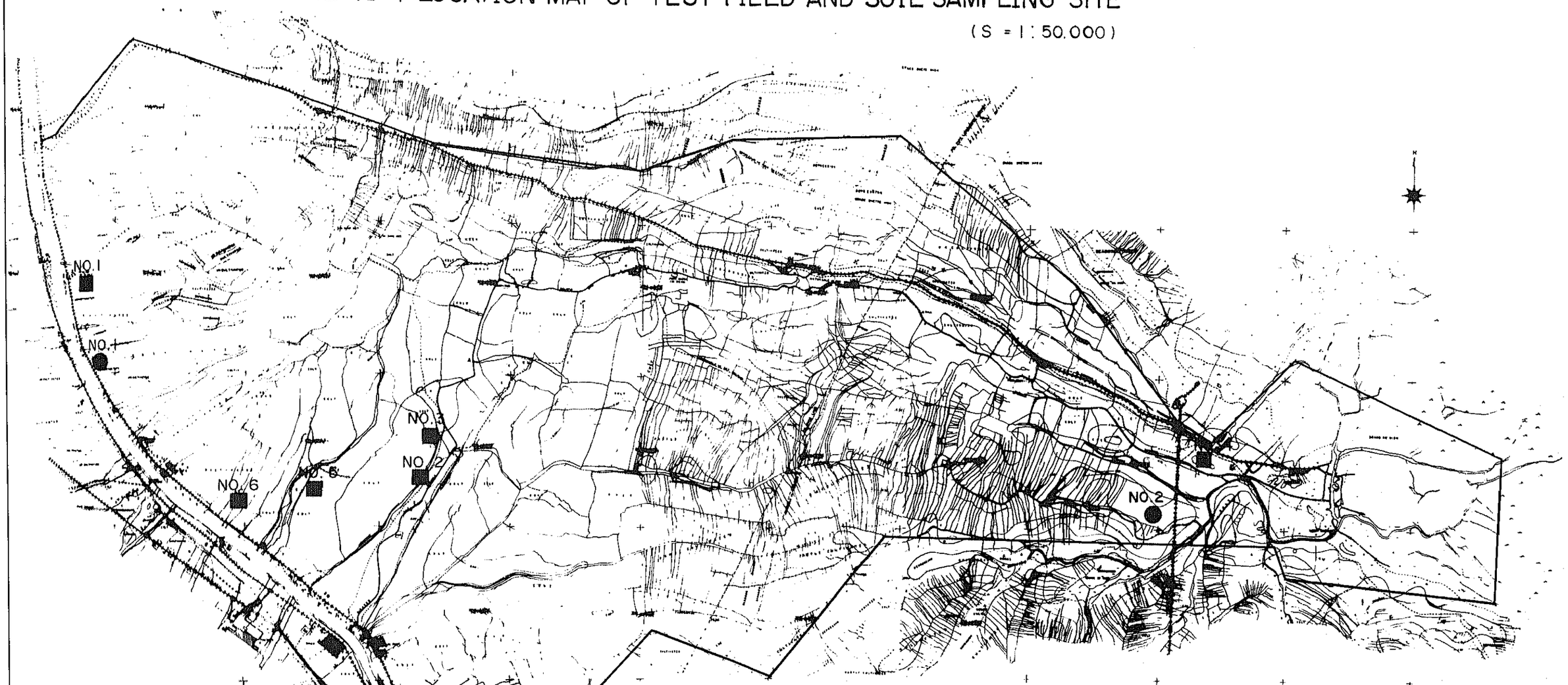
Table 4D-15 Measurements of Water Requirements in Paddy Field (4)
(Winter Season)

Item		Test Field No.3		
1. Location		Central parts of the area		
2. Testing Date		1979 January 31 to February 2		
3. Field Condition				
Irrigation		Irrigation canal provided lift irrigation in summar season		
Drainage		No facilities		
Farm flat		Test field size 45 sq.m		
Soil texture		Silty clay loam		
Water table		No observation		
Paddy cultivation		Stumps of paddy plant grown in the previous season		
4. Measurement		Test (A)	Test (B)	Mean
4-1. By N-type instrument				
Water requirement in depth	(mm)	72	70	71
Evaporation	(mm)	1.8	2.6	2.2
Percolation	(mm)	70.2	67.4	68.8
4-2. By Direct Reading				
Water requirement in depth	(mm)	75	70	73
Evaporation	(mm)	1.8	2.6	2.2
Percolation	(mm)	73.2	67.4	70.8

FIGURE 4D-1 LOCATION MAP OF TEST FIELD AND SOIL SAMPLING SITE

(S = 1 : 50,000)



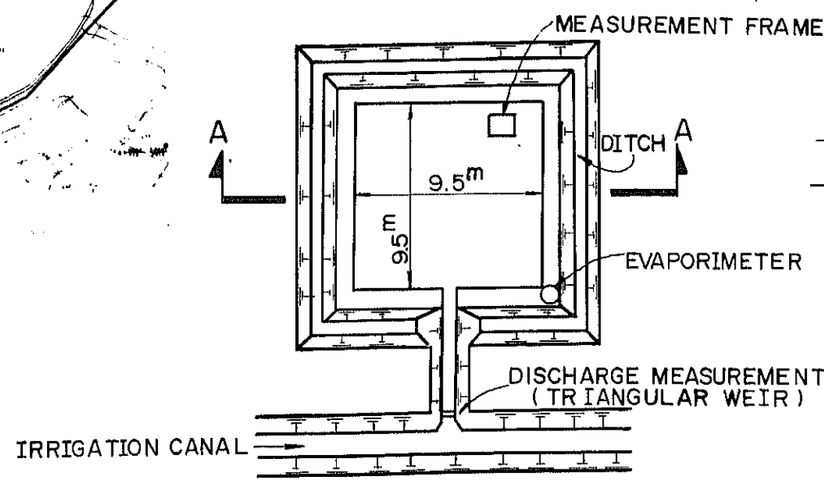
LEGEND

NO.1 ---- SOIL SAMPLING SITE FOR MEASURIG INTAKE RATE

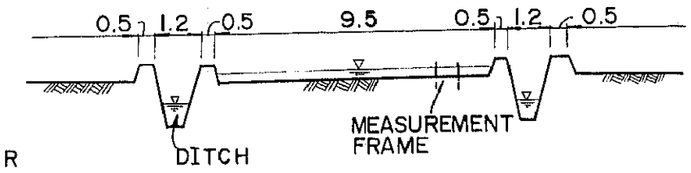
NO.1 ---- TEST FIELD FOR MEASURING WATER REQUIREMENT IN PADDY

FIELD

---- PROJECT BOUNDARY



TYPICAL PLAN OF TEST FIELD



SECTION A-A (UNIT:M)

Table 4D-16 Water Requirements during Land Soaking Period

(Unit: mm/day)

Day	Irrigation Practices	Water Requirement
1st	Top Soil Saturation[1/]	50[2/]
2nd	- do -	50
3rd	Puddling	60[3/]
4th	Maintenance of Standing Water	30[4/]
5th	- do -	30
6th	- do -	30
(7th)	(Sowing)	(-)
	Total	250

Note: 1/: To saturate top soil with 15 cm depth, pre-irrigation water will be supplied for two days ahead of puddling, taking into consideration capacity of farm ditches and required time of water to fill a farm plot.

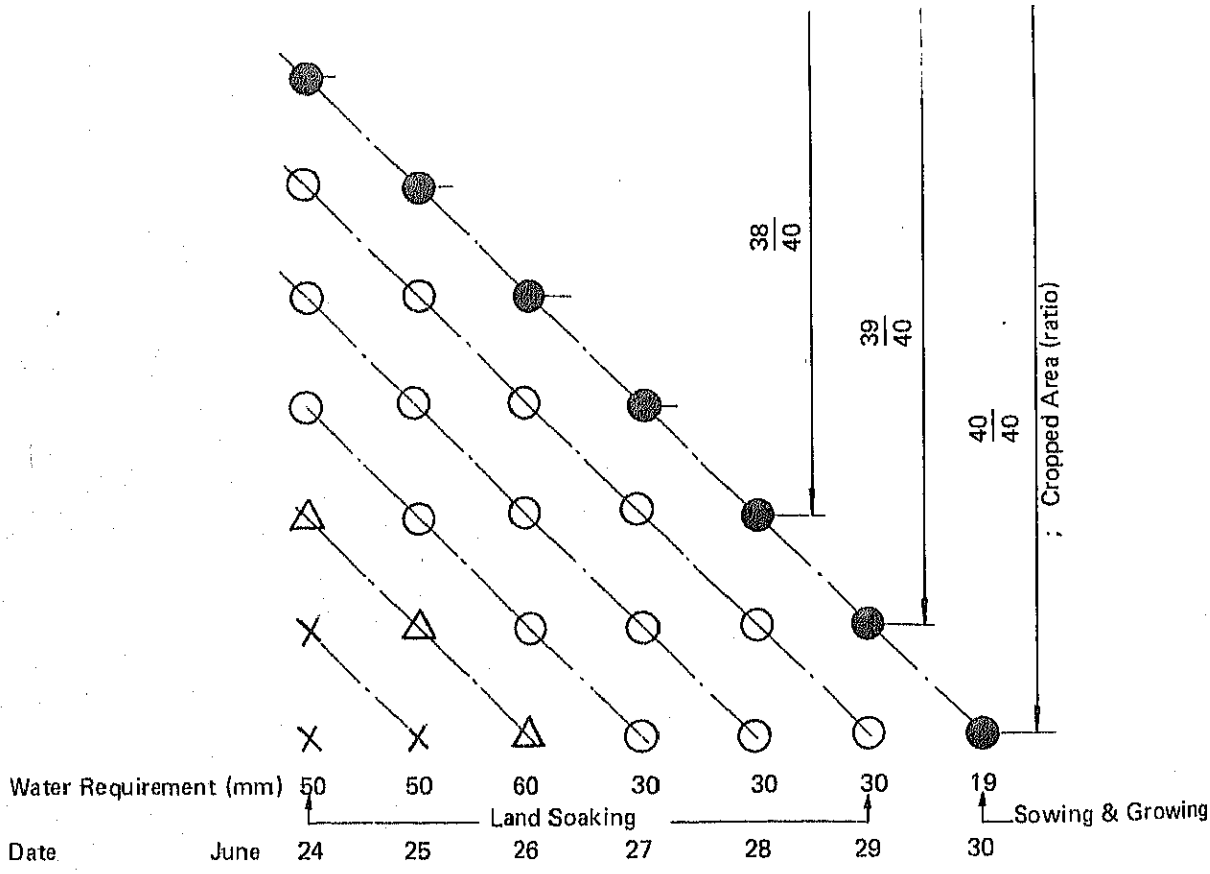
2/: 150 (top soil depth) x 0.4 (porosity) x 1/2 day + 20 (percolation)

3/: 30 (percolation + evaporation) + 30 (standing water)

4/: 30 (percolation + evaporation)

Table 4D-17 Weighted Net Water Requirements for Paddy Cultivation

Date	Calculation	Requirement mm/day
June 24	$(50 \times 2 + 60 + 30 \times 3) \times \frac{1}{40} + 27.1 \times \frac{34}{40} = 6.3 + 23.0 =$	29.3
25	$(50 + 60 + 30 \times 3) \times \frac{1}{40} + 27.1 \times \frac{35}{40} = 5.0 + 23.7 =$	28.7
26	$(60 + 30 \times 3) \times \frac{1}{40} + 27.1 \times \frac{36}{40} = 3.8 + 24.4 =$	28.2
27	$(30 \times 3) \times \frac{1}{40} + 27.1 \times \frac{37}{40} = 2.3 + 25.1 =$	27.4
28	$(30 \times 2) \times \frac{1}{40} + 27.1 \times \frac{38}{40} = 1.5 + 25.7 =$	27.2
29	$(30 \times 1) \times \frac{1}{40} + 27.1 \times \frac{39}{40} = 0.8 + 26.4 =$	27.0
30	$27.1 \times \frac{40}{40} =$	27.1



4D-2 Depth and Interval of Irrigation Water Supply

1) Measurements of Intake Rate

During the field survey made in July 1979, measurements of intake rate were made at two sites which were located in the vicinity of the Kahlaa River and the marsh as shown in Fig. 4D-1 under the different conditions, i.e., wet and dry.

Dry conditions mean existing conditions of the field without any water supply and wet ones mean the field keeping water after 24 hours of soil saturation.

Intake rate for each test field was measured by using a cylinder infiltrometer and the reading of the water depth within the cylinder was made every 5 to 10 minutes at the initial stage and 30 minutes after one hour. Results of intake rate measurements are plotted on a logarithmic paper as shown in Fig. 4D-2,3. In parallel with such measurements, soil samples in each 10 cm depth were taken to analyze physical properties of the field, such as specific gravity, void ratio, field capacity, moisture equivalent and wilting point. Table 4D-18 shows the summary of physical properties at two sites.

2) Depth and Interval of Irrigation Application

Depth and interval of irrigation application is determined in accordance with the following procedure.

(a) Determination of effective root zone

(b) Determination of moisture extraction pattern

(c) Calculation of available moisture of each layer within effective root zone

(d) Calculation of total available moisture

(e) Determination of depth and interval of irrigation application

(i) Depth of Effective Root Zone

The depth of effective root zone will be determined on the basis of field investigations on root zone and soil moisture for each proposed crop over the growing period. However, such investigations were not made due to the limited period of field survey. Therefore, the depth of effective root zone for wheat and barley is assumed at 40 cm.

(ii) Moisture Extraction Pattern

Consumptive use of soil moisture by crop evapotranspiration will vary depending on the depth of soil.

This consumptive rate of soil moisture is so called "moisture extraction pattern", which will be determined on the basis of the field investigations.

Due to the lack of data concerned, the following pattern was applied.

Depth of Effective Root Zone (cm)	Ratio of Moisture Extraction (%)
0 - 10	40
10 - 20	30
20 - 30	20
30 - 40	10

(iii) Available Moisture in each Layer within Effective Root Zone

Available moisture (A.M) is obtained from the following equation.

$$A.M = \frac{1}{100}(Fc-Wp)d$$

Where, Fc: Water holding capacity after 24 hours of soil saturation (%)

Wp: Moisture ratio at wilting point (%)

d: Depth of soil in each layer (mm)

(iv) Total Available Moisture (T.R.A.M)

Total available moisture (T.R.A.M) is calculated by the followings:

In the soil layer concerned,

$$\text{consumed moisture} = \frac{\text{available moisture}}{\text{ratio of moisture extraction}}$$

The layer presenting minimum value obtained from the above equation is the restricting layer of moisture and it's value becomes total available moisture.

The above calculations are shown in table 4D-19 and T.R.A.M, i.e., net amount of water to be replaced becomes 51.5 mm.

(v) Interval of Irrigation Application

Interval of irrigation application is obtained by dividing T.R.A.M by maximum crop evapotranspiration.

Crop	T.R.A.M (mm)	Maximum Evapotranspiration (mm)	Interval (days)
Wheat	51.5	5.9	8
Barley	51.5	4.9	10

From a view point of water management, the same interval of irrigation application is favourable, therefore, 8-day interval is adopted.

Table 4D-18 Physical Features of Soils

Location	Condition	Soil Depth (cm)	Real Specific Gravity (Sr) (g/cm^3)	Apparent Specific Gravity (Sa) (g/cm^3)	Prosity (P) (%)	Void Ratio (%)	Field Capacity (Fc) (%)	Moisture Equivalent (Me) (%)	Wilting Point (Wp) (%)
No. 1	Dry Condition	10	2.56	1.35	48	0.92	32.96	12.6	16.08
		20	2.54	1.28	50	1.00	33.68	20.3	15.74
		30	2.58	1.43	45	0.81	31.86	18.2	14.28
		40	2.61	1.55	41	0.69	31.87	16.4	12.99
		50	2.54	1.48	42	0.72	38.09	23.3	16.45
	Wet Condition	10	2.63	1.60	40	0.66	33.74	23.6	15.34
		20	2.51	1.67	34	0.51	34.25	28.0	15.89
		30	2.50	1.73	31	0.44	35.46	27.0	13.27
		40	2.68	1.62	40	0.66	35.75	25.0	12.93
		50	2.66	1.72	36	0.56	37.82	23.0	13.50
No. 2	Dry Condition	10	2.53	1.80	29	0.40	37.98	27.0	16.31
		20	2.67	1.73	36	0.98	32.56	24.0	16.27
		30	2.53	1.56	39	0.63	34.66	23.0	14.91
		40	2.52	1.63	36	0.56	33.01	25.0	14.39
		50	2.57	1.54	41	0.69	35.80	28.0	15.52
	Wet Condition	10	2.53	1.39	46	0.58	35.40	25.5	13.67
		20	2.63	1.39	48	0.92	33.33	24.8	13.12
		30	2.52	1.36	47	0.88	34.54	25.2	14.28
		40	2.53	1.34	48	0.92	34.52	26.0	15.97
		50	2.56	1.36	47	0.88	36.16	18.0	16.57

Note: Location of measuring site of intake rate is shown in Figure 4D-1.

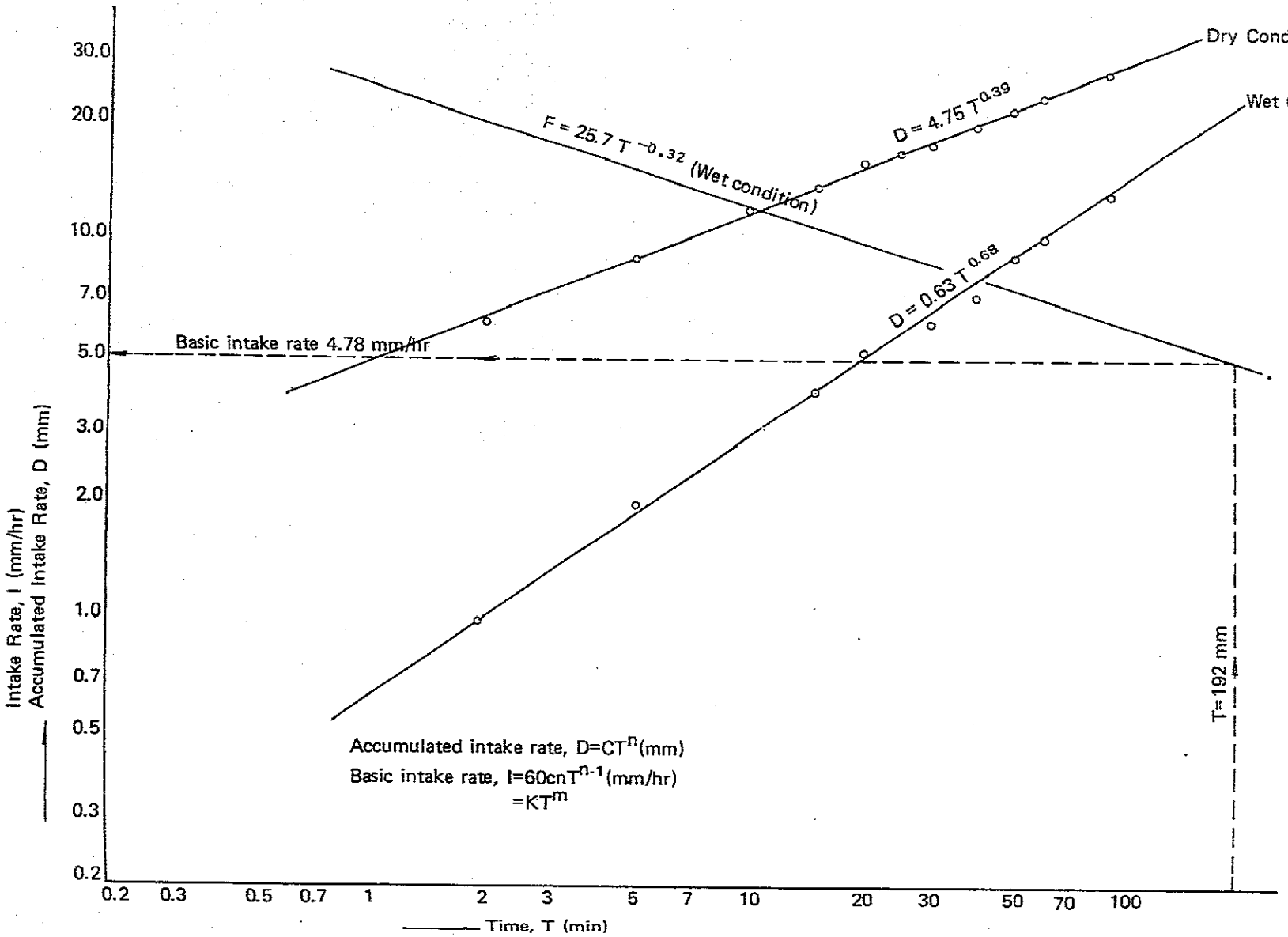
Table 4D-19 Net Amount of Water to be Replaced for Crops

(1) Depth (cm)	(2) Available[1/] Moisture (AM) (mm)	(3) Ratio of Moisture-Extraction	(4) (2)/(3) (mm)	(5) Restricting Layer of Moisture*	(6) TRAM[2/] (mm)	(7) Net Amount of Water to be Replaced (mm)
0-10	20.6	0.4	51.5	*	51.5	51.5
10-20	20.6	0.3	68.7			
20-30	20.6	0.2	103.0			
30-40	20.6	0.1	206.0			

Note: 1/ : AM = 10cm x 20.6% x 10 = 20.6

2/ : TRAM = Total Readily Available Moisture

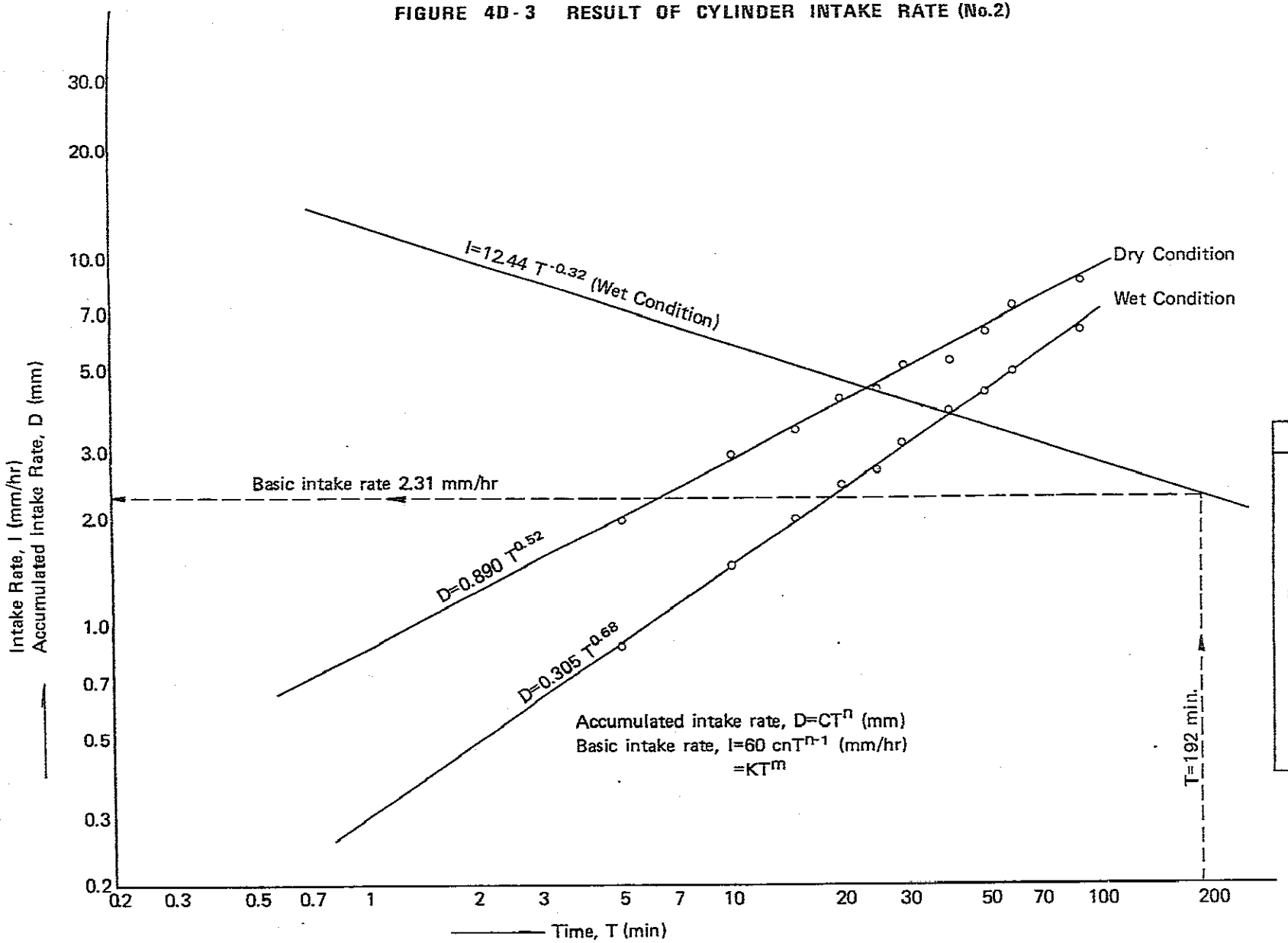
FIGURE 4D-2 RESULT OF CYLINDER INTAKE RATE (No.1)



	Dry Con.	Wet Con.
n	0.39	0.68
C	4.804	0.630
K	112.41	25.70
m	−0.61	− 0.32
T	366.0	192.0
I_{Bi}	3.07	4.78

Note: K=60 cn
m=n−1
T=600(n−1)

FIGURE 4D-3 RESULT OF CYLINDER INTAKE RATE (No.2)



	Dry Con.	Wet Con.
n	0.52	0.68
c	0.890	0.305
K	27.77	12.44
m	−0.48	−0.32
T	288.0	192.0
Ibi	1.83	2.31

Note: K=60 cn
m=n−1
T=600(n−1)

4D-3. Design of Irrigation Canal

1) Design Discharge for Main and Secondary Irrigation Canals

Design discharge of main and secondary irrigation canals is calculated by the following formula;

$$Q = q \cdot A$$

$$q = \frac{dmm \times 10^{-3} \times 1.0\ ha \times 10^{4} \times 10^{3}}{86,400 \times Ep}$$

Where; Q: design discharge (cu.m/sec)

q: unit water requirement (cu.m/sec/ha)

A: net irrigation area (ha)

d: maximum field water requirement (mm/day)

paddy field: d=29.3 mm/day
green belt : d=10.6 mm/day

Ep: irrigation efficiency

paddy field: 0.80
green belt: 0.60

Based upon the above formula, unit water requirement is calculated as follows;

Paddy fields; q=4.239 ℓ/sec/ha
Green belt ; 2=2.045 ℓ/sec/ha

and, the design discharge of main and secondary irrigation canals, is calculated as shown below;

Design Discharge of Irrigation Canals

Canal	Area (ha)		Discharge (cu.m/sec)		
	Paddy Fields	Green Belt	Paddy Fields	Green Belt	Total
Irrigation pump	6,300	330	26.70	0.34	27.04
MIC-1-1	3,261	189	13.82	0.19	14.01
MIC-1-2	1,473	85	6.24	0.09	6.33
MIC-2-1	3,039	141	12.88	0.14	13.02
MIC-2-2	1,737	66	7.36	0.07	7.43
SIC-1-1	1,788	104	7.58	0.10	7.68
SIC-1-2	530	31	2.25	0.03	2.28
SIC-1-3	952	55	4.03	0.06	4.09
SIC-1-4	521	30	2.21	0.03	2.24
SIC-2-1	1,302	75	5.52	0.07	5.59
SIC-2-2	608	23	2.58	0.02	2.60
SIC-2-3	966	37	4.09	0.04	4.13
SIC-2-4	678	26	2.87	0.03	2.90

Note: Discharge for green belt is calculated on the assumption that 50 percent of green belt area will be irrigated taking into account the rotation.

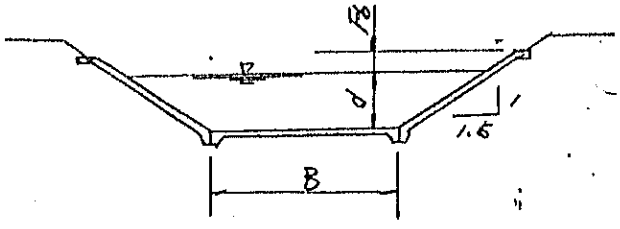
Figure 4D-4 indicates the diagram of proposed irrigation system showing the design discharge and area.

