Table IX-1 Comparison of Design Values between Site-A and Site-B

Case		Site - A			Site - B		
		A - 1	A - 2	A - 3	B - 1	B - 2	B - 3
Crest elevation of weir		EL. 9.0	10.0	11.0	9.0	10.0	11.0
Emergency flood water discharge $Q = 650\ m^3/sec$ Water level in downstream WL. 12.75 m	Allowable water level in upstream	WL. 13.0	13.0	13.0	13.0	13.0	13.0
	Maximum overflow water depth	4.0	3.0	2.0	4.0	3.0	2.0
	Water depth in downstream from crest of weir	3.75	2.75	1.75	3.75	2.75	1.75
	Minimum width of weir	WL. 12.0	12.0	12.0	12.0	12.0	12.0
Maximum ordinary discharge $Q = 91\ m^3/sec$	Allowable water level in upstream	WL. 12.0	12.0	12.0	12.0	12.0	12.0
	Maximum overflow water depth	3.0	2.0	1.0	3.0	2.0	1.0
	Minimum width of weir	9.3	19.0	60.0	9.3	19.0	60.0
Actual width of weir		70	110	200	220	220	220
Actual overflow water depth	Emergency flood water discharge	3.90	2.90	1.90	3.77	2.78	1.83
	Maximum ordinary water discharge	0.93	0.70	0.47	0.43	0.43	0.43
Actual water level in upstream	Emergency flood water discharge	WL. 12.9	12.9	12.9	12.77	12.78	12.83
	Maximum ordinary water discharge	WL. 9.93	10.7	11.47	9.43	10.43	11.43

Table IX-2 Work Quantities and Costs of Diversion Weir

Work	Unit	Work Quantities						Costs (US$ 1,000)					
		Site - A			Site - B			Site - A			Site - B		
		A - 1	A - 2	A - 3	B - 1	B - 2	B - 3	A - 1	A - 2	A - 3	B - 1	B - 2	B - 3
Weir													
Concrete Type A	m3	2,750	2,750	2,750	3,100	3,100	3,100	154	154	154	174	174	174
Concrete Type B	"	5,500	9,200	17,900	24,000	26,000	28,100	275	460	895	1,200	1,300	1,405
Reinforcement bar	ton	220	220	220	250	250	250	117	117	117	133	133	133
Concrete form	m2	5,830	6,380	8,030	8,500	9,000	9,600	29	32	40	43	45	48
Rock riprap	m3	4,070	4,840	6,270	6,300	6,300	6,300	85	102	132	132	132	132
Rock excavation	"	17,800	27,200	47,200	4,200	4,200	4,200	96	147	255	23	23	23
Excavation	"	342,600	431,400	706,200	55,400	55,400	55,400	445	561	1,035	72	72	72
(Sub-total)								(1,201)	(1,573)	(2,628)	(1,777)	(1,879)	(1,987)
Dike													
Excavation	m3	100,000	100,000	100,000	-	-	-	130	130	130	-	-	-
Embankment	"	426,000	426,000	426,000	-	-	-	1,704	1,704	1,704	-	-	-
Rock riprap	"	13,400	13,400	13,400	-	-	-	281	281	281	-	-	-
Sod facing	m2	34,800	34,800	34,800	-	-	-	17	17	17	-	-	-
(Sub-total)								(2,132)	(2,132)	(2,132)			
Cofferdam													
Concrete Type A	m3	-	-	-	900	900	900	-	-	-	50	50	50
Reinforcement bar	ton	-	-	-	55	55	55	-	-	-	29	29	29
Concrete form	m2	-	-	-	700	700	700	-	-	-	4	4	4
Embankment	m3	15,000	15,000	15,000	30,000	30,000	30,000	30	30	30	72	72	72
(Sub-total)								(30)	(30)	(30)	(155)	(155)	(155)
						Total :		3,363	3,735	4,790	1,932	2,034	2,142

Table IX-3 Work Quantities and Costs of Main Irrigation Canal

Work	Unit	Work Quantities						Costs (US$ 1,000)					
		Site - A			Site - B			Site - A			Site - B		
		A - 1	A - 2	A - 3	B - 1	B - 2	B - 3	A - 1	A - 2	A - 3	B - 1	B - 2	B - 3
(Length)	Km	48	48	52	48	48	52						
Excavation	10^3 m^3	3,540	3,230	2,902	3,890	3,320	3,100	4,602	4,199	3,773	5,057	4,316	4,030
Embankment	"	790	940	1,070	920	1,000	1,230	1,580	1,880	2,140	1,840	2,000	2,460
						Total :		6,128	6,079	5,913	6,897	6,316	6,490

Table IX-4 Compensation Costs

Item	Unit	Areas to be submerged						Compensation Costs (US$ 1,000)					
		Site - A			Site - B			Site - A			Site - B		
		A - 1	A - 2	A - 3	B - 1	B - 2	B - 3	A - 1	A - 2	A - 3	B - 1	B - 2	B - 3
Paddy field	ha	11	14	17	9	12	16	18	23	28	15	20	27
Upland crop field	"	2	2	2	-	2	2	3	3	3	-	3	3
Waste land	"	78	90	105	67	80	100	21	25	29	18	22	28
Plantation	"	96	120	148	72	100	120	76	95	117	57	79	95
House yard	10^3 m^2	20	34	49	6	24	45	208	354	510	62	250	469
						(Sub-total)		(326)	(500)	(687)	(152)	(374)	(622)
					Administration charge (1.5% x Sub-total)			5	8	10	2	6	9
						Total :		331	508	697	154	380	631

Fig. IX-7 Backwater Curve

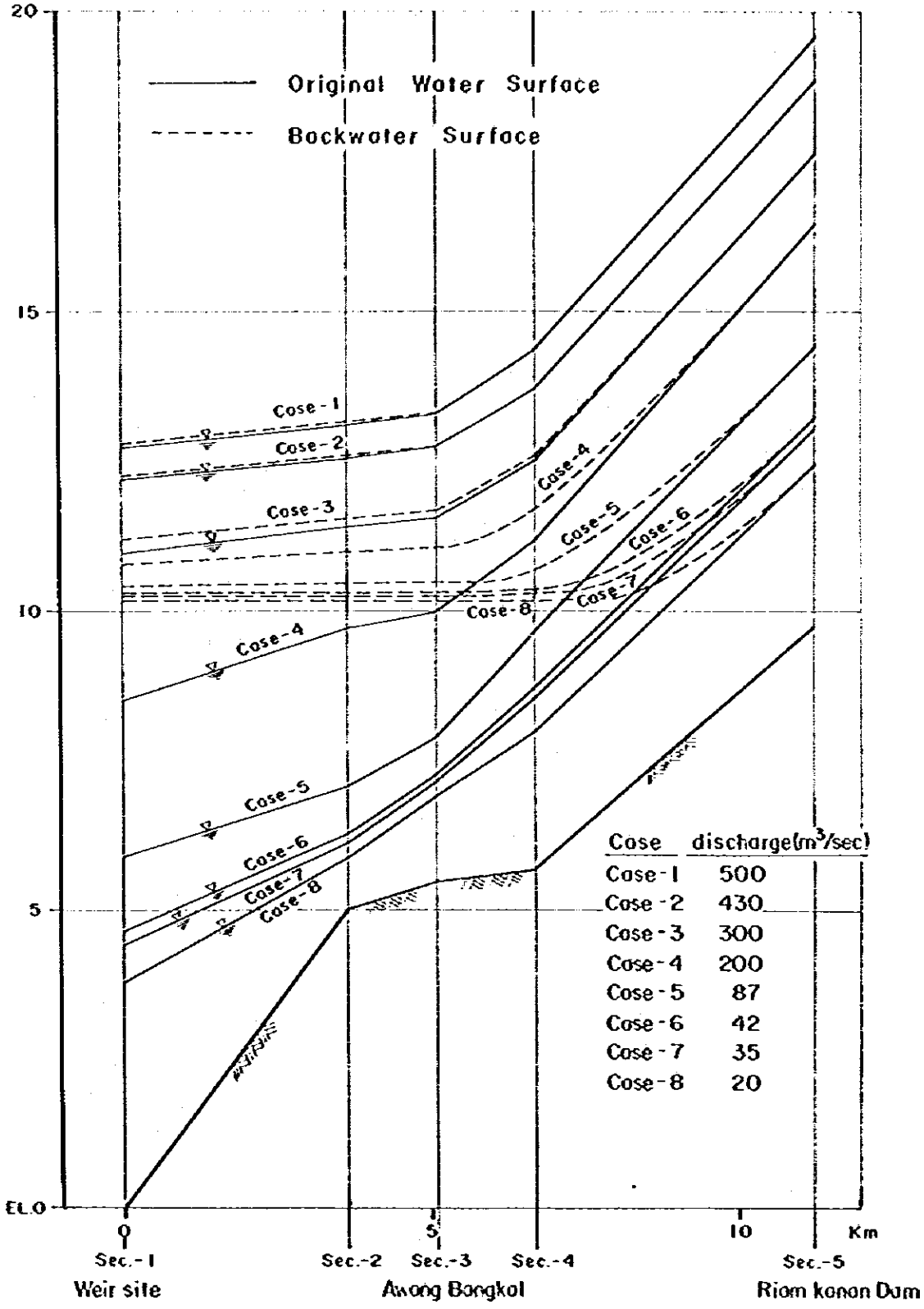
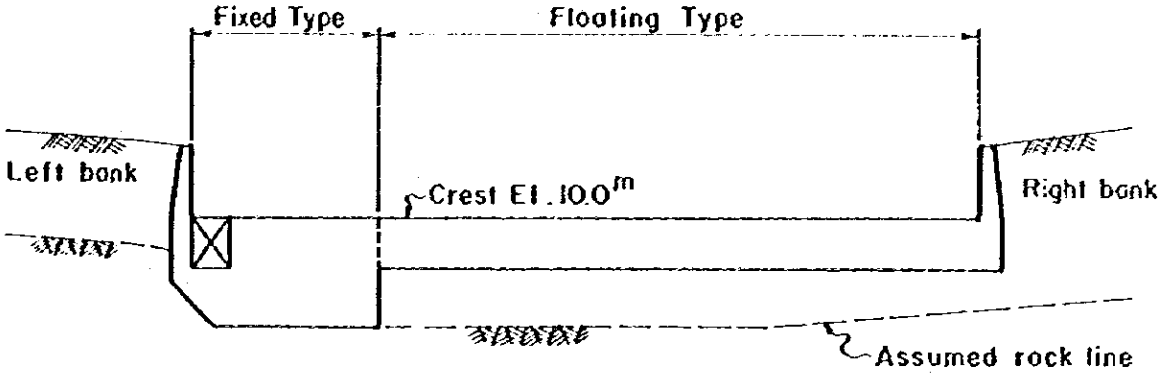


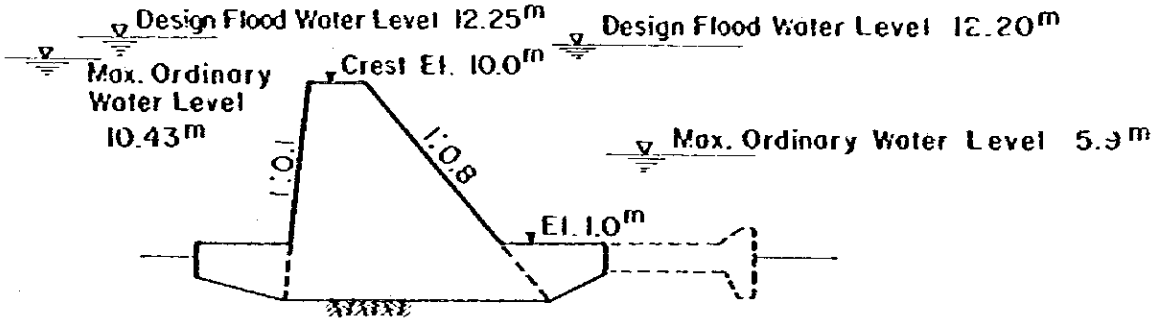
Table IX-5 Stability Analysis of Weir

Section	Water level in upstream	M (t.m)	V (t)	H (t)	L (m)	Stability for falling: $e = \frac{M}{V} - \frac{L}{2}$ (m)	Stability for falling: $\frac{L}{6}$ (m)	Stability for sliding: $1.2 \frac{H}{V}$	Stability for sliding: f	Land reaction: $\frac{V}{L}(1 \pm \frac{6e}{L})$ (t/m²)	Land reaction: Qa (t/m²)
Section-1	WL 10.00 m	1,721.1	232.0	112.6	14.7	0.07	2.45	0.58	0.7	15.8	80
	HWL 10.43 m	1,557.3	230.8	50.5	14.7	0.6	2.45	0.29	0.7	19.5	80
	FWL 12.25 m	1,274.8	234.2	0.6	14.7	1.9	2.45	0.01	0.7	28.3	80
Section-2	WL 10.00 m	198.7	51.8	25.3	7.2	0.64	1.2	0.49	0.7	11.3	30
	HWL 10.43 m	147.5	43.4	18.8	7.2	0.2	1.2	0.52	0.7	7.0	30
	FWL 12.25 m	114.0	39.2	0.3	7.2	0.7	1.2	0.01	0.7	8.6	30

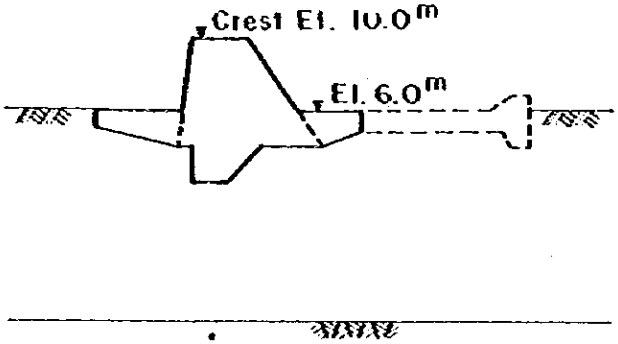
M : Total moments on the weir
V : Total vertical loads (ton)
H : Total horizontal loads (ton)
L : The bottom length of the weir
e : Eccentricity
f : Coefficient of friction
Qa : Bearing capacity

Fig. IX-8 Stability Analysis of Weir



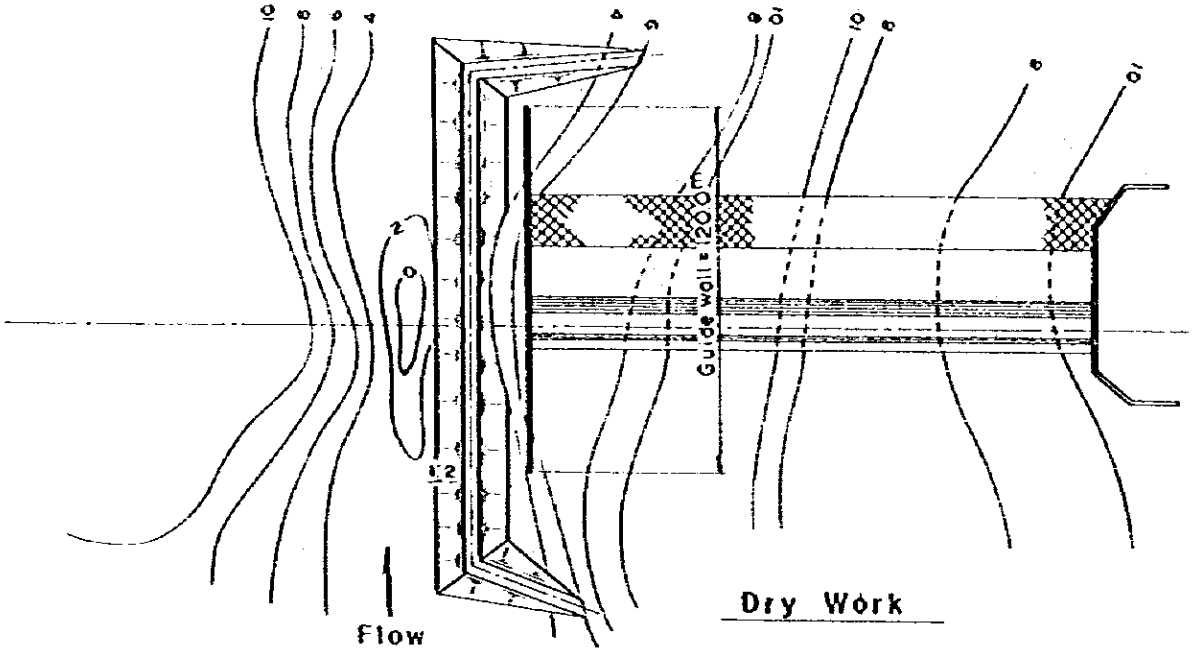


Section-1 (Fixed Type)

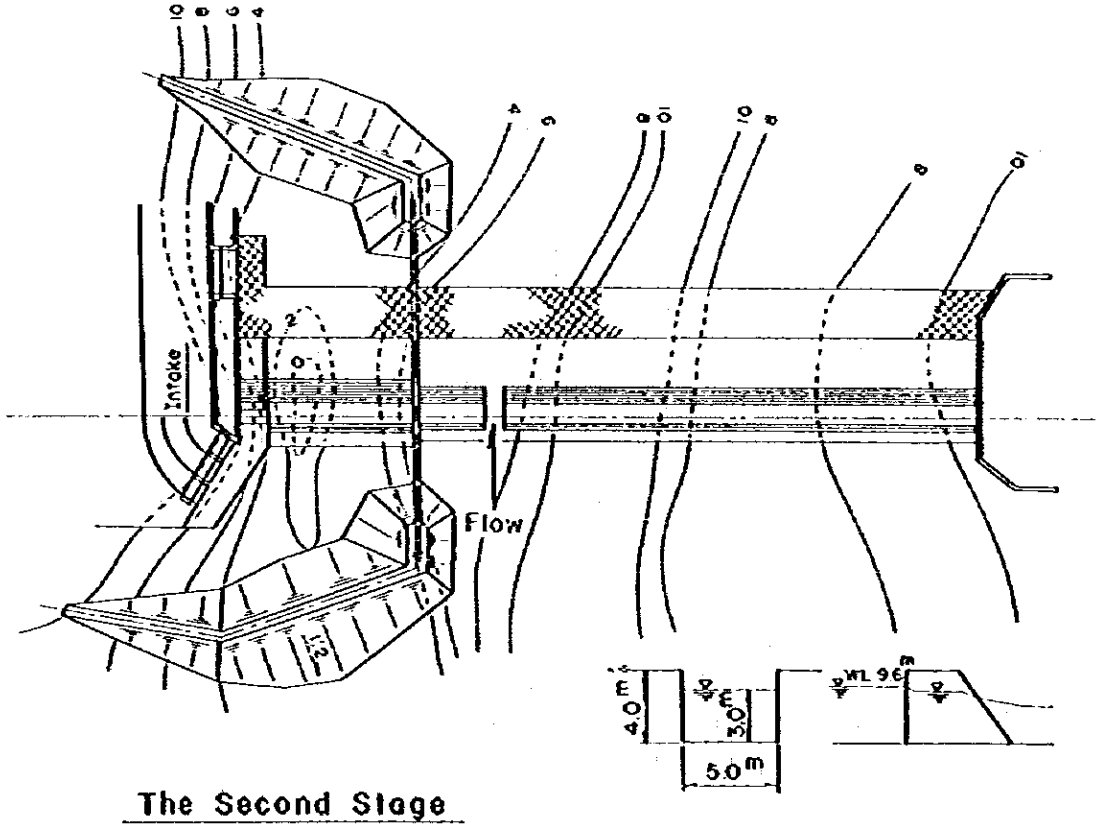


Section-2 (Floating Type)

