

farm roads. The construction of the Himo river system will last 1 year and 10 months, starting from May 1986 immediately after the completion of the Rau river system.

The construction of the Makuyuni scheme will commence in May 1986 and completed by the end of February of 1987. After completion of the Makuyuni scheme, the Ghona and Kileo scheme will be started in June 1987. The concrete flumes of head reaches of each main canals are of cast-in-site reinforced concrete construction. Other lining of irrigation canals will be made by use of a longitudinally operated slip-form machine.

The earthworks for canals, drains and farm road will follow the same method as the other schemes.

(4) Groundwater development scheme

Prior to the construction of the groundwater scheme, the test well drilling is needed. The test drilling is scheduled to be carried out during the Project preparatory works. The construction of tubewells will commence in May 1983, starting from the north groundwater scheme, and completed by the end of 1986. The power distribution line will be initiated in July 1984 so that the pump operation can be made in early 1985.

2.3.2 On-farm development works

The on-farm development works include the construction of tertiary irrigation canals, drainage canals, farm roads, filed ditches, drains and roads and land levelling. The on-farm development works will be carried out keeping pace with the progress of the main construction works to expedite farm operation. As soon as possible after completion of the main and on-farm facilities, partial operation will be introduced.

The on-farm development works of the Rau river system will last 38 months starting from January 1983. The Miwaleni scheme will be initiated in May 1984. After completion of the Rau river system, the Himo river system will follow. The groundwater scheme will commence in May 1984 keeping pace with the availability of the electric power supply and well drilling.

With on-farm development works, the following hectarages can be brought into farming operation.

<u>Year</u>	<u>Rau River Scheme</u>	<u>Miwaleni Pump Lift Scheme</u>	<u>Himo River Scheme</u>	<u>Ground-water Scheme</u>	<u>Total</u>
1984	500	-	-	-	500
1985	1,200	-	-	200	1,400
1986	2,000	1,200	-	400	3,600
1987	2,000	2,000	400	700	5,100
1988	2,000	2,000	980	1,020	6,000
1989	2,000	2,000	980	1,020	6,000

2.4 Work Quantities, Construction Materials and Equipments

The work quantities of major work items are presented for each river system as shown in Table VIII-2. The required quantities of major construction materials are estimated for each river system as shown in Table VIII-3. The major construction equipment and O & M equipment required for the Project are as shown in Table VIII-4 and Table VIII-5, respectively.

3. Operation and Maintenance

All facilities constructed by the Project will be owned, operated and maintained by the Government. The farm plots, which are re-shaped and equipped with irrigation facilities by the Project, will be allocated to farmers by the Government either on individual or communal bases.

The operation and maintenance (O & M) of the main facilities will be the responsibility of the Project Office, whereas the O & M of on-farm facilities will be entrusted to the farmers concerned.

As will be mentioned in ANNEX IX, the farmers will be capable of bearing the O & M cost of the Project including both for the main and on-farm facilities, when the Project reaches the full development stage of agriculture.

4. Project Cost

4.1 General

The Costs for the implementation of the Project are estimated on the basis of the preliminary design of the Project works taking into account the construction method to be applied, productivity of labour and machinery and based on the following assumptions:

- (1) The exchange rate used is:
US\$ 1.00 = TS 8.18
- (2) The main construction works will be carried out by Contractor(s) selected through international tendering. The construction machinery and equipment needed for the Project works will be imported by the Contractor.
- (3) Taxes on the construction materials, machinery and equipment to be imported from abroad are exempted from estimation of construction cost.
- (4) The unit prices are divided into foreign and local currency portions. Local currency portion is estimated based on the current prices in early 1980 in Kilimanjaro region, and on the cost data of on-going civil works obtained from the Government authorities concerned. Foreign currency portion is

estimated based on the CIF prices at Dar es Salaam, making reference to FOB prices of materials and equipment in Japan in 1980. The classification of local and foreign currency portions is defined as follows:

Local Currency Portion

- Labour force
- Wooden materials
- Inland transportation cost
- Administration expenses

Foreign Currency Portion

- Reinforcing bar
- Depreciation of construction equipment and machinery
- Pumping plant and electrical facilities
- Steel gates for intakes and canal related structures
- Structural steel
- Contractor's general expenses and profits for foreign contractors
- Expenses and fees of engineering services by foreign consultants

Besides the above estimate, the foreign Currency portion includes some proportions of the purchase cost of materials imported but purchasable with local currency, such as fuel and cement, in the extent of the border price.

- (5) Physical contingency of the cost estimate is 10% of the construction cost.
- (6) Price contingency applied in the estimate is: 7.5% per annum for the foreign currency portion and 10% per annum for the local currency portion.

4.2 Cost Estimate

4.2.1 Construction cost and annual disbursement schedule

The construction cost for the Project is estimated at US\$ 77 million equivalent, comprising US\$ 46 million of foreign currency and TS 257 million of local currency as summarized in Table VIII-6. The annual disbursement schedule is worked out based on the implementation schedule as shown in Table VIII-7.

The detailed breakdowns of the construction cost, procurement cost of O & M equipment, and other related expenses are shown in Table VIII-8 to Table VIII-15.

The prices of basic local materials and labour wages used in the estimate and the unit prices for major work items are as shown in Table VIII-16 and VIII-17. The cost components of the direct construction works are estimated in Table VIII-20.

4.2.2 Operation and maintenance costs

Operation and maintenance costs at the full operation stage of the Project is estimated at TS 4,170 x 10³, comprising costs for: (1) operation and maintenance of project offices including personnel cost, (2) operation and maintenance of the Project facilities. These costs are shown in Table VIII-21.

4.2.3 Cost for replacement of project facilities

Pumping equipment and electrical facilities, and steel gates for intakes and canal related structures have to be periodically replaced. The economic life of each facility and costs for replacement are given in Table VIII-23.

Table VIII-1 WORK DAYS FOR CONSTRUCTION WORKS

Conditions for estimate

(1) <u>Daily rainfall (mm)</u>	0 - 10	10 - 30	30 - 50	50 -
(2) <u>Time needed for suspension (day)</u>	0	0.5	1.0	2.0

Estimate of Work days (Typical year of 1979)

	<u>J</u>	<u>F</u>	<u>M</u>	<u>A</u>	<u>M</u>	<u>J</u>	<u>J</u>	<u>A</u>	<u>S</u>	<u>O</u>	<u>N</u>	<u>D</u>
(1) <u>Rainfall frequency (day/month)</u>												
10-30 ^{mm}	-	-	1	5	5	2	-	-	-	-	-	1
30-50 ^{mm}	2	1	1	-	1	-	2	-	-	-	1	-
50- ^{mm}	-	-	-	3	-	-	-	-	-	-	-	-
(2) <u>Time length to be suspended (day)</u>												
	2	1	1.5	8.5	3.5	1	2	-	-	-	1	0.5
(3) <u>Sundays, national holiday & maintenance days (day)</u>												
	6	7	7	7	7	6	6	7	5	5	6	7
(4) <u>Total (day), (2) + (3)</u>												
	8	8	9	16	11	7	8	7	5	5	7	8

Work days

Main construction works

23	20	-	-	-	23	23	24	25	26	23	23	<u>210</u>
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On-farm development works

23	20	20	-	20	23	23	24	25	26	23	23	<u>250</u>
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QUANTITIES OF CONSTRUCTION WORKS

WORKS	UNIT	RAU RIVER SYSTEM	MIVALANI PUMP LIFT SCHEME	HIMO RIVER SCHEME	GROUND WATER SCHEME	TOTAL
1. Clearing and stripping	Ha	230	730	90	70	1,120
2. Excavation, common	m ³	600,000	589,000	178,000	302,000	1,669,000
3. Compacted embankment	m ³	935,000	922,000	403,000	501,000	2,761,000
4. Concrete lining	m ³	7,400	11,400	6,000	8,300	33,100
5. Concrete for structures	m ³	6,400	6,000	4,300	1,700	18,400
6. Reinforcing steel	ton	250	430	400	110	1,190
7. Concrete pipe	m	1,800	1,100	700	1,000	4,600
8. Gate and hoist	Nos.	12	2	4	-	18
9. Pump discharge pipe	ton	-	520	-	-	520
10. Structural steel	ton	5	5	2	2	14
11. Installation of pumps	set	-	4	-	20	24
12. 11 kV distribution line	km	-	5.5	-	30	355
13. Gravel pavement of road	m ³	13,000	4,000	-	-	17,000
14. Wet rubble masonry	m ²	8,000	6,300	1,900	6,100	22,300
15. Gabion	m ²	-	6,800	-	8,900	15,700
16. Concrete unit of division box	No.	680	660	290	1,020	2,650
17. Land levelling and/or grading, Earth moving	m ³	800,000	690,000	309,000	306,000	2,105,000

MAJOR CONSTRUCTION MATERIALS

Table VIII-3

CONSTRUCTION MATERIALS	UNIT	RAU RIVER SYSTEM	MIVALENI PUMP LIFT SCHEME	HIMO RIVER SYSTEM	GROUND WATER SYSTEM	TOTAL
1. Ordinary portland cement	ton	4,000	4,900	3,000	2,900	14,800
2. Reinforcing steel bar	ton	250	430	400	110	1,190
3. Structural steel	ton	5	525	2	2	534
4. Gate and hoist	Nos.	12	2	4	-	18
5. Sand for concrete	m ³	6,400	8,000	4,700	4,600	23,700
6. Gravel for concrete	m ³	12,700	15,900	9,400	9,200	47,200
7. Gravel for road pavement	m ³	12,500	3,900	-	-	16,400
8. Fuel	kℓ	4,320	3,840	1,920	1,920	12,000
9. Lubricant	kℓ	108	96	48	48	300

Table VIII-4

CONSTRUCTION EQUIPMENT

EQUIPMENT	DESCRIPTION	REQUIRED NUMBER (Nos.)
1. Bulldozer	21 ton	12
2. Bulldozer	17 ton	7
3. Bulldozer	11 ton	12
4. Backhoe	0.6 m ³	4
5. Backhoe	0.3 m ³	10
6. Motor scraper	11 m ³	3
7. Tractor shovel	1.2 m ³	2
8. Wheel loader	1.2 m ³	2
9. Dump truck	8 ton	12
10. Tamping roller	7.5-15.2 ton	5
11. Tire roller	6-10 ton	4
12. Motor grador	3.7 m	2
13. Vibrating compactor	100 kg	3
14. Rammer	60-100 kg	10
15. Tamper	60-100 kg	10
16. Water tanker	5.5 kℓ	6
17. Belt-conveyor	10 m	5
18. Breaker (attachment for backhoe)	200 kg	1
19. Concrete batcher plant	0.5m ³ x1	2
20. Concrete mixer	0.4 m ³	4
21. Concrete mixer	0.2 m ³	5
22. Agitator truck	1.6 m ³	5
23. Full scale slip form with trimming machine and accessories		1
24. Vibrator	45 mm	20
25. Truck crane	15 ton	1
26. Wheel crane	5.5 ton	1
27. Cargo truck with crane	3 ton	3
28. Cargo truck	6 ton	10
29. Fork lift	3 ton	2
30. Fuel tanker	10 kℓ	1
31. Fuel tanker	4 kℓ	2
32. Pick-up car	1 ton	10
33. Micro bus	25 persons	4
34. Jeep	4 drive	10
35. Maintenance car	6 ton	1
36. Grease car	6 ton	1
37. Submersible pump	100 mm	2
38. Submersible pump with generator	50 mm	5
39. Power supply system		One lot
40. Water supply system		One lot
41. Testing and survey equipment		One lot
42. Repair shop equipment		One lot
43. Truck mounted rotary drilling machine with accessories		One lot

Table VIII-5

MAJOR EQUIPMENT FOR OPERATION AND MAINTENANCE

<u>ITEM NO.</u>	<u>EQUIPMENT</u>	<u>REQUIRED NUMBER</u>
1.	Backhoe, 0.6 m ³	1
2.	Bulldozer, 11 ton	1
3.	Wheel loader, 1.2 m ³	1
4.	Motor grader, 3.7 m	1
5.	Slope compactor, 3 HP	2
6.	Concrete mixer, 0.2-0.3 m ³	1
7.	Submersible pump, ϕ 100	2
8.	Generator, 2 kW	2
9.	Dump truck, 8 ton	1
10.	Dump truck, 2 ton	2
11.	Cargo truck with crane, 8 ton	1
12.	Cargo truck with crane, 2 ton	2
13.	Truck, 4-wheel drive, 1 ton	4
14.	Jeep, 4-wheel drive, hardtop	4
15.	Sedan, 6 person	1
16.	Motor-cycle	6
17.	Spare parts (30%)	

Table VIII-6

SUMMARY OF CONSTRUCTION COST

ITEM	FC	LC	TOTAL	FC	LC	TOTAL
	(10 ³ US\$)			(10 ³ TS)		
1. Preparatory works	810	355	1,165	6,630	2,900	9,530
2. Main construction works						
- Rau river system	3,590	2,694	6,284	29,360	22,040	51,400
- Miwaleni pump lift scheme	6,092	3,329	9,421	49,830	27,230	77,060
- Himo river system	1,759	1,308	3,067	14,390	10,700	25,090
- Groundwater system	3,343	2,046	5,389	27,340	16,740	44,080
3. On-farm development works						
- Rau river system	2,778	1,831	4,609	22,720	14,980	37,700
- Miwaleni pump lift scheme	2,941	2,089	5,030	24,060	17,090	41,150
- Himo river system	1,255	944	2,199	10,270	7,720	17,990
- Groundwater system	1,770	1,275	3,045	14,480	10,430	24,910
4. Office and quarters	400	1,193	1,593	3,270	9,760	13,030
<u>Sub-total</u>	<u>24,738</u>	<u>17,064</u>	<u>41,802</u>	<u>202,350</u>	<u>139,590</u>	<u>341,940</u>
5. O & M equipment	734	37	771	6,000	300	6,300
6. Engineering services and administration expenses	4,110	917	5,027	33,620	7,500	41,120
7. Contingencies						
- Physical contingency	2,958	1,802	4,760	24,200	14,740	38,940
- Price contingency	13,370	11,616	24,986	109,370	95,020	204,390
Total	45,910	31,436	77,346	375,540	257,150	632,690

Table VIII-7 ANNUAL DISBURSEMENT SCHEDULE OF CONSTRUCTION COST

Unit: FC: 10³ US\$
LC: 10³ TS

DESCRIPTION	1981		1982		1983		1984		1985		1986		1987		1988		
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	
1. Preparatory Works	810	2,900	-	400	1,450	410	1,450	-	-	-	-	-	-	-	-	-	-
2. Main Construction Works																	
- Rau river system	3,590	22,040	-	-	1,475	9,040	1,430	9,040	685	3,960	-	-	-	-	-	-	-
- Mivaleni pump lift scheme	6,092	27,230	-	-	-	3,465	15,470	2,250	10,110	300	1,360	77	290	-	-	-	-
- Himo river system	1,759	10,700	-	-	-	-	-	-	-	740	4,500	870	5,240	149	960	-	-
- Groundwater system	3,343	16,740	-	-	240	1,170	770	3,850	935	4,690	830	4,180	500	2,120	68	730	-
3. On-farm Development Works																	
- Rau river system	2,778	14,980	-	-	700	3,750	970	5,240	1,108	5,990	-	-	-	-	-	-	-
- Mivaleni pump lift scheme	2,941	17,090	-	-	-	440	2,560	1,120	6,490	1,120	6,490	261	1,550	-	-	-	-
- Himo river system	1,255	7,720	-	-	-	-	-	-	-	320	2,010	750	4,550	185	1,160	-	-
- Groundwater system	1,770	10,430	-	-	130	730	250	1,460	420	2,500	420	2,500	420	2,500	130	740	-
4. Office and Quarters	400	9,760	-	400	9,760	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total (Item 1 to 4)	24,738	129,590	-	800	11,210	2,955	16,140	7,325	27,620	6,518	22,740	3,730	21,040	2,878	16,250	532	3,590
5. O & M Equipment	734	300	-	172	80	-	-	-	-	562	220	-	-	-	-	-	-
6. Engineering Services and Administration Expenses	4,110	7,500	640	200	615	2,200	635	1,400	555	1,400	495	1,400	495	1,400	80	300	-
7. Physical Contingency	2,958	14,740	65	160	1,150	355	1,730	795	3,900	764	3,540	423	2,240	335	1,770	61	390
Sub-total (Item 1 to 7)	32,540	162,130	705	220	1,747	12,640	8,755	42,920	8,399	28,900	4,648	24,680	3,708	19,420	673	4,280	-
8. Price Contingency	13,370	95,020	53	22	272	2,658	2,940	19,920	3,660	23,750	2,528	19,040	2,444	18,420	527	4,900	-
TOTAL	45,910	257,150	758	242	2,019	15,298	4,851	25,380	13,695	62,840	7,176	43,720	6,152	37,840	1,200	9,280	-