2) Determination of Cross Section of Main and Secondary Irrigation Canals

The manning formula has been applied to determine the cross section of canals as shown below;

$$Q = V \cdot A$$

$$v = \frac{1}{n} R^{2/3} \cdot I^{1/2}, \quad R = A/P$$



Where; Q: discharge (cu.m/s)

A: cross sectional area of flow (sq.m)

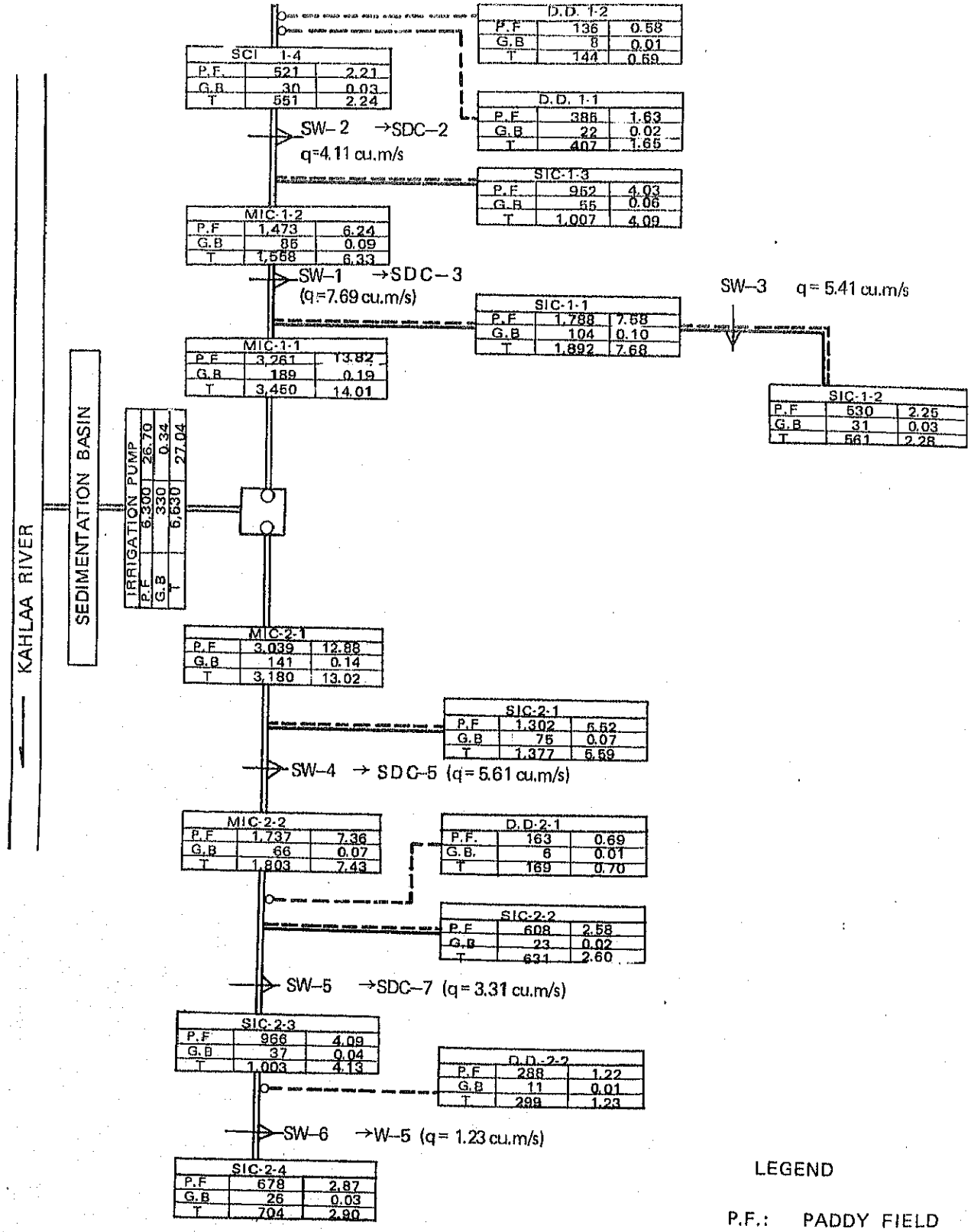
V: mean water velocity (m/sec)

n: roughness coefficient, 0.015

R: hydraulic radius (m)

I: hydraulic gradient

FIGURE 4D - 4 DIAGRAM OF IRRIGATION CANAL SYSTEM



LEGEND

P.F.: PADDY FIELD
G.B.: GREEN BELT
T: TOTAL
D.D.: DIRECT DIVERSION
S.W: SPILL WAY

CANAL NAME		
P.F	AREA	DISCHARGE
G.B	AREA	DISCHARGE
T	AREA	DISCHARGE

The freeboad is determined as follows;

$$Fb = 0.05d + hv + 0.15$$

Where; Fb: freeboad (m)
d: depth at designed maximum discharge (m)
hv: velocity head (m)

Hydraulic calculation for each canal is culculated as shown belows;

(a) Main Irrigation Canal (M.I.C.)

- MIC-1-1, (Q=14.01 cu.m/s)

B=6.40, h=2.00, I=1/12,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
2.00	18.80	13.61	1.381	1.240	0.75	14.1	>	14.01

- MIC-1-2, (6.33 cu.m/s)

B=4.10, h=1.50, I=1/12,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.50	9.53	9.51	1.002	1.001	0.67	6.4	>	6.33

- MIC-2-1, (13.02 cu.m/s)

B=5.50, h=2.00, I=1/10,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discahrge
2.00	17.00	12.71	1.338	1.214	0.81	13.8	>	13.02

- MIC-2-2, (7.43 cu.m/s)

B=4.50, h=1.60, I=1/10,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.60	11.04	10.24	1.075	1.049	0.70	7.7	>	7.43

(b) Secondary Irrigation Canal (S.I.C.)

° SIC-1-1, (7.68 cu.m/s)

B=4.50, h=1.60, I=1/10,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.60	11.04	10.24	1.075	1.049	0.70	7.7	>	7.68

° SIC-1-2, (2.28 cu.m/s)

B=2.00, h=1.20, I=1/10,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.20	4.56	6.33	0.72	0.804	0.54	2.5	>	2.28

° SIC-1-3, (4.10 cu.m/sec)

B=2.50, h=1.50, I=1/10,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.50	7.13	7.91	0.901	0.933	0.62	4.4	>	4.10

° SIC-1-4, (2.24 cu.m/s)

B=2.10, h=1.20, I=1/12,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.20	4.68	6.43	0.728	0.809	0.49	2.3	>	2.24

° SCI-2-1, (5.59 cu.m/s)

B=3.50, h=1.50, I=1/10,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.50	8.63	8.91	0.968	0.979	0.65	5.6	>	5.59

° SCI-2-2, (2.60 cu.m/s)

B=2.60, h=1.20, I=1/10,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.20	5.28	6.93	0.962	0.834	0.56	3.0	>	2.60

° SCI-2-3, (4.13 cu.m/s)

B=2.50, h=1.50, I=1/10,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.50	7.13	7.91	0.901	0.933	0.62	4.4	>	4.13

o SCI-2-4, (2.90 cu.m/s)

B=2.60, h=1.20, I=1/10,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.20	5.28	6.93	0.762	0.834	0.56	3.0	>	2.90

(c) Freeboad (Fb)

Canal	d	0.05d	V	hv	Fb
MIC-1-1, MIC-2-1	2.00	0.10	0.81	0.03	0.23 → 0.30
MIC-2-2, SIC-1-1	1.60	0.08	0.70	0.02	0.25 → 0.30
MIC-1-2, SIC-2-1 SIC-1-3, SIC-2-3	1.50	0.08	0.67	0.02	0.25 → 0.30
SIC-2-4, SIC-2-2 SIC-1-4, SIC-1-2	1.20	0.06	0.56	0.02	0.23 → 0.30

4D-4. Design of Drainage Canal

1) Design Drainage Discharge

The design drainage discharge is calculated on the basis of the following equation;

$$Q = q \cdot A$$

$$q = \frac{dmm \times 10^{-3} \times 1.0^{ha} \times 10^{4} \times 10^{3}}{86,400}$$

Where; Q: design discharge (cu.m/s)
q: unit drainage discharge (cu.m/s/ha)
A: drainage area (ha)
d: drainage modulus, 7 mm/day

Following table indicates the drainage discharge estimated by the above formula;

Design Discharge of Drainage Canal

Canal	Drainage Area (ha)	Drainage Discharge (cu.m/sec)	Discharge of Spillway (cu.m/sec)
SDC-1	334	0.27	-
SDC-2	677	0.55	4.11
SDC-3	1,176	0.95	7.69
SDC-4	1,371	1.17	-
SDC-5	590	0.48	5.61
SDC-6	603	0.49	-
SDC-7	522	0.42	3.31
SDC-8	103	0.08	-
SDC-9	161	0.13	-
SDC-10	142	0.12	-
SDC-11	152	0.12	-
SDC-12	81	0.07	1.23
SDC-13	704	0.57	-
SDC-14	633	0.51	-
MDC-1	3,735	3.02	7.69
MDC-2	5,926	4.80	7.69
MDC-3	6,630	5.37	7.69

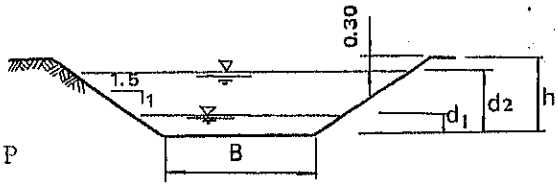
Figure 4D-5 indicates the diagram of the proposed drainage system showing the design discharge and area.

2) Determination of Cross Section of Main and Secondary Drainage Canal

The manning formula has been applied to determine the cross section of canal:

$$Q = V \cdot A$$

$$V = \frac{1}{n} R^{2/3} \cdot I^{1/2}, \quad R = A/P$$



o Roughness coefficient
n = 0.030

Where; Q: discharge (cu.m/s)
A: cross sectional area of flow (sq.m/s)
V: mean water velocity (m/sec)
n: roughness coefficient, 0.030
R: hydraulic radius (m)
P: wetted perimeter (m)
I: hydraulic gradient

Hydraulic calculation for each canal is calculated as shown belows;

(a) Main Drainage Canal (M.D.C.)

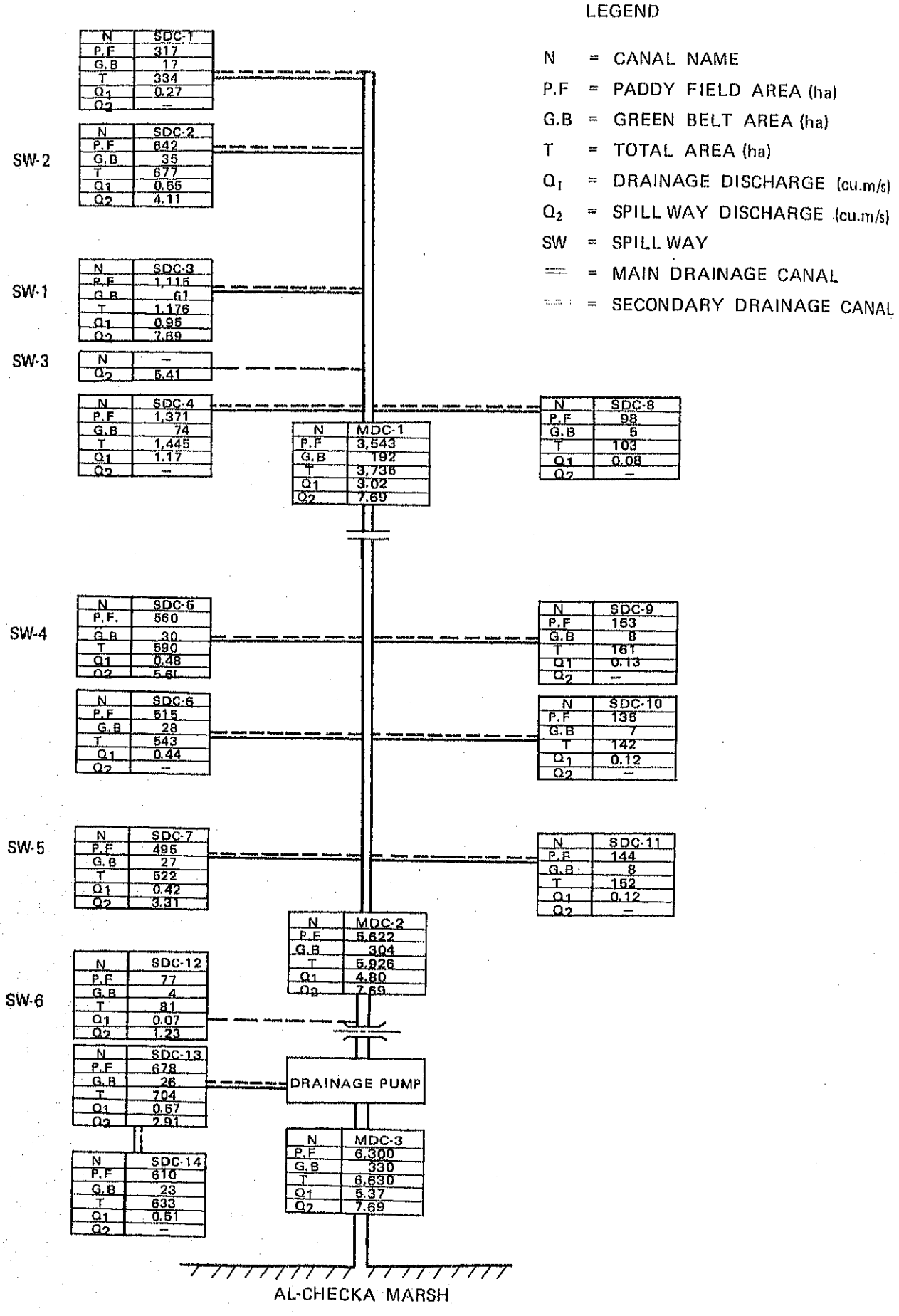
o MDC-1 B=4.00 d_1=1.50 D_2=2.70 H=3.00 I=1/7,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.5	9.37	9.43	0.994	0.996	0.40	3.75	>	3.02
2.7	21.74	13.73	1.583	1.358	0.54	11.74	>	7.69

o MDC-2 B=5.50 d_1=1.50 d_2=2.70 H=3.00 I=1/7,000

d	A	P	R	$R^{2/3}$	V	Q		Design Discharge
1.5	11.63	10.93	1.064	1.042	0.42	4.88	>	4.80
2.7	25.79	15.23	1.693	1.420	0.57	14.70	>	7.69

FIGURE 4D-5 DIAGRAM OF PROPOSED DRAINAGE CANAL SYSTEM



- MDC-3 B=9.00 d_1= 1.60 d_2=2.70 H=3.00 I=1/12,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
1.50	16.88	14.43	1.170	1.110	0.33	5.57	> 5.37
2.70	35.24	18.73	1.881	1.524	6.46	16.21	> 7.69

(b) Secondary Drainage Canal (S.D.C.)

- SDC-1 B=1.50 d_1=0.55 d_2= - H=1.65 I=1/5,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
0.55	1.27	3.62	0.351	0.498	0.23	0.29	> 0.27

- SDC-2 B=4.00 d_1=0.80 d_2=1.60 H=1.90 I=1/5,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
0.80	4.16	6.88	0.605	0.715	0.33	1.37	> 0.55
1.60	10.24	9.77	1.048	1.032	0.48	4.91	> 4.11

- SDC-3 B=4.50 d_1=1.20 d_2=2.00 H=2.30 I=1/5,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
1.20	7.56	8.83	0.856	0.902	0.43	3.25	> 0.95
2.00	15.00	11.71	1.281	1.180	0.56	8.40	> 7.69

- SDC-4 B=4.00 d_1=0.80 d_2= — H=1.90 I=1/7,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
0.80	4.16	6.88	0.605	0.715	0.29	1.21	> 1.17

- SDC-5 B=4.50 d_1=1.00 d_2=1.80 H=2.10 I=1/7,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
1.00	6.00	8.10	0.741	0.819	0.32	1.92	> 0.48
1.80	12.96	10.99	1.179	1.116	0.44	5.70	> 5.61

- SDC-6 B=2.00 d_1=0.75 d_2= -- H=1.85 I=1/5,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
0.75	2.34	4.70	0.498	0.628	0.25	0.59	> 0.44

° SDC-7 B=3.00 d_1=0.75 d_2=1.55 H=1.85 I=1/5,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
0.75	3.09	5.70	0.542	0.665	0.31	0.96	> 0.42
1.55	8.25	8.59	0.960	0.973	0.46	3.80	3.31

° SDC-8 - SDC-11 B=1.50 d_1=0.50 d_2= -- H=1.60 I=1/5,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
0.50	1.13	3.30	0.342	0.489	0.23	0.26	> 0.08 - 0.13

° SDC-12 B=1.50 d_1=0.50 d_2=1.30 H=1.60 I=1/5,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
0.50	1.13	3.30	0.342	0.489	0.23	0.26	> 0.07
1.30	4.49	6.19	0.725	0.807	0.38	1.71	> 1.23

° SDC-13 B=4.0 d_1=0.75 d_2= -- H=1.85 I=1/12,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
0.75	3.09	5.70	0.542	0.665	0.20	0.62	> 0.57

° SDC-14 B=2.00 d_1=0.75 d_2= — H=1.85 I=1/5,000

d	A	P	R	$R^{2/3}$	V	Q	Design Discharge
0.75	2.34	4.70	0.498	0.628	0.25	0.59	> 0.51

4D-5. Design of Pump Facilities

1. Required Number of Pumps and Bore Diameter

The maximum design discharges for irrigation and drainage are as follows;

Irrigation pump	Qmax = 27.04 cu.m/s
Drainage pump	Qmax = 5.37 cu.m/s

The required number of pumps should be more than two sets, taking the trouble of pumps into consideration. The general relation between discharge and bore diameter are as follows;

Bore, D (mm)	Discharge, Q(cu.m/m)
900	90 - 115
1,000	115 - 150
1,200	150 - 200
1,350	200 - 255
1,500	255 - 325
1,650	325 - 400

The following table indicates the capacity of pump for irrigation and drainage in case of various numbers of pumps.

Irrigation Pump

Number	Capacity of Pump per One Unit		Bore Diameter
	Q(cu.m/s)	Q(cu.m/m)	
11 unit	2.46	147.6	ø1,000
9	3.00	180.0	ø1,200
7	3.86	231.6	ø1,350
6	4.51	270.6	ø1,500
5	5.41	324.6	ø1,650

Drainage Pump

Number	Capacity of Pump per One Unit Q(cu.m/s)	Q(cu.m/m)	Bore Diameter
3 unit	1.79	107.4	ø900
2	2.69	161.4	ø1,200

Regarding the number of pump units, in general as the number will be increased, the required cost of pump facilities and also operation and maintenance costs will become large, while a plenty number of pump units make it more advantageous from view point of pump operation and dispersion of danger against emergencies.

In determining adequate number of pump units, due considerations on severe conditions in Iraq such as climate and water quality and also on the fact that the vertical pumps having the diameter of around 900 m/m to 1,000 m/m are favorable in Iraq have been paid.

Under the these conditions, the required numbers of irrigation and drainage pumps are decided at 11 units with 1,000 mm diameters and 3 units with 900 mm diameters respectively.

2. Type of pump

The required total head of pumps for irrigation and drainage is about 5.6 m and 2.2 m respectively, and the suitable pump type of meet such low head pump is axial flow pump or mixed flow pump. Both types of these pumps are futher classified into two types, vertical type and holizontal type. These pumps have some merits and demetits. In General, the merits and demerits are tabulated as follow.

Comparison of Mixed and Axial Flow Pump

Item	Mixed Flow Pump	Axial Flow Pump
Weight of pump	heavy	light
Pump efficiency	high	a little low
Shaft house power	constant in wide head variation	a shaft house power in shut-off operation is more than twice of that in normal operation
Suction performance	superior	inferior
Unit cost	a little expensive	inexpensive
Operation	to adopt all variation	to adopt about 135% to 70% of designed head
Application total pump head	horizontal type; less than about 8 m vertical type; less than about 20m	less than 4 m

Comparison of Horizontal and Vertical Pumps

Item	Horizontal Type	Vertical type
Floor space	large	small
Pliming device	necessary	unnecessary
Operation	complication	simple
Cavitation	for suction lift too high cavitation many occur	easy to avoid cavatation
Checking maintenance and repair	convenient	inconvenient

Irrigation Pump

Necessary total head for irrigation pump is 5.6 m, so the mixed flow pump can be adopted. Furthermore, since water level of the Kahlaa river fluctuates ranging from W.L. 6.95 m to W.L. 3.40 m

through year. Cavitation phenomenon will occur in case of the horizontal pump type. Therefore, suitable pump type for irrigation is decided at vertical mixed flow pump.

Drainage Pump

Necessary total head for drainage pump is 2.20 m, so both types of pump, axial flow pump and mixed flow pump can be applicable. From view point of cavitation phenomenon, in case that the mixed flow pump is adopted as drainage pump, the horizontal pump type, which is more economical in comparison with vertical one, can be used. However, taking into account that some type at pumps as those for irrigation is more convenient from view point of operation and maintenance of facilities and also the vertical pump type is more favorable in Iraq in case of large bore diameter of pumps. Under the consideration, the vertical axial flow pump will be used for drainage purposes.

3. Decision of Pump Dimension

Designed actual head

Irrigation pump

Delivery water level: WL8.40 m

Suction water level : WL3.40 m

Designed actual head, Ha = WL8.40 - WL3.40 = 5.00m

Drainage pump

Highest delivery water level: HWL 4.80

Lowest suction water level : LWL 2.80

Designed actual head, Ha=(HWL4.80 - LWL2.80) x 0.8 ≒ 1.60 m)

Total loss head

Item	Unit	Irrigation	Drainage
Delivery capacity	cu.m/s	2.46	1.79
Diameter of pipe D_1	mm	1,000	900
Diameter of delivery pipe D_2	mm	1,350	1,100
Length of pipe D_1 : ℓ_1	m	10.0	6.0
Length of pipe D_2 : ℓ_2	m	0.5	2.5
Velocity at D_1 : V_1	m/s	3.13	2.81
Velocity at D_2 : V_2	m/s	1.72	1.88
Velocity head of V_1 : HV_1	m	0.53	0.40
Velocity head of V_2 : HV_2	m	0.16	0.18
Valve loss head : h_1	m	0.13	0.10
Reducer loss head : h_2	m	0.05	0.04
Delivery loss head : h_3	m	0.24	0.27
Bending loss head (45°): h_4	m	-	0.06
Friction loss head : h_5	m	0.11	0.08
Total loss head : Σh	m	0.53 ≒0.60	0.55 ≒0.60

Total head

Irrigation pump

Total head = Actual head + Total loss head

= 5.0 + 0.60 = 5.60 m

Drainage pump

Total head = 1.60 + 0.60 = 2.20 m

Required output of the motor

The required output of the moter is calculated by the following equation;

$$RHP = \frac{K.r.Q.H.\ (1+\alpha)}{n_p \cdot n_g}$$

Where; PHP: Required output (KW)

K : Coefficient 0.163

r : Specific gravity of water 1.0

Q : Delivery capacity (cu.m/min)

H : Total head (m)

α : Surplus coefficient 0.15

n_p: Pumping efficiency

ø900	77%
ø1,000	80%

ng: Conduction efficiency in case of using the reduction gear 0.95

Irrigation pump:

$$RHP = \frac{0.163 \times 1.0 \times 147.6 \times 5.6 \times (1+0.15)}{0.80 \times 0.95} \fallingdotseq 200 \text{ kw}$$

Drainage pump:

$$RHP = \frac{0.163 \times 1.0 \times 107.4 \times 2.2 \times (1+0.15)}{0.77 \times 0.95} \fallingdotseq 60 \text{ kw}$$

Selection of prime mover

The moter or diesel engine is used as a prime mover of pump. Their merits and demerits are as follows.

Comparison of Moter and Diesel Engine

Item	Motor	Diesel Engine
Installation cost	not expensive except those of special specifications	expensive
Maintenance	simple and easy	periodic operating for maintenance is required
Operation	simple and easy	complication
Vibration & Noise	comparatively silent	severe
Countermeasure of power stoppage	generator is required	small capacity generator is required for auxiliary equipment

After comparison of these prime movers motors and adopted in the project.

Auxiliary electric power facilities to generate the power when electric power is interupted will not be provided in the project, because crops in the fields will not be damaged during the short peirods of time of power interruption, owing to the stored water in the fields which will play the function of reservoirs.

4D-6. Study on Required Capacity of Desilting Reservoir

According to the data on silt contents in the Tigris river, which was derived from the report of soil and soil conditions in Iraq, 1953, it was found that monthly silt content in the Tigris river fluctuates remarkably by season as shown in attached Table 4D-20, and average silt contents during paddy growing season, May to October, and winter season, November to April, are observed to be 712 g/cu.m and 878 g/cu.m respectively.

Required volume of silt treatment could be calculated on the assumption that 93 percent of silt will be sedimented in the sedimentation basin, and an annual sedimental volume are estimated at 153.7 x 10^3 cu.m as shown below;

Annual Sedimented Volume by Irrigation Water

Crops	Water Requirement 1/ ($10^6 m^3$)	Silt Content (Kg/m^3)	Sedimentation Ratio 2/ (%)	Sedimented Volume ($10^6 Kg$)	Sedimented Volume ($10^3 cu.m$)
Paddy	289.4	0.712	93	191.6	147.4
Wheat and Barley	15.9	0.878	93	12.9	9.9
Green Belt	5.7	0.795	93	4.2	3.2
Total	311.0	-	-	208.7	160.5

1/: derived from Table 4D-11, Appendix 4D-1

2/: derived from actual sedimented ratio at Missan Sugar Cane Factory at the month of December 1968 and May 1969

3/: bulk density of silt, 1.3 ton/cu.m

The required capacity of sedimentation basin could be determined based on the river bed elevation of the Kahlaa river and workable depth of pump dredger etc,.