Fig. IX-9 Plan of Coffering Works

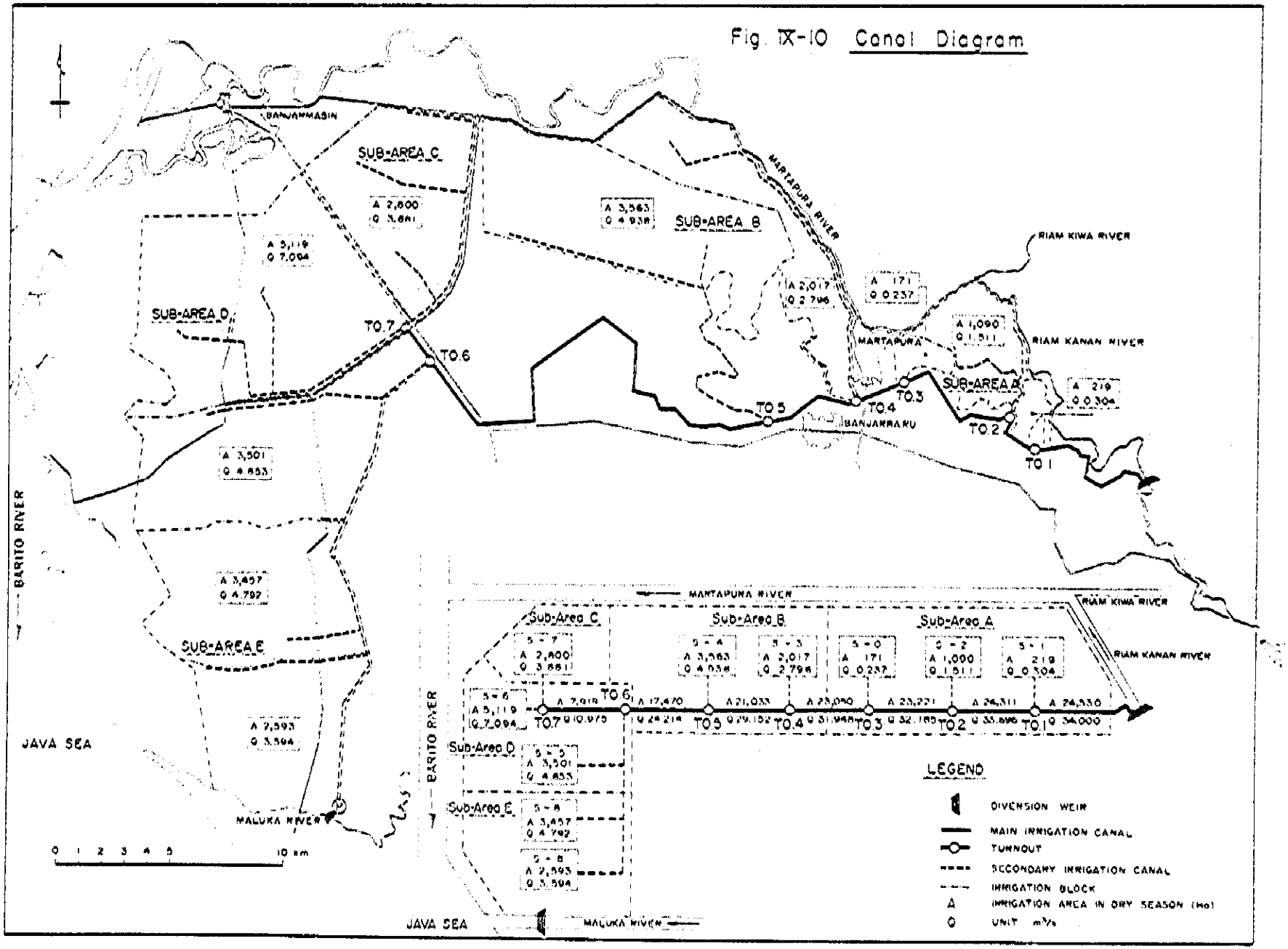


The First Stage



The Second Stage

Fig. IX-10 Canal Diagram



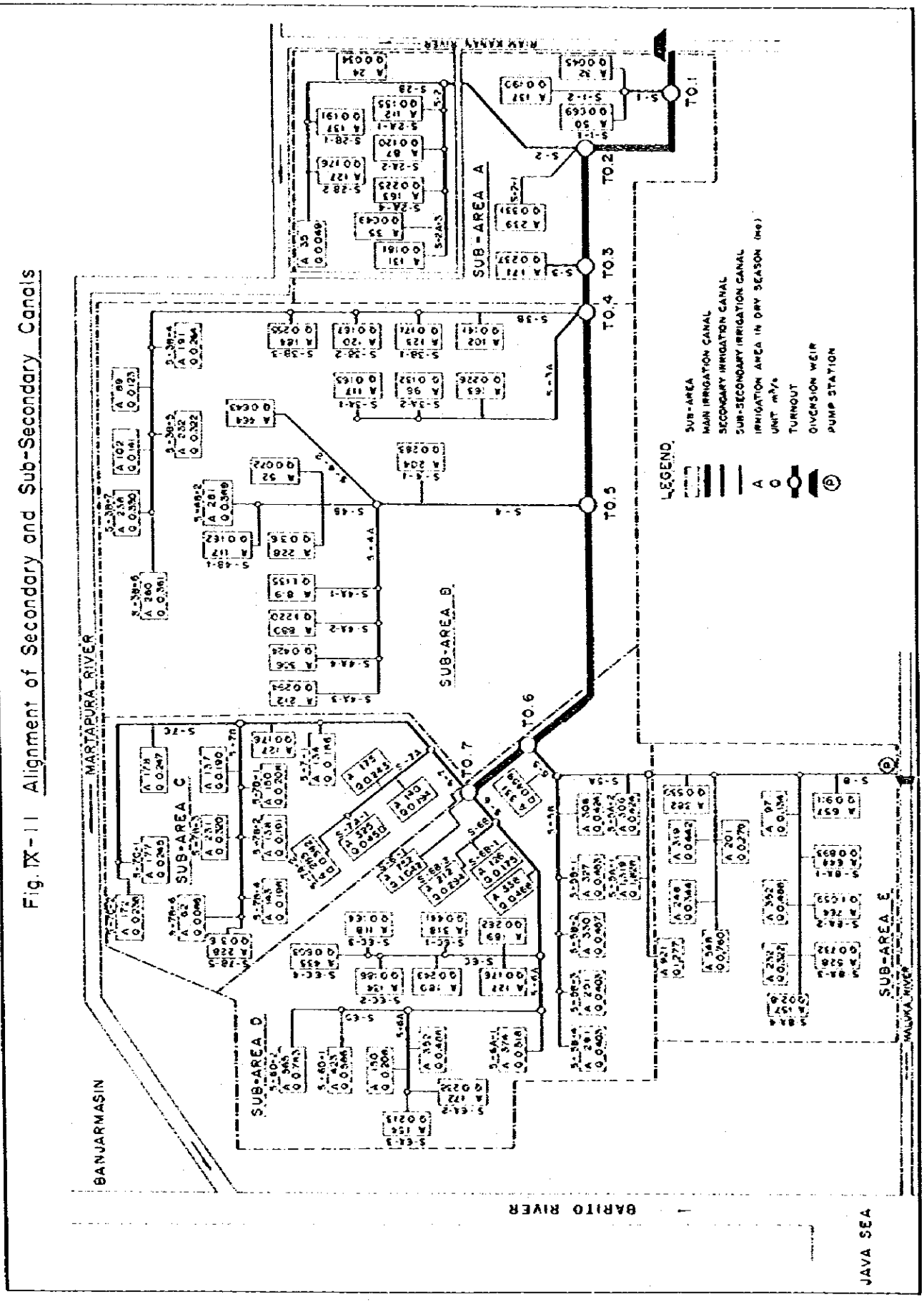


Fig. IX-11 Alignment of Secondary and Sub-Secondary Canals

Fig. IX-12 Drain Diagram

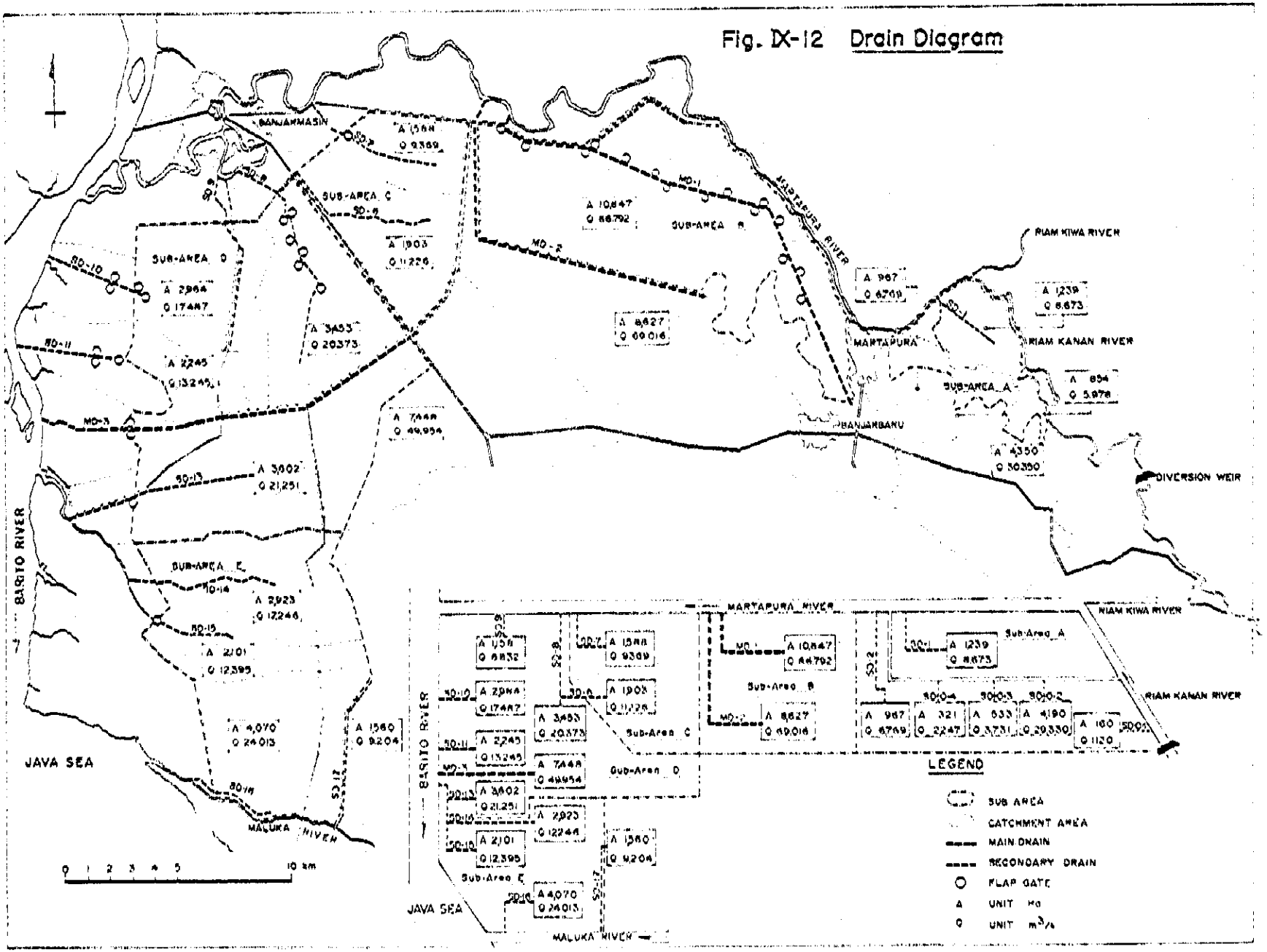


Fig. IX-13 Alignment of Secondary and Sub-Secondary Drains

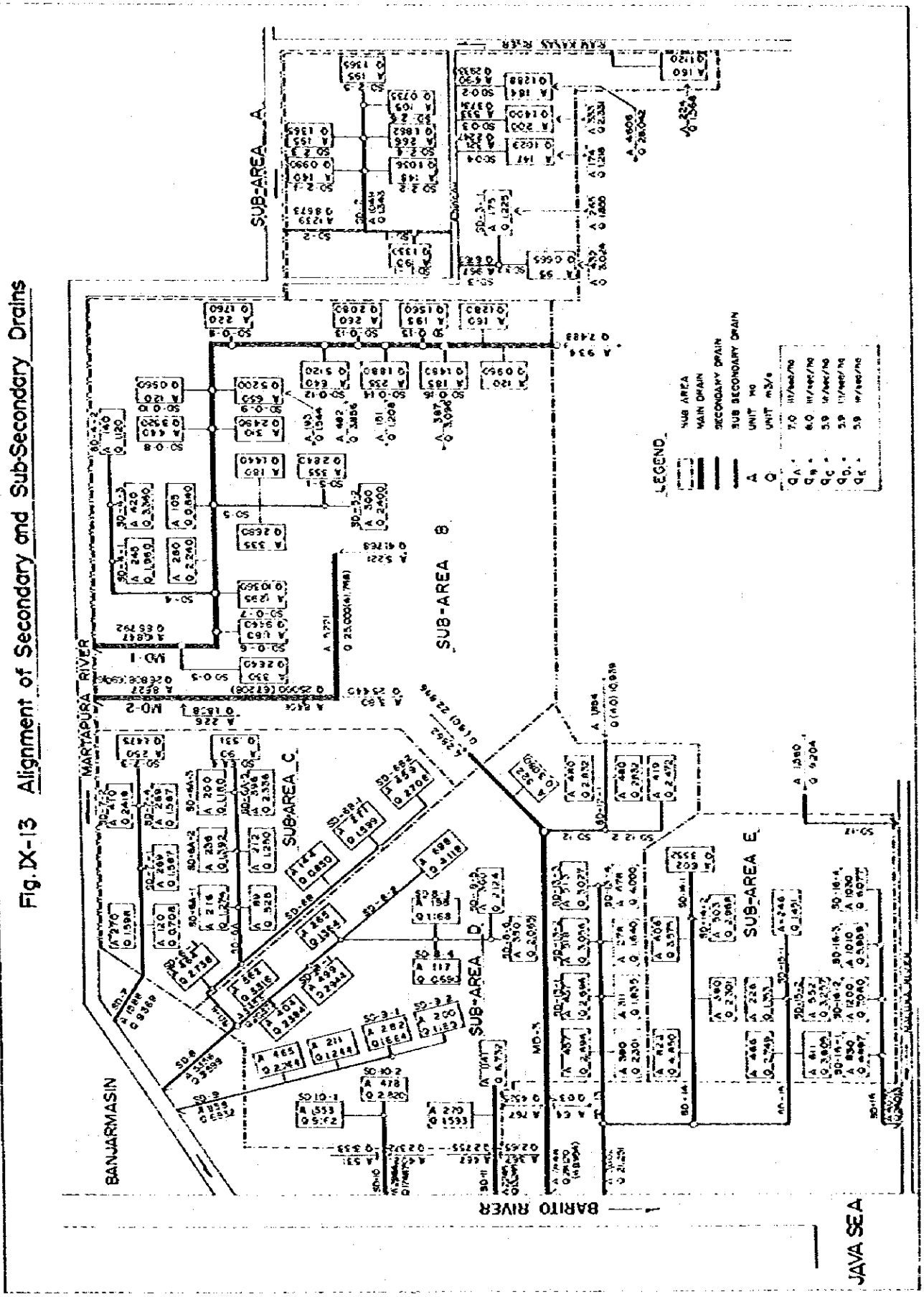


Table IX-6 Length of Canals, Drains and Roads, and Number of Related Structures

Item	Unit	Total	Sub-Area A	B	C	D	E
1. Secondary and Sub-secondary Canals							
(1) Secondary Canal	Km	131	9	43	20	35	24
(2) Sub-secondary Canal	Km	145	15	34	11	51	31
(3) Related Structures							
Turnout	Nos	54	6	14	10	15	9
Check Gate Structure	Nos	31	4	7	5	9	6
Bridge	Nos	85	8	22	13	28	14
Syphon	Nos	2	1	-	-	1	-
2. Main Drain							
(1) Main Drain	Km	53	-	36	-	17	-
(2) Related Structures							
Bridge	Nos	14	-	11	-	3	-
Culvert	Nos	1	-	-	-	1	-
3. Secondary and Sub-secondary Drains							
(1) Secondary Drain	Km	85	6	7	13	33	26
(2) Sub-secondary Drain	Km	136	14	33	16	38	35
(3) Related Structures							
Drainage Sluice	Nos	40	-	16	3	18	3
Bridge	Nos	66	7	14	9	22	14
Culvert	Nos	2	-	1	-	1	-
4. Roads							
(1) Main Road	Km	122	9	64	5	27	17
(2) Secondary Road	Km	361	39	99	42	114	67

Fig.IX-14 Volume of Stored Water and Level of Water for Design of Main Drain, MD-2

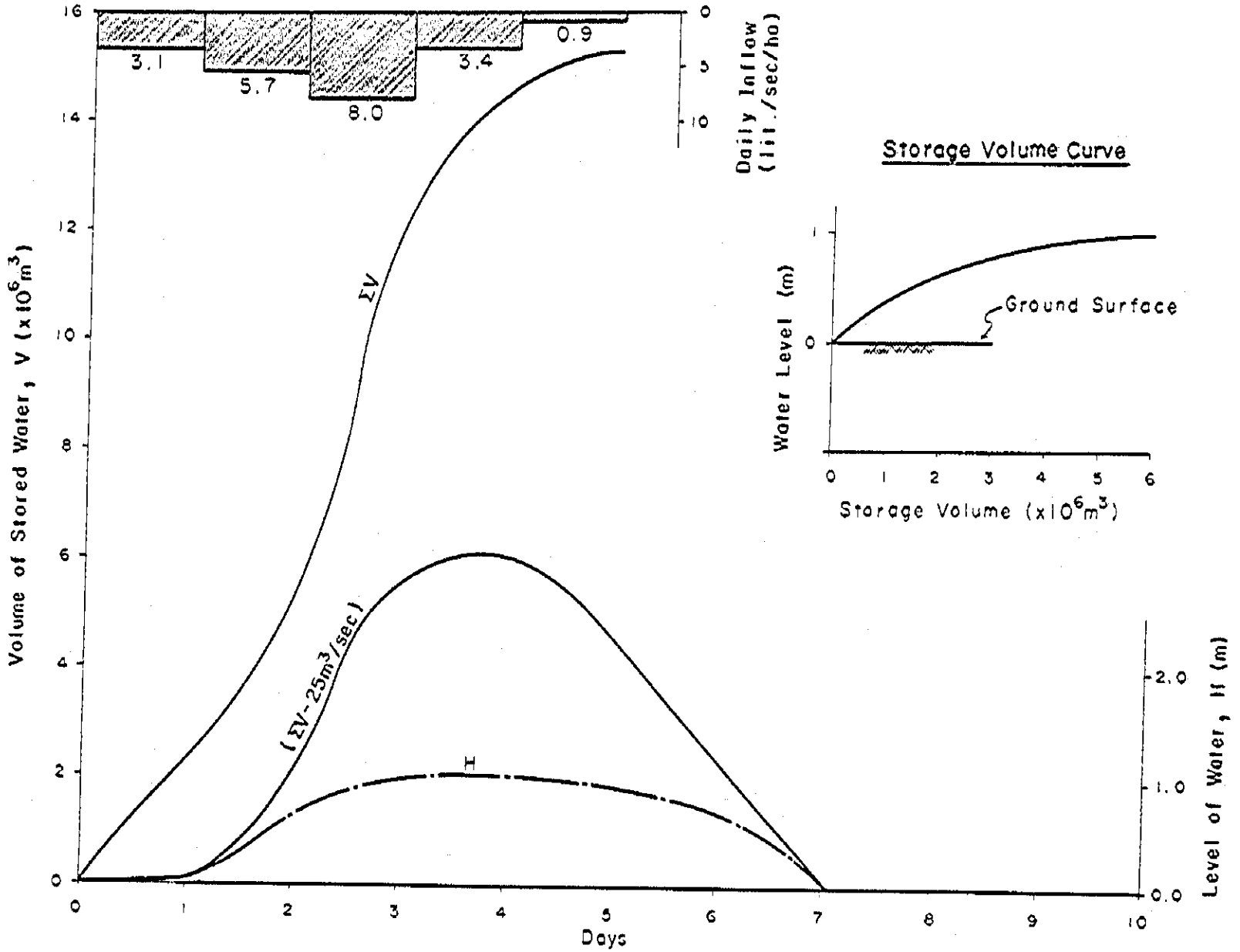
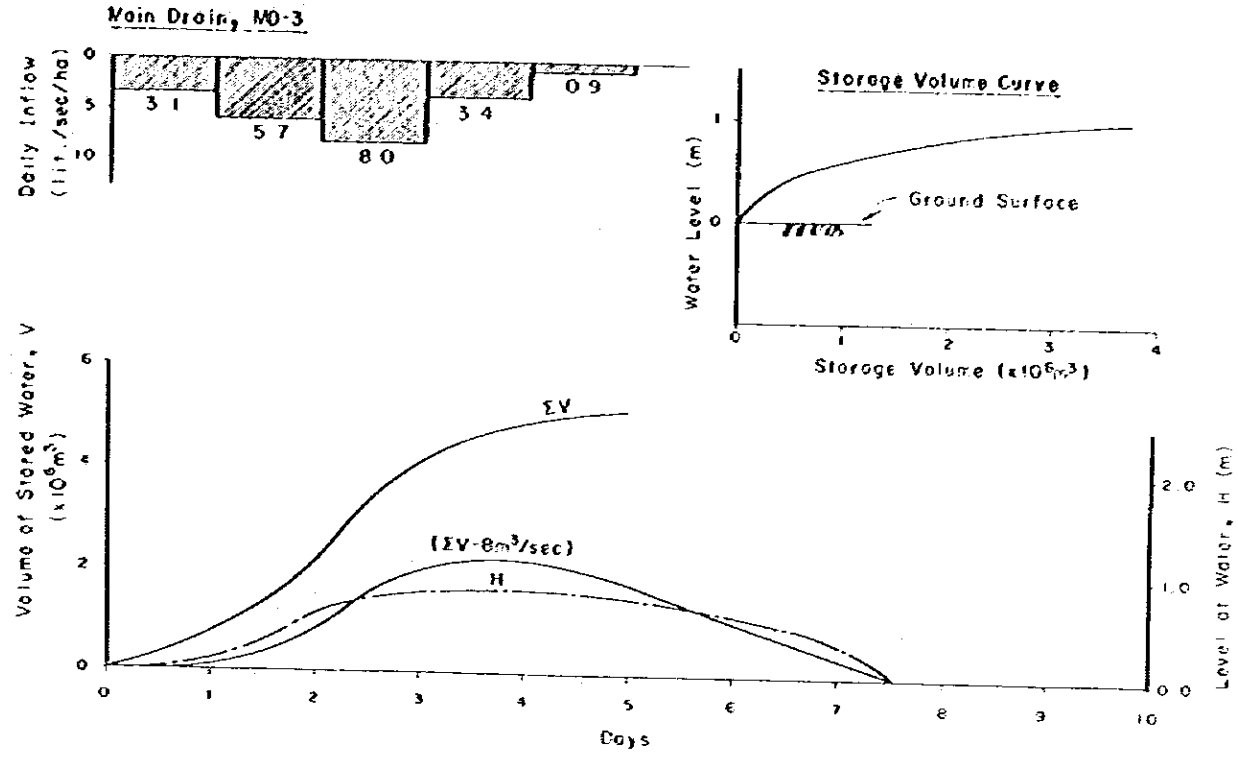


Fig. IX-15 Volume of Stored Water and Level of Water for Design of Main Drain, MD-3



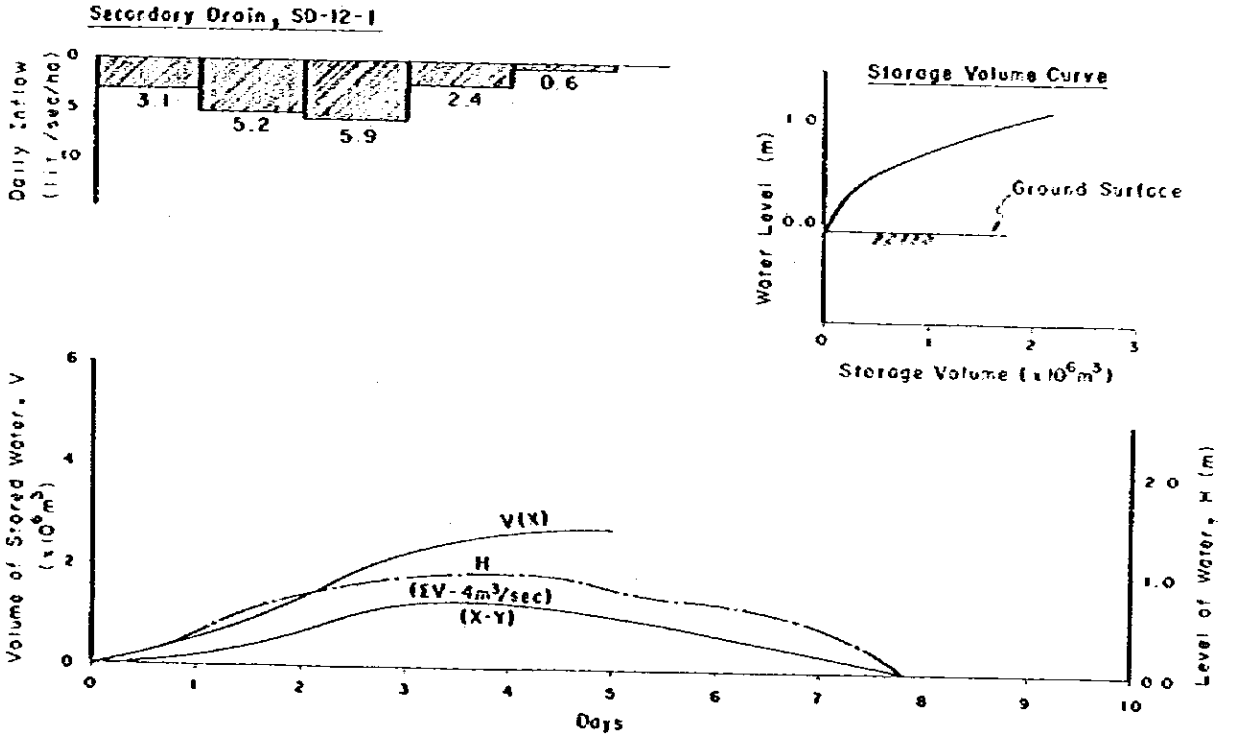
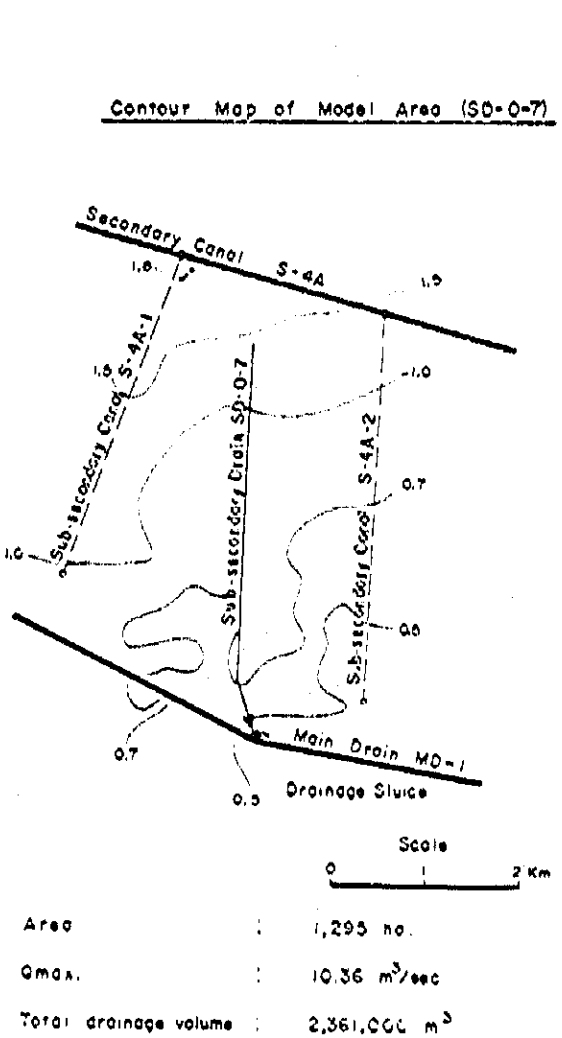


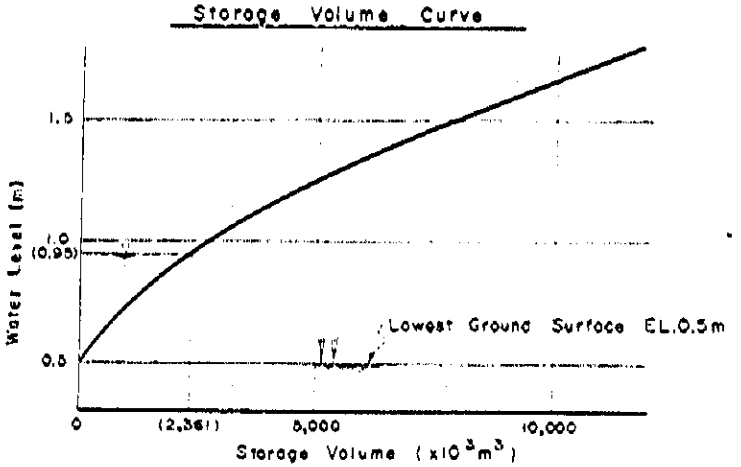
Fig. IX-16 Relation Between Outside Water Level and Inside Water Level (Sub-area B)



Area : 1,295 ha.

