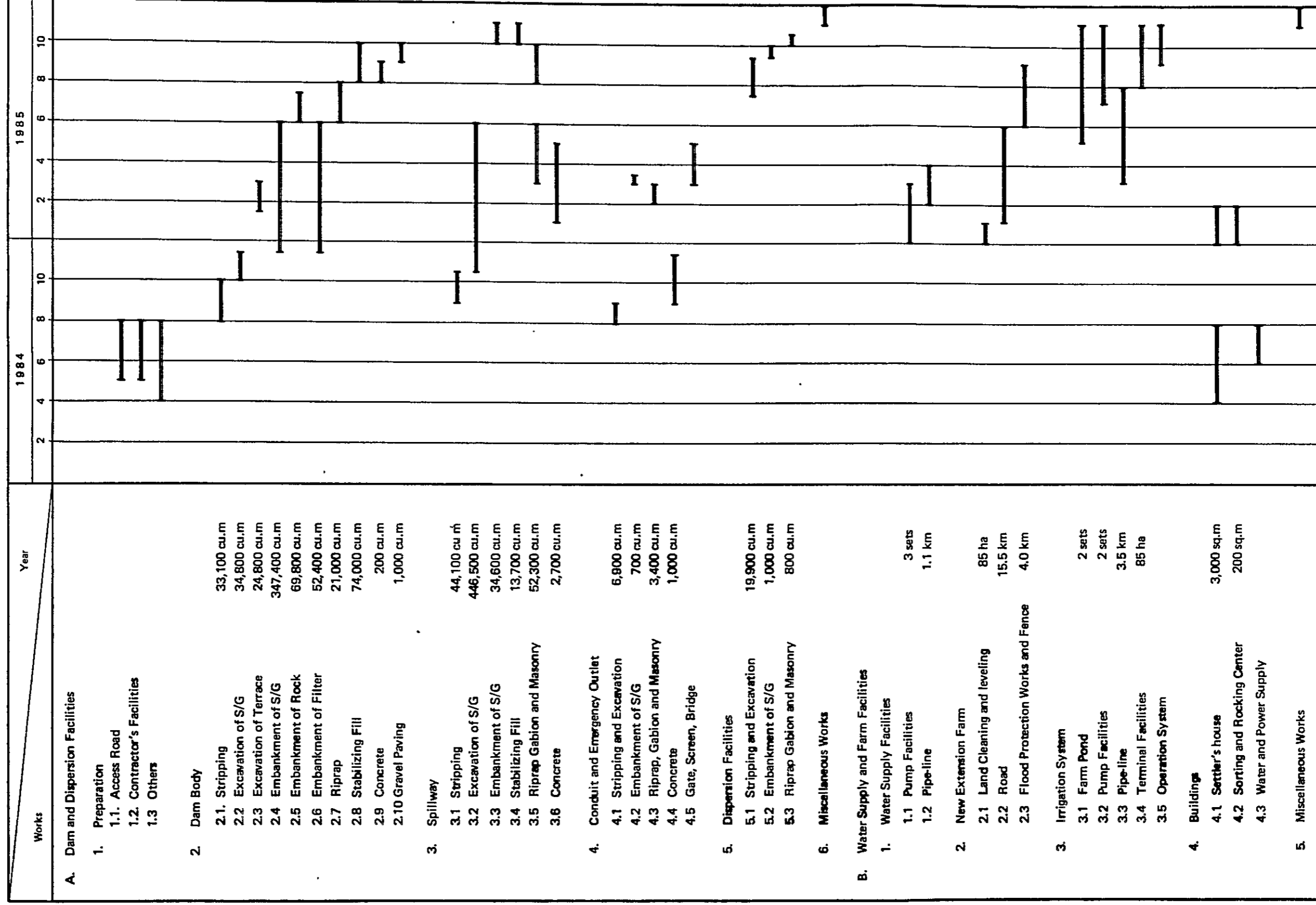
Since the outlet conduit is located beneath the dambody, the conduit works will be completed prior to the embankment works of the dambody.

The construction works of water supply facilities and farm will be executed within above-mentioned period by applying the same equipments of the detention dam.

The construction schedule covering the entire works is shown in Figure K-1, i.e., the construction of the facilities will start from May 1984 and the Project will complete by the end of 1985.

The schedule is not tight, and it is conceivable that the contractor may work longer hours a day for shortening the schedule.

FIGURE K-1 CONSTRUCTION SCHEDULE OF MAJOR WORKS



Pre-engineering Works

For the commencement of the final design, the following survey and investigation should be completed:

(a) Dam and Structures

1) Topographic Survey and Cross Sectional and Longitudinal Survey

Detention Dam

Topographic Survey:

Reservoir Area : 250 ha (scale 1:2,000)

Longitudinal Section:

Dam Axis : L = 1,300m

Spillway : L = 700

Conduit : L = 250

Emergency Outlet : L = 450

Total $\Sigma L = 2,700$

Cross Section:

Dam : L = 3,000m (20 sections @150m)

Spillway : L = 2,000 (10 sections @200m)

Conduit : L = 300 (15 sections @ 20m)

Emergency Outlet : L = 90 (6 sections @ 15m)

Total $\Sigma L = 5,390$

Dispersion Facilities

Longitudinal Section:

Dike : L = 150m

Canal : L = 11,150

Cross Section:

Dike : L = 150m

Canal : L = 400

2) Geological Survey

Bore-hole Drilling:

<u>Item</u>	<u>Site ^{1/}</u>						
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>
Bore-hole Drilling (m)	40	30	30	40	30	30	30
Penetration Test (time)		20		30			
Permeability Test (time)	3	2	2	3	2	2	2

1/ : Refer to Figure K-2

Material Investigation :

Physical tests for : 3 samples
embankment materials

(b) New Extension Farm Land

Topographic survey : 200 ha (scale 1:1,000)

FIGURE K-2 LOCATION MAP FOR ADDITIONAL

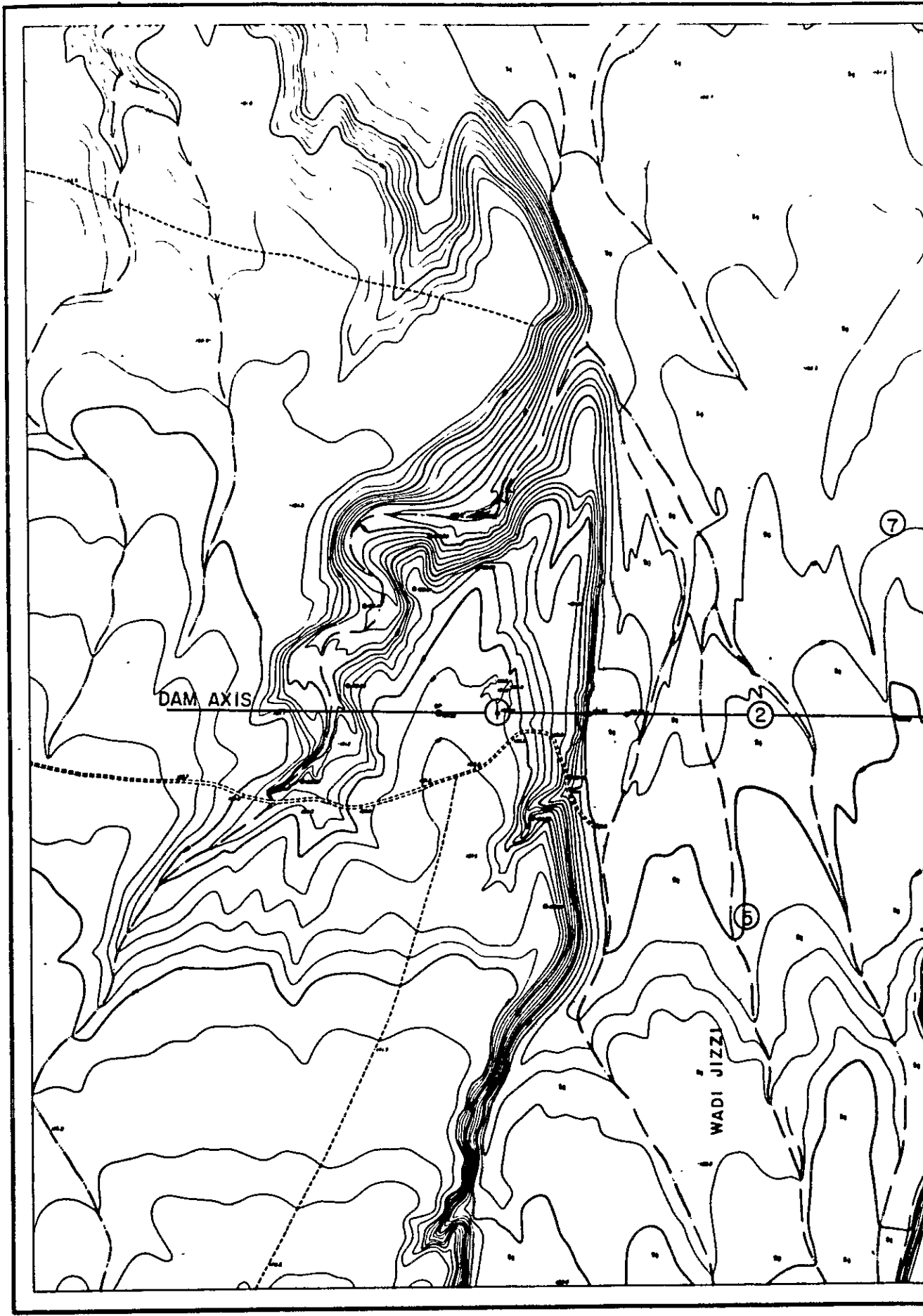
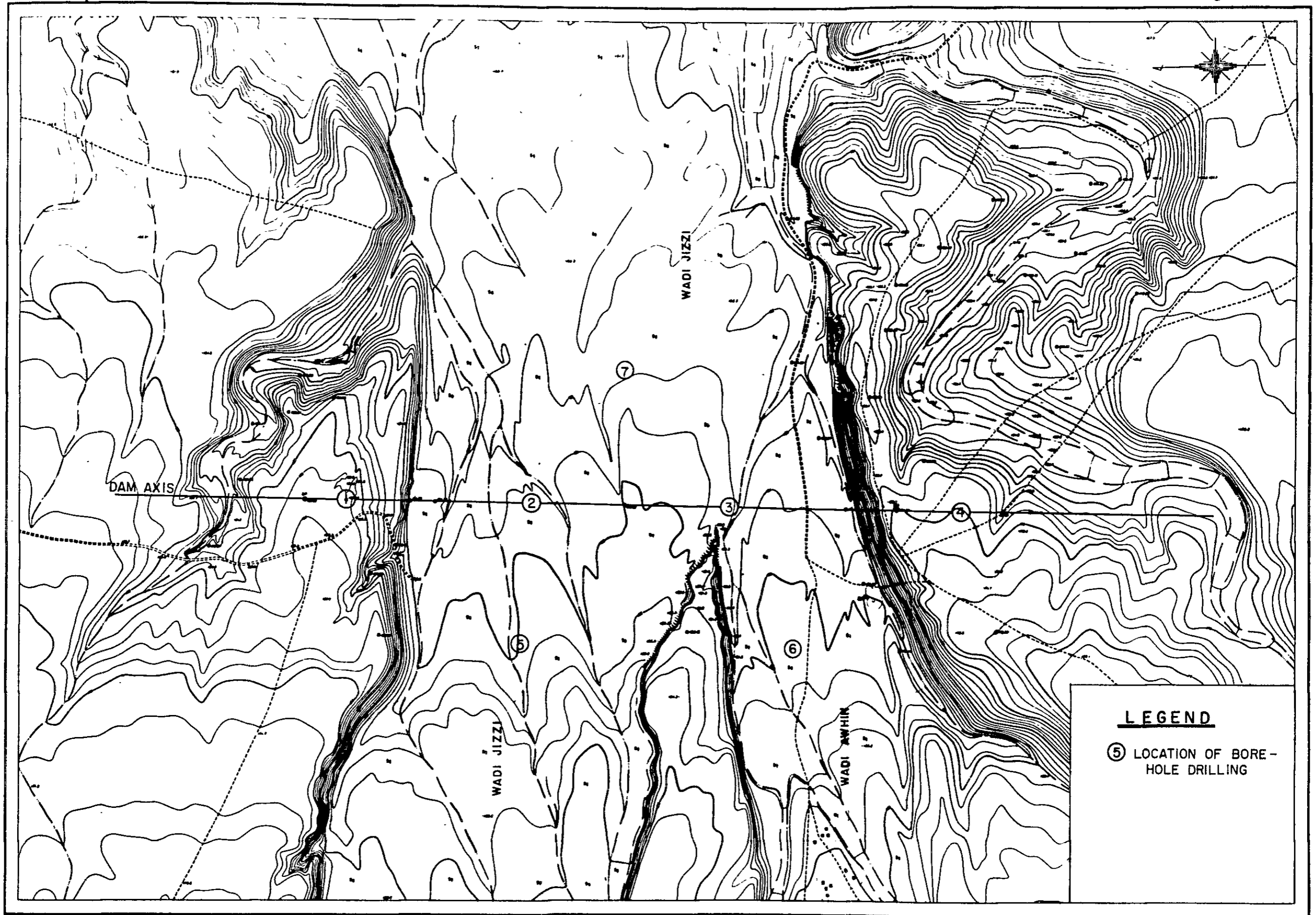


FIGURE K-2 LOCATION MAP FOR ADDITIONAL BORE-HOLE DRILLING SURVEY



LEGEND

⑤ LOCATION OF BORE-HOLE DRILLING

2,000

Operation and Maintenance Cost

1. Salaries and Wages

<u>Item</u>	<u>Description</u>	<u>No. of Personnel</u>	<u>Salary per Annum (R.O.)</u>	<u>Total Salary per Annum (R.O.)</u>
O&M Office (Main Office)				
	Manager	1	6,000	6,000
	Deputy manager	1	5,000	5,000
	Administrative officer	1	3,500	3,500
	Accountant	1	3,000	3,000
	Driver	1	2,000	2,000
	Equipment Operator	1	3,500	3,500
	Store Keeper	1	1,500	1,500
	Securing guard	1	1,000	1,000
	<u>Total</u>	<u>8</u>		<u>25,500 (G)</u> ^{1/}

2. Equipment Operation

a) O&M Office

<u>Depreciation Cost</u>	<u>Quantity</u>	<u>Unit Cost (R.O.)</u>	<u>Total Cost (R.O.)</u>	<u>Depreciation Cost (R.O.)</u>
Station wagon, 4x4	2	5,000	10,000	1,000

Fuel and Oil

2 units x 10,000 km/year x 0.2 ℓ/km x 0.126 R.O./ℓ = 504

Sub-total 1,504 (G)

b) Branch Office

<u>Depreciation Cost</u>	<u>Quantity</u>	<u>Unit Cost (R.O.)</u>	<u>Total Cost (R.O.)</u>	<u>Depreciation Cost (R.O.)</u>
Station wagon, 4x4	2	5,000	10,000	1,000
Saloon car	1	5,000	5,000	500
Truck	2	10,000	20,000	2,000

^{1/} : O&M cost expended by the Government.

Fuel and Oil

(3 units x 10,000 km/year x 0.2 ℓ/km + 1 unit x 10,000 km/year x 0.3 ℓ/km) x 0.126 R.O./ℓ =	1,134
<u>Sub-total</u>	4,634 (F)
<u>Total</u>	<u>6,140</u>

3. Materials and Supplies

a) Detention Dam

Removal of sediment deposit :	
81,200 cu.m/year x 1.00 R.O./cu.m =	<u>81,200 (G)</u>

b) Irrigation and Farm Facilities

Irrigation facilities : 419,900 R.O. x 0.025 =	10,497
Farm facilities : 137,500 R.O. x 0.020 =	2,750
<u>Sub-total</u>	<u>13,247 (F)</u>

c) Pump Operation Cost (See Table K-1 and Table K-2)

Lifting Pump :	3,338
Delivery Pump :	7,004
<u>Sub-total</u>	<u>10,342 (F)</u>

d) Building

Branch office : 200 sq.m x 100 R.O./sq.m x 0.025 =	500
Pump stations : 159 sq.m x 120 R.O./sq.m x 0.025 =	477
<u>Sub-total</u>	<u>977 (F)</u>
<u>Total</u>	<u>105,770</u>

4. Administration and General Expenditure ^{1/}

25,500 R.O. x 15% =	3,825 (G)
<u>Grand Total</u>	<u>141,230</u>

^{1/} : Inclusive of O&M cost for monitoring system.