Required acreage of sedimentation basin (A).

$$= \frac{\text{Sedimented Volume (cu.m)}}{\text{Sedimentation Depth (m)}}$$

$$= \frac{153.7 \times 10^6}{0.4} \fallingdotseq 40 \text{ ha}$$

Bed elevation of basin: 2.0 m

Law water level in Kahlaa river: 3.4 m (including 10cm water head loss)

Expectable depth of sedimentation, (m): 3.4m - 2.0m = 1.4m basin

Workable depth of pump dredger, (h)

Actual sedimentation depth, M=(m)-(n)=1.4-1.0=0.4m

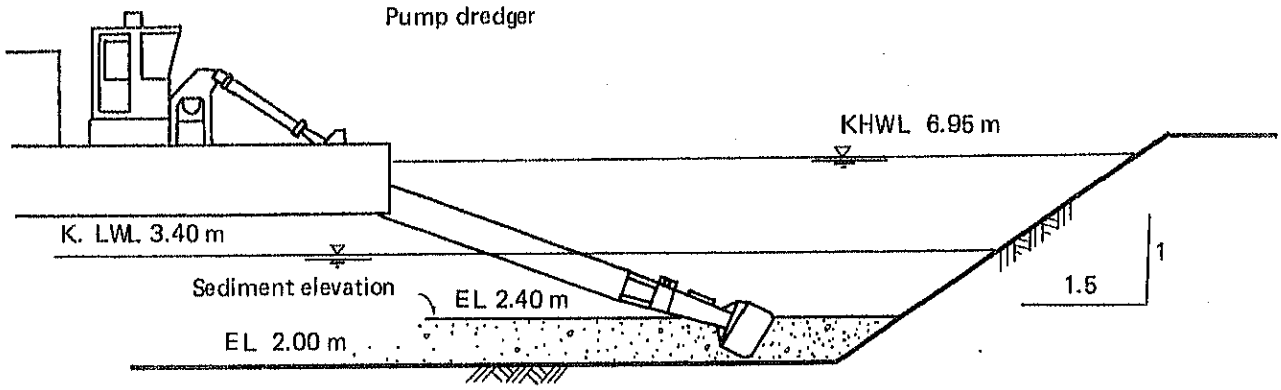


Table 4D-20 Average Discharge and Silt Content of the Tigris River

Month	Average Discharge (cu.m/s)	Average Silt Contents (g/cu.m)
Jan.	922	380
Feb.	1,355	650
Mar.	1,985	1,400
Apr.	2,909	2,300
May	2,777	2,100
Jun.	1,661	1,200
Jul.	870	380
Aug.	480	240
Sep.	360	180
Oct.	352	170
Nov.	496	220
Dec.	682	320
	1,236	795

Source: Soil and Soil Conditions in Iraq, 1953 by Dr. P. Buringh, Station; near Baghdad

Average silt contents;

May - Oct.; 712 g/cu.m

Nov. - Apr.; 878 g/cu.m

Average silt contents mentioned above are shown graphicaly as follows;

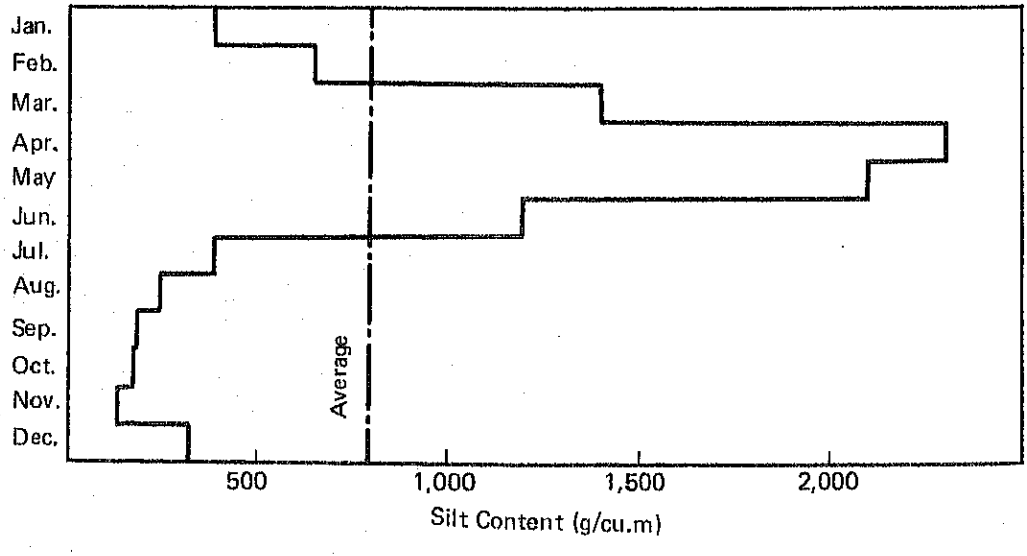


FIGURE 4D-6 EFFECTIVENESS OF DIFFERENT LEACHING PROGRAM IN RELATION TO INITIAL SALINITY IN THE TOP METER

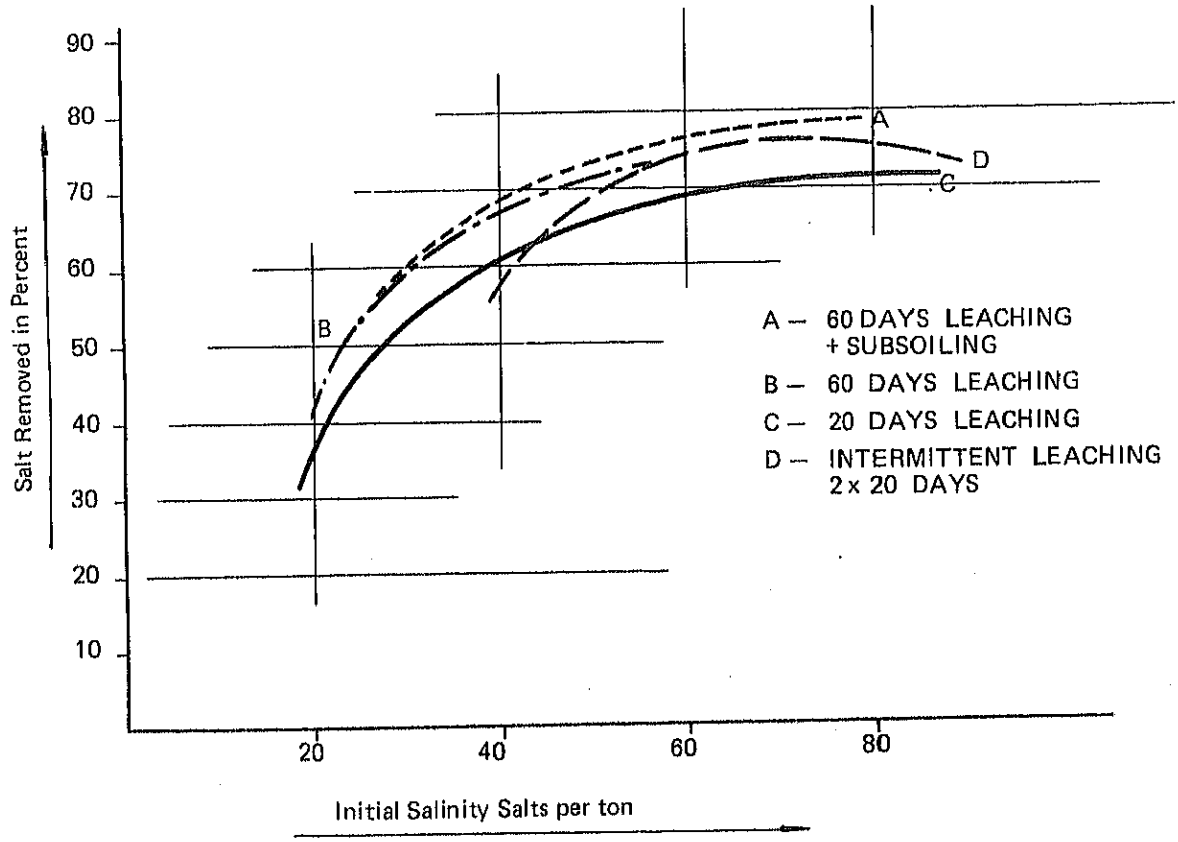


Table 4D-21 Average of Salt Balance in the Top Meter under Different Leaching Programs

Leaching Schedule	Initial Salinity <40ton salts/ha				Initial Salinity >40ton salts/ha			
	Tested Area ha	Before Leaching ton	After Leaching ton	Salt removed %	Tested Area ha	Before Leaching ton	After Leaching ton	Salt removed %
60 days	252	25.2	10.4	58.4	183	49.6	14.8	70.3
60 days + Subsoiling	319	25.6	10.4	59.8	131	51.6	14.4	72.1
20 days	228	25.6	14.0	45.3	104	60.0	18.0	70.0
2 x 20days	69	33.2	10.8	67.2	162	78.8	23.2	60.6

Note: The above data are based on "Drainage and Soil Reclamation of Maisan Cane Sugar Project" prepared by Dr. Ibrahim M. Habib.

4D-7. Underdrain with Rice Chaffs

Soils in the project area, specially those of upper layers than the depth of 150 cm from the ground surface are of heavy texture of clay or silty clay and their permeability is generally low at 10^{-4} cm/sec.

Such impermeability and the poor drainage capacity hinder the growth of paddy rice and bring difficulties in agricultural operations. In addition, salinization will be accelerated by application of irrigation water containing salinity under arid climate.

To improve those impermeable soil layers, provisions of underdrains with rice chaffs are recommendable as one of appropriate measures, taking into concideration the following advantages.

(i) Excavated portions filled with rice chaffs form pervious zones.

(ii) Rice chaffs have higher durability comparing with other organic materials placed as filter material.

(iii) Rice chaffs are easily available from a viewpoint of the cost and the supply quantity.

Depending on structures and construction methods, underdrain with rice chaffs are classified into two types.

Type A

After excavating the trench, rice chaffs are placed at the bottom of the trench with about 5 cm thickness and the drain pipe is installed on rice chaffs. The upper parts of the drain pipe are filled with rice chaffs of 5 cm thickness and buried with excavated material.

This type involves the following disadvantages.

- Permeability at excavated parts filled with soil material is low.
- Impervious layers will be formed at the upper parts above the drain pipes due to compaction done by cultivating machines at the time of plowing and harvesting.

Type B

Rice chaffs are filled upto the surface of the paddy field after placing the drain pipe which is installed at the central part of a farm plot as a main underdrain. Supplemental underdrain, trenches filled only with rice chaffs are provided to meet the main underdrain at the right angle.

The pervious zone buried with rice chaffs are formed over the layer from a plowing layers to drain pipes.

In addition, this type has the following advantages:

- Cracks developing in mid-summer drainage easily continue to the wall of rice chaffs which is formed upto the plowsole.
- The efficiency on collection of drainage water becomes higher than that of type A.
- Even in a previous period to mid-summer drainage in which cracks do not develop on paddy fields, the pervious layer is formed from the surface of the field to the drain pipe through crop roots extending inside the wall of rice chaffs from the plowing layer.

Besides the above mentioned types, combination of mole drains and underdrains with rice chaffs is also effective in a paddy field under heavy texture of clay or silty clay soil.

Generally, the suitable interval and depth to place underdrains with rice chaffs are modified during implementation of the project,

referring the effect of underdrains.

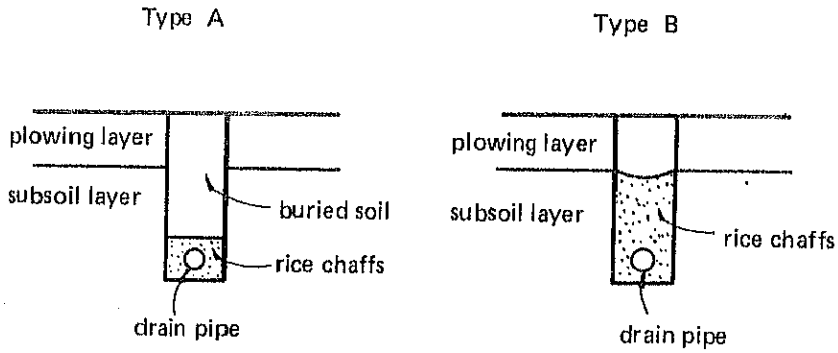
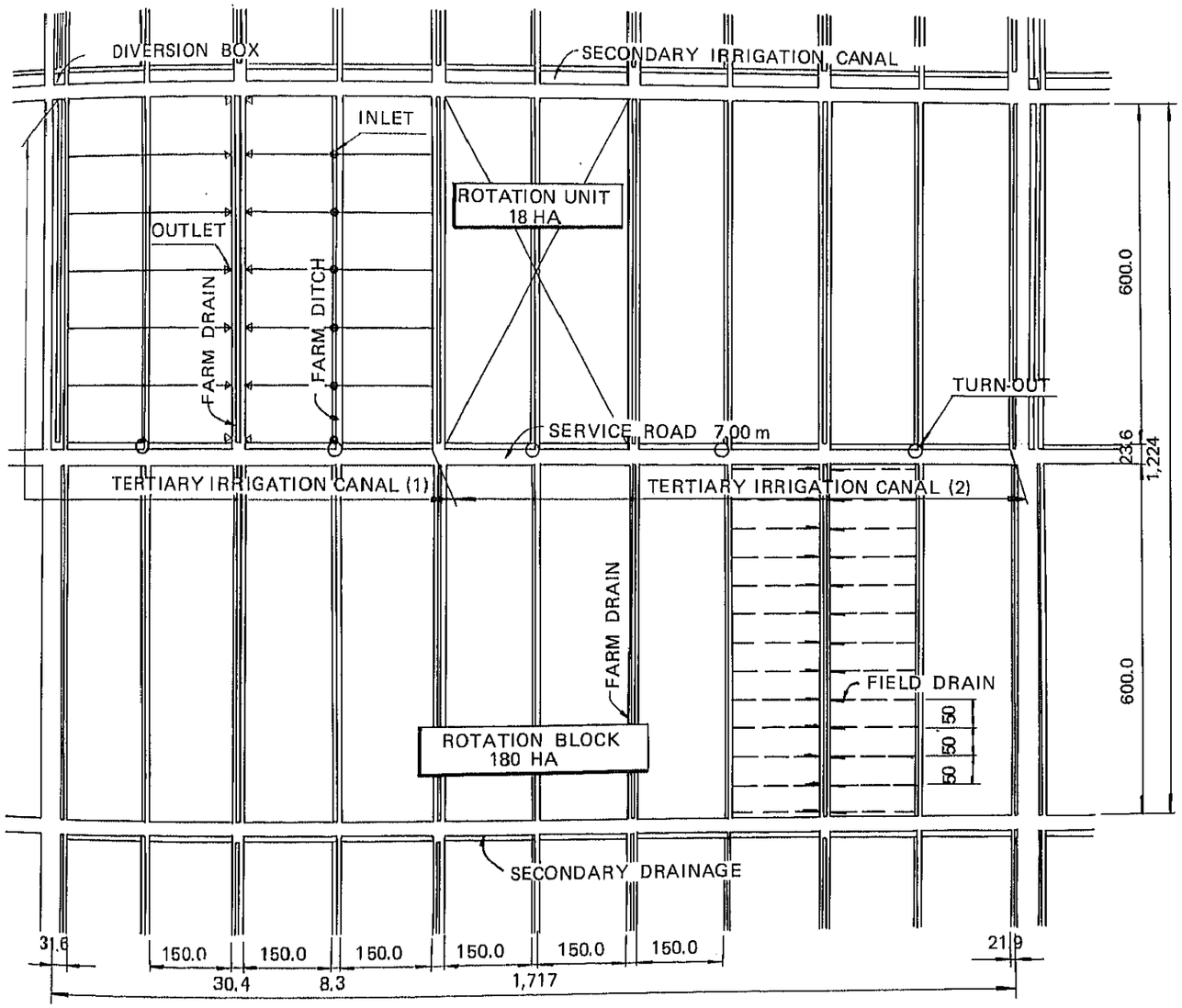
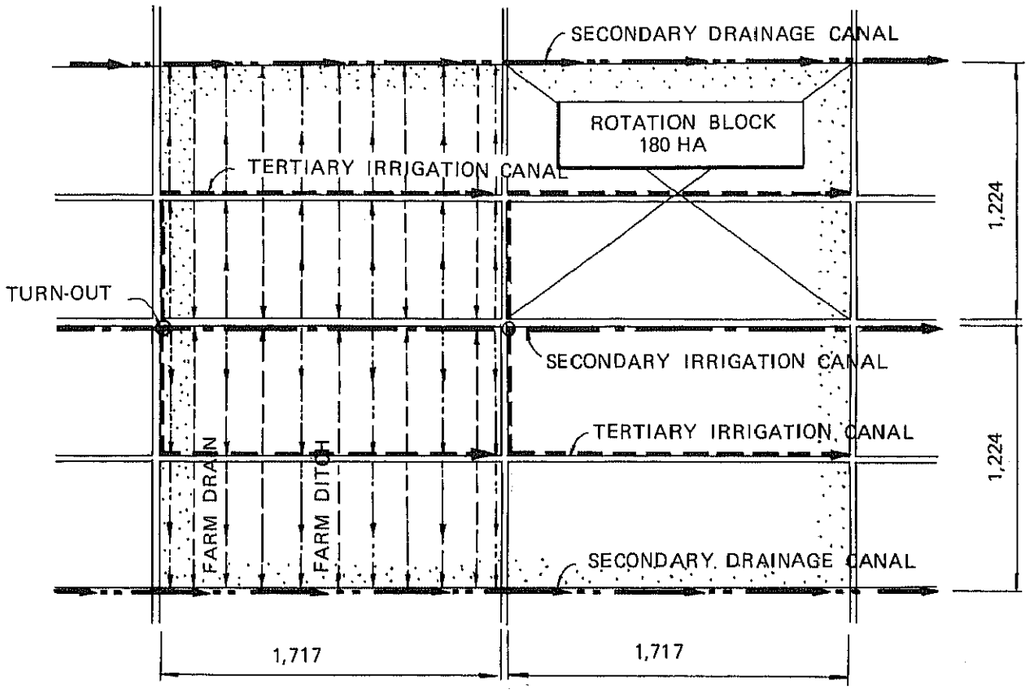


FIGURE 4D-7 TYPICAL LAYOUT OF ON-FARM WATER DISTRIBUTION SYSTEM (SCALE 1: 10,000)

ROTATION BLOCK



IRRIGATION BLOCK



FARM PLOT:	1.5 ha	(150m x 100m)
FARM BLOCK:	9.0 ha	(1.5ha x 6 plots)
ROTATION UNIT:	18.0 ha	(9.0ha x 2 units)
IRRIGATION UNIT:	36.0 ha	(18ha x 2 units)
ROTATION BLOCK:	180.0 ha	(36ha x 5 units)
OPERATION UNIT: (STANDARD)	720.0 ha	(180ha x 4 blocks)

Estimation of Reduction Ratio;

Total acreage of rotation block:	210.2 ha
Acreage of on-farm facilities	30.0 ha
Service road:	4.0 ha
Farm ditch:	5.0 ha
Farm drain (including on-farm road):	21.0 ha
Reduction ratio:	14.3%

Table 4D-22 Estimated Earth Moving Works at On-farm Level

Case I; Land Leveling within Plot (No Land Adjustment in Elevation)

Alternatives	Total Net Area (ha) (1)	Size of Farm Plot (m) x (m) (2)	Total Earth Moving Volume (m^3) (3)	Average Hauling Distance (m) (4)	Earth Moving Works ($10^6 m^4$) (5)=(3)x(4)	Earth Moving Volume per Hectare (m^3/ha) (6)=(3)/(1)
Plan - A	72.34	150 x 600	47,570	286.5	13.63	658
B	72.43	150 x 300	35,045	156.3	5.48	484
C	72.31	150 x 200	30,106	107.7	3.24	416
D	72.33	150 x 150	26,855	83.3	2.24	371
E	72.24	150 x 100	23,601	71.2	1.68	327
F	72.89	150 x 50	20,544	70.6	1.45	282

Case II; Land Leveling within Block with Land Adjustment in Elevation of 5 cm

Alternatives	Total Net Area (ha) (1)	Size of Farm Plot (m) x (m) (2)	Total Earth Moving Volume (m^3) (3)	Average Hauling Distance (m) (4)	Earth Moving Works ($10^6 m^4$) (5)=(3)x(4)	Earth Moving Volume per Hectare (m^3/ha) (6)=(3)/(1)
Plan - A	72.34	150 x 600	47,570	286.5	13.63	658
B	72.43	150 x 300	62,689	306.6	19.22	866
C	72.31	150 x 200	56,501	323.5	18.28	782
D	72.33	150 x 150	58,277	318.3	18.55	806
E	72.24	150 x 100	49,547	314.2	15.57	686
F	72.89	150 x 50	44,468	313.7	13.95	610

Table 4D-23 Hauling Quantity and Distance (Alternative A: $600^{m} \times 150^{m}$)

Block No.	Case I: Within Plot Quat. (cu.m)	Within Plot Dis. (m)	Among Plots Quat. (cu.m)	Among Plots Dis. (m)	Total Quat. (cu.m)	Average Dis. (m)	Case II: Within Plot Quat. (cu.m)	Within Plot Dis. (m)	Among Plot Quat. (cu.m)	Among Plot Dis. (m)	Total Quat. (cu.m)	Average Dis. (m)
1.	3,730	200.1	-	-	3,730	200.1	3,730	200.1	-	-	3,730	200.1
2.	3,270	273.3	-	-	3,270	273.3	3,270	273.3	-	-	3,270	273.3
3.	779	89.5	-	-	779	89.5	779	89.5	-	-	779	89.5
4.	10,295	368.9	-	-	10,295	368.9	10,295	368.9	-	-	10,295	368.9
5.	8,779	359.9	-	-	8,779	359.9	8,779	359.9	-	-	8,779	359.9
6.	6,136	326.3	-	-	6,136	326.3	6,136	326.3	-	-	6,136	326.3
7.	5,870	298.0	-	-	5,870	298.0	5,870	298.0	-	-	5,870	298.0
8.	4,156	22.9	-	-	4,156	22.9	4,156	22.9	-	-	4,156	22.9
9.	4,555	244.9	-	-	4,555	244.9	4,555	244.9	-	-	4,555	244.9
Total	47,570	286.5	-	-	47,570	286.5	47,570	286.5	-	-	47,570	286.5
	Earth moving works, Q.D=13,628.9 x $10^{3}m^{4}$						Earth moving works, Q.D=13,628.9 x $10^{3}m^{4}$					

Table 4D-24 Hauling Quantity and Distance (Alternative B: $300^{m} \times 150^{m}$)

Block No.	Case I: Within Plot Quat. (cu.m)	Within Plot Dis. (m)	Among Plots Quat. (cu.m)	Among Plots Dis. (m)	Total Quat. (cu.m)	Average Dis. (m)	Case II: Within Plot Quat. (cu.m)	Within Plot Dis. (m)	Among Plot Quat. (cu.m)	Among Plot Dis. (m)	Total Quat. (cu.m)	Average Dis. (m)
1.	2,780	109.7	-	-	2,780	109.7	948	130.0	3,001	304.3	3,949	262.5
2.	2,262	154.2	-	-	2,262	154.2	2,262	154.2	-	-	2,262	154.2
3.	778	89.9	-	-	778	89.9	778	89.9	-	-	778	89.9
4.	7,749	161.9	-	-	7,749	161.9	-	-	15,963	367.4	15,963	367.4
5.	5,191	120.3	-	-	5,191	120.3	-	-	15,016	338.1	15,016	338.1
6.	4,023	189.2	-	-	4,023	189.2	65	190.0	9,284	329.6	9,349	328.6
7.	4,354	184.2	-	-	4,354	184.2	555	189.9	6,909	338.0	7,464	327.0
8.	4,160	164.7	-	-	4,160	164.7	4,160	164.7	-	-	4,160	164.7
9.	3,784	167.6	-	-	3,748	167.6	3,748	167.6	-	-	3,748	167.6
Total	35,045	156.3	-	-	35,045	156.3	12,516	157.6	50,173	343.8	62,689	306.6
	Earth moving works, Q.D=5,477.5 x $10^{3}m^{4}$						Earth moving works, Q.D=19,220.4 x $10^{3}m^{4}$					

Table 4D-25 Hauling Quantity and Distance (Alternative C: 200^{m}x150^{m})

Block No.	Case I: Within Plot Quat. (cu.m)	Case I: Within Plot Dis. (m)	Case I: Among Plots Quat. (cu.m)	Case I: Among Plots Dis. (m)	Case I: Total Quat. (cu.m)	Case I: Average Dis. (m)	Case II: Within Plot Quat. (cu.m)	Case II: Within Plot Dis. (m)	Case II: Among Plots Quat. (cu.m)	Case II: Among Plots Dis. (m)	Case II: Total Quat. (cu.m)	Case II: Average Dis. (m)
1.	2,852	95.1	-	-	2,852	95.1	1,567	100.6	1,998	293.1	3,565	208.5
2.	1,900	102.9	-	-	1,900	102.9	1,900	102.9	-	-	1,900	102.9
3.	783	88.9	-	-	783	88.9	783	89.0	-	-	783	89.0
4.	7,421	110.2	-	-	7,421	110.2	971	131.6	13,716	427.3	14,687	407.8
5.	4,730	105.6	-	-	4,730	105.6	1,491	126.1	11,035	406.5	12,526	373.1
6.	3,466	124.7	-	-	3,466	124.7	516	120.1	7,724	371.9	8,240	356.1
7.	2,722	114.9	-	-	2,722	114.9	28	118.0	7,878	341.4	7,906	340.6
8.	3,528	111.9	-	-	3,528	111.9	1,763	105.5	2,346	209.9	4,109	165.1
9.	2,704	92.3	-	-	2,704	92.3	2,253	90.2	532	192.3	2,785	109.7
Total	30,106	107.7	-	-	30,106	107.7	11,272	105.8	45,229	377.8	56,501	323.5

Earth moving works, Q.D=3,242.4 x $10^3 m^4$ | Earth moving works, Q.D=18,278.1x $10^3 m^4$

Table 4D-26 Hauling Quantity and Distance (Alternative D: 150^{m}x150^{m})

Block No.	Case I: Within Plot Quat. (cu.m)	Case I: Within Plot Dis. (m)	Case I: Among Plots Quat. (cu.m)	Case I: Among Plots Dis. (m)	Case I: Total Quat. (cu.m)	Case I: Average Dis. (m)	Case II: Within Plot Quat. (cu.m)	Case II: Within Plot Dis. (m)	Case II: Among Plots Quat. (cu.m)	Case II: Among Plots Dis. (m)	Case II: Total Quat. (cu.m)	Case II: Average Dis. (m)
1.	2,507	72.6	-	-	2,507	72.6	1,531	84.5	2,850	307.6	4,381	229.6
2.	1,758	81.9	-	-	1,758	81.9	1,758	81.9	-	-	1,758	81.9
3.	789	88.0	-	-	789	88.0	789	88.0	-	-	789	88.0
4.	7,480	84.7	-	-	7,480	84.7	126	86.8	14,248	419.3	14,374	416.4
5.	3,912	83.7	-	-	3,912	83.7	-	-	13,631	347.4	13,631	347.4
6.	2,524	82.2	-	-	2,524	82.2	260	100.0	8,020	374.9	8,280	366.3
7.	2,397	85.9	-	-	2,397	85.9	798	97.9	6,413	373.4	7,211	342.9
8.	3,021	88.9	-	-	3,021	88.9	1,380	90.6	3,560	178.2	4,940	153.7
9.	2,467	80.4	-	-	2,467	80.4	1,581	74.2	1,321	172.0	2,902	118.7
Total	26,855	83.3	-	-	26,855	83.3	8,234	85.1	50,043	356.7	58,277	318.3

Earth moving works, Q.D=2,237.0 x $10^3 m^4$ | Earth moving works, Q.D=18,549.6 x $10^3 m^4$

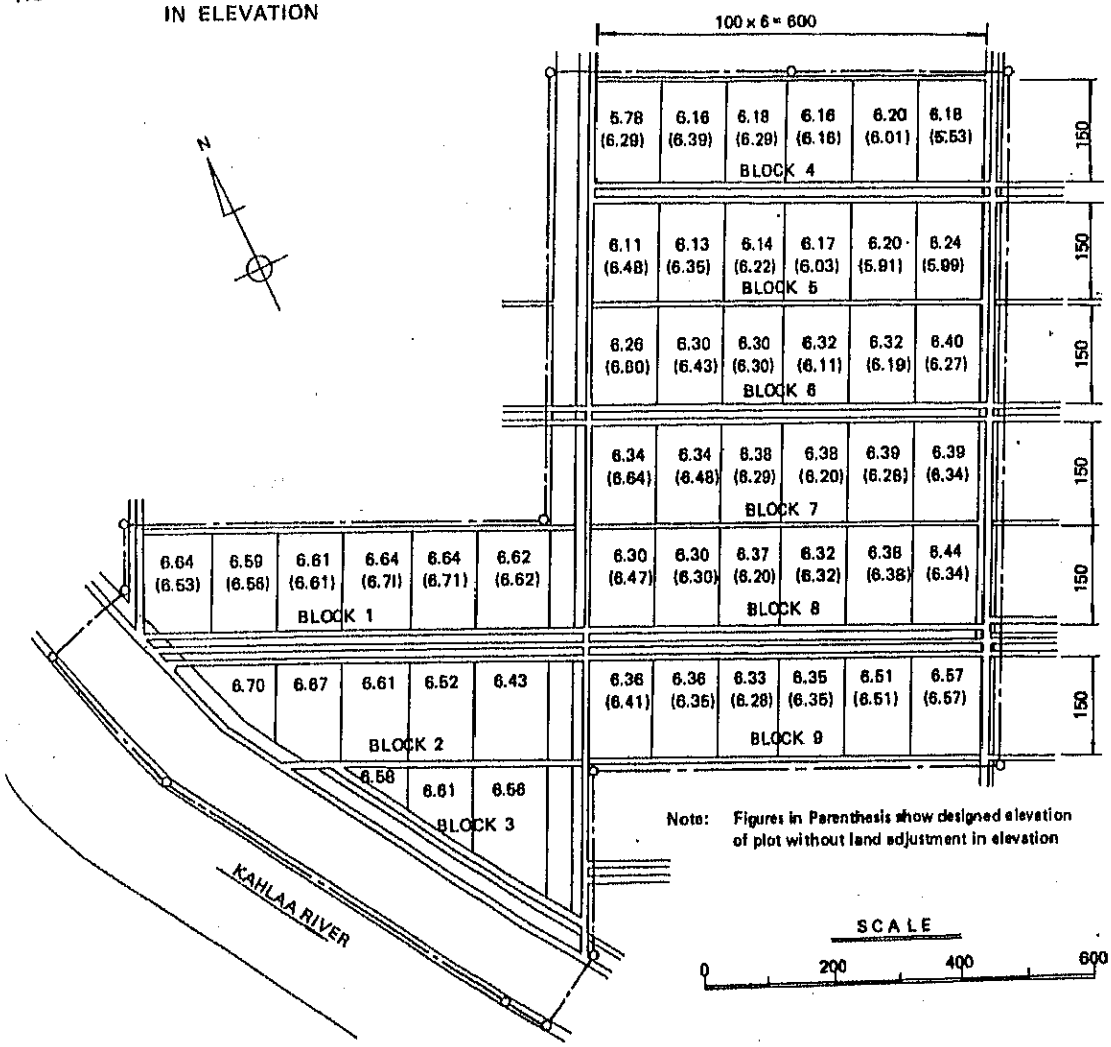
Table 4D-27 Hauling Quantity and Distance (Alternative E: 150^{m}x100^{m})