Qmax. : 10.36 m^3/sec

Total drainage volume : 2,361,000 m^3



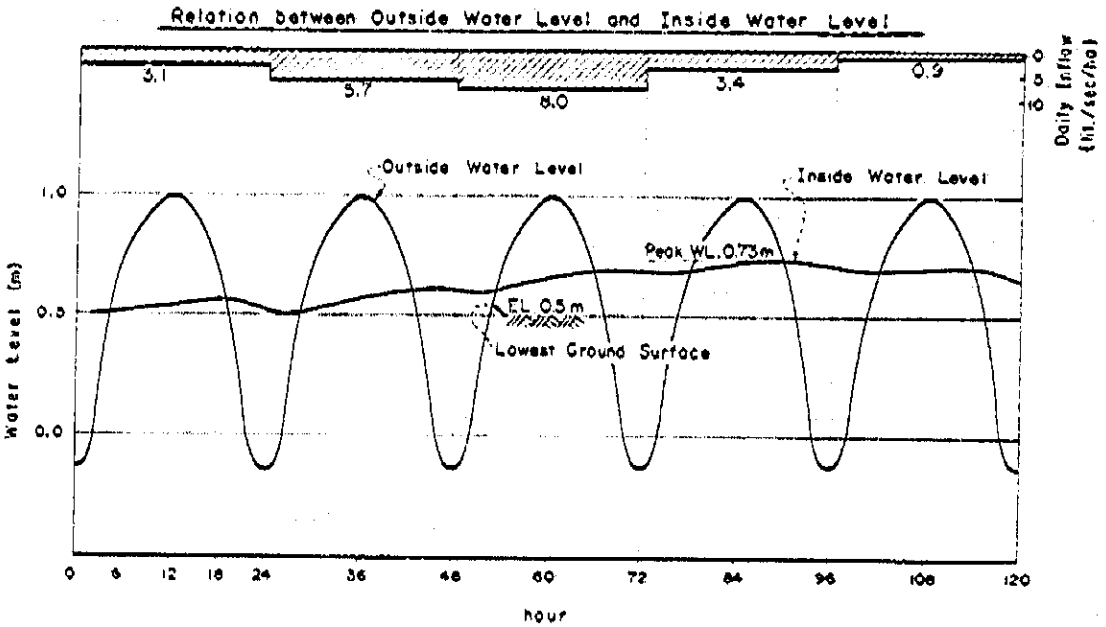
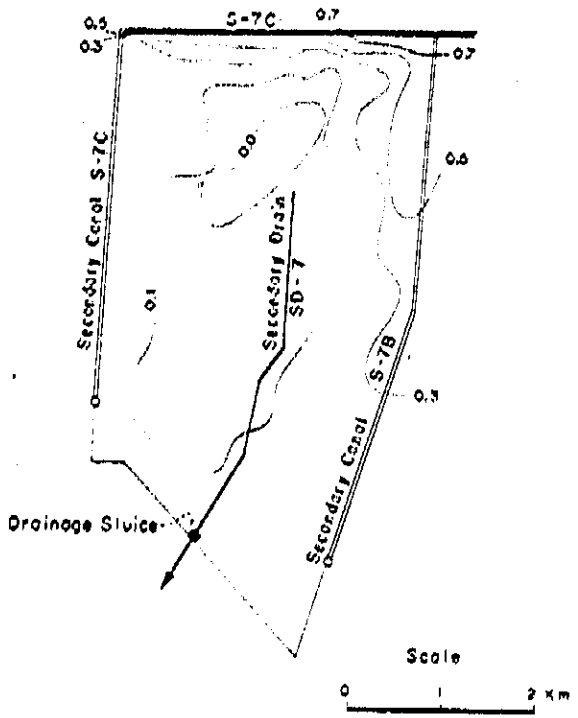


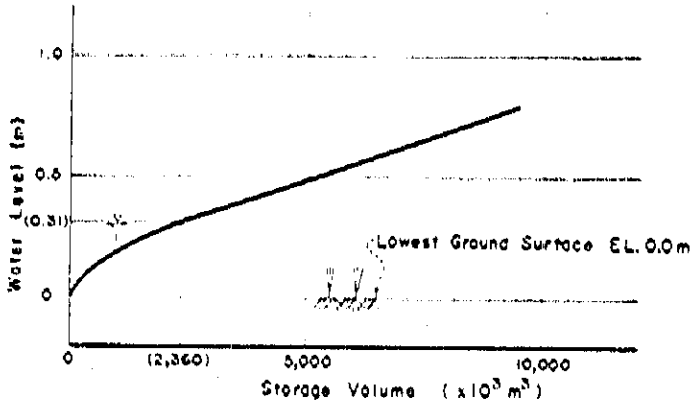
Fig. IX-17 Relation Between Outside Water Level and Inside Water Level (Sub-area C)

Contour Map of Model Area (SD-7)



Area	:	1,588 ha.
Qmax.	:	0.37 m^3/sec
Total drainage volume	:	2,360,000 m^3

Storage Volume Curve



Relation between Outside Water Level and Inside Water Level

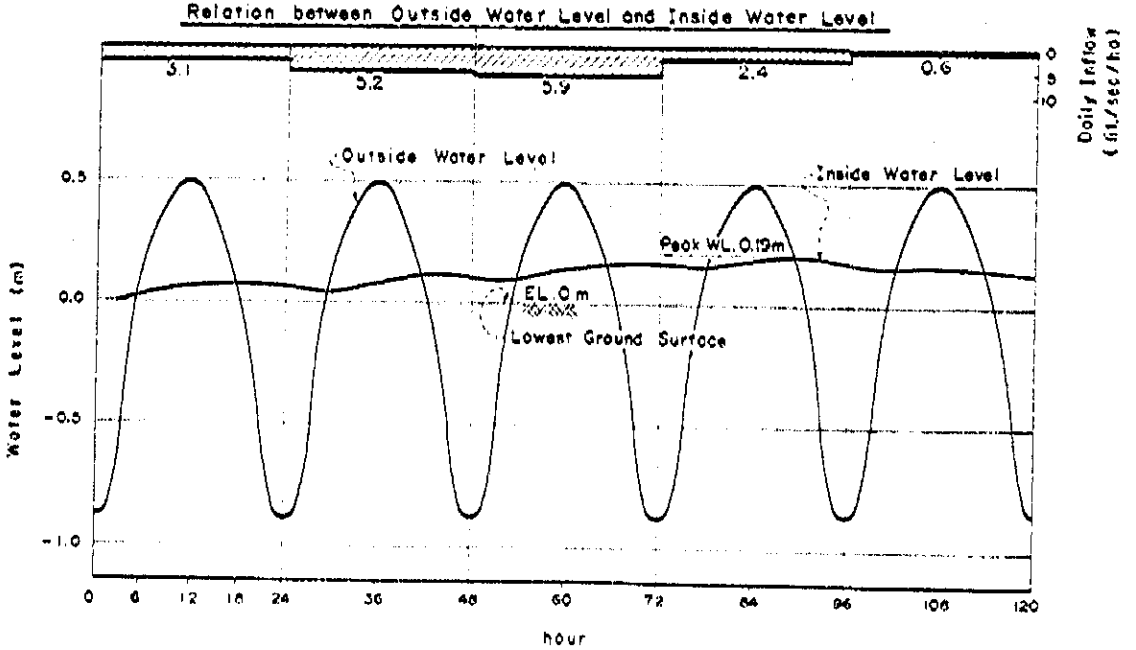
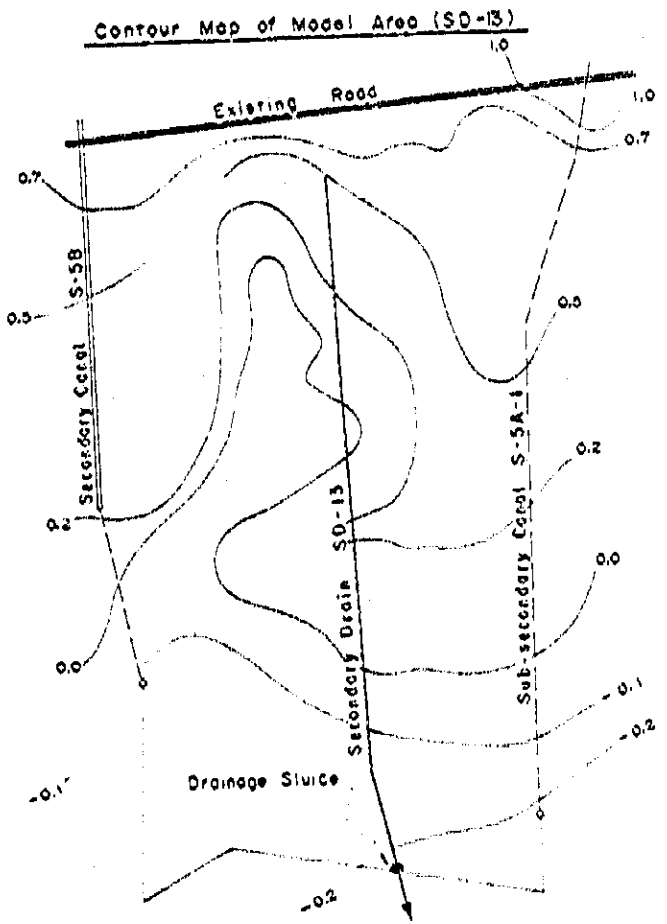


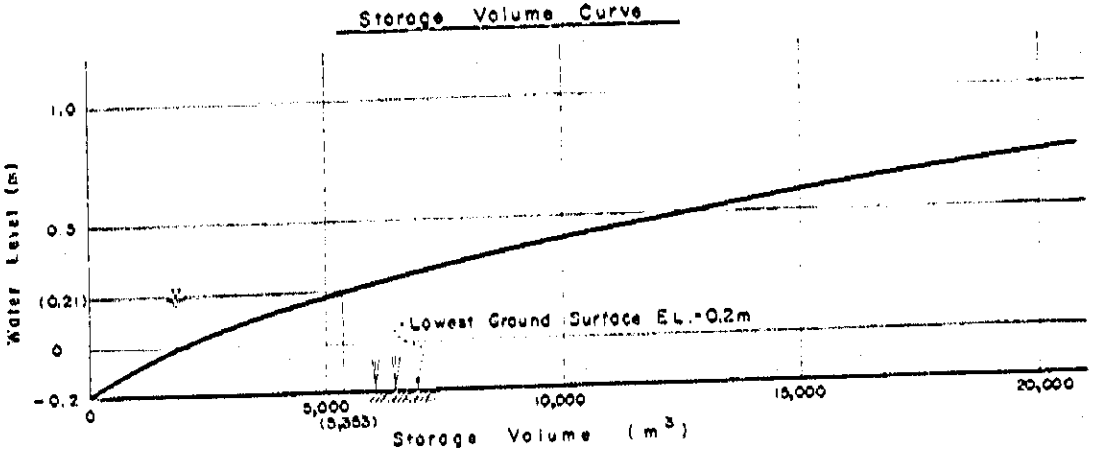
Fig. IX-18 Relation Between Outside Water Level and Inside Water Level (Sub-area D)



Area : 3,602 ha.

Qmax. : 21.25 m³/sec

Total drainage volume : 5,353,000 m³



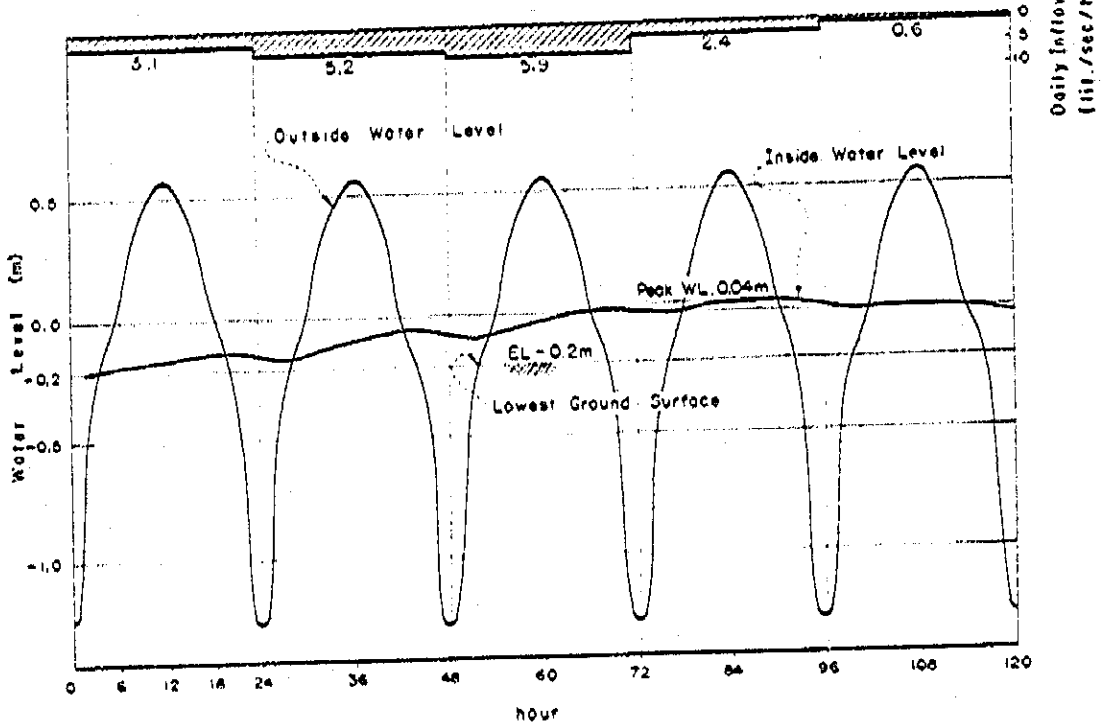
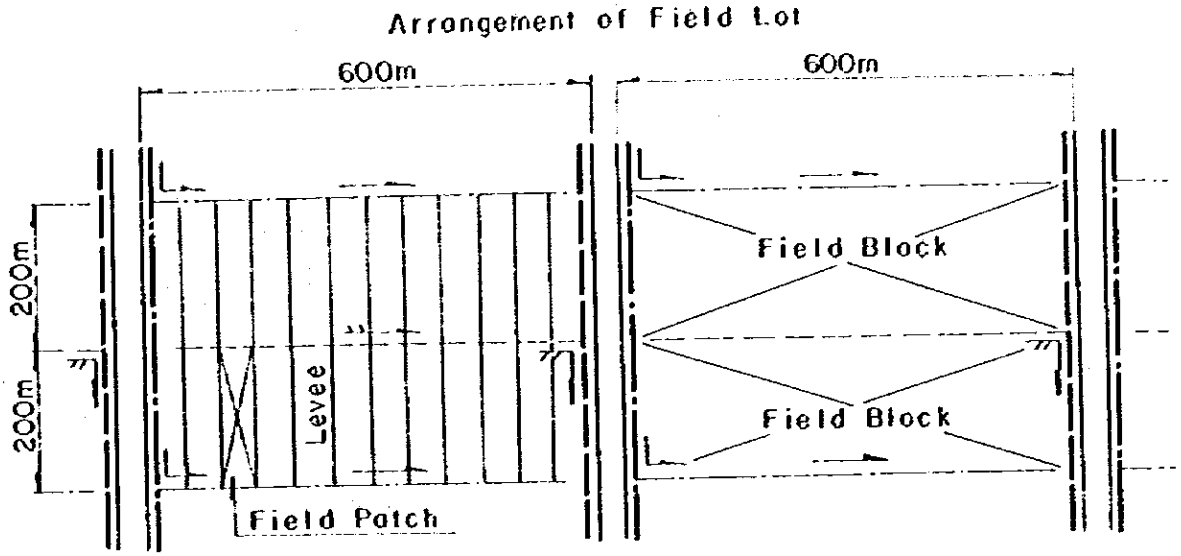


Fig. IX-19 Tertiary Development



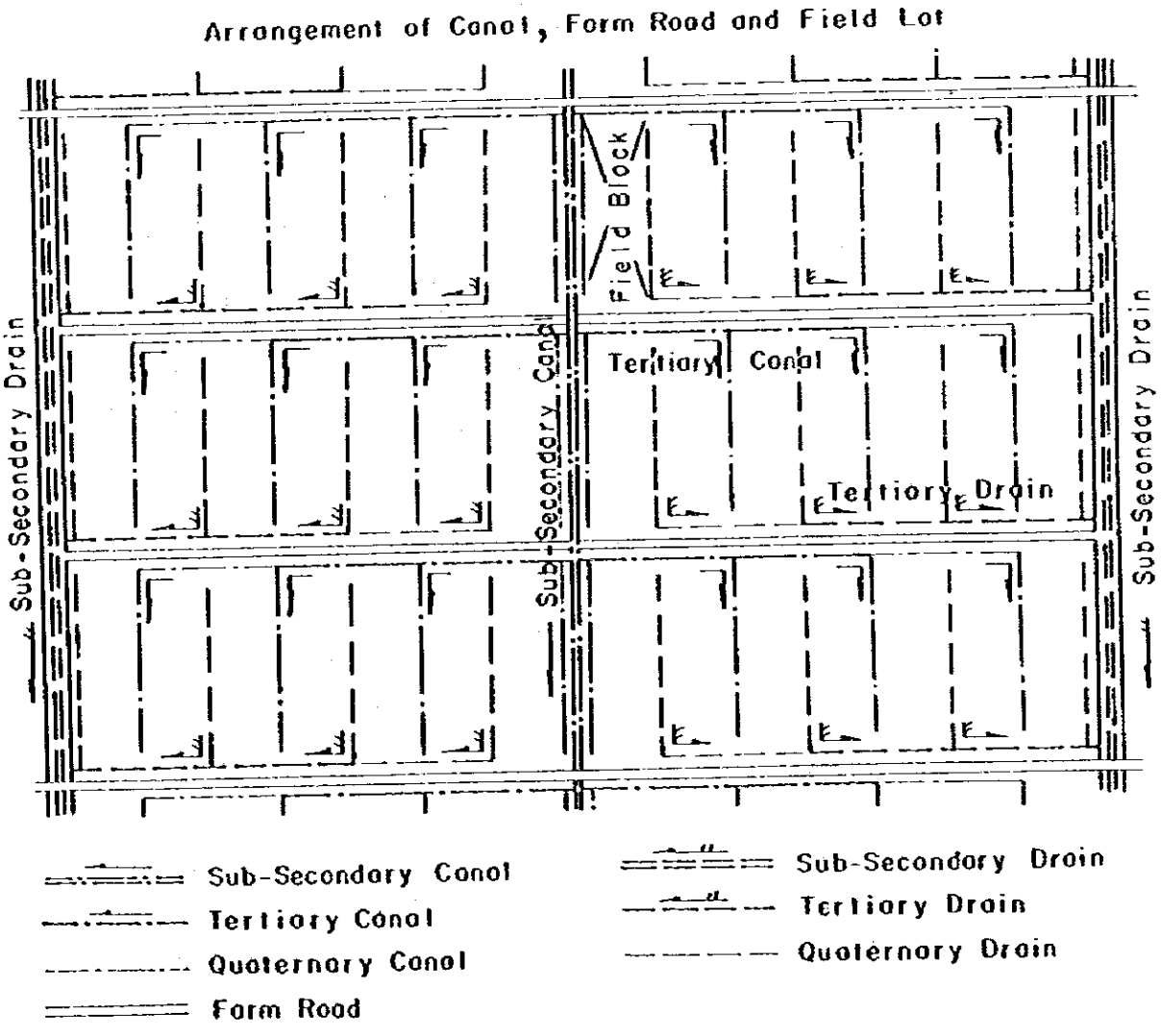
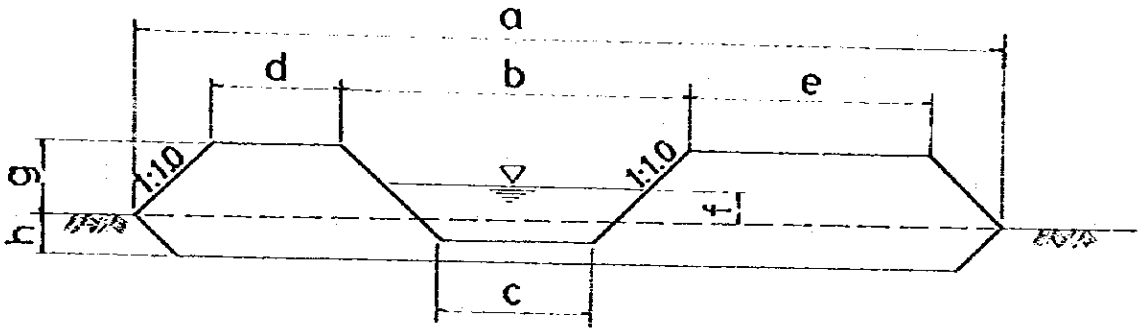


Table IX-7 Typical Dimensions for Tertiary and Quaternary Canals and Drains

Tertiary and Quaternary Canals

	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)	f (mm)	g (mm)	h (mm)
Tertiary Canal	5,500	2,200	600	500	2,000	200	400	200
Quaternary Canal	6,700	1,900	500	2,000	2,000	200	400	200



Tertiary and Quaternary Drains

	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)	f (mm)	g (mm)	h (mm)	i (mm)
Tertiary Drain	6,900	3,800	1,000	500	2,000	100	800	300	200
Quaternary Drain	5,000	2,900	700	500	1,000	100	500	300	200

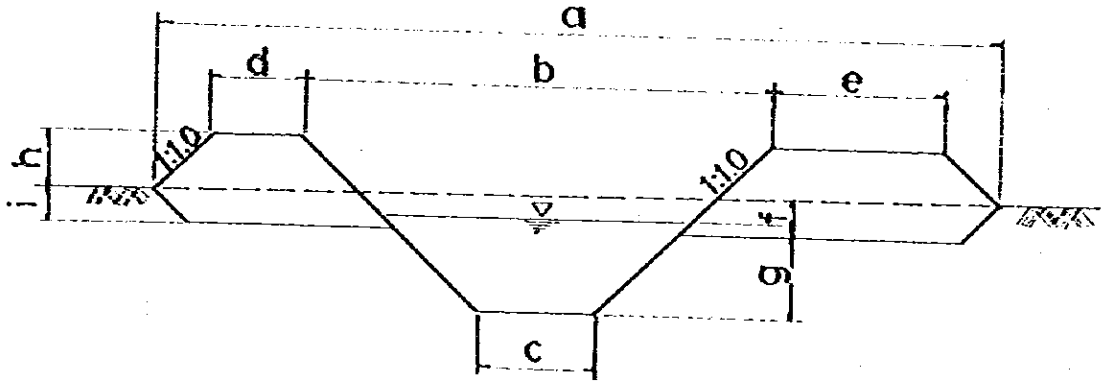
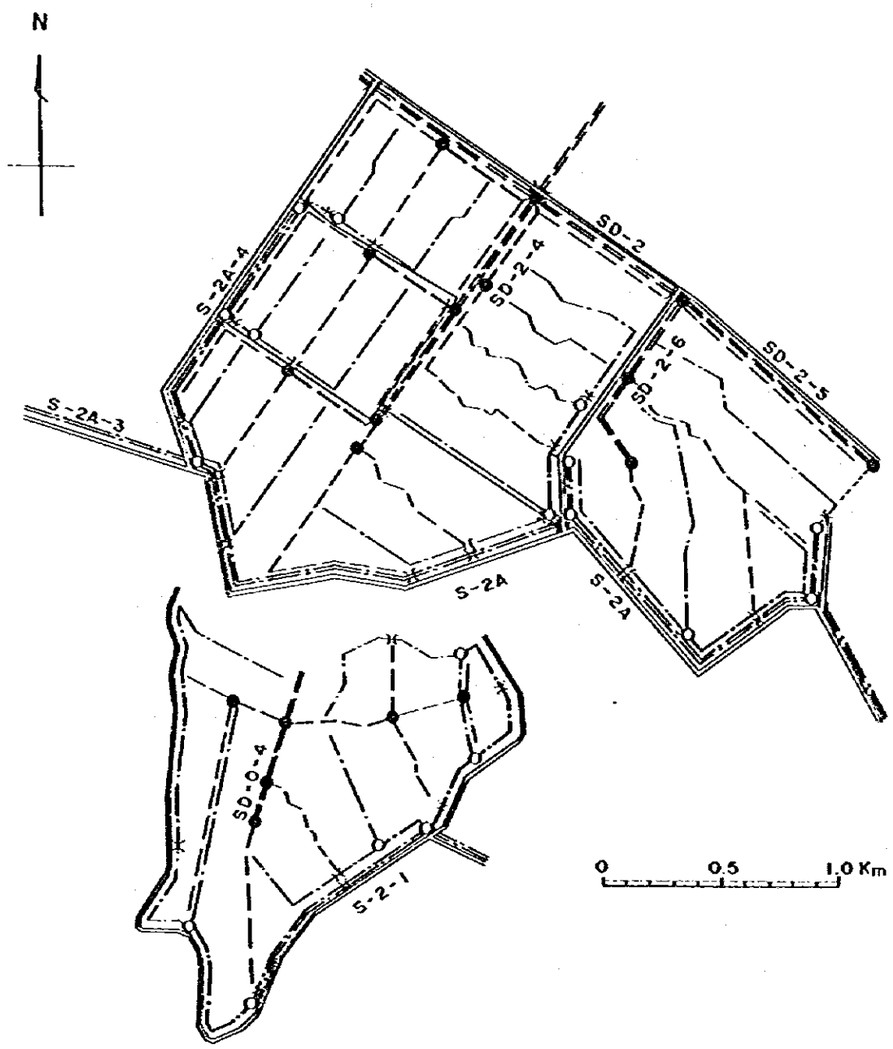