Table K-1 Estimation of Annual Lifting Pump Operation Cost

<u>Month</u>	<u>Water Requirement</u> ('000 cu.m)	<u>Annual Operation Hour</u> ^{1/} (hr)	<u>Annual Power Consumption</u> ^{2/} (kwhr)	<u>Annual Operation Cost</u> ^{3/} (R.O.)
Jan.	65.5	244.2	8,180.7	163.6
Feb.	46.5	173.4	5,808.9	116.2
Mar.	93.3	347.9	11,654.7	233.1
Apr.	107.1	399.3	13,376.6	267.5
May	147.1	548.5	18,374.8	367.5
Jun.	152.5	568.6	19,048.1	380.9
Jul.	156.5	583.5	19,547.3	390.9
Aug.	148.7	554.4	18,572.4	371.5
Sep.	133.7	498.5	16,699.8	334.0
Oct.	122.5	456.7	15,299.5	305.9
Nov.	88.6	330.4	11,068.4	221.4
Dec.	74.5	277.8	9,306.3	186.1
<u>Total</u>	<u>1,336.5</u>	<u>4,983.2</u>	<u>166,937.5</u>	<u>3,338.6</u>

^{1/} : Annual Operation Hour = Water Requirement / Pump Capacity
Pump Capacity ;

SE-1 : 2.21 cu.m/min

SE-2 : 0.77

SE-3 : 1.49

Total 4.47

^{2/} : Annual Power Consumption = Annual Operation Hour x Motor Capacity

Motor Capacity ;

SE-1 : 18.5 kw

SE-2 : 7.5

SE-3 : 7.5

Total 33.5

^{3/} : Annual Operation Cost = Annual Power Consumption x Power Rate

Power Rate : 20 Baiza/kwh

Table K-2 Estimation of Annual Delivery Pump Operation Cost

<u>Month</u>	<u>Water Requirement</u> ('000 cu.m)	<u>Annual Operation Hour</u> <u>1/</u> (hr)	<u>Annual Power Consumption</u> <u>2/</u> (kwhr)	<u>Annual Operation Cost</u> <u>3/</u> (R.O.)
Jan.	65.5	63.6	17,172	343.4
Feb.	46.5	44.2	11,934	238.7
Mar	93.3	90.6	24,462	489.2
Apr.	107.1	104.0	28,080	561.6
May	147.1	142.9	38,583	771.7
Jun.	152.5	148.1	39,987	799.7
Jul.	156.5	152.0	41,040	820.8
Aug.	148.7	144.4	38,988	779.8
Sep.	133.7	129.9	35,073	701.5
Oct.	122.5	118.9	32,103	642.1
Nov.	88.6	86.0	23,220	464.4
Dec.	74.5	72.4	19,548	390.9
<u>Total</u>	<u>1,336.5</u>	<u>1,297.0</u>	<u>350,190</u>	<u>7,003.8</u>

1/ : Annual Operation Hour = Water Requirement / Pump Capacity
Pump Capacity ;

$$P_1 = 11.44 \text{ cu.m/min (2.859 cu.m/min x 4 units)}$$

$$P_2 = 5.72 \text{ (2.859 cu.m/min x 2 units)}$$

$$\underline{\text{Total}} \quad \underline{17.16}$$

2/ : Annual Power Consumption = Annual Operation Hour x Motor Capacity

Motor Capacity ;

$$P_1 = 180 \text{ kw (45 kw x 4 units)}$$

$$P_2 = 90 \text{ kw (45 kw x 2 units)}$$

$$\underline{\text{Total}} \quad \underline{270}$$

3/ : Annual Operation Cost = Annual Power Consumption x Power Rate
Power Rate = 20 Baiza/kwh

Term of Reference for the Consultant's Services

1. Objectives

The purpose of the Consultant's services is to assist the Government in the effective implementation of the project.

The Consultant's services are divided into following five stages as follows:

- i) Pre-engineering for the additional survey and investigation,
- ii) Final detailed design of the project,
- iii) Preparation of tender documents and tendering of the project,
- iv) Construction supervision of the project, and
- v) Operation and maintenance stage.

2. Specific term of Reference

The Consultants will provide a team to undertake the following Consultant's services.

- a) To conduct the arrangement for contract of additional survey and investigation.
- b) To conduct the detailed design, cost estimates, specifications and tender documents for civil works and for procurement of operation and maintenance equipments, construction machineries, construction materials and other goods and instruments necessary for the project.
- c) To conduit the project in the supervision of construction works.
- d) To assist and advise the Project Manager in preparing monthly construction schedule and work records.
- e) To assist and advise for operation and maintenance of the facilities.
- f) To train local counterpart personnel in all phases of project activities.

3. Expertise

- a) Senior Project Engineer with sufficient experience in the Planning, design, construction and operation and maintenance of the facilities and with sufficient seniority of function of team leader.
- b) Hydrologist with sufficient experience in evaluating the climatical and hydrological data and also analysing run-off discharge, water balance, and sedimentation.
- c) Engineering Geologist with sufficient experience in the geological investigation for the major structures such as retention dam, dispersion facility, structures and etc.
- d) Hydrogeologist with sufficient experience in the hydrogeological investigation and evaluation of potential yield of groundwater.
- e) Soil Mechanical Engineer with sufficient experience for soil mechanical investigation, test and stability analysis of dam and foundation by applying computer.
- f) Irrigation Engineer with sufficient experience to set up for applied research on several upland crops to be used in the proposed cropping scheme.
- g) Agronomist with sufficient experience in the crop and soil management under upland crops at the farm level as well as in agricultural supporting services.
- h) Design Engineer with sufficient experience in the planning, design and construction of dam, pump and pipeline, farm and irrigation system and housing.
- i) Mechanical Engineer with experience in management and organization of operation and maintenance of construction equipment.
- j) Electrical Engineer with experience for planning and designing of electric facilities.

- k) Construction planner with sufficient experience in planning and designing of project construction.
- l) Cost Estimator to prepare the project costs in the both manners of force account and contract bases.
- m) Tender documents specialist and specification writer with sufficient experience for the preparation of tender documents and specifications of the project.
- n) Surveyor to prepare the required survey map for the detailed design of dams and structures.

4. Services to be provided by the Government

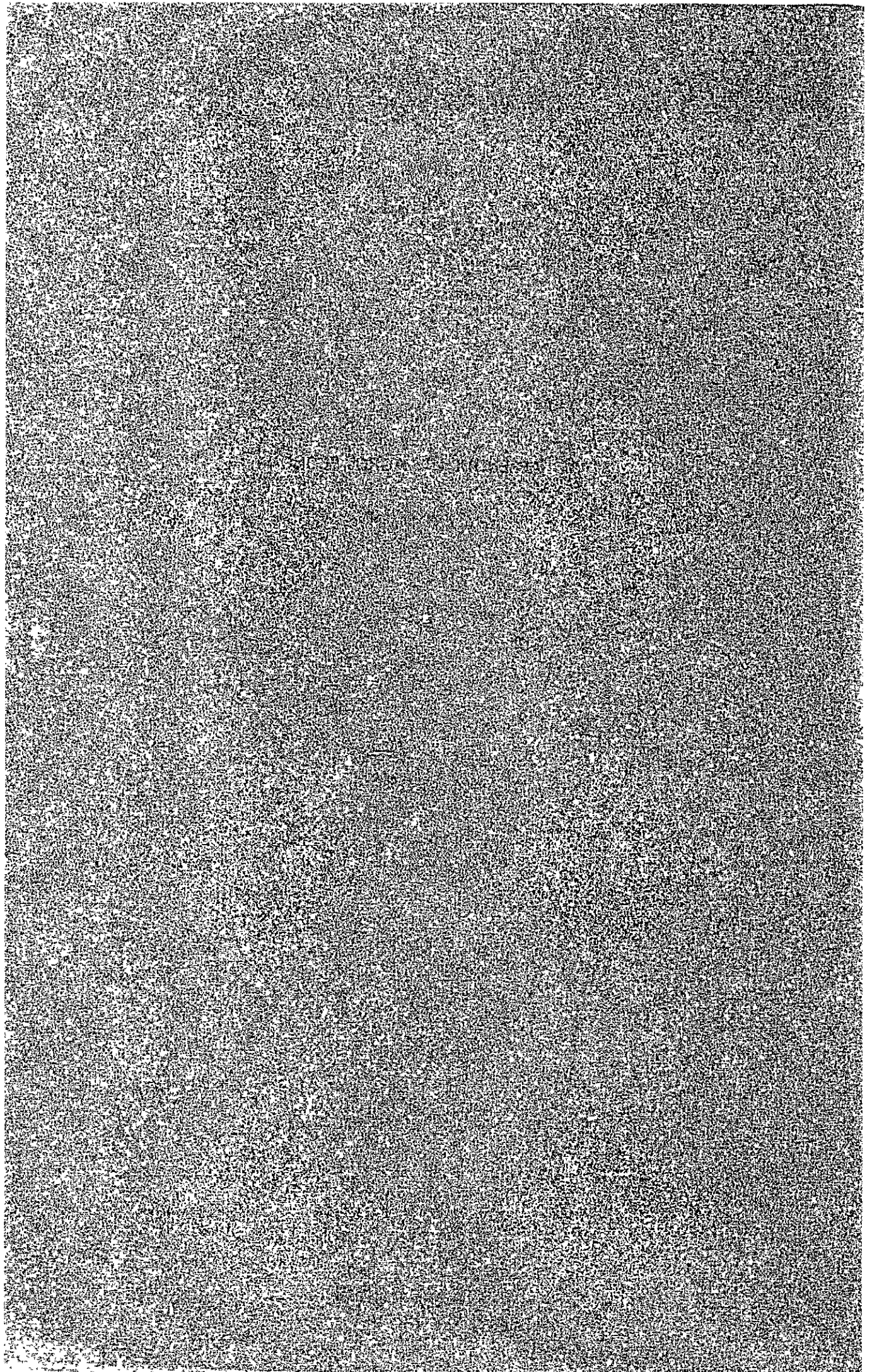
The Government will provide the followings for carrying out the Consultant's services.

- a) All available documents, drawings, maps, statistics, data and other information related to the Project in the area.
- b) Suitable counterparts personnel, including engineers, technicians and professionals, as required for the project; and
- c) The Consultants should be obeyed to the existing laws of the Sultanate of Oman while they serve in the country; however, in principle, to exempt the Consultants from (or bear the cost of) any taxes, duties, fees, levies and other impositions imposed under its laws and regulations in the respect of;
 - ° Any payment made to the Consultants in connection with the carrying out their services;
 - ° Any equipment, materials and supplies brought into the territories of the Government for the purpose of carrying out the services; and
 - ° Any property brought by the members of the Consultants for their personnel use and consumption.

Description	Year				1986		1985		1984		1983		Man-Month	
	1983	1984	1985	1986	4	8	4	8	4	8	4	8	Oman	Foreign
I. Pre-Engineering Stage														
1. Project Engineer (Leader)	—												1-1	3
2. Geologist	—												1-2	1
3. Design Engineer	—												1-3	2
Sub-total													6	
II. Detailed Design Stage														
1. Project Engineer (Leader)	—												2-1	1
2. Hydrologist	—												2-2	1
3. Geologist	—												2-3	1
4. Hydrogeologist	—												2-4	1
5. Soil Mechanical Engineer	—												2-5	1
6. Irrigation Engineer	—												2-6	1
7. Agronomist	—												2-7	1
8. Design Engineer (Dam)	—												2-8	1
9. Design Engineer (Pump & Pipeline)	—												2-9	1
10. Design Engineer (Farm & Irrigation System)	—												2-10	1
11. Design Engineer (Housing)	—												2-11	1
12. Mechanical Engineer	—												2-12	1
13. Electric Engineer	—												2-13	1
14. Construction Planner	—												2-14	1
15. Cost Estimator	—												2-15	1
16. Surveyor (A)	—												2-16	5
17. Surveyor (B)	—												2-17	5
18. Specification Writer	—												2-18	
19. Specialist for Tender Documents	—												2-19	2
Sub-total													25	55
III. Tendering Stage														
1. Project Engineer (Leader)													3-1	3
2. Mechanical Engineer													3-2	1
3. Cost Estimator													3-3	1
Sub-total													5	1
IV. Construction Supervisor														
1. Project Engineer													4-1	10
2. Project Engineer (Site Manager)													4-2	20
3. Civil Engineer													4-3	4
4. Mechanic for Pump and Pipeline													4-4	11
5. Mechanic for Irrigation System													4-5	11
6. Geologist													4-6	8
7. Hydrogeologist													4-7	4
8. Site Laboratory Engineer													4-8	15
9. Housing Engineer													4-9	4
10. Electric Engineer													4-10	4
Sub-total													91	
V. Operation and Maintenance														
1. Project Engineer (Site Manager)													5-1	8
Sub-total													8	
Total													135	56

FIGURE K-3 PROPOSED SHCHEDULE FOR CONSULTING SERVICES

APPENDIX L. AGRO - ECONOMY



APPENDIX L. AGRO-ECONOMY

- L-1. Estimation of Population
- L-2. Foreign Trade
- L-3. Prices
- L-4. Farm Income of Average Farm at Present
- L-5. Alternative of Optimum Farm Size
- L-6. Farm Economy Study
- L-7. Benefits

Estimation of population

Data with the population in Sohar is available from the first agricultural census carried out in 1980 and the preliminary report on water supplies to Sohar water resource evaluation, phase 2, 1978.

The former is estimated based on sample census and not comprehensive census.

The topographic map in 1:50,000 made by JICA based on the aerial photography carried out in March 1981 shows a distribution of housings. The number of these housings is useful to estimation of population.

Case 1. Estimation based on topographic map.

Population in the Project Area:

Right bank of Wadi al Jizzi to Wadi al Kadaq
--- about 1,200 housing x 7 persons = 8,400 persons

Left bank of Wadi al Jizzi to Majis
--- about 700 housing x 7 persons ÷ 4,900 persons

Total 13,300 persons

Case 2. Estimation based on the First Agricultural Census.

Population in the Project Area:

- a. Number of holdings of farm land in Sohar Wilayat-----3,564
- b. Number of residents of holdings in Sohar Wilayat----25,322persons
- c. Farm land area in Sohar Wilayat ----- 6,494 ha
- d. Farm land area in Project area ----- 3,830 ha
- e. Ratio of farm land area d ÷ c ----- 59%

f. Number of residents of farm land holding in Project area

$$b \times e, 25,322 \times 0.59 = 14,940 \text{ persons}$$

this figure include full time hired labour of about
1,000 persons

g. Number of farm land holding in Project area

$$a \times e, 3,564 \times 0.59 = 2,100$$

h. Ratio of number of farm land holding with non-agricultural
occupation $1,232 \div 3,564 = 35\%$

i. Assumption of non-farm household

It is assumed that number of non-farm household
take 10% of total household.

Total household 2,350

Farm household 2,100 (90%)

Non-farm household 250 (10%)

j. Number of population of non-farm household

$$250 \times 7 = 1,750 \text{ persons}$$

k. Total population in Project area

$$14,940 + 1,750 = 16,690 \doteq 16,000 \text{ persons}$$

Case 3. Estimation based on the Power and Urban Water Supply Study

Population in the town of Sohar:

a. 1978 population in permanent and temporary accomodation

<u>Sohar District</u>	<u>Population</u>
1) Sohar Town	7,000
2) Agricultural Area	2,000
3) South of Sohar	2,500
Total 1) + 2) + 3)	11,500
1) + 3)	9,500

b. Estimation of population based on topographic map

Right bank of Wadi al Jizzi to Wadi al Kadaq

$$1,200 \text{ housing} \times 7 \text{ persons} = 8,400 \text{ persons}$$

From Wadi al Kadaq to Royal Farm land

$$180 \text{ housing} \times 7 \text{ persons} \doteq 1,300 \text{ persons}$$

Total 9,700

c. Estimation of population based on the first agricultural Census

a) Number of farm land holding in the town of Sohar

$$2,100 \times 0.63 = 1,330 \quad (1,200 \div 1,900 = 0.63)$$

b) Total household

$$1,330 \div 0.9 = 1,480$$

c) Total population

$$1,480 \times 7 = 10,400 \text{ person}$$

Foreign Trade

The balance of foreign trade has been surplus every year since 1971 according to the Statistical Year Book. The recorded exports of 787 million R.O. in 1979 were shared by 94.7% of oil, 4.7% of re-exported and 0.6% of Omani origin export.