Table VIII-7

Table VIII-8

SUMMARY OF DIRECT CONSTRUCTION COST OF EACH SYSTEM

Unit: FC: 10³US\$
LC: 10³TS

WORKS	RAU RIVER SYSTEM		MIWALENI PUMP LIFT SCHEME		HIMO RIVER SYSTEM		GROUND WATER SYSTEM		TOTAL	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
A. MAIN CONSTRUCTION WORKS										
1. Irrigation Facilities	1,908.0	10,783	4,474.4	15,820	1,451.0	8,862	2,704.2	11,318	10,537.6	46,783
2. Drainage Facilities	536.3	3,659	213.6	1,476	61.0	433	-	-	810.9	5,568
3. Farm Roads	848.1	5,852	451.6	2,882	247.0	1,405	-	-	1,546.7	10,139
4. Flood Protection	297.6	1,746	952.4	7,052	-	-	638.8	5,422	1,888.8	14,220
<u>Sub-total</u>	<u>3,590.0</u>	<u>22,040</u>	<u>6,092.0</u>	<u>27,230</u>	<u>1,759.0</u>	<u>10,700</u>	<u>3,343.0</u>	<u>16,740</u>	<u>14,784.0</u>	<u>76,710</u>
B. ON-FARM DEVELOPMENT WORKS										
1. Tertiary Canal	661.3	3,329	1,054.8	5,551	458.0	2,342	887.5	4,257	3,061.6	15,479
2. Tertiary Drain	106.5	565	152.9	811	126.8	681	61.1	344	447.3	2,401
3. Tertiary Farm Road	458.4	2,600	388.0	2,201	175.4	995	380.7	2,167	1,402.5	7,963
4. Land Levelling	1,151.8	5,206	1,165.3	5,247	464.8	2,094	440.7	1,989	3,222.6	14,536
5. Field Ditch, Drain and Road	400.0	3,280	180.0	3,280	30.0	1,608	-	1,673	610.0	9,841
<u>Sub-total</u>	<u>2,778.0</u>	<u>14,980</u>	<u>2,941.0</u>	<u>17,090</u>	<u>1,255.0</u>	<u>7,720</u>	<u>1,770.0</u>	<u>10,430</u>	<u>8,744.0</u>	<u>50,220</u>
TOTAL	6,368.0	37,020	9,033.0	44,320	3,014.0	18,420	5,113.0	27,170	23,528.0	126,930

Table VIII-8

Table VIII-9 SUMMARY OF DIRECT CONSTRUCTION COST - RAU RIVER SYSTEM

WORKS	UPPER MAROGINI		MAROGINI		RAU YA KATI		CHEKERENI		JOINT FACILITIES		TOTAL	
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC
A. MAIN CONSTRUCTION WORKS												
I. Irrigation Facilities												
1. Intake weir	51.0	385	61.0	444	110.9	876	117.8	897	-	-	340.7	2,602
2. Main canal	36.4	166	214.4	1,081	229.9	1,077	179.8	1,014	-	-	660.5	3,338
3. Secondary canal	32.0	154	349.8	1,904	154.0	798	371.0	1,987	-	-	906.8	4,843
II. Drainage Facilities												
1. Lead drain	-	-	67.1	475	-	9	-	-	183.0	1,180	183.0	1,180
2. Main drain	7.4	59	78.9	586	41.3	372	57.9	303	-	-	126.8	787
3. Secondary drain	-	-	13.4	73	-	-	76.2	550	-	-	203.8	1,567
4. Catch drain	-	-	-	-	-	-	9.3	52	-	-	22.7	125
III. Farm Roads												
1. Chekereni trunk farm road	7.6	44	44.9	255	78.2	444	42.6	243	367.0	3,120	367.0	3,120
2. Main farm road	38.6	219	88.4	502	23.4	132	137.4	893	-	-	173.3	986
3. Secondary farm road	61.0	383	24.1	110	110.5	652	102.0	601	-	-	307.8	1,746
Sub-total	214.0	1,410	942.0	5,430	750.0	4,360	1,114.0	6,540	550.0	4,300	3,590.0	22,040
B. ON-FARM DEVELOPMENT WORKS												
1. Tertiary canal	56.2	294	237.9	1,300	133.0	670	214.2	1,065	-	-	661.3	3,329
2. Tertiary drain	3.4	19	38.1	199	25.8	138	39.2	209	-	-	106.5	565
3. Tertiary farm road	18.4	104	164.0	931	118.6	672	157.4	893	-	-	458.4	2,600
4. Land levelling	86.0	387	432.0	1,950	230.6	1,044	403.2	1,825	-	-	1,151.8	5,206
5. Field ditch, drain and road	30.0	246	150.0	1,230	80.0	656	140.0	1,148	-	-	400.0	3,280
Sub-total	194.0	1,050	1,042.0	5,610	588.0	3,180	954.0	5,140	-	-	2,778.0	14,040
TOTAL	428.0	2,460	1,984.0	11,040	1,338.0	7,540	2,068.0	11,680	550.0	4,300	6,368.0	37,020

Table VIII-9

Table VIII-11(1) BREAKDOWN OF PREPARATORY WORKS

WORKS	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
1. Temporary access road	L.S.	4,000	130,000
2. Water supply system	L.S.	70,000	100,000
3. Power supply system	L.S.	220,000	200,000
4. Temporary site office, residential quarters, labour rest house and first aid facilities	L.S.	260,000	1,300,000
5. Warehouse, workshop and laboratory, etc.	L.S.	180,000	600,000
6. Land preparation for base camp including fencing, etc.	L.S.	76,000	570,000
TOTAL		810,000 (US\$1,165,000)	2,900,000

Table VIII-11(2) BREAKDOWN OF DIRECT CONSTRUCTION COST
- UPPER MABOGINI SCHEME (1)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
A. MAIN CONSTRUCTION WORKS				
I. Irrigation Facilities				
1. Intake weir				
1.1 Preparatory works		LS	10,400	78,000
1.2 Excavation	m ³	400	400	2,000
1.3 Earthfill	m ³	1,600	3,900	22,000
1.4 Concrete works	m ²	346	26,800	219,000
1.5 Masonry works	m	300	2,400	57,000
1.6 Slide gate	Nos.	2	7,100	7,000
			<u>51,000</u>	<u>385,000</u>
2. Main canal				
2.1 Site clearing and stripping	Ha	0.5	400	2,000
2.2 Excavation	m ³	150	200	1,000
2.3 Earthfill	m ³	2,000	5,700	33,000
2.4 Concrete lining	m ³	125	9,600	65,000
2.5 Related structures				
- Turnout	Nos.	3	11,200	45,000
- Check structure	No.	1	9,300	20,000
			<u>36,400</u>	<u>166,000</u>
3. Secondary canal				
3.1 Site clearing and stripping	Ha	0.4	300	1,000
3.2 Excavation	m ³	350	400	2,000
3.3 Earthfill	m ³	1,500	3,300	19,000
3.4 Concrete lining	m ³	95	7,300	49,000
3.5 Related structures				
- Turnout	Nos.	4	11,300	45,000
- Check structure	No.	1	3,800	9,000
- Culvert	No.	1	1,800	11,000
- Spillway	No.	1	2,700	12,000
- Drop	No.	1	1,100	6,000
			<u>32,000</u>	<u>154,000</u>
			<u>119,400</u>	<u>705,000</u>
II. Drainage Facilities				
1. Secondary drain				
1.1 Excavation	m ³	1,300	1,300	7,000
1.2 Related structures				
- Drainage culvert	Nos.	3	5,300	33,000
- Drop	Nos.	2	800	19,000
			<u>7,400</u>	<u>59,000</u>

Table VIII-11(2) BREAKDOWN OF DIRECT CONSTRUCTION COST
- UPPER MABOGINI SCHEME (2)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
III. Farm Roads				
1. Main farm road				
1.1 Site clearing and stripping	Ha	0.6	400	2,000
1.2 Excavation	m ³	300	300	2,000
1.3 Embankment	m ³	2,850	6,900	40,000
			<u>7,600</u>	<u>44,000</u>
2. Secondary farm road				
2.1 Site clearing and stripping	Ha	3.4	2,400	11,000
2.2 Excavation	m ³	1,700	1,700	9,000
2.3 Embankment	m ³	14,200	34,500	199,000
			<u>38,600</u>	<u>219,000</u>
			<u>46,200</u>	<u>263,000</u>
IV. Flood Protection Dike				
1. Site clearing and stripping	Ha	8.5	8,800	41,000
2. Embankment	m ³	29,000	52,200	342,000
			<u>61,000</u>	<u>383,000</u>
<u>Sub-total (Item A)</u>			<u>234,000</u>	<u>1,410,000</u>
B. ON-FARM DEVELOPMENT WORKS				
1. Tertiary canal				
1.1 Site clearing and stripping	Ha	5.6	4,000	19,000
1.2 Excavation	m ³	2,000	2,000	10,000
1.3 Earthfill	m ³	29,500	30,700	181,000
1.4 Related structures				
- Division box	Nos.	27	15,400	60,000
- Culvert	Nos.	5	1,800	11,000
- Drop	Nos.	10	2,300	13,000
			<u>56,200</u>	<u>294,000</u>
2. Tertiary drain				
2.1 Excavation	m ³	1,300	1,300	7,000
2.2 Related structures				
- Culvert	Nos.	2	700	4,000
- Drop	Nos.	6	1,400	8,000
			<u>3,400</u>	<u>19,000</u>

Table VIII-11(2) BREAKDOWN OF DIRECT CONSTRUCTION COST
- UPPER MABOGINI SCHEME (3)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
3. Tertiary farm road				
3.1 Site clearing and stripping	Ha	2.2	1,600	7,000
3.2 Earthfill	m ³	6,900	16,800	97,000
			<u>18,400</u>	<u>104,000</u>
4. Land levelling, earth moving	m ³	60,000	<u>86,000</u>	<u>387,000</u>
5. Field ditch, drain and road	Ha	150	<u>30,000</u>	<u>246,000</u>
			<u>194,000</u>	<u>1,050,000</u>
			<u>428,000</u>	<u>2,460,000</u>
				<u>(US\$729,000)</u>

Table VIII-11(3) BREAKDOWN OF DIRECT CONSTRUCTION COST
- MABOGINI SCHEME (1)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
A. MAIN CONSTRUCTION WORKS				
I. Irrigation Facilities				
1. Intake weir				
1.1 Preparatory works		L.S.	12,300	89,000
1.2 Excavation	m ³	300	300	2,000
1.3 Earthfill	m ³	2,500	6,100	35,000
1.4 Concrete works	m ³	377	29,400	244,000
1.5 Masonry works	m ²	330	2,700	63,000
1.6 Slide gate	Nos.	2	10,200	11,000
			<u>61,000</u>	<u>444,000</u>
2. Main canal				
2.1 Site clearing and stripping	Ha	3.5	2,500	12,000
2.2 Excavation	m ³	6,000	6,000	31,000
2.3 Earthfill	m ³	15,000	31,900	185,000
2.4 Concrete lining	m ³	950	72,900	492,000
2.5 Related structures				
- Turnout	Nos.	9	33,600	136,000
- Check structure	Nos.	5	46,700	102,000
- Culvert	No.	1	3,600	21,000
- Spillway	Nos.	2	9,900	60,000
- Drop	No.	1	1,900	11,000
- Syphon	No.	1	5,400	31,000
			<u>214,400</u>	<u>1,081,000</u>
3. Secondary canal				
3.1 Site clearing and stripping	Ha	6.4	4,500	22,000
3.2 Excavation	m ³	3,000	3,000	15,000
3.3 Earthfill	m ³	22,600	53,700	310,000
3.4 Concrete lining	m ³	1,760	135,000	912,000
3.5 Related structures				
- Turnout	Nos.	25	70,500	280,000
- Check structure	Nos.	8	30,100	74,000
- Culvert	Nos.	10	17,700	110,000
- Spillway	Nos.	7	18,600	86,000
- Drop	Nos.	10	11,400	62,000
- Cross drain	Nos.	2	5,300	33,000
			<u>349,800</u>	<u>1,904,000</u>
			<u>625,200</u>	<u>3,429,000</u>

Table VIII-11(3) BREAKDOWN OF DIRECT CONSTRUCTION COST
- MABOGINI SCHEME (2)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
II. Drainage Facilities				
1. Main drain				
1.1 Excavation	m ³	42,500	42,500	219,000
1.2 Related structures				
- Drainage culvert	Nos.	5	18,100	103,000
- Drop	Nos.	10	6,500	153,000
			<u>67,100</u>	<u>475,000</u>
2. Secondary drain				
2.1 Excavation	m ³	42,600	42,600	220,000
2.2 Related structures				
- Drainage culvert	Nos.	16	28,300	175,000
- Drop	Nos.	20	8,000	191,000
			<u>78,900</u>	<u>586,000</u>
3. Catch drain				
3.1 Excavation	m ³	9,900	9,900	51,000
3.2 Related structures				
- Drainage culvert	Nos.	2	3,500	22,000
			<u>13,400</u>	<u>73,000</u>
			<u>159,400</u>	<u>1,134,000</u>
III. Farm Roads				
1. Main farm road				
1.1 Site clearing and stripping	Ha	3.4	2,400	11,000
1.2 Excavation	m ³	1,700	1,700	9,000
1.3 Earthfill	m ³	16,800	40,800	235,000
			<u>44,900</u>	<u>255,000</u>
2. Secondary farm road				
2.1 Site clearing and stripping	Ha	7.9	5,600	27,000
2.2 Excavation	m ³	3,800	3,800	20,000
2.3 Earthfill	m ³	32,500	79,000	455,000
			<u>88,400</u>	<u>502,000</u>
			<u>133,300</u>	<u>757,000</u>

Table VIII-11(3) BREAKDOWN OF DIRECT CONSTRUCTION COST
- MABOGINI SCHEME (3)

WORKS	UNIT	Q'TY	FOREIGN	LOCAL
			CURRENCY (US\$)	CURRENCY (TS)
IV. Flood Protection Dike				
1. Site clearing and stripping	Ha	3.9	4,000	19,000
2. Earthfill	m ³	6,000	10,800	71,000
3. Sluice way	No.	1	9,300	20,000
			<u>24,100</u>	<u>110,000</u>
		<u>Sub-total (Item A)</u>	<u>942,000</u>	<u>5,430,000</u>
B. ON-FARM DEVELOPMENT WORKS				
1. Tertiary Canal				
1.1 Site clearing and stripping	Ha	23	16,300	72,000
1.2 Excavation	m ³	8,100	8,100	42,000
1.3 Earthfill	m ³	120,000	124,900	740,000
1.4 Related structures				
- Division box	Nos.	173	98,600	388,000
- Culvert	Nos.	15	5,400	33,000
- Drop	Nos.	20	4,600	25,000
			<u>257,900</u>	<u>1,300,000</u>
2. Tertiary drain				
2.1 Excavation	m ³	34,000	34,000	175,000
2.2 Related structures				
- Drainage culvert	Nos.	5	1,800	11,000
- Drop	Nos.	10	2,300	13,000
			<u>38,100</u>	<u>199,000</u>
3. Tertiary farm road				
3.1 Site clearing and stripping	Ha	19.8	14,100	67,000
3.2 Earthfill	m ³	61,700	149,900	864,000
			<u>164,000</u>	<u>931,000</u>
4. Land levelling, Earth moving				
	m ³	300,000	<u>432,000</u>	<u>1,950,000</u>
5. Field ditch, drain and road				
	Ha	750	<u>150,000</u>	<u>1,230,000</u>
		<u>Sub-total (Item B)</u>	<u>1,042,000</u>	<u>5,610,000</u>
Total			1,984,000	11,040,000
				(US\$3,334,000)

Table VIII-11(4) BREAKDOWN OF DIRECT CONSTRUCTION COST
- RAU YA KATI SCHEME (1)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
A. MAIN CONSTRUCTION WORKS				
I. Irrigation Facilities				
1. Intake weir				
1.1 Preparatory works		L.S.	21,900	176,000
1.2 Excavation	m ³	8,200	8,200	42,000
1.3 Earthfill	m ³	4,200	4,400	26,000
1.4 Concrete works	m ³	829	65,000	538,000
1.5 Masonry works	m ²	450	3,600	86,000
1.6 Slide gate	Nos.	2	7,800	8,000
			<u>110,900</u>	<u>876,000</u>
2. Main canal				
2.1 Site clearing and stripping	Ha	3.0	2,100	10,000
2.2 Excavation	m ³	3,000	3,000	15,000
2.3 Earthfill	m ³	11,000	25,800	149,000
2.4 Concrete lining	m ³	910	69,800	472,000
2.5 Related structures				
- Turnout	Nos.	13	48,500	197,000
- Check structure	Nos.	7	65,300	142,000
- Culvert	No.	1	3,600	21,000
- Spillway	Nos.	2	9,900	60,000
- Drop	No.	1	1,900	11,000
			<u>229,900</u>	<u>1,077,000</u>
3. Secondary canal				
3.1 Site clearing and stripping	Ha	2.6	1,800	9,000
3.2 Excavation	m ³	1,000	1,000	5,000
3.3 Earthfill	m ³	10,600	26,100	151,000
3.4 Concrete lining	m ³	670	51,400	347,000
3.5 Related structures				
- Turnout	Nos.	11	31,000	123,000
- Check structure	Nos.	6	22,600	56,000
- Culvert	Nos.	3	5,300	33,000
- Spillway	Nos.	3	8,000	37,000
- Drop	Nos.	6	6,800	37,000
			<u>154,000</u>	<u>798,000</u>
			<u>494,800</u>	<u>2,751,000</u>