Table IX-8 Density and Length of Tertiary and Quaternary Canals and Drains, and Tertiary Farm Road

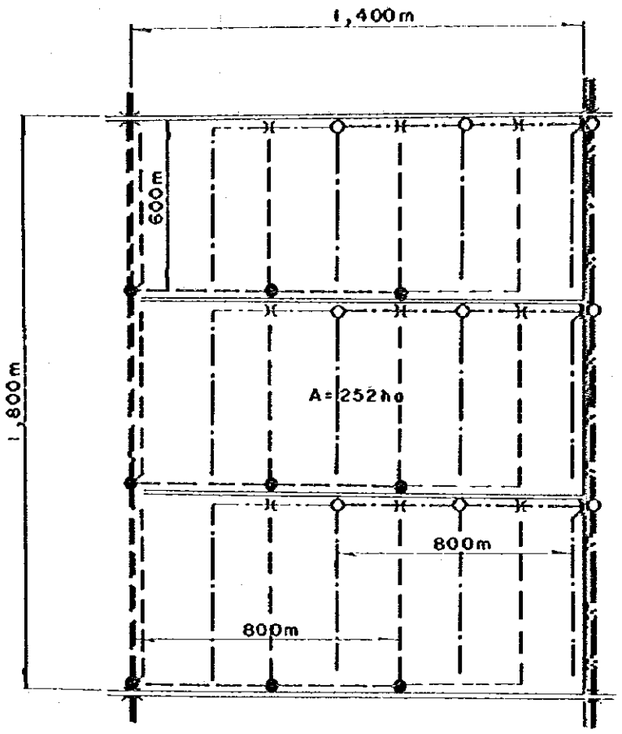
Item	Sub-area A (2,200 ha)		Sub-area B (8,700 ha)		Sub-area C (4,400 ha)		Sub-area D (13,550 ha)		Sub-area E (9,510 ha)	
	Density (m/ha)	Length (m)	Density (m/ha)	Length (m)	Density (m/ha)	Length (m)	Density (m/ha)	Length (m)	Density (m/ha)	Length (m)
Tertiary Canal	6.4	14,080	9.5	82,650	8.9	39,160	9.6	130,080	9.8	93,198
Tertiary Drain	4.6	10,120	9.5	82,650	6.7	29,480	9.1	123,305	8.9	84,639
Quaternary Canal	31.3	68,860	33.3	289,710	36.5	160,600	28.8	390,240	37.1	352,820
Quaternary Drain	32.3	71,060	33.3	289,710	25.8	113,520	20.9	283,195	21.7	206,367
Tertiary Farm Road	4.5	9,900	11.1	96,570	9.1	40,040	10.1	136,855	14.8	140,748

Fig. IX-20 Typical Alignment of Tertiary Downwards for Each Sub-Area

(1) Type-A



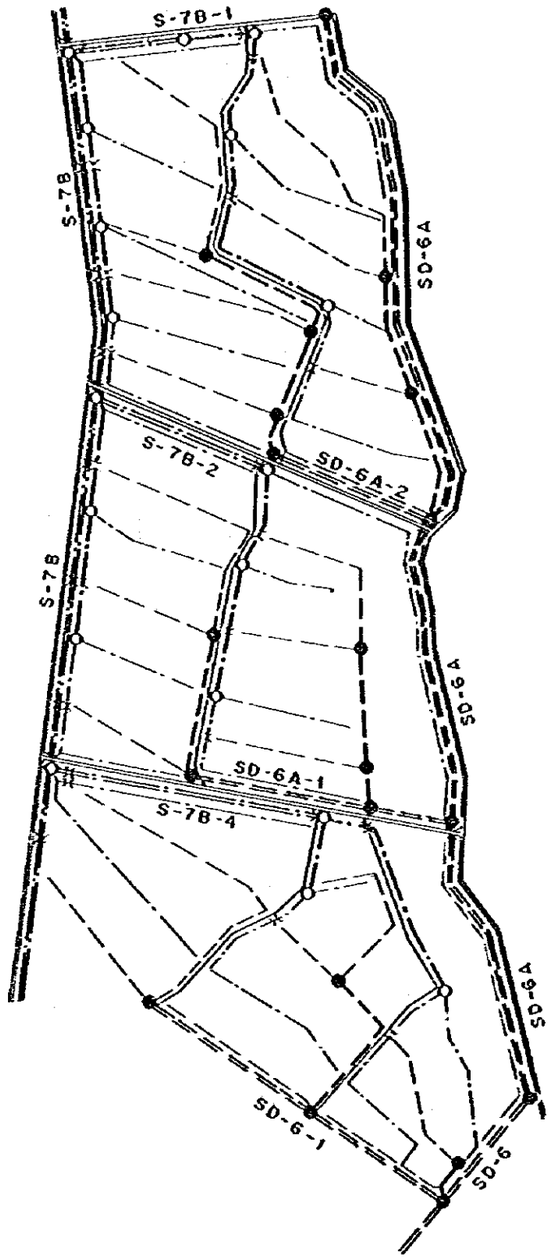
(2) Type-B



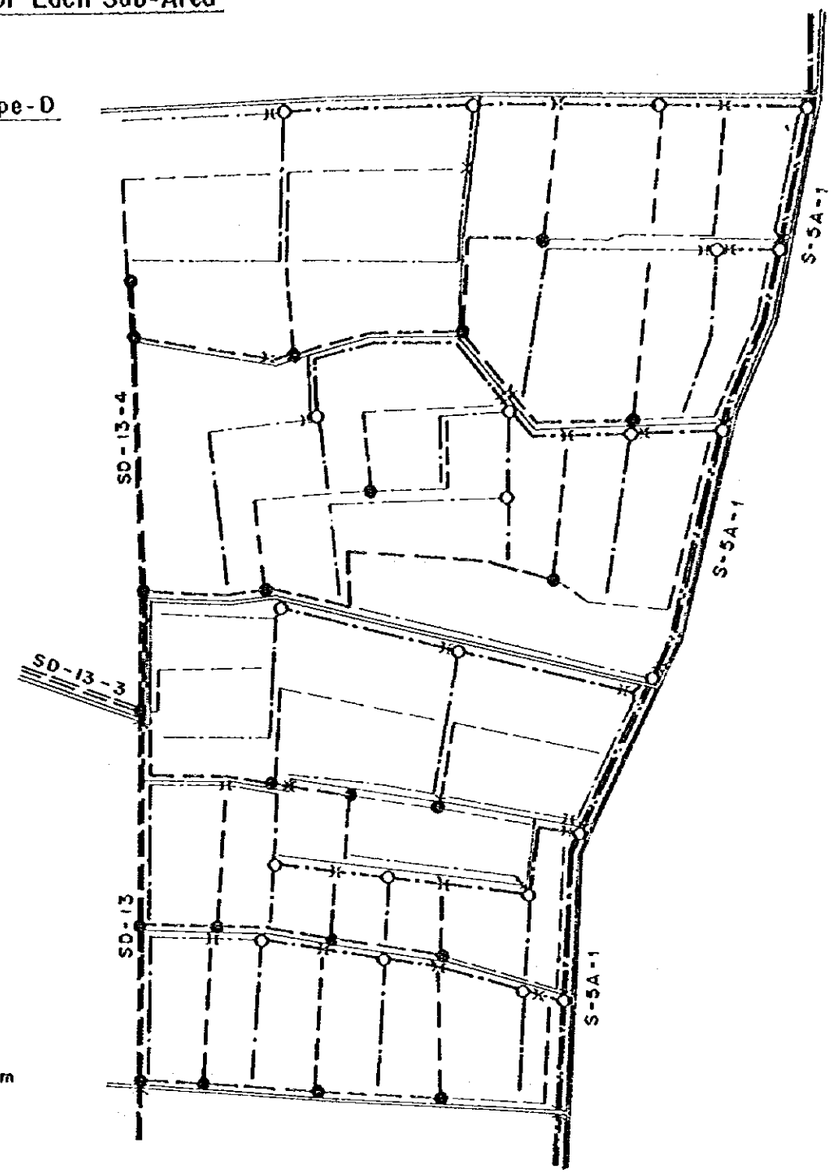
Secondary and Sub-Secondary Canal	Secondary and Sub-Secondary Drain
Tertiary Canal	Tertiary Drain
Quaternary Canal	Quaternary Drain
Secondary Farm Road	Tertiary Farm Road

Fig. IX-20 Typical Alignment of Tertiary Downwards for Each Sub-Area

(3) Type-C

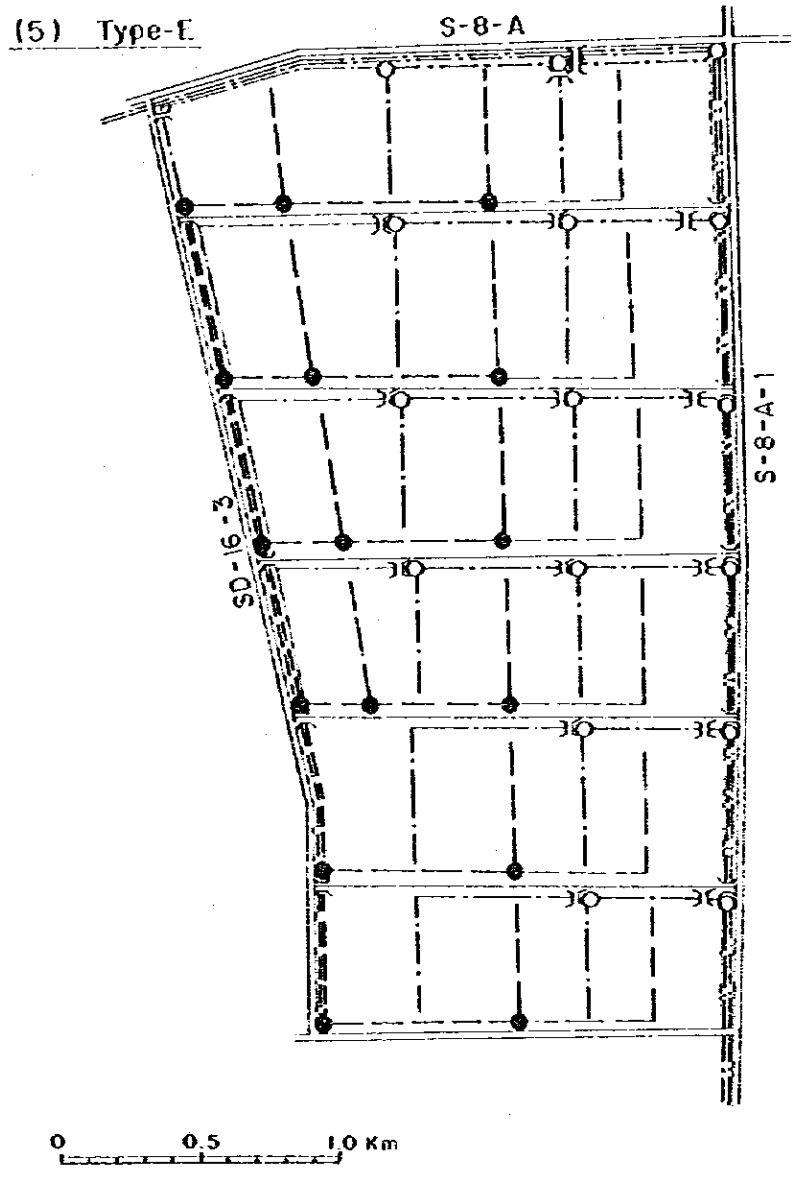


(4) Type-D



Secondary and Sub-Secondary Canal	Secondary and Sub-Secondary Drain
Tertiary Canal	Tertiary Drain
Quaternary Canal	Quaternary Drain
Secondary Farm Road	Tertiary Farm Road

Fig.IX-20 Typical Alignment of Tertiary Downwards for Each Sub-Area



Secondary and Sub-Secondary Canal	Secondary and Sub-Secondary Drain
Tertiary Canal	Tertiary Drain
Quaternary Canal	Quaternary Drain
Secondary Farm Road	Tertiary Farm Road

Fig. IX-21 Road Network

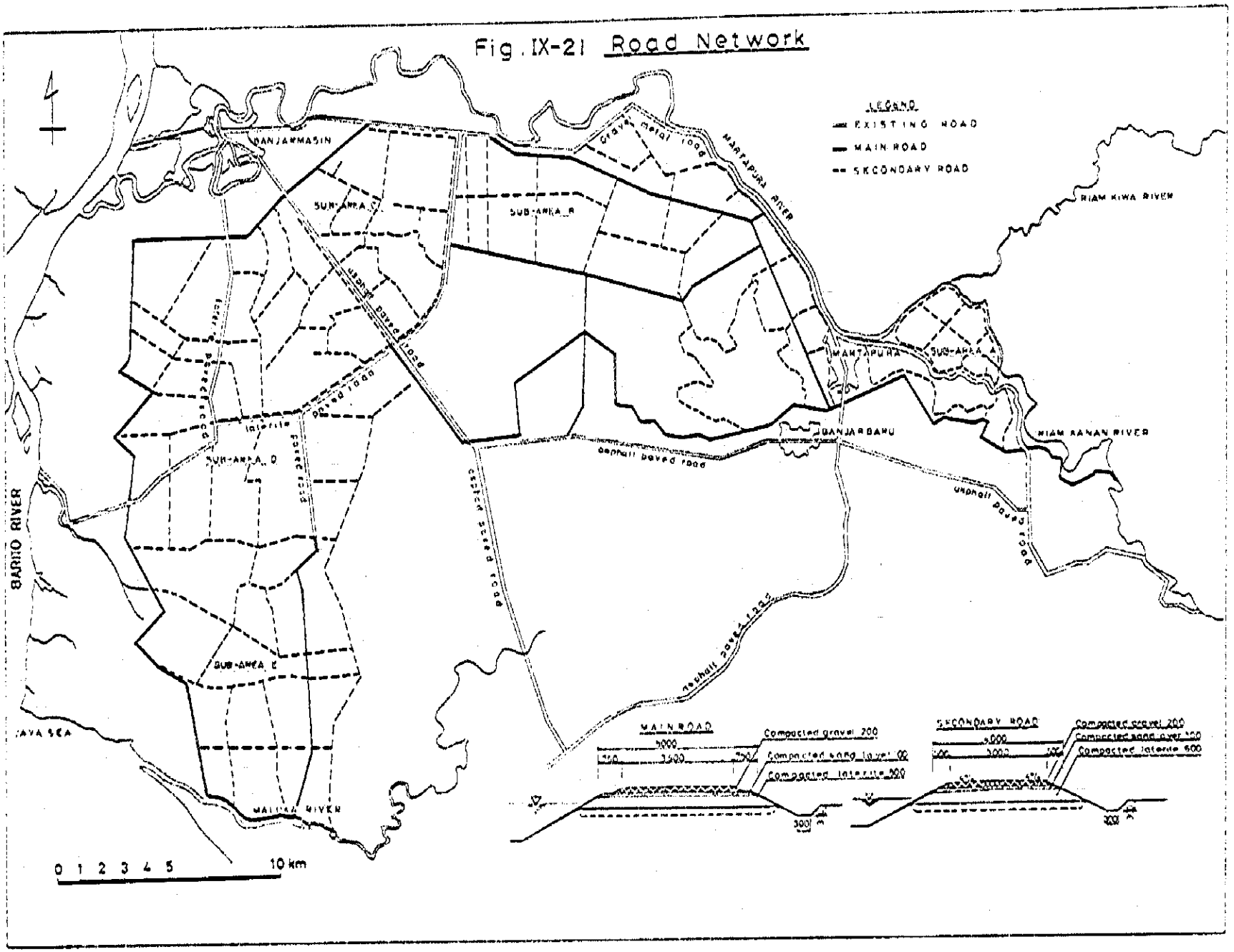


Fig. IX-22 Proposed Plan of By-pass Structure Case-I

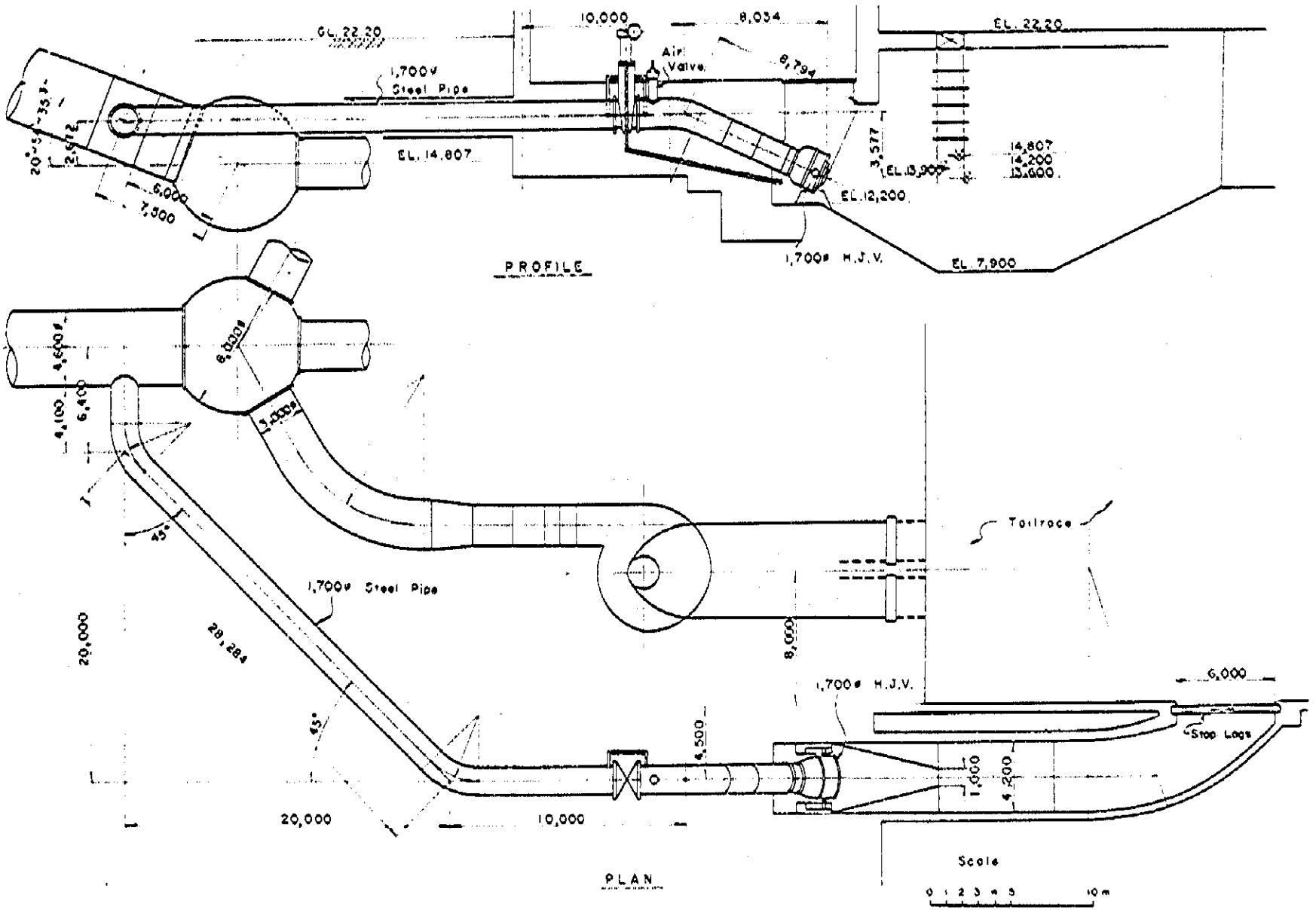
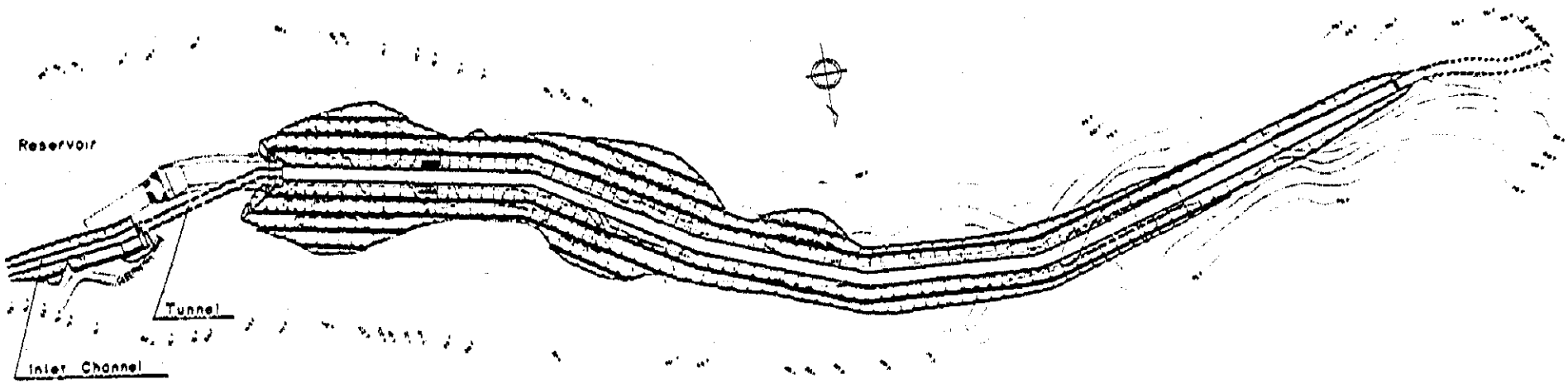
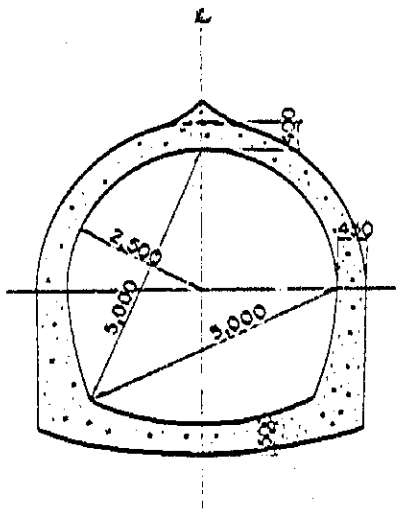
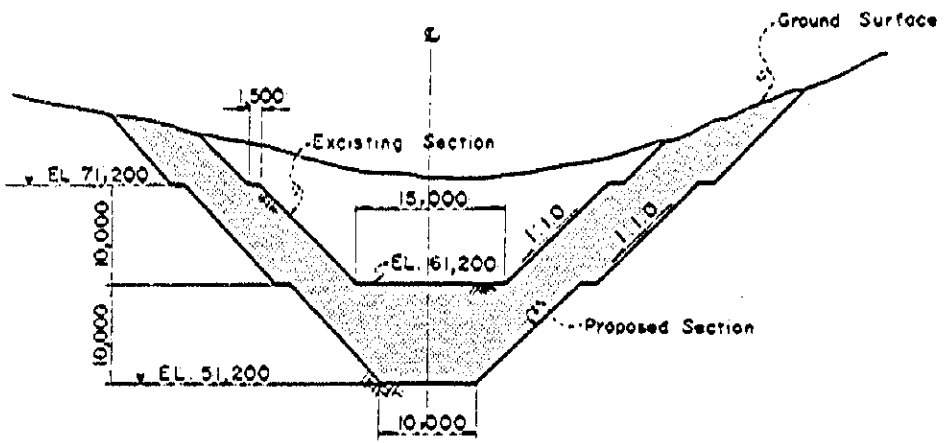


Fig. IX-23 Proposed Plan of By-pass Structure Case - II





SECTION OF TUNNEL



SECTION OF APPROACH CHANNEL

Table IX-9 Preliminary Cost Estimates of By-pass Structures

(1) Case I

Work	Unit	Q'ty	Amount (US$ 1,000)
1. Excavation	m^3	6,000	26
2. Backfill	"	3,500	23
3. Concrete	"	1,300	73
4. Reinforcement bar	ton	50	27
5. Steel pipe, ϕ1,700	m	60	128
6. Sluice valve, ϕ1,700	no.	1	393
7. H. J. valve, ϕ1,700	"	1	445
8. Valve house	m^2	50	35
9. Miscellaneous	L.S.		250
Total :			1,400

(2) Case II

Work	Unit	Q'ty	Amount (US$ 1,000)
1. Excavation in inlet	m^3	22,000	251
2. Excavation in channel			
common	"	250,000	1,075
rock	"	70,000	609
3. Concrete	"	4,200	235
4. Reinforcement bar	ton	300	159
5. Tunnel	m	90	270
6. Roller gate	no.	2	440
7. Rock rip rap	m^3	2,000	42
8. Miscellaneous	L.S.		619
Total :			3,700

ANNEX X

PROJECT IMPLEMENTATION SCHEDULE

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ANNEX X PROJECT IMPLEMENTATION SCHEDULE

X.1 BASIC CONSIDERATIONS FOR CONSTRUCTION

The main construction works for this Project are excavation and embankment of the irrigation and drainage canals as well as the road network. For these earth moving works, the most important factor is equipment trafficability which is governed by the rainfall and soil conditions. Considering the rainfall in the rainy season which lasts from November to April, it would be difficult to carry out the earth works during the rainy season, except for preparatory works, minor works and dredging works.