The percentage of Omani origin exports of 4.56 million R.O. in 1980 consist of 43.9% of fish frozen dry and salted, 11.5% of fresh fruits and vegetables, 17.2% of dry limes, 4.4% of dry dates and preserved dates and 21.9% of flour. These goods are mostly exported to U.A.E. The exports of fresh fruits and vegetables have been extended from 0.2% in 1976 to 11.5% in 1980, though dry dates and dry limes have been stagnated.

The percentage of re-exports of 45.29 million R.O. in 1980 consist of 72.3% of machinery and transport equipment, 6.4% of manufacture goods, 5.2% of food and live animal and 7.8% of beverage and tobacco.

The recorded imports were 598 million R.O. in 1980. The percentage of main goods were 39.4% of machinery and transport equipment, 16.1% of manufactured goods, 12.2% of good and live animals and 10.8% of mineral fuels and lubricants.

The recorded imports by region and principal countries of export in 1980 are classified in 35.7% of Western Europe including 15.6% by U.K., 22.6% of Middle East including 17.3% by U.A.E. 30.5% of other Asia including 19.7% by Japan and 6.5% of America.

The trading value of food and live animal in 1980 was 77.4 million R.O. of which the imports were 72.9 million R.O. and the exports 4.5 million R.O. The imports consist of 15.9 million R.O. of cereals and cereal preparation, 14.4 million R.O. of fruits and vegetables, 12.9 million R.O. of dairy products and eggs, and 12.7 million R.O. of meat and meat preparation.

The foods and live animals were exported in the value at 2.0 million R.O. of fish and fish preparation, 1.0 million R.O. of cereals and cereal preparation, and 1.5 million R.O. of fruits and vegetables respectively.

Table L-1 The Recorded Imports and Exports

(Unit: 10⁶R.O.)

	<u>Total Recorded Imports</u>	<u>Exports</u>			<u>Total</u>
		<u>Oil</u>	<u>Re-export</u>	<u>Other</u>	
1971	13.8	87.6		0.4	88.0
1972	18.7	88.2		0.4	88.6
1973	40.7	114.3		0.6	114.9
1974	135.6	418.7		0.4	419.1
1975	264.3	488.1		1.1	489.2
1976	250.5	543.8		1.4	545.2
1977	302.1	545.9		1.5	547.4
1978	327.2	521.8	26.9	3.3	552.0
1979	430.5	745.7	37.0	4.7	787.4
1980	598.2		45.3	4.6	

Source: Statistical Year Book 1980.

Table L-2 Export and Re-export Value
(Unit: 1,000 R.O.)

Items	1978			1979			1980		
	Re-export	Omani		Re-export	Omani		Re-export	Omani	
		Origin	Total		Origin	Total		Origin	Total
1. Food and live animal	978.7	3,291.4	4,270.1	1,874.9	4,672.1	6,547.0	2,355.9	4,545.3	6,901.2
2. Beverages and tobacco	4,949.1	28.1	4,977.3	7,989.2	34.6	8,023.8	3,544.1	18.2	3,562.3
3. Crude materials, inedible	73.5	-	73.5	436.3	4.2	440.6	371.0	-	371.0
4. Mineral fuels, lubricants and related materials	63.6	-	63.6	129.8	-	129.8	175.8	-	175.8
5. Animal and vegetable oils and fats	250.0	-	250.0	230.9	-	230.9	215.7	-	215.7
6. Chemicals	249.4	-	249.4	323.4	-	323.4	164.9	-	164.9
7. Manufactured goods	3,633.0	-	3,633.0	4,246.9	-	4,246.9	2,929.4	-	2,929.4
8. Machinery and transport equipment	14,680.8	-	14,680.8	19,840.0	-	19,840.0	32,736.9	-	32,736.9
9. Miscellaneous manufactured articles	2,027.0	3.4	2,030.4	1,955.8	6.2	1,962.0	2,798.6	-	2,798.6
Total	26,905.1 (89.0)	3,322.9 (11.0)	30,228.1 (100.0)	37,027.2 (88.7)	4,717.2 (11.3)	41,744.4 (100.0)	45,292.3 (90.8)	4,563.5 (9.2)	49,855.8 (100.0)

Source: Statistical Year Book, 1980.

Table L-3 Non-Oil Exports (Omani origin export)

(Unit: 1,000 R.O.)

<u>Commodity</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Fresh fruits and vegetables	2.1	0.3	123.6	306.4	525.8
Dry dates and preserved dates	109.8	81.0	347.9	577.8	199.3
Dry limes	1,272.4	1,053.9	1,468.9	1,544.2	786.8
Fish frozen dry and salted and wet (sardines)	0.4	63.6	571.7	1,454.1	2,002.6
Tobacco	8.8	4.9	28.1	34.6	18.2
Flour	-	320.8	779.3	751.7	999.6
Other products	16.0	3.5	3.4	10.4	31.2
Total exports	<u>1,409.5</u>	<u>1,527.9</u>	<u>3,322.9</u>	<u>4,677.2</u>	<u>4,563.5</u>

Source: Statistical Year Book, 1980.

Table L-4 Non-Oil Exports (Omani origin export)

(Unit: %)

<u>Commodity</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Fresh fruits and vegetables	0.2	0.0	3.7	6.6	11.5
Dry dates and preserved dates	7.8	5.3	10.5	12.3	4.4
Dry limes	90.3	69.0	44.2	33.0	17.2
Fish frozen dry and salted and wet (sardines)	0.0	4.2	17.2	31.1	43.9
Tobacco	0.6	0.3	0.8	0.7	0.4
Flour	-	21.0	23.5	16.1	21.9
Other products	1.1	0.2	0.1	0.2	0.7
Total exports	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Source: Statistical Year Book, 1980.

Table L-5 Non-Oil Exports by Country of Destination, 1978

	<u>U.A.E.</u>	<u>India</u>	<u>Saudi- Arabia</u>	<u>Jordan</u>	<u>Kuwait</u>	<u>Lebanon</u>	<u>Qatar</u>	<u>Total</u>
Fresh fruits and vegetables	123.6	-	-	-	-	-	-	123.6
Dry dates and preserved dates	57.0	290.8	-	-	-	-	-	347.9
Dry limes	1,468.9	-	-	-	-	-	-	1,468.9
Fish frozen dry and salted and wet	175.3	-	224.3	105.0	58.3	7.9	0.8	571.7
Tobacco	28.1	-	-	-	-	-	-	28.1
Flour	779.3	-	-	-	-	-	-	779.3
Other products	3.4	-	-	-	-	-	-	3.4
Total exports	2,635.6 (79.3)	290.8 (8.8)	224.3 (6.8)	105.0 (3.1)	58.3 (1.8)	7.9 (0.2)	0.8 (0.0)	3,322.9 (100.0)

Source : Statistical Year Book, 1980.

Table L-6 Percentage of Re-export Goods Value

<u>Items</u>	(Unit: %)		
	<u>1978</u>	<u>1979</u>	<u>1980</u>
1. Food and live animal	3.6	5.0	5.2
2. Beverage and tobacco	18.4	21.6	7.8
3. Crude materials, inedible, except fuels	0.3	1.2	0.8
4. Mineral fuels, lubricants and related materials	0.3	0.4	0.4
5. Animal and vegetable oils and fats	0.9	0.6	0.5
6. Chemicals	0.9	0.9	0.4
7. Manufactured goods	13.5	11.5	6.4
8. Machinery and transport equipment	54.6	53.6	72.3
9. Miscellaneous manufactured articles	7.5	5.2	6.2
Total	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Source: Statistical Year Book, 1980.

Table L-7 Comparison of Imports with Omani Origin Export on Food and Live Animal

(Unit: '000 R.O.)

	1978		1979		1980	
	<u>Import</u>	<u>Export</u>	<u>Import</u>	<u>Export</u>	<u>Import</u>	<u>Export</u>
1. Live animals	264	-	714	6.9	857	30.6
2. Meat and meat preparation	5,624	-	7,579	-	12,763	-
3. Dairy products and eggs	7,155	-	8,618	-	12,875	-
4. Fish and fish preparation	590	571.7	655	1,485.1	455	2,002.6
5. Cereals and cereal preparation	9,523	779.3	14,598	751.7	15,968	999.6
6. Fruits and vegetables	9,637	1,940.4	9,835	2,428.4	14,397	1,511.9
7. Sugar, Sugar preparation	2,086	-	2,530	-	4,208	-
8. Coffee, tea, cocoa	4,966	-	5,116	-	6,393	-
9. Feeding stuff for animal	456	-	980	-	1,777	0.6
10. Miscellaneous food preparation	2,062	-	2,689	-	3,212	-
Total value	42,363	3,291.4	53,314	4,672.1	72,904	4,545.3
Gross trading value	45,654.4		57,986.1		77,449.3	
Share (%)	(92.8)	(7.2)	(91.9)	(8.1)	(94.1)	(5.9)

Source : Statistical Year Book, 1980.

Table L-8 Percentage of Imports and Omani Origin Export on Food and Live Animal

(Unit: %)

	1978		1979		1980	
	Import	Exprt	Import	Export	Import	Export
1. Live animals	0.6	-	1.3	0.1	1.2	0.7
2. Meat and meat preparation	13.6	-	14.3	-	17.5	-
3. Dairy products and eggs	16.8	-	16.2	-	17.7	-
4. Fish and fish preparation	1.4	17.4	1.2	31.8	0.6	44.0
5. Cereals and cereal preparation	22.5	23.7	27.4	16.1	21.9	22.0
6. Fruits and vegetables	22.7	58.9	18.4	52.0	19.7	33.3
7. Sugar, Sugar preparation	4.9	-	4.7	-	5.8	-
8. Coffee, tea, cocoa	11.7	-	9.6	-	8.8	-
9. Feeding stuff for animal	1.0	-	1.8	-	2.4	0.0
10. Miscellaneous	4.8	-	5.1	-	4.4	-
Total	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Source : Statistical Year Book, 1980.

Table L-9 Recorded Imports Value
(Unit: 1,000 R.O. and %)

	1971	1976	1977	1978	1979	1980
1. Food and live animals	4,998	30,390	38,116	42,363	53,314	72,904
2. Beverages and tobacco	420	4,827	6,322	11,548	18,761	14,843
3. Crude materials, inedible, except fuels	263	5,944	6,414	4,833	5,068	9,863
4. Mineral fuels, lubricants	955	17,138	21,461	27,542	28,953	64,574
5. Animal and vegetables oils and fats	*	1,171	1,973	3,134	2,927	3,221
6. Chemicals	577	9,384	11,139	13,618	16,348	20,820
7. Manufactured goods	2,233	47,739	53,782	58,649	68,272	96,310
8. Machinery and transport equipment	3,451	102,063	123,563	125,933	171,433	235,726
9. Miscellaneous manufactured goods	697	22,536	29,425	31,961	32,318	45,147
* Articled not classified	170	9,348	9,870	7,640	33,123	34,838
Total	<u>13,784</u>	<u>250,540</u>	<u>302,064</u>	<u>327,221</u>	<u>430,517</u>	<u>598,246</u>
1. Food and live animals	36.3	12.1	12.6	12.9	12.4	12.2
2. Beverages and tobacco	3.0	1.9	2.1	3.5	4.4	2.5
3. Crude materials, inedible, except fuels	1.9	2.4	2.1	1.5	1.2	1.6
4. Mineral fuels, lubricants	6.9	6.8	7.1	8.4	6.7	10.8
5. Animal and vegetables oils and fats	*	0.5	0.7	1.0	0.7	0.6
6. Chemicals	4.2	3.7	3.7	4.2	3.8	3.5
7. Manufactured goods	16.2	19.1	17.8	17.9	15.9	16.1
8. Machinery and transport equipment	25.0	40.8	40.9	38.5	39.8	39.4
9. Miscellaneous manufactured goods	5.1	9.0	9.7	9.8	7.5	7.5
* Articles not classified	1.4	3.7	3.3	2.3	7.7	5.8
Total	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Note: Separate figure not available, include under section 0.
Source: Statistical Year Book, 1980.

Table L-10 Recorded Imports Classified by Regions and Principal Countries of Export

	(Unit: %)					
	<u>1971</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
<u>Western Europe</u>	<u>30.2</u>	<u>37.5</u>	<u>43.3</u>	<u>41.3</u>	<u>41.9</u>	<u>35.7</u>
United Kingdom	19.6	6.3	23.1	20.7	16.8	15.6
West Germany	2.6	6.3	6.5	6.4	6.3	5.6
Netherlands	3.6	3.1	4.7	2.5	7.8	5.6
France	0.4	3.0	2.1	2.8	3.6	1.8
Italy	0.5	1.3	2.1	2.0	2.2	1.8
<u>Middle East</u>	<u>24.2</u>	<u>22.8</u>	<u>19.7</u>	<u>20.1</u>	<u>18.7</u>	<u>22.6</u>
U.A.E.	17.8	17.1	14.7	15.7	15.1	17.3
Iran	5.8	2.0	0.6	0.5	0.2	-
Kuwait	*	0.9	0.4	0.2	0.2	0.4
Lebanon	0.2	0.2	0.3	0.3	0.3	0.2
Bahrain	*	1.9	2.6	2.8	2.4	4.4
Others	0.3	0.7	1.2	1.0	0.6	0.3
<u>Other Asia</u>	<u>31.0</u>	<u>22.6</u>	<u>25.6</u>	<u>27.8</u>	<u>27.0</u>	<u>30.5</u>
Japan	6.1	12.1	13.6	15.5	15.4	19.7
India	7.0	4.6	4.9	4.4	3.7	2.9
Singapore	1.3	2.1	2.2	2.5	2.6	3.3
<u>America</u>	<u>1.7</u>	<u>6.1</u>	<u>7.4</u>	<u>6.9</u>	<u>8.3</u>	<u>6.5</u>
United States	1.0	6.1	7.1	6.3	8.0	5.7
<u>Oceania</u>	<u>7.1</u>	<u>1.9</u>	<u>2.7</u>	<u>2.1</u>	<u>2.6</u>	<u>2.5</u>
Australia	7.0	1.9	2.5	1.9	2.4	1.9
<u>Eastern Europe</u>	<u>1.3</u>	<u>0.6</u>	<u>0.4</u>	<u>0.3</u>	<u>0.6</u>	<u>1.2</u>
<u>Africa</u>	<u>4.5</u>	<u>0.4</u>	<u>0.9</u>	<u>1.2</u>	<u>0.8</u>	<u>1.0</u>
<u>Unclassified</u>	-	<u>8.0</u>	-	-	-	-
Total all countries	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>

Note: Kuwait, Bahrain and Qatar are included in the figures for the United Arab Emirates in 1971.

Source: Statistical Year Book, 1980.

Prices

Table L-11 The Prices Received by Farmers

(Unit: Baiza per kg)

<u>No. of farmer surveyed</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
<u>Market Sold</u>	Ruwi City Agri. Market Center, MOA	Sohar & UAE	UAE Abu Dhabi	Sohar
Vegetables				
Cabbage	75	250	300	250
Califlower	150	-	-	-
Onion	100	100	-	100
Tomato	100	200	500	-
Potatoes	200	250	500	-
Watermelon	75	200	-	-
Radish	150	50	-	-
Eggplants	75	100	350	-
Cucumber	-	250	-	-
Okra	-	250	500	-
Pepper	-	250	1,000	250
Fodder Crops				
Alfalfa	50 (UAE)	100	-	70
Misibla	-	(UAE) 150	-	150
Fruits				
Dates	Fresh 500, half dried 200, dried 100.			
Lime	Fresh 300 to 500, dried 810.			
Mango	50 to 110.			
Banana	200 (include 50 of subsidy)			

Source: 1/ Prices of vegetable and fodder were collected from Management Survey conducted by JICA team, January 1982.

2/ Prices of fruits are those purchased from farmers by Production Farm, Sohar. Data source is the extension centres at Sohar.

3/ Price of Alfalfa of Farm D was estimated based on one R.O. per eight bundle (15kg).