Block No.	Case I						Case II					
	Within Plot		Among Plots		Total	Average	Within Plot		Among Plots		Total	Average
	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)
1.	2,376	74.0	-	-	2,376	74.0	1,361	56.6	2,251	318.4	3,612	219.8
2.	1,607	71.4	-	-	1,607	71.4	1,607	71.4	-	-	1,607	71.4
3.	778	85.1	-	-	778	85.1	778	85.1	-	-	778	85.1
4.	6,367	68.1	-	-	6,367	68.1	338	60.0	12,561	436.9	12,899	427.0
5.	3,482	73.1	-	-	3,482	73.1	9	86.0	9,987	365.8	9,996	365.5
6.	1,933	66.0	-	-	1,933	66.0	276	74.6	6,960	362.7	7,236	351.7
7.	1,899	64.1	-	-	1,899	64.1	59	85.6	6,453	307.1	6,512	305.1
8.	2,723	82.3	-	-	2,723	82.3	1,752	84.0	2,540	208.6	4,292	157.7
9.	2,376	67.0	-	-	2,376	67.0	1,877	57.9	738	204.5	2,615	99.3
Total	23,601	71.2	-	-	23,601	71.2	8,057	59.6	41,490	362.6	49,547	314.2
	Earth moving works, Q.D=1,680.4 x $10^{3}m^{4}$						Earth moving works, Q.D=15,567.7 x $10^{3}m^{4}$					

Table 4D-28 Hauling Quantity and Distance (Alternative F: 150^{m}x50^{m})

Block No.	Case I						Case II					
	Within Plot		Among Plots		Total	Average	Within Plot		Among Plots		Total	Average
	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)	Quat. (cu.m)	Dis. (m)
1.	2,358	74.0	-	-	2,358	74.0	1,327	89.1	2,140	312.8	3,467	227.1
2.	1,486	67.6	-	-	1,486	67.6	1,420	70.5	97	87.3	1,517	71.6
3.	733	93.0	-	-	733	93.0	733	93.0	-	-	733	93.0
4.	5,355	71.1	-	-	5,355	71.7	198	49.7	11,097	416.9	11,295	410.5
5.	2,942	64.7	-	-	2,942	64.7	78	59.0	8,689	377.3	8,767	374.5
6.	1,575	60.9	-	-	1,575	60.9	38	66.8	6,160	341.3	6,198	339.6
7.	1,499	51.6	-	-	1,499	51.6	160	62.8	6,213	340.5	6,373	333.5
8.	2,559	83.6	-	-	2,559	83.6	1,403	85.3	2,434	195.0	3,837	154.9
9.	2,037	72.7	-	-	2,037	72.7	1,344	62.7	937	169.9	2,281	106.7
Total	20,544	70.6	-	-	20,544	70.6	6,701	77.2	37,767	355.7	44,468	313.7
	Earth moving works, Q.D=1,450.4 x $10^{3}m^{4}$						Earth moving works, Q.D=13,949.6 x $10^{3}m^{4}$					

FIGURE 4D-8 DESIGNED ELEVATION OF PLOT IN CASE OF WITH AND WITHOUT LAND ADJUSTMENT IN ELEVATION



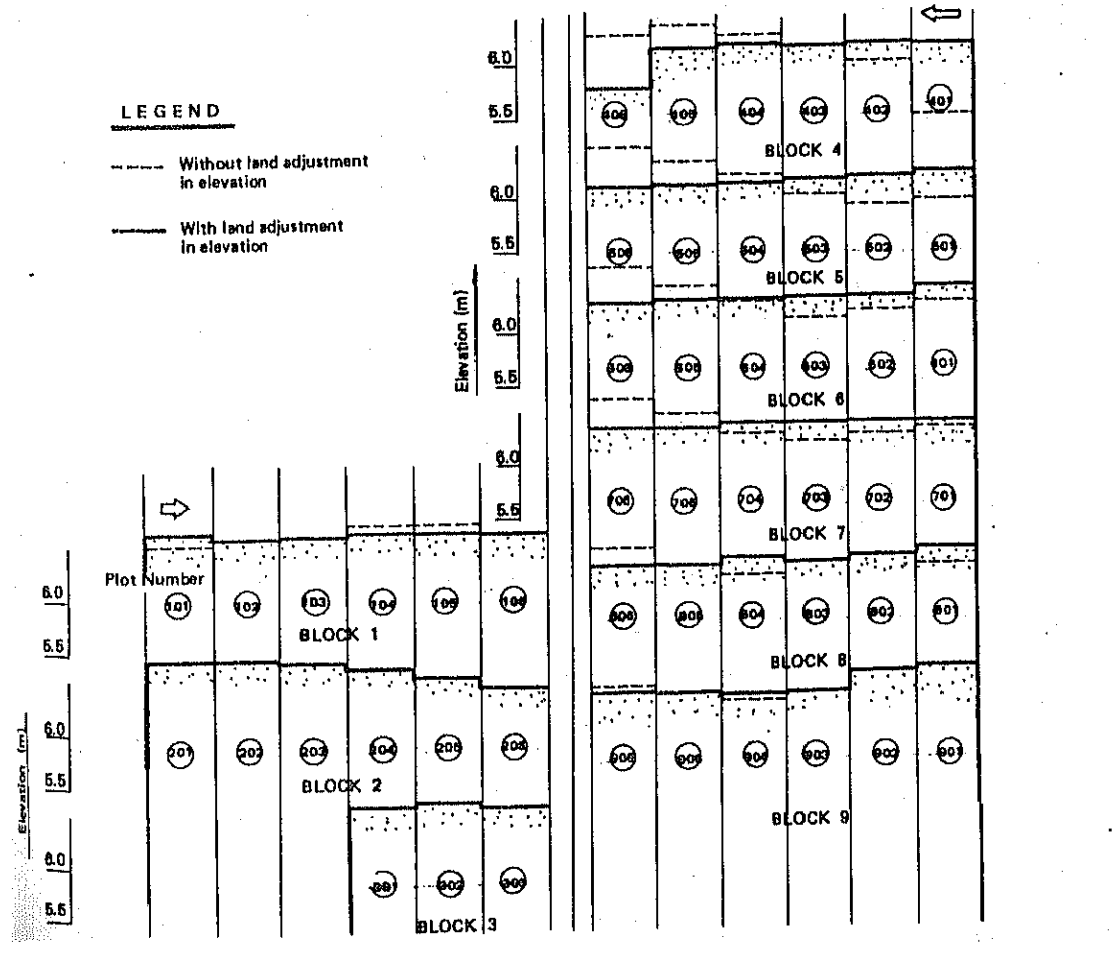


Table 4E-1 Investment Cost of the Project (Financial Cost)

Description	Total		Foreign Currency		Local Currency	
	('000I.D)	(US$'000)	('000I.D)	(US$'000)	('000I.D)	(US$'000)
1. Civil Works	10,836	36,624	6,081	20,552	4,755	16,072
1-1. Sedimentation Basin	230	777	118	399	112	378
1-2. Irrigation Pump Facilities	2,424	8,192	2,188	7,394	236	798
1-3. Drainage Pump Facilities	550	1,860	472	1,595	78	265
1-4. Irrigation Canal	859	2,905	154	520	705	2,385
1-5. Drainage Canal	247	834	93	314	154	520
1-6. On-farm	4,978	16,825	2,967	10,027	2,011	6,798
1-7. Road	1,235	4,174	62	211	1,173	3,963
1-8. Dike	224	754	16	53	208	701
1-9. Green Belt	82	281	11	39	71	242
1-10. Pre-Engineering	7	22	-	-	7	22
2. Construction and Maintenance Equipments	2,791	9,433	2,791	9,433	-	-
3. Farm Facilities	689	2,329	-	-	689	2,329
4. Farm Machineries and Equipment	1,778	6,010	1,778	6,010	-	-
5. Operation and Maintenance Cost	795	2,687	-	-	795	2,687
6. Project Facilities	230	777	9	30	221	747
7. Project Administration	646	2,183	-	-	646	2,183
8. Consulting Services	663	2,241	451	1,524	212	717
Sub-total (1 to 8)	18,428	62,287	11,110	37,552	7,318	24,735
9. Contingency (10%)	1,843	6,229	1,111	3,755	732	2,474
Sub-total (1 to 9)	20,271	68,516	12,221	41,307	8,050	27,209
10. Price Escalation (9%)	7,828	26,459	4,316	14,588	3,512	11,871
Total (1 to 10)	28,099	94,975	16,537	55,895	11,562	39,080

(1) Civil Work

Description	Quantity	Unit	Total Cost (I.D)	Foreign Currency (F.C)			Local Currency (L.C)		
				Depreciation (I.D)	Material (I.D)	Total (I.D)	Material (I.D)	Labor (I.D)	Total (I.D)
1. Civil Work									
1-1. Sedimentation Basin	LS		371,928	142,265	117,926	260,191	37,510	74,227	111,737
1-2. Irrigation Pump Facilities	LS		2,429,788	6,031	2,187,660	2,193,691	192,264	43,833	236,097
1-3. Drainage Pump Facilities	LS		552,666	2,249	471,940	474,189	61,525	16,952	78,477
1-4. Irrigation Canal	LS		953,944	94,517	153,967	248,484	511,436	194,024	705,460
1-5. Drainage Canal	LS		309,017	62,506	92,816	155,322	39,812	113,883	153,695
1-6. On-Farm	LS		6,012,151	1,034,560	2,966,512	4,001,072	444,452	1,566,627	2,011,079
1-7. Road	LS		1,328,651	93,564	62,540	156,104	1,008,189	164,358	1,172,547
1-8. Dike	LS		245,960	22,846	15,620	38,466	187,405	20,089	207,494
1-9. Green Belt	LS		99,408	15,961	11,740	27,701	31,588	40,119	71,707
1-10. Pre-Engineering	LS		6,630	-	-	-	-	6,630	6,630
Total			12,310,143	1,474,499	6,030,721	7,555,220	2,514,181	2,240,742	4,754,923
			(US$41,608.2x10^3)			(US$25,536.6x10^3)			(US$16,071.6x10^3)

Description	Quantity	Unit	Total Cost (I.D)	Foreign Currency (F.C) Depreciation (I.D)	Material (I.D)	Total (I.D)	Local Currency (L.C) Material (I.D)	Loabr (I.D)	Total (I.D)	No. of Unit Cost
1-1. Sedimentation Basin										
Excavation	800,000	m^3	305,600	133,600	98,400	232,000	18,400	55,200	73,600	8
Intake	LS		47,706	8,665	19,526	28,191	12,859	6,656	19,515	
Sub-total			353,306	142,265	117,926	260,191	31,259	61,856	93,115	
Other	LS		18,622	-	-	-	6,251	12,371	18,622	
Total			371,928 (US1,257.1x10^3$)	142,265	117,926	260,191 (US879.4x10^3$)	37,510	74,227	111,737 (US377.7x10^3$)	
1-2. Irrigation Pump Facilities										
Reinforced concrete	2,454	m^3	21,636	888	412	1,300	18,000	2,336	20,336	1
Plain concrete	68	m^3	588	24	11	35	489	64	553	2
Dental concrete	159	m^3	1,365	57	26	83	1,131	151	1,282	3
Deformed bar	191	ton	27,564	-	24,257	24,257	431	2,876	3,307	6
Metal form	5,381	m^2	8,424	-	1,947	1,947	2,103	4,374	6,477	5
Wood form	470	m^2	2,007	-	474	474	285	1,248	1,533	4
Curring	2,295	m^2	502	-	-	-	408	94	502	7
Building	640	m^2	38,400	-	-	-	28,800	9,600	38,400	21
Excavation	10,700	m^2	4,086	1,786	1,316	3,102	257	727	984	8
Back-fill	8,900	m^3	419	245	44	289	26	104	130	12
Pumping facilities	1	LS	2,130,000	-	2,023,500	2,023,500	95,850	10,650	106,500	
Screen	205	m^2	43,050	-	41,000	41,000	1,025	1,025	2,050	14
Hand rail	1,700	Kg	400	-	382	382	-	18	18	11
Roller gate (2.5^mx4.0^m)	4	LS	76,000	-	60,800	60,800	13,680	1,520	15,200	15
Concrete Pile										
$\phi 400^{mm}$ $\ell=20^m$	35	pile	5,585	604	4,581	5,185	3	397	400	18
$\phi 450^{mm}$ $\ell=20^m$	72	"	13,642	1,398	11,316	12,714	8	920	928	20
$\phi 400^{mm}$ $\ell=15^m$	27	"	2,926	165	2,653	2,818	-	108	108	17
$\phi 450^{mm}$ $\ell=15^m$	128	"	16,378	864	14,941	15,805	4	569	573	19
Sub-total			2,392,972	6,031	2,187,660	2,193,691	148,820	35,261	184,081	
Other		LS	36,816	-	-	-	29,764	7,052	36,816	
Total			2,429,788 (US8,212.7x10^3$)	6,031	2,187,660	2,193,691 (US7,414.7x10^3$)	192,264	43,933	236,097 (US798.0x10^3$)	

Description	Quantity	Unit	Total Cost (I.D)	Foreign Currency (F.C) Depreciation (I.D)	Foreign Currency (F.C) Material (I.D)	Foreign Currency (F.C) Total (I.D)	Local Currency (L.C) Material (I.D)	Local Currency (L.C) Labor (I.D)	Local Currency (L.C) Total (I.D)	No. of Unit Cost
1-3. Drainage Pump Facilities										
Reinforced concrete	1,334	m^3	11,707	482	225	707	9,731	1,269	11,000	1
Plain concrete	41	m^3	353	14	6	20	294	39	333	2
Dental concrete	112	m^3	961	40	18	58	797	106	903	3
Deformed bar	107	ton	15,441	-	13,589	13,589	241	1,611	1,852	6
Metal form	2,611	m^2	4,087	-	945	945	1,020	2,122	3,142	5
Wood form	342	m^2	1,460	-	345	345	207	908	1,115	4
Earth work	11,800	m^3	884	354	283	637	59	188	247	13
Building	245	m^2	14,700	-	-	-	11,025	3,675	14,700	21
Roller gate	2	LS	50,000	-	40,000	40,000	9,000	1,000	10,000	16
Pumping facilities	1	LS	410,000	-	389,500	389,500	18,450	2,050	20,500	
Screen	41	m^2	8,610	-	8,200	8,200	205	205	410	14
Hand rail	700	Kg	164	-	157	157	-	7	7	11
Curring	1,327	m^2	290	-	-	-	236	54	290	7
Concrete pile ($\phi 450^{mm}$ $\ell=15.0^{m}$)	84	pile	10,748	567	9,805	10,372	3	373	376	19
" ($\phi 400^{mm}$ $\ell=15.0^{m}$)	54	"	5,856	331	5,307	5,638	1	217	218	17
" ($\phi 450^{mm}$ $\ell=20.0^{m}$)	6	"	1,135	116	943	1,059	-	76	76	20
" ($\phi 400^{mm}$ $\ell=20.0^{m}$)	20	"	3,191	345	2,617	2,962	2	227	229	18
Sub-total			539,587	2,249	471,940	474,189	51,271	14,127	65,398	
Other		LS	13,079	-	-	-	10,254	2,825	13,079	
Total			552,666 (US$1,868.0x10^3)	2,249	471,940 (US$1,602.7x10^3)	474,189	61,525	16,952	78,477 (US$265.3x10^3)	

Description	Quantity	Unit	Total Cost (I.D)	Foreign Currency (F.C) Depreciation (I.D)	Material (I.D)	Total (I.D)	Local Currency (L.C) Material (I.D)	Labor (I.D)	Total (I.D)	No. of Unit Cost
1-4. Irrigation Canal										
1-4-1 Main irrigation canal 1-1	2,700	m	60,508	7,217	5,246	12,463	36,371	11,674	48,045	22
" 1-2	2,800	m	46,697	5,882	4,306	10,188	27,264	9,245	36,509	23
" 2-1	3,700	m	73,085	8,569	7,481	16,050	42,957	14,078	57,035	24
" 2-2	4,400	m	73,707	9,807	7,229	17,036	41,742	14,929	56,671	25
1-4-2 Secondary irrigation canal 1-1	6,200	m	103,863	13,820	10,187	24,007	58,820	21,036	79,856	26
" 1-2	8,000	m	91,664	14,496	10,888	25,384	46,904	19,376	66,280	27
" 1-3	2,600	m	33,804	4,524	3,369	7,893	18,933	6,978	25,911	28
" 1-4	1,700	m	20,285	3,310	2,494	5,804	10,151	4,330	14,481	29
" 2-1	5,000	m	72,275	9,530	7,025	16,555	40,975	14,745	55,720	30
" 2-2	1,800	m	22,453	3,537	2,656	6,193	12,376	3,884	16,260	31
" 2-3	2,300	m	33,898	5,582	4,206	9,788	16,962	7,148	24,110	32
" 2-4	3,400	m	42,414	6,681	5,018	11,699	23,378	7,337	30,715	33
1-4-3 Related Structures										
Crossing works	11	LS	31,591	466	14,216	14,682	11,213	5,696	16,909	34
Spillway	3	LS	16,393	232	6,371	6,603	6,388	3,402	9,790	35
Check gate (Type A)	1	LS	2,243	31	993	1,024	762	457	1,219	36
" (Type B)	1	LS	7,061	116	3,334	3,450	2,893	718	3,611	37
Diversion box (Type A)	2	LS	8,133	112	3,406	3,518	2,862	1,753	4,615	38
" (Type B)	6	LS	17,825	241	7,394	7,635	6,220	3,970	10,190	39
" (Type C)	18	LS	20,148	225	7,523	7,749	6,640	5,759	12,399	40
" (Type D)	17	LS	13,621	138	4,865	5,003	4,340	4,278	8,618	41
Radial gate (2.5^mx2.25^m)	3	LS	30,000	-	24,000	24,000	5,400	600	6,000	42
Sluice gate (1.2^mx1.2^m)	3	LS	4,200	-	3,360	3,360	756	84	840	43
" (2.0^mx2.0^m)	5	LS	10,500	-	8,400	8,400	1,890	210	2,100	44
Sub-total			836,368	94,517	153,967	248,484	426,197	161,687	587,884	
Other		LS	117,576	-	-	-	85,239	32,337	117,576	
Total			953,944	94,517	153,967	248,484	511,436	194,024	705,460	
			(US$3,224.3x10^3)			(US$839.9x10^3)			(US$2,384.4x10^3)	

Description	Quantity	Unit	Total Cost (I.D)	Foreign Currency (F.C) Depreciation (I.D)	Material (I.D)	Total (I.D)	Local Currency (L.C) Material (I.D)	Labor (I.D)	Total (I.D)	No. of Unit Cost
1-5. Drainage Canal										
1-5-1 Main drainage -1	7,000	m	59,255	11,606	6,454	17,514	1,141	40,600	41,741	45
canal " -2	6,600	m	29,217	12,256	7,154	19,410	1,267	8,540	9,807	46
" -3	2,100	m	12,409	5,275	3,076	8,351	894	3,164	4,058	47
1-5-2 Secondary drainage canal -1	3,100	m	3,405	1,261	734	1,995	133	1,277	1,410	48
" -2	4,100	m	8,428	3,312	1,931	5,243	344	2,841	3,185	49
" -3	5,400	m	15,108	6,112	3,564	9,676	642	4,790	5,432	50
" -4	6,700	m	13,774	5,414	3,155	8,569	562	4,643	5,205	51
" -5	5,000	m	12,455	4,980	2,890	7,870	535	4,050	4,585	52
" -6	5,000	m	7,910	2,740	1,610	4,350	630	2,930	3,560	53
" -7	2,300	m	3,931	1,518	886	2,404	159	1,368	1,527	54
" -8	300	m	317	116	68	184	12	121	133	55
" -9	1,400	m	1,485	544	317	861	57	567	624	56
" -10	1,400	m	1,485	544	317	861	57	567	624	57
" -11	700	m	743	272	159	431	29	283	312	58
" -12	1,500	m	1,591	583	340	923	61	607	668	59
" -13	7,000	m	11,963	4,620	2,695	7,315	483	4,165	4,648	60
" -14	2,100	m	3,320	1,150	676	1,826	264	1,230	1,494	61
1-5-3 Related structure										
Check strucutre	1	LS	2,503	63	1,364	1,427	696	380	1,076	
Roller gate (5.0^{m}x2.8^{m})	1	LS	41,000	-	32,800	32,800	7,380	820	8,200	
Crossing work	29	LS	53,103	686	22,625	23,312	17,831	11,960	29,791	62
Sub-total			283,402	62,506	92,816	155,322	33,177	94,903	128,080	
Other		LS	25,615	-	-	-	6,635	18,980	25,615	
Total			309,017 (US$1,044.5x10^{3})	62,506	92,816	155,322 (US$525.0x10^{3})	39,812	113,883	153,695 (US$519.5x10^{3})	

Description	Quantity	Unit	Total Cost (I.D)	Foreign Currency (F.C) Depreciation (I.D)	Material (I.D)	Total (I.D)	Local Currency (L.C) Material (I.D)	Labor (I.D)	Total (I.D)	No. of Unit Cost
1-6. On-Farm										
1-6-1 Cost per 72.24 ha (Sample area)										
Land levelling	72.24	ha	9,124	3,924	2,945	6,869	545	1,710	2,255	63
Tertiary irr. canal (1)	578	m	772	242	192	434	33	305	338	64
Tertiary irr. canal (2)	330	m	411	128	101	229	17	165	182	65
Farm ditch	3,763	m	3,268	1,061	842	1,903	146	1,219	1,365	66
Farm drain	4,042	m	3,207	1,123	654	1,777	121	1,309	1,430	67
Field drain	17,551	m	10,581	824	8,617	9,441	368	772	1,140	68
Service road [along tertiary irr. canal(1)]	330	m	689	233	184	417	31	241	272	69
Service road [along tertiary irr. canal(2)]	875	m	1,913	649	513	1,162	87	664	751	70
On-farm road	6,036	m	12,294	3,615	2,861	6,476	488	5,330	5,818	71
Road crossing (Type A)	4	LS	1,317	23	162	185	677	455	1,132	72
" (Type B)	2	LS	589	8	85	93	259	237	496	73
" (Type C)	2	LS	396	5	53	58	187	151	338	74
" (Type D)	2	LS	295	4	40	44	137	114	251	75
Ridge work	6,020	m	240	-	-	-	-	240	240	81
Road crossing (Type E)	4	LS	2,994	-	2,779	2,779	-	215	215	76
" (Type F)	4	LS	2,395	-	2,223	2,223	-	172	172	77
Turn-out	5	LS	6,520	13	5,633	5,646	366	508	874	78
Inlet	35	LS	2,866	11	1,687	1,698	381	787	1,168	79
Check structure	6	LS	8	-	8	8	-	-	-	80
Green belt	1,012	m	581	-	-	-	404	177	581	96
Outlet	58	LS	4,636	-	4,437	4,437	-	199	199	82
Sub-total			65,096	11,863	34,016	45,879	4,247	14,970	19,217	
Cost per hectare			901,107	162,216	470,875	635,091	58,790	207,226	266,016	
1-6-2 Total cost for 6,300 ha			5,676,972	1,034,560	2,966,512	4,001,072	370,377	1,305,523	1,675,900	
Other		LS	335,179	-	-	-	74,075	261,104	335,179	
Total			6,012,151	1,034,560	2,966,512	4,001,072	444,452	1,566,627	2,011,079	
			(US$20,321.1x10^3)			(US$13,523.6x10^3)			(US$6,797.5x10^3)	

Description	Quantity	Unit	Total Cost (I.C)	Foreign Currency (F.C) Depreciation (I.D)	Material (I.D)	Total (I.D)	Local Currency (L.C) Material (I.D)	Labor (I.D)	Total (I.D)	No. of Unit Cost
1-7. Road										
1-7-1 Independent road	45,300	m	92,229	30,804	24,416	55,220	4,122	32,887	37,009	88
Asphalt pavement	85,000	m^2	162,265	1,955	1,445	3,400	156,655	2,210	158,865	86
Gravel pavement	141,500	m^2	145,462	-	-	-	141,500	3,962	145,462	87
1-7-2 Road (along irrigation canal)	44,600	m	51,289	15,833	12,577	28,410	2,140	20,739	22,879	83
Asphalt pavement	17,000	m^2	32,453	391	289	680	31,331	442	31,773	86
Gravel pavement	206,000	m^2	217,768	-	-	-	206,000	11,768	217,768	87
1-7-3 Road (along drainage canal)	53,100	m	121,650	41,471	22,036	63,507	4,088	54,055	58,143	84
Asphalt pavement	25,000	m^2	47,725	575	425	1,000	46,075	650	46,725	86
Gravel pavement	240,500	m^2	247,234	-	-	-	240,500	6,734	247,234	87
1-7-4 Road (along drainage canal-1)	6,500	m	7,442	2,535	1,352	3,887	247	3,308	3,555	85
Gravel pavement	7,500	m^2	7,710	-	-	-	7,500	210	7,710	87
Sub-total			1,133,227	93,564	62,540	156,104	840,158	136,965	977,123	
1-7-5 Other		LS	195,424	-	-	-	168,031	27,393	195,424	
Total			1,328,651 ($US4,490.8x10^3$)	93,564	62,540	156,104 ($US527.6x10^3$)	1,008,189	164,358	1,172,547 ($US3,963.2x10^3$)	
1-8. Dike (ℓ=6,800 m)										
Embankment	100,980	m^3	54,023	21,508	14,844	36,352	3,534	14,137	17,671	89
Filter	6,120	m^3	27,540	-	-	-	27,540	-	27,540	90
Gravel pavement	34,000	m^3	34,952	-	-	-	34,000	952	34,952	91
Riprap	16,524	m^3	94,863	1,338	776	2,114	91,097	1,652	92,749	92
Sub-total			211,378	22,846	15,620	38,466	156,171	16,741	172,912	
Other		LS	34,582	-	-	-	31,234	3,348	34,582	
Total			245,960 ($US831.3x10^3$)	22,846	15,620	38,466 ($US130.0x10^3$)	187,405	20,089	207,494 ($US701.3x10^3$)	

Description	Quantity	Unit	Total Cost (I.D)	Foreign Currency (F.C)			Local Currency (L.C)			No. of Unit Cost
				Depreciation (I.D)	Material (I.D)	Total (I.D)	Material (I.D)	Labor (I.D)	Total (I.D)	
1-9. Green Belt										
Tree planting	296.05	ha	34,045	-	-	-	23,683	10,362	34,045	95
Farm road	96,100	m	49,969	14,319	11,050	25,369	2,402	22,198	24,600	93
Embankment	26,500	m^3	3,444	1,642	690	2,332	239	873	1,112	94
Sub-total			87,458	15,961	11,740	27,701	26,324	33,433	59,757	
Other		LS	11,950	-	-	-	5,264	6,686	11,950	
Total			99,408	15,961	11,740	27,701	31,588	40,119	71,707	
			(US$336.0x10^3)			(US$93.6x10^3)			(US$242.4x10^3)	

Item	Description	Quantity	Unit	Rate F.C (I.D)	Rate L.C (I.D)	Amount F.C (I.D)	Amount L.C (I.D)
1-10.	Pre-Engineering						
1-10-1	Survey Works						
	Topographic survey						
	Irrigation pumping site	1.0	ha		100		100
	Drainage pumping site	1.0	ha		100		100
	Desilting Reservoir	50.0	ha		100		5,000
	Bridge	0.5	ha		100		(50)
	Profile survey						
	Irrigation pumping site	0.1	Km		100		10
	Drainage pumping site	0.1	Km		100		10
	Cross section survey						
	Bridge (3 sections, 200^{m}x3)	0.6	Km		150		(90)
	Sub-total						5,200
							(5,360)
1-10-2	Geological Investigation						
	Irrigation pumping site	30	m		8		240
	Drainage pumping site	30	m		8		240
	Desilting Reservoir	30	m		8		240
	Bridge, 50^{m} x 2 holes x 2 sites	200	m		8		(1,600)
	Rice processing facilities	30	m		8		240
	Sub-total						960
							(2,560)
1-10-3	Material Test						
	Embankment materials for reservoir		LS		150		150
	Embankment materials for canal		LS		150		150
	Embankment materials for dike		LS		150		150
	Sub-total						450
	Total						6,630
							(8,370)
							US$22.4 x 10^3
							(US$28.3 x 10^3)

(2) Construction and Maintenance Equipments[1/]

Item	Equipment	Specification	No.	Unit Price (I.D)	Amount (I.D)
2-1.	Construction Equipments				
	Bulldozer	11ton, 140ps	29	15,200	440,800
	Bulldozer	21ton, 203ps	18	30,700	552,600
	Backhoe	0.6m^3, 97ps	1	23,100	23,100
	Backhoe	1.2m^3, 200ps	6	42,600	255,600
	Motor grader	3.7m, 125ps	1	17,000	17,000
	Tractor shovel	1.6m^3, 120ps	2	16,800	33,600
	Dump truck	11ton, 283ps	5	10,600	53,000
	Motor scraper	12m^3, 335ps	10	55,500	555,000
	Agitator truck	1.6m^3, 154ps	5	2,230	11,150
	Mobile batcher	0.35m^3, 19.5Kw	1	15,000	15,000
	Generator	35KVA, 48ps	1	4,100	4,100
	Diesel hammer	2.5 ton	1	44,400	44,400
	Trencher	1.8m, 60ps	10	8,300	83,000
	Tire roller	8-20ton, 65ps	15	10,000	150,000
	Water tank truck	5,500 ℓ	5	6,300	31,500
	Asphalt finisher	5.0 m	1	23,400	23,400
	Road roller	10-12 ton	1	9,000	9,000
	Vibrator	ø28m/m, 0.4ps	15	150	2,250
	Fuel truck	4,000 ℓ	1	3,560	3,560
	Station wagon		5	3,400	17,000
	Trailer	25 ton	1	5,000	5,000
	Water pump	2-4", 8ps	5	300	1,500
	Stake truck	6 ton	3	5,000	15,000
	Lubricating car		1	17,000	17,000
	Repair workshop		1	22,000	22,000
	Spare part (6%)				143,133
	Transportation (2.5%)		LS		63,217
	Sub-total				2,591,910

1/: estimation of required construction equipment is given in Appendix 5B-2.