Annual workable days for construction equipment to be adopted for this Project are estimated at 140 days based on the long-term rainfall records in the project area. Sundays and national holidays are not included in the above workable days.

Taking into account the scale of this project, the mechanized construction method would be principally introduced in the main construction works. In order to maximize the employment opportunity in and around the project area, however, man-power construction would have to be adopted as much as possible.

In this context, large-scale civil works such as diversion weir, main canal, main drains, etc. would be carried out mainly by heavy construction machinery. The minor civil works for secondary networks and tertiary development would be carried out mainly by man-power with minor construction equipment.

X.2 IMPLEMENTATION SCHEDULE

Fig. X-1 shows the schedule for both the detailed design and the construction. The former will last two years, 1980 and 1981, including time necessary for survey works, detailed design works, project organization, tender calling, etc. Whilst the latter will last six years from 1982 to 1987 for the major civil works.

The project mobilization which includes financing, legalization, establishment of the project organization would have to be completed by the end of 1981. Tender calling, and award of contract for civil engineering works and procurement of construction equipment as well as employment of consultants for supervision would be proceeded from the latter half of 1981.

Prior to commencement of major construction works, preparatory works such as land acquisition for structures and construction of access roads and temporary buildings would be carried out. The major civil works for the Project comprise the construction of a headwork, irrigation and drainage facilities with related structures, and roads.

X.2.1 Diversion Weir

The construction of the diversion weir would be started from the beginning of the dry season in 1982, and completed within two years as shown in Fig. X-1. The construction would be carried out in two stages, the right bank in the first stage and the left bank in the second stage.

The first stage would be commenced in the dry season in 1982 by constructing temporary structures and jungle clearing. These would be followed by the excavation of the foundation using bulldozers for the top 2 to 3 m and, then, by crushing using rakedozers. The finishing to the designed section would be carried out by manpower. The spoil (excavated soil) would be moved out toward both upper and lower reaches. The soil thus obtained would be used for the construction of the temporary coffer dam. After the excavation would have progressed to the designed level, concrete works would be made. A series of concrete works such as pouring of concrete for levelling - bar arrangement - shuttering - concrete pouring - removal of shuttering, would follow until the weir, apron and guide wall would be built in their final shape.

The second stage would be started in the dry season in 1983 by pushing out the excavated earth toward the river bed for construction of the closing-level by using the guide wall which would have been completed in the previous year. The works after the unwatering consist of the construction of the remaining part of the weir and the intake structure.

X.2.2 Main Irrigation Canal

The construction of the main canal would be carried out by dividing the works into several job-divisions in order to complete the construction in keeping pace with that of the diversion weir. For the perfection of its earth works, the construction period would be limited during the dry seasons, starting in May and finishing in October from 1982 to 1985. The initial work for canal construction would be the excavation which is to be started from the points easily accessible for the construction machinery, and all the excavated earth would be used for embankment except for the surface layer to be stripped. The embankment materials would be layered as soon as possible after excavation and well compacted. Spraying of water by water tankers would be required to give the materials the optimum moisture content. Embankment work would need uniform compaction, otherwise cracking would cause resulting in leakage of water after the work. The construction of the related structures would be carried out even in the rainy season if the condition for concrete works would allow in order to make progress as much as possible.

X.2.3 Secondary Development in each Sub-area

The construction of the secondary canals, the sub-secondary canals, the main drains (sub-areas B and D), the secondary drains and the sub-secondary drains would be carried out in order of sub-areas A, B, C, D and E (from the upper stretches of the main canal) for practicing irrigation farming for the land where possible at the earliest date. Within the above basic concept, the construction of canals would proceed to construct drains so as not to disturbe the present farming.

The construction of the secondary canals in the sub-areas A and B would be commenced from May 1982. Since the length and the size of the canals in the sub-area A would not be so large, the construction would be completed in two dry seasons from 1982 to 1983 including the installation of the related structures. On the other hand, since the length and size of the canals in the sub-area B would be fairly large, three dry seasons would be required for the constructoin. The construction of the related structures would be made even in the rainy season during the above three years.

The construction of the secondary canals in the sub-areas C and D would be started from May 1983. Since the length and the size of the canals in the sub-area C would not be so large, most of the construction would be completed in two dry seasons, and the remaining works would be completed in three months in the third year. On the other hand, since the length and the size of the canals in the sub-area D would be fairly large, the construction would be carried out in the four full dry seasons from 1983 to 1986. The construction of the related structures would be performed during the excavation and embankment works including the rainy seasons.

The construction of the secondary canals and related structures would be started at the beginning of the dry season in 1986, and completed within two years.

The excavation works for three main drains (two in the sub-area B and one in the sub-area D) are expected to be made over five years from 1982 to 1985. Since the length and the size of the main drains would be so large, the heavy construction machinery such as dragline and swamp bulldozer would be required, and the excavation works in the marshy land would be carried out even in the rainy season by dredger.

The excavation works of the secondary drains in the sub-areas A and B would be commenced from May 1982. Since the length and the size of the drains in the sub-area A would not be so large, the construction work would be completed in two dry seasons including the installation of the related structures. On the other hand, because the length and the size of the drains in the sub-area B would be fairly large, the excavation works would be carried out in three dry seasons from 1982 to 1984. The installation of the related structures would be made concurrently with the above works.

The excavation works of the secondary drains in the sub-areas C and D would be started from the dry season in 1983. The construction period to be required for both areas are two dry seasons in the sub-area C and four dry seasons in the sub-area D, respectively.

The excavation works of the secondary drains in the sub-area E would be started from the dry season in 1986, and completed within two years. Dredging works could be carried out even in the rainy season.

X.2.4 Tertiary Development

The construction of the tertiary canals and tertiary drains in the sub-area A would be carried out in the dry season in 1983. Time period for the installation of the related structures would also be included in the above period. On the other hand, since the length of the tertiary canals and drains in the sub-area B would be more than four times that in the sub-area A, three dry seasons would be required for the completion. The construction of the tertiary canals would be 30 months from May 1982 to October 1984, whilst that of the tertiary drains, 16 months from July 1983 to October 1984. The construction of the related structures would also be made during the above periods including rainy seasons.

Time required for the construction of the tertiary canals and drains in the sub-areas C and D would be three to four dry seasons. In the sub-area C, the canal construction would be commenced in August 1983 and be completed in August 1985, and the drain from May to December 1984. In the sub-area D, the canal construction would be started in May 1983 and be completed in October 1986, and drains from May 1984 to October 1986.

In the sub-area E, the canals and drains construction would be started in May 1986 and be completed in October 1987.

X.2.5 Construction Equipment

As mentioned before, the major civil works of the project would principally be carried out by the construction equipment. The type and number of construction equipment required for the major civil works are estimated based on the work quantity, construction time schedule and natural conditions of the project area.

The proposed construction equipment required for the construction works are listed in Table X-1.

X.3 IMPLEMENTATION SCHEDULE FOR COMBINED GRAVITY AND PUMP IRRIGATION SCHEME

In case that pump irrigation scheme is implemented as a series of the proposed project works, the whole works including scheme could be constructed within eight years. The executing manner of the construction regarding the irrigation and drainage canals including tertiary canals and drains would be the same as that of the proposed project works. The construction of the tide gates and the pump station would be started at the beginning of the dry season in 1986. Main part of the civil works would be made in 1986. The installation of gates and pump equipment would be carried out in the dry season in 1987. The preliminary construction schedule of the future stage development is shown in Fig. X-2.

On the other hand, if the pump scheme is constructed independently in the future, it would take three years for its implementation including preparatory works such as detailed design and project mobilization. The additional secondary canal which is connected with the pumping station would be constructed within one year.

Table X-1 List of Required Construction Equipment

	Equipment	Specification	Required Number
1.	Motor scraper	11 m^3	2
2.	Swamp bulldozer	21 ton	36
3.	Bulldozer	21 ton	24
4.	Rake dozer	21 ton	15
5.	Bulldozer	11 ton	27
6.	Backhoe	0.6 m^3	8
	Trapezoid backet attachment	0.6 m^3	8
7.	Swamp backhoe	0.6 m^3	8
8.	Rock braker	500 kg	6
9.	Dragline	0.8 m^3	7
10.	Wheel loader	2.3 m^3	5
11.	- do -	2.0 m^3	2
12.	- do -	1.2 m^3	15
13.	Dump truck	8 ton	160
14.	Motor grader	3.7 m	10
15.	Tire roller	15 ton	13
16.	Macadam roller	10 ton	4
17.	Vibration roller	1.1 ton	17
18.	Soil compactor	125 kg	20
19.	Portable batcher plant	40 m^3/hr.	2
20.	Agitator truck	3.2 m^3	10
21.	Concrete pump (truck mounted)	30 - 65 m^3/hr.	2
22.	Crawler drill	17 m^3/min.	4
23.	Portable compressor	21 m^3/min.	4
24.	Dredger	160 m^3/hr.	2
25.	Pile driver	18.5 m	1
26.	Truck crane	11 ton	3
27.	Crushing plant	100 ton/hr.	1
28.	Screening plant	140 ton/hr.	1
29.	Ordinary truck	8 ton	10
30.	Water tanker	8 kl	4

.... to be continued

	Equipment	Specification	Required Number
31.	Fuel tanker	8 kl	4
32.	Grease car	6 ton	2
33.	Maintenance car	6 ton	3
34.	Trailer truck	30 ton	1
35.	Forklift truck	3 ton	3
36.	Diesel generator	250 KVA	2
37.	- do -	120 KVA	1
38.	Diesel light for night work	5 KW	50
39.	4 - wheel jeep	-	20
40.	Testing equipment	-	L.S.
41.	Miscellaneous equipment	-	L.S.

Fig. X - 1 Construction Schedule

WORK ITEM	QUANTITY
1. Preparatory Works	
1) Detailed Design	--
2) Office and Quarters	L S
3) Land Acquisition	--
2. Pilot Demonstration Scheme	500ha
3. Head Works	--
4. Main Canal	4,316,000m³
5. Sub-area A	
1) Land Reclamation	850ha
2) Seco. & Sub-seco. Canals	310,000 m³
3) Tertiary Canals	46,000 m³
4) Farm Roads	137,200 m
5) Seco. & Sub-seco. Drains	251,000 m³
6) Tertiary Drains	26,000 m³
6. Sub-area B	
1) Land Reclamation	4,200 ha
2) Seco. & Sub-seco. Canals	921,000 m³
3) Tertiary Canals	273,000 m³
4) Farm Roads	259,800 m
5) Main Drains	2,761,000 m³
6) Seco. & Sub-seco. Drains	731,000 m³
7) Tertiary Drains	210,000 m³
7. Sub-area C	
1) Land Reclamation	100 ha
2) Seco. & Sub-seco. Canals	432,000 m³
3) Tertiary Canals	129,000 m³
4) Farm Roads	86,800 m
5) Seco. & Sub-seco. Drains	716,000 m³
6) Tertiary Drains	88,000 m³
8. Sub-area D	
1) Seco. & Sub-seco. Canals	1,308,000 m³
2) Tertiary Canals	429,000 m³
3) Farm Roads	278,500 m
4) Main Drains	499,000 m³
5) Seco. & Sub-seco. Drains	2,646,000 m³
6) Tertiary Drains	420,000 m³
9. Sub-area E	
1) Seco. & Sub-seco. Canals	820,000 m³
2) Tertiary Canals	305,000 m³
3) Farm Roads	225,000 m
4) Seco. & Sub-seco. Drains	2,270,000 m³
5) Tertiary Drains	290,000 m³
10. Quaternary Networks	
1) Sub-area A	
2) Sub-area B	
3) Sub-area C	
4) Sub-area D	
5) Sub-area E	

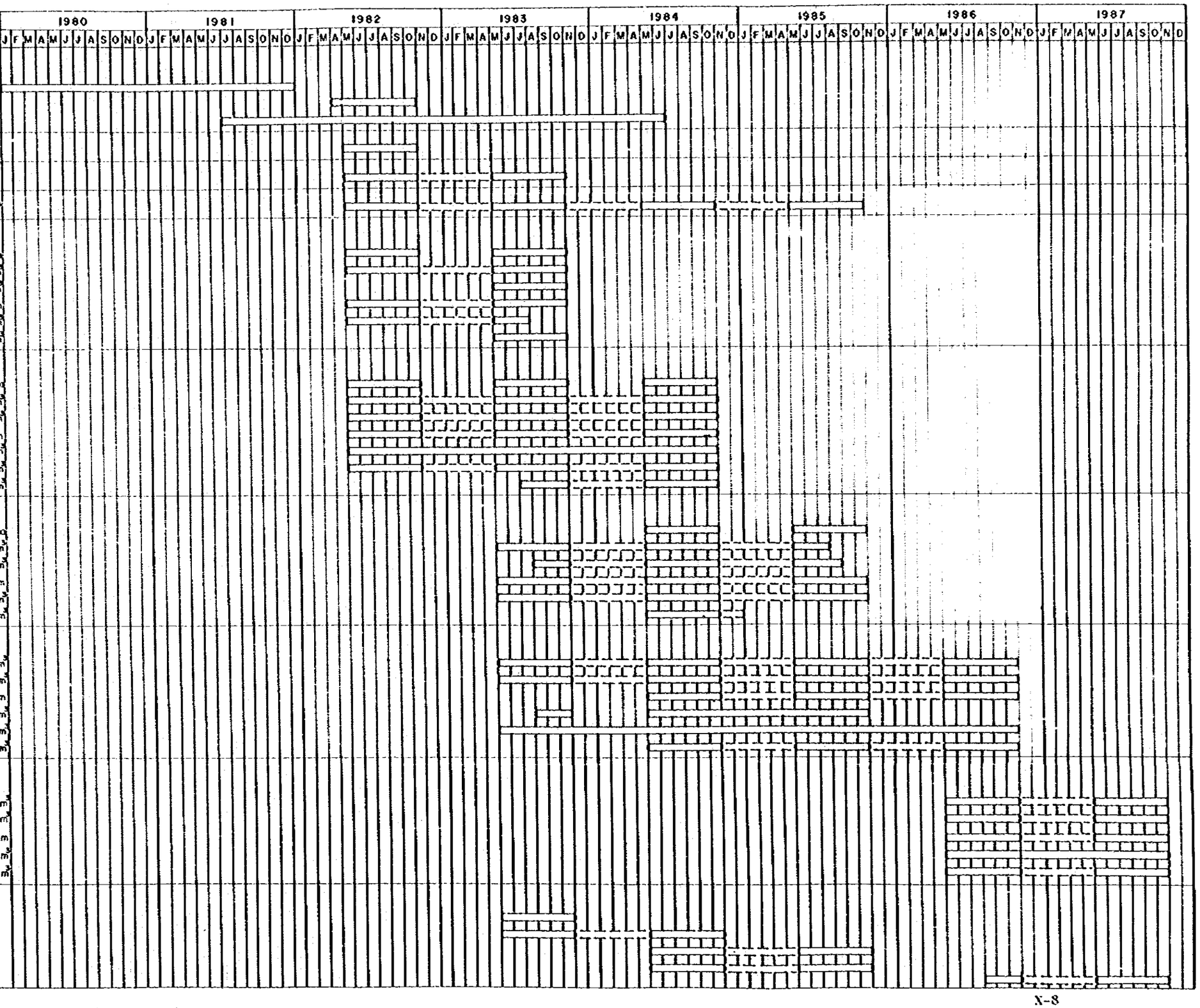
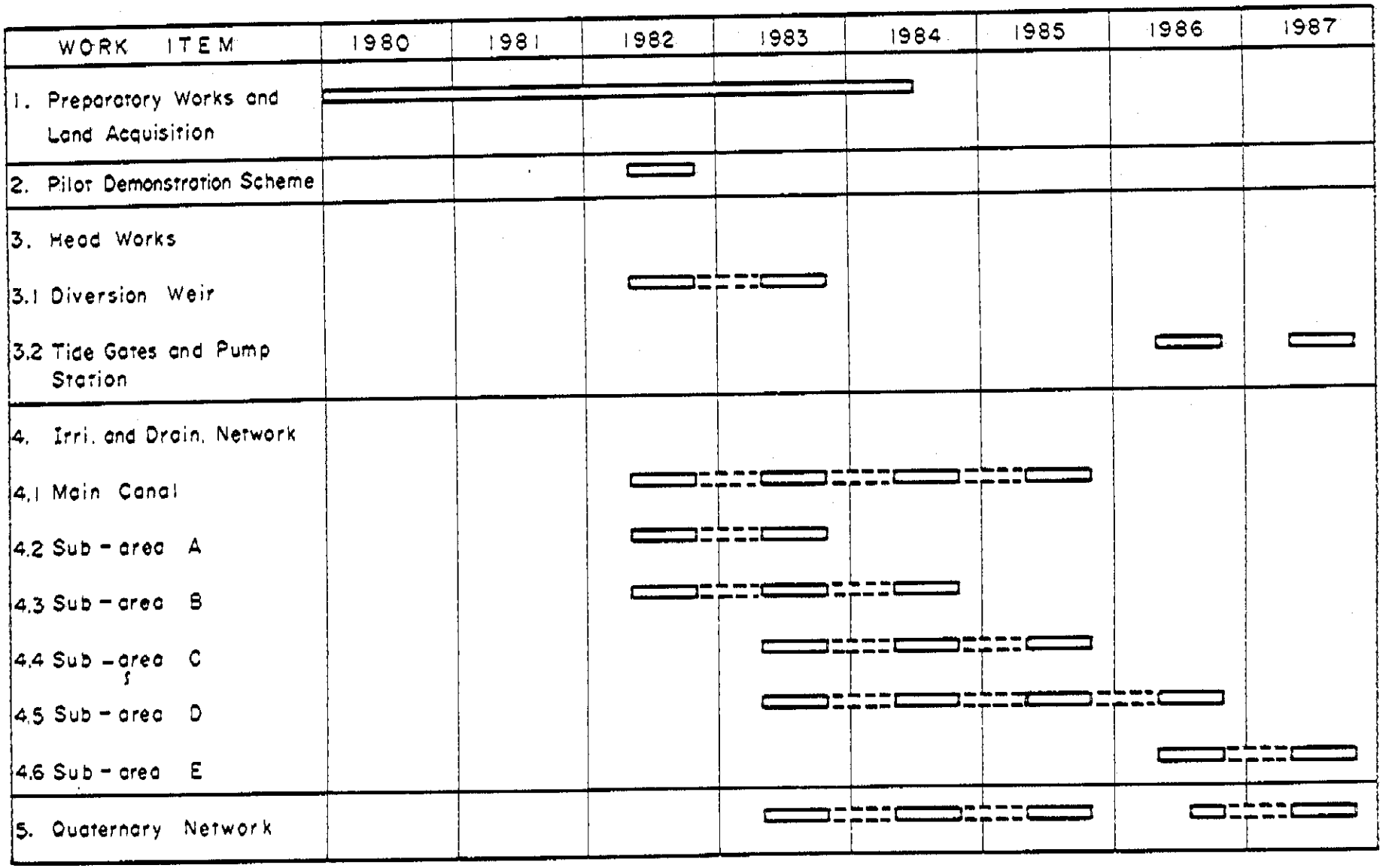


Fig.X-2 Preliminary Construction Schedule of Combined Gravity and Pump Irrigation Scheme



ANNEX XI

COST ESTIMATES

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ANNEX XI. COST ESTIMATES

XI.1. GENERAL

The construction cost is estimated based on the following assumptions:

(1) The exchange rate used is:

US$1.00 = Rp. 625 as of April, 1979.

(2) Civil engineering works are to be carried out on the contract basis. The heavy construction machinery and equipment are provided for the contractors free of charge under the control of the project office. The machinery and equipment are procured on international tender basis.

(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 South Kalimantan Province in early 1979, and on the data obtained from the on-going and completed irrigation projects in Java and Sumatra. Foreign currency portion is estimated based on the CIF prices at Surabaya, making reference to FOB prices of materials and equipment in Japan in 1979. The classification of local and foreign currency portions is defined as follows:

Local Currency Portion

- Labour force,
- Wooden materials,
- Fuel, oil, etc.,
- Inland transportation costs,
- Steel gates for canal related structures,
- Contractors' general expenses and profit, and
- Minor works.

Foreign Currency Portion

- Reinforcement bar,
- Cement,
- Steel gates for diversion weir and drainage sluices, and other structural steel,
- Heavy construction machinery, equipment and plants, and,
- Expense and fees of engineering services by foreign consultants.

(5) Sand and gravel are to be produced by the procured construction plants.

(6) For the construction of the Quaternary Network, only the costs of materials necessary to make the division boxes are included in the construction cost. The construction works of the Quaternary Network are to be carried out by local farmers themselves under the guidance of the project office.

(7) The associated costs to be financed by the Government such as the cost for the strengthening the extension services, for the facilities of the water users' association, for the improvement of the social infrastructures, etc. for the project execution are not included in the construction cost.

XI.2. COST ESTIMATE

XI.2.1 Total Construction Cost

The total construction costs of the Project are estimated at US$190.67 million, comprising US$83.79 million of foreign currency and US$106.88 million equivalent of local currency, which are presented as the price level in 1979. The annual disbursement schedule is worked out based on the construction time schedule, which is stated in Annex X, as follows:

Year	Local Currency (US$1,000)	Foreign Currency (US$1,000)	Total (US$1,000)
1980	80	900	980
1981	340	1,130	1,470
1982	16,110	23,330	39,440
1983	23,530	27,930	51,460
1984	22,680	10,120	32,800
1985	13,320	9,600	22,920
1986	18,530	7,350	25,880
1987	12,290	3,430	15,720
Total	106,880	83,790	190,670

The detailed breakdown of the construction cost, procurement cost of machinery and equipment, and detailed annual disbursement of the construction cost are shown in Tables XI - 1, 2, 3 and 4.