Table L-12 Retail Price in RUWI and Muttrah - Marketing Survey

(Unit: Baiza per kg)

Item	RUWI				Agri. Marketing Center, MOA (Purchased Price from Farmer)
	Central Market	First trade Super Market	Consumer Co-operative Society	Muttrah Cold Market	
	15 January 1982	21 January 1982	21 January 1982	21 January 1982	
Tomato	300	300	250	250	150
Cucumber	700	800	600	-	350
Eggplants	300	-	200	-	100
Cabbage	400	500	-	350	-
Okra	500	-	-	-	-
Onion	300 (Iran), 300 (India)	300	-	270	-
	1,700/12kg (Iran)	-	-	-	-
	2,400/14kg (India)	-	-	-	-
Lettuce	300 700 (Lebanon)	-	-	600	-
String beans	1,000 (Cairo)	800	800	-	-
Califlower	800 (Lebanon)	-	600	-	-
Potato	300 (Lebanon)	350	300	400	-
Carrot	-	700	700	-	-
Sweet Pepper	-	600	-	500	-
Welsh Onion	-	-	-	660 (2 piece)	-
Orange	3,500/90 pieces (Jordan)	400/6 pieces	-	-	-
Lime	Fresh 1,000	1,000	-	-	-
Banana	-	700	300	-	150 (consumer 100)

Source: Marketing survey was conducted by JICA team.

Table L-13 Consumer Price in Capital Area

(Unit: R.O.)

<u>Item of Consumption</u>	<u>Quantity</u>	<u>Price</u>	
		<u>1979</u>	<u>1980</u>
1. Cereal Products			
Rice, Basmatic, Pakistan	4 kg	1.575	1.483
Basmatic, India	4 kg	1.500	1.600
Uncle Bens, U.S.A.	4.53 kg	2.600	2.417
2. Meat and Eggs			
Fresh meat - mutton, Indian	1 kg	1.500	1.200
Frozen meat - mutton, Australia	1 kg	1.500	1.000
Frozen meat - Beef, Australia	1 kg	1.500	1.800
Chicken - Frozen, Denmark	1 kg	0.738	0.750
Egg, Imported, Kentish	1 doz	1.100	1.300
Local, Oman Farms	1 doz	0.700	0.688
3. Milk Products			
Fresh milk	1 lit	0.300	0.300
Evaporated milk			
Rainbow, Holland	170 g	0.095	0.108
Carnation, Holland	170 g	0.080	0.083
Powdered milk			
Nido, Holland	2.5 kg	2.530	3.388
Nono, Australia	2.5 kg	-	2.600
Butter, Australia	1 lb	0.414	0.544
Cheese, Spread (with grass), Australia	250 g	0.555	0.608
4. Fruits and Nuts			
Apples (Red)	1 doz	1.325	1.300
Oranges	1 doz	0.988	0.725
Banana	1 doz	0.675	0.683
Dates, Ministry of Agriculture	1 kg	-	0.500
Canned Fruits			
Pine Apple, Gold pine, Australia	850 g	0.425	0.463
Appicot, Ardmona, Australia	850 g	0.438	0.465

<u>Item of Consumption</u>	<u>Quantity</u>	<u>Price</u>	
		<u>1979</u>	<u>1980</u>
Edible nuts			
Cashew nuts, Planters, U.S.A.	340 g	1.350	2.083
Peanuts, Sunpat, Planters, U.S.A.	340 g	0.850	0.850
5. Fresh and Dried Vegetables			
Potatoes	1 kg	0.433	0.450
Tomatoes	1 kg	1.450	1.088
Cabbage	1 kg	0.867	0.838
Cucumber	1 kg	1.138	0.950
Onion	1 kg	0.233	0.275
Califlower	1 kg	1.000	1.075
Lettuce	1 kg	1.450	0.933
Okra (Ladies Finger)	1 kg	-	0.650
Eggplant (Brinzal)	1 kg	-	0.550
Vegetable Marrow	1 kg	-	0.600
Lemon	1 kg	-	0.875
Lime	1 kg	-	1.000
6. Canned Vegetables			
Peas, Engel	440 kg	0.250	0.350
Beans, Engel	440 g	0.265	0.350
Mixed vegetable, Engel	440 g	0.265	0.375
Tomato Paste, Zaza, Italy	70 g	0.038	0.041
7. Frozen vegetables			
Peas, Birds-eye	1 lb	0.630	0.780
Brussel spnouts, Birds-eye	2 lb	1.600	1.595
Califlower, Birds-eye	2 lb	1.620	1.627
Sliced green Beans, Birds-eye	3/4 lb	0.660	0.760
Leguminous vegetable			
Lentils, whitewalk, U.K.	1 kg	-	0.425

Source: Department of Internal and Foreign Trade Statistics
Development Council.

Table L-14 Capital Area Consumer Price Index of Food, Beverages and Tobacco
- Average Value, July - December 1978 = 100 -

	1979			1980			1981			
	Mar.	Jun.	Sep.	Mar.	Jun.	Sep.	Mar.	Jun.	Dec.	
1. Cereal products	102.0	106.6	100.1	107.8	102.9	109.0	112.4	111.2	110.6	111.8
2. Meat and eggs	103.5	102.5	109.0	111.7	118.9	109.1	120.3	117.9	121.2	122.0
3. Fish	111.2	111.7	109.6	113.4	98.5	99.4	98.3	99.6	101.4	102.4
4. Milk products	99.6	98.0	97.1	99.5	109.1	118.2	118.4	120.6	120.7	124.5
5. Fruits and nuts	87.6	101.4	102.3	113.5	104.7	109.3	107.0	109.7	111.2	116.3
6. Vegetables	97.0	94.0	98.0	106.5	99.5	102.1	109.7	117.0	108.4	113.3
7. Sugar and Confectionery	98.8	100.4	98.4	113.4	139.8	162.3	167.3	189.3	205.1	167.9
8. Spices and salt	110.0	118.5	107.6	115.9	113.4	112.5	120.0	139.4	130.1	134.4
9. Fats and edible oils	110.9	110.8	123.5	122.1	116.7	116.9	118.1	122.2	123.8	123.8
10. Tea and Coffee	87.3	91.7	90.8	88.8	89.6	100.4	99.4	102.4	103.9	101.3
11. Beverages	110.3	107.8	105.4	111.1	123.7	127.6	129.0	130.6	131.8	129.6
12. Other food items	98.8	98.8	98.0	98.5	110.6	108.7	110.1	129.9	129.1	128.4
13. Cigarettes and tobacco	110.9	111.3	110.4	110.1	122.1	121.9	121.9	137.9	138.1	138.1
All food items	100.3	102.4	103.1	108.5	109.7	111.9	115.8	119.3	119.9	120.1

Source: 1/ Statistical Year Book, Development Council, Technical Secretariat. D.G.N.S., 1980
2/ Quarterly Bulletin on Main Economic Indicators, June 1981, D.G.N.S.

Table L-15 Capital Area Consumer Price Index of Main Foods
(Basic prices equal to Average prices for the period July - December 1978)

Item of Consumption	1979			1980			1981			
	Mar.	Jun.	Sep.	Mar.	Jun.	Sep.	Dec.	Mar.	Jun.	
Fresh and dried vegetables	88.0	84.1	93.5	107.3	89.2	93.4	103.3	106.8	93.9	100.7
Frozen vegetables	107.2	110.8	110.5	112.3	118.4	125.0	121.9	135.2	135.2	134.2
Fresh and dried fruits	81.6	102.4	103.5	122.2	106.9	114.8	108.2	110.8	111.7	114.8
Canned vegetables	115.5	113.7	106.8	104.1	120.2	118.6	122.4	137.3	137.3	138.4
Canned fruits	96.7	101.3	99.1	99.9	101.4	103.3	107.1	107.4	109.7	117.7
Fresh/evaporated milk	106.1	103.9	104.1	113.6	114.3	116.4	118.7	120.1	120.6	139.7
Fresh/frozen meat	104.9	106.0	110.6	108.8	118.5	103.3	118.5	115.7	118.6	123.0
Chicken-frozen	100.0	93.9	105.8	109.5	115.0	111.3	113.8	111.3	113.8	113.8
Eggs	105.1	106.1	109.2	128.8	128.8	128.8	141.5	141.5	148.3	135.6
Frozen fish	115.4	115.4	115.4	115.4	100.0	100.0	100.0	100.0	100.0	100.0
Rice, Basmatic, Pakistan	105.0	112.0	98.0	110.3	91.0	105.0	114.8	103.9	102.7	105.0
Rice, Basmatic, India	90.7	113.4	113.4	113.4	105.8	105.8	105.8	120.9	108.3	107.6
Rice, Uncle Bens, U.S.A.	100.7	99.9	100.0	108.0	106.5	110.4	114.3	100.4	98.3	115.3
Wheat flour, Domestic	103.9	106.0	106.0	132.5	128.1	128.1	128.1	119.3	119.3	119.3
Wheat flour, Imported	96.2	105.3	94.1	98.5	100.0	99.7	106.2	115.7	125.7	125.7

Source: Statistical Year Book, Development Council, Technical Secretariat,
Directorate General of National Statistics, 1980, A.D. Nineth Issue.

Table L-16 Growth Rate per Year of Price of Building Materials to Contractors

(March 1974 = 100)

<u>Material</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Ordinary bagged cement	+ 7.0	-25.2	+ 9.8	+10.9	<u>+22.3</u>
White cement	- 3.4	- 7.8	+ 3.8	- 0.1	<u>+33.0</u>
Mild steel bars	-17.2	- 1.9	+44.2	+29.3	± 0
Hard wood	-17.1	+35.6	-19.2	+51.3	+ 2.5
Soft wood	-10.8	- 3.6	+ 2.5	- 8.5	+16.0
Ply wood	+ 9.3	-12.2	+ 5.5	+37.7	+ 1.9
Sand	+13.5	-13.3	- 2.4	± 0	<u>+30.6</u>
Pre-cast concrete blocks	± 0	- 2.8	- 0.7	<u>+10.9</u>	<u>+ 8.6</u>
Glass	-26.7	- 1.9	+ 4.8	+ 0.9	+ 0.9
PVC pipes	- 2.5	- 0.9	+ 5.2	<u>+ 7.4</u>	<u>+ 4.6</u>
Cast iron pipes	-15.7	- 4.0	+22.4	- 0.8	- 1.7
Pitch fibre pipes	- 5.4	- 9.8	+11.7	+ 8.0	- 8.9
Cement wash	+32.8	-20.8	- 9.8	+27.2	+ 8.6
Emulsion paint	- 4.0	+ 7.0	+ 0.7	+10.4	+38.8
Glass paint	+10.0	- 7.8	+ 5.6	+ 3.3	+22.6
Crusher	+25.2	-24.5	- 7.5	+ 2.7	<u>+33.3</u>

Source: Statistical Year Book 1980.