Item	Equipment	Specification	No.	Unit Price (I.D)	Amount (I.D)
2-2.	Maintenance Equipments				
	Dump truck	11ton, 283ps	1	10,600	10,600
	Stake truck	6ton	2	5,000	10,000
	Station wagon		11	3,400	37,400
	Jeep utility (4 wheel driven)		7	2,500	17,500
	Water pump, 2-4"		2	300	600
	Front end loader	1.6 m^3	1	14,600	14,600
	Motor grader	3.7m, 120ps	1	17,000	17,000
	Tire roller	8-20ton, 65ps	1	10,000	10,000
	Dump dredger		1	25,000	25,000
	Flashing machine for field drain		2	16,000	32,000
	Trender	1.8m, 60ps	1	8,300	8,300
	Concrete mixer	0.3 m^3	1	1,300	1,300
	Weed cutter		10	500	5,000
	Spare part (5%)				9,465
	Sub-total				198,765
	Total				2,790,675
					(US$9,432.5x$10^3$)

(3) Farm Facilities

Item	Description	Quantity	Unit	Rate F.C (I.D)	Rate L.C (I.D)	Amount F.C (I.D)	Amount L.C (I.D)
	Farm store	2,500	sq.m		40		100,000
	Equipment store	300	sq.m		40		12,000
	Workshop	2,400	sq.m		40		96,000
	Machinery garage	6,500	sq.m		40		260,000
	Worker's rest house	300	sq.m		50		15,000
	Material shed	500	sq.m		40		20,000
	Runway (2 places)	80,000	sq.m		2.33		186,400
	Total				-		689,400

(US2,330.2 \times 10^3$)

(4) Farm Machinery and Equipment

Equipment	Quantity	Unit Cost F.C (I.D)	Unit Cost L.C (I.D)	Amount F.C (I.D)	Amount L.C (I.D)
4-1. Machinery and Equipment for Project					
Motorcar	4	2,700		10,800	
Survey car (station wagon)	14	2,700		37,800	
Pick-up	10	1,100		11,000	
Wheel tractor	85	7,600		646,000	
Crawler tractor	8	11,700		93,600	
Bottom plow	26	590		15,340	
Disk harrow	16	530		8,480	
Tooth harrow	10	280		2,800	
Pudding rotor	31	560		17,360	
Broadcaster	4	1,400		5,600	
Culti-packer	8	100		800	
Combine	37	15,000		555,000	
Trailer	56	1,300		72,800	
Motorcycle	50	100		5,000	
Grain pump	2	6,000		12,000	
Tank lorry	2	5,500		11,000	
Water pump	30	380		11,400	
Ridger	8	250		2,000	
Seeder & Weeder	40	2,700		108,000	
Manure spreader 3^t	8	1,400		11,200	
Hay baler	9	5,280		47,520	
Front loader	4	900		3,600	
Seed center	LS	40,000		40,000	
Work shop	LS	22,870		22,870	
Sub-total	462			1,751,970	-

Equipment	Quantity	Unit Cost F.C (I.D)	Unit Cost L.C (I.D)	Amount F.C (I.D)	Amount L.C (I.D)
4-2. Machinery and Equipment for Experimental Farm					
Rotary harrow, 2.6m	2	1,230		2,460	
Seed drill, 21 rows	2	1,710		3,420	
Power sprayer	5	260		1,300	
Mist duster, 20 Kg	5	10		50	
Transplanter, 8 rows	3	1,810		5,430	
Ridzer	2	250		500	
Lime sower, 400 ℓ	3	300		900	
Motorcycle	5	100		500	
Pick up	3	1,100		5,500	
Others				540	
Sub-total				20,600	
4-3. Laboratory Equipment					
Thermostatic germinators	1	336		336	
Testing rice husker, for one sheaf	1	46		46	
Testing rice pearling mill	1	155		155	
Stalk balances (200g)	1	23		23	
Specific garvity balance	1	112		112	
Granometers	2	9		18	
Rice & barley moisture meter	1	93		93	
Rice shattering habit tester	1	139		139	
Fertility counter (Seed sortor & counter)	1	464		464	
Indoor seedling farm set	1	85		85	
Quadrate sampling thresher	1	58		58	
Seed collecting thresher	1	186		186	
Quadrate sampling huller	1	155		155	
Quadrate sampling winnower	1	97		97	
Quadrate sampling rice separator	1	23		23	
Rice polisher (18ℓ)	1	62		62	

Equipment	Quantity	Unit Cost F.C (I.D)	Unit Cost L.C (I.D)	Amount F.C (I.D)	Amount L.C (I.D)
Quadrate sampling grain dryer	1	232		232	
Soil sampler for 100 mℓ cylinder	1	32		32	
Soil sampler cylinders (100 mℓ)	10	5		50	
Soil tensiometers 3 type	30	10.8		325	
Paddy field receded depth tester	10	23.2		232	
Electric conductivity meters	1	23		23	
Oxidation-reduction potential meter	1	31		31	
Glass electrode pH meter	1	32		32	
Incubators (97x53x67)	1	274		274	
Large-scaled hot air dryer	1	528		528	
Stirrer	1	93		93	
Ion-exchange desalinized water equipment	1	186		186	
Automatic balance	2	355.5		711	
Refrigerator	1	232		232	
Others				287	
Sub-total				5,320	
Total				1,777,890	
				(US$6,009.3x10)^3	

(5) Operation and Maintenance Cost

(Unit: I.D)

Description	1981	1982	1983	1984	1985	1986	1987	1988	Total (1981-1987)
Salary and Wage	11,520	15,120	16,440	35,700	70,380	102,000	116,560	(127,560)	367,720
Equipment and Machinery				1,260	19,524	60,460	90,476	(90,476)	171,720
Materials and Supplies			16,814	33,629	50,443	67,258	76,977	(76,977)	245,121
Total	11,520	15,120	33,254	70,589	140,347	229,718	284,511	(295,013)	795,059

(US2,687.3x10^3$)

Note: Detail estimation is given in Appendix 5C-1.

(6) Project Facilities

Item	Description	Quantity	Unit	Rate F.C (I.D)	Rate L.C (I.D)	Amount F.C (I.D)	Amount L.C (I.D)
6-1.	Building and Furniture						
	Building Furniture						
	Project office	2,000	sq.m	-	90	-	180,000
	Laboratory	300	sq.m	-	70	-	21,000
	Furniture	LS		-	-	-	20,100
	Sub-total					-	221,100
6-2.	Equipment						
	Office equipment						
	Copy machine	4	unit	700	-	2,800	-
	Surveying equipment	2	set	1,400	-	2,800	-
	Current meter	1	set	160	-	160	-
	Meteorological equipment	1	set	1,350	-	1,350	-
	Communication system	LS		1,600	-	1,600	-
	Sub-total					8,710	-
	Total					8,710	221,100
						(US$29.4x10^3)	(US$747.3x10^3)

(7) Consulting Services

Item	Description	Quantity	Unit	Rate F.C	Rate L.C	Amount F.C	Amount L.C
7-1.	Foreign Exchange Cost						
	Final Design						
	Consultant's remuneration	72	man-month	2,000	-	144,000	-
	International travel expense	8	trip	600	-	4,800	-
	Miscellaneous & communication	LS		-	-	3,000	-
	Sub-total					151,800	
	Construction Supervision						
	Consultant's remuneration	71	man-month	2,000	-	142,000	-
	International travel expense	6	trip	600	-	3,600	-
	Sub-total					145,600	
	Agriculture Farming Guidance						
	Consultant's remuneration	76	man-month	2,000	-	152,000	-
	International travel expense	3	trip	600		1,800	
	Sub-total					153,800	
7-2.	Local Currency Cost						
	Final Design						
	Consultant's per diem	2,160	day	-	25	-	54,000
	Construction Supervision						
	Consultant's per diem	2,130	day	-	25	-	53,250
	Housing and furniture	LS					24,000
	Agriculture Farming Services						
	Consultant per diem	2,280	day	-	25	-	57,000
	Housing and furniture	LS					24,000
	Sub-total						212,250
	Total					451,200	212,250
						(US$1,525.0x10^3)	(US$717.4x10^3)

Table 4E-2 Disbursement Schedule of Investment Cost (Financial Cost)

(Unit: '000 I.D)

	Total			1st Year (1981)			2nd Year (1982)			3rd Year (1983)			4th Year (1984)			5th Year (1985)			6rd Year (1986)			7th Year (1987)		
	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total
1. Civil Works	6,081	4,755	10,836	-	7	7	-	-	-	2,364	585	2,949	1,138	907	2,045	1,479	1,759	3,238	1,100	1,497	2,597	-	-	-
1-1. Sedimentation Basin	118	112	230	-	-	-	-	-	-	118	112	230	-	-	-	-	-	-	-	-	-	-	-	-
1-2. Irrigation Pump Facilities	2,188	236	2,424	-	-	-	-	-	-	2,188	236	2,424	-	-	-	-	-	-	-	-	-	-	-	-
1-3. Drainage Pump Facilities	472	78	550	-	-	-	-	-	-	-	-	-	472	78	550	-	-	-	-	-	-	-	-	-
1-4. Irrigation Canal	154	705	859	-	-	-	-	-	-	-	-	-	31	141	172	62	282	344	61	282	343	-	-	-
1-5. Drainage Canal	93	154	247	-	-	-	-	-	-	-	-	-	19	30	49	37	62	99	37	62	99	-	-	-
1-6. On-farm	2,967	2,011	4,978	-	-	-	-	-	-	42	28	70	602	408	1,010	1,350	915	2,265	973	660	1,633	-	-	-
1-7. Road	62	1,173	1,235	-	-	-	-	-	-	-	-	-	12	235	247	25	468	493	25	470	495			
1-8. Dike	16	208	224	-	-	-	-	-	-	16	208	224	-	-	-	-	-	-	-	-	-	-	-	-
1-9. Green Belt	11	71	82	-	-	-	-	-	-	-	1	1	2	15	17	5	32	37	4	23	27	-	-	-
1-10. Pre-Engineering	-	7	7	-	7	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Construction and Maintenance Equipments	2,791	-	2,791	-	-	-	1,296	-	1,296	1,296	-	1,296	199	-	199	-	-	-	-	-	-	-	-	-
3. Farm Facilities	-	689	689	-	-	-	-	344	344	-	345	345	-	-	-	-	-	-	-	-	-	-	-	-
4. Farm Machineries and Equipments	1,778	-	1,778	-	-	-	-	-	-	25	-	25	361	-	361	809	-	809	583	-	583	-	-	-
5. Operation and Maintenance Cost	-	795	795	-	12	12	-	15	15	-	33	33	-	70	70	-	140	140	-	230	230	-	295	295
6. Project Facilities	9	221	230	-	-	-	9	147	156	-	74	74	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total (1 to 6)	10,659	6,460	17,119	-	19	19	1,305	506	1,811	3,685	1,037	4,722	1,698	977	2,675	2,288	1,899	4,187	1,683	1,727	3,410	-	295	295
7. Project Administration (10%)	-	646	646	-	2	2	-	50	50	-	104	104	-	98	98	-	190	190	-	173	173	-	29	29
8. Consulting Services	451	212	663	153	72	225	9	4	13	27	13	40	86	40	126	77	36	113	99	47	146	-	-	-
Sub-total (1 to 8)	11,110	7,318	18,428	153	93	246	1,314	560	1,874	3,712	1,154	4,866	1,784	1,115	2,899	2,365	2,125	4,490	1,782	1,947	3,729	-	324	324
9. Contingency (10%)	1,111	732	1,843	15	9	24	132	56	188	371	115	486	178	112	290	237	213	450	178	195	373	-	32	32
Sub-total (1 to 9)	12,221	8,050	20,271	168	102	270	1,446	616	2,062	4,083	1,269	5,352	1,962	1,227	3,189	2,602	2,338	4,940	1,960	2,142	4,102	-	356	356
10. Price Escalation (9%)	4,316	3,512	7,828	8	4	12	201	86	287	986	307	1,293	693	434	1,127	1,236	1,111	2,347	1,192	1,302	2,494	-	268	268
Total (1 to 10)	16,537	11,562	28,099	176	106	282	1,647	702	2,349	5,069	1,576	6,645	2,655	1,661	4,316	3,838	3,449	7,287	3,152	3,444	6,596	-	624	624

Table 4E-3 Investment Cost of the Project (Including Depreciation Cost)

Description	Total		Foreign Currency		Local Currency	
	('000I.D)	(US$'000)	('000I.D)	(US$'000)	('000I.D)	(US$'000)
1. Civil Works	12,310	41,608	7,555	25,537	4,755	16,072
1-1. Sedimentation Basin	372	1,257	260	879	112	378
1-2. Irrigation Pump Facilities	2,430	8,213	2,194	7,415	236	798
1-3. Drainage Pump Facilities	552	1,868	474	1,603	78	265
1-4. Irrigation Canal	954	3,224	249	840	705	2,385
1-5. Drainage Canal	309	1,045	155	525	154	520
1-6. On-farm	6,012	20,321	4,001	13,523	2,011	6,798
1-7. Road	1,329	4,491	156	528	1,173	3,963
1-8. Dike	246	831	38	130	208	701
1-9. Green Belt	99	336	28	94	71	242
1-10. Pre-Engineering	7	22	-	-	7	22
2. Construction and Maintenance Equipments	199	672	199	672	-	-
3. Farm Facilities	689	2,329	-	-	689	2,329
4. Farm Machineries and Equipments	1,778	6,010	1,778	6,010	-	-
5. Operation and Maintenance Cost	795	2,687	-	-	795	2,687
6. Project Facilities	230	777	9	30	221	747
7. Project Administration	646	2,183	-	-	646	2,183
8. Consulting Services	663	2,241	451	1,524	212	717
Sub-total (1 to 8)	17,310	58,508	9,992	33,773	7,318	24,735
9. Contingency (10%)	1,731	5,851	999	3,377	732	2,474
Sub-total (1 to 9)	19,041	64,359	10,991	37,150	8,050	27,209
10. Price Escalation (9%)	8,036	27,162	4,524	15,291	3,512	11,871
Total (1 to 10)	27,077	91,520	15,515	52,441	11,562	39,080

Table 4E-4 Disbursement Schedule of Investment Cost (Including Depreciation Cost)

(Unit: '000 I.D)

	Total			1st Year (1981)			2nd Year (1982)			3rd Year (1983)			4th Year (1984)			5th Year (1985)			6th Year (1986)			7th Year (1987)		
	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total	F.C	L.C	Total
1. Civil Works	7,555	4,755	12,310	-	7	7	-	-	-	2,548	585	3,133	1,404	907	2,311	2,058	1,759	3,817	1,545	1,497	3,042	-	-	-
1-1. Sedimentation Basin	260	112	372	-	-	-	-	-	-	260	112	372	-	-	-	-	-	-	-	-	-	-	-	-
1-2. Irrigation Pump Facilities	2,194	236	2,430	-	-	-	-	-	-	2,194	236	2,430	-	-	-	-	-	-	-	-	-	-	-	-
1-3. Drainage Pump Facilities	474	78	552	-	-	-	-	-	-	-	-	-	474	78	552	-	-	-	-	-	-	-	-	-
1-4. Irrigation Canal	249	705	954	-	-	-	-	-	-	-	-	-	50	141	191	99	282	382	100	282	382	-	-	-
1-5. Drainage Canal	155	154	309	-	-	-	-	-	-	-	-	-	31	30	61	62	62	124	62	62	124	-	-	-
1-6. On-farm	4,001	2,011	6,012	-	-	-	-	-	-	56	28	84	812	408	1,220	1,821	915	2,736	1,312	660	1,972			
1-7. Road	156	1,173	1,329	-	-	-	-	-	-	-	-	-	31	235	266	63	468	531	62	470	532	-	-	-
1-8. Dike	38	208	246	-	-	-	-	-	-	38	208	246	-	-	-	-	-	-	-	-	-	-	-	-
1-9. Green Belt	28	71	99	-	-	-	-	-	-	-	1	1	6	15	21	13	32	45	9	23	32	-	-	-
1-10. Pre-Engineering	-	7	7	-	7	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Construction and Maintenance Equipments	199	-	199	-	-	-	-	-	-	-	-	-	199	-	199	-	-	-	-	-	-	-	-	-
3. Farm Facilities	-	689	689	-	-	-	-	344	344	-	345	345	-	-	-	-	-	-	-	-	-	-	-	-
4. Farm Machineries and Equipment	1,778	-	1,778	-	-	-	-	-	-	25	-	25	361	-	361	809	-	809	583	-	583	-	-	-
5. Operation and Maintenance Cost	-	795	795	-	12	12	-	15	15	-	33	33	-	70	70	-	140	140	-	230	230	-	295	295
6. Project Facilities	9	221	230	-	-	-	9	147	156	-	74	74	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total (1 to 6)	9,541	6,460	16,001	-	19	19	9	506	515	2,573	1,037	3,610	1,964	977	2,941	2,867	1,899	4,766	2,128	1,727	3,855	-	295	295
7. Project Administration (10 %)	-	646	646	-	2	2	-	50	50	-	104	104	-	98	98	-	190	190	-	173	173	-	29	29
8. Consulting Services	451	212	663	153	72	225	9	4	13	27	13	40	86	40	126	77	36	113	99	47	146	-	-	-
Sub-total (1 to 8)	9,992	7,318	17,310	153	93	246	18	560	578	2,600	1,154	3,754	2,050	1,115	3,165	2,944	2,125	5,069	2,227	1,947	4,174	-	324	324
9. Contingency (10 %)	999	732	1,731	15	9	24	2	56	58	260	115	375	205	112	317	294	213	507	223	195	418	-	32	32
Sub-total (1 to 9)	10,991	8,050	19,041	168	102	270	20	616	636	2,860	1,269	4,129	2,255	1,227	3,482	3,238	2,338	5,576	2,450	2,142	4,592	-	356	356
10. Price Escalation (9 %)	4,524	3,512	8,036	8	4	12	2	86	88	691	307	998	796	434	1,230	1,538	1,111	2,649	1,489	1,302	2,791	-	268	268
Total (1 to 10)	15,515	11,562	27,077	176	106	282	22	702	724	3,551	1,576	5,127	3,051	1,661	4,712	4,776	3,449	8,225	3,939	3,444	7,383	-	624	624

1. Major Unit Cost

(Unit: I.D)

No.	Description	Quantity	Unit	Total Cost	Foreign Currency (F.C)			Local Currency (L.C)			Remarks
					Depreciation	Material	Total	Fuel, Repair & Material	Labour	Total	
1.	Reinforced concrete	1	m^3	8.817	0.362	0.168	0.530	7.295	0.952	8.287	σ_{28} = 180 Kg/cm^2
2.	Plain concrete	1	m^3	8.671	0.362	0.168	0.530	7.189	0.952	8.141	σ_{28} = 160 Kg/cm^2
3.	Dental concrete	1	m^3	8.593	0.362	0.168	0.530	7.211	0.952	8.063	σ_{28} = 130 Kg/cm^2
4.	Wood form	1	m^2	4.274	-	1.010	1.010	0.607	2.657	3.264	
5.	Metal form	1	m^2	1.566	-	0.362	0.362	0.391	0.813	1.204	
6.	Deformed bar	1	ton	144.319	-	127.000	127.000	2.259	15.060	17.319	
7.	Curing	1	m^2	0.219	-	-	-	0.178	0.041	0.219	
8.	Excavation	1	m^3	0.382	0.167	0.123	0.290	0.024	0.068	0.092	for Desilting Reservoir and Pumping Facilities
9.	Gravel pavement	1	m^2	1.028	-	-	-	1.000	0.028	1.028	
10.	Stone wall	1	m^2	6.380	-	-	-	5.000	1.380	6.380	
11.	Simple steel structure	1	Kg	0.236	-	0.225	0.225	-	0.011	0.011	
12.	Back fill (21 ton Bull)	100	m^3	4.732	2.757	0.505	3.262	0.293	1.177	1.470	21^{ton} Bulldozer
13.	Earth work (")	1	cu.m	0.075	0.030	0.024	0.054	0.005	0.016	0.021	21^{ton} Bulldozer
14.	Screen	1	m^2	210.000	-	200.000	200.000	5.000	5.000	10.000	
15.	Roller gate (2.5^mx4.0^m)	1	LS	19,000.000	-	15,200.000	15,200.000	3,420.000	380.000	3,800.000	
16.	Roller gate (3.5^mx4.0^m)	1	LS	25,000.000	-	20,000.000	20,000.000	4,500.000	500.000	5,000.000	
17.	Concrete pile	1	pile	108.500	6.134	98.294	104.428	0.035	4.037	4.072	$\phi 400^{mm}$ $\ell=15^m$
18.	Concrete pile	1	pile	159.617	17.266	130.887	148.153	0.101	11.363	11.464	$\phi 400^{mm}$ $\ell=20^m$
19.	Concrete pile	1	pile	127.972	6.756	116.730	123.486	0.039	4.447	4.486	$\phi 450^{mm}$ $\ell=15^m$
20.	Concrete pile	1	pile	189.500	19.425	157.180	176.605	0.113	12.782	12.895	$\phi 450^{mm}$ $\ell=20^m$
21.	Building	1	m^2	60.000	-	-	-	45.000	15.000	60.000	Brick made
22.	Main irrigation canal 1-1	1	m	22.411	2.673	1.943	4.616	13.471	4.324	17.795	
23.	" 1-2	1	m	16.678	2.101	1.538	3.639	9.737	3.302	13.039	
24.	" 2-1	1	m	19.753	2.316	2.022	4.338	11.610	3.805	15.415	
25.	" 2-2	1	m	16.752	2.229	1.643	3.872	9.487	3.393	12.880	
26.	Secondary irrigation canal 1-1	1	m	16.752	2.229	1.643	3.872	9.487	3.393	12.880	
27.	" 1-2	1	m	11.458	1.812	1.361	3.173	5.863	2.422	8.285	
28.	" 1-3	1	m	13.002	1.740	1.296	3.036	7.282	2.684	9.966	
29.	" 1-4	1	m	11.932	1.947	1.467	3.414	5.971	2.547	8.518	
30.	" 2-1	1	m	14.455	1.906	1.405	3.311	8.195	2.949	11.144	
31.	" 2-2	1	m	12.475	1.965	1.476	3.441	6.876	2.158	9.034	

(Unit: I.D)

No.	Description	Quantity	Unit	Total Cost	Foreign Currency (F.C) Depreciation	Material	Total	Local Currency (L.C) Fuel, Repair & Material	Labour	Total	Remarks
32.	Secondary irrigation 2-3	1	m	14.739	2.427	1.829	4.256	7.375	3.108	10.483	
33.	" 2-4	1	m	12.475	1.965	1.476	3.441	6.876	2.158	9.034	
34.	Crossing work	1	LS	2,872.073	42.426	1,292.409	1,334.835	1,019.408	517.830	1,537.238	for Irrigation Canal
35.	Spill way	1	LS	5,464.851	77.468	2,123.904	2,201.372	2,129.298	1,134.181	3,263.479	
36.	Check gate (Type A)	1	LS	2,243.695	31.204	993.099	1,024.303	762.476	456.916	1,219.392	
37.	Check gate (Type B)	1	LS	7,061.633	116.564	3,333.716	3,450.280	2,892.897	718.456	3,611.353	
38.	Diversion box (Type A)	1	LS	4,066.445	56.110	1,703.076	1,759.186	1,430.596	876.663	2,307.259	
39.	Diversion box (Type B)	1	LS	2,970.816	40.182	1,232.334	1,272.516	1,036.561	661.739	1,698.300	
40.	Diversion box (Type C)	1	LS	1,119.481	12.597	417.997	430.594	368.932	319.955	688.887	
41.	Diversion box (Type D)	1	LS	801.279	8.145	286.178	294.323	255.283	251.673	506.956	
42.	Radial gate (2.5^mx2.25^m)	1	LS	10,000.000	-	8,000.000	8,000.000	1,800.000	200.000	2,000.000	
43.	Sluice gate (1.2^mx1.2^m)	1	LS	1,400.000	-	1,120.000	1,120.000	252.000	28.000	280.000	
44.	Sluice gate (2.0^mx2.0^m)	1	LS	2,100.000	-	1,680.000	1,680.000	378.000	42.000	420.000	
45.	Main Drainage Canal -1	1	m	8.465	1.580	0.922	2.502	0.163	5.800	5.963	
46.	" -2	1	m	4.427	1.857	1.084	2.941	0.192	1.294	1.486	
47.	" -3	1	m	5.910	2.512	1.465	3.977	0.426	1.507	1.933	
48.	Secondary Drainage Canal -1	1	m	1.099	0.407	0.237	0.644	0.043	0.412	0.455	
49.	" -2	1	m	2.056	0.808	0.471	1.279	0.084	0.693	0.777	
50.	" -3	1	m	2.798	1.132	0.660	1.792	0.119	0.887	1.006	
51.	" -4	1	m	2.056	0.808	0.471	1.279	0.084	0.693	0.777	
52.	" -5	1	m	2.491	0.996	0.578	1.574	0.107	0.810	0.917	
53.	" -6	1	m	1.582	0.548	0.322	0.870	0.126	0.586	0.712	
54.	" -7	1	m	1.709	0.660	0.385	1.045	0.069	0.595	0.664	
55.	" -8	1	m	1.062	0.389	0.227	0.616	0.041	0.405	0.446	
56.	" -9	1	m	1.062	0.389	0.227	0.616	0.041	0.405	0.446	
57.	" -10	1	m	1.062	0.389	0.227	0.616	0.041	0.405	0.446	
58.	" -11	1	m	1.062	0.389	0.227	0.616	0.041	0.405	0.446	
59.	" -12	1	m	1.062	0.389	0.227	0.616	0.041	0.405	0.446	
60.	" -13	1	m	1.709	0.660	0.385	1.045	0.069	0.595	0.664	
61.	" -14	1	m	1.582	0.548	0.322	0.870	0.126	0.586	0.712	

(Unit: I.D)

No.	Description	Quantity	Unit	Total Cost	Foreign Currency (F.C)			Local Currency (L.C)			Remarks
					Depreciation	Material	Total	Fuel, Repair & Material	Labour	Total	
62.	Crossing work	1	LS	1,831.168	23.674	780.192	803.866	614.883	412.419	1,027.302	for Drainage Canal
63.	Land levelling	1	ha	126.323	54.320	40.770	95.090	7.551	23.681	31.232	
64.	Tertiary Irr. Canal (1)	1	m	1.337	0.419	0.333	0.752	0.057	0.528	0.585	
65.	" " (2)	1	m	1.249	0.388	0.308	0.696	0.053	0.500	0.553	
66.	Farm ditch	1	m	0.869	0.282	0.224	0.506	0.039	0.324	0.363	
67.	Farm drain	1	m	0.794	0.278	0.162	0.440	0.030	0.324	0.354	
68.	Field drain	1	m	0.603	0.047	0.491	0.538	0.021	0.044	0.065	
69.	Service road	1	m	2.094	0.707	0.560	1.267	0.096	0.731	0.827	Along tertiary irrigation canal (1)
70.	Service road	1	m	2.188	0.742	0.587	1.329	0.100	0.759	0.859	Along tertiary irrigation canal (2)
71.	On-farm road	1	m	2.037	0.599	0.474	1.073	0.081	0.883	0.964	
72.	Road crossing (Type A)	1	LS	329.930	5.940	40.676	46.616	169.383	113.931	283.314	
73.	" (Type B)	1	LS	295.283	4.452	42.717	47.169	129.168	118.946	248.114	
74.	" (Type C)	1	LS	198.920	2.903	26.587	29.490	93.787	75.647	169.430	
75.	" (Type D)	1	LS	148.225	2.208	20.305	22.514	68.613	57.098	125.711	
76.	" (Type E)	1	LS	748.900	-	694.980	694.980	-	53.920	53.920	
77.	" (Type F)	1	LS	599.120	-	555.984	555.984	-	43.196	43.136	
78.	Turn-out	1	LS	1,304.176	2.613	1,126.630	1,129.243	73.202	101.731	174.933	
79.	Inlet	1	LS	81.928	0.325	48.212	48.537	10.891	22.500	33.391	
80.	Check structure	1	LS	1.535	-	1.470	1.470	-	0.065	0.065	
81.	Ridge work	1	m	0.040	-	-	-	-	0.040	0.040	
82.	Outlet	1	LS	79.938	-	76.500	76.500	-	3.438	3.438	
83.	Road	1	m	1.150	0.355	0.282	0.637	0.048	0.465	0.513	Along irrigation canal
84.	Road	1	m	1.145	0.390	0.208	0.598	0.038	0.509	0.547	Along drainage canal-1
85.	Road	1	m	2.291	0.781	0.415	1.196	0.077	1.018	1.095	Along drainage canal-2
86.	Asphalt pavement	1	m^2	1.909	0.023	0.017	0.040	1.843	0.026	1.869	
87.	Gravel pavement	1	m^2	1.028	-	-	-	1.000	0.028	1.028	
88.	Independent road	1	m	2.036	0.680	0.529	1.219	0.101	0.726	0.827	
89.	Embankment	1	m^3	0.535	0.213	0.147	0.360	0.035	0.140	0.175	
90.	Filter	1	m^3	4.500	-	-	-	4.500	-	4.500	
91.	Gravel pavement	1	m^3	1.028	-	-	-	1.000	0.028	1.028	
92.	Riprap	1	m^3	5.741	0.081	0.047	0.128	5.513	0.100	5.613	