XI.2.2 Operation and Maintenance Costs

Operation and maintenance costs of the Project consist of the expenses for project offices including personnel cost as well as maintenance cost of the project facilities. These costs are shown in Table XI-7.

XI.2.3 Costs for Replacement of Project Facilities

The steel gates provided for the diversion weir and canal related structures would have to be periodically replaced. The economic life of the steel gates and costs for replacement are given in Table XI-8.

XI.3 COST ESTIMATE FOR COMBINED GRAVITY AND PUMP IRRIGATION SCHEME

XI.3.1 Total Construction Cost

The total construction cost for the combined gravity and pump irrigation scheme is estimated, adding the cost for the pumping station, tide gates and additional secondary canal to the construction cost for the proposed project. The total construction cost would be US$201.97 million, comprising US$92.19 million of foreign currency and US$109.78 million of local currency at the price level in early 1979 including the price contingency. The summary and breakdown of the construction cost are shown in Tables XI-5 and XI-6, respectively.

XI.3.2 Operation and Maintenance Costs

The operation and maintenance costs for the future stage development are the sum of the cost for the proposed project and the expenses for operation and maintenance for the pumping station and the tide gates. These costs are shown in Table XI-7.

XI.3.3 Costs for Replacement of Project Facilities

Some parts of the project facilities would have to be periodically replaced. They would be steel gates provided for the diversion weir, tide gates and canal related structures, and the pump equipment and the diesel engines. The economic life of each facility and costs for replacement are given in Table XI-14.

Table XI-1 Cost Estimate
(US$1,000)

	Work Item	Total	Local Currency	Foreign Currency
1	Preparatory Works	710	280	430
2	Pilot Scheme	700	240	460
3	Civil Works	66,334	52,167	14,167
3.1	Diversion Weir	2,840	1,428	1,412
3.2	Main Canal & Related Structures	9,418	6,630	2,788
3.3	Irrigation Network	22,900	19,337	3,563
3.4	Drainage Network	17,879	12,382	5,497
3.5	Farm Road Network	9,830	8,979	851
3.6	Quaternary Network	290	290	-
3.7	Land Reclamation	3,177	3,121	56
4	Construction Equipment	36,100	1,720	34,380
5	Land Acquisition	2,223	2,223	-
6	Administration	2,660	2,660	-
7	Engineering Service	6,720	280	6,440
8	Contingencies	75,223	47,310	27,913
8.1	Physical Contingency	18,061	9,479	8,582
8.2	Price Contingency	57,162	37,831	19,331
	Total (1 - 8)	190,670	106,880	83,790

Table XI-2. Breakdown of Construction Cost

U.P. : Unit Price

Work	Unit	Quantity	Total (US$1.000)	L.C. U.P. (US$)	L.C. Amount (US$1.000)	F.C. U.P. (US$)	F.C. Amount (US$1.000)
I. Preparatory Works							
Office and Quarters	L.S.		530		210		320
I. Total			530		210		320
II. Pilot Scheme							
1. Excavation of inlet channel	m^3	8,000	12.8	0.6	4.8	0.1	8.0
2. Structural excavation	"	1,200	0.8	0.57	0.7	0.03	0.1
3. Backfill	"	300	1.1	3.3	1.0	0.2	0.1
4. Concrete, Type A	"	350	16.5	22.0	7.7	25.0	8.8
5. Reinforcement bar	ton	30	15.9	80.0	2.4	450.0	13.5
6. Wooden form	m^2	1,800	16.2	9.0	16.2	-	-
7. Concrete pile, 20m	Nos.	200	70.0	250.0	50.0	100.0	20.0
8. Steel sheet pile	ton	5	3.1	150.0	0.8	450.0	2.3
9. Wet masonry	m^3	150	4.4	19.0	2.9	10.0	1.5

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
10. Pump house	L.S.		45.0		25.0		20.0
11. Pump equipment	"		293.0		7.0		286.0
12. Office and laboratory	"		100.0		100.0	-	-
13. Experimental apparatus and agricultural machinery	"		65.0		5.0		60.0
14. Miscellaneous			56.2		16.5		39.7
II. Total			700.0		240.0		460.0
III. Diversion Weir							
III.1. Weir							
1. Excavation, Type A	m^3	55,400	38.7	0.6	33.2	0.1	5.5
2. Excavation, rock	"	4,200	12.2	2.3	9.7	0.6	2.5
3. Concrete, Type A	"	3,100	145.7	22.0	68.2	25.0	77.5
4. Concrete. Type B	"	26.000	1,066.0	21.0	546.0	20.0	520.0
5. Metal form	m^3	9,000	45.0	1.0	9.0	4.0	36.0
6. Reinforcement bar	ton	250	2.3	9.0	2.3	-	-

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
7. Riprap	m^3	6,300	75.6	9.0	56.7	3.0	18.9
8. Steel slide gate, 2.0m x 2.0m	Nos.	2	15.1	380.0	0.8	7,150	14.3
9. Coffering			114.6		60.9		53.7
1) Concrete, Type A	m^3	900	(42.3)	22.0	(19.8)	25.0	(22.5)
2) Reinforcement bar	ton	55	(29.2)	80.0	(4.4)	450.0	(24.8)
3) Metal form	m^2	700	(3.5)	1.0	(0.7)	4.0	(2.8)
4) Embankment	m^3	36,000	(39.6)	1.0	(36.0)	0.1	(3.6)
10. Land clearing	m^2	300,000	60.0	0.2	60.0	-	-
11. Temporary bridge	L.S.		70.0		70.0		-
12. Access road	m	9,000	115.2	11.8	106.2	1.0	9.0
13. Miscellaneous	L.S.		263.6		153.0		110.6
III. 1. Sub-Total			2,024.0		1,176.0		848.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
III. 2. Intake							
1. Excavation, Type A	m^3	31,000	21.7	0.6	18.6	0.1	3.1
2. Excavation, rock	m^3	3,000	8.7	2.3	6.9	0.6	1.8
3. Backfilling	"	3,700	12.9	3.3	12.2	0.2	0.7
4. Foundation gravel	"	850	5.9	6.5	5.5	0.5	0.4
5. Concrete, Type A	"	4,600	216.2	22.0	101.2	25.0	115.0
6. Reinforcement bar	ton	370	196.1	80.0	29.6	450.0	166.5
7. Metal form	m^2	2,000	10.0	1.0	2.0	4.0	8.0
8. Wooden form	"	3,300	29.7	9.0	29.7	-	-
9. Trash rack	ton	1.5	3.0	2,000	3.0	-	-
10. Steel slide gates $^{B}2.0m \times {}^{H}3.0m$	Nos.	9	205.7	1,150	10.4	21,700	195.3
11. Miscellaneous	L.S.		106.1		32.9		73.2
III. 2. Sub-Total			816.0		252.0		564.0
III. Total			2,840.0		1,428.0		1,412.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
IV. Main Canal & Related Structures							
1. Excavation, Type A	m^3	3,320,000	2,324.0	0.6	1,992.0	0.1	332.0
2. Embankment, Type A	"	1,000,000	1,100.0	1.0	1,000.0	0.1	100.0
3. Disposal of excavated soil	m^3/km	800,000	320.0	0.3	240.0	0.1	80.0
4. Earth lining	m^3	78,000	218.4	2.5	195.0	0.3	23.4
5. Sod facing	m^2	352,000	176.0	0.5	176.0	-	-
6. Gravel	m^3	43,000	301.0	6.5	279.5	0.5	21.5
7. Concrete, Type B	"	54,000	2,214.0	21.0	1,134.0	20.0	1,080.0
8. Weephole	Nos.	99,500	477.7	0.1	10.0	4.7	467.7
9. Related structures			1,059.2		739.0		320.2
1) Turnout	Nos.	8	(115.6)		(90.3)		(25.3)
2) Checkgate	"	4	(280.7)		(220.7)		(60.0)
3) Siphon	"	1	(34.6)		(24.2)		(10.4)
4) Cross drain	"	26	(239.3)		(147.9)		(91.4)
5) Bridge	"	7	(148.2)		(98.8)		(49.4)
6) Overshoot drain	"	1	(229.1)		(150.1)		(79.0)
7) Washing basin	"	6	(11.7)		(7.0)		(4.7)

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
10. Miscellaneous	L.S.		1,227.7		864.5		363.2
IV. Total			9,418.0		6,630.0		2,788.0
V. Secondary and Sub-secondary Irrigation Canal							
V.1. Sub-area A							
1. Stripping	m^3	83,700	50.3	0.5	41.9	0.1	8.4
2. Excavation, Type A	"	6,200	4.3	0.6	3.7	0.1	0.6
3. Excavation, Type B	"	14,600	24.8	1.7	24.8	-	-
4. Embankment, Type B	"	20,800	14.6	0.6	12.5	0.1	2.1
5. Embankment, Type C	"	268,200	911.9	3.1	831.4	0.3	80.5
6. Sod facing	m^2	88,400	44.2	0.5	44.2	-	-
7. Related structures			109.3		73.8		35.5
1) Turnout for sub-secondary canals	Nos.	7	(10.8)		(7.5)		(3.3)
2) Turnout for tertiary canals	"	47	(27.3)		(19.6)		(7.7)
3) Checkgate	"	4	(18.7)		(8.8)		(9.9)

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
4) Bridge	Nos.	8	(39.6)		(28.8)		(10.8)
5) Siphon	"	1	(12.9)		(9.1)		(3.8)
8. Miscellaneous	L.S.		116.6		103.7		12.9
V. 1. Sub-Total			1,276.0		1,136.0		140.0
V.2. Sub-area B							
1. Stripping	m^3	276,500	166.0	0.5	138.3	0.1	27.7
2. Excavation, Type A	"	65,000	45.5	0.6	39.0	0.1	6.5
3. Excavation, Type B	"	151,000	256.7	1.7	256.7	-	-
4. Embankment, Type B	"	216,000	151.2	0.6	129.6	0.1	21.6
5. Embankment, Type C	"	490,000	1,666.0	3.1	1,519.0	0.3	147.0
6. Sod facing	m^2	292,000	146.0	0.5	146.0	-	-
7. Related structures			421.0		300.1		120.9
1) Turnout for sub-secondary canals	Nos.	15	(42.9)		(33.3)		(9.6)
2) Turnout for tertiary canal	"	311	(181.0)		(129.9)		(51.1)
3) Checkgate	"	7	(60.3)		(39.6)		(20.7)
4) Bridge	"	22	(136.8)		(97.3)		(39.5)

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
8. Miscellaneous	L.S.		284.6		252.3		32.3
V.2 Sub-Total			3,137.0		2,781.0		356.0
V.3 Sub-area C							
1. Stripping	m^3	114,100	68.5	0.5	57.1	0.1	11.4
2. Excavation, Type A	"	16,000	11.2	0.6	9.6	0.1	1.6
3. Excavation, Type B	"	62,000	105.4	1.7	105.4	-	-
4. Embankment, Type B	"	78,000	54.6	0.6	46.8	0.1	7.8
5. Embankment, Type C	"	277,000	941.8	3.1	858.7	0.3	83.1
6. Sod facing	m^2	121,000	60.5	0.5	60.5	-	-
7. Related structures			201.6		142.4		59.2
1) Turnout for sub-secondary canal	Nos.	10	(25.8)		(20.3)		(5.5)
2) Turnout for tertiary canal	"	102	(59.4)		(42.6)		(16.8)
3) Checkgate	"	5	(40.5)		(25.2)		(15.3)
4) Bridge	"	13	(75.9)		(54.3)		(21.6)
8. Miscellaneous	L.S.		145.4		128.5		16.9
V.3 Sub-Total			1,589.0		1,409.0		180.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
V.4 Sub-area D							
1. Stripping	m^3	323,000	193.8	0.5	161.5	0.1	32.3
2. Excavation, Type A	"	89,000	62.3	0.6	53.4	0.1	8.9
3. Excavation, Type B	"	206,000	350.2	1.7	350.2	-	-
4. Embankment, Type B	"	295,000	206.5	0.6	177.0	0.1	29.5
5. Embankment, Type C	"	717,000	2,437.8	3.1	2,222.7	0.3	215.1
6. Sod facing	m^2	341,000	170.5	0.5	170.5	-	-
7. Related structures			515.1		372.0		143.1
1) Turnout for sub-secondary canal	Nos.	15	(59.0)		(47.7)		(11.3)
2) Turnout for tertiary canal	"	282	(164.1)		(117.8)		(46.3)
3) Checkgate	"	9	(101.3)		(69.0)		(32.3)
4) Bridge	"	28	(177.2)		(128.2)		(49.0)
5) Siphon	"	1	(13.5)		(9.3)		(4.2)
8. Miscellaneous	L.S.		393.8		350.7		43.1
V.4 Sub-Total			4,330.0		3,858.0		472.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
V.5 Sub-area E							
1. Stripping	m^3	203,000	121.8	0.5	101.5	0.1	20.3
2. Excavation, Type A	"	56,000	39.2	0.6	33.6	0.1	5.6
3. Excavation, Type B	"	130,000	221.0	1.7	221.0	-	-
4. Embankment, Type B	"	186,000	130.2	0.6	111.6	0.1	18.6
5. Embankment, Type C	"	450,000	1,530.0	3.1	1,395.0	0.3	135.0
6. Sod facing	m^2	215,000	107.5	0.5	107.5	-	-
7. Related structures			319.1		230.5		88.6
1) Turnout for sub-secondary canal	Nos.	9	(36.9)		(29.8)		(7.1)
2) Turnout for tertiary canal	"	198	(119.9)		(86.1)		(33.8)
3) Checkgate	"	6	(70.2)		(47.9)		(22.3)
4) Bridge	"	14	(92.1)		(66.7)		(25.4)
8. Miscellaneous	L.S.		248.2		221.3		26.9
V.5 Sub-total			2,717.0		2,422.0		295.0
V. Total			13,049.0		11,606.0		1,443.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
VI. Tertiary Irrigation Canal							
VI.1 Sub-area A							
1. Stripping	m^3	14,000	8.4	0.5	7.0	0.1	1.4
2. Excavation, Type B	"	8,500	14.5	1.7	14.5	-	-
3. Embankment, Type B	"	8,500	6.0	0.6	5.1	0.1	0.9
4. Embankment, Type C	"	29,500	100.4	3.1	91.5	0.3	8.9
5. Related structures			473.7		338.5		135.2
1) Division box	Nos.	120	(14.9)		(4.7)		(10.2)
2) Bridge	"	122	(419.8)		(308.4)		(111.4)
3) Washing basin	"	44	(39.0)		(25.4)		(13.6)
6. Miscellaneous	L.S.		60.0		45.4		14.6
VI.1 Sub-Total			663.0		502.0		161.0
VI.2 Sub-area B							
1. Stripping	m^3	81,000	48.6	0.5	40.5	0.1	8.1
2. Excavation, Type B	"	49,600	84.3	1.7	84.3	-	-
3. Embankment, Type B	"	49,600	34.8	0.6	29.8	0.1	5.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
4. Embankment, Type C	m^3	173,600	590.3	3.1	538.2	0.3	52.1
5. Related structures			1,563.6		1,116.4		447.2
1) Division box	Nos.	500	(61.9)		(19.6)		(42.3)
2) Bridge	"	414	(1,424.6)		(1.046.6)		(378.0)
3) Washing basin	"	87	(77.1)		(50.2)		(26.9)
6. Miscellaneous	L.S.		232.4		180.8		51.6
VI.2 Sub-Total			2,554.0		1,990.0		564.0
VI.3 Sub-area C							
1. Stripping	m^3	38,400	23.0	0.5	19.2	0.1	3.8
2. Excavation, Type B	"	23,500	40.0	1.7	40.0	-	-
3. Embankment, Type B	"	23,500	16.5	0.6	14.1	0.1	2.4
4. Embankment, Type C	"	82,200	279.5	3.1	254.8	0.3	24.7
5. Related structures			708.2		497.8		210.4
1) Division box	Nos.	310	(38.4)		(12.2)		(26.2)
2) Bridge	"	172	(591.8)		(434.8)		(157.0)
3) Washing basin	"	88	(78.0)		(50.8)		(27.2)

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
6. Miscellaneous	L.S.		106.8		82.1		24.7
VI.3 Sub-Total			1,174.0		908.0		266.0
VI.4 Sub-area D							
1. Stripping	m^3	127,500	76.6	0.5	63.8	0.1	12.8
2. Excavation, Type B	"	78,000	132.6	1.7	132.6	-	-
3. Embankment, Type B	"	78,000	54.6	0.6	46.8	0.1	7.8
4. Embankment, Type C	"	273,200	928.9	3.1	846.9	0.3	82.0
5. Related structures			1,698.8		1,203.7		495.1
1) Division box	Nos.	470	(58.2)		(18.4)		(39.8)
2) Bridge	"	407	(1,400.5)		(1,028.9)		(371.6)
3) Washing basin	"	271	(240.1)		(156.4)		(83.7)
6. Miscellaneous	L.S.		289.5		229.2		60.3
VI.4 Sub-Total			3,181.0		2,523.0		658.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
VI.5 Sub-area E							
1. Stripping	m^3	91,000	54.6	0.5	45.5	0.1	9.1
2. Excavation, Type B	"	56,000	95.2	1.7	95.2	-	-
3. Embankment, Type B	"	56,000	39.2	0.6	33.6	0.1	5.6
4. Embankment, Type C	"	195,500	664.8	3.1	606.1	0.3	58.7
5. Related structures			1,219.1		863.6		355.5
1) Division box	Nos.	330	(42.4)		(13.4)		(29.0)
2) Bridge	"	280	(1,001.6)		(736.1)		(265.5)
3) Washing basin	"	190	(175.1)		(114.1)		(61.0)
6. Miscellaneous	L.S.		206.1		164.0		42.1
VI.5 Sub-total			2,279.0		1,808.0		471.0
VI. Total			9,851.0		7,731.0		2,120.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
VII. Main Drain							
VII.1 Sub-area B							
1. Dredging excavation	m^3	1,940,000	1,358.0	0.6	1,164.0	0.1	194.0
2. Excavation in existing channel	"	821,000	574.7	0.6	492.6	0.1	82.1
3. Spoiled bank	"	2,761,000	1,104.4	0.3	828.3	0.1	276.1
4. Related structures			242.8		157.0		85.8
1) Bridge	Nos.	11	(242.8)		(157.0)		(85.8)
5. Miscellaneous	L.S.		328.1		264.1		64.0
VII.1 Sub-Total			3,608.0		2,906.0		702.0
VII.2 Sub-area D							
1. Dredging excavation	m^3	220.000	154.0	0.6	132.0	0.1	22.0
2. Excavation in existing channel	"	279.000	195.3	0.6	167.4	0.1	27.9
3. Spoiled bank	"	499,000	199.6	0.3	149.7	0.1	49.9
4. Related structures			94.9		60.6		34.3
1) Bridge	Nos.	3	(66.2)		(42.8)		(23.4)
2) Culvert	"	1	(28.7)		(17.8)		(10.9)

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
5. Miscellaneous	L.S.		65.2		51.3		13.9
VII.2 Sub-Total			709.0		561.0		148.0
VII. Total			4,317.0		3,467.0		850.0
VIII. Secondary & Sub-secondary Drain							
VIII.1 Sub-area A							
1. Excavation in existing channel	m^3	251,000	175.7	0.6	150.6	0.1	25.1
2. Spoiled bank	"	251,000	100.4	0.3	75.3	0.1	25.1
3. Related structures			44.1		31.6		12.5
1) Bridge	Nos.	7	(44.1)		(31.6)		(12.5)
4. Miscellaneous	L.S.		31.8		25.5		6.3
VIII.1 Sub-Total			352.0		283.0		69.0
VIII.2 Sub-area B							
1. Excavation in existing channel	m^3	731,000	511.7	0.6	438.6	0.1	73.1
2. Spoiled bank	"	731,000	292.4	0.3	219.3	0.1	73.1
3. Related structures			1,445.5		401.9		1,043.6
1) Bridge	Nos.	14	(109.4)		(77.6)		(31.8)

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
2) Drainage sluice	Nos.	16	(1,329.1)		(319.8)		(1,009.3)
3) Culvert	"	1	(7.0)		(4.5)		(2.5)
4. Miscellaneous	L.S.		225.4		106.2		119.2
VIII.2 Sub-Total			2,475.0		1,166.0		1,309.0
VIII.3 Sub-area C							
1. Excavation in existing channel	m^3	716,000	501.2	0.6	429.6	0.1	71.6
2. Spoiled bank	"	716,000	286.4	0.3	214.8	0.1	71.6
3. Related structures			387.9		141.1		246.8
1) Bridge	Nos.	9	(65.8)		(46.8)		(19.0)
2) Drainage sluice	"	3	(322.1)		(94.3)		(227.8)
4. Miscellaneous	L.S.		117.5		78.5		39.0
VIII.3 Sub-Total			1,293.0		864.0		429.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
VIII.4 Sub-area D							
1. Excavation in existing channel	m^3	2,646,000	1,852.2	0.6	1,587.6	0.1	264.6
2. Spoiled bank	"	2,646,000	1,058.4	0.3	793.8	0.1	264.6
3. Related structures			1,639.5		477.5		1,162.0
1) Bridge	Nos.	22	(160.8)		(114.4)		(46.4)
2) Drainage sluice	"	18	(1,467.4)		(356.2)		(1,111.2)
3) Culvert	"	1	(11.3)		(6.9)		(4.4)
4. Miscellaneous	L.S.		455.9		286.1		169.8
VIII.4 Sub-Total			5,006.0		3,145.0		1,861.0
VIII.5 Sub-area E							
1. Excavation in existing channel	m^3	2,270	1,589.0	0.6	1,362.0	0.1	227.0
2. Spoiled bank	"	2,270	908.0	0.3	681.0	0.1	227.0
3. Related structures			398.0		169.0		229.0
1) Bridge	Nos.	14	(124.6)		(93.1)		(31.5)
2) Drainage sluice	"	3	(273.4)		(75.9)		(197.5)
4. Miscellaneous	L.S.		290.0		221.0		69.0
VIII.5 Sub-total			3,185.0		2,433.0		752.0
VIII. Total			12,311.0		7,891.0		4,420.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
IX. Tertiary Drain							
IX.1 Sub-area A							
1. Excavation in existing channel	m^3	26,000	18.2	0.6	15.6	0.1	2.6
2. Spoiled bank	"	26,000	10.4	0.3	7.8	0.1	2.6
3. Miscellaneous	L.S.		3.4		2.6		0.8
IX.1 Sub-Total			32.0		26.0		6.0
IX.2 Sub-area B							
1. Excavation in existing channel	m^3	210,000	147.0	0.6	126.0	0.1	21.0
2. Spoiled bank	"	210,000	84.0	0.3	63.0	0.1	21.0
3. Miscellaneous	L.S.		23.0		19.0		4.0
IX.2 Sub-Total			254.0		208.0		46.0
IX.3 Sub-area C							
1. Excavation in existing channel	m^3	88,000	61.6	0.6	52.8	0.1	8.8
2. Spoiled bank	"	88,000	35.2	0.3	26.4	0.1	8.8
3. Miscellaneous	L.S.		9.2		7.8		1.4
IX.3 Sub-Total			106.0		87.0		19.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
IX.4 Sub-area D							
1. Excavation in existing channel	m^3	420,000	294.0	0.6	252.0	0.1	42.0
2. Spoiled bank	"	420,000	168.0	0.3	126.0	0.1	42.0
3. Miscellaneous	L.S.		46.0		38.0		8.0
IX.4 Sub-Total			508.0		416.0		92.0
IX.5 Sub-area E							
1. Excavation in existing channel	m^3	290.000	203.0	0.6	174.0	0.1	29.0
2. Spoiled bank	"	290.000	116.0	0.3	87.0	0.1	29.0
3. Miscellaneous	L.S.		32.0		26.0		6.0
IX.5 Sub-total			351.0		287.0		64.0
IX. Total			1,251.0		1,024.0		227.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
X. Farm Road							
X.1 Sub-area A							
1. Main farm road	m	8,700	111.4		102.7		8.7
2. Secondary farm road	"	38,600	416.8		382.1		34.7
3. Tertiary road	"	9,900	51.5		46.5		5.0
4. Miscellaneous	L.S.		58.3		53.7		4.6
X.1			638.0		585.0		53.0
X.2 Sub-area B							
1. Main farm road	m	64,500	828.7		763.8		64.9
2. Secondary farm road	"	98,700	1,065.9		977.1		88.8
3. Tertiary farm road	"	96,600	502.3		454.0		48.3
4. Miscellaneous	L.S.		239.1		219.1		20.0
X.2 Sub-Total			2,636.0		2,414.0		222.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
X.3 Sub-area C							
1. Main farm road	m	4,700	60.2		55.5		4.7
2. Secondary farm road	"	42,100	454.7		416.8		37.9
3. Tertiary farm road	"	40,000	208.0		188.0		20.0
4. Miscellaneous	L.S.		73.1		66.7		6.4
X.3 Sub-Total			796.0		727.0		69.0
X.4 Sub-area D							
1. Main farm road	m	27,100	414.6		378.8		35.8
2. Secondary farm road	"	114,500	1,236.7		1,133.6		103.1
3. Tertiary farm road	"	136,900	711.9		643.4		68.5
4. Miscellaneous	L.S.		235.8		215.2		20.6
X.4 Sub-Total			2,599.0		2,371.0		228.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
X.5 Sub-area E							
1. Main farm road	m	17,000	1,410.0		1,288.0		122.0
2. Secondary farm road	"	67,000	730.0		669.0		61.0
3. Tertiary farm road	"	141,000	734.0		663.0		71.0
4. Miscellaneous	L.S.		287.0		262.0		25.0
X.5 Sub-total			3,161.0		2,882.0		279.0
X. Total			9,830.0		8,979.0		851.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
XI. Quaternary Networks							
XI.1 Sub-area A							
Materials for structures	L.S.		16.0		16.0		
XI.1 Sub-Total			16.0		16.0		
XI.2 Sub-area B							
Materials for structures	L.S.		63.0		63.0		
XI.2 Sub-Total			63.0		63.0		
XI.3 Sub-area C							
Materials for structures	L.S.		32.0		32.0		
XI.3 Sub-Total			32.0		32.0		
XI.4 Sub-area D							
Materials for structures	L.S.		98.0		98.0		
XI.4 Sub-Total			98.0		98.0		
XI.5 Sub-area E							
Materials for structures	L.S.		81.0		81.0		
XI.5 Sub-total			81.0		81.0		
XI. Total			290.0		290.0		