Table VIII-11(4) BREAKDOWN OF DIRECT CONSTRUCTION COST
- RAU YA KATI SCHEME (2)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
II. Drainage Facilities				
1. Main drain				
1.1 Excavation	m ³	1,800	<u>1,800</u>	<u>9,000</u>
2. Secondary drain				
2.1 Excavation	m ³	24,400	24,400	126,000
2.2 Related structures				
- Drainage culvert	Nos.	5	8,900	55,000
- Drop	Nos.	20	8,000	191,000
			<u>41,300</u>	<u>372,000</u>
			<u>43,100</u>	<u>381,000</u>
III. Farm Roads				
1. Main farm road				
1.1 Site clearing and stripping	Ha	5.8	4,100	19,000
1.2 Excavation	m ³	3,100	3,100	16,000
1.3 Earthfill	m ³	29,200	71,000	409,000
			<u>78,200</u>	<u>444,000</u>
2. Secondary farm road				
2.1 Site clearing and stripping	Ha	5.8	1,500	7,000
2.2 Excavation	m ³	1,000	1,000	5,000
2.3 Earthfill	m ³	8,600	20,900	120,000
			<u>23,400</u>	<u>132,000</u>
			<u>101,600</u>	<u>576,000</u>
IV. Flood Protection Dike				
1. Site clearing and stripping	Ha	16.0	16,600	77,000
2. Earthfill	m ³	47,000	84,600	555,000
3. Sluice way	No.	1	9,300	20,000
			<u>110,500</u>	<u>652,000</u>
<u>Sub-total (Item A)</u>			<u>750,000</u>	<u>4,360,000</u>

Table VIII-11(4) BREAKDOWN OF DIRECT CONSTRUCTION COST
- RAU YA KATI SCHEME (3)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
B. <u>ON-FARM DEVELOPMENT WORKS</u>				
1. Tertiary canal				
1.1 Site clearing and stripping	Ha	11.5	8,200	39,000
1.2 Excavation	m ³	3,800	3,800	20,000
1.3 Earthfill	m ³	60,000	62,400	368,000
1.4 Related structures				
- Division box	Nos.	90	51,300	202,000
- Culvert	Nos.	5	1,800	11,000
- Drop	Nos.	20	4,600	25,000
- Cross drain	No.	1	900	5,000
			<u>133,000</u>	<u>670,000</u>
2. Tertiary drain				
2.1 Excavation	m ³	19,200	19,200	99,000
2.2 Related structures				
- Drainage culvert	Nos.	15	5,400	33,000
- Drop	Nos.	5	1,200	6,000
			<u>25,800</u>	<u>138,000</u>
3. Tertiary farm road				
3.1 Site clearing and stripping	Ha	14.3	10,200	48,000
3.2 Earthfill	m ³	44,600	108,400	624,000
			<u>118,600</u>	<u>672,000</u>
4. Land levelling, Earth moving	m ³	160,000	<u>230,600</u>	<u>1,044,000</u>
5. Field ditch, drain and road	Ha	400	<u>80,000</u>	<u>656,000</u>
			<u>588,000</u>	<u>3,180,000</u>
Sub-total (Item B)			588,000	3,180,000
Total			1,338,000	7,540,000
				(US\$2,260,000)

Table VIII-11(5) BREAKDOWN OF DIRECT CONSTRUCTION COST
- CHEKERENI SCHEME (1)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
A. MAIN CONSTRUCTION WORKS				
I. Irrigation Facilities				
1. Intake weir				
1.1 Preparatory works		L.S.	23,400	177,000
1.2 Excavation	m ³	9,500	9,500	49,000
1.3 Earthfill	m ³	5,000	5,200	31,000
1.4 Concrete works	m ³	839	65,900	543,000
1.5 Masonry works	m ²	450	3,600	86,000
1.6 Slide gate	Nos.	2	10,200	11,000
			<u>117,800</u>	<u>897,000</u>
2. Main canal				
2.1 Site clearing and stripping	Ha	3.8	2,700	13,000
2.2 Excavation	m ³	5,500	5,500	28,000
2.3 Earthfill	m ³	15,000	31,900	185,000
2.4 Concrete lining	m ³	1,040	79,800	539,000
2.5 Related structures				
- Turnout	Nos.	5	18,700	76,000
- Check structure	Nos.	2	18,700	41,000
- Culvert	Nos.	2	7,200	41,000
- Spillway	Nos.	2	9,900	60,000
- Syphon	No.	1	5,400	31,000
			<u>179,900</u>	<u>1,014,000</u>
3. Secondary canal				
3.1 Site clearing and stripping	Ha	6.1	4,300	20,000
3.2 Excavation	m ³	3,700	3,700	19,000
3.3 Earthfill	m ³	31,000	74,200	428,000
3.4 Concrete lining	m ³	1,860	142,700	963,000
3.5 Related structures				
- Turnout	Nos.	28	79,000	313,000
- Check structure	Nos.	11	41,400	102,000
- Culvert	Nos.	7	12,400	77,000
- Spillway	Nos.	4	10,600	49,000
- Cross drain	No.	1	2,700	16,000
			<u>371,000</u>	<u>1,987,000</u>
			<u>668,600</u>	<u>3,898,000</u>
II. Drainage Facilities				
1. Main drain				
1.1 Excavation	m ³	50,700	50,700	262,000
1.2 Drainage culvert	Nos.	2	7,200	41,000
			<u>57,900</u>	<u>303,000</u>

Table VIII-11(5) BREAKDOWN OF DIRECT CONSTRUCTION COST
- CHEKERENI SCHEME (2)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
2. Secondary drain				
2.1 Excavation	m ³	61,100	61,100	315,000
2.2 Related structures				
- Drainage culvert	Nos.	4	7,100	44,000
- Drop	Nos.	20	8,000	191,000
			<u>76,200</u>	<u>550,000</u>
3. Catch drain				
3.1 Excavation	m ³	5,800	5,800	30,000
3.2 Drainage culvert	Nos.	2	3,500	22,000
			<u>9,300</u>	<u>52,000</u>
			<u>143,400</u>	<u>905,000</u>
III. Farm Roads				
1. Main farm road				
1.1 Site clearing and stripping	Ha	3.2	2,300	11,000
1.2 Excavation	m ³	1,700	1,700	9,000
1.3 Earthfill	m ³	15,900	38,600	223,000
			<u>42,600</u>	<u>243,000</u>
2. Secondary farm road				
2.1 Site clearing and stripping	Ha	19.0	13,500	64,000
2.2 Earthfill	m ³	59,200	143,900	829,000
			<u>157,400</u>	<u>893,000</u>
			<u>200,000</u>	<u>1,136,000</u>
IV. Flood Protection Dike				
1. Site clearing and stripping	Ha	13.0	13,500	62,000
2. Earthfill	m ³	44,000	79,200	519,000
3. Sluice way	No.	1	9,300	20,000
			<u>102,000</u>	<u>601,000</u>
			<u>1,114,000</u>	<u>6,540,000</u>
<u>Sub-total (Item A)</u>			<u>1,114,000</u>	<u>6,540,000</u>

Table VIII-11(5) BREAKDOWN OF DIRECT CONSTRUCTION COST
- CHEKERENI SCHEME (3)

WORKS	UNIT	QTY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
B. ON-FARM DEVELOPMENT WORKS				
1. Tertiary canal				
1.1 Site clearing and stripping	Ha	18.4	13,100	62,000
1.2 Excavation	m ³	6,000	6,000	31,000
1.3 Earthfill	m ³	96,000	99,800	589,000
1.4 Related structures				
- Division box	Nos.	160	91,200	358,000
- Culvert	Nos.	10	3,600	22,000
- Drop	Nos.	20	500	3,000
			<u>214,200</u>	<u>1,065,000</u>
2. Tertiary drain				
2.1 Excavation	m ³	31,500	31,500	163,000
2.2 Related structures				
- Drainage culvert	Nos.	15	5,400	33,000
- Drop	Nos.	10	2,300	13,000
			<u>39,200</u>	<u>209,000</u>
3. Tertiary farm road				
3.1 Site clearing and stripping	Ha	19.0	13,500	64,000
3.2 Earthfill	m ³	59,200	143,900	829,000
			<u>157,400</u>	<u>893,000</u>
4. Land levelling, Earth moving	m ³	280,000	<u>403,200</u>	<u>1,825,000</u>
5. Field ditch, drain and road	Ha	700	<u>140,000</u>	<u>1,148,000</u>
			<u>954,000</u>	<u>5,140,000</u>
<u>Sub-total (Item B)</u>			<u>954,000</u>	<u>5,140,000</u>
Total			2,068,000	11,680,000
				(US\$3,496,000)

Table VIII-11(6) BREAKDOWN OF DIRECT CONSTRUCTION COST
- MIWALENI PUMP LIFT SCHEME (1)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
A. MAIN CONSTRUCTION WORKS				
I. Irrigation Facilities				
1. Pump station				
1.1 Inlet channel				
- Excavation	m ³	2,500	2,400	10,000
- Concrete lining	m ³	630	48,300	326,000
1.2 Pump house sub-structures				
- Excavation	m ³	1,650	1,700	9,000
- Concrete works	m ³	990	96,400	1,002,000
- Backfill	m ³	620	500	18,000
1.3 Building works				
- Concrete works	m ³	340	42,000	435,000
- Finishing works	m ²	336	42,500	435,000
1.4 Discharge pipeline				
- Excavation	m ³	12,000	11,500	51,000
- Concrete works	m ³	1,530	93,200	818,000
- Metal works	ton	520	1,470,000	818,000
1.5 Outlet structures				
- Excavation	m ³	350	400	2,000
- Backfill	m ³	160	100	5,000
- Concrete works	m ³	120	11,100	111,000
- Slide gate	Nos.	2	17,500	12,000
1.6 Pumping plant	sets	4	455,000	385,000
1.7 Power transmission line, sub-station and receiving facilities	km	5.5	350,000	1,524,000
			<u>2,642,600</u>	<u>5,961,000</u>
2. Main canal				
2.1 Site clearing and stripping	Ha	11.5	8,200	39,000
2.2 Excavation	m ³	25,900	25,900	134,000
2.3 Earthfill	m ³	25,800	31,700	186,000
2.4 Concrete lining	m ³	4,600	352,800	2,383,000
2.5 Related structures				
- Turnout	Nos.	14	52,200	212,000
- Check structure	Nos.	9	84,000	183,000
- Culvert	No.	1	3,600	21,000
- Spillway	Nos.	4	19,900	121,000
- Syphon	Nos.	3	16,300	93,000
- Cross drain	Nos.	4	21,700	124,000
			<u>616,300</u>	<u>3,496,000</u>

Table VIII-11(6) BREAKDOWN OF DIRECT CONSTRUCTION COST
- MIWALENI PUMP LIFT SCHEME (2)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
3. Secondary canal				
3.1 Site clearing and stripping	Ha	15.3	10,900	51,000
3.2 Excavation	m ³	7,800	7,800	40,000
3.3 Earthfill	m ³	65,000	156,100	902,000
3.4 Concrete lining	m ³	4,800	368,200	2,486,000
3.5 Related structures				
- Turnout	Nos.	65	183,300	727,000
- Check structure	Nos.	48	180,500	447,000
- Culvert	Nos.	21	37,200	230,000
- Spillway	Nos.	11	29,300	135,000
- Drop	Nos.	13	14,800	81,000
- Cross drain	No.	1	2,700	16,000
			<u>990,800</u>	<u>5,115,000</u>
4. Farm pond				
4.1 Site clearing and stripping	Ha	2.5	1,800	8,000
4.2 Excavation	m ³	12,200	11,600	51,000
4.3 Earthfill	m ³	9,000	9,400	55,000
4.4 Concrete lining	m ³	1,700	130,400	881,000
4.5 Related structures	Nos.	5	71,500	253,000
			<u>224,700</u>	<u>1,248,000</u>
			<u>4,474,400</u>	<u>15,820,000</u>
II. Drainage Facilities				
1. Main drain				
1.1 Excavation	m ³	7,000	7,000	36,000
1.2 Related structures, drop	Nos.	5	3,500	76,000
			<u>10,500</u>	<u>112,000</u>
2. Secondary drain				
2.1 Excavation	m ³	69,400	69,400	358,000
2.2 Related structures				
- Drainage culvert	Nos.	25	44,300	274,000
- Drop	Nos.	35	14,000	334,000
			<u>127,700</u>	<u>966,000</u>
3. Catch drain				
3.1 Excavation	m ³	66,500	66,500	343,000
3.2 Drainage culvert	Nos.	5	8,900	55,000
			<u>75,400</u>	<u>398,000</u>
			<u>213,600</u>	<u>1,476,000</u>

Table VIII-11(6) BREAKDOWN OF DIRECT CONSTRUCTION COST
-- MIWALENI PUMP LIFT SCHEME (3)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
III. Farm Roads				
1. Miwaleni trunk farm road				
1.1 Site clearing and stripping	Ha	5.5	3,900	18,000
1.2 Excavation	m ³	6,900	6,900	36,000
1.3 Earthfill	m ³	19,000	46,200	266,000
1.4 Gravel pavement	m ³	3,850	98,200	878,000
			<u>155,200</u>	<u>1,198,000</u>
2. Main farm road				
2.1 Site clearing and stripping	Ha	11.3	8,000	38,000
2.2 Excavation	m ³	6,000	6,000	31,000
2.3 Earthfill	m ³	56,400	137,100	790,000
			<u>151,100</u>	<u>859,000</u>
3. Secondary farm road				
3.1 Site clearing and stripping	Ha	13.0	9,200	44,000
3.2 Excavation	m ³	6,300	6,300	33,000
3.3 Earthfill	m ³	53,400	129,800	748,000
			<u>145,300</u>	<u>825,000</u>
			<u>451,600</u>	<u>2,882,000</u>
IV. Flood Protection				
1. Flood way				
1.1 Site clearing and stripping	Ha	43.2	30,700	145,000
1.2 Excavation	m ³	223,700	212,500	935,000
1.3 Earthfill	m ³	174,700	181,700	1,073,000
1.4 Gabion	m ²	9,400	63,900	1,889,000
1.5 Wet rubble masonry	m ²	4,500	36,200	860,000
			<u>525,000</u>	<u>4,902,000</u>
2. Flood protection dike				
2.1 Site clearing and stripping	Ha	17.5	12,400	59,000
2.2 Earthfill	m ³	95,000	171,000	1,121,000
2.3 NAFCO canal syphon		L.S.	244,000	970,000
			<u>427,400</u>	<u>2,150,000</u>
			<u>952,400</u>	<u>7,052,000</u>
Sub-total (Item A)			<u>6,092,000</u>	<u>27,230,000</u>

Table VIII-11(6) BREAKDOWN OF DIRECT CONSTRUCTION COST
- MIWALENI PUMP LIFT SCHEME (4)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
B. ON-FARM DEVELOPMENT WORKS				
1. Tertiary canal				
1.1 Site clearing and stripping	Ha	57.1	40,500	192,000
1.2 Excavation	m ³	18,600	18,600	96,000
1.3 Earthfill	m ³	299,600	705,500	4,067,000
1.4 Related structures				
- Division box	Nos.	45.9	261,600	1,028,000
- Culvert	Nos.	54	19,400	118,000
- Drop	Nos.	36	8,300	45,000
- Cross drain	No.	1	900	5,000
			<u>1,054,800</u>	<u>5,551,000</u>
2. Tertiary drain				
2.1 Excavation	m ³	97,200	97,200	502,000
2.2 Related structures				
- Culvert	Nos.	27	9,700	59,000
- Drop	Nos.	200	46,000	250,000
			<u>152,900</u>	<u>811,000</u>
3. Tertiary farm road				
3.1 Site clearing and stripping	Ha	46.8	33,200	157,000
3.2 Earthfill	m ³	146,000	354,800	2,044,000
			<u>388,000</u>	<u>2,201,000</u>
4. Land levelling and grading				
4.1 Land clearing	Ha	530	171,200	759,000
4.2 Levelling and grading, earth moving	m ³	690,000	994,100	4,488,000
			<u>1,165,300</u>	<u>5,247,000</u>
5. Field ditch, drain and road	Ha	2,000	180,000	3,280,000
			<u>2,941,000</u>	<u>17,090,000</u>
<u>Sub-total (Item B)</u>			<u>2,941,000</u>	<u>17,090,000</u>
Total			9,033,000	44,320,000 (US\$14,451,000)