(Unit: I.D)

No.	Description	Quantity	Unit	Total Cost	Foreign Currency (F.C)			Local Currency (L.C)			Remarks
					Depreciation	Material	Total	Fuel, Repair & Material	Labour	Total	
93.	Farm road	1	m	0.520	0.149	0.115	0.264	0.025	0.231	0.256	
94.	Embankment	1	m^3	0.130	0.062	0.026	0.088	0.009	0.033	0.042	
95.	Tree Planting	1	ha	115.000	-	-	-	80.000	35.000	115.000	
96.	"	1	m	0.575	-	-	-	0.400	0.175	0.575	

2. Labor Cost

Personnel	Unit	Cost (I.D)
Worker	day	1.3
Foreman (Common)	"	5.0
" (Construction)	"	5.0
Chief worker	"	5.0
Vehicle operator	"	3.5
Assistant to vehicle operator	"	2.0
Heavy equipment operator	"	4.0
Assistant to heavy equipment operator	"	3.0
Mason	"	5.0
Carpenter	"	7.0
Smith	"	7.0
Painter	"	8.0
Welder	"	7.0
Watcher	"	2.0
Head carpenter	"	10.0
Head smith	"	10.0
Head welder	"	10.0

3. Material Cost

Description	Unit	F.C	L.C	Total	Remarks
Portland cement	ton	-	12.000	12.000	Sulphate Packed
Sand	cu.m	-	4.500	4.500	Coarse Sand
Gravel	"	-	5.000	5.000	Washed
Benzine	ℓ	-	0.035	0.035	Ordinary
Gas oil	"	-	0.010	0.010	For Diesel
Deformed bars	ton	112.000	-	112.000	
Wood	cu.m	-	80.000	80.000	
Vinyl pipe (100 mm)	m	0.450	-	0.450	
Reinforced concrete pipe (600 mm)	m	-	14.300	14.300	
" " (450 mm)	m	-	10.800	10.800	
" " (200 mm)	m	-	9.000	9.000	
" " (150 mm)	m	-	6.800	6.800	
Asphalt mixture	ton	7.500	-	7.500	
Tree	piece	-	2.000	2.000	For wind break
Concrete pile (450 mm ℓ=20m)	pile	135.500	-	135.500	
" (400 mm ℓ=20m)	"	112.800	-	112.800	
" (400 mm ℓ=15m)	"	94.000	-	94.000	
" (450 mm ℓ=15m)	"	112.000	-	112.000	

4. Operation Cost of Construction Equipments

Equipment	Capital Cost	Life Time	Depreciation Cost	Repair Cost			Fuel and Lubricant Cost		Labor (Operator)	Administration Rate		Operation Cost	
				Rate	Parts Cost	Labor Cost						Foreign	Local
	(1)	(2)	(3) 1/	(4)	(5) 2/	(6) 3/		(7)	(8)	(9)	(10) 4/	(3)+(5)	(6)+(7)+(8)+(10)
	(I.D)	(ha)	(I.D)	(%)	(I.D)	(I.D)	(ℓ/h)	(I.D)	(I.D)	(%)	(I.D)	(I.D)	(I.D)
Bulldozer 11^t 140^{ps}	15,200	7,200	1.900	105	1.550	0.664	6.5	0.110	0.822	6.5	0.136	3.450	1.732
" 21^t 203^{ps}	30,700	7,200	3.838	105	3.133	1.343	20.0	0.260	0.822	6.5	0.277	6.971	2.702
Backhoe $0.6m^3$ 97^{ps}	23,100	6,500	3.198	75	1.865	0.799	9.0	0.117	0.822	6.5	0.231	5.063	1.969
" $1.2m^3$ 200^{ps}	42,600	6,500	5.898	75	3.440	1.474	14.5	0.188	0.822	6.5	0.426	9.338	2.910
Tractor Shovel $1.6m^3$ 102^{ps}	16,800	6,600	2.290	95	1.692	0.725	11.5	0.149	0.822	6.5	0.165	3.982	1.861
Dump Truck 11^t 283^{ps}	10,600	6,800	1.402	80	0.872	0.374	9.0	0.117	0.428	10.0	0.155	2.274	1.074
Motor Scraper $12m^3$ 102^{ps}x2	68,100	7,200	8.512	95	6.289	2.695	43.7	0.568	0.822	6.5	0.614	14.801	4.699
Agitator Truck $1.6m^3$ 154^{ps}	2,230	5,000	0.401	60	0.187	0.080	17.7	0.230	0.428	6.5	0.028	0.588	0.766
Mobile Batcher $0.35m^3$ 18.5Kw	15,000	5,400	2.500	70	1.361	0.583	-	-	-	6.5	0.180	3.861	0.763
Generator 35KVA 48^{ps}	4,100	4,200	0.878	39	0.266	0.114	5.5	0.071	-	5.0	0.048	1.144	0.233
Diesel Hammer 2.5^t	44,400	6,000	6.660	90	4.662	1.998	3.0	0.039	0.822	6.5	0.481	11.322	3.340
Trencher 1.8m	8,300	2,800	2.668	110	2.282	0.978	3.5	0.045	0.822	5.0	0.148	4.950	1.993
Tire Roller 8-20^t 65^{ps}	10,000	7,000	1.286	85	0.850	0.364	6.7	0.087	0.822	6.5	0.092	2.136	1.365
Water Tank Truck 5,500ℓ	6,300	6,500	0.872	78	0.529	0.226	15.5	0.201	0.428	6.5	0.063	1.401	0.918
Asphalt Finisher 5.0m	23,400	4,800	4.387	85	2.900	1.243	8.0	0.104	0.822	6.5	0.317	7.287	2.486
Road Roller 10-12^t	9,000	7,000	1.157	85	0.764	0.327	8.8	0.114	0.822	6.5	0.083	1.921	1.346
Motor Grader 3.7m 125^{ps}	17,000	6,600	2.318	85	1.532	0.656	12.2	0.158	0.822	6.5	0.167	3.850	1.803

Note; 1/: $(3)=\frac{(1-0.1)\times(1)}{(2)}$ 2/: $(5)=\frac{(1)\times(4)}{(2)}\times 0.7$ 3/: $(6)=\frac{(1)\times(4)}{(2)}\times 0.3$ 4/: $(10)=\frac{(1)\times(9)}{(2)}$

Construction Schedule of Civil Works

A. Irrigation Pumping Facilities and Sedimentation Basin

1) Construction Schedule

The construction of irrigation pumping facilities and sedimentation basin will be started in FY 1983 which corresponds to only one year after the completion of the project facilities in FY 1982, and will be completed within one year, in order to supply irrigation water to the experimental farm, of which management and leaching test will be started in FY 1984.

The order of manufacturing of pump facilities and gates will be given in FY 1982 and will be installed along with the commencement of civil works.

2) Construction Equipment

Necessary construction equipment for the construction of irrigation pumping station and sedimentation basin are estimated as follows, based on the construction schedule and work volume.

List of Construction Equipment

Equipment	Specification	Quantity
Bulldozer	21 ton, 203 PS	1
Motor scraper	11 cu.m, 335 PS	9
Diesel hammer	2.5 ton	1
Mobile batcher	350 liter, 19.5 Kw	1
Generator	35 KVA, 48 PS	1
Agitator truck	1.6 cu.m, 154 PS	5

B. Drainage Pump Facilities and Dike

1) Construction Schedule

Prior to the commencement of the construction of drainage pumping facilities, dikes will be provided at the eastern part of the Project Area to prevent from flooding during the winter season, and the construction of pumping facilities will be started in FY 1984. Drainage for the experimental farm, which has been already constructed in FY 1983, will be made by the portable drainage pumps to be provided temporarily, during the drainage pump construction period in FY 1984.

2) Construction Equipment

List of Construction Equipment

Equipment	Specification	Quantity
Bulldozer	21 ton, 203 PS	1
Bullozer	11 ton, 140 PS	1
Tire roller	8-20 ton, 65 PS	1
Water tank truck	5,500 liter	1
Backhoe	0.6 cu.m, 97 PS	1
Tractor shovel	1.6 cu.m, 120 PS	2
Dump truck	11 ton, 283 PS	5
Diesel hammer	2.5 ton	1
Agitator truck	1.6 cu.m, 154 PS	5
Mobile batcher	350 liter, 19.5 KW	1
Generator	35 KVA, 48 PS	1

C. Irrigation and Drainage Canals, Road and Wind Break

1) Construction Schedule

The construction of main and secondary irrigation and drainage canals and roads will be started in June FY 1983 and will be completed in FY 1985. The construction of these facilities should be conducted, in accordance with the on-farm development schedule as mentioned in item D below.

2) Construction Equipment

Equipment	Specification	Quantity
Bulldozer	21 ton, 203 PS	5
Bulldozer	11 ton, 140 PS	9
Tire roller	8-20 ton, 65 PS	5
Road roller	10-12 ton	1
Motor grader	3.7 m, 125 PS	1
Asphalt finisher	5.0 m	1
Water tank truck	5,500 liter	1
Backhoe	1.2 cu.m, 200 PS	1
Agitator truck	1.6 cu.m, 154 PS	5
Mobile batcher	350 liter	1
Generator	35 KVA, 48 PS	1

D. On-Farm Development

1) Construction Schedule

On-farm development of the area will be started from FY 1984 which corresponds to only one year late from the commencement of construction of the irrigation pumping station, and will be completed in FY 1986. Yearly on-farm development area to be reclaimed is decided as shown below through the study on projected reclamation area equipped with land levelling and on-farm facilities.

On-Farm Development Area

Year	Area to be Reclaimed (ha)	Cropping Area (ha)	Remarks
1983	90		Experimental farm
1984	1,280	90	On-farm (Block A)
1985	2,870	1,370	-do- (Block B)
1986	2,060	4,240	-do- (Block C)
1987		6,300	
Total	6,300		

Yearly extent of the reclamation area is shown in Figure 5B-1.

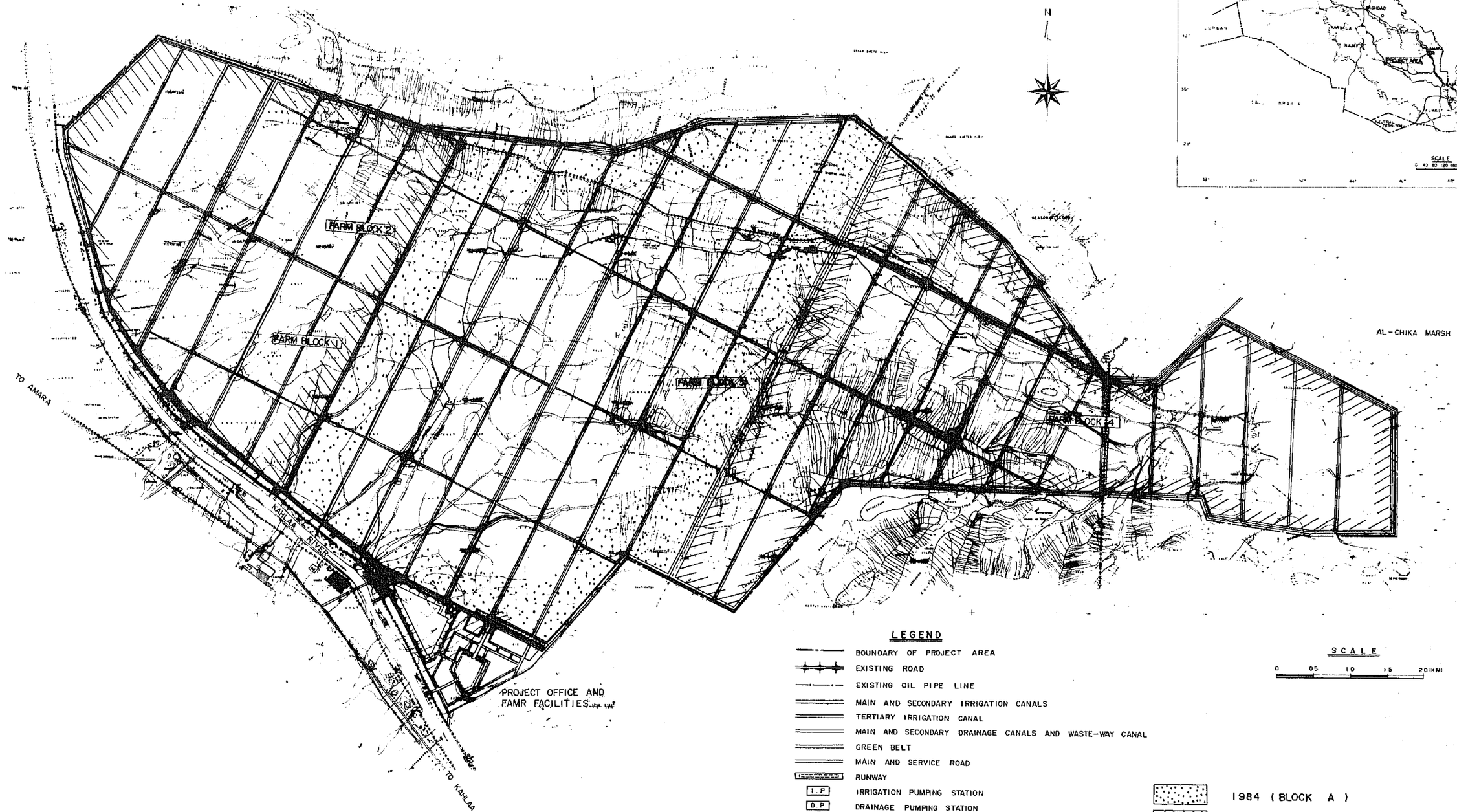
2) Construction Equipment

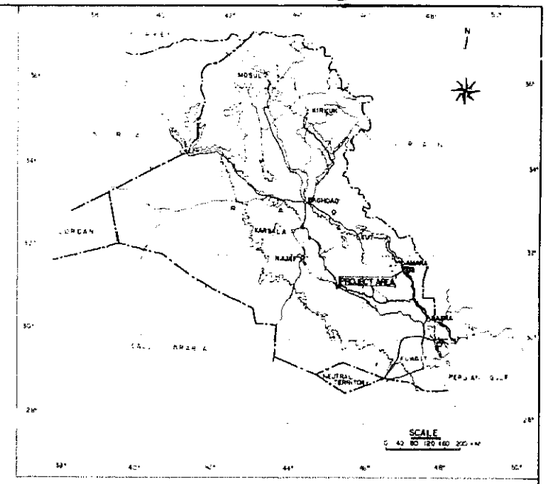
Necessary construction equipment for the construction of on-farm development are estimated based on the construction schedule and work volumes, as follows:

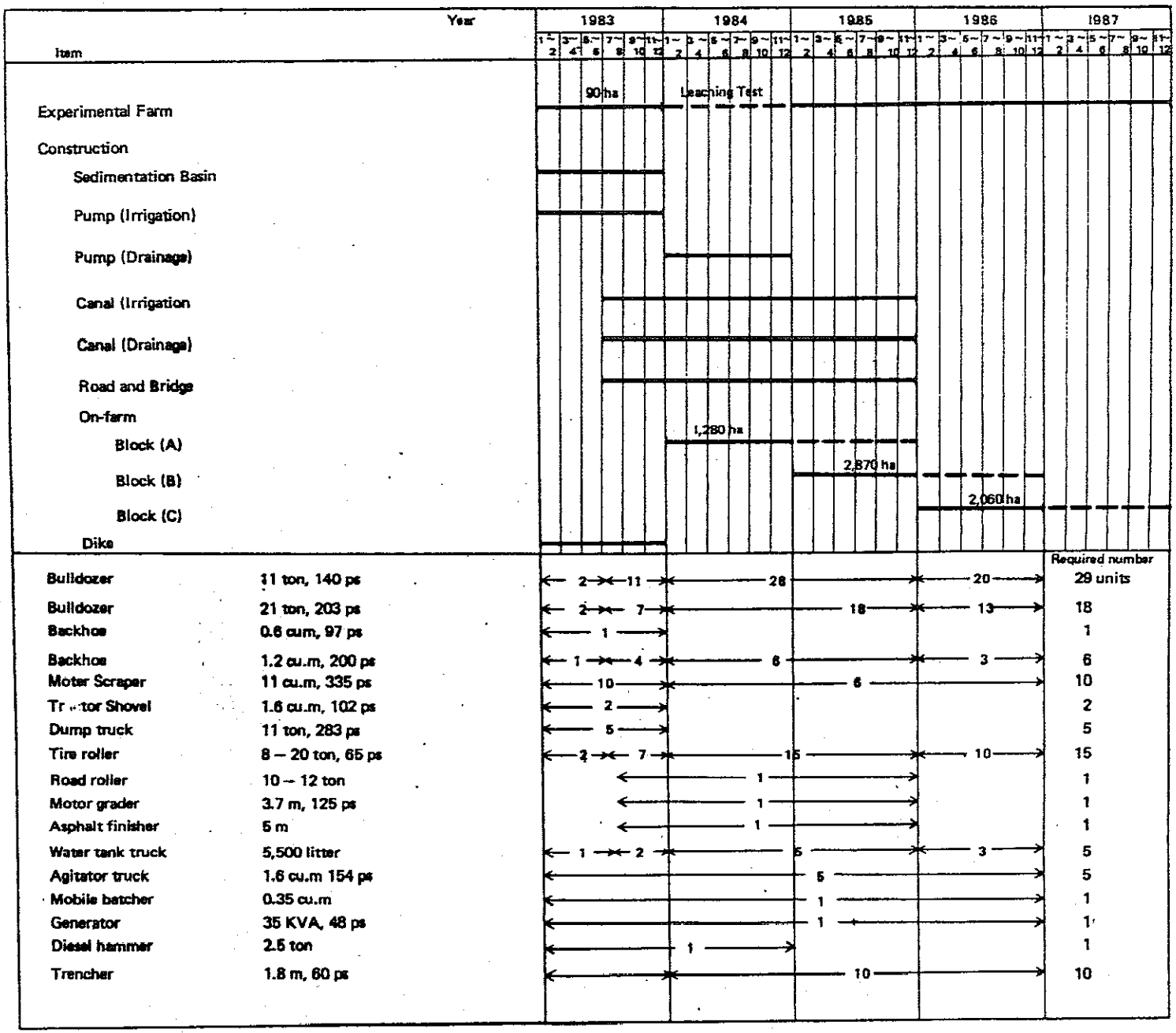
List of Construction Equipment

Equipment	Specification	Quantity
Bulldozer	21 ton, 203 PS	13
Bulldozer	11 ton, 140 PS	20
Tire roller	8-20 ton	10
Water tank truck	5,500 liter	1
Backhoe	1.2 cu.m, 200 PS	3
Motor scraper	11 cu.m, 335 PS	6
Trencher	1.8 m, 60 PS	10
Agitator truck	1.6 cu.m, 154 PS	5
Mobile batcher	350 liter	1
Generator	35 KVA, 48 PS	1

FIGURE 5B-1 YEARLY ON-FARM DEVELOPMENT SCHEDULE OF THE PROJECT






Year
Item
1983
1984
1985
1986
1987
90 ha
Leaching Test
Experimental Farm
Construction
Sedimentation Basin
Pump (Irrigation)
Pump (Drainage)
Canal (Irrigation
Canal (Drainage)
Road and Bridge
On-farm
1,280 ha
Block (A)
2,870 ha
Block (B)
2,060 ha
Block (C)
Dike
Required number
Bulldozer 11 ton, 140 ps 2 11 28 20 29 units
Bulldozer 21 ton, 203 ps 2 7 18 13 18
Backhoe 0.6 cum, 97 ps 1 1
Backhoe 1.2 cu.m, 200 ps 1 4 6 3 6
Moter Scraper 11 cu.m, 335 ps 10 6 10
Tr - tor Shovel 1.6 cu.m, 102 ps 2 2
Dump truck 11 ton, 283 ps 5 5
Tire roller 8 – 20 ton, 65 ps 2 7 15 10 15
Road roller 10 – 12 ton 1 1
Motor grader 3.7 m, 125 ps 1 1
Asphalt finisher 5 m 1 1
Water tank truck 5,500 litter 1 2 5 3 5
Agitator truck 1.6 cu.m 154 ps 5 5
Mobile batcher 0.35 cu.m 1 1
Generator 35 KVA, 48 ps 1 1
Diesel hammer 2.5 ton 1 1
Trencher 1.8 m, 60 ps 10 10

Required Number of Construction Equipment

The required number of construction equipment can be calculated based upon the total volume of works and operation hours of equipment during the construction period. Table 5B-1 indicates the required number of construction equipment in each work, and the total required numbers of each equipment are estimated by adding the required numbers of construction equipment in each work in the year as shown in Figure 5B-2.

Table 5B-1. Calculation of Required Number of Construction Equipment

Item	Construction Year	Equipment	Total Operation Hours[1] (hr) (1)	Construction Period[2] (hr) (2)	Required Number (1)/(2) (unit)	Required Number Number of Equipment (unit)
Experimental Farm	1983	Bulldozer, 21 ton	1,019	1,932	0.5	1
		" , 11 ton	1,628	1,932	0.8	1
		Tire roller	827	1,932	0.4	1
		Water tank truck	276	1,932	0.1	1
		Backhoe	238	1,932	0.1	1
		Motor scraper	486	1,932	0.3	1
		Trencher	391	1,932	0.2	1
		Agitator truck	73	1,932	-	5
		Mobile batcher	15	1,932	-	1
Sedimentation Basin and Irrigation Pump Facilities	1983	Bulldozer, 21 ton	64	155	0.4	1
		Motor scraper	16,593	1,932	8.6	9
		Diesel hammer	456	483	1.0	1
		Agitator truck	1,232	483	2.6	5
		Mobile batcher	237	483	0.5	1
Irrigation and Drainage Canal, Road and Wind Break	1983-1985	Bulldozer, 21 ton	20,471	4,830	4.2	5
		" , 11 ton	42,314	4,830	8.7	9
		Tire roller	22,084	4,830	4.6	5
		Road roller	700	4,830	0.1	1
		Motor grader	279	4,830	0.1	1
		Asphalt finisher	152	4,830	-	1
		Water tank truck	6,536	4,830	1.4	2
		Backhoe	10,476	4,830	2.2	3
		Agitator truck	15,977	4,830	3.3	5
		Mobile batcher	3,075	4,830	0.6	1
Drainage Pump Facilities	1984	Bulldozer, 21 ton	92	161	0.6	1
		Diesel hammer	204	322	0.6	1
		Agitator truck	459	322	1.4	5
		Mobile batcher	88	322	0.3	1

Item	Construction Year	Equipment	Total Operation Hours/1 (hr) (1)	Construction Period/2 (hr) (2)	Required Number (1)/(2) (unit)	Required Number Number of Equipment (unit)
Dike	1983					
		Bulldozer, 11 ton	1,909	1,932	1.0	1
		Tire roller	874	1,932	0.5	1
		Water tank tractor	292	1,932	0.2	1
		Backhoe	888	1,932	0.5	1
		Tractor shovel	2,596	1,932	1.3	2
		Dump truck	7,768	1,932	4.1	5
On-Farm	1984-1985					
		Bulldozer, 21 ton	70,318	5,796	12.1	13
		" , 11 ton	112,354	5,796	19.4	20
		Tire roller	57,080	5,796	9.8	10
		Water tank truck	17,400	5,796	3.0	3
		Backhoe	16,419	5,796	2.8	3
		Motor scraper	33,526	5,796	5.8	6
		Trencher	26,993	5,796	4.7	5
		Agitator truck	5,072	5,796	0.9	5
		Mobile batcher	1,031	5,796	0.2	1

/1 --- Total work volume/hourly production of construction equipment

/2 --- Annual workable day is decided as shown below:

Annual workable day = 365 — non-workable day

Non-workable day;

Annual rainy day (more than 5 mm/day)	:	9 days (see table below)
Annual holiday and national holiday	:	58 days
Ramadan (30 days x 50%)	:	15 days
Total	:	82 days

Annual workable day = 365 - 82 = 283 days
Monthly workable day = 283/12 ≒ 23 days
Annual workable hour = 23 days x 7 hrs/day x 12 months = 1,932 hrs.

Annual rainy day (10-year average): -

January	2.4 days	July	-	
February	1.8 "	Aug.	-	
March	1.0 "	Sept.	-	
April	1.3 "	Oct.	-	0.2
May	0.2 "	Nov.	-	0.6
June	-	Dec.	-	1.4
		Total		8.9 days ≒ 9 days

(Unit: I.D.)

Operation and Maintenance Cost

1. Salary and Wage

Designation	1981		1982		1983		1984		1985		1986		1987		1988	
	No.	Wages	No.	Wages	No.	Wages	No.	Wages	No.	Wages	No.	Wages	No.	Wages	No.	Wages
a) Management & Administration Staff																
Director General (D.G.)	1	1,560	1	1,560	1	1,560	1	1,560	1	1,560	1	1,560	1	1,560	1	1,560
Deputy D.G.	-	-	-	-	1	1,320	1	1,320	1	1,320	1	1,320	1	1,320	1	1,320
Technical Adviser	-	-	1	1,200	1	1,200	2	2,400	2	2,400	2	2,400	2	2,400	2	2,400
Managing Adviser	-	-	1	1,200	1	1,200	1	1,200	1	1,200	1	1,200	1	1,200	1	1,200
Irrigation Engineer	-	-	-	-	-	-	1	1,200	1	1,200	1	1,200	1	1,200	1	1,200
Asst. Irrigation Engr.	-	-	-	-	-	-	1	1,080	1	1,080	1	1,080	1	1,080	1	1,080
Agricultural Engineer	-	-	-	-	-	-	3	3,600	4	4,800	5	6,000	6	7,200	7	7,200
Asst. Agric. Engineer	-	-	-	-	-	-	3	3,240	5	5,400	6	6,480	7	7,560	8	8,640
Mechanical Engineer	-	-	-	-	-	-	-	-	1	1,200	1	1,200	1	1,200	1	1,200
Asst. Mechanical Engr.	-	-	-	-	-	-	-	-	1	1,080	1	1,080	1	1,080	1	1,080
Head of Department	1	1,200	1	1,200	1	1,200	1	1,200	2	2,400	2	2,400	2	2,400	2	2,400
Head of Section	2	2,160	2	2,160	2	2,160	2	2,160	5	5,400	9	9,720	11	11,880	13	14,040
Supervisor	-	-	-	-	-	-	1	1,200	1	1,200	2	2,400	2	2,400	2	2,400
Accountant	1	1,080	1	1,080	1	1,080	1	1,080	1	1,080	1	1,080	1	1,080	1	1,080
Asst. Accountant	1	840	1	840	1	840	1	840	1	840	1	840	1	840	1	840
Staff	-	-	-	-	-	-	3	2,160	14	10,080	27	19,440	37	26,640	44	31,680
Store keeper	-	-	-	-	-	-	-	-	4	2,880	6	4,320	6	4,320	6	4,320
Weignt keeper	-	-	-	-	-	-	-	-	2	1,320	4	2,640	4	2,640	4	2,640
Clerk	3	1,800	3	1,800	3	1,800	4	2,400	5	3,000	7	4,200	7	4,200	7	4,200
Typist	2	1,080	2	1,080	2	1,080	3	1,620	5	2,700	8	4,320	9	4,860	10	5,400
Building keeper	-	-	-	-	-	-	-	-	-	-	2	1,320	2	1,320	2	1,320
Pump keeper	-	-	-	-	-	-	2	1,440	4	2,880	4	2,880	4	2,880	4	2,880
Gateman	-	-	-	-	-	-	-	-	5	6,000	10		10	6,000	10	6,000
Sub-total	11	9,720	13	12,120	14	13,440	31	29,700	67	58,020	103	85,080	118	96,880	130	107,280
b) Skilled Labor																
Mechanic	-	-	-	-	-	-	-	-	1	840	2	1,680	3	2,520	3	2,520
Asst. Mechanic	-	-	-	-	-	-	-	-	1	720	2	1,440	3	2,160	3	2,160
Fitter	-	-	-	-	-	-	-	-	1	600	1	600	2	600	2	600
Asst. Fitter	-	-	-	-	-	-	-	-	1	600	2	1,200	2	1,200	2	1,200
Driver for Administration	3	1,800	5	3,000	6	3,000	10	6,000	14	8,400	16	9,600	18	10,800	19	11,400
Pump Operator and Water Watchman	-	-	-	-	-	-	-	-	2	1,200	4	2,400	4	2,400	4	2,400
Sub-total	3	1,800	5	3,000	6	3,000	10	6,000	20	12,360	27	16,920	32	19,680	33	20,280
TOTAL	14	11,520	18	15,120	20	16,440	41	35,700	87	70,380	130	102,000	150	116,560	163	127,560

NOTE: Unit price of wage and annual salary are shown in Table .