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
XII. Land Reclamation							
XII.1. Sub-area A							
1. Plantation	ha	760	732.6	940.0	714.4	24.0	18.2
2. Shurb	"	90	41.0	450.0	40.5	6.0	0.5
3. Miscellaneous	L.S.		77.4		75.1		2.3
XII.1 Sub-Total			851.0		830.0		21.0
XII.2. Sub-area B							
1. Plantation	ha	200	192.8	940.0	188.0	24.0	4.8
2. Shurb	"	4,000	1,824.0	450.0	1,800.0	6.0	24.0
3. Miscellaneous	L.S.		202.2		199.0		3.2
XII.2 Sub-Total			2,219.0		2,187.0		32.0
XII.3 Sub-area C							
1. Plantation	ha	100	96.4	940.0	94.0	24.0	2.4
2. Miscellaneous	L.S.		10.6		10.0		0.6
XII.3 Sub-Total			107.0		104.0		3.0
XII. Total			3,179.0		3,122.0		57.0

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
XIII. Land Acquisition							
1. Weir site and submerged area	ha	232	380.5	1,640	380.5		
2. Main canal	"	400	68.0	170	68.0		
3. Main drain	"	450	76.5	170	76.5		
4. Irrigation & drainage network	"	2,160	1,468.8	680	1,468.8		
5. Borrow pit	"	150	25.5	170	25.5		
6. Miscellaneous	L.S.		203.7		203.7		
XIII. Total			2,223.0		2,223.0		
XIV. Administration							
1. Personnel expense	L.S.		1,520.0		1,520.0		
2. General expense	L.S.		900.0		900.0		
3. Miscellaneous	L.S.		240.0		240.0		
XIV. Total			2,200.0		2,200.0		

Work	Unit	Quantity	Total (US$1,000)	L.C. U.P. (US$)	L.C. Amount (US$1,000)	F.C. U.P. (US$)	F.C. Amount (US$1,000)
XV. Engineering Service							
XV.1 Detail Design Stage							
1. Remuneration	M/M	220	1,760.0				1,760.0
2. General expense	L.S.		310.0		90		270.0
XV.1 Sub-Total			2,120.0		90		2,030.0
XV.2 Construction Supervision Stage							
1. Remuneration	M/M	480	3,840.0				3,840.0
2. General expense	L.S.		760.0		190.0		570.0
XV.2 Sub-Total			4,600.0		190.0		4,410.0
XV. Total			6,720.0		280.0		6,440.0

Table XI-3 Cost Estimate of Construction Equipment

(US$ 1,000)

No.	Equipment	Spec.	Number	Purchase Cost[/1] (F.C) Unit Cost	Purchase Cost[/1] (F.C) Amount	L.C[/2]	Depre. Rate	Depre. Cost
1.	Motor scraper	11 m^3	2	255	510	26	0.85	434
2.	Swamp bulldozer	21 ton	26	128	3,328	166	0.9	2,996
3.	Bulldozer	21 ton	24	115	2,760	138	"	2,485
4.	Rake dozer	21 ton	15	131	1,965	98	"	1,769
5.	Bulldozer	11 ton	27	59	1,593	80	"	1,434
6.	Backhoe	0.6 m^3	8	58	464	23	0.85	394
	Trapezoid backet attachment	0.6 m^3	8	2.6	21	1	"	18
7.	Swamp backhoe	0.6 m^3	8	61	488	24	"	415
8.	Rock braker	500 kg	6	26	156	8	"	133
9.	Dragline	0.8 m^3	7	102	714	36	0.8	571
10.	Wheel loader	2.3 m^3	5	90	450	23	0.9	405
11.	- do -	2.0 m^3	2	91	182	9	0.8	146
12.	- do -	1.2 m^3	15	37	555	28	0.9	500
13.	Dump truck	8 ton	160	24	3,840	192	"	3,457
14.	Motor grader	3.7 m	10	64	640	32	0.8	512
15.	Tire roller	15 ton	13	38	494	25	"	395
16.	Macadam roller	10 ton	4	34	136	7	0.5	68
17.	Vibration roller	1.1 ton	17	8	136	7	0.6	82
18.	Soil compactor	125 kg	20	1.3	26	1	0.5	13
19.	Portable batcher plant	40 m^3/hr.	2	235	470	24	0.7	329
20.	Agitator truck	3.2 m^3	10	36	360	18	0.9	324

/1 CIF Cost
/2 Inland transportation, etc.

No.	Equipment	Spec.	Number	Purchase Cost (F.C) Unit Cost	Amount	L.C	Depre. Rate	Depre. Cost
21.	Concrete pump(truck mounted)	30-65 m^3/hr.	2	84	168	8	0.9	151
22.	Crawler drill	17 m^3/min.	4	58	232	12	"	209
23.	Portable compressor	21 m^3/min.	4	39	156	8	"	140
24.	Dredger	160 m^3/hr.	2	993	1,986	99	0.4	794
25.	Pile driver	18.5 m	1	113	113	6	0.7	79
26.	Truck crane	11 ton	3	68	204	10	"	143
27.	Crushing plant	100 ton/hr.	1	523	523	26	0.9	471
28.	Screening plant	140 ton/hr.	1	314	314	16	"	283
29.	Ordinary truck	8 ton	10	28	280	14	"	252
30.	Water tanker	8 kl	4	34	136	7	"	122
31.	Fuel tanker	8 kl	4	33	132	7	"	119
32.	Grease car	6 ton	2	46	92	5	0.7	64
33.	Maintenance car	6 ton	3	41	123	6	"	86
34.	Trailer truck	30 ton	1	66	66	3	0.35	23
35.	Fork-lift truck	3 ton	3	17	51	3	"	18
36.	Diesel generator	250 KVA	2	37	74	4	0.7	52
37.	- do -	120 KVA	1	21	21	1	"	15
38.	Diesel light for night work	5 KW	50	2	100	5	0.9	90
39.	4-wheel jeep	-	20	10	200	10	"	180
40.	Testing equipment	-	L.S	-	186	9	"	167
41.	Miscellaneous equipment	-	L.S	-	830	42	"	747

Table XI-1 Annual Disbursement Schedule (US$1,000)

	Description	Total			1980			1981			1982			1983			1984			1985			1986			1987		
		Total	L.C	F.C	Total	L.C	F.C	Total	L.C	F.C	Total	L.C	F.C	Total	L.C	F.C	Total	L.C	F.C	Total	L.C	F.C	Total	L.C	F.C	Total	L.C	F.C
1	Preparatory Works	710	280	430	-	-	-	-	-	-	530	210	320	-	-	-	-	-	-	180	70	110	-	-	-	-	-	-
2	Pilot Scheme	700	240	460	-	-	-	-	-	-	700	240	460	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Civil Works (3.1-3.7)	66,331	52,167	14,167	-	-	-	-	-	-	10,475	8,245	2,230	16,736	12,587	4,149	15,286	11,973	3,313	8,091	6,240	1,854	9,832	8,142	1,690	5,901	4,973	931
3.1	Diversion Weir	2,840	1,428	1,412	-	-	-	-	-	-	809	470	339	2,031	958	1,073	-	-	-	-	-	-	-	-	-	-	-	-
(1)	Weir	(2,024)	(1,176)	(848)	-	-	-	-	-	-	(809)	(470)	(339)	(1,215)	(706)	(509)	-	-	-	-	-	-	-	-	-	-	-	-
(2)	Intake	(816)	(252)	(564)	-	-	-	-	-	-	-	-	-	(816)	(252)	(564)	-	-	-	-	-	-	-	-	-	-	-	-
3.2	Main Irri. Canal	9,418	6,630	2,788	-	-	-	-	-	-	1,884	1,326	558	2,825	1,989	836	2,825	1,989	836	1,884	1,326	558	-	-	-	-	-	-
3.3	Sub-area A	3,828	3,378	450	-	-	-	-	-	-	1,594	1,446	148	2,234	1,932	302	-	-	-	-	-	-	-	-	-	-	-	-
(1)	Irrigation Network	(1,939)	(1,638)	(301)	-	-	-	-	-	-	(638)	(568)	(70)	(1,301)	(1,070)	(231)	-	-	-	-	-	-	-	-	-	-	-	-
(2)	Drainage Network	(384)	(309)	(75)	-	-	-	-	-	-	(281)	(170)	(41)	(173)	(139)	(34)	-	-	-	-	-	-	-	-	-	-	-	-
(3)	Farm Road Network	(638)	(585)	(53)	-	-	-	-	-	-	(319)	(293)	(26)	(319)	(292)	(27)	-	-	-	-	-	-	-	-	-	-	-	-
(4)	Quaternary Network	(16)	(16)	-	-	-	-	-	-	-	-	-	-	(16)	(16)	-	-	-	-	-	-	-	-	-	-	-	-	-
(5)	Land Reclamation	(851)	(830)	(21)	-	-	-	-	-	-	(426)	(415)	(11)	(425)	(415)	(10)	-	-	-	-	-	-	-	-	-	-	-	-
3.4	Sub-area B	16,916	13,715	3,231	-	-	-	-	-	-	5,533	4,479	1,060	5,678	4,597	1,081	5,729	4,639	1,090	-	-	-	-	-	-	-	-	-
(1)	Irrigation Network	(5,691)	(4,771)	(920)	-	-	-	-	-	-	(1,897)	(1,591)	(306)	(1,897)	(1,590)	(307)	(1,897)	(1,590)	(307)	-	-	-	-	-	-	-	-	-
(2)	Drainage Network	(6,337)	(4,280)	(2,057)	-	-	-	-	-	-	(2,028)	(1,358)	(670)	(2,131)	(1,441)	(690)	(2,178)	(1,481)	(697)	-	-	-	-	-	-	-	-	-
(3)	Farm Road Network	(2,636)	(2,414)	(222)	-	-	-	-	-	-	(874)	(801)	(73)	(874)	(801)	(73)	(888)	(812)	(76)	-	-	-	-	-	-	-	-	-
(4)	Quaternary Network	(63)	(63)	-	-	-	-	-	-	-	-	-	-	(36)	(36)	-	(27)	(27)	-	-	-	-	-	-	-	-	-	-
(5)	Land Reclamation	(2,219)	(2,187)	(32)	-	-	-	-	-	-	(749)	(729)	(11)	(749)	(729)	(13)	(739)	(729)	(10)	-	-	-	-	-	-	-	-	-
3.5	Sub-area C	5,697	4,131	966	-	-	-	-	-	-	649	524	125	982	802	180	2,030	1,651	379	1,436	1,154	282	-	-	-	-	-	-
(1)	Irrigation Network	(2,763)	(2,317)	(446)	-	-	-	-	-	-	(359)	(301)	(58)	(574)	(490)	(84)	(1,163)	(973)	(192)	(668)	(553)	(115)	-	-	-	-	-	-
(2)	Drainage Network	(1,359)	(951)	(448)	-	-	-	-	-	-	(182)	(124)	(58)	(219)	(164)	(85)	(537)	(375)	(162)	(431)	(288)	(143)	-	-	-	-	-	-
(3)	Farm Road Network	(796)	(727)	(69)	-	-	-	-	-	-	(104)	(95)	(9)	(162)	(148)	(14)	(265)	(242)	(23)	(265)	(242)	(23)	-	-	-	-	-	-
(4)	Quaternary Network	(32)	(32)	-	-	-	-	-	-	-	(1)	(1)	-	-	-	-	(9)	(9)	-	(19)	(19)	-	-	-	-	-	-	-
(5)	Land Reclamation	(107)	(104)	(3)	-	-	-	-	-	-	-	-	-	-	-	-	(54)	(52)	(2)	(53)	(52)	(1)	-	-	-	-	-	-
3.6	Sub-area D	16,431	12,972	3,459	-	-	-	-	-	-	-	-	-	2,986	2,309	677	4,702	3,691	1,011	4,774	3,760	1,014	3,969	3,209	760	-	-	-
(1)	Irrigation Network	(7,511)	(6,381)	(1,130)	-	-	-	-	-	-	-	-	-	(1,879)	(1,596)	(283)	(1,879)	(1,596)	(283)	(1,877)	(1,595)	(282)	(1,876)	(1,594)	(282)	-	-	-
(2)	Drainage Network	(6,223)	(4,122)	(2,101)	-	-	-	-	-	-	-	-	-	(1,107)	(713)	(394)	(1,956)	(1,307)	(649)	(1,991)	(1,335)	(656)	(1,169)	(767)	(402)	-	-	-
(3)	Farm Road Network	(2,599)	(2,371)	(228)	-	-	-	-	-	-	-	-	-	-	-	-	(867)	(791)	(76)	(866)	(790)	(76)	(866)	(790)	(76)	-	-	-
(4)	Quaternary Network	(95)	(98)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(40)	(40)	-	(58)	(58)	-	-	-	-
3.7	Sub-area E	11,774	9,913	1,861	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,870	4,940	930	5,901	4,973	931
(1)	Irrigation Network	(4,996)	(1,230)	(766)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(2,488)	(2,115)	(383)	(2,488)	(2,115)	(383)
(2)	Drainage Network	(3,536)	(2,720)	(816)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(1,768)	(1,360)	(408)	(1,768)	(1,360)	(408)
(3)	Farm Road Network	(3,161)	(2,882)	(279)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(1,580)	(1,441)	(139)	(1,581)	(1,441)	(140)
(4)	Quaternary Network	(81)	(81)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(24)	(24)	-	(57)	(57)	-
4	Construction Equipment	36,100	1,720	34,380	-	-	-	-	-	-	13,650	650	13,000	14,420	692	13,760	2,400	120	2,280	3,180	150	3,030	1,710	80	1,630	650	33	650
5	Land Acquisition	2,223	2,223	-	-	-	-	-	-	-	1,666	1,666	-	850	850	-	333	333	-	-	-	-	-	-	-	-	-	-
6	Administration	2,660	2,660	-	-	-	-	220	220	-	440	440	-	440	440	-	440	440	-	440	440	-	440	440	-	240	240	-
7	Engineering Services	6,720	280	6,440	958	58	900	1,162	32	1,130	777	32	745	1,118	18	1,070	916	38	878	800	33	767	796	32	764	193	7	186
7.1	Detailed Design	2,120	90	2,030	958	58	900	1,162	32	1,130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.2	Construction Supervision	4,600	190	4,410	-	-	-	-	-	-	777	32	745	1,118	18	1,070	916	38	878	800	33	767	796	32	764	193	7	186
	Sub-total (1-7)	115,497	59,570	55,877	958	58	900	1,382	252	1,130	27,662	10,877	16,785	33,591	14,615	18,979	19,355	12,884	6,471	12,694	6,933	5,761	12,785	8,701	4,084	7,017	5,250	1,767
8	Contingencies	75,223	47,310	27,913	22	22	-	88	88	-	11,778	5,233	6,545	17,866	8,915	8,951	13,445	9,796	3,649	10,206	6,387	3,819	13,095	9,829	3,266	8,703	7,040	1,663
8.1	Physical Contingency	18,061	9,479	8,582	8	8	-	38	38	-	4,251	1,635	2,616	5,151	2,192	2,958	2,916	1,937	1,009	1,911	1,018	893	2,308	1,569	739	1,412	1,050	362
8.2	Price Contingency	57,162	37,831	19,331	14	14	-	50	50	-	7,527	3,598	3,929	12,712	6,719	5,993	10,529	7,859	2,640	8,262	5,341	2,911	10,787	8,260	2,527	7,291	5,990	1,301
	Total	190,670	106,880	83,790	980	80	900	1,470	340	1,130	39,440	16,110	23,330	51,457	23,530	27,930	32,800	22,680	10,120	22,900	13,320	9,600	25,880	18,530	7,350	15,720	12,290	3,430

Table XI-5 Preliminary Estimate of Construction Cost for the Combined Gravity and Pump Irrigation Scheme

(US$1,000)

	Work Item	Total	Local Currency	Foreign Currency
1.	Preparatory Works	360	300	460
2.	Pilot Scheme	700	240	460
3.	Civil Works	71,384	53,247	18,137
3.1	Diversion Weir	2,840	1,428	1,412
3.2	Main Canal & Related Structures	9,418	6,630	2,788
3.3	Tide Gates & Pump Station	5,050	1,080	3,970
3.4	Irrigation Network	22,900	19,337	3,563
3.5	Drainage Network	17,879	12,382	5,497
3.6	Farm Road Network	9,830	8,979	851
3.7	Quaternary Network	290	290	-
3.8	Land Reclamation	3,177	3,121	56
4.	Construction Equipment	36,420	1,740	34,680
5.	Land Acquisition	2,223	2,223	-
6.	Administration	2,830	2,830	-
7.	Engineering Services	6,910	290	6,620
8.	Contingencies	80,743	48,910	31,833
8.1	Physical Contingency	19,222	9,740	9,482
8.2	Price Contingency	61,521	39,170	22,351
	Total (1 - 8)	201,970	109,780	92,190

Table XI-6 Breakdown of Construction Cost for the Combined Gravity and Pump Irrigation Scheme

(US$ 1,000)

Work	Unit	Quantity	Total	L.C	F.C
1. Preparatory Works	L.S		760	300	460
2. Pilot Scheme	L.S		700	240	460
3. Civil Works			71,381	53,247	18,137
3.1 Diversion Weir	L.S		(2,840)	(1,428)	(1,412)
3.2 Main Canal & Related Structures	L.S		(9,418)	(6,630)	(2,788)
3.3 Tide Gates					
- Earthwork	m^3	7,300	(16)	(15)	(1)
- Concrete	"	1,400	(194)	(95)	(99)
- Concrete form	m^2	3,100	(28)	(28)	(-)
- Reinforcement bar	ton	260	(138)	(21)	(117)
- Concrete pile	NOS.	750	(293)	(128)	(165)
- Roller gate	ton	190	(1,740)	(90)	(1,650)
- Temporary works	L.S		(440)	(240)	(200)
- Miscellaneous	"		(569)	(123)	(448)
3.3 Sub-total			(3,420)	(740)	(2,680)
3.4 Pump Station					
- Earthwork	m^3	2,500	(5)	(4)	(1)
- Concrete	"	600	(28)	(13)	(15)
- Concrete form	m^2	3,200	(29)	(29)	(-)
- Reinforcement bar	ton	60	(32)	(5)	(27)
- Concrete pile	NOS.	360	(140)	(61)	(79)
- Pump equipment and metal works	L.S		(1,120)	(170)	(940)
- Miscellaneous	"		(276)	(58)	(218)
3.4 Sub-total			(1,630)	(340)	(1,290)

--- to be continued -

Work	Unit	Quantity	Total	L.C	F.C
3.5 Irrigation Network					
- Sub-area A	L.S		(1,939)	(1,638)	(301)
- Sub-area B	"		(5,691)	(4,771)	(920)
- Sub-area C	"		(2,763)	(2,317)	(446)
- Sub-area D	"		(7,511)	(6,381)	(1,130)
- Sub-area E	"		(4,996)	(4,230)	(776)
3.5 Sub-total			(22,900)	(19,337)	(3,563)
3.6 Drainage Network					
- Sub-area A	L.S		(381)	(309)	(73)
- Sub-area B	"		(6,337)	(4,280)	(2,057)
- Sub-area C	"		(1,399)	(951)	(448)
- Sub-area D	"		(6,223)	(4,122)	(2,101)
- Sub-area E	"		(3,536)	(2,720)	(816)
3.6 Sub-total			(17,879)	(12,382)	(5,497)
3.7 Farm Road Network					
- Sub-area A	L.S		(638)	(585)	(53)
- Sub-area B	"		(2,636)	(2,414)	(222)
- Sub-area C	"		(796)	(727)	(69)
- Sub-area D	"		(2,599)	(2,371)	(228)
- Sub-area E	"		(3,161)	(2,882)	(279)
3.7 Sub-total			(9,830)	(8,979)	(851)
3.8 Quaternary Network					
- Sub-area A	L.S		(16)	(16)	-
- Sub-area B	"		(63)	(63)	-
- Sub-area C	"		(32)	(32)	-
- Sub-area D	"		(98)	(98)	-
- Sub-area E	"		(81)	(81)	-
	"				
3.8 Sub-total			(290)	(290)	-

--- to be continued -

Work	Unit	Quantity	Total	L.C	F.C
3.9 Land Reclamation					
- Sub-area A	L.S		(851)	(830)	(21)
- Sub-area B	"		(2,219)	(2,187)	(32)
- Sub-area C	"		(107)	(101)	(3)
3.9 Sub-total			(3,177)	(3,121)	(56)
4. Construction Equipment	L.S		36,420	1,740	34,680
5. Land Acquisition	L.S		2,223	2,223	-
6. Administration			2,830	2,830	-
6.1 Personnel expense	L.S		(1,630)	(1,630)	(-)
6.2 General expense	"		(940)	(940)	(-)
6.3 Miscellaneous	"		(260)	(260)	(-)
7. Engineering Service			6,910	290	6,620
7.1 Remuneration	M/M	720	(5,760)	(-)	(5,760)
7.2 General expense	L.S		(1,150)	(290)	(860)

Table XI-7 Annual Operation and Maintenance Cost

(US$ 1,000)

Item	Proposed Project	Combined Gravity and Pump Irrigation Scheme
1. Personnel Cost	272	284
2. Equipment and Operation Cost	202	202
3. Maintenance Cost for Facilities	38	38
4. Operation and Maintenance Cost for Pump Station and Tide Gates	-	51
5. Office and General Expense	293	325
Total	805	900
	(US$21.7/ha)	(US$27.6/ha)

Table XI-8 Costs for Replacement of Project Facilities

(US$1,000)

Item	Life (Years)	Costs for Replacement		
		Total (US$ 1,000)	L.C (US$ 1,000)	F.C (US$ 1,000)
1) Proposed Project				
- Steel Gates at Diversion Weir and Intake	20	221	11	210
- Steel Gates in Irrigation Canals	20	640	640	-
- Steel Gates in Drainage Canals	15	2,130	215	1,915
Total		2,991	866	2,125
2) Combined Gravity and Pump Irrigation Scheme				
- Tide Gates and Pump Equipment	15	2,560	260	2,300
- Diesel Engines	7	340	40	300
- Steel Gates at Diversion Weir and Intake	20	221	11	210
- Steel Gates in Irrigation Canals	20	640	640	-
- Steel Gates in Drainage Canals	15	2,130	215	1,915
Total		5,891	1,166	4,725

Table XI-9 Unit Price

(US$)

No.	Work	Unit	Total	L.C	F.C
1.	Clearing and grubbing	m^2	0.2	0.2	-
2.	Stripping	m^3	0.6	0.5	0.1
3.	Excavation, common, Type A	"	0.7	0.6	0.1
4.	- do - , Type B	"	1.7	1.7	-
5.	Excavation, rock	"	2.9	2.3	0.6
6.	Dredging excavation	"	0.7	0.6	0.1
7.	Excavation in existing channel	"	0.7	0.6	0.1
8.	Structural excavation, Type A	"	0.6	0.57	0.03
9.	- do - , Type B	"	1.7	1.7	-
10.	Embankment, Type A(Excavated)	"	1.1	1.0	0.1
11.	- do - , Type B(-do-)	"	0.7	0.6	0.1
12.	- do - , Type C(Pit-run)	"	3.4	3.1	0.3
13.	Spoiled bank	"	0.4	0.3	0.1
14.	Backfilling	"	3.5	3.3	0.2
15.	Disposal of excavated soil	m^3/km	0.4	0.3	0.1
16.	Gravel metalling	m^3	6.4	5.9	0.5
17.	Sand filling	"	3.3	2.8	0.5
18.	Foundation gravel	"	7.0	6.5	0.5
19.	Sod facing	m^2	0.5	0.5	-
20.	Concrete, Type A (1:2:4)	m^3	47.0	22.0	25.0
21.	- do -, Type B (1:3:6)	"	41.0	21.0	20.0
22.	- do -, Type C (1:4:8)	"	35.0	20.0	15.0
23.	Metal form	m^2	5.0	1.0	4.0
24.	Wooden form	"	9.0	9.0	-
25.	Reinforcement bar	ton	530	80	450

---to be continued

No.	Work	Unit	Total	L.C	F.C
26.	Concrete pipe Ø500m/m	m	20.0	6.0	14.0
27.	- do - Ø1,000m/m	"	50.0	12.0	38.0
28.	Concrete piling l=20m	NO.	390	170	220
29.	PVC water stop 230mm	m	25.0	4.0	21.0
30.	" 150mm	"	17.0	4.0	13.0
31.	Wet masonry	m^3	29.0	19.0	10.0
32.	Riprap	"	12.0	9.0	3.0
33.	Steel slide gate				
	B(width)=30cm	m^2	900	900	-
	B =50cm	"	950	950	-
	B =100cm	"	1,050	1,050	-
	B =150cm	"	1,100	1,100	-
	B =200cm	"	1,300	1,300	-
	B =250cm	"	2,350	2,350	-
34.	Trash rack	ton	2,000	2,000	-
35.	Hand rail	"	1,800	1,800	-
36.	Timber work	m^3	310	250	60
37.	Wooden pile Ø200m/m	m	6.7	6.6	0.1
38.	Asphalt pavement for bridge	m^2	5.0	4.8	0.2
39.	Rubber shoe for bearing	NO.	6.6	1.3	5.3

ANNEX XII

BENEFITS AND JUSTIFICATION

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ANNEX XII PROJECT BENEFITS AND JUSTIFICATION

XII.1 GENERAL

The economic feasibility of the Project is made by calculating the economic internal rate of return. Sensitivity analysis is also made with respect to changes in paddy yields, market price of paddy, build-up period and the project costs.