Table VIII-11(7) BREAKDOWN OF DIRECT CONSTRUCTION COST
- MAKUYUNI SCHEME (1)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
A. MAIN CONSTRUCTION WORKS				
I. Irrigation Facilities				
1. Intake weir (Rehabilitation)				
1.1 Preparatory works		L.S.	6,100	30,000
1.2 Excavation	m ³	4,000	4,000	21,000
1.3 Earthfill	m ³	500	500	3,000
1.4 Concrete works	m ³	130	9,000	68,000
1.5 Masonry works	m ²	100	800	19,000
1.6 Slide gate	Nos.	2	10,200	11,000
			<u>30,600</u>	<u>152,000</u>
2. Main canal				
2.1 Site clearing and stripping	Ha	2.9	2,100	10,000
2.2 Excavation	m ³	11,900	11,900	61,000
2.3 Earthfill	m ³	12,800	17,000	99,000
2.4 Concrete (flume) works	m ³	865	96,800	905,000
2.5 Concrete lining	m ³	990	75,900	513,000
2.6 Related structures				
- Turnout	Nos.	7	26,100	106,000
- Check structure	Nos.	3	28,000	61,000
- Culvert	Nos.	6	21,700	124,000
- Spillway	Nos.	2	9,900	60,000
- Drop	Nos.	20	38,800	211,000
- Syphon	No.	1	5,400	31,000
			<u>333,600</u>	<u>2,181,000</u>
3. Secondary canal				
3.1 Site clearing and stripping	Ha	4.3	3,100	14,000
3.2 Excavation	m ³	2,200	2,200	11,000
3.3 Earthfill	m ³	18,400	43,100	248,000
3.4 Concrete lining	m ³	1,350	103,500	699,000
3.5 Related structures				
- Turnout	Nos.	9	25,400	101,000
- Check structure	Nos.	9	33,800	84,000
- Culvert	Nos.	10	17,700	110,000
- Spillway	Nos.	4	10,600	49,000
- Drop	Nos.	20	22,800	125,000
- Cross drain	Nos.	2	5,300	33,000
			<u>267,500</u>	<u>1,474,000</u>

Table VIII-11(7) BREAKDOWN OF DIRECT CONSTRUCTION COST
- MAKUYUNI SCHEME (2)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
4. Farm pond				
4.1 Site clearing and stripping	Ha	1.2	900	4,000
4.2 Excavation	m ³	4,800	4,600	20,000
4.3 Earthfill	m ³	5,200	5,400	32,000
4.4 Concrete lining	m ³	860	66,000	445,000
4.5 Related structures	Nos.	2	28,600	101,000
			<u>105,500</u>	<u>602,000</u>
			<u>737,200</u>	<u>4,409,000</u>
II. Drainage Facilities				
1. Secondary drain				
1.1 Excavation	m ³	15,000	15,000	77,000
1.2 Related structures				
- Drainage culvert	Nos.	3	5,300	33,000
- Drop	Nos.	10	4,000	96,000
			<u>24,300</u>	<u>206,000</u>
2. Catch drain				
2.1 Excavation	m ³	14,400	14,400	74,000
2.2 Related structures				
- Drainage culvert	Nos.	2	3,500	22,000
			<u>17,900</u>	<u>96,000</u>
			<u>42,200</u>	<u>302,000</u>
III. Farm Roads				
1. Main farm road				
1.1 Site clearing and stripping	Ha	2.7	1,900	9,000
1.2 Excavation	m ³	3,400	3,400	18,000
1.3 Embankment	m ³	28,600	69,500	400,000
			<u>74,800</u>	<u>428,000</u>
2. Secondary farm road				
2.1 Site clearing and stripping	Ha	6.9	4,900	23,000
2.2 Excavation	m ³	3,400	3,400	18,000
2.3 Embankment	m ³	28,600	69,500	400,000
			<u>77,800</u>	<u>441,000</u>
			<u>152,600</u>	<u>869,000</u>
			<u>932,000</u>	<u>5,580,000</u>
			<u>Sub-total (Item A)</u>	<u>932,000</u>

Table VIII-11(7) BREAKDOWN OF DIRECT CONSTRUCTION COST
- MAKUYUNI SCHEME (3)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
B. <u>ON-FARM DEVELOPMENT WORKS</u>				
1. Tertiary canal				
1.1 Site clearing and stripping	Ha	17.2	12,200	58,000
1.2 Excavation	m ³	5,600	5,600	29,000
1.3 Earthfill	m ³	90,000	93,600	553,000
1.4 Related structures				
- Division box	Nos.	176	100,300	394,000
- Culvert	Nos.	54	19,400	118,000
			<u>231,100</u>	<u>1,152,000</u>
2. Tertiary drain				
2.1 Excavation	m ³	47,000	47,000	243,000
2.2 Related structures				
- Culvert	Nos.	42	15,100	92,000
- Drop	Nos.	120	27,600	150,000
			<u>89,700</u>	<u>485,000</u>
3. Tertiary farm road				
3.1 Site clearing and stripping	Ha	13.4	9,500	45,000
3.2 Earthfill	m ³	41,800	101,600	585,000
			<u>111,100</u>	<u>630,000</u>
4. Land levelling, earth moving	m ³	147,000	<u>212,100</u>	<u>959,000</u>
5. Field ditch, drain and road	Ha	490	-	<u>804,000</u>
			<u>644,000</u>	<u>4,030,000</u>
Sub-total (Item B)			644,000	4,030,000
Total			1,576,000	9,610,000
			(US\$2,751,000)	

Table VIII-11(8) BREAKDOWN OF DIRECT CONSTRUCTION COST
- GHONA & KILEO SCHEME (1)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
A. MAIN CONSTRUCTION WORKS				
I. Irrigation Facilities				
1. Intake weir				
1.1 Preparatory works		L.S.	6,200	27,000
1.2 Excavation	m ³	200	200	1,000
1.3 Earthfill	m ³	100	200	1,000
1.4 Concrete works	m ³	164	11,500	86,000
1.5 Masonry works	m ²	100	800	19,000
1.6 Slide gate	Nos.	2	10,200	11,000
			<u>29,100</u>	<u>145,000</u>
2. Main canal				
2.1 Site clearing and stripping	Ha	1.4	1,000	5,000
2.2 Excavation	m ³	9,200	9,200	47,000
2.3 Earthfill	m ³	9,400	11,200	66,000
2.4 Concrete flume	m ³	1,340	148,500	1,351,000
2.5 Concrete lining	m ³	490	37,600	254,000
2.6 Related structures				
- Turnout	Nos.	4	14,900	61,000
- Check structure	Nos.	2	18,700	41,000
- Culvert	Nos.	2	7,200	41,000
- Spillway	Nos.	2	9,900	60,000
- Syphon	No.	1	5,400	31,000
			<u>263,600</u>	<u>1,957,000</u>
3. Secondary canal				
3.1 Site clearing and stripping	Ha	5.8	4,100	19,000
3.2 Excavation	m ³	3,000	3,000	15,000
3.3 Earthfill	m ³	24,500	58,300	337,000
3.4 Concrete lining	m ³	1,800	138,000	932,000
3.5 Related structures				
- Turnout	Nos.	16	45,100	179,000
- Check structure	Nos.	12	45,100	112,000
- Culvert	Nos.	6	10,600	66,000
- Spillway	Nos.	4	10,600	49,000
- Drop	Nos.	6	6,800	37,000
- Syphon	No.	1	2,700	16,000
- Cross drain	Nos.	2	5,300	33,000
			<u>329,600</u>	<u>1,795,000</u>

Table VIII-11(8) BREAKDOWN OF DIRECT CONSTRUCTION COST
- GHONA & KILEO SCHEME (2)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
4. Farm pond				
4.1 Site clearing and stripping	Ha	1.1	800	4,000
4.2 Excavation	m ³	5,200	4,900	22,000
4.3 Embankment	m ³	3,800	4,000	23,000
4.4 Concrete lining	m ³	880	67,500	456,000
4.5 Related structures	No.	1	14,300	51,000
			<u>91,500</u>	<u>556,000</u>
			<u>713,800</u>	<u>4,453,000</u>
II. Drainage Facilities				
1. Secondary drain				
1.1 Excavation	m ³	13,700	13,700	71,000
1.2 Related structures				
- Drainage culvert	Nos.	2	3,500	22,000
- Drop	Nos.	4	1,600	38,000
			<u>18,800</u>	<u>131,000</u>
III. Farm Roads				
1. Main farm road				
1.1 Site clearing and stripping	Ha	3.9	2,800	13,000
1.2 Excavation	m ³	2,100	2,100	11,000
1.3 Embankment	m ³	19,400	47,100	272,000
			<u>52,000</u>	<u>296,000</u>
2. Secondary farm road				
2.1 Site clearing and stripping	Ha	3.7	2,600	12,000
2.2 Excavation	m ³	1,900	1,900	10,000
2.3 Embankment	m ³	15,600	37,900	218,000
			<u>42,400</u>	<u>240,000</u>
			<u>94,400</u>	<u>536,000</u>
			<u>827,000</u>	<u>5,120,000</u>
Sub-total (Item A)			<u>827,000</u>	<u>5,120,000</u>

Table VIII-11(8) BREAKDOWN OF DIRECT CONSTRUCTION COST
- GHONA & KILEO SCHEME (3)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
B. ON-FARM DEVELOPMENT WORKS				
1. Tertiary canal				
1.1 Site clearing and stripping	Ha	7.7	5,500	26,000
1.2 Excavation	m ³	4,800	4,800	25,000
1.3 Earthfill	m ³	66,000	154,800	893,000
1.4 Related structures				
- Division box	Nos.	106	60,400	237,000
- Culvert	Nos.	4	1,400	9,000
			<u>226,900</u>	<u>1,190,000</u>
2. Tertiary drain				
2.1 Excavation	m ³	25,000	25,000	129,000
2.2 Related structures				
- Drainage culvert	Nos.	6	2,200	13,000
- Drop	Nos.	43	9,900	54,000
			<u>37,100</u>	<u>196,000</u>
3. Tertiary farm road				
3.1 Site clearing and stripping	Ha	7.7	5,500	26,000
3.2 Earthfill	m ³	24,200	58,800	339,000
			<u>64,300</u>	<u>365,000</u>
4. Land levelling and grading				
4.1 Land clearing	Ha	60	19,400	86,000
4.2 Leveling	m ³	162,000	233,300	1,049,000
			<u>252,700</u>	<u>1,135,000</u>
5. Field ditch, drain and road	Ha	490	<u>30,000</u>	<u>804,000</u>
<u>Sub-total (Item B)</u>			<u>611,000</u>	<u>3,690,000</u>
Total			1,438,000	8,810,000
			(US\$2,515,000)	

Table VIII-11(9) BREAKDOWN OF DIRECT CONSTRUCTION COST
- NORTH GROUND WATER SCHEME (1)

WORK	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
A. MAIN CONSTRUCTION WORKS				
I. Irrigation Facilities				
1. Production well	m	1,400	<u>700,000</u>	<u>2,205,000</u>
2. Pump house and farm pond				
2.1 Pump house	m ²	168	42,000	435,000
2.2 Pumping plant	set	14	347,000	302,000
2.3 11 kV distribution line and transformer	km	18	196,000	1,474,000
2.4 Farm pond				
- Site clearing and stripping	Ha	3.5	2,500	12,000
- Excavation	m ³	17,600	16,700	74,000
- Embankment	m ³	15,200	15,800	93,000
- Concrete lining	m ³	2,240	171,800	1,160,000
- Related structures	Nos.	14	89,900	302,000
			<u>881,700</u>	<u>3,852,000</u>
3. Secondary canal				
3.1 Site clearing and stripping	Ha	2.8	2,000	9,000
3.2 Excavation	m ³	3,200	3,200	17,000
3.3 Earthfill	m ³	9,400	19,500	113,000
3.4 Concrete lining	m ³	1,400	107,400	725,000
3.5 Related structures				
- Turnout	Nos.	70	197,400	783,000
- Culvert	Nos.	14	24,800	153,000
- Spillway	Nos.	14	37,200	171,000
			<u>391,500</u>	<u>1,971,000</u>
			<u>1,973,200</u>	<u>8,028,000</u>
II. Floodway				
1. Site clearing and stripping	Ha	7.0	5,000	24,000
2. Excavation	m ³	224,400	224,200	1,155,000
3. Embankment	m ³	317,500	301,600	1,327,000
4. Wet masonry	m ²	5,900	47,500	1,127,000
5. Gabion	m ²	8,900	60,500	1,789,000
			<u>638,800</u>	<u>5,422,000</u>
<u>Sub-total (Item A)</u>			<u>2,612,000</u>	<u>13,450,000</u>

Table VIII-11(9) BREAKDOWN OF DIRECT CONSTRUCTION COST
- NORTH GROUND WATER SCHEME (2)

WORK	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
B. <u>ON-FARM DEVELOPMENT WORKS</u>				
1. Tertiary canal				
1.1 Site clearing and stripping	Ha	10.0	7,100	34,000
1.2 Excavation	m ³	15,400	15,400	79,000
1.3 Earthfill	m ³	2,000	2,100	12,000
1.4 Concrete lining	m ³	2,660	204,000	1,378,000
1.5 Division box	Nos.	840	478,800	1,882,000
			<u>707,400</u>	<u>3,385,000</u>
2. Tertiary drain				
2.1 Excavation	m ³	22,400	22,400	116,000
2.2 Drainage culvert	Nos.	70	25,200	153,000
			<u>47,600</u>	<u>269,000</u>
3. Tertiary farm road				
3.1 Site clearing and stripping	Ha	28	19,900	94,000
3.2 Earthfill	m ³	112,000	272,200	1,568,000
			<u>292,100</u>	<u>1,662,000</u>
4. Land grading - Earth-moving	m ³	252,000	<u>362,900</u>	<u>1,636,000</u>
5. Field ditch, drain and road	Ha	840	-	<u>1,378,000</u>
			<u>1,410,000</u>	<u>8,330,000</u>
<u>Sub-total (Item B)</u>			<u>1,410,000</u>	<u>8,330,000</u>
Total			4,022,000	21,780,000 (US\$6,685,000)

Table VIII-11(10) BREAKDOWN OF DIRECT CONSTRUCTION COST
- EAST GROUND WATER SCHEME (1)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
A. MAIN CONSTRUCTION WORKS				
1. Irrigation Facilities				
1. Production well	m	600	300,000	945,000
2. Pump house and farm pond				
2.1 Pump house	m ²	72	18,000	186,000
2.2 Pumping plant	set	6	77,900	67,000
2.3 11 kV distribution line and transformer	km	12	106,000	892,000
2.4 Farm pond				
- Site clearing and stripping	Ha	1.2	900	4,000
- Excavation	m ³	4,700	4,500	20,000
- Embankment	m ³	4,100	4,300	25,000
- Concrete lining	m ³	600	46,000	311,000
- Related structures	Nos.	6	38,500	129,000
			<u>296,100</u>	<u>1,634,000</u>
3. Secondary canal				
3.1 Site clearing and stripping	Ha	2.5	1,800	8,000
3.2 Excavation	m ³	1,400	1,400	7,000
3.3 Earthfill	m ³	4,000	8,300	45,000
3.4 Concrete lining	m ³	600	46,000	311,000
3.5 Related structures				
- Turnout	Nos.	18	50,800	201,000
- Culvert	Nos.	6	10,600	66,000
- Spillway	Nos.	6	16,000	73,000
			<u>134,900</u>	<u>711,000</u>
<u>Sub-total (Item A)</u>			<u>731,000</u>	<u>3,290,000</u>
B. ON-FARM DEVELOPMENT WORKS				
1. Tertiary canal				
1.1 Site clearing and stripping	Ha	6.3	4,500	21,000
1.2 Excavation	m ³	4,700	4,700	24,000
1.3 Earthfill	m ³	600	6,200	4,000
1.4 Concrete lining	m ³	810	62,100	420,000
1.5 Division box	Nos.	180	102,600	403,000
			<u>180,100</u>	<u>872,000</u>
2. Tertiary drain				
2.1 Excavation	m ³	7,000	7,000	36,000
2.2 Drainage culvert	Nos.	18	6,500	39,000
			<u>13,500</u>	<u>75,000</u>

Table VIII-11(10) BREAKDOWN OF DIRECT CONSTRUCTION COST
- EAST GROUND WATER SCHEME (2)