Table 5C-1. Annual Salary and Wages

a) Management and Administrative Staff

Designation	No. of Person	Salary Per Person	
		Monthly (I.D.)	Annual (I.D.)
Director-General (D.G.)	1	130	1,560
Deputy Director General	1	110	1,320
Technical Adviser	2	100	1,200
Managing Adviser	1	100	1,200
Irrigation Engineer	1	100	1,200
Asst. Irrigation Engineer	1	90	1,080
Agricultural Engineer	7	100	1,200
Asst. Agricultural Engineer	8	90	1,080
Mechanical Engineer	1	100	1,200
Asst. Mechanical Engineer	1	90	1,080
Head of Department	2	100	1,200
Head of Section	13	90	1,080
Supervisor	2	100	1,200
Accountant	1	90	1,080
Asst. Accountant	1	70	840
Staff	44	60	720
Store keeper	6	60	720
Weight keeper	4	55	660
Clerk	7	50	600
Typist	10	45	540
Building keeper	2	55	660
Pump keeper	4	60	720
Gateman	10	50	600
Sub-total	130		
b) Skilled Labor			
Mechanic	3	70	840
Assistant Mechanic	3	60	720
Fitter	2	50	600
Assistant Fitter	2	50	600
Driver	19	50	600
Pump Operator & Water Watchman	4	50	600
Driver	50	50	600
Sub-total	83		
c) Unskilled labor	32,282 persons/1		

NOTE: Wages of /1 above were counted in crop production cost.

Table 5C-2 Equipments and Machineries

a) Depreciation Cost

Equipment	Quantity	Unit Cost (I.D.)	Total Cost (I.D.)	Depreciation Cost (I.D.)
(1) Project Office				
Dump truck (11 ton)	1	10,600	10,600	
Stake truck (6 ton)	2	5,000	10,000	
Station wagon	10	3,400	34,000	
Jeep utility (4-wheel drive)	5	2,500	12,500	
Water Pump 2-4"	2	300	600	
Front end loader (1.6 m^3)	1	14,600	14,600	
Motor grader (l=3.7 m)	1	17,000	17,000	
Tire roller, 8-20 ton	1	10,000	10,000	
Pump dredger	1	25,000	25,000	
Flashing machine for field drain	2	16,000	32,000	
Trencher, 1.8 m 60 PS	1	8,300	8,300	
Concrete mixer, 0.3 m^3	1	1,300	1,300	
Weed cutter	10	500	5,000	
Communication system	L.S.	1,600	1,600	
Meteorological station	1	1,350	1,350	
Copy machine	3	700	2,100	
Surveying equipment	2	1,400	2,800	
Current meter	1	200	200	
Miscellaneous tools and equipment	L.S.		3,000	
Sub-total (1% of total cost of item (1)			191,950	1,920
Spare parts (5%)- (191,950 x 5%)				9,600
Total (1)				11,520
(2) Laboratory				
Station wagon	1	3,400	3,400	
Jeep utility (4-wheel drive)	2	2,500	5,000	
Copy machine	1	700	700	
Laboratory equipment	L.S.		6,000	
Sub-total (1% of total cost of item (2)			15,100	151
Spare parts (5%)- (15,100 x 5%)				755
Total (2)				906

cont'd.

Equipment	Quantity	Unit Cost (I.D.)	Total Cost (I.D)	Depreciation Cost (I.D.)
3) Pumping				
Irrigation pump				
Pump: 2,206 x 10^3 I.D. x 0.2% =				4,412
Building: 640 m^2 x 60 I.D./m^2 x 2% =				768
Drainage pump				
Pump: 460 x 10^3 I.D. x 0.2% =				920
Building: 245 m^2 x 60 I.D/m^2 x 2% =				294
Total (3)				6,394
b) Fuel and Oil Cost				
Pump running cost				
Irrigation pump, 200 KW x 11 units x 3,100 hr/yr. x 0.01 I.D./KWH =				68,200
Drainage pump, 60KW x 3 units 1,920 hr/yr x 0.01 I.D/KWH				3,456
Total (4)				71,656
Total (1 + 2 + 3 + 4)				90,476

Table 5C-3. Materials and Supplied

a) Canal Maintenance	
Main and secondary irrigation canal -	
954 x 10^3 I.D. x 2% =	19,080
Main and secondary drainage canal -	
309 x 10^3 I.D. x 2% =	6,180
On-farm facilities	
6,012 x 10^3 I.D. x 0.5% =	30,060
Total (1)	55,320
b) Road Maintenance - 1,329 x 10^3 I.D. x 0.5% = 6,645	
Total (2)	6,645

c) Building Maintenance

Project Office, 2,000 m^2 x 90 I.D/m^2 x 2%	=	3,600
Laboratory, 300 m^2 x 70 I.D./m^2 x 2%	=	420
Farm facility (building)		
Farm store, 2,500 m^2 x 40 I.D/m^2 x 2%	=	2,000
Equipment store, 300 m^2 x 40 I.D/m^2 x 2%	=	240
Workshop, 2,400 m^2 x 40 I.D./m^2 x 2%	=	1,920
Machinery garage, 6,500 m^2 x 40 I.D/m^2 x 2%	=	5,200
Workers' rest house, 300 m^2 x 50 I.D/m^2 x 2%	=	300
Material shed, 500 m^2 x 40 I.D/m^2 x 2%	=	400
Total (3)		14,080

D) Runway Maintenance

80,000 m^2 x 2.33 x 0.5%	=	932
Total (4)		932
TOTAL (1 + 2 + 3 + 4)		76,977

Terms of Reference for Consultant's Services

1. Objectives

The purpose of the consultant's services is to assist the Government in the effective implementation of the Project.

2. Specific Terms of Reference

The consultants will provide a team to undertake the following consulting services:

a) To prepare detailed design, cost estimates, specifications and tender documents for civil works and for procurement of operation and maintenance equipment, construction machineries, construction materials and other goods and instruments necessary for the Project;

b) To assist the Government in the supervision of construction works under the Project;

c) To assist and advise the Project Manager in preparing monthly construction schedule and work records;

d) To assist the relevant Government agencies to establish the rice farm management program which will include provision for:

   i) effective education of farm labor through farm experimentation and other means to enable them to adopt new cropping systems and improve cultivation practices;

   ii) establishment of new organizations for the effective channelling of agricultural services.

e) To train government staff in all phases of project activities.

3. Expertise

a) Senior Irrigation Engineer with sufficient experience in the planning, design, and operation and maintenance of irrigation and drainage system and with sufficient seniority to function as team leader;

b) Design Engineer with sufficient experience in the planning, design and construction of the pumps, canal systems, on-farm facilities and roads;

c) Engineering Geologist with sufficient experience in the geological and soil mechanical investigation for the major structures such as canal structures, pumping stations, bridge, etc.

d) Equipment Engineer with experience in management and organization of operation and maintenance of construction equipment;

e) Agronomist with sufficient experience in the crop and soil management under paddy irrigation and upland crops at the farm level;

f) Mechanical Farm Expert with sufficient experience of large-scale mechanized rice farming;

g) Farm Management Expert with broad experience in the agricultural supporting services for state rice farm; and,

h) Economist with sufficient experience in the establishment of farm budgets, marketing and credit services and in the evaluation of economic and financial viability of the state rice farming project.

4. Services to be Provided by the Government

The Government will provide the following for carrying out the Consultant's services:

a) All available documents, drawing, maps, statistics, data and other information related to the Project;

b) Suitable full-time counterparts personnel, including engineers, technicians and professionals, as required for the project; and,

c) 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 respect of:

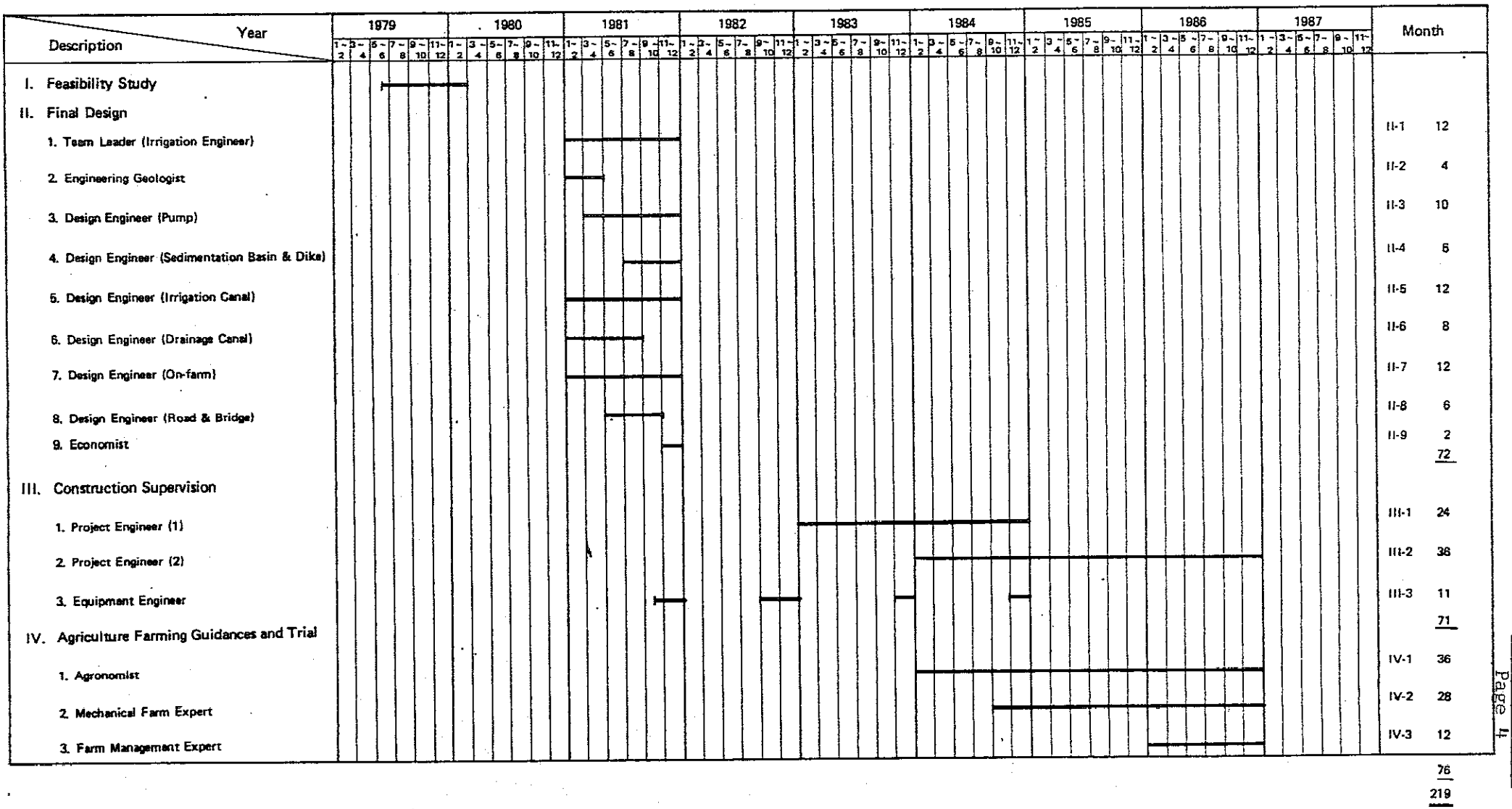
   i) any payment made to the Consultants in connection with the carrying-out of their services;

   ii) any equipment and materials and supplies brought into the territories of the Government for the purpose of carrying their services;, and

   iii) any property brought-in by the members of the Consultants for their personal use and consumption.

Figure 5D-1 shows the Proposed Schedule for the Consultant's Services.

FIGURE 5D-1 PROPOSED SCHEDULE FOR CONSULTANT'S SERVICES



6C-1. Price at Present

1) Rising rate of Commodities Prices

The rising rate of commodity prices seems to be not so high according to the index of consumer's price.

The index showed the 18 percent raise from 1973 to 1975 as shown in the following Table, according to UN report.

Table 6C-1 Index of Consumer Price in Iraq

- 1970 = 100 -

	1965	1971	1972	1973	1974	1975	1976
General	84	104	109	114	124	136	150
Foods	86	104	110	116	129	147	153

Source: UN "Statistical Yearbook, 1976"

This comparatively low rate is due to the subsidy policy by Iraqi government. The main goods to be subsidized are as follows; chemical fertilizer, farm machinery, seeds, wheat, bread, edible oil, meat imported and chicken, etc.

According to the Annual Abstract Statistics, 1977, Iraq, the consumer price index indicates 9.2 percent from 1976 to 1977. Index of food stuffs was 8.2 percent.

The World Bank reported the average annual rate of inflation in the world as shown in the following Table. Iraqi annual inflation rate was reported as 17.5 percent during 1970 to 1976. This rate seems to be moderate in comparison with that in the Central East Asian countries excluding Jordan and Egypt.

Table 6C-2 Consumer Price Index Numbers on the Country Level For the Years, 1974 - 77 (1973 = 100)

Group	1976 -77	1977	1976	1975	1974
Food Stuffs	8.2	145.3	134.3	120.8	110.1
Tobacco, Sunff alcholic drinks	9.1	114.4	104.9	102.0	101.7
Cloth & clothing	11.3	152.8	137.3	125.1	115.3
Shoe & bags	13.2	206.0	181.9	146.9	125.5
Domestic commodities	8.2	166.2	153.6	136.4	117.1
Fuel	4.4	110.9	106.2	95.1	94.4
Cleaning & cosmetic materials	1.3	137.2	139.0	118.7	110.4
Culture & Recreation	9.3	118.8	108.7	106.7	101.3
Housing & related services	9.6	139.8	127.5	115.2	102.1
Miscellaneous, commodities and services	11.6	152.8	136.9	101.0	100.0
General Index Number	9.2	145.3	133.1	118.0	107.7

Source: Annual Abstract Statistics, 1977

Table 6C-3 Average Annual Rate of Inflation (%)

	1960-70	1970-76
Iraq	1.7	17.5
Iran	1.1	25.2
Turkey	5.5	19.8
Saudi-Arabia	1.0	33.3
Syrian Arab Rep.	1.8	18.8
Jordan	1.1	9.6
Egypt	3.5	5.2
Israel	5.9	23.7
Kuwait	0.6	35.6
Japan	4.8	10.1
United States	2.8	6.8
France	4.2	9.3
Germany, Fed. Rep.	3.1	6.4
United Kingdom	4.1	13.3

Source: World Development Report, 1978
The World Bank, August 1978

2) Price of Agricultural Products

The Commercial Bulletin reports the prices of commodities every week. In this report the trend of prices for the years from 1976 to 1979 were studied on specific week of every month.

Wholesale prices of imported rice are reported on three kinds of Basmatic, California and Thailand. These prices show the constant price during these four years. Each price is 9.625 I.D. per sack with the weight of in 50 kg of Basmatic, 8.625 I.D. of U.S.A. and 7.125 I.D. of Thailand, 5% broken.

The imported price of Thailand rice, 5% broken per ton is 142.5 I.D. The price of rice, 25 - 35% broken is evaluated at 102.6 I.D. This price will be converted to 56.4 I.D. per ton of paddy by using 55% of conversion rate.

Wholesale prices of domestic rice are 9.625 I.D. per 50 kg of Amber 1st class, 6.125 I.D. of Amber 2nd class, 5.125 I.D. of Naima, 3.5 I.D. Ghribe.

Wholesale prices of domestic rice except Amber 1st class are cheaper than the imported rice from Thailand and U.S.A.

Regarding the price of paddy, however, the farm gate price of Amber 2nd class is rather higher than the prices of paddy imported and the wholesale price of domestic paddy.

Wholesale price of imported paddy per ton, from Thailand, 25 - 35% broken - - - - - - - - - - - - - - - 56.4 I.D.

Retail price of imported paddy per ton, from Thailand, 25 - 35% - - - - - - - - - - - - - - - - - - 59.2 I.D.

Farm gate price of 2nd class paddy per ton of Amber (purchasing price by Grin board 85 I.D.- transportation cost 4 I.D.) - - - - - - - - - - - - - - - 81 I.D.

Wholesale price of 2nd class paddy per ton - - - - - - - 67 I.D.

Prices of wheat are as follows:

Farm gate price of wheat per ton - - - - - - - - - - - - - -	47	I.D.
Wholesale price of wheat per ton		
1st class ----- before 1979, May - - - - - - - - - -	48	I.D.
since 1979, Jun. - - - - - - - - -	51	
2nd class ----- before 1979, May - - - - - - - - - -	44	
since 1979, Jun. - - - - - - - - -	47	

Retail prices of vegetables and fruits show the high rising rate.

The rates for the years from 1976 to 79 were 15 - 22% of tomato, 59 - 90% of cucumber, 32% of watermelon, 35 - 47% of egg-plant, 11 - 33% of Okra, 49% of lettuce, 12% of sour lemon and 79% of grape.

Table 6C-4 Wholesale Price of Imported Rice

Fils per sack of 50 kg

Kinds		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Basmati	1976	-	-	-	-	-	-	9,625	9,625	9,625	9,625	-	-	9,625
	1977	-	-	-	-	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625
	1978	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625
	1979	9 625	(15) 1/	(15)	(15)	(15)	(15)	(15)	(15)					
U.S.A. 2/	1976	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625
	1977	8,625	8,625	-	-	-	-	8,625	8,625	8,625	8,625	8,625	8,625	8,625
	1978	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625	8,625
	1979	8,625	(9)	(9)	(9)	(9)	(9)	(9)	(9)					
Thailand	1976 3/	5,625	5,265	5,625	5,625	5,625	-	-	-	-	-	-	-	
	1977 4/	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125
	1978	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125	7,125
	1979	7,124	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)	(7.5)					

Note: 1/ Figures in parenthesis indicate the retail prices. 2/ Unbroken.
3/ 1976 years: 15% broken 4/ 1977 - 1979: 5% broken

Wholesale Price of Imported Paddy from Thailand, broken 25 - 35%.

1. Wholesale Price of Rice, broken 5% 7,125 I.D./50kg 142.5 I.D./ton
2. " 25 - 35% 102.6 I.D./ton
3. " Paddy " 56.4 I.D./ton

Source: Commercial Bulletin, by Weekly, Directorate of Research and Publication.

Table 6C-5 Wholesale Price of Local Rice

Fils or I.D. per sack of 50 kg

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Amber 1st Grade	1976	7,625	7,625	7,625	7,625	7,625	7,625	7,625	7,625	7,625	7,625	7,625	7,625	7,625
	1977	7.625	7,625	7,625	7,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	8,958
	1978	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625
	1979	9,625	(12)	(12)	(12)	(12)	(12)	(12)	(12)					
Amber 2nd Grade	1976	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125
	1977	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125
	1978	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125	6,125
	1979	6,125	(8.5)	(8.5)	(8.5)	(8.5)	(8.5)	(8.5)	(8.5)					
Naima	1976	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125
	1977	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125
	1978	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125
	1979	5,125												
Gharibe	1976	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	1977	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	1978	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	1979	3.5												

Note: Figures in Parenthesis indicate the retail prices.

Source: Commercial Bulletin, by Weekly, Directorate of Research and Publication.

Table 6C-6 Wholesale Price of Broken Rice

I.D. per ton

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Fine	1976	60	60	60	65	65	75	75	85	95	95	95	95	77
	1977	100	110	105	90	70	60	60	60	70	60	60	60	75
	1978	58	55	55	55	n.a.	50	50	55	55	55	65	65	56
	1979	65	(75)	n.a.	(81.25)	(72.5)	(60)	(60)						
Coarse	1976	70	70	70	75	75	85	85	95	100	100	100	100	85
	1977	100	100	120	100	90	75	75	75	75	75	65	65	85
	1978	63	60	60	58	n.a.	55	55	65	65	65	75	75	63
	1979	75	(82)	n.a.	(92.5)	(82.5)	(70)	(65)						

Note: Figures in Parenthesis indicate the retail prices
n.a: Data are not available.

Table 6C-7 Wholesale Price of Wheat and Barley

I.D. per ton

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Fine Wheat (1st Grade)	1976						46	46	46	46	46	46	46	46
	1977	46	46	46	46	46	46	48	48	48	48	48	48	47
	1978	48	48	48	48	48	48	48	48	48	48	48	48	48
	1979				48	48	51	n.a.	51					
Fine Wheat (2nd Grade)	1975						42	42	42	42	42	42	42	42
	1977	42	42	42	42	42	42	46	46	46	46	46	46	44
	1978	44	44	44	44	44	44	44	44	44	44	44	44	44
	1979				44	44	47	n.a.	47					
Coarse Wheat	1976						43	43	43	43	43	43	43	43
	1977	43	43	43	43	43	43	46	46	46	46	46	46	44.5
	1978	46	46	46	46	46	46	46	46	46	46	46	46	46
	1979				46	46	49	n.a.	49					
Barley	1976						35	35	35	35	35	35	35	35
	1977	65	65	35	35	35	35	85	85	85	85	85	85	65
	1978	40	40	40	40	40	40	40	40	40	40	40	40	40
	1979				40	40	43	n.a.	43					

Table 6C-8 Average Retail Prices of Vegetables & Fruits in Baghdad

Maximum Commodities Prices in Fields per Kilo

	1976		1977		1978		1979 (to Aug.)	
	Fils	%	Fils	%	Fils	%	Fils	%
Tomato (1st)	124	100	165	133	151	122	147	119
Tomato (2nd)	98	100	109	111	114	115	116	118
Cucumber (1st)	98	100	150	153	186	190	129	132
Cucumber (2nd)	59	100	108	183	94	159	90	153
Watermelon	28	100	28	100	37	132	(55)	
Eggplant (1st)	58	100	72	124	85	147	(270)	
Eggplant (2nd)	46	100	57	124	62	135	(153)	
Dry Onion	83	100	103	124	103	124	(120)	
Okra (1st)	156	100	170	109	208	133	(265)	
Okra (2nd)	101	100	112	111	112	111	(140)	
Lettuce	47	100	53	113	70	149	(70)	
Potatoes	95	100	125	132	128	135	(125)	
Sour Lemon	239	100	274	115	267	112	(435)	
Apples (1st)	200	100	169	85	163	82	(163)	
Grapes (Black, 1st)	77	100	136	177	138	179	(130)	
Apricot (1st)	180	100	200	111	180	100	270	

3) Price of Construction Material

The trend of prices of sand, gravels, bricks, cement, iron and petroleum products during 1976 to 1979 will be characterized as follows.

1. Prices of bricks, iron and petroleum products have been in constant situation because of the price system controled by government.

2. Price of cement which was raised 16 to 32% in 1977 have been in constant. Price of cement has been kept constant since 32% raise from 16% in 1977.

3. Retail prices of sand and gravels have been fluctuating especially since the high percentage raise of price in these two years of 1978 and 1979.

Retail Price per M^3	1976	1977	1978	1979 (to Aug.)
Coarse Sand Granded, White	100	103	112	157
Gravels (Washed)	100	130	136	173

4) Wage Rate of Buildings and Construction Workers in the Socialist Sectors

The classes of workers consist of engineers, labours, administrators, attendants, guards and others according to Annual Abstract of Statistics 1977.

Average wages paid per year increased from 356 I.D. per one worker in 1973 to 961 I.D. in 1977. But the raising rate for 1975 to 1977 shows pretty low rate as 701 I.D. to 961 I.D.

Table 6C-9 Price Index of Construction Materials

Source: Weekly Bulletin, Directorate of Research and Publication

	1976		1977		1978		1979(to Aug.)	
	I.D.	%	I.D.	%	I.D.	%	I.D.	%
Sand (Retail Price, M^3)								
Coarse Sand Granded, White	2.438	100	2.500	103	2.727	112	3.833	157
Coarse Sand Granded, Red	2.438	100	2.500	103	2.727	112	3.833	157
Gravels (Washed) (Retail, M^3)	2.500	100	3.250	130	3.409	136	4.333	173
Bricks (Socialist Sector Prices)								
3,000 Bricks at the Kiln	28	100	28	100	28	100	-	
1,000 Bricks, 1st grade (devld at site)	-		-		-		19	
1,000 Bricks, Excellent Quality	-		-		-		20	
Yellow Concrete Bricks, per 1,000	12	100	12	100	12	100	12	100
Red "	10	100	10	100	10	100	10	100
Cement								
Portland Ordinary Bulk, ex-plant	5.900	100	5.900(to Apr.) 7.000(from May)	119	7	119	7	119
Portland Ordinary Packed, ex-plant	6.900	100	6.900 8.000 (")	116	8	116	8	116
Portland Sulphate Resisting Bulk, ex-plant	8.750	100	8.750 11.000 (")	126	11	126	11	126
Portland Sulphate Packed, ex-plant	9.750	100	9.750 12.000 (")	123	12	123	12	123

Continue

	1976 I.D.	%	1977 I.D.	%	1978 I.D.	%	1979 I.D.	%
IRON (Wholesale Prices, Ton)								
Round bars, Guage 6, 8mm Smooth	119	100	119	100	119	100	119	100
" 10, 12mm	114.250	100	114.250	100	114.250	100	114.250	100
" 16mm	109.500	100	109.500	100	109.250	100	109.250	100
Deformed bars Guage 10, 12mm	116.500	100	116.500	100	116.500	100	116.500	100
" 16mm	112	100	112	100	112	100	112	100
Flat Sheet Iron Guage 22/24 mm								
" 26/28mm	148	100	148	100	148	100	148	100
" 30mm	158	100	158	100	158	100	158	100
Petroleum Products	(Sales centre)		(Wholesale)		(Retail)		(Retail)	
Kerosine, litter	0.008	100	0.008	100	0.008	100	0.008	100
Fuel "	0.003	100	0.003	100	0.003	100	0.003	100
Diesel Oil "	0.005	100	0.005	100	0.005	100	0.005	100

Table 6C-10 Wage Rate paid to workers in the Building and Constructions of Socialist Sector 1973-1977

Unit: Fils

Worker	1973	1974	1975	1976	1977
Engineers	1,325	1,673	2,189	2,351	2,256
Labourers	332	477	671	722	919
Administrators	518	1,050	968	1,110	1,172
Attendants and Guards	164	171	232	287	376
Others	566	708	1,284	1,030	943
Average	356	507	701	768	961

Source: Annual Abstract of Statistics, 1977

Table 6C-11 Wage Rate Index

Worker	1973	1974	1975	1976	1977
Engineers	100	126	165	177	170
Labourers	100	144	202	217	277
Administrations	100	203	187	214	226
Attendants and Guards	100	104	141	175	229
Others	100	125	227	182	167
Average	100	142	197 (100)	216 (110)	270 (137)

6C-2. Trade

Gross export was valued about 2,450 million I.D. in 1975 of which oil value occupied about 98.5 percent. The sectors concerned to trade are divided in the socialist, foreign and private sector. For the years 1970 to 1977 the share traded by the socialist sector raised 54 percent to 80 percent on exports value and 58 to 87 on imports value. (See the following table)

The value of exports to Asian countries occupied the largest value in 1977. The imports from western countries have been increasing, on the other hand, valued the largest, and Asian countries follow.

Recently, the imports from Japan increased to occupy.

The official exchange rate is shown as follows.

Foreign Exchange Rate according to the Bulletin issued by Iraqi Central Bank.

	Selling Rate to One Dinar	
	American Dollar	Japanese Yen
31, July 1979	3.377778	734.678868
6, Jun. 1979	3.377778	736.036739
12, May 1979	3.377778	715.660671
28, Apr. 1979	3.377778	744.183966
1976	3.377778	
1975	3.377778	

The import custom tariff system at present has been based on the tariff as of 1955. The latter was revised in 1964. A method of taxation is an ad valorem duty which is fixed on the basis of the domestic wholesale prices. Tariff is ranged from 5 percent to 100 percent.

The tariff on durable consumption goods, competition goods with domestic products, luxury etc. are levied to high rate.

The production goods, row and processed and packing material for domestic products are levied to low rate.

The import tariff was raised in 10 percent, 1967 and 15 percent, 1969.

The export tariff is levied as 1 percent on pure gold and 1 percent on foreign products to be re-exported.