FIGURE L-1 CAPITAL AREA CONSUMER PRICE INDEX

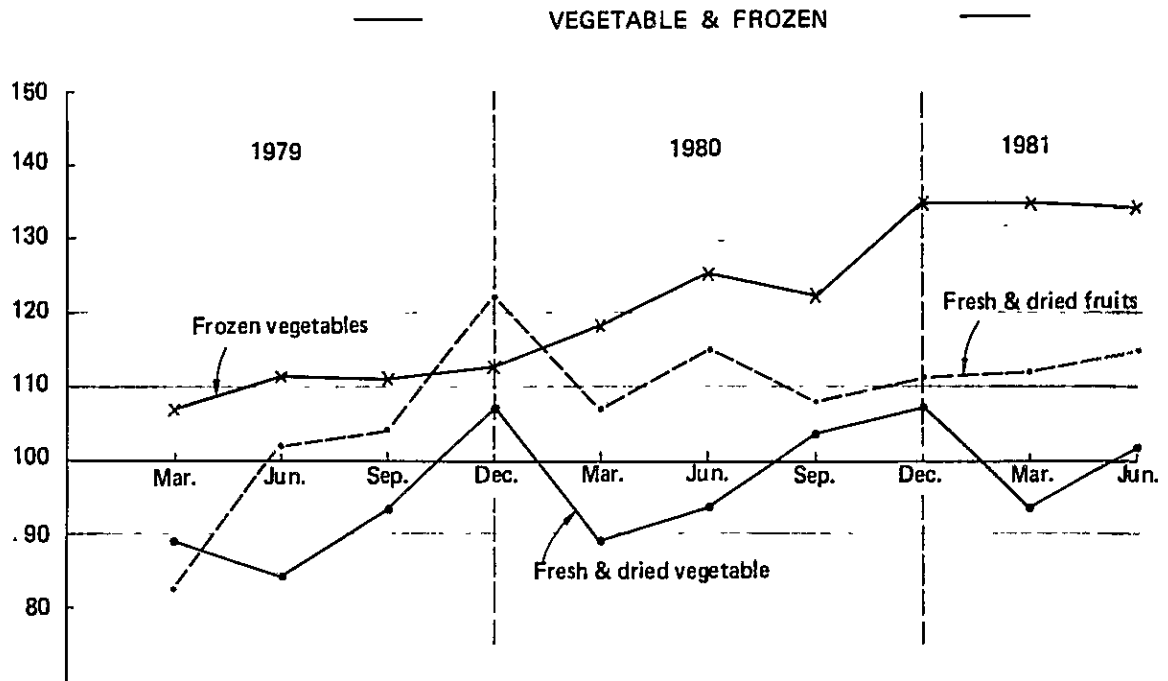


FIGURE L-2 — MEAT, CHICKEN & FISH —

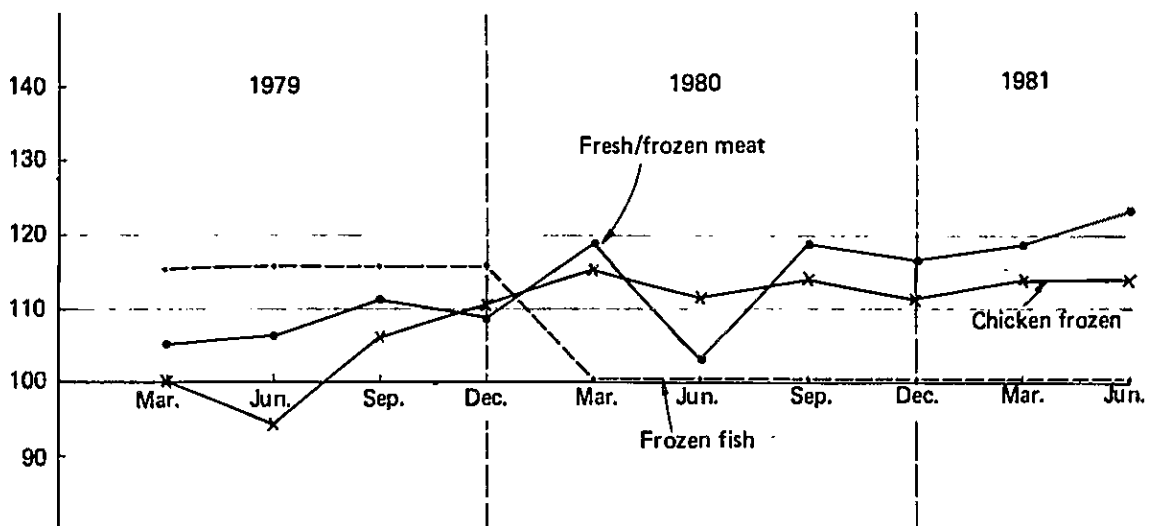


FIGURE L-3 CAPITAL AREA CONSUMER PRICE INDEX

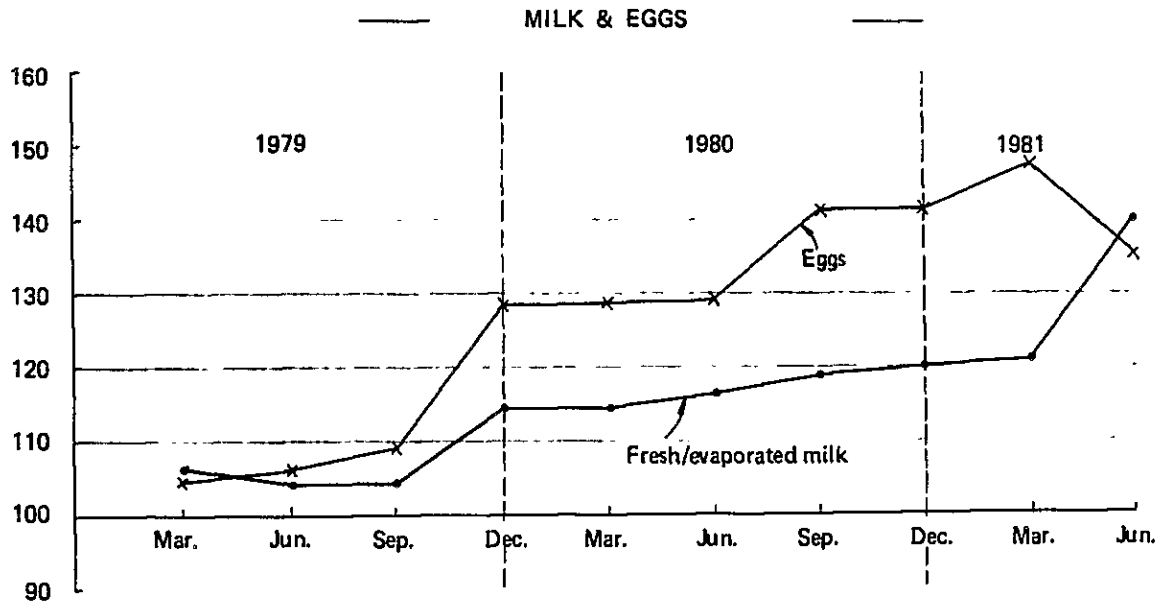


FIGURE L-4 RICE

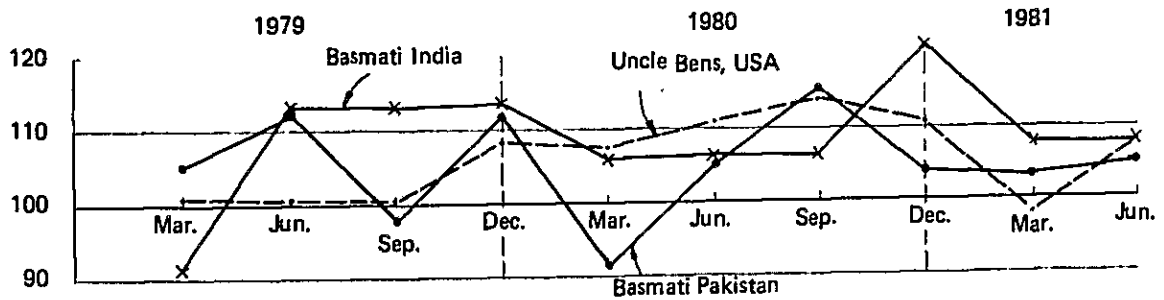


FIGURE L-5 WHEAT FLOUR

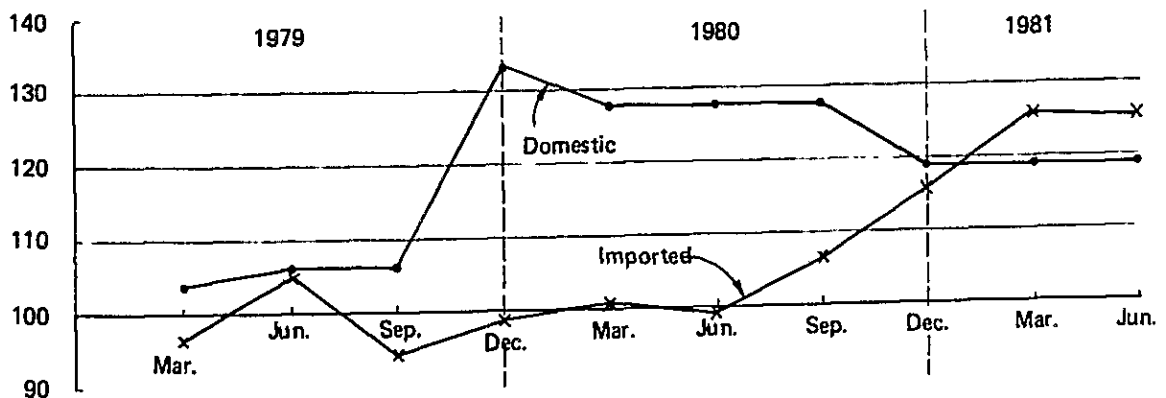


FIGURE L-6 CAPITAL AREA CONSUMER PRICE INDEX

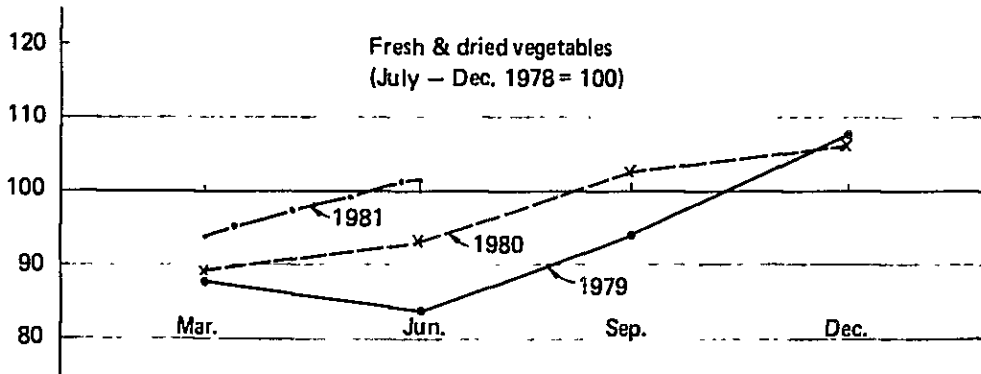


FIGURE L-7
Fresh & dried fruits
(July - Dec. 1978 = 100)

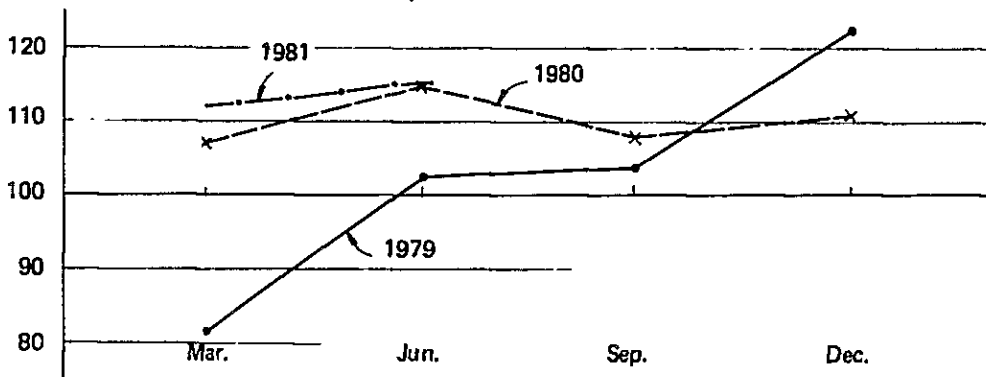


FIGURE L-8
Frozen vegetables
(July - Dec. 1978 = 100)

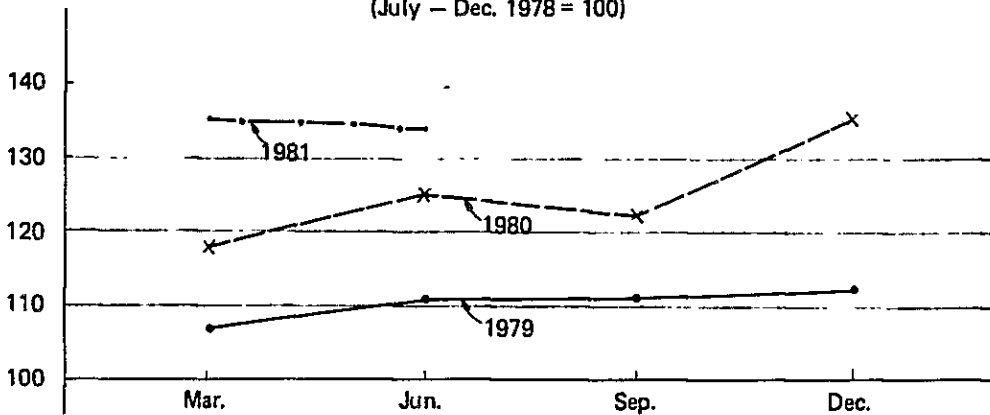


FIGURE L-9

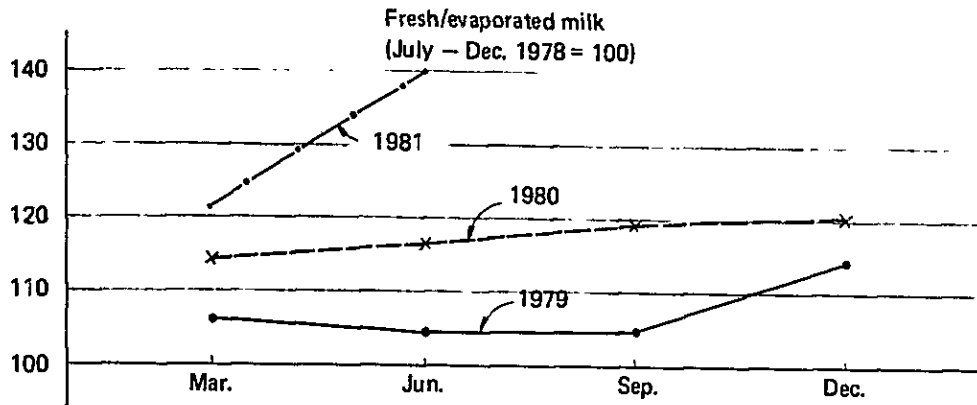


FIGURE L-10

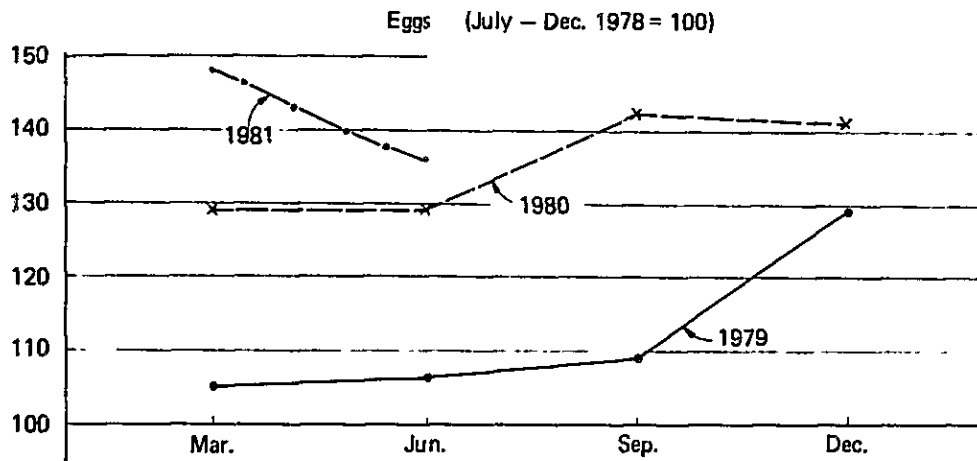


FIGURE L-11

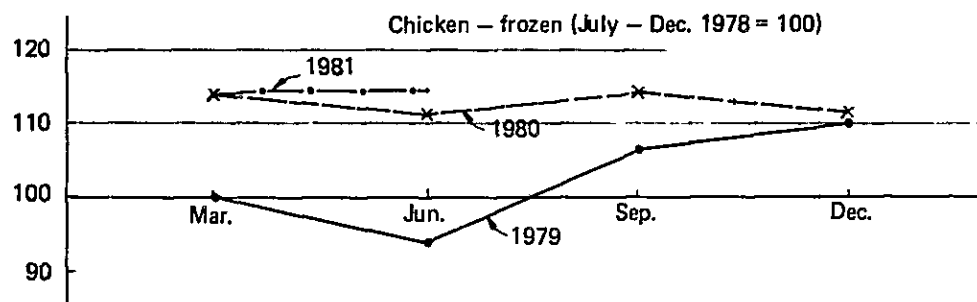


FIGURE L-12

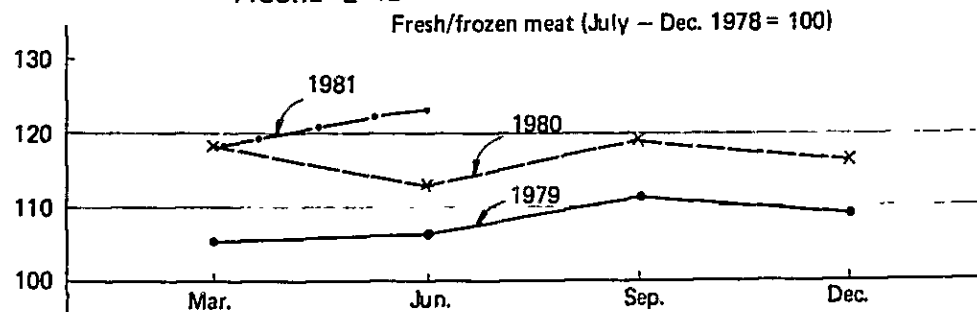


FIGURE L-13
Frozen fish (July - Dec. 1978 = 100)

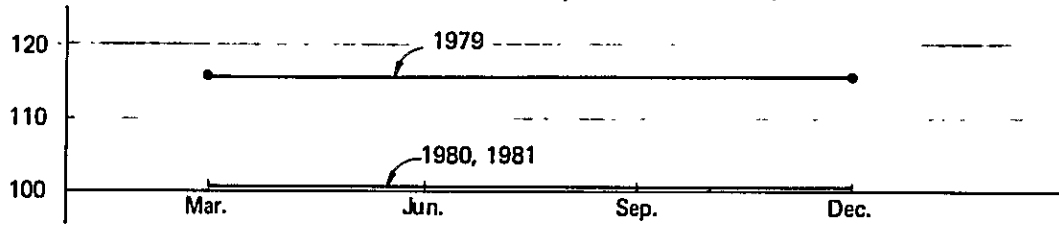


FIGURE L-14
Rice - Basmatic, Pakistan (July - Dec. 1978 = 100)

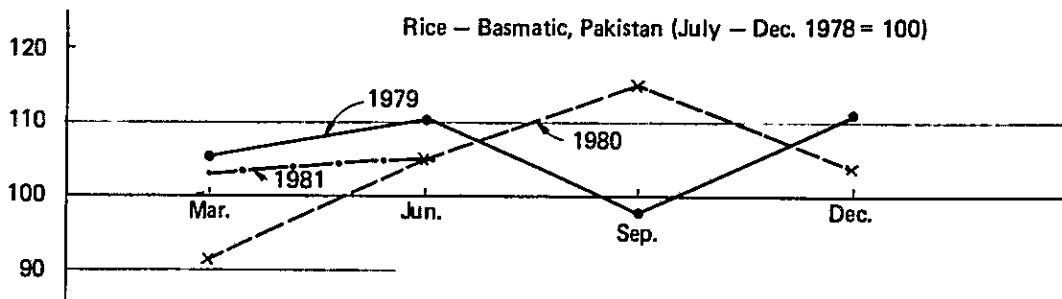


FIGURE L-15
Wheat flour (Domestic)