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
3. Tertiary farm road				
3.1 Site clearing and stripping	Ha	8.5	6,000	29,000
3.2 Earthfill	m ³	34,000	82,600	476,000
			<u>88,600</u>	<u>505,000</u>
4. Land grading - Earth moving	m ³	54,000	<u>77,800</u>	<u>353,000</u>
5. Field ditch, drain and road	Ha	180	-	<u>295,000</u>
			<u>360,000</u>	<u>2,100,000</u>
			<u>Sub-total (Item B)</u>	
			<u>1,091,000</u>	<u>5,390,000</u>
			(US\$1,750,000)	
			<u>Total</u>	

Table VIII-11(11) BREAKDOWN OF DIRECT CONSTRUCTION COST
- JOINT FACILITIES

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
I. Chekereni Trunk Farm Road				
1. Excavation	m ³	22,000	22,000	115,000
2. Earthfill	m ³	25,000	26,000	155,000
3. Gravel pavement	m ³	12,500	319,000	2,850,000
			367,000	3,120,000
II. Lead Drain (Mabogini - Chekereni - Lake)				
1. Excavation	m ³	172,000	163,500	720,000
2. Related structures				
2.1 Drop	Nos.	10	19,500	460,000
			183,000	1,180,000
III. NAFCO Canal Syphon				
1. Excavation, common	m ³	51,000	48,500	221,000
2. Backfill	m ³	6,000	7,200	50,000
3. Concrete works	m ³	490	172,200	317,000
4. Wet masonry works	m ²	2,000	16,100	382,000
			244,000	970,000

Table VIII-11(12) BREAKDOWN OF DIRECT CONSTRUCTION COST
OFFICE AND QUARTERS

WORKS	UNIT	Q'TY	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)
1. Main office	m ²	400	28,000	760,000
2. Branch office	m ²	320	19,000	510,000
3. Repair shop	m ²	400	20,000	480,000
4. Store house	m ²	1,800	90,000	4,500,000
5. Quarters	m ²	1,200	93,000	2,500,000
6. Motor pool	m ²	6,200	10,000	60,000
7. Land preparation for office yard including fencing, etc.		L.S.	140,000	950,000
TOTAL			400,000	9,760,000
			(US\$1,593,000)	

Table VIII-12 LIST OF CONSTRUCTION EQUIPMENT (1)

ITEM NO.	EQUIPMENT	DESCRIPTION	UNIT PRICE (US\$)	Q'TY	PROCURE- MENT COST (US\$)
1.	Bulldozer	21 ton	142,000	12	1,704,000
2.	Bulldozer	17 ton	83,200	7	582,400
3.	Bulldozer	11 ton	64,000	12	768,000
4.	Backhoe	0.6 m ³	89,000	4	356,000
5.	Backhoe	0.3 m ³	54,000	10	540,000
6.	Motor scraper	11 m ³	264,000	3	792,000
7.	Tractor shovel	1.2 m ³	51,800	2	103,600
8.	Wheel loader	1.2 m ³	34,000	2	68,000
9.	Dump truck	8 ton	28,000	12	336,000
10.	Tamping roller	10 ton	25,000	5	125,000
11.	Tire roller	6-10 ton	33,000	4	132,000
12.	Motor grader	3.7 m	69,700	2	139,400
13.	Vibrating compactor	100 kg	1,400	3	4,200
14.	Rammer	60-100 kg	700	10	7,000
15.	Tamper	60-100 kg	650	10	6,500
16.	Water tanker	5.5 kl	15,500	6	93,000
17.	Belt conveyor	10 m	1,000	5	5,000
18.	Breaker (attachment for backhoe)	200 kg	5,000	1	5,000
19.	Concrete batcher plant	0.5m ³ x1	50,000	2	100,000
20.	Concrete mixer	0.4 m ³	7,600	4	30,400
21.	Concrete mixer	0.2 m ³	3,400	5	17,000
22.	Agitator truck	1.6 m ³	21,000	5	105,000
23.	Full section slip form with trimming machine and accessories			1	220,000
24.	Concrete vibrator	φ45 mm	800	20	16,000
25.	Truck crane	15 ton	92,000	1	92,000
26.	Wheel crane	5.5 ton	47,600	1	47,600
27.	Truck-bed crane	3 ton	32,000	3	96,000
28.	Cargo truck	6 ton	20,000	10	200,000

Table VIII-12 LIST OF CONSTRUCTION EQUIPMENT (2)

ITEM NO.	EQUIPMENT	DESCRIPTION	UNIT PRICE (US\$)	Q'TY	PROCUREMENT COST (US\$)
29.	Fork lift	3 ton	21,600	2	43,200
30.	Fuel tanker	10 kℓ	33,600	1	33,600
31.	Fuel tanker	4 kℓ	16,800	2	33,600
32.	Pick-up car (4-W drive)	1 ton	4,500	10	45,000
33.	Micro bus	25 persons	14,000	4	56,000
34.	Jeep	4-W drive	10,800	10	108,000
35.	Maintenance car	7 ton	54,800	1	54,800
36.	Grease car	6 ton	44,400	1	44,400
37.	Submersible pump	100 mm	4,400	2	8,800
38.	Submersible pump	50 mm	2,300	5	11,500
39.	Power supply system			One lot	220,000
40.	Water supply and sewerage system			One lot	70,000
41.	Testing equipment			One lot	60,000
42.	Survey equipment			One lot	30,000
43.	Repairshop equipment			One lot	100,000
44.	Other equipment			One lot	80,000
45.	Truck mounted rotary drilling machine with standard operating accessories, drilling tools and miscellaneous equipment	200 m depth 3 1/2 inch drilling pipe		One lot	420,000
		Sub-total			8,110,000
46.	Spare parts of the construction machinery			20 %	1,620,000
TOTAL					9,730,000

Table VIII-13

PROCUREMENT COST OF MAJOR EQUIPMENT
FOR OPERATION AND MAINTENANCE

(Unit: US\$)

<u>ITEM NO.</u>	<u>EQUIPMENT</u>	<u>UNIT PRICE</u>	<u>REQUIRED NUMBER</u>	<u>AMOUNT</u>
1.	Backhoe, 0.6 m ³	85,000	1	85,000
2.	Bulldozer, 11 ton	64,000	1	64,000
3.	Wheel loader, 1.2 m ³	46,000	1	46,000
4.	Motor grader, 3.7 m	71,000	1	71,000
5.	Slope compactor, 3 HP	2,000	2	4,000
6.	Concrete mixer, 0.2-0.3 m ³	8,000	1	8,000
7.	Submersible pump, ϕ100	1,600	2	3,200
8.	Generator, 2 kW	1,500	2	3,000
9.	Dump truck, 8 ton	34,000	1	34,000
10.	Dump truck, 2 ton	11,000	2	22,000
11.	Cargo truck with crane, 8 ton	38,000	1	38,000
12.	Cargo truck with crane, 2 ton	12,000	2	24,000
13.	Truck, 4-wheel drive, 1 ton	5,000	10	50,000
14.	Jeep, 4-wheel drive, hardtop	11,000	10	110,000
15.	Sedan, 6 person	11,000	2	22,000
16.	Motor-cycle	1,500	6	9,000
17.	Spare parts (30%)	L.S.		177,800
Total				771,000

Table VIII-14

COST ESTIMATE OF ENGINEERING SERVICES

(1980 Price Level)

<u>ITEM</u>	<u>QUANTITY</u>	<u>AMOUNT</u> (US\$)
<u>1. Detailed Design Stage</u>		<u>1,130,000</u>
1. Remuneration ^{1/}	115 M/M	920,000
2. Per diem ^{2/}	65 M/M	78,000
3. Air freight ^{3/}	14 nos.	70,840
4. Documentation	L.S.	20,000
5. Other related cost	L.S.	41,160
<u>2. Construction Stage</u>		<u>2,980,000</u>
1. Remuneration	290 M/M	2,320,000
2. Per diem	290 M/M	348,000
3. Air freight	35 trips	177,100
4. Other related cost ^{4/}	L.S.	134,900
<u>Total</u>		<u>4,110,000</u>

Note: 1/: \$8,000 per M/M on average,

2/: \$1,200 per M/M,

3/: International freight = \$5,000/trip

Domestic freight = \$60/t (=TS490/t)

Total = 5,060/t

4/: Construction costs for test wells are not included.

Table VIII-15 ADMINISTRATION EXPENSES - CONSTRUCTION STAGE

ITEM	QUANTITY	UNIT PRICE (TS)	AMOUNT (TS 1,000)
1. Staff salary	5 years	1,040,000	5,200
2. Labour wage	600 M/M	500	300
3. Office expenses	L.S.	-	500
4. Equipment	L.S.	-	1,000
5. Other related cost	L.S.	-	500
Total			7,500 (TS 1.5 x 10 ⁶ /year)

Table VIII-16

PRICE LIST OF BASIC LOCAL
MATERIALS AND LABOUR WAGES

March, 1980

ITEM	UNIT	UNIT PRICE (TS)
A. Materials		
1. Gravel (crushed stone)	m ³	145
2. Sand (Natural Sand)	m ³	90
3. Ordinary portland cement	ton	1,100/1
4. Concrete block 23x23x45	No.	8
15x23x45	No.	6
5. Timber, Hard wood	m ³	3,000
" , Soft wood	m ³	2,000
6. Plywood, t = 6mm	m ²	80
7. P.V.C. pipe		
φ300 (up to head 100m)	Lin.m	370
φ250 "	Lin.m	290
φ200 "	Lin.m	155
φ150 "	Lin.m	80
φ100 "	Lin.m	37
φ75 "	Lin.m	25
φ65 (up to head 70m)	Lin.m	23
φ50	Lin.m	16
φ40	Lin.m	10
B. Fuel		
1. Gasoline	ℓ	8.0
2. Light diesel oil	ℓ	4.5
3. Diesel engine oil	ℓ	10.0
4. Grease	kg	12.0
C. Labour		
1. Common labour	Man-day	15
2. Concrete worker	Man-day	21
3. Mason	Man-day	21
4. Iron worker	Man-day	21
5. Plasterer	Man-day	25
6. Welder	Man-day	25
7. Carpenter	Man-day	25
8. Foreman	Man-day	45
9. Operator	Man-day	50
10. Assistant operator	Man-day	40

Table VIII-17

LIST OF UNIT PRICE FOR
MAJOR WORK ITEMS (1)

WORK ITEMS	UNIT	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)	TOTAL (US\$)
1. Site clearing and stripping	Ha	710	3,360	1,120
2. Excavation				
- Common by hand	m ³	-	17	2.08
- Common by machine	m ³	1.00	5.16	1.63
- Floodway excavation	m ³	0.95	4.18	1.46
3. Compacted earthfill				
- with excavated material (Haul: less than 50m)	m ³	1.04	6.14	1.79
- with excavated material (Haul: up to 500m)	m ³	2.43	14.0	4.14
- with excavated material (Haul: up to 2000m)	m ³	3.03	17.6	5.18
4. Backfill by manpower	m ³	0.84	29.0	4.39
5. Land clearing	Ha	323	1,432	498
6. Land levelling and grading	m ³	1.44	6.50	2.23
7. Concrete				
- Concrete canal lining	m ³	76.7	518	140
- Concrete 28 = 210 kg/cm ²	m ³	59.3	546	126
- Concrete 28 = 180 kg/cm ²	m ³	56.0	510	118
- Concrete 28 = 120 kg/cm ²	m ³	51.2	473	109
- Concrete mortar 1:3	m ³	58.1	564	127
8. Wooden form for concrete				
- Form, complex structure	m ²	-	134	16.4
- Form, simple structure	m ²	-	72	8.80
9. Reinforcement steel bar	ton	650	700	736
10. Pavement of road	m ³	25.5	228	53.4
11. Wet rubble masonry	m ²	8.05	191	31.4

Table VIII-17

LIST OF UNIT PRICE FOR
MAJOR WORK ITEMS (2)

WORK ITEMS	UNIT	FOREIGN CURRENCY (US\$)	LOCAL CURRENCY (TS)	TOTAL (US\$)
12. Concrete pipe ϕ 300	m	3	91	23
ϕ 500	m	7	209	53
ϕ 600	m	10	286	74
ϕ 700	m	12	380	98
ϕ 800	m	15	485	126
ϕ 900	m	19	611	160
ϕ 1,000	m	23	754	197
13. Metal works for canal	ton	1,500	2,000	1,740
14. Slide gate ϕ 300	No.	780	650	860
ϕ 400	No.	890	750	980
ϕ 500	No.	1,160	1,000	1,280
ϕ 600	No.	1,320	1,160	1,460
ϕ 700	No.	1,540	1,360	1,710
ϕ 800	No.	2,000	1,830	2,220
ϕ 900	No.	2,270	2,100	2,530
ϕ 1,000	No.	2,740	2,540	3,050
1,000 x 1,000	No.	5,100	5,600	5,780
1,200 x 1,200	No.	5,510	5,800	6,220
1,500 x 1,500	No.	8,730	6,000	9,460
2,000 x 2,000	No.	11,320	6,800	12,150

Table VIII-18

ASSIGNMENT SCHEDULE OF
FOREIGN CONSULTANTS (1)

Detailed Design Stage

SPECIALITY	MAN - MONTH		
	Field	Home	Total
1. Team Leader	7	5	12
2. Irrigation Engineer	6	5	11
3. - do -	6	5	11
4. Drainage Engineer	6	5	11
5. Soil Mechanical Engr.	3	1	4
6. Foundation Engr.	3	1	4
7. Design Engineer	6	6	11
8. - do -	6	6	11
9. Survey Engineer	6	-	6
10. Hydrogeologist	6	3	9
11. Drilling Expert	6	-	6
12. Building Engineer	2	3	5
13. Pump Engineer	-	3	3
14. Electric Engineer	-	3	3
15. Mechanical Engineer	-	3	3
16. Construction Engineer	2	3	5
Total	65	50	115

Table VIII-18

ASSIGNMENT SCHEDULE OF
FOREIGN CONSULTANTS (2)Construction Stage

NO.	SPECIALITY	MAN - MONTH
<u>I. Main Construction Works</u>		
1.	Team Leader	68
2.	Construction Engineer	68
3.	Hydrogeologist	10
4.	Pump Engineer	5
5.	Electric Engineer	5
<u>II. On-farm Development Works</u>		
1.	Construction Engineer	62
2.	Design Engineer	62
3.	Surveyor	10
Total		290

Table VIII-19

STAFFING FOR THE PROJECT OFFICE- CONSTRUCTION STAGE

(Construction Stage)

ITEM	REQUIRED NUMBER	YEARLY SALARY	
		Unit Rate (TS)	Amount (TS)
<u>1. Project Office</u>			
Project Manager	1	42,000	42,000
Secretary/Typist	1	13,000	13,000
<u>2. Administrative Section</u>			
Admin. Officer (Section Chief)	1	24,000	24,000
Accountant	1	20,000	20,000
Asst. Accountant	3	16,000	48,000
Cashier	1	8,000	8,000
Personnel Officer	1	18,000	18,000
Clerk	3	10,000	30,000
Typist	5	10,000	50,000
Office boy	2	6,000	12,000
<u>3. Design Section</u>			
Irrigation Engr. (Section Chief)	1	24,000	24,000
Design Engineer	12	15,000	180,000
Draftman	7	10,000	70,000
Surveyor	12	12,000	144,000
<u>4. Implementation Section</u>			
Construction Engr. (Section Chief)	1	24,000	24,000
Supervisor	12	15,000	180,000
<u>5. Mechanical Section</u>			
Mechanical Engineer (Section Chief)	1	24,000	24,000
Operator	3	9,000	27,000
Driver	10	8,400	84,000
Mechanic	2	9,000	18,000
Total	80		1,040,000

Table VIII-20 COMPONENT OF DIRECT CONSTRUCTION COST

ITEM	COMPOSITION
A. Foreign Currency Portion	
1. Machinery cost	53%
2. Foreign material cost	47%
	100%
B. Local Currency Portion	
1. Fuel and OM&R cost of construction machinery	17%
2. Repairing and maintenance Cost of Construction Machinery	12%
3. Wages	33%
4. Local material cost	38%
	100%