Financial evaluation is carried out by analyzing typical farm budget and by repayment analysis. The farm budget analysis is made to sound the viability of the development from the farmer's point of view. The repayment analysis is made to evaluate the repayment capability of the development based on the estimated fund requirements with assumed financial terms of the anticipated loan and the expected revenue from the development.

The indirect benefits from the development which would give the effects on the regional development are also studied briefly.

XII.2 PROJECT COSTS AND BENEFITS

XII.2.1 Basic Consideration for Cost-Price Prospects

The prospective cost-price concerning the farm products, farm inputs, construction materials and equipment, etc. is studied to assess the economic prices and financial prices for the purpose of evaluating both economic and financial viabilities of the Project. In this context, all the conversions between local currency portion (Rupiah: Rp.) and foreign currency portion (U.S. Dollars: US$) are made at the exchange rate of Rp. 625 = US$ 1.0. Besides, in the capitalization of the economic construction cost, 7% of price escalation for the foreign currency is taken into account, according to the projection made by IBRD on the world market inflation. While, 10% of price escalation for the local currency portion is adopted.

Economic Prices

Economic farm gate price of paddy is estimated based on the projected international market price forecasted by IBRD for the period of 1980 to 1985 in 1978 constant US Dollars. The economic prices of the construction materials and equipment to be imported from abroad are estimated based on CIF prices at SURABAYA, making reference to the projected international market prices forecasted by IBRD.

The local market prices given in Annex XI include the transfer payments, e.g. direct and indirect taxes, profits, etc. These transfer payments are excluded from the local currency portion in terms of the economic cost.

Financial Prices

The financial prices are the price for the financial evaluation on the Project. These prices are directly estimated based on the current local market prices in early 1979.

XII.2.2 Project Cost

Financial Cost

Based on the cost-prices at the current market price level in early 1979, the financial cost for the Project is estimated at US$190.67 million as shown in Table XI-1. The summary of disbursement schedule during the period of the implementation is shown in Table XII-1. In this estimation, the physical contingency is estimated at 15% of the direct cost, and the price contingency is estimated at about 50% of the direct cost by taking the price escalation at 10% and 7% per annum for the local and foreign currency portion, respectively.

Economic Costs

The economic costs capitalized for 1980 calendar year, taking into account the price escalation from 1979 to 1980, is estimated at US$130.41 million as shown in Table XII-2. The disbursement schedule of the economic costs is given in Table XII-3.

In the capitalization of the above economic costs, the following conditions are taken into account: the transfer payment to be deducted from the direct costs of local currency portion would be 10% of the total construction cost including preparatory works, pilot demonstration scheme, civil works, and also 10% of the administration cost, and 2% of the engineering services. The cost for land acquisition is excluded from the economic cost, except for the cost for compensation of lands to be submerged by the construction of the diversion weir. This compensation cost for submerged area would be included in the economic costs.

The physical contingency is estimated at about 15% of direct cost which does not include the above transfer payments.

Operation and Maintenance Costs

The operation and maintenance costs estimated in Annex XI are capitalized to US$886,000 for 1980 calendar year as the financial O & M costs.

The economic O & M costs are estimated by deducting the prospective transfer payment (10%) from the financial costs. Thus, it is estimated at US$797,000.

XII.2.3 Project Benefits

The project benefits to be expected from the project implementation are evaluated in terms of both direct and indirect benefits. The direct benefits would come from the increment of crop production with irrigation development and drainage improvement. The indirect benefits are anticipated from the contribution to (1) saving of the foreign exchanges particularly for rice import, (2) quality improvement of products, (3) improvement of living standard, (4) increase of employment opportunity and other socio-economic impacts.

Direct Benefits

The direct benefits are the primary project benefits which would come from the increment of paddy rice production by the project implementation.

Economic farm gate price of paddy is estimated at Rp.180,000/ton on the basis of the projected international market price forecasted by IBRD for the period of 1980 to 1985 in 1978 constant dollars, taking into account the costs for transportation, processing and others. Details of the estimation are shown in Table XII-4.

Similar to the estimation of price of paddy, the economic production costs both under with and without-project conditions are estimated. Details of the estimation are shown in Table XII-5.

The anticipated annual gross production value and incremental net production value in the future are calculated in Table XII-6(1). The net annual production value at the full development stage is summarized as shown below.

Future With-Project (US$ 1,000)	Future Without-Project (US$ 1,000)	Increment Value (US$ 1,000)
41,100	12,600	28,500

In the evaluation on the production values under the future without-project condition, it is anticipated that paddy yield would increase to 2.0 tons/ha of dry paddy owing to the probable contribution to be attributable to the Pelita III. It would be the potential maximum yield of the local varieties of paddy in the project area from the viewpoint of the field conditions and plant physiological characteristics of local paddy.

Indirect Benefits

The indirect benefits are the secondary profits to be anticipated from the project implementation. Most of these benefits are generally intangible, but their contributions to the rural and national economy would be promised.

Saving in Foreign Exchanges

As stated in the previous Annex, the rice production in Indonesia is still insufficient to meet the demand, and about 1.5 million tons of rice are imported to supplement the shortage. It is expected that the future increment of rice production in the project area would contribute to the attainment of the self-sufficiency of rice. As a result, the foreign exchange necessary for rice import could be saved.

With the completion of the Project, paddy production would increase to about 240,000 tons per annum from the present production of 37,000 tons. As discussed in VI.5.1, out of the total production, it is expected that the marketable rice would be about 120,000 tons per annum after deducting the local consumption of rice. The savings of foreign exchanges would be US$43 million per annum as follows:

- Increment of marketable rice:

  120,000 tons with-project - 18,000 tons at present
  = 102,000 tons

- Prospective savings of foreign exchanges:

  102,000 tons x US$423/ton = US$43,146,000

Note: US$423/ton is the unit price at CIF Surabaya estimated from US$410/ton at FOB Bangkok.

Quality Improvement of Products

According to the statistical data provided by the Depot Logistik Kalimantan Selatan, Banjarmasin and the results of yield check survey, the quality of rice in the project area is still at low level due to uneven maturing and low milling coefficient. The selling price of rice in the area is lower than the basic price in the market.

With the introduction of improved farming with irrigation and drainage improvement, the growing conditions of paddy rice would be much improved. High marketability of rice would be expected in the future with the Project.

Improvement of Living Standard

In the central part of the project area (in and around Gambut), local inhibitant spend either money or labour force for collecting the drinking water from the river Martapura, since the surface water is very strong acid and rich in humus and brackish problems in the use of ground water. The Project would improve such meager water conditions.

The living conditions particularly of health and sanitary condition would also be improved by the drainage improvement and control of the seasonal floodings as well as supply of fresh water through irrigation canals.

Potentiality for Fishery Development

The after-bay with a water surface area of about 2.8 km^2 could be used for the fishery development. The development would contribute to the local consumption especially for supply of animal protein.

Socio-Economic Impacts

The increase of paddy rice production would bring a considerable amount of net profits to the farmers. The profits would not only improve the farmer's living standard but also stabilize the rural economic situation through overall effects on the economic activities.

Improvement of local transportation system would also be anticipated by the project implementation and its operation. This would also contribute to the improvement of rural economic activities including the agricultural activities.

The increase of employment opportunity would be expected by the project implementation and the operation and maintenance of the project facilities. Besides, the people would gain more experience, technical know-how, skillfulness in the various working fields. These accumulations would provide motive power for the future development in the South Kalimantan.

Seasonal employment opportunities would also increase in the intensive paddy cultivation. As stated in Annex VI, there exists a considerable unemployment in and around the project area. These social problems would also be improved by the project implementation.

XII.3 ECONOMIC EVALUATION

In order to ascertain whether the Project is wise and useful for the national economy, the economic evaluation of the Project is made by using the following two methods:

1) Internal rate of return (IRR)

2) Benefit/Cost ratio (B/C)

In this calculation, economic project benefits are estimated based on the direct benefits only derived from the paddy production. The calculation is made based on 50 years of the project life starting from 1980.

XII.3.1 Internal Rate of Return (IRR)

The internal rate of return of the Project is calculated at 13.5%. This internal rate of return indicates the economic soundness of the Project.

XII.3.2 Benefit/Cost Ratio (B/C)

All though it is practically difficult to fix an objective discounting rate in calculation of Benefit/cost ratio, 12% of interest rate for a long term loan by the Central Bank of Indonesia is applied tentatively as the discounting rate.

The result of calculation is as follows:

Present Worth		
Benefit (US$ 10^6)	Cost (US$ 10^6)	B/C
92.0	79.3	1.16

XII.3.3 Sensitivity Analysis

In the evaluation on the IRR of the Project, sensitivity analysis is also made for the Project with respect to the following conditions :

(1) Paddy yield to be lowered
(2) Market price of paddy to be down
(3) Build-up period to be extended more long
(4) Project costs to be increased
(5) Changes of costs and benefits due to technical alternatives

Paddy yield to be lowered

The target yield anticipated at 8.5 tons/ha/year would be expected by good water management, introduction of high yielding varieties of paddy with improved farming practices, and enhancement of farmer's incentives under favourable supporting services provided by the government agencies concerned. If some causes are aggregated in the above conditions, the anticipated crop yield would be decreased from the original estimation. Making reference to the irrigated paddy cultivation being underdeveloped in Indonesia, it is estimated that a probable paddy yield under the conditions with some causes would be 6.5 tons/ha (3 tons/ha in the wet season and 3.5 tons/ha in the dry season). In addition to the above, some irrigable land be reduced by the urban and/or sub-urban development. This development would be accelerated by the further increase of population in the project area owing to the rural socio-economic development and improvement of living standard after the project implementation is completed. However, since the reduction of production due to this fact is estimated at about 0.5% only of the total paddy production, this reduction can be included in 2.0 ton/ha of reduction of paddy yield estimated above.

Market price of paddy to be down

In the projection of the international market price made by IBRD, the price of rice is forecasted to rise for future decade. However, slight fluctuation of the market price of rice would be expected in response to the variation of the international economic situation. In this context, 10% of the market price of rice to be down is taken up for the sensitivity analysis.

Build-up period to be extended more long

As discussed in Annex VI, the background for further agricultural production would be developed within the Pelita III during the period from 1979 to 1983. If this anticipation is disappointed by some causes, the prospective build-up period would extend one more period for 5 years in probable Pelita IV, say 12 years in total requirement from the completion of the project implementation.

Project costs to be increased

According to the statistical Year-Book and the Indicator Economy in Indonesia (1978), recent trend of the domestic market prices particularly for the construction materials were escalated year by year at the annual rate of 10.1% for the past 7 years from 1971 to early 1978, while several percent per annum in the general commodities for living. On the other hand, the world inflation, which could be expressed in the situation of the OECD countries, will slightly decline to 7 to 7.5% for 1985 from 8% in early 1978, according to IBRD projection. To speak in general, the domestic inflation is closely influenced by that in the world situation. Considering this general economic aspect, it is expected that the present price escalation rate in the local market would be reduced to a certain extent. Thus, some 15% of cost over-run is estimated for the sensitivity analysis.

Changes of costs and benefits due to technical alternatives

In the course of the feasibility study on the Riam Kanan Irrigation Project, some proposals of the technical alternatives have been discussed, though which are not incorporated into this report mainly because of the lack of reliable data. However, these technical alternatives would have to be re-examined in those technical and economic possibilities in the next stage for the betterment of the Project, prior to the commencement of the project implementation.

Among them, the following two items are main alternative plans :

a) Quantity of river maintenance discharge of the Martapura river

b) Lining in the upper reaches of the main irrigation canals

When the some technical modifications would be made on the basis of the further study on the above items, the costs and/or benefits of the Project would be changed. In this context, the above items are considered for the sensitivity analysis.

a) Quantity of river maintenance discharge of the Martapura river

As discussed in section III.5.2, two alternative river maintenance discharges, 8 m^3/sec and 12 m^3/sec, to be released from the diversion weir are proposed, and 8 m^3/sec of discharge is tentatively adopted for the maintenance of downstream reaches of the Martapura river. However, the most optimum maintenance discharge would have to be decided in the next stage based on the further investigation. If 12 m^3/sec of discharge would be adopted, available irrigation water from the Riam Kanan river would be decreased from 34 m^3/sec of discharge presented in this report to 30 m^3/sec. The anticipated benefits derived from the Project, therefore, would be decreased due to the decrease of the project area to be irrigated in the dry season. The amount of reduction for benefit is estimated as follows :

	Reduction of amount (US$ 1,000)
Annual benefit at target stage	2,350

The detailed breakdown of the above estimation is given in Table XII-7.

b) Lining in the upper reaches of the main irrigation canal

As stated in section IX.3.2, the down reaches of the main irrigation canal between turnout No. 5 and the end point would be lined with thin concrete due to the poor soil conditions. On the contrary, the upper reaches from the beginning point to the turnout No. 5 would be unlined because of favourable soil conditions, except for the reaches between turnouts No. 2 and No. 3 which would be lined with suitable earth material due to existence of gravel layers.

The velocity of irrigation water in upper reaches would be about 53 cm/sec even during the period of supplying peak discharge due to the gentle slope of canal bed and fairly large coefficient of roughness. Under the condition of velocity less than 60 cm/sec, sedimentation of sand and silt, and densely growing weeds in the canal would be expected. In order to keep normal flow condition in the canal and smooth operation, considerable maintenance works would be required. In this context, canal lining with wet masonry are proposed as the alternative for the upper reaches of the main irrigation canal. The additional economic cost, capitalized for 1980 calendar year, required for this is estimated at about US$4.55 million. The detailed breakdown of the additional cost is given in Table XII-8.

On the basis of the critical conditions discussed in the above, the sensitivity analysis is made as shown on next page and illustrated in Fig. XII-1.

Case	Decrese in paddy yield (%)	Lowering of paddy price (%)	Build-up period over-run (year)	Increase in project cost (%)	Cost change by technical alternatives (US$ 1,000)	IRR
I	25	-	-	-	-	10.9
II	-	10	-	-	-	11.3
III	-	-	5	-	-	11.7
IV	-	-	-	15	-	12.1
V	25	10	-	-	-	8.9
VI	25	-	5	-	-	9.5
VII	25	-	-	15	-	9.7
VIII	25	10	5	-	-	8.0
IX	25	-	5	15	-	8.5
X	-	10	5	15	-	8.9
XI	-	-	5	15	-	10.3
XII	-	-	-	-	Benefit - 2,350	12.7
XIII	-	-	-	-	Cost + 4,550	13.1

XII.4 FINANCIAL EVALUATION

XII.4.1 General

The financial feasibility of the Project is evaluated from the farmer's economy. In this connection, the preliminary assessment of water charge to be collected from the water users in the future is made. The study on the repayment capability of the project capital is also made by preparing the cash flow table.

XII.4.2 Typical Farm Budget

For evaluating the project feasibility from the farmer's economy, farm budget analysis is made on typical farm under both the future without-project and the future with-project conditions.

In order to estimate the farm budget under the future with-project condition, it is assumed that the present average holding of 1.0 ha per farm household would not be changed even after the completion of the Project.

Financial gate prices of farm products are estimated based on available data on market prices of farm products in Banjarmasin and Banjarbaru, and on the results of field survey. The estimated financial prices of the farm products are given in Table XII-9.

Financial prices of farm inputs at the farm gate are also estimated based on the results of field survey and are shown in Table XII-10.

The IPEDA tax is estimated at Rp.12,500/ha, corresponding to about 3% of the net income, based on the information obtained from the Provincial IPEDA Office in Banjarmasin. The living expenses are estimated at Rp.323,500 per farm household per year in the future when the crop production attains to its target, based on the increase trend of prices of foodstuff (8% per annum) and other consumables (1 to 2% per annum) in the past 10 years in the South Kalimantan.

It is also assumed that the future without-project condition would be mostly the same as the present condition, though some improvement of agricultural conditions and slight increase of crop production are expected. The results of the estimate are shown in Tables XII-11 and XII-12 and summarized on next page.

Description	With-project condition (Rp.)	Without-project condition (Rp.)
1. Gross production income	642,120	248,720
2. Total outgo including production cost, living expenses, tax, etc.	532,000	247,170
3. Capacity to pay	110,120	1,550

The capacity to pay to be expected under the future with-project condition would increase to Rp.110,120 (US$176.2) per annum.

XII.4.3 Water Charge

It is generally accepted that the water charge is the duty of the water users. The charge is used for the operation and maintenance of the facilities including replacement and also for repayment of the project capital.

Traditionally in Indonesia, the farmers do not pay any water charge directly for the capital cost of the facilities, but contribute indirectly through the IPEDA tax, e.g. Rp.3,500 to Rp.4,000/ha of the irrigated paddy field and Rp.2,500 to Rp.3,000/ha of the rain-fed paddy field, at present. Very recently, payment system of the water charge has been accepted by the farmers in small cases as seen in the Tadjum irrigation projects in the central Java and the ground water irrigation projects being developed in the central and east Java. For these projects, the charges are estimated at about Rp.18,000/ha to Rp.20,000/ha to cover the O & M costs of the facilities and some part of the capital cost financed by the international organizations.

As seen in Table XI-13, the annual O & M cost required for the Project is estimated at US$886,000 which is equivalent to about US$27/ha. This value corresponds to about 15% of the capacity to pay, US$176.2/ha/annum, estimated before. This would prove that the capacity to pay would be able to cover the O & M cost. On the other hand, the annual equivalent to repayment of the capital cost is estimated at about US$197/ha for the foreign currency portion and at about US$168/ha for the local currency portion as calculated in Table XII-13. These values would not be covered obviously with the capacity to pay from the viewpoint of the farmer's economy.

The water charge to be collected from the water users would have to be within a reasonable range in the capacity to pay that could still give sufficient incentive to the farmers for agricultural production increase. With this view, the prospective water charge is recommended at Rp.16,500 to Rp.17,000/ha/annum (US$27/ha) which corresponds to the annual O & M cost per ha.

XII.4.4 Repayment Capability

Repayment capability for the project capital is studied by preparing the cash flow table based on the anticipated project revenue and the fund requirements.

The direct revenue for repayment of the capital cost from the Project would not be anticipated because the water charge would cover only the O & M cost. However, the increased IPEDA tax income would be expected as an indirect revenue for this purpose. Contribution to the saving of the foreign exchanges by reducing the rice import owing to the increase of crop production in the project area would be also expected as a kind of indirect revenue in terms of the foreign currency.

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

(1) Foreign currency portion : The capital is financed by bilateral or international organizations with an interest 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 with no interest and no repayment.

With the above assumptions, the repayment schedule for the foreign currency portion is prepared as shown in Table XII-14. As seen in this table, the direct revenue from the water charge could not cover the annual repayment of the fund, except for the O & M cost. The repayment of the fund would have to be made by the subsidy of the Governments, which is estimated at US$6.85 million per annum or US$210/ha during the repayment period. In due consideration of the indirect revenue for the Government from the Project, it would be able to allocate the subsidy in the national budget. Particularly, the saving of the foreign exchanges mentioned before could be anticipated to be allocated to the fund repayment indirectly.

XII.5 COMBINED GRAVITY AND PUMP IRRIGATION SCHEME

XII.5.1 General

As mentioned in the previous Annexes, total irrigation area during the dry season would increase to 27,990 ha through the introduction of the pump irrigation scheme using the river Maluka with the combined gravity and pump irrigation scheme. The preliminary evaluation on this scheme is made in order to sound tentatively the economic feasibility of the further development of the project area.

XII.5.2 Economic Construction Cost

The financial construction cost including the cost for further development is estimated at US$201.97 million consisting of US$92.19 million of foreign currency portion and US$109.78 million equivalent of local currency portion as stated in Annex XI.

The economic construction cost capitalized for 1980 calendar year, taking into account the price escalation from 1979 to 1980, is estimated at US$137.66 million as shown in Table XII-2. The disbursement schedule of the economic construction cost is given in Table XII-3.

In the capitalization of the economic costs, the transfer payments are deducted from the direct costs of local currency portion. The physical contingency is estimated at 20% of the direct cost for the additional project works.

XII.5.3 Operation and Maintenance Costs

The operations and maintenance costs estimated in Annex XI are capitalized to US$990,000 for 1980 calendar year as the financial O & M costs. The economic O & M costs are estimated by deducting the prospective transfer payment (10%) from the financial costs. Thus, it is estimated at US$891,000.

XII.5.4 Direct Benefits

The direct benefits would increase through further increase of double cropping area by introducing the pump scheme into sub-area E. The benefits at the full development stage after the completion of future pump scheme would be US$31.25 million as shown in Table XII-6 (2).

XII.3.5 Evaluation

The internal rate of return of the Project including further development is estimated at 13.9 % based on the preliminary estimate of the costs and the benefits. This preliminary evaluation shows an economic soundness for the introduction of the pump irrigation scheme into the project area.

Table XII-1 Annual Disbursement of Financial Cost
(US$1,000)

Item	Total Cost			1980			1981			1982		
	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.
1. Base Cost	108,727	59.290	49.437	-	-	-	220	220	-	26.885	10.845	16.040
2. Engineering Service	6,720	280	6,440	958	58	900	1,162	32	1,130	777	32	745
3. Contingency	75,223	47,310	27.913	22	22	-	88	88	-	11,778	5.233	6.545
Total	190.670	106,880	83.790	980	80	900	1,470	340	1.130	39.440	16.110	23.330

Item	