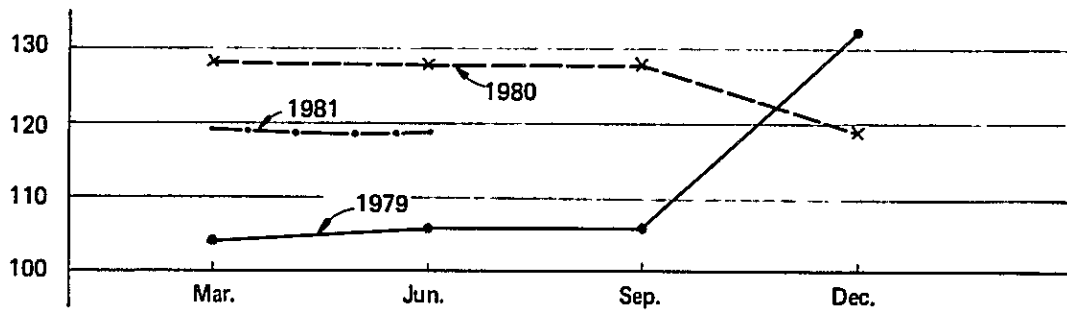
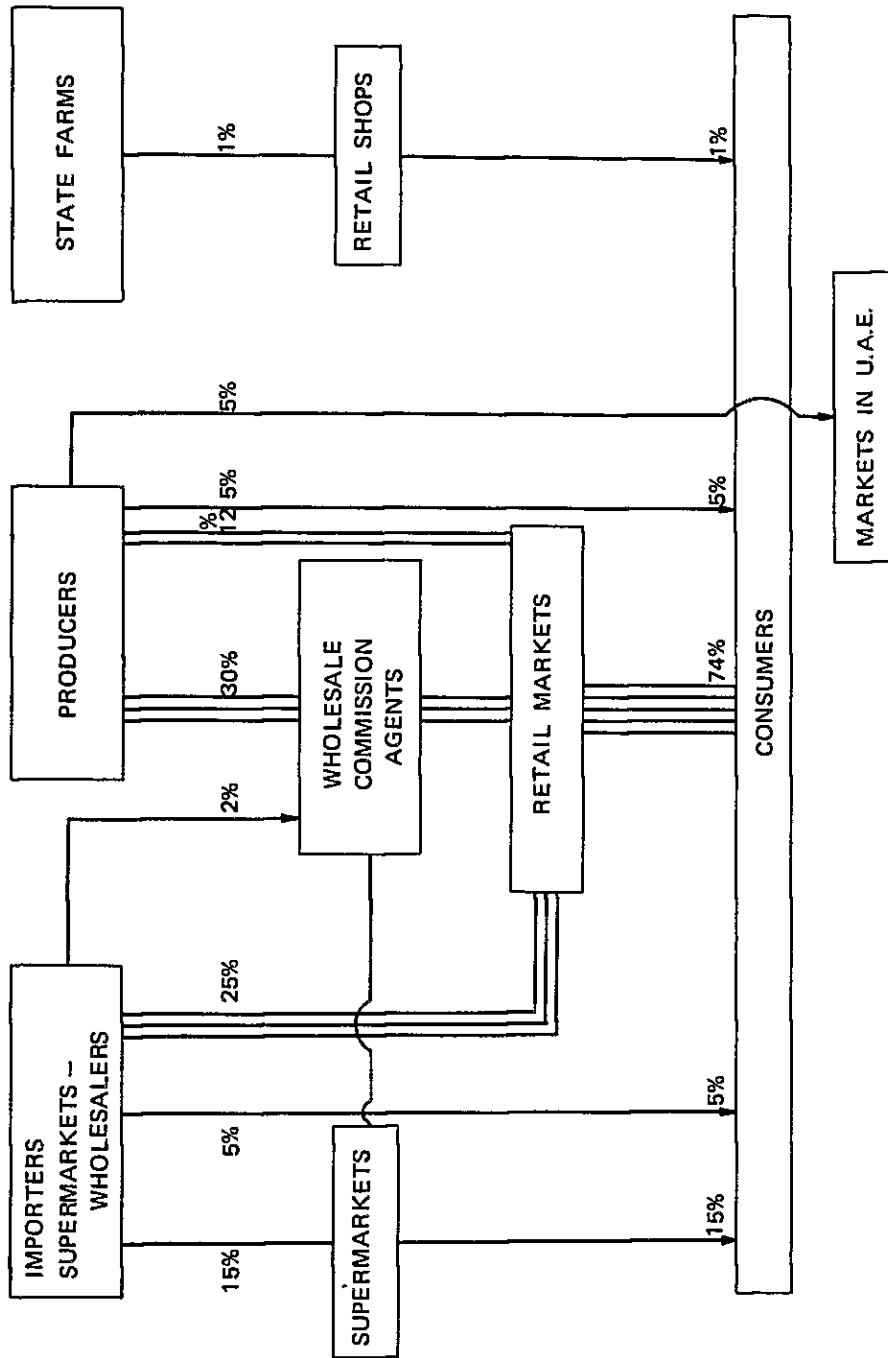


FIGURE L-16 DIAGRAM OF FRUIT AND VEGETABLE MARKETING CHANNELS



Source: Agricultural Cooperative in Oman, Profile, FAO, October 1980.

Farm Income of Average Farm at Present

Size of farm 1.24 ha

Gross Income:

<u>Crops</u>	<u>ha</u>	<u>ton/ha</u>	<u>Qt</u> (t)	<u>Unit Price</u> (t)	<u>Gross Income</u> (R.O)
Dates	0.41	1.3	0.533	500	267
Limes	0.07	10.0	0.700	300	210
Mango	0.19	1.0	0.209	110	23
Banana	0.29	13.3	3.857	150	579
Vegetable	0.04	25.0(Cabbage)	1.000	250	250
Alfalfa	0.04	43.0	1.72	100	171
Fallow	0.20	-			
Livestock	2 head			180	360
Total					<u>1,860</u>

Production Cost:

Seeds	Cabbage	0.120	
	Alfalfa	1.900	
Fertilizer		230	
Transport cost		60	
Labor	full time	288	(0.4 x 60 R.O.x 12)
	part time	48	(0.2 x 20 R.O.x 12)
Pump cost		165	
Tractor fee (negligible)			
Total		793.02	≐ <u>790</u>

Farm income:

Gross income	1,860 (100%)
(-) Prod cost	790 (43)
<u>Farm income</u>	<u>1,070 (57)</u>

Net Farm income:

Farm income	1,070
(-) Family labor	720
<u>Net farm income</u>	<u>350</u>

Note: Seeds and fertilizer cost are subsidized.

Source: JICA's estimates.

Alternative of Optimum Farm Size

1. Farm income of average farm

Size of farm	1.24 ha	
Gross income	1,860 R.O.	(1,500 R.O./ha)
Production cost	790	(640 ")
Farm income	1,070	(860 ")

2. Alternative of farm economy

	<u>1 ha</u>	<u>2 ha</u>	<u>3 ha</u>	<u>4 ha</u>	<u>5 ha</u>
Gross income	1,500	3,000	4,500	6,000	7,500
Pro. cost	640	1,280	1,920	2,560	3,200
Farm income	860	1,720	2,580	3,440	4,300
Living cost 7person x 300R.O./year/person	2,100	2,100	2,100	2,100	2,100
Net income	-1,240	-380	480	1,340	2,200
Living cost 7 x 400R.O.	2,800	2,800	2,800	2,800	2,800
Net income	-1,940	-1,080	-220	640	1,500
Living cost 7 x 500R.O.	3,500	3,500	3,500	3,500	3,500
Net income	-2,640	-1,780	-920	-60	800

Source: JICA's estimates.

Table L-17 Farm Income Subsidized (Financial) per One Farm with Project

- Farm Economy Study -
(Unit: R.O.)

	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>
(1) Gross income	5,553	9,058	11,863	14,263	14,263	19,860	19,860	19,860	19,860	19,860	27,130
(2) Production cost subsidized	3,407	3,914	4,321	5,014	5,084	5,435	5,435	5,795	5,435	5,435	5,435
(3) Net farm income (1)-(2)	2,146	5,144	7,542	9,249	9,179	14,425	14,425	14,065	14,425	14,425	21,695
(4) Interest of fixed capital (3.5%)	3,160	3,160	3,160	3,160	7,430	7,430	7,430	7,430	7,430	7,430	7,430
(5) Irrigation fee	1,182	1,182	1,182	1,182	1,182	1,182	1,182	1,182	1,182	1,182	1,182
(6) Sub-total (4)+(5)	4,342	4,342	4,342	4,342	8,612	8,612	8,612	8,612	8,612	8,612	8,612
Balance (3)-(6)	2,196	802	3,200	4,907	567	5,813	5,813	5,453	5,813	5,813	13,083

Note: Table was estimated using output and input which were projected on the new farm. Actual figures are based on Table L-18.

Source: JICA's estimates.

Table L-18 Financial Farm Income per Hectare with Project
- Farm Economy Study -

(Unit: R.O)

	Gross Income		Production Cost					Farm Income		
	Yield ton	R.O/ton	G.I.	Seed	Fertilizer	Chemical	Machine		Labor	Total
Dates	12	500	6,000	-	234	1	344	330	909	5,091
Lime	20	600	12,000	-	234	12	473	384	1,103	10,897
Banana	13	150	1,950	-	153	166	1,143	306	1,768	182
Tomato	40	200	8,000	2	234	21	1,031	516	1,804	6,196
Cabbage	25	250	6,250	9	206	5	623	312	1,155	5,095
Watermelon (w)	15	200	3,000	10	234	3	321	198	766	2,234
Watermelon (s)	10	200	2,000	10	234	3	394	204	845	1,155
Eggplant	25	100	2,500	2	234	10	783	468	1,497	1,003
Redpepper	15	250	3,750	2	234	6	429	342	1,013	2,737
Alfalfa	60	70	4,200	-	206	46	844	252	1,348	2,852

Note: This table was made using financial prices for study on the profitability by crop with the Project. Crop yield is target. Unit price is financial price. Production cost is estimated using the inputs with the Project.

Source: JICA's estimates.

Table L-19 Fixed Capital and Interest per One Farm
— Farm Economy Study —

		Term of repayment of 20 years in- cluding grace period of 4 years	
		Interest 3.5 %	2.5 %
Farm land	5 ha x 7,000 R.O. = 35,000 R.O.	(1,230) 2,890	(880) 2,680
House building	150sq.m x 160 R.O./sq.m = 24,000 R.O.	(840) 1,980	(600) 1,840
Irrigation facilities	419,900 R.O. ÷ 20 farm = 21,000 R.O.	(740) 1,730	(530) 1,610
Farm facilities	137,500 R.O. ÷ 20 farm = 6,900 R.O.	(240) 570	(170) 530
Farm machine	3,100 R.O.	(110) 260	(80) 240
<u>Total</u>	<u>90,000 R.O.</u>	<u>(3,160) 7,430</u>	<u>(2,260) 6,900</u>

$$I = \frac{i+(1+i)^n}{(1+i)^n - 1} = 0.0826 \text{ or } 0.0766$$

Benefit

Table L-20 Estimation of Shadow Exchange Rate

<u>Goods</u>	<u>Value</u> (1,000 R.O.)	<u>%</u>	<u>Tarrif</u> %	<u>Weighted</u> <u>Average</u> <u>Tariff</u> %
<u>Imports</u>				
Beverages	3,619	0.01	75	0.75
Tobacco	8,592	0.02	30	0.60
Selected Construction Materials with tarrif of 20%	6,118	0.02	20	0.40
Foods with tariff of Zero	38,411	0.11	0	0
Fertilizer	602	0.00	0	0
Cement	12,893	0.00	0	0
Petroleum Products	24,994	0.07	0	0
All other goods	258,038	0.74	2	1.48
Total	353,267 (36.0%)	1.00		3.23
<u>Exports</u>				
	628,933 (64.0%)	1.00	0	0
<u>Total</u>				
	982,200 (100.0%)			

Source: Trading value is average of three years 1977 to 1979,
based on the Statistical Year Book, 1980.

Tarriff is based on the Oman Facts and Figures, 1980.

Note: Import - $36.0\% \times 3.23 = 1.16\%$

Export - $64.0\% \times 0 = 0$

$1.16\% - 0 = 1.16\% \doteq 1.2\%$

Official exchange rate = U.S.D. = 0.342 R.O.

Shadow exchange rate = U.S.D. = 0.346 R.O. (0.342×1.012)

Domestic market is higher at 1.2% than international price.

Table L-21 Estimation of Demand on Vegetable in Sohar Market

1. Population in the Project Area

	Growth rate		
	<u>0%</u>	<u>3%</u>	<u>4%</u>
1978	16,000		
1985		19,600	21,000
1990		22,800	25,600
1995		26,400	31,100

2. Vegetable Consumption per Capita

1978	50 kg	(annual growth rate 0%)
1985	50 kg	(annual growth rate 0%)
1990	70 kg	(annual growth rate 5%)
1995	90 kg	(annual growth rate 5%)

3. Demand on vegetable (ton)

	Population Growth Rate		
	<u>0%</u>	<u>3%</u>	<u>4%</u>
1978	800		
1985		980	1,050
1990		1,600	1,790
1995		2,370	2,800

4. Supply of vegetable from the Project Area 610 ton
(Onion, Gerlic, Tomato, Potato, Okra, Others)

5. Balance

	<u>1978</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	
Supply	610	750	870	1,010	(growth rate 4%)
Demand	800	980	1,600	2,370	(population 3%)
Balance	Δ190	Δ240	Δ730	Δ1,360	
Project Supply		356	690	790	

Table L-22 Vegetable Consumption in the Five EEC Countries
- 1975 -

Unit: kg per capita

<u>Vegetable</u>	<u>Belgium- Luxembourg</u>	<u>France</u>	<u>Netherlands</u>	<u>United Kingdom</u>	<u>West Germany</u>
Asparagus	0.1	0.8	0.3	0.02	0.4
Cabbage	2.5	2.9	1.6	9.6	7.5
Capsicums	0.3	0.5	0.5	0.1	1.4
Carrots	9.3	10.5	3.6	4.7	3.5
Cauliflowers	3.4	3.7	6.5	4.4	3.9
Celery	3.3	0.5	n.a.	1.3	n.a.
Cucumbers and gherkins	4.0	1.8	5.5	1.2	3.5
Globe artichokes	0.2	2.6	-	0.01	0.02
Green beans	3.5	3.7	2.1	0.5	0.4
Green peas	0.2	0.4	0.2	n.a.	2.0
Lettuce	8.6	4.2	3.3	3.0	2.9
Onions & Garlic	5.4	4.2	3.3	6.7	6.3
Potatoes	107.0	74.6	294.6	134.0	92.0
Tomatoes	8.9	6.6	4.2	4.9	6.8
Albergines	1.7	0.3	0.15	n.a.	0.1
(Total)	158.4	117.3	325.85	170.43	130.72

Source: The market for fruit and vegetables in five EEC countries, in Eastern Europe and The USSR. Summary Volume Prepared for World Bank. Prepared by Landell Mills Associates Limited, London. March, 1978.

Table L-23 Economic Farm Gate Price of Vegetable,
Fruits and Fodder Crop

(Unit: R.O/ton)

Crops	Price Recieved		Transport R.O/ton 2/	Financial Farm Gate Price	Economic Farm Gate Price 3/
	BZ/kg 1/	R.O/ton			
Tomato	200	200	0.4	199.6÷200	197
Water-melon	200	200	0.4	199.6÷200	197
Cabbage	250	250	0.4	249.6÷250	247
Eggplant	100	100	0.4	99.6÷100	98
Red pepper	250	250	0.4	249.6÷250	247
Dates	500	500	-	500	494
Lime	600	600	-	600	593
Banana	150	150	0.4	149.6÷150	148
Alfalfa	70	70	0.4	69.6÷70	69
Cauliflower	300	300	0.4	229.6÷300	296
Onion	100	100	0.4	99.6÷100	98

1/ Vegetables are sold at Sohar Market. Dates and lime are prices which the Production Farms purchased from farmers.

2/ Transportation cost

Vegetable 50 BZ/km/ton x 8 km = 400 BZ/ton

8 km: Farm to Sohar Market

3/ Standard Conversion Factor $0.342 \div 0.346 = 0.988$

Economic price of tomato

$199.6 \times 0.988 = 197.2 \div 197$

Table L-24 Economic Farm Gate Price of Pesticides

(Unit: R.O/kg)

	<u>Financial</u>	<u>Economic</u>
Diathane M45	1.6	1.58
Kafil	1.6	1.58
Dimethoate 40EC	1.6	1.58
Pirimor	0.1	0.1
Omit	1.6	1.58
Furadan	1.5	1.48
Nemacur	1.5	1.48
Nogos (ℓ)	0.025	0.025

Note: Economic price of diathane : S.C.F = 0.988

$$1.6 \times 0.988 = 1.5808 \div 1.58$$

Financial price (A) = paid by farmer + subsidy (A x 0.9)

Table L-25 Economic Price of Gasoline

(Unit: R.O/ℓ)

	<u>Super</u>	<u>Regular</u>	<u>MO. Gas</u>
Market price	0.123	0.116	0.097
Economic price	0.122	0.115	0.096

Note: Market prices are those at Muscat.

Prices in Sohar are 0.126 R.O. of Super, 0.119 R.O. of regular. The difference is considered as transport cost.

Table L-26 Economic Farm Gate Price of Seeds

(Unit: R.O/kg)

	<u>Financial</u>	<u>Economic</u>
Tomato	4	3.95
Water-melon (Winter)	4	3.95
Water-melon (Summer)	4	3.95
Cabbage	2.5	2.47
Red pepper	2	1.98
Eggplant	2	1.98
Alfalfa	20	19.76
Dates	1.5	1.48
Lime	0.3	0.296
Banana	0.05	0.049

Table L-27 Economic Farm Gate Price of Green Manure

(Unit: R.O/ton)

	<u>1982</u>		<u>1985</u>		<u>1990</u>	
	<u>Financial</u>	<u>Economic</u>	<u>Financial</u>	<u>Economic</u>	<u>Financial</u>	<u>Economic</u>
Green manure	8	7.9	9.6	9.5	10.1	10.0

Note: Prices on 1985 and 1990 are estimated using the growth rate of Nitrogen price prospected by World Bank.