Table VIII-21 ANNUAL OPERATION AND MAINTENANCE COST

ITEM	CALCULATION	COST	
		Amount (TS 1,000)	per Ha (TS/ha)
<u>1. Salaries & Wages</u>		<u>572</u>	(91)
1.1 Staffs salaries	(see next Table)	472	
1.2 Labour wages	200 M/M x @500	100	
<u>2. Office Expenses</u>	L.S.	<u>100</u>	(16)
<u>3. Operation Cost</u>		<u>1,768</u>	
1.1 Electricity charge			
(1) Miwaleni scheme	2,500MWH x @320	800	(400)
(2) Groundwater scheme	2,400MWH x @320	768	(753)
1.2 Vehicles	L.S.	200	(32)
<u>4. Maintenance Cost (0.5% of direct construction cost)</u>		<u>1,610</u>	
(1) Rau river system (2,300 ha)		450	(196)
(2) Miwaleni scheme (2,000 ha)		590	(295)
(3) Himo river system (1,000 ha)		220	(220)
(4) Groundwater scheme (1,020 ha)		350	(343)
<u>5. Miscellaneous (3% for the above items)</u>		<u>120</u>	(19)
<u>Total:</u>			
Rau river system		810	(352)
Miwaleni scheme		1,705	(853)
Himo river system		378	(378)
Groundwater scheme		1,277	(1,245)
<u>GRAND TOTAL</u>		<u>4,170</u>	<u>(660)</u>

Table VIII-22 PROJECT STAFFS AND THEIR EXPENSES AT O&M STAGE

ITEM	REQUIRED NUMBER	YEARLY SALARY	
		Unit Rate (TS)	Amount (TS)
<u>1. Project Office</u>	<u>2</u>		<u>55,000</u>
Project Manager	1	42,000	42,000
Secretary/Typist	1	13,000	13,000
<u>2. Administrative Section</u>	<u>8</u>		<u>112,000</u>
Admin. Officer (Section Chief)	1	24,000	24,000
Accountant	1	20,000	20,000
Asst. Accountant	1	16,000	16,000
Cashier	1	8,000	8,000
Personnel Officer	1	18,000	18,000
Clerks/Typists	2	10,000	20,000
Watchman	1	6,000	6,000
<u>3. Operation Section</u>	<u>12</u>		<u>159,000</u>
Irrigation Engr. (Section Chief)	1	24,000	24,000
Irrigation Overseers	3	15,000	45,000
Pump Engineer	1	15,000	15,000
Electrician	1	15,000	15,000
Gate Keepers	6	10,000	60,000
<u>4. Maintenance Section</u>	<u>14</u>		<u>148,000</u>
Mechanical Engr. (Section Chief)	1	24,000	24,000
Mechanics	2	9,000	18,000
Artisans	2	9,000	18,000
Senior Operator	1	18,000	18,000
Operators	2	9,000	18,000
Drivers	5	8,400	42,000
Storekeeper	1	10,000	10,000
Total	36		472,000

Table VIII-23

REPLACEMENT COST AND USEFUL LIFE

ITEM	USEFUL LIFE (Years)	REPLACEMENT COST (10 ³ US\$)
A. O&M Equipment	5	630
B. Project Facilities		
1. Bau river system, Gate	25	286
2. Miwareni pump lift scheme		
- Gate	25	235
- Pump & motor	25	455
- Discharge pipeline	25	1,470
- Transmission line	25	350
3. Himo river system, Gate	25	149
4. Groundwater schemes		
- Gate	25	158
- Pumps and motor	25	425
- Distribution line	25	302

Fig. VIII - 1 ORGANIZATION CHART AT IMPLEMENTATION STAGE

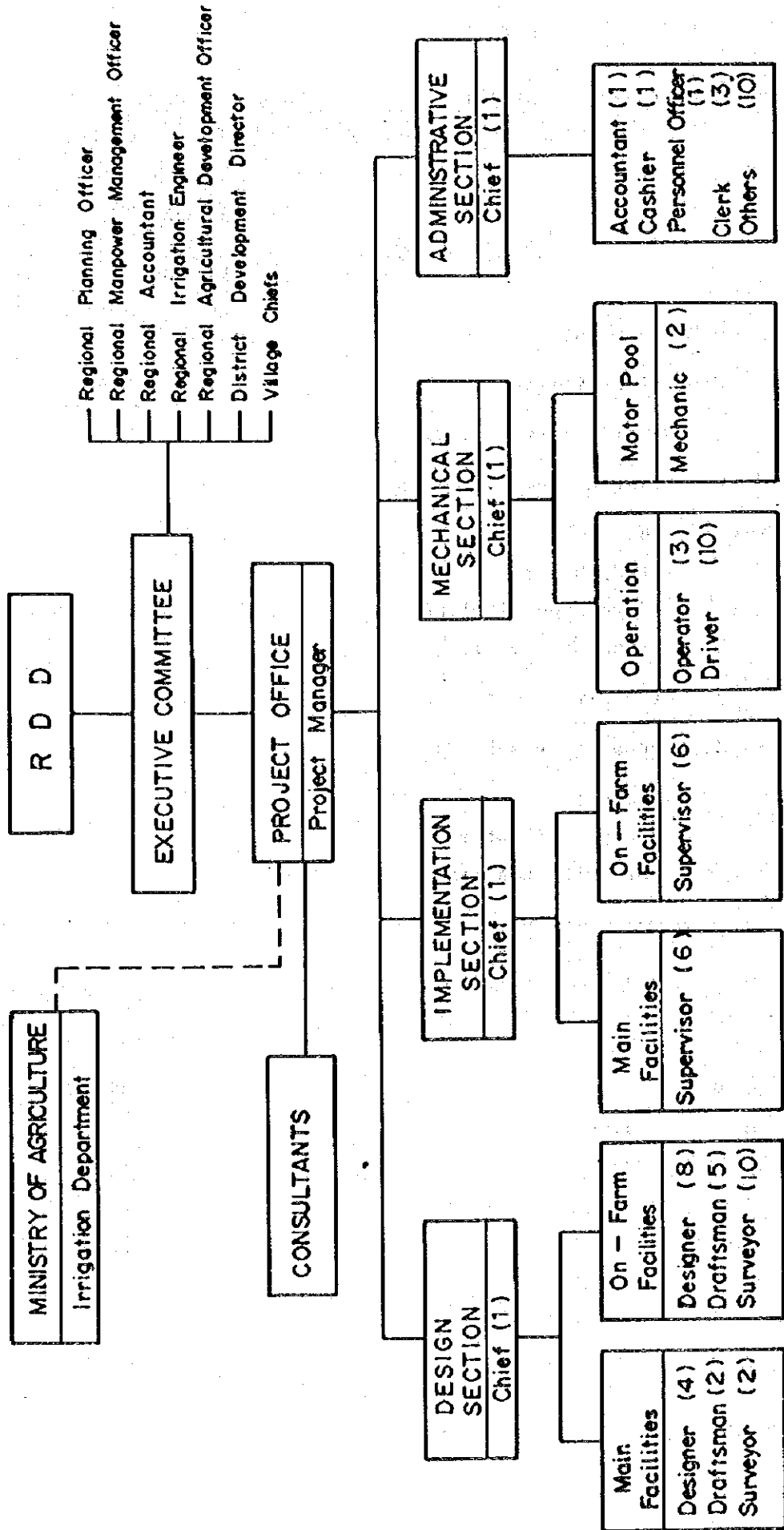


Fig. VIII - 2 ORGANIZATION CHART AT O & M STAGE

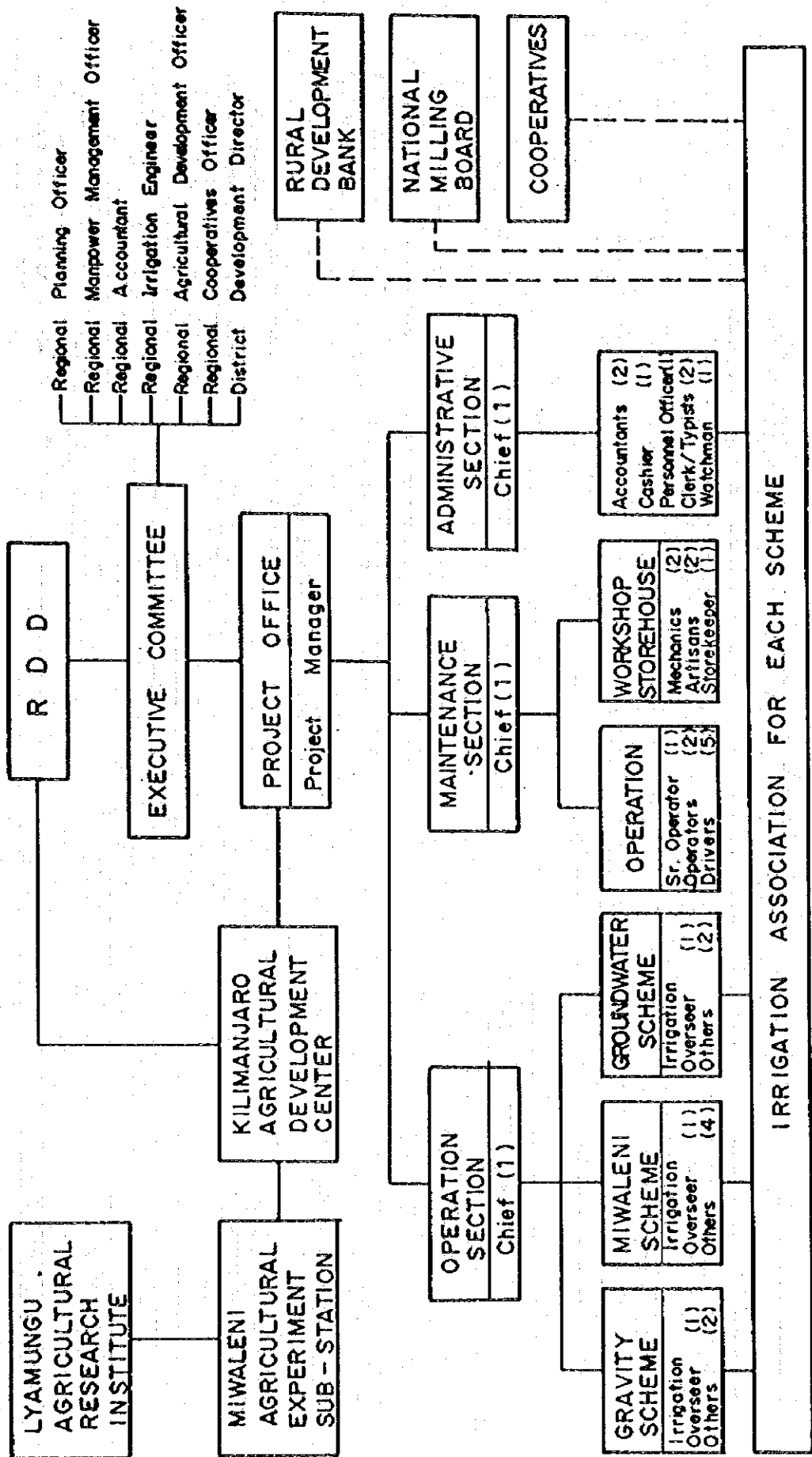
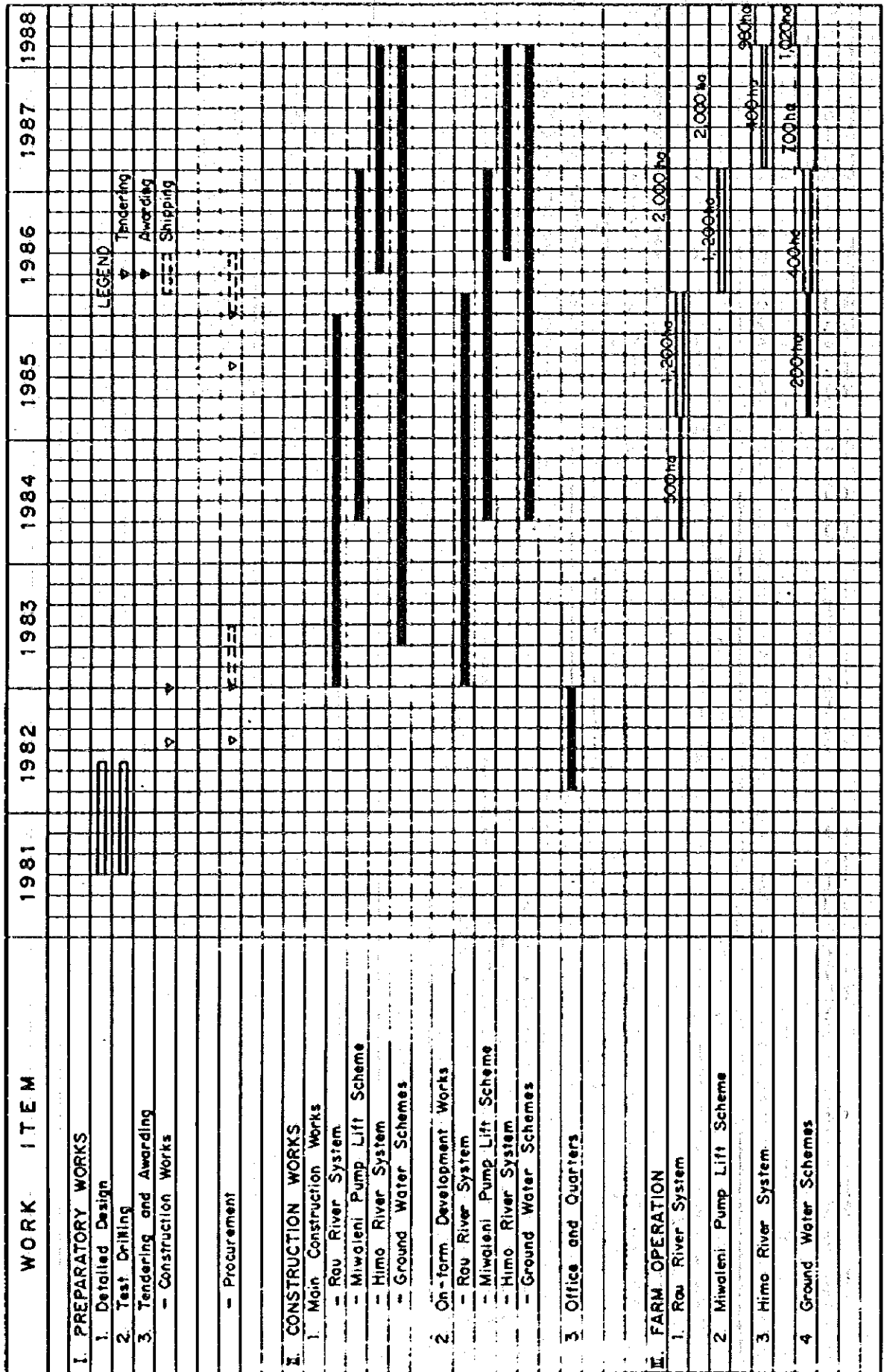
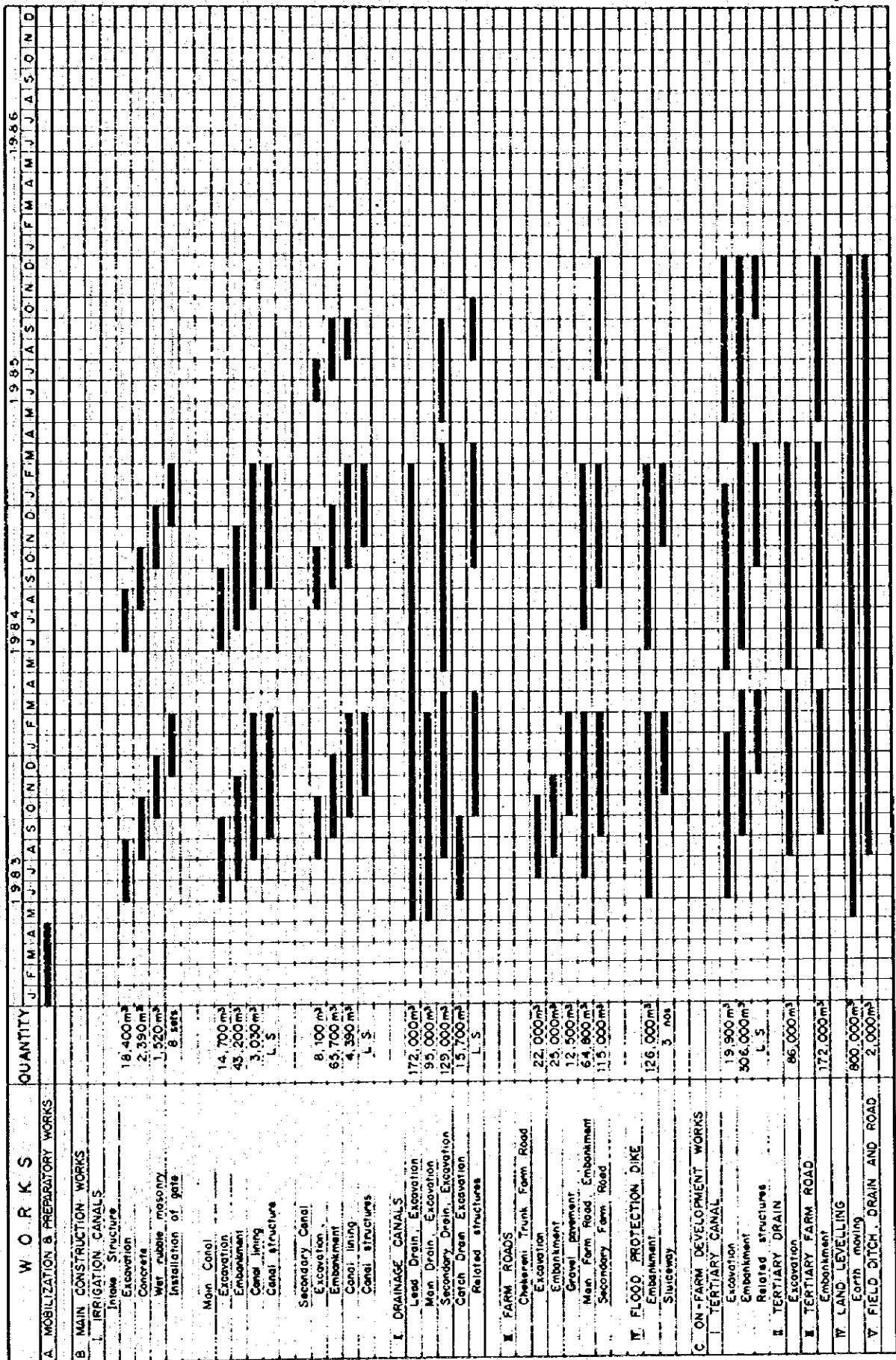