Table 6C-12 Value of Imports and Exports by Sector, 1970-1977

- thousand I.D. -

Year	Exports[1] Total	%	Foreign	%	Private	%	Socialist	%
1970	22,566	100	183	0.8	10,081	44.7	12,302	54.5
1971	22,782	100	104	0.4	10,882	47.8	11,796	51.8
1972	28,614	100	-	-	12,664	44.3	15,950	55.7
1973	32,523	100	29	0.1	13,889	42.7	18,605	57.2
1974	28,130	100	86	0.3	10,622	37.8	17,422	61.9
1975	35,565	100	200	0.6	8,261	23.2	27,104	76.2
1976[2]	46,530	100	43	0.1	8,357	18.0	38,130	81.9
1977[2]	42,670	100	-	-	8,372	19.6	34,298	80.4

Year	Imports Total	%	Foreign	%	Private	%	Socialist	%
1970	181,651	100	13,575	7.5	61,411	33.8	106,665	58.7
1971	248,870	100	6,000	2.4	43,315	17.4	199,495	80.2
1972	234,680	100	3,256	1.4	37,945	16.2	193,479	82.4
1973	270,317	100	9,033	3.4	35,440	13.1	225,844	83.5
1974	773,432	100	13,617	1.8	64,450	8.3	695,365	89.9
1975	1,426,858	100	9,863	0.7	94,868	6.6	1,322,127	92.7
1976[2]	1,150,898	100	2,572	0.2	126,651	11.0	1,021,675	88.8
1977[2]	1,151,268	100	1,801	0.1	148,252	12.9	1,001,215	87.0

Note: 1/ Except oil export. 2/ Primary figure

Source: Annual Abstract of Statistics, 1977.

Table 6C-13 Export and Import

Unit: 1,000 I.D.

Area	1975 Export	1975 Import	1976 Export	1976 Import	1977 Export	1977 Import
1. Arab	11,241	36,081	8,749	20,605	10,735	19,790
2. Western European	4,923	666,783	8,596	624,808	5,209	562,607
3. Socialist European	2,442	116,515	3,637	114,028	2,630	118,375
4. Asian Socialist	2,105	20,766	7,484	17,039	9,136	20,833
5. Other Asian	9,061	327,529	14,712	225,688	13,000	297,939
6. African exclude Arab	102	5,191	53	1,531	272	1,451
7. North American	5,392	158,664	2,988	90,022	1,374	76,989
8. South American	-	73,740	-	25,874	-	27,267
9. Oceania	319	21,589	317	31,321	313	26,017
Grand Total	35,565	1,426,858	46,530	1,150,898	42,670	1,151,268

Source: Annual Abstract of Statistics, 1977.

Table 6C-14 Imports Ranking by Overseas Countries

Unit: 1,000 I.D.

Name of Country	1977 Imports	1977 Ranking	1975 Imports	1975 Ranking
Japan	216,317	1	240,471	2
Germany (F.R.)	189,883	2	273,832	1
United Kingdom	82,872	3	83,008	5
France	62,857	4	89,262	4
Italy	61,495	5	65,939	7
U.S.A.	55,879	6	120,089	3
Holland	48,373	7	20,787	13
USSR	42,374	8	34,224	8
Australia	24,085	9	15,230	17
Switzerland	22,911	10	15,676	16
Belgium	21,064	11	30,790	9
China (PR)	20,735	12	20,545	14

Source: Annual Abstract of Statistic, 1977.

6C-3. Economic Evaluation of Commodities and Labor Prices

Rice and wheat are the traded goods. The farm gate price of both goods were evaluated as the following price structure analysis. The border prices indicated by US$ were converted to Iraqi Dinar using the shadow exchange rate of US$ = 0.329 I.D.(ID = 3.04 US$). This shadow rate is equivalent to the reciprocal of the Standard Conversion Factor. The Standard Conversion Factor was assumed at 0.9. This factor was roughly calculated by using the recent data on trade and custom tariff.

The economic evaluation of non-traded goods and some of traded goods were calculated by using the Standard Conversion Rate.

Agricultural labor is considered to be an unskilled labor. Shadow wage rate was evaluated on the basis of an opportunity cost of labor employed in the new project.

The opportunity cost was assumed on the basis of the income of farmer in the Project area.

According to the farm survey conducted at Emi Al-ward village in the Project area, some farmer gained the farm income of 874 I.D. in the summer season, 1978 and winter season, 1978 to 1979. This farmer cropped 6 donum of paddy, 8 of wheat, 12 of barley and 4 of broad beam, then total area is 30 donum. And sheep of 50 heads and cow of 2 heads are raised. The farm income of 874 I.D. consists of 574 I.D. of crop and 300 I.D. of sheep.

One farm household consisting of three laborers has 360 working days in a year. In accordance with above figures, the income per laborer was estimated at 0.8 I.D. per day. This wage rate was assumed at shadow wage rate to market wage rate of 1.0 I.D.

It is assumed that the rate of 0.8 I.D. correspond to a shadow rate in comparison with the market wage rate of 1.0 I.D.

Table 6C-15 Price Structure for Paddy Rice 1979 & 1985[1/]

	1979		1985	
	I.D./ton	US$/ton	I.D./ton	US$/ton
1) Export Price of Thai 5% broken, f.o.b. Bangkok	130	389	155	460
2) Export Price of Thai 25-35% broken, f.o.b. Bangkok	95	280	110	331
3) Ocean Freight and Insurance from Bangkok to Basra[2/]	15	40	15	40
4) Port Handling Charge[3/]	5	15	5	15
5) Price of Rice, Basra	115	335	130	386
6) Transportation Cost from Port to Rice Mill[4/]	-5	-14	-5	-14
7) Price of milled Rice Area	110	321	125	372
8) Paddy Equivalent Price[5/]	60	177	75	223
9) Milling Costs less Value of By-Products[6/]	-1	-3	-1	-3
10) Transportation Cost from Farm to Mill[7/]	0	0	0	0
11) Farm Gate Paddy Price	60	174	75	220
12) Financial Farm gate Paddy Price (Amber 2nd)	(85)		(70)[9/]	
(Thailand Paddy Rice imported: wholesale prices 25 - 35% broken)[8/]	(62)			

Note: 1/ I.D./ton and US$/ton values at 1979 constant prices using the shadow exchange rate of US$ = 0.329 I.D. Dinar rounded to nearest I.D. 5.00.
2/ Ocean freight was assumed by using other case.
3/ Port handling charge also was assumed by using other case in consideration of the actual situation of accumulation of cargo.
4/ Based on 4 I.D. per ton as a result of the field survey. Consume center will be considered to be built in Basra.

Continued

5/ Milling rate of Amber is in a range of 51 to 55 percent at present. In future, if the mill and rice varieties would be improved, milling rate would go up to 60 percent.

6/ Milling rate is 51%, burn is 16 fils/kg.

7/ Mills locate in the Project Area.

8/ Imported Thailand Paddy Rice was based on the Commercial Bulletin Bi Weekly.

9/ 1979 financial price is actual. 1985 financial prices calculated by using 0.296 I.D. of the official exchange rate.

Table 6C-16 Price Structure for Wheat 1979 & 1985[1/]

	1979		1985	
	I.D./ton	US$/ton	I.D./ton	US$/ton
1) Export Price of Canadian No.1 Western Red Spring, Thunder Bay	60	170	70	204
2) Ocean Freight and Insurance, Canada to Basra[2/]	10	30	10	30
3) Port Handling Charge[3/]	5	15	5	15
4) Price of Wheat, Basra	75	215	85	249
5) Transportation Cost from Port to Mill[4/]	-5	-14	-5	-14
6) Price of Wheat Ex-mill	70	201	80	235
7) Transportation Cost from/to Mill	0	0	0	0
8) Farm Gate Wheat Price	70	201	80	235
9) Financial Farm Gate Wheat Price (Saber beh)	(51)[5/]		(70)[6/]	

Note: 1/ I.D. Rice price structure

2/ Ocean freight was assumed by using other case.

3/ I.D. Rice price structure

4/ I.D. Rice price structure

5/ 1979 financial price is actual.

6/ 1985 financial price is calculated by using 0.296 I.D. of the official exchange rate.

Table 6C-17 Economic and Financial Price

Commodities	Unit	At Present (1979) Actual Price	At Present (1979) Economic Price	In Future (1985) Financial Price	In Future (1985) Economic Price
Cereal					
Paddy 1/	I.D./ton	85	60	70	75
Wheat 2/	I.D./ton	51	70	70	80
Barley 3/	I.D./ton	43	39	43	39
Seeds					
Paddy	I.D./ton	137.4	97 4/	70	75 5/ (122)
Wheat	I.D./ton	65.7	90 4/	93	103 5/
Barley	I.D./ton	50.4	45	50	45
Fertilizer					
Urea	I.D./ton	41	58 6/	64	58
TSP	I.D./ton	35.7	50 6/	56	50
Herbicide 7/					
Kitajin		120	96	107	96
Satan		333	270	300	270
Fuel					
Kerosin	Fils/ℓ	8	7	8	7
Diesel Oil		10	9	10	9

Note: 1/, 2/ based on the price structure analysis.

3/ the standard comersion rate.

4/ Paddy: 137.4 x 60/85. Wheat: the same, 137.4 x 60/85.

5/ Paddy seeds are producted in this Project.
Wheat: 80 x 65.7/51

6/ Actual prices are the subsidized price.
Rate of subsidy was assumed at 50 percent.
Figures of mark 6/ were estimated based on this subsidy and transportation cost.

7/ Actual prices are based on the domestic price in Japan.
Economic prices were estimated by deducting indirect tax. Price of Pilazorate is about 1,000 yen (1.364 I.D.) in Japan.

6C-4. Escalation factor for Project Cost

Escalation factor of the foreign currency portion was estimated at 6.0% based on the index of international inflation, IBRD, 1975,May.

Index of international inflation

	1979	1980	1981	1982	1985	1990
1979 = 100	100.0	106.0	112.4	119.2	141.9	181.1
Yearly change %	-	6.0	6.0	6.0	6.0	6.0

Escalation factor of the local currency portion would be decided in consideration of price escalation of construction materials and labor in recent years.

Price index of Construction Materials

Materials	1976	1977	1978	1979
Sand	100	103	112	157
Gravel	100	130	136	173
Bricks	100	100	100	100
Cement 1/	100	116	116	116
Iron 2/	100	100	100	100
Fuel	100	100	100	100

Note: 1/ Portland ordinary packed ex-plant.
2/ Round bars, Gauge.

Wage Rate

	1975	1976	1977
Labour 1/	100	107	127

Note: 1/ Wage rates to labour in the building and constructions of Socialist Sector.

Components of construction materials and labor are estimated as follows. The weighted escalation factor would be conservatively estimated at 10% in consideration of the following figures.

Escalation factor of local currency

Materials	Component % (A)	Annual escalation (B)	Escalation factor (A) x (B)
Sand	43 x 0.15 = 6.4	1.19	7.6
Gravel	43 x 0.60 = 25.8	1.24	32.0
Bricks work	10	1.0	10.0
Labor	47	1.14	53.6
Total	100		114

114 ÷ 100 = 1.14

0.06 x 0.6 + 0.14 x 0.4 = 0.036 + 0.056 = 0.092 ≒ 10%
(F.C. : L.C. = 6 : 4)

6C-5. Benefit Evaluation

Table 6C-18 Economic Gross Production Value with Project

	Unit Price	1986 8th Quantity	1986 8th Value	1987 9th Q	1987 9th V	1988 10th Q	1988 10th V	1989 11th Q	1989 11th V
	ID/ton	ton	I.D.	ton	I.D.	ton	I.D.	ton	I.D.
Paddy	75	6,950	521,250	14,880	1,116,000	21,755	1,631,625	25,545	1,915,875
	(70)		(486,500)		(1,041,600)		(1,522,850)		(1,788,150)
Wheat	80	1,104	88,320	2,010	160,800	2,772	221,760	2,934	234,720
	(70)		(77,280)		(140,700)		(194,040)		(205,380)
Barley	39	828	32,292	1,542	60,138	2,126	82,914	2,256	87,984
	(43)		(35,604)		(66,306)		(91,418)		(97,008)
Total		8,882	641,862	18,432	1,336,938	26,653	1,936,299	30,735	2,238,579
			(599,384)		(1,248,606)		(1,808,308)		(2,090,438)

Note: Parenthesized figures show Financial Gross Production Value with project.

1990 12th Q	1990 12th V	1991 13th Q	1991 13th V
ton	I.D.	ton	I.D.
27,260	2,044,500	27,945	2,095,875
	(1,908,200)		(1,956,150)
3,000	240,000	3,000	240,000
	(210,000)		(210,000)
2,300	89,700	2,300	89,700
	(98,900)		(98,900)
32,560	2,374,200	33,245	2,425,575
	(2,217,100)		(2,265,050)

Table 6C-19 Production Cost With Project

Cost Material	Unit Price I.D/ton	1986 Quantity ton	1986 Value I.D.	1987 Q ton	1987 V I.D.	1988 Q ton	1988 V I.D.	1989 Q ton	1989 V I.D.	1990 Q ton	1990 V I.D.	1991 Q ton	1991 V I.D.
Seed Paddy	70	278	19,460	484	33,880	621	43,470	621	43,470	621	43,470	621	43,470
Wheat	93	55.2	5,133	93.6	8,704	120	11,160	120	11,160	120	11,160	120	11,160
Barley	50	55.2	2,760	93.6	4,680	120	6,000	120	6,000	120	6,000	120	6,000
Urea	64	563.18	36,043	1,157.5	74,080	1,659.93	106,235	1,950.84	124,853	2,007.5	128,480	2,048.6	131,110
TSP	56	336.84	18,863	693.74	38,849	1,001.24	56,069	1,155.95	64,733	1,227.14	68,719	1,254.54	70,254
(Pilazorate)	(1,090)	41.7	(45.453)	72.6	(79.134)	93.15	(101,533)	93.15	(101,533)	93.15	(101,533)	93.15	(101,533)
Satan	300	41.7	12,510	72.6	21,780	93.15	27,945	93.15	27,945	93.15	27,945	93.15	27,945
Kitajin	107	83.4	8,923	145.2	15,536	186.3	19,934	186.3	19,934	186.3	19,934	186.3	19,934
Machinery Cost (excluding depreciation cost)			21,744		37,652		48,302		48,302		48,302		48,302
Total (Satan)			125,436		235,161		319,115		346,397		354,010		358,175
(Pilazorate)			158,379		292,515		392,703		419,985		427,598		431,763
Machinery Cost (including depreciation cost)			93,264		161,472		207,144		207,144		207,144		207,144
Total (Satan)			196,956		358,981		477,957		505,239		512,852		517,017

Table 6C-20 Machinery Cost Including Depreciation Cost

	Cost/Ha I.D.	1986 Ha	1986 Cost	1987 Ha	1987 Cost	1988 Ha	1988 Cost	1989 Ha	1989 Cost	1990 Ha	1990 Cost	1991 Ha	1991 Cost
Paddy	26.4	2,780	73,392	4,840	127,776	6,210	163,944	6,210	163,944	6,210	163,944	6,210	163,944
Wheat	21.6	460	9,936	780	16,848	1,000	21,600	1,000	21,600	1,000	21,600	1,000	21,600
Barley	21.6	460	9,936	780	16,848	1,000	21,600	1,000	21,600	1,000	21,600	1,000	21,600
Total			93,264		161,472		207,144		207,144		207,144		207,144

Table 6C-21 Macninery Cost Excluding Depreciation Cost

	Machinery Cost per Ha. excluding depreciation cost	1986 Machinery Ha	1986 Machinery Cost	1987 Ha	1987 Cost	1988 Ha	1988 Cost	1989 Ha	1989 Cost	1990 Ha	1990 Cost	1991 Ha	1991 Cost
Paddy	6.2 I.D.	2,780	17,236	4,840	30,008	6,210	38,502	6,210	38,502	6,210	38,502	6,210	38,502
Wheat	4.9	460	2,254	780	3,822	1,000	4,900	1,000	4,900	1,000	4,900	1,000	4,900
Barley	4.9	460	2,254	780	3,822	1,000	4,900	1,000	4,900	1,000	4,900	1,000	4,900
Total Machinery Cost			21,744		37,652		48,302		48,302		48,302		48,302

Note: Above costs consist of fuel and repair costs.

Table 6C-22 Salary and Wages with Project

Unit: I.D.

Labor	1981	1982	1983	1984	1985	1986	1987	1988
1) Management & administration staff	9,720	12,120	13,440	29,700	58,020	85,080	96,880	107,280
2) Skilled labor	1,800	3,000	3,000	6,000	12,360	33,510	48,518	57,082
3) Unskilled labor	-	-	-	-	-	13,132	22,761	29,181
4) Total Labor Cost	11,520	15,120	16,440	35,700	70,380	118,590	168,159	193,543
2) Skilled labor	(1,800)	(3,000)	(3,000)	(6,000)	(12,360)	(33,510)	(48,518)	(57,082)
(a) Farm operation (driver)						13,800	23,400	30,000
(b) Work shop (mechanic fitter)					2,760	4,920	7,080	7,080
(c) Operation & Maintenance of irrigation facilities				600	1,200	2,400	2,400	2,400
(d) Driver for administration	1,800	3,000	3,000	5,400	8,400	9,600	10,800	11,400
(e) Driver are included in unskilled labor						2,790	4,838	6,202
5) Economic unskilled labor cost 3) x 0.8 (shadom wage rate)	-	-	-	-	-	10,506	18,209	23,345
6) Economic skilled labor cost to be included into crop production cost (2)-(a)	-	-	-	-	-	13,800	23,400	30,000
7) Economic Labor Cost 5) + 6)	-	-	-	-	-	24,306	41,609	53,345

Table 6C-23 Net Production Value with Project

Unit: ID x 10^3

	1986 8th	1987 9th	1988 10th	1989 11th	1990 12th	1991 13th
Gross Production Value	599	1,248	1,808	2,090	2,217	2,265
Production Cost	125	235	319	346	354	358
Labor Cost	24	42	53	53	53	53
Net Production Value	450	971	1,436	1,691	1,810	1,854

Table 6C-24 N.P.V. Without Project

Crop	Cultivated Area ha	Yield kg/ha	Total Production tons	Unit Price ID/ton	G.P.V. IDx10³	P.C. Ratio %	P.C. IDx10³	N.P.V. IDx10³
Summer Crop								
Paddy	37.5	952	35.7	75	2.7	0.3	0.8	1.9
Sorghum	225	700	157.5	46	7.2	0.25	1.8	5.4
Vegetables[1/]	14.75	6,000	88.5	56[3/]	5.0	0.45	2.25	2.75
Corn	6.25	1,300	8.2	40	0.3	0.3	0.09	0.21
Winter Crop								
Wheat	750	800	600	80	48.0	0.3	14.4	33.6
Barley	1,000	1,000	1,000	39	39.0	0.32	12.5	26.5
Broad Beans	125	3,200	400	90	36.0	0.3	10.8	25.2
Vegetables	3.25[2/]	7,000	22.7	25[4/]	0.6	0.45	0.27	0.33
Total	2,161.75		2,312.6		138.8		42.91	95.89
					≒ 139		≒ 43	≒ 96

Note: 1/ Vegetables 13.5 ha, Water melon 1.25 ha

2/ Vegetables 1.25 ha, Tomato 1.75 ha, Dry onion 0.25 ha

3/ 4/ Represented by Cubbage

Table 6C-25 Net Production Value Without Project (in future)

Unit: I.D. x 10^3

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
G.P.V.	139	141	143	145	147	149	151	153	155	157	159	161	163
P.C.	43	43	44	44	45	45	46	46	47	47	48	48	49
N.P.V.	96	98	99	101	102	104	105	107	108	110	111	113	114

Note: Annual growth rate of G.P.V. and P.C. were assumed at 1.5% and 1%, respectively.

6C-6. Economic Cost Evaluation

Table 6C-26 Project Economic Cost

Unit: 10^3I.D.

	1981	1982	1983	1984	1985	1986	1987	Total
1. Civil Works	7	-	2,831	1,963	3,108	2,493	-	10,402
2. Construction and Maintenance Equipment	-		294	295	295	295	295	1,474
3. Farm Facilities	-	344	345	-	-	-	-	689
4. Farm Machinery and Equipment	-	-	25	361	809	583	-	1,778
5. Operation & Maintenance Cost	9	11	29	61	121	203	264	698
6. Project Facilities	-	156	74	-	-	-	-	230
Sub total (1 to 6)	16	511	3,598	2,680	4,333	3,574	559	15,271
of which F.C.	-	9	2,588	1,748	2,524	1,934	295	9,098
L.C.	16	502	1,010	932	1,809	1,640	264	6,173
7. Project Administration L.C. of 6x0.1	2	50	101	93	181	164	26	617
8. Consulting Services	225	13	40	126	113	146	-	663
Sub-total (1 to 8)	243	574	3,739	2,899	4,627	3,884	585	16,551
9. Contingency (10%)	24	57	374	290	463	388	59	1,655
10. Economic Total Cost	267	631	4,113	3,189	5,090	4,272	644	18,206

Table 6C-27 Project Financial Cost

Unit: 10^3I.D.

	1981	1982	1983	1984	1985	1986	1987	Total
1. Civil Works	7	-	2,949	2,045	3,238	2,597	-	10,836
2. Construction and Maintenance Equipment	-	1,296	1,296	199	-	-	-	2,791
3. Farm Facilities	-	344	345	-	-	-	-	689
4. Farm Machinery and Equipment			25	361	809	583	-	1,778
5. Operation and Maintenance Cost	12	15	33	70	140	230	295	795
6. Project Facilities	-	156	74	-	-	-	-	230
Sub total (1 to 6)	19	1,811	4,722	2,675	4,187	3,410	295	17,119
7. Project Administration (10%)	2	50	104	98	190	173	29	646
8. Consulting Services	225	13	40	126	113	146	-	663
Sub-total (1 to 8)	246	1,874	4,866	2,899	4,490	3,729	824	18,428
9. Contingency (10%)	24	188	486	290	450	373	32	1,843
10. Financial Total Cost	270	2,062	5,352	3,189	4,940	4,102	356	20,271

Table 6C-28 Economic Civil Works Cost

Unit: 10^3I.D.

	1981	1982	1983	1984	1985	1986	1987	Total
Civil Work Cost	7	-	2,949	2,045	3,238	2,597	-	10,836
Unskilled Labor Cost 1/	-	-	590	409	648	519	-	2,166
Economic Unskilled Labor Cost 2/	-	-	472	327	518	415	-	1,732
Economic Civil Work Cost	7	-	2,831	1,963	3,108	2,493	-	10,402

Note: 1/ 20% of Civil Work Cost

2/ 1/ x 0.8

Table 6C-29 Economic Construction and Maintenance Equipment Costs

Unit: 10^3I.D.

1. Purchasing Cost 2,791
   of which Construction Equipment 2,592
   include parts of 152
   Maintenance Equipment 199

2. Depresication Cost of Construction Equipment 1,474

3. Residual Value of Construction Equipment 966

   2,592 - 152 - 1,474 = 966

4. Depreciation Cost Re-estimated

	1983	1984	1985	1986	1987	Total
Financial	184	266	579	445		1,474
Economic	294	295	295	295	295	1,474

6C-7. Present Worth Value of Benefit and Cost

Table 6C-30 Present Worth Value of Benefit

Unit: 10^6I.D.

Project Year	Year	Benefit	Residual Value	Total Value	P. W. V. 3%	5%	8%
1981	1	-	-				
82	2	-	-	-			
83	3	-	-	-			
84	4	-	-	-			
85	5	-	-	-			
86	6	0.386	-	0.386	0.323	0.288	0.243
87	7	0.952	(-)0.966	0.014	(-)0.011	(-)0.010	(-)0.008
88	8	1.454	-	1.454	1.148	0.984	0.786
89	9	1.729	-	1.729	1.325	1.115	0.865
90	10	1.854	-	1.854	1.380	1.138	0.859
91	11	1.901	-	1.901	1.373	1.112	0.815
92	12	1.901	-	1.901	$\sum_{50}^{12}$		
93	13	1.901	-	1.901			
94	14	1.901	-	1.901	31.323	18.914	9.685
95	15	1.901	-	1.901			
96	16	1.901	-	1.901			
⋮	⋮						
2030	50	1.901	-	1.901			
Total		82.415	(-)0.966	81.449	36.861	23.541	13.245

Table 6C-31 Present Worth Value of Project Economic Cost

- Including Farm Machinery Cost -

Unit: 10^6I.D.

Project Year	Year	Project Cost	O & M Cost	Replacement Cost	Total Cost		P. W. V. 3%	P. W. V. 5%	P. W. V. 8%
1981	1	0.267	-	-	0.267		0.259	0.254	0.247
82	2	0.631	-	-	0.631		0.595	0.572	0.541
83	3	4.113	-	-	4.113		3.764	3.553	3.265
84	4	3.189	-	-	3.189		2.833	2.624	2.344
85	5	5.090	-	-	5.090		4.391	3.988	3.464
86	6	4.272	-	-	4.272		3.578	3.188	2.692
87	7	0.644	-	-	0.644		0.524	0.458	0.376
88	8	-	0.272	-	0.272				
89	9	-	0.272	-	0.272	$\sum_{12}^{8}$	1.013	0.837	0.633
90	10	-	0.272	-	0.272				
91	11	-	0.272	-	0.272				
92	12	-	0.272	-	0.272				
93	13	-	0.272	0.025	0.297		0.202	0.157	0.109
94	14	-	0.272	0.361	0.633		0.418	0.320	0.215
95	15	-	0.272	0.809	1.081		0.694	0.520	0.341
96	16	-	0.272	0.583	0.855		0.532	0.392	0.250
97	17	-	0.272	-	0.272				
98	18	-	0.272	-	0.272	$\sum_{22}^{17}$	0.918	0.632	0.367
99	19	-	0.272	-	0.272				
2000	20	-	0.272	-	0.272				
01	21	-	0.272	-	0.272				
02	22	-	0.272	-	0.272				
03	23	-	0.272	2.231	2.503		1.268	0.815	0.426
04	24	-	0.272	0.911	1.183		0.581	0.367	0.187
05	25	-	0.272	0.809	1.081		0.516	0.319	0.158
06	26	-	0.272	0.583	0.855		0.396	0.240	0.115
07	27	-	0.272	-	0.272				
08	28	-	0.272	-	0.272	$\sum_{32}^{27}$	0.683	0.388	0.170
09	29	-	0.272	-	0.272				
2010	30	-	0.272	-	0.272				
11	31	-	0.272	-	0.272				

(Continue: Present Worth Value)

Project Year	Year	Project Cost	O & M Cost	Replacement cost	Total Cost		P. W. V. 3%	P. W. V. 5%	P. W. V. 8%
2012	32	-	0.272	-	0.272				
13	33	-	0.272	0.025	0.297		0.112	0.059	0.023
14	34	-	0.272	0.361	0.633		0.232	0.120	0.046
15	35	-	0.272	0.809	1.081		0.384	0.196	0.073
16	36	-	0.272	0.583	0.855		0.295	0.148	0.053
17	37	-	0.272	-	0.272	37			
18	38	-	0.272	-	0.272	Σ	0.508	0.238	0.079
19	39	-	0.272	-	0.272	42			
20	40	-	0.272	-	0.272				
21	41	-	0.272	-	0.272				
22	42	-	0.272	-	0.272				
23	43	-	0.272	2.231	2.503		0.702	0.307	0.091
24	44	-	0.272	0.911	1.183		0.322	0.138	0.040
25	45	-	0.272	0.809	1.081		0.286	0.120	0.034
26	46	-	0.272	0.583	0.855		0.219	0.091	0.025
27	47	-	0.272	-	0.272	47			
28	48	-	0.272	-	0.272	Σ	0.260	0.102	0.026
29	49	-	0.272	-	0.272	50			
2030	50	-	0.272	-	0.272				
Total		18.206	11.696	12.624	42.526		26.485	21.143	16.390

Note: Replacement Cost Unit: 10^3I.D.

	1983	1984	1985	1986	Total	Terms of Replacement
Farm Machinery	25	361	809	583	1,778	10 years
Irrigation Pump	2,206	-	-	-	2,206	20 "
Drainage Pump	-	550	-	-	550	20 "

6C-8. Financial Analysis

State Farm Economy in Full Benefit Stage

Gross Production Value

Crop	Production Quantity ton	Financial Price I.D	G.P.V. 10^3I.D
Paddy	27,945	70	1,956
Wheat	3,000	70	210
Barley	2,300	43	99
Total	33,245		2,265

Production Cost

(1)

Cost Material	Application Quantity ton	Financial Price	P.C. 10^3I.D
Seed: Paddy	621	70	43
Wheat	120	93	11
Barley	120	50	6
Urea	2,048.6	64	131
TSP	1,254.54	56	70
Satan	93.15	300	28
Kitajin	186.3	107	20
Total			309

(2) Machinery Cost Including Depreciation Cost

Crop	Machinery Cost/ha	Cropping Area	Cost
Paddy	26.4 I.D	6,210 ha	164 10^3I.D
Wheat	21.6	1,000	22
Barley	21.6	1,000	22
Total			208