Table L-28 Price Structure for Urea in 1982 Constant

(Unit: R.O./ton)

Item	1982		1985		1990	
	Financial	Economic	Financial	Economic	Financial	Economic
1. Export price, F.O.B. Europe (US\$/ton) (1)	218	218	262	262	276	276
2. Ocean freight (US\$/ton) (2)	35	35	36	36	36	36
3. Import price, C.I.F., Mutrah (US\$/ton) (3)	253	253	298	298	312	312
	88	88	104	104	109	109
4. Port handling, storage and processing (4)	13	12.8	15	14.8	15	14.8
5. Ex-godown price	101	100.8	119	118.8	124	123.8
6. Transport cost from Port Mutrah to Sohar fertilizer agents storage	12	11.8	13	12.8	13	12.8
7. Unloading charge and others at storage	5	4.9	6	5.9	6	5.9
8. Transport cost storage to farm	2	2.0	2	2.0	2	2.0
9. Farm gate price per M/T (5)	120	119.5	140	139.5	145	144.5
10. Farm gate price, per 50 kg bag	6	6	7	7	7.25	7.23
11. N: R.O.per kg (6)	0.267	0.267	0.311	0.311	0.322	0.321
	±0.27	±0.27	±0.31	±0.31	±0.32	±0.32

Note: (1) Constant prices in 1982 were estimated based on the Commodity Price Forecasts, Updating dated June, 22, 1981. IBRD.
(2) Ocean freight was assumed referring to the Appraisal Report of ADB on the irrigation project in other country.
(3) Official exchange rate is US\$1.00 = R.O.0.348, R.O.1.00 = US\$2.874
(4) Port handling, storage and processing cost was assumed at around 15 percent of R.O.88.
(5) Oman Sun Farm imported directly Urea with 120 R.O/ton from Sundi and Kuwait.
(6) Component of nitrogen is 45 percent.

Table L-29 Price Structure for TSP in 1982 Constant
(Unit: R.O./ton)

Item	1982		1985		1990	
	Financial	Economic	Financial	Economic	Financial	Economic
1. Export price, F.O.B. U.S. Gulf (US\$/ton)	(1) 199	199	244	244	254	254
2. Ocean freight (US\$/ton)	(2) 50	50	50	50	50	50
3. Import price C.I.F. Mutrah (US\$/ton)	249	249	294	294	304	304
(R.O./ton)	87	87	102	102	106	106
4. Port handling, storage and processing	(4) 13	12.8	15	14.8	15	14.8
5. Ex-godown price	100	99.8	117	116.8	121	120.8
6. Transport cost from Port Mutrah to Sohar fertilizer agent storage	12	11.8	13	12.8	13	12.8
7. Unloading charge and others at storage	5	4.9	6	5.9	6	5.9
8. Transport cost storage to farm	2	2.0	2	2.0	2	2.0
9. Farm gate price per M/T	119	118.5	138	137.5	142	141.5
10. Farm gate price per 50 kg bag	5.95	5.93	6.9	6.9	7.1	7.1
11. P: R.O. per kg	(5) 0.298	0.297	0.345	0.345	0.350	0.350
	±0.3	±0.3	±0.35	±0.35	±0.36	±0.36

Note: (1), (2), (3), (4) are same to description in Urea.
(5) Component of TSP is 40% of P₂O₅.

Table L-30 Price Structure for Potassium Chloride
(Unit: R.O./ton)

Item	1982		1985		1990	
	Financial	Economic	Financial	Economic	Financial	Economic
1. Muriat of Potash (F.O.B. Vancouver) (US\$/ton) (1)	103	103	94	94	99	99
2. Ocean freight (US\$/ton) (2)	100	100	100	100	100	100
3. Import price, C.I.F. Mutrah (US\$/ton) (3)	203	203	194	194	199	199
	71	71	68	68	69	69
4. Port handling, storage and processing (4)	10	9.9	10	9.9	10	9.9
5. Ex-godown price	81	80.9	78	77.9	79	78.9
6. Transport cost from Port Mutrah to Sohar fertilizer agents storage	12	11.8	13	12.8	13	12.8
7. Unloading charge and others at storage	5	4.9	5	4.9	5	4.9
8. Transport cost storage to farm	2	2.0	2	2.0	2	2.0
9. Farm gate price per M/T	100	99.6	98	97.6	99	98.6
10. Farm gate price per 50 kg bag	5	5.0	4.9	4.9	5.0	4.9
11. K: R.O.per kg (5)	0.167	0.167	0.163	0.163	0.167	0.163
	±0.17	±0.17	±0.16	±0.16	±0.17	±0.16

Note: (1), (2), (3), (4) are same to description in Urea.
(5) Component of K is 60% of K₂O.

Table L-31 Study on Marginal Cost of Unskilled Labor

1) Family labor is Sohar Wilaya

	<u>Number of residents of the holding</u>					
	Male		Female		Total	
	<u>No.</u>	<u>Per Farm</u>	<u>No.</u>	<u>Per Farm</u>	<u>No.</u>	<u>Per Farm</u>
Up to 14 years	5,918	1.66	5,786	1.62	11,704	3.28
15 - 64 years	6,776	1.90	6,666	1.87	13,442	3.77
Over 64 years	110	0.03	66	0.02	176	0.05
<u>Total</u>	<u>12,804</u>	<u>3.59</u>	<u>12,518</u>	<u>3.51</u>	<u>25,322</u>	<u>7.10</u>

Note: Total No. of holding is 3564.

Source: The First Agriculture Census, 1978 - 79.

	<u>No. of family labor</u>			
	<u>Total No. (A)</u>	<u>Family Labor (B)</u>	<u>(B)/(A) (%)</u>	<u>Family Labor Per Farm</u>
Up to 14 years	11,704	154	1.3	
15 - 64 years	13,442	3,332	24.8	
Over 64 years	176	110	62.5	
<u>Total</u>	<u>25,322</u>	<u>3,596</u>	<u>14.2</u>	<u>1.0</u>

Number of farmer using family labor

	<u>Household</u>	<u>Percent</u>	
Full time labor	2,794	88.8	
Part time labor	176	5.6	
Casual labor	66	2.1	
Full time x Part time	66	2.1	
Full time x Casual time	22	0.7	
Part time x Casual time	22	0.7	
<u>Total</u>	<u>3,146</u>	<u>100.0</u>	<u>88.0</u>
Don't use	418		12.0
<u>Total</u>	<u>3,564</u>		<u>100.0</u>

No. of family labor per one farm

$3,596 \div 3,146 = 1.14$ person

2) Hired labor in Sohar Wilaya

No. of hired labor

	<u>Total No.</u>
Up to 14 years	-
15 - 64	1,892
Over 64	286
<u>Total</u>	<u>2,178</u>

No. of farmer using hired labor

	<u>Household</u>	<u>Percent</u>	
Full time labor	902	63.1	
Part time labor	264	18.5	
Casual labor	154	10.8	
Full time x Part time	44	3.1	
Full time x Casual time	44	3.1	
Part time x Casual time	22	1.4	
Total	<u>1,430</u>	<u>100.0</u>	<u>40.0</u>
Don't use	2,134		60.0
<u>Total</u>	<u>3,564</u>		<u>100.0</u>

No. of hired labor per one farm

$2,178 \div 1,430 = 1.52$ person

3) Total labor in Sohar Wilaya

	<u>Family Labor</u>		<u>Hired Labor</u>		<u>Total</u> (%)
	<u>Percent</u>	<u>No.</u>	<u>Percent</u>	<u>No.</u>	
Full time labor	88.8	3,193	63.1	1,374	4,567 (79.1)
Part time labor	5.6	201	18.5	403	604 (10.5)
Casual labor	2.1	76	10.8	235	311 (5.4)
Full time x Part	2.1	76	3.1	68	144 (2.5)
Full x Casual	0.7	25	3.1	68	93 (1.5)
Part x Casual	0.7	25	1.4	30	55 (1.0)
<u>Total</u>	<u>100.0</u>	<u>3,596</u>	<u>100.0</u>	<u>2,178</u>	<u>5,774 (100.0)</u>
		(62%)		(38%)	(100%)

4) Labor in the Project Area

No. of farm household 2,100

No. of family labor 3,596 persons x 2,100/3,564
= 3,596 x 0.589 = 2,118

No. of hired labor 2,178 persons x 0.589 = 1,283

	<u>Family Labor</u>		<u>Hired Labor</u>	
	<u>Percent</u>	<u>Person</u>	<u>Percent</u>	<u>Person</u>
Full time labor	90.9	1,925	69.3	889
Part time labor	6.3	134	19.9	255
Casual labor	2.8	59	10.8	139
<u>Total</u>	<u>100.0</u>	<u>2,118</u>	<u>100.0</u>	<u>1,283</u>

5) Present Requirement of Labor by Crops in the Project Area

(Unit: '000 hr)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Dates per ha 1,820 ha	112	136	92	60	92	160	162	192	60	62	90	92	1,310
	204	248	167	109	167	291	295	349	109	113	164	167	
Lime per ha 392 ha	137	86	152	140	72	290	262	62	105	77	60	97	1,540
	54	34	60	55	28	114	103	24	41	30	24	38	
Banana per ha 128 ha	129	56	107	114	86	84	146	89	84	119	87	129	1,228
	17	7	14	15	11	11	19	11	11	15	11	17	
Tomato per ha 17 ha	272	135	34	-	-	-	-	160	100	134	1,005	212	2,052
	5	2	1					3	2	2	17	4	
Alfalfa per ha 166 ha	85	80	88	83	85	86	85	85	86	85	83	88	1,019
	14	13	15	14	14	14	14	14	14	14	14	15	
Okra per ha 5 ha	89	86	122	180	192	146	34						849
	1	1	1	1	1	1	1						
Cabbage per ha 6 ha	82	320	18	-	-	-	-	5	157	431	129	112	1,254
	1	2	1					1	1	3	1	1	
Eggplants per ha 10 ha	262	78	-	-	-	-	-	160	95	111	816	354	1,876
	3	1						2	1	1	8	4	
Total	299	308	259	194	221	431	432	404	179	178	239	246	3,390

Note: Figures in 1st line by crop indicate the labor hours per hectare. The cropping acreage in 2nd line by crop is JICA's estimates based on the Agricultural Census. For example, labor hours of dates on Jan. is calculated at $112 \times 1,820 = 204,000$.

6) Estimation of Actual Labor Hour by Family Labor in the Project Area

Family Labor: (Unit: '000 hr)

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Labor hour per day	8	8	8	8	5	5	5	8	8	8	8	8	8
Full time labor													
Labor days per month	25	25	25	25	25	30	30	25	25	25	25	25	25
No. of labor	1,925	1,925	1,925	1,925	1,925	1,925	1,925	1,925	1,925	1,925	1,925	1,925	1,925
Labor hours (1,000) (A)	385	385	385	385	241	289	289	385	385	385	385	385	385
Part time labor													
Labor days per month	13	13	13	13	13	15	15	13	13	13	13	13	13
No. of labor	134	134	134	134	134	134	134	134	134	134	134	134	134
Labor hours (1,000) (B)	14	14	14	14	9	20	20	14	14	14	14	14	14
Casual labor													
Labor days per month	25	25	25	25	25	30	30	25	25	25	25	25	25
No. of labor	59	59	59	59	59	59	59	59	59	59	59	59	59
Labor hours (1,000) (C)	12	12	12	12	7	9	9	12	12	12	12	12	12
A + B + C	411	411	411	411	257	318	318	411	411	411	411	411	411

7) Estimation of Actual Labor Hour by Hired Labor in the Project Area

(Unit: '000 hr)

Hired Labor:

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Labor hour per day	8	8	8	8	5	5	5	8	8	8	8	8	8
Full time labor													
Labor day per month	25	25	25	25	25	30	30	25	25	25	25	25	25
No. of labor	889												
Labor hour (1,000) (A)	178	178	178	178	111	133	133	178	178	178	178	178	178
Part time labor													
Labor day per month	10	10	10	10	10	15	15	10	10	10	10	10	10
No. of labor	255												
Labor hour (1,000) (B)	20	20	20	20	13	19	19	20	20	20	20	20	20
Casual labor													
Labor day per month	10	10	10	10	10	15	15	10	10	10	10	10	10
No. of labor	139												
Labor hour (1,000) (C)	11	11	11	11	7	10	10	11	11	11	11	11	11
A + B + C	209	209	209	209	131	162	162	209	209	209	209	209	209

8) Monthly Salary of the Hired Farm Labor

- Farm Management Survey -

A	B	C	D
Manager (Egypt) 150 R.O. (43 yrs) Permanent labor (Egypt & India) 60 Driver (Omani) 90	Manager (Egypt) 90 R.O. (35 yrs) Permanent labor (Omani) 125 (Pakistan) 55	Manager (Pakistan) 150 R.O. (30 yrs) Permanent labor (Bangladesh) 60	Permanent labor (Bengalis) 70 R.O. (Omanis) 50 R.O.

(Unit: R.O.)

Note: These are the rate without meal cost

A,B,C and D indicate the sample farmer.

9) Average Monthly Salary Based on Labor Cards Issued During
1980 by the Directorate General of Labor Affairs

(Unit: R.O.)

Occupation	Salary	Number of Labor
General farmers, farm workers, farm machinery operator	54	6,306
Carpenters	61	12,149
Bricklayers, reinforced concreters roofers and plasters	58	26,476
Drivers, transport equipment operator	78	6,013
Fishermen	56	57
Blacksmiths, hammersmiths	65	3,875
Painter	63	2,755

10) Estimation of Marginal Cost of Hired Farm Labor

(Unit: '000 hr)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Requirement	299	308	259	194	221	431	432	404	179	178	239	246	3,390
Actual labor													
Family labor	411	411	411	411	257	318	411	411	411	411	411	411	4,592
Hired labor	209	209	209	209	131	162	162	209	209	209	209	209	2,336
Total	620	620	620	620	388	480	480	620	620	620	620	620	6,928
% of hired labor	34	34	34	34	34	34	34	34	34	34	34	34	34

- 1) Number of hired labor is 1,283 person.
- 2) Available maximum labor per month by hired labor is calculated as the follows:
 $1,283 \text{ persons} \times 8 \text{ hour} \times 30 \text{ days} = 307,920 \div 308,000 \text{ hours}$
- 3)
$$\frac{209}{308} + \frac{209}{308} + \frac{209}{308} + \frac{131}{308} + \frac{162}{308} + \frac{162}{308} + \frac{209}{308} + \frac{209}{308} + \frac{209}{308} + \frac{209}{308} + \frac{209}{308} + \frac{209}{308} + \frac{209}{308} = 0.632$$

12

- 4) Marginal salary of hired farm labor

$$\text{Market salary rate } 60 \text{ R.O.} \times 0.632 = 37.9 \div 38 \text{ R.O.}$$

Table L-52 Net Production Value per ha. by Crop (Economic Price) with Project

(Unit: R.O)

	Gross Prod. Value		Production Cost				Net Prod. Value					
	Yield R.O./ton	R.O.	Seed Fertilizer	Chemical	Machine Labor	Irrigation fee	Total Irrig. fee	Exclude Irrig. fee	Include Irrig. fee			
Dates	12 ^t	494	5,928	-	234	1	340	209	(343)	784	5,144	4,801
Lime	20	593	11,860	-	234	11	465	243	(343)	953	10,907	10,564
Banana	13	148	1,924	-	153	160	570	194	(343)	1,077	847	503
Tomato	40	197	7,880	2	234	20	1,019	327	(343)	1,602	6,278	5,935
Cabbage	25	247	6,175	9	206	5	615	198	(343)	1,033	5,142	4,799
Watermelon (Winter)	15	197	2,955	9	234	3	318	125	(343)	689	2,266	1,923
Watermelon (Summer)	10	197	1,970	9	234	3	389	129	(343)	764	1,206	863
Eggplant	25	98	2,450	2	234	10	773	296	(343)	1,315	1,135	792
Redpepper	15	247	3,705	2	234	6	425	217	(343)	884	2,821	2,478
Alfalfa	60	69	4,140	-	206	46	833	160	(343)	1,245	2,895	2,552

Note: Irrigation fee is included in the O & M cost on an estimation of interval rate of return.
Total value does not include irrigation fee.