Fig. VIII - 3 PROJECT IMPLEMENTATION SCHEDULE



CONSTRUCTION TIME SCHEDULE - RAU RIVER SYSTEM

Fig. VII - 4



CONSTRUCTION TIME SCHEDULE - HIMO RIVER SYSTEM

Fig. VIII - 6

WORKS	QUANTITY	1986												1987												1988												1989												
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
A. MAIN CONSTRUCTION WORKS																																																		
I. IRRIGATION CANAL																																																		
Initial Structure																																																		
Excavation	4,200 m ³																																																	
Concrete	295 m ³																																																	
Wet rubble masonry	200 m ²																																																	
Installation of gate	4 sets																																																	
Main Canal																																																		
Excavation	21,100 m ³																																																	
Embankment	22,200 m ³																																																	
Canal lining	2,210 m ²																																																	
Canal structures	L.S.																																																	
Secondary Canal and Farm Pond																																																		
Excavation	14,500 m ³																																																	
Embankment	46,400 m ³																																																	
Canal lining	4,490 m ²																																																	
Canal structures	L.S.																																																	
II. DRAINAGE CANALS																																																		
Secondary Drain, Excavation	30,800 m ³																																																	
Catch Drain, Excavation	14,400 m ³																																																	
Related structures	L.S.																																																	
III. FARM ROADS																																																		
Main Farm Road, Embankment	52,000 m ³																																																	
Secondary Farm Road, Embankment	42,800 m ³																																																	
B. ON - FARM DEVELOPMENT WORKS																																																		
I. TERTIARY CANAL																																																		
Excavation	9,700 m ³																																																	
Embankment	156,000 m ³																																																	
Related structures	L.S.																																																	
II. TERTIARY DRAIN																																																		
Excavation	70,000 m ³																																																	
III. TERTIARY FARM ROAD																																																		
Embankment	80,900 m ³																																																	
IV. LAND LEVELLING																																																		
Land clearing	60 ha																																																	
Earth moving	309,000 m ³																																																	
V. FIELD DITCH DRAIN AND ROAD																																																		
Excavation	980 ha																																																	

ANNEX IX

PROJECT EVALUATION

FEASIBILITY REPORT
ON
THE LOWER-MOSHI AGRICULTURAL DEVELOPMENT PROJECT

ANNEX IX PROJECT EVALUATION

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ANNEX IX

PROJECT EVALUATION

1. General

The economic viability of the proposed agricultural development is found by estimating the internal rate of return (IRR) for four irrigation systems individually and also for the total project. In this evaluation, the sensitivity analysis is also made, aiming to assess the elasticity range of the project under changed conditions due to various causes, such as over-running the project cost, delaying the attainment to production target, drop in the market prices of crops etc. In addition, the financial evaluation of the proposed development is made by analysing the capacity to pay for the water charges at the farm level.

2. Project Cost and Benefit

2.1 Basic Consideration for Cost and Price Prospects

The prospective costs and prices of farm products, farm inputs, construction materials and equipment, etc. are studied to assess the economic and financial prices for the purpose of evaluating both economic and financial viabilities of the Project. In this context, all the conversions between the local currency portion (L.C.: Shillings or Shs) and foreign currency portion (F.C.: U.S. Dollars or US\$) are made at the exchange rate of Shs 8.18 equal to US\$1.0 in terms of the financial prices, and at Shs 8.92 equal to US\$1.0 in terms of the economic prices, taking into account the shadow price factor (SPF) at 1.09. In addition, in the capitalization of the project cost, the annual price escalations at 7.5% and 10.0% are preliminarily applied particularly to the construction materials and equipment to be imported (F.C portion) and local materials and labour wages (L.C portion), respectively, based on reference to the projection made by IBRD on world market inflation.

2.1.1 Economic prices

As stated in Annex VI, economic farm gate prices of crop production and farm inputs are estimated based on the projected international market price forecasted by IBRD in the short term range for 1985 and in the long term range for 1990 based on 1977 constant U.S. Dollars.

The economic prices of the construction materials and equipment to be imported from abroad are estimated based on the CIF prices in Dar es Salaam which are preliminarily converted from the present FOB prices in Japan, and cost/price related to the inland transportation between Dar es Salaam and Moshi. In this context, the border prices are converted to local currency by applying the shadow price factor at 1.09.

As for the local materials, labour wages, etc. related to the construction and farming practices, the present market price is directly taken into account.

2.1.2 Financial prices

The present prices of agricultural commodities are controlled and/or subsidized in certain extent by the Government. However, the prospective financial prices of them are estimated on the basis of the current market price, so as to realistically assess the financial feasibility of Project.

As far as the construction cost is concerned, the financial prices are also estimated based on the current market prices in March, 1980.

2.2 Project Cost

The project cost is the capital investment for the project implementation. The cost estimates include the cost for (1) preparatory works, (2) civil works of major facilities and on-farm development, (3) general administrative management, (4) procurement of O&M machinery and equipment, (5) engineering services and (6) price and physical contingencies.

2.2.1 Economic cost

The economic cost of the Project is as shown in Tables IX-1 and IX-2, and summarized below:

<u>Economic Cost</u>	
<u>Major Irrigation Systems</u>	<u>Total Cost (Ts x 10³)</u>
Rau River System ^{/1}	93,780
Miwaleni Pump Scheme	124,860
Kimo River System ^{/2}	45,300
Groundwater System ^{/3}	72,750
(Sub-total) ^{/4}	336,690
<u>Total Related Costs</u>	<u>115,560</u>
<u>Total</u>	<u>452,250</u>

Note: ^{/1}; The system includes the Upper Mabogini, Mabogini, Rau ya Kati, and Chekereni schemes.

^{/2}; The system includes the Makuyuni and Ghona/Kileo schemes.

^{/3}; The scheme consists of the North and East groundwater schemes.

^{/4}; The costs include the O & M equipment, engineering services, administration expenses, office and quarters and physical contingency.

In the above economic costs, the physical contingency is estimated at 10% of the basic cost inclusive of engineering services.

2.2.2 Financial cost

On the basis of the cost/price at the current market price level in early 1980, the financial costs are capitalized to Ts 632.69 million including price contingency as shown in Tables IX-3 and IX-4. In this estimation, the physical contingency also include 10% of the basic cost.

2.2.3 O&M and Replacement cost

The annual operation and maintenance cost as well as the replacement costs of the Project facilities, such as O & M equipment, pump and motor, discharge pipeline, gate, etc. estimated in Annex VIII are about Ts $5,518 \times 10^3$ at the full development stage of the Project in terms of the financial prices.

The economic O & M costs are estimated at Shs $4,170 \times 10^3$ as shown in Table IX-5.

2.3 Project Benefits

The project benefits to be anticipated from the Project implementation are evaluated in terms of both direct and indirect benefits.

The direct benefits will come from the increment of crop production with irrigation development, flood protection and drainage improvement. The indirect benefits are generally intangible, and can be anticipated from their contribution to (1) saving foreign exchange particularly for the importation of food crops, (2) rural and regional economy and other sociological impacts with particular increase in the labour opportunity, and (3) greatly raising and enhancing the land value particularly in the lowlying area.

2.3.1 Direct benefits

The direct benefits herein defined are the primary benefits to be attributed to Project implementation. Based on the projection made of the crop production and price prospects in Annex VI (Tables VI-74 and VI-75), the anticipated annual incremental net production values in each irrigation system are estimated in terms of economic prices as shown in Table IX-6.

2.3.2 Indirect benefits

The indirect benefits are the secondary profits to be anticipated from the project implementation. Most of these are, however, intangible in general, but their contributions to the rural and national economy are highly valued.

(1) Increase of Internal Exchanges
and Saving in Foreign Exchanges

As stated previously in Annex VI, the rice production in the Region is small at present, and thus, supplemented by some 4,000 tons of imported rice. In the future-with the Project, it is anticipated that a large increment of rice production in the project area will not only contribute to the attainment of regional self-sufficiency in rice but well also help meet the national demand for rice to a certain extent. As a result, the present foreign exchange necessary for rice import could be saved and internal exchanges will also be extended as well. In addition, an increment of oil-seeds production will contribute to both external and internal trade and also induce the agro-industrial development in the region.

With the realization of the Project, paddy rice and oil-seeds production will increase to about 16,850 tons of paddy rice and 2,060 tons of oil-seeds from the present production of 2,320 tons and 60 tons. The home consumption of paddy rice and oil-seed in the region at present is estimated at 3,000 tons of paddy rice and 1,060 tons of oil-seeds. Therefore, it is expected that the marketable surplus would be about 11,530 tons of paddy rice and about 940 tons of oil-seeds after deducting the home consumption. Thus, the savings of foreign exchange or contribution to the rural and national economy would be US\$6.15 million per annum as follows:

- Marketable surplus in the future (1990)
Annual total increment with the Project - Total home consumption =
Paddy rice; 16,850 tons - (2,320 + 3,000) tons = 11,530 tons
Oil-seeds ; 2,060 tons - (60 1,060) tons = 940 tons
- Prospective savings of foreign exchanges or expansion of internal exchange =
Rice ; 11,530 tons x 0.62 x 750US\$ = US\$5.36 x 10⁶
Oil-seeds ; 940 tons x 1.0 x 840US\$ = US\$0.79 x 10⁶
Total US\$6.15 x 10⁶

Note: US\$750/ton is the unit price of rice CIF Tanga, and
TS840/ton is the oil-seeds FOB Moshi price.

(2) Socio-economic Impacts

The increase of crop production will bring a considerable amount of net profit to farmers. These profits will not only improve the farmers' living standard but also stabilize the rural economy through overall effects on the economic activities.

Improvement of local transportation and communication systems can also be anticipated by the project implementation particularly of the farm road network. This will also contribute to the improvement of rural economic activities including agricultural activities.

A large increase of employment opportunities can be expected by project implementation, and in operation/maintenance works of the project facilities. In addition, employment opportunities will also increase in the agro-business, particularly of oil-milling which might be induced in the Region by the large quantity of oil-seeds production in the Project area.

Through the project implementation and the operation/maintenance works, the people will gain more experience, technical know-how and skillfulness in the various working field. Thus accumulation will provide the motive source for further development in the Kilimanjaro Region.

(3) Enhancing Land Value

Enhancing the land value is one of the biggest indirect benefits attributed to the project implementation. In the proposed development, there are three contributions to land enhancement.

The first one is the large increase of the arable land particularly in the lowlying areas along the Rau and Mue rivers by implementation of the flood control and drainage improvement. Practically, about 1,000 ha in gross of the virgin land will be newly reclaimed and a further 800 ha of the land will become arable since it will be free of the seasonal flood constraints.

Secondly, stabilization of the crop productivity is also a large contribution in this project. As a result of the above, capacity for settlement will increase far beyond that at present.

The third one contribution is the improvement of the social environment, communication and transportation. This will give sufficient incentives to the local people to improve their livelihood.

3. Economic Evaluation

3.1 Internal Rate of Return

On the basis of the project cost and benefits estimated in the above, the internal rate of return (IRR) of the Lower-Moshi Agricultural Development Project is calculated individually for four irrigation systems and for the whole project. In this calculation, economic project benefits are estimated based on the direct benefits derived from the crop production to be attributable to both flood protection and irrigation development. The benefits derived from the livestock production, which will also be incremented to a certain extent with the proposed project implementation, are conceptionally excluded from this evaluation. The calculation is made based on 50 years of the project life starting from 1981 which will be a starting year of the project implementation, and assuming that attainment of the project target is primarily 5 years after completion of the construction works. The results are shown in Tables IX-7 and IX-8 and summarized as follows:

Internal Rate of Return

<u>Irrigation Systems</u>	<u>Internal Rate of Return</u> (%)
Rau River System	15.3
Miwaleni Pump Scheme	12.4
Himo River System	9.8
Groundwater Schemes	8.1
Total Project	12.1

As seen in the above, the Rau River System shows the highest economic viability and is followed by the Miwaleni Pump Schemes. The total project also shows a high IRR, proving the project feasible economically.

3.2 Sensitivity Analysis

In the evaluation of the internal rate of return of the project, sensitivity analysis is also made with respect to the following critical conditions, to test the sensitivity of the project to possible changes in its economic assumptions.

- (1) if the project cost runs over the price and physical contingencies.
- (2) if the market prices decline.
- (3) if the attainment of the Project target is delayed.

Paying attention to the critical conditions above, the sensitivity analysis is made as shown in Table IX-8. As seen in Table IX-8, the elasticity of the Project feasibility for the critical condition is not so sensitive ranging from 7.9 under the most adverse conditions caused by 20% price decline and 20% cost over-run to 12.1 under the normal conditions assumed.

4. Financial Evaluation

The financial viability of the Project is evaluated from the viewpoint of the farmer. In this context, the repayment capability for the capital investment is studied by analysing the capacity to pay for the water charges at the farmers' level.

4.1 Capacity to Pay

As stated in Annex VI, the net production returns estimated in terms of the financial price are at Shs 34.5 million (eqv. US\$4.2 million) in the whole Lower-Moshi area and these returns correspond to about Shs 3,320 (eqv. US\$406) per farm household on average.

As far as the forecast farm economy in the irrigation schemes is concerned, the primary income per farm household is estimated at Shs 4,275 (eqv. US\$523) in the case of the typical paddy grower, and Shs 4,320 (eqv. US\$528) in the case of the typical oil-seeds growers. These are respectively increased about 3.3 times and 5.5 times from the present conditions.

The home consumption of major crop products is estimated about Shs 1,900 (eqv. US\$232) based on the food requirements studied in the previous Section 5.3.1, Annex VI. Thus, deducting the values for home consumption from the primary income of farm households, the forecast capacity to pay is obtained at Shs 2,375 (eqv. US\$290) per annum in case of paddy grower and Shs 2,420 (eqv. US\$295) in case of the typical oil-seeds growers.

4.2 Repayment Capability by Water Charges

In general, it is considered that water charges should be borne by the water users. The water charges collected will be used for the operation and maintenance of the facilities, including replacement cost, and also for the repayment of the capital investment for construction of the facilities.

Up to present, no specific regulation on water charges has been established in Tanzania, and hence, the farmers are now using the irrigation water freely based on traditional rights. In only the rare case, the farmers have recently paid charges of TS 1,000/ha/crop in the dry season for pump operation as seen in the present Mwaleni groundwater irrigation area.

For the proposed irrigation schemes, the water charges were preliminarily studied for the following two cases:

- (1) Water charges as estimated only for repayment on the foreign currency portion of the capital investment. In this context, it is assumed that the repayment conditions be made at an interest rate at 3% per annum and 30 years repayment period including 10 years grace period.
- (2) Water charges as estimated only for payment of the annual operation and maintenance costs as well as the replacement costs.

As seen in Table IX-9, the estimated water charges on the first assumption (1) would be TS 4,790 (eqv. US\$585)/ha/year. corresponding to about twice of the primary capacity to pay in the farmer's economy. As far as the capacity to pay of the farmers is concerned, the rate of water charges is very hard on the farmers.

In the case of assumption (2), the water charge, which is equal to the annual O&M and replacement cost, is estimated at TS 875 (eqv. US\$107)/ha/year. This charge corresponds to about 35% of the primary capacity to pay. The water charges to be collected from the water users should be within a reasonable range in the capacity to pay that could still give sufficient incentives to the farmers for agricultural production increase. In this view, it is anticipated that the farmers could pay the annual operation and maintenance cost, and have the repayment capability for replacement of the project facilities.

4.3 Cash-flow Table

Repayment capability for the Project capital is studied by preparing the cash-flow table based on the anticipated project revenue and the fund requirement. The project revenue is anticipated directly from the water charges (called annual O&M and replacement costs).

For the repayment capability analysis, it is assumed that the capital required for the project implementation be arranged under the following conditions as mentioned in the previous section:

- (1) Foreign currency portion; The capital is financed by bilateral or international organizations with an interest rate of 3% per annum. Repayment period is 30 years including 10 years of grace period.
- (2) Local currency portion; The capital is financed by the budget allocation of the Government as the national investment policy.

With the above assumptions, the analysis is made to clarify how the direct revenue will be able to contribute to repayment the fund and also covering the annual O&M and replacement costs, and to estimate the requirement of special fund for the repayment as the Government subsidy. The results of the analysis are summarized in Table IX-10.

As seen in the Table, the direct revenue collected as the water charges is equal to the annual O&M and replacement costs. The amount for the loan repayment is estimated at TS 30.32 million (eqv. US\$3.7 million) per annum or TS 4,800/ha (eqv. US\$586/ha) per annum during the repayment period. This annual repayment would be subsidized by the Government. In consideration of the indirect revenue for the Government from the Project, it would be able to allocate the subsidy in the national budget. Particularly, saving of the foreign exchanges described before could be anticipated to be allocated to the loan repayment indirectly.

Table IX-1

SUMMARY OF ECONOMIC COST

ITEM	ECONOMIC COST (10 ³ TS)
1. Preparatory Works	<u>10,130</u>
2. Main Construction Works	<u>208,510</u>
- Rau river system	54,040
- Miwaleni pump lift scheme	81,540
- Himo river system	26,390
- Groundwater system	46,540
3. On-Farm Development Works	<u>128,180</u>
- Rau river system	39,740
- Miwaleni pump lift scheme	43,320
- Himo river system	18,910
- Groundwater system	26,210
4. Office and Quarters	<u>13,320</u>
<u>Sub-total</u>	<u>360,140</u>
5. O & M Equipment	<u>6,840</u>
6. Administration Expenses	<u>7,500</u>
7. Engineering Expenses	<u>36,650</u>
8. Physical Contingency	<u>41,120</u>
TOTAL	452,250

Table IX-2
ANNUAL DISBURSEMENT SCHEDULE OF ECONOMIC COST

	(Unit: 10 ³ TS)								
	TOTAL	1981	1982	1983	1984	1985	1986	1987	1988
1. Preparatory Works	<u>10,130</u>	-	5,020	5,110	-	-	-	-	-
2. Main Construction Works	<u>208,510</u>								
Rau River System	54,040	-	-	22,180	21,810	10,050	-	-	-
Mivaleni Pump Lift Scheme	81,540	-	-	-	46,360	30,180	4,030	970	-
Himo River System	26,390	-	-	-	-	-	11,100	13,000	2,290
Groundwater System	46,540	-	-	3,300	10,720	13,030	11,580	6,560	1,350
3. On-farm Development Works	<u>128,180</u>								
Rau River System	39,740	-	-	9,990	13,880	15,870	-	-	-
Mivaleni Pump Lift Scheme	43,320	-	-	-	6,480	16,480	16,480	3,880	-
Himo River Scheme	18,910	-	-	-	-	-	4,870	11,240	2,800
Groundwater System	26,210	-	-	1,880	3,680	6,250	6,250	6,250	1,900
4. Office and Quarters	<u>13,320</u>	-	13,320	-	-	-	-	-	-
Sub-total	<u>360,140</u>	-	18,340	42,460	102,930	91,860	54,310	41,900	8,340
5. O & M Equipment	<u>6,840</u>	-	1,610	-	-	5,230	-	-	-
6. Engineering Services and Administration Expenses	<u>44,150</u>	5,910	5,680	6,510	7,060	6,350	5,810	5,810	1,020
7. Physical Contingency	<u>41,120</u>	600	2,580	4,900	10,990	10,350	6,010	4,760	930
TOTAL	<u>452,250</u>	6,510	28,210	53,870	120,980	113,790	66,130	52,470	10,290

Table IX-3

SUMMARY OF FINANCIAL COST

ITEM	(Unit: 10 ³ TS)	
	FOREIGN CURRENCY	LOCAL CURRENCY
1. Preparatory Works	<u>6,630</u>	<u>2,900</u>
2. Main Construction Works	<u>120,920</u>	<u>76,710</u>
- Rau river system	29,360	22,040
- Mivaleni pump lift scheme	49,830	27,230
- Himo river system	14,390	10,700
- Ground water system	27,340	16,740
3. On-farm Development Works	<u>71,530</u>	<u>50,220</u>
- Rau river system	22,720	14,980
- Mivaleni pump lift scheme	24,060	17,090
- Himo river system	10,270	7,720
- Ground water system	14,480	10,430
4. Office and Quarters	<u>3,270</u>	<u>9,760</u>
Sub-total	<u>202,350</u>	<u>139,590</u>
6. O&M Equipment	<u>6,000</u>	<u>300</u>
7. Engineering Services and Administration Expenses	<u>33,620</u>	<u>7,500</u>
8. Contingencies	<u>133,570</u>	<u>109,760</u>
- Physical contingency	24,200	14,740
- Price contingency	109,370	95,020
TOTAL	375,540	257,150

- Note: 1. Exchange rate; 1 US\$ = 8.18 TS = 250 Yen
2. Interest during the construction is not included in the above estimate.
3. Price contingencies are estimated on the basis of yearly rate of 7.5% for foreign currency and 10.0% for local currency, respectively.

Table IX-4

ANNUAL DISBURSEMENT SCHEDULE OF FINANCIAL COST

Units: FC: 10⁷ US\$
LC: 10⁷ TS

DESCRIPTION	1981		1982		1983		1984		1985		1986		1987		1988		
	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	FC	LC	
1. Preparatory Works	810	2,900	-	-	400	1,450	410	1,450	-	-	-	-	-	-	-	-	-
2. Main Construction Works																	
- Rau river system	3,590	22,040	-	-	-	-	1,475	9,040	1,430	9,040	685	3,960	-	-	-	-	-
- Mivaleni pump lift scheme	6,092	27,230	-	-	-	-	-	3,465	15,470	2,250	10,110	300	1,360	77	290	-	-
- Himo river system	1,759	10,700	-	-	-	-	-	-	-	-	-	740	4,500	870	5,240	149	960
- Groundwater system	3,343	16,740	-	-	-	-	240	1,170	770	3,850	935	4,690	830	4,180	500	2,120	68
3. On-farm Development Works																	
- Rau river system	2,778	14,980	-	-	-	-	700	3,750	970	5,240	1,108	5,990	-	-	-	-	-
- Mivaleni pump lift scheme	2,941	17,090	-	-	-	-	-	440	2,560	1,120	6,490	1,120	6,490	261	1,550	-	-
- Himo river system	1,255	7,720	-	-	-	-	-	-	-	-	-	320	2,010	750	4,550	185	1,160
- Groundwater system	1,770	10,430	-	-	-	-	130	750	250	1,460	420	2,500	420	2,500	420	2,500	130
4. Office and Quarters	400	9,760	-	-	400	9,760	-	-	-	-	-	-	-	-	-	-	-
Sub-total (Item 1 to 4)	24,738	139,500	-	-	800	11,210	2,955	16,140	7,325	37,620	6,518	31,740	3,730	21,040	2,878	16,250	532
5. O & M Equipment	734	300	-	-	172	80	-	-	-	-	562	220	-	-	-	-	-
6. Engineering Services and Administration Expenses	4,110	7,500	640	200	615	200	595	1,200	635	1,400	555	1,400	495	1,400	495	1,400	80
7. Physical Contingency	2,958	14,740	65	20	160	1,150	355	1,730	795	3,900	764	3,540	423	2,240	335	1,770	61
Sub-total (Item 1 to 7)	32,540	162,130	705	220	1,747	12,640	2,905	19,070	8,755	42,920	8,399	38,900	4,648	24,680	3,708	19,420	672
8. Price Contingency	13,370	95,020	53	22	272	2,658	946	6,310	2,940	19,920	3,660	23,750	2,528	19,040	2,444	18,420	527
TOTAL	45,910	257,150	758	242	2,019	15,298	4,851	25,380	11,695	62,840	12,059	62,650	7,176	43,720	6,152	37,840	1,200

Table IX-

Table IX-5 ANNUAL OPERATION AND MAINTENANCE COST - ECONOMIC BASIS

(Unit: 10³TS)

SYSTEM	1984	1985	1986	1987	1988
Rau River System	203	486	810	810	810
Mivaleni Pump Lift Scheme			1,023	1,705	1,705
Himo River System				154	378
Groundwater System		250	501	876	1,277
TOTAL	203	736	2,334	3,545	4,170

Table IX-6 ANNUAL NET INCREMENTAL BENEFIT - ECONOMIC BASIS

(Unit: 10³TS)

SYSTEM	1984	1985	1986	1987	1988	1989	1990	1991	1992
Rau River System	3,845	9,867	17,556	20,119	22,683	24,605	25,630	25,630	25,630
Mivaleni Pump Lift Scheme			9,637	17,668	20,346	23,022	25,699	26,770	26,770
Himo River System				1,807	4,728	5,467	6,205	6,943	7,380
Groundwater System		1,218	2,639	4,871	7,529	8,563	9,396	10,024	10,350
TOTAL	3,845	11,085	29,832	44,465	55,286	61,657	66,930	69,367	70,130

Table IX-5
Table IX-6

Table IX-7 CASHFLOW FOR INTERNAL RATE OF RETURN CALCULATION

(Unit: 10³ TS)

YEAR	ECONOMIC COST			SUB-TOTAL	BENEFIT
	CONSTRUCTION	REPLACEMENT	O & M		
1981	6,510	0	0	6,510	0
1982	28,210	0	0	28,210	0
1983	53,870	0	0	53,870	0
1984	120,980	0	203	121,183	3,845
1985	113,790	0	736	114,526	11,085
1986	66,130	0	2,334	68,464	29,832
1987	52,470	0	3,545	56,015	44,465
1988	10,290	0	4,170	14,460	55,286
1989	0	0	4,170	4,170	61,657
1990	0	5,617	4,170	9,787	66,930
1991	0	0	4,170	4,170	69,367
1992	0	0	4,170	4,170	70,130
1993	0	0	4,170	4,170	70,130
1994	0	0	4,170	4,170	70,130
1995	0	5,617	4,170	9,787	70,130
1996	0	0	4,170	4,170	70,130
1997	0	0	4,170	4,170	70,130
1998	0	0	4,170	4,170	70,130
1999	0	0	4,170	4,170	70,130
2000	0	5,617	4,170	9,787	70,130
2001	0	0	4,170	4,170	70,130
2002	0	0	4,170	4,170	70,130
2003	0	0	4,170	4,170	70,130
2004	0	0	4,170	4,170	70,130
2005	0	5,617	4,170	9,787	70,130
2006	0	0	4,170	4,170	70,130
2007	0	0	4,170	4,170	70,130
2008	0	0	4,170	4,170	70,130
2009	0	0	4,170	4,170	70,130
2010	0	39,766	4,170	43,936	70,130
2011	0	0	4,170	4,170	70,130
2012	0	0	4,170	4,170	70,130
2013	0	0	4,170	4,170	70,130
2014	0	0	4,170	4,170	70,130
2015	0	5,617	4,170	9,787	70,130
2016	0	0	4,170	4,170	70,130
2017	0	0	4,170	4,170	70,130
2018	0	0	4,170	4,170	70,130
2019	0	0	4,170	4,170	70,130
2020	0	5,617	4,170	9,787	70,130
2021	0	0	4,170	4,170	70,130
2022	0	0	4,170	4,170	70,130
2023	0	0	4,170	4,170	70,130
2024	0	0	4,170	4,170	70,130
2025	0	5,617	4,170	9,787	70,130
2026	0	0	4,170	4,170	70,130
2027	0	0	4,170	4,170	70,130
2028	0	0	4,170	4,170	70,130
2029	0	0	4,170	4,170	70,130
2030	0	5,617	4,170	9,787	70,130

IRR = 12.1 %

Table IX-8 ECONOMIC EVALUATION OF THE PROJECTS

1. Economic Internal Rate of Return : 12.1%

2. Sensitivity Analysis

COST OVER-RUN	INTERNAL RATE OF RETURN (%)			
	Production or Price Decline			Target Attainment Delay
	0	-10%	-20%	3 years
0	12.1	10.9	9.7	11.7
+10%	11.0	9.9	8.7	10.7
+20%	10.1	9.0	7.9	9.8

3. Economic Evaluation of Each System

SYSTEM	INTERNAL RATE OF RETURN (%)
1. Rau River System	15.3
2. Mivaleni Pump Lift Scheme	12.4
3. Himo River System	9.8
4. Groundwater Schemes	8.1

Table IX-9

PRELIMINARY ESTIMATE OF WATER CHARGES

<u>Years</u>	<u>Total Capital Investment</u>		<u>Total</u> (TSx10 ³)
	<u>Local Currency</u> <u>Portion</u> (TSx10 ³)	<u>Foreign Currency</u> <u>Portion</u> (eqv. TSx10 ³)	
1981	242	6,200	6,442
1982	15,298	11 16,520	31,818
1983	25,380	39,680	65,060
1984	62,840	95,660	158,500
1985	62,650	98,640	161,290
1986	43,720	58,700	102,420
1987	37,840	50,320	88,160
1988	9,180	9,820	19,000
1989	-	-	-
1990	(307,860)	(451,010)	(758,870)

Note: Figures in parentheses are the total cost capitalized for 1990 in calendar year by 3% per annum of interest.

Assumption I: Annual equivalent to the repayment of foreign currency (3% in interest, 30 years including 10 years of grace period)

$$\text{Eqv. TS } 451,010 \times 10^3 \times \frac{0.03}{1 - (1 + 0.03)^{-20}} = \text{TS } 30,315 \times 10^3$$

$$\text{TS } 30,315 \times 10^3 \times 1/6,320 \text{ ha} = \underline{\text{TS } 4,800/\text{ha}}$$

Assumption II: O&M cost and replacement cost to be required annually at the full development stage of the Project.

$$\text{Annual requirement: TS } 5,518 \times 10^3$$

$$\text{TS } 5,518 \times 10^3 \times 1/6,320 \text{ ha} = \text{Shs } 873/\text{ha}$$

$$\div \underline{\text{Shs } 875/\text{ha}}$$

CASHFLOW STATEMENT

Table IX-10

Unit: 10³ TS

Year	PROJECT INVESTMENT			CASH OUTFLOW				CASH INFLOW				BALANCE OF CASH PLAN	
	P.C.	L.C.		REPLACEMENT COST	O & M COST	LOAN REPAYMENT	TOTAL	LOAN ARRANGEMENT	GOVERNMENT BUDGET	WATER CHARGE /2	LOAN REPAYMENT		GOVERNMENT SUBSIDY PART OF REPLACEMENT COST
1981	6,200	242		-	-	-	6,422	242		-	-	-	6,442
82	16,520	15,298		-	-	-	31,818	15,298		-	-	-	31,818
83	39,680	25,380		-	-	-	65,060	25,380		-	-	-	65,060
84	95,660	62,840		203	203	-	158,703	62,840		203	-	-	158,703
85	98,640	62,650		1,348 (238)/2	736	-	163,374	62,650		974	1,110	-	163,374
86	58,700	43,720		1,348 (754)/2	2,334	-	106,102	43,720		3,088	594	-	106,102
87	50,320	37,840		1,348 (1,146)/2	3,545	-	93,053	37,840		4,691	202	-	93,053
88	9,820	9,180		1,348	4,170	-	24,518	9,180		5,518	-	-	24,518
89	-	-		1,348	4,170	-	5,518	-		5,518	-	-	5,518
1990	(451,030)/1			(5,154)/2	4,170	-	5,518	-		5,518	-	-	5,518
91				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
92				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
93				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
94				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
95				(5,154)/2	4,170	30,320	35,838	-		5,518	30,320	-	35,838
96				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
97				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
98				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
99				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
2000				(5,154)/2	4,170	30,320	35,838	-		5,518	30,320	-	35,838
01				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
02				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
03				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
04				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
05				(5,154)/2	4,170	30,320	35,838	-		5,518	30,320	-	35,838
06				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
07				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
08				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
09				1,348	4,170	30,320	35,838	-		5,518	30,320	-	35,838
2010				(36,483)/4	4,170	30,320	5,518	-		5,518	30,320	-	35,838

1/ Compound amount of investment for foreign currency.
 2/ Annual replacement cost collected from farmers.
 3/ Replacement cost or compound amount of annual replacement cost for O & M equipment.
 4/ Replacement cost or compound amount of annual replacement cost for O & M and other project equipment.
 5/ Inclusive of replacement cost and O & M cost to be collected from farmers.