Table L-33 Incremental Benefit Caused by Protection of Salt Damage on 800 ha.

Year	Without Project		With Project		Incremental Benefit 10 ³ R.O.
	Cropped area ha	N.P.V 10 ³ R.O.	Cropped area ha	N.P.V 10 ³ R.O.	
1983	1,100	476	1,100	476	-
1984	1,100	476	1,100	476	-
1985	1,100	476	1,100	476	-
1986	1,100	476	1,100	585	109
1987	1,100	476	1,100	585	109

Note Yield of date
at present ----- 1.3 ton/ha
with Project ---- 1.5 ton/ha (+15%)

	<u>Without Project</u>	<u>With Project</u>
G.P.V	1.3 ton x 494 R.O. = 642 R.O/ha	1.5 ton x 494 R.O. = 741 R.O/ha
P.C	209 R.O/ha	209 R.O/ha
N.P.V	433 R.O/ha	532 R.O/ha

Flood Damage Study

1. The precipitation on February 12 to 14, 1982, was the largest one which have been observed by the rain gauge at Sohar office of Department of Water Resources. This heavy rain damaged to pretty degree in the North Batinah Region. After one week it rained again.

The precipitation in February is shown as follows.

Feb. 12th day	0.6 mm	22th day	4.7 mm
13 "	91.0 "	23 "	17.0 "
14 "	16.0 "	24 "	7.9 "

2. Flood flow down many Wadi spreading on the river bed and flow into the sea through mainly the Wadi Sallan and Wadi al Khadaq crossing the national road. The national road concerned in the Project Area has the crossing points of ten places which consist of eight culverts and four Irish-crossing.

The elevation at the Irish-crossing point where the Wadi Al Jizzi cross the national road is 7.9 meters in comparison with road surface with elevation of 13.5 meters. This point shows the least elevation on the national road concerned. Then the greater parts of flood discharge will flow into the sea through this Irish-crossing point.

It is said that the overflow at above point has been caused from the precipitation of around 40 mm per day and over. But the staff at Sohar office of Department of Water Resources talked that the rainfall of 15.2 mm as of 30, April, 1981 caused to be overflowed at above point, because of the previous rainfall during April 26 to 28.

Considering above experience, the frequency at flood to inundate at the Irish-crossing point with the least elevation mentioned above will be assumed as one time per year.

3. Types of flood damage are classified by the following items.
 - 1) Social and economic damages issued from the stop of traffic.
 - 2) Vegetable which is cropped in the farms locating along the national road is inundated.
 - 3) Vegetable in sea side area is also inundated.
 - 4) Loss of livestock.
 - 5) Damage of car caught by flood stream.
 - 6) When the filling flood occur at high tide, the water in the river channel of Wadi Sallem shall overflow the river dike, inundate the residence area and flow into the sea through the road. A part of inundated water damage vegetable.
 - 7) Many of buildings in the farms locating in the interior side along the national road are simple constructions. Flood inundate floor and household goods.
 - 8) Farm land locating along the Wadi is surrounded by sandy levee to protect flood. But then the strong flush water destroy these levee and then the field land is eroded.

The Damages mentioned above were observed during February 12 to 14, 1982. The marks of damage were still observed during the field study carried out on March 3 to 5, 1982.

The flood area is an alluvial fan and sandy land. Then, it is considered that the flood does not stay for a long time at any places, but flow to any lower place.

The eight damaged types mentioned above were studied to be measured in monetary terms.

- 1) It is said that the stop of traffic continued for about 24 hours on 12th days, February 1982. The Jeep of Study Team, however, stopped for about nine hours from nine o'clock, a.m. to six, p.m. at the Irish-crossing point of Wadi Al Jizzi. The horsepower of engine of the passenger cars is small and there exhaust pipe's mouth is in short distance from water surface. Then the driver of these cars were obliged to stay for a long time.

These traffic stop shall temporary prevent the smooth marketing of goods in a view point of national economy. The delay of time when vegetables and fruits are delivered to the markets will occur the loss of goods value.

- 2), 3) and 6):

Damage value of vegetable will be estimated based on actual situation. Every farms are surrounded by the fence made of wire. The careful farmers built small sandy levee with high of 30 to 50 centimeter along the foot of fence to protect invasion of flooding. Vegetables cultivated in the farms without levee or with incomplete levee were suffered from invasion of floodwater. Especially, the field on which a seedling of vegetable has just finished or the vegetable which is in a short time after germination were heavy

damaged. Some field ridges were eroded by floodwater. Farmers must dig up soil to repair the ridges eroded, because roots of crop exposed will be injured by sunshine after recover of weather. This works need pretty labor days. These labor will be estimated in manetary terms under some assumption.

4): Loss of livestocks was not found in the period of flood on February 14, 1982. Staff of Sohar office of Department of Water Resources said that TV and radio correctly reported the weather forecast, then the inhabitants could protect their livestocks.

5): Two passenger cars were damaged. These cars attempted to go across the flood stream, but they were washed away.

7): As the weather recover after pass of flood, the farm labor and manager living in the farm building dried in the sun their wetted mats and blanket. These will be estimated as the flooded damage below the floor level.

8): Both side of Wadi are natural earth bank. A part of this banks are destroyed whenever Wadi flood. Farmer live in farm locating along the Wadi must repair banks after pass of flood. This repair cost will be able to estimat.

Damage value of vegetable

1. Inundated area of February 12 to 14, 1982
 - a) Sesonal cropping field 338 ha
 - b) Palm trees area 275 ha
 - Total 613 ha

2. Vegetable area on February 12 to 14, 1982

	<u>a)</u>	<u>b)</u>	<u>Total</u>
Field area (total)	338	275	613
Cropped area (0.80)	270	220	490
Fruits	45	220	300
Vegetables	95	5	<u>100</u>
Fooder crops	80	5	85
Fallow	50	-	50

3. Cropping calendar of main vegetable on February 12 to 14:

Tomato, eggplant, red pepper, cabbage and bean are in a harvesting period. Water melon for winter season and okra are in seedling period.

4. Damaged acreage for vegetable

a) Production loss

Water melon	100 ha	x 20%	x medium mature	50%	= 10 ha
Tomato	100 "	x 10%	x "		= 10 "
Eggplant	100 "	x 10%	x "		= 10 "
Red pepper	100 "	x 5%	x "		= 5 "
Cabbage	100 "	x 20%	x "		= 20 "
Okra	100 "	x 5%	x "		= 5 "
Bean	100 "	x 5%	x "		= 5
				<u>Total</u>	<u>65 ha</u>

b) Repair of ridge eroded 100 ha

5. Damaged value 158,245 R.O.

a) Production loss 136,895 R.O.

Water melon (923 R.O.)

Seed cost $9.5 \text{ R.O.} \times 10 \text{ ha} = 95 \text{ R.O.}$

Fertilizer $\text{Chemical } 82 \text{ R.O. } 10 \text{ ha} = 820 \text{ R.O.}$

Labor of seedling $46 \text{ hr} \times 10 \text{ ha} = 460 \text{ hr}$
 $460 \text{ hr} \div 8 \text{ hr} = 5.8 \text{ days}$
 $5.8 \text{ days} \times 1.3 \text{ R.O.} = 8 \text{ R.O.}$

Okra (457 R.O.)

Seed cost $10 \text{ R.O.} \times 5 \text{ ha} = 50 \text{ R.O.}$

Fertilizer $80 \text{ R.O.} \times 5 \text{ ha} = 400 \text{ R.O.}$

Labor of seedling $90 \text{ hr} \times 5 \text{ ha} = 450 \text{ hr}$
 $450 \text{ hr} \div 8 \text{ ha} = 5.6 \text{ day}$
 $5.6 \text{ days} \times 1.3 \text{ R.O.} = 7 \text{ R.O.}$

Tomato

NPV: $1,271 \text{ R.O./ha} \times 10 \text{ ha} = 12,710 \text{ R.O.}$

Eggplants

$100 \text{ R.O./ha} \times 10 \text{ ha} = 10,010 \text{ R.O.}$

Red Pepper

$866 \text{ R.O./ha} \times 5 \text{ ha} = 4,330 \text{ R.O.}$

Cabbage

$5,266 \text{ R.O.} \times 20 \text{ ha} = 105,320 \text{ R.O.}$

Bean

$629 \text{ R.O.} \times 5 \text{ ha} = 3,145 \text{ R.O.}$

b) Repair cost for ridge eroded 3,800 R.O.

$100 \text{ ha} \times 15 \text{ dys} \times 2 \text{ labor} = 3,000 \text{ days}$

$3,000 \text{ day} \div 30 \text{ days} \times 38 \text{ R.O./M.M} = 3,800 \text{ R.O.}$

c) Two passenger cars 6,000 R.O.

$3,000 \text{ R.O.} \times 2 = 6,000 \text{ R.O.}$

- d) Blanket spoiled 180 R.O.
30 holding x 2 pieces x 3 R.O. = 180 R.O.
- e) Repair cost of bank of Wadi 8,340 R.O.
 $6 \text{ R.O./m}^3/\text{m} \times 0.632 \text{ (shadow rate)} \times 200 \text{ m} \times 11 \text{ bank}$
 $\div 8,340$
- f) Loss of current meter facilities 3,030 R.O.
 $1,000,000 \text{ Yen} \div 230 \text{ Yen} \div 2.87\$ = 1,515 \text{ R.O.}$
 $1,515 \text{ R.O.} \times 2 = 3,030 \text{ R.O.}$

6. Annual damaged value

Production loss -----	137.0 R.O. x 10 ³
Repair cost for ridges eroded -----	3.8
Car loss -----	6.0
Damage below the floor level -----	0.2
Repair cost of bank of Wadi -----	8.3
Others -----	3.0
	<hr/>
Total	158.3

Estimation of Land Value

Case 1. to use rent of public land

Public land consists mainly of desert and other uncultivated land, land occupied by roads, etc. These lands can be rented to be irrigated by means of pumps for a maximum of 49 years according to the Interim Report, "Water Resources Development Project, North Oman, January 1975".

The maximum area that can be rented is 1.2 hectares 3 members or 2 hectares for a family with more than 3 members. In both cases the rent is 2.5 R.O. per hectare per year.

Capitalized value using land rent of 2.5 R.O. per ha.

<u>Interest</u>	<u>Land Value per ha</u>
Ordinary deposit 5%	$2.5 \text{ R.O.} \div 0.05 = 50 \text{ R.O.}$
Fixed deposit	
Minimum 7%	$2.5 \text{ R.O.} \div 0.07 = 36 \text{ R.O.}$
Maximum 9.5%	$2.5 \text{ R.O.} \div 0.095 = 26 \text{ R.O.}$

Case 2. to use net farm income of 350 R.O. per ha

<u>Interest</u>	<u>Land value per ha</u>
5%	7,000 R.O.
7%	5,000 R.O.
9.5%	3,685 R.O.

Case 3. to use the actual land value resulted from Farm Management Survey

Sample No.4

Arable land 12 feddan = 5.06 ha = 80,000 R.O.

1 ha = 15,810 R.O.

Table L-34 Water Cost per Cubic Meter per Year on
GHUBRAH Desalination Plant

1. Capital Cost per cubic meter per year

Capital Cost per cubic meter --- 1.0 R.O.

Percentage of redemption by annual installments

$$R = \frac{i (1+i)^n}{(1+i)^n - 1} \quad i = 0.10 \quad n = 20$$

R = 0.1174

Capital cost per cubic meter per year

$$1.0 \text{ R.O.} \times 0.1174 = 117 \text{ BZ}$$

2. Variable Cost per cubic meter per year

Case 1 ----- 330 baizer

Case 2 ----- 503 "

3. Annual total water cost per cubic meter

Case 1 ----- 117 + 330 = 447 baizer

Case 2 ----- 117 + 503 = 620 "

Note: Case 1 is based on the Feasibility Report,
The Wadi AL KHAWD, 1981.

Case 2 is based on the information from Ministry of
Electricity and Water.

Table L-35 Capital Cost per Cubic Meter on GHUBRAH
Desalination Plant (Extension)

1. Construction Cost ----- 10 million R.O.

This Plant is scheduled to supply the water from July, 1982.

2. Production ----- 6.0 million gallon per day

one cubic meter = 220 gallon (gallon = 4.546 liter)

6.0 million ÷ 220 = 27,272 cu.m. per day

27,272 x 365 = 9,954,280 cu.m. per year

(0.75 = optimal load factor)

3. Capital cost per cubic meter

10 million R.O. ÷ 9,954 million cu.m. = 1.0 R.O. per cu.m.

= 4.5 BZ per gallon

Note: Above data is based on the information from
the Ministry of Electric and Water, Directorate
Planning and Project.

Table L-36 O & M Cost Per Cubic Meter on Desalination Plant
(based on the Feasibility Report, The Wadi Al Khawd)

1. Total production	6.21 MCM	
2. Total production operating cost (R.O.'000)		1,535
3. Fixed operating cost (R.O.'000)		262
4. Variable cost (R.O.'000) (4-3)		1,273
5. Variable treatment cost (R.O.'000)		267
6. Total variable cost		1,540
7. Variable cost per cubic meter		248 baiza
8. The costs in 1982		

$$248 \times 1.10 \times 1.10 \times 1.10 = 330 \text{ baiza per cubic meter}$$

Source: The Feasibility Report, The Wadi Al Khawd,
Aquifer Recharge Project, 1981. Aug.

Table L-37 O & M Cost per Cubic Meter on Desalination Plant
(based on the information from Ministry of Electricity and Water)

1. Existing GHUBRAH Desalination Plant was established in 1975 and have been supplied since 1977.
2. Production ----- 6.0 million gallon per day
 $6.0 \text{ million gallon} \div 220 \text{ gallon/m}^3 = 27,272 \text{ cu.m. per day}$
 $27,272 \times 365 = 9,954,280 \text{ cu.m. per year}$
(Optimal load factor is not considered to estimate moderately)
3. O & Cost ----- 5.0 million R.O.per year
 $5.0 \text{ million R.O.} \div 9,954 \text{ million cu.m.} = 502 \text{ BZ per cu.m.}$
 $502 \text{ BZ} \div 220 \text{ gallon} = 2.28 \text{ BZ per gallon}$
4. Deliverly Cost 2.0 BZ per gallon
5. Fixed O & M Cost . $2.28 \times 0.17 = 0.39 \text{ BZ per gallon}$
(17% is based on the Feasibility Report, the Wadi Al Khawd)
6. Variable O & M Cost $2.28 - 0.39 = 1.89 \text{ BZ per gallon}$
7. Variable Treatment Cost 0.40 BZ per gallon
(This figure was assumed based on the Feasibility Report, the Wadi Al Khawd)
8. Total Variable Cost $1.89 + 0.40 = 2.29 \text{ BZ per gallon}$
one cubic meter = 220 gallon
Variable cost per cubic meter $2.29 \times 220 = 503 \text{ Baiza}$

Table L-38 Water Cost of Falaj System for Sensitive Analysis

1. Alternative Cost of Falaj for Project

<u>Distance</u>	<u>Depth of Falaj</u>	<u>Unit Cost</u>	<u>Cost</u>
Upstream 0-1 km	15 m	200 R.O./m	
1-2	20	"	
2-3	25	"	
Downstream 3-6	25	"	
<u>Total 6 km</u>		<u>200 R.O./m</u>	<u>1,200,000 R.O.</u>

Source: Unit cost was based on the information from MOAF, Oman.

2. Pump

One set head 20m
 Peak yield 70 l/sec.
 Cost: 10,000,000 ¥ = 15,400 R.O. 650 ¥/R.O.

Source: Head and peak yield was based on the information from JICA, survey team groundwater expert.

3. O & M Cost

Operation Cost 200 R.O.
 Maintenance Cost (1,200,000 + 15,400) x 0.05 = 60,770 R.O.

Source: The information from MOAF, Oman.

4. Production per Year 1,260,000 cu.m.

Note: This figure is the groundwater to be recharged by dam.

5. Capital Cost per Cubic Meter 0.965 R.O.

6. Capital Cost per Cubic Meter per Year

$$0.965 \text{ R.O.} \times 0.1174 = 113 \text{ BZ}$$

$$R = \frac{i(1+i)^n}{(1+i)^n - 1} \quad i = 0.10, \quad n = 20 \quad R = 0.1174$$

7. O & M Cost per Cubic Meter 48 BZ.

8. Water Cost per Cubic Meter

$$113 + 48 = 161 \text{ BZ.}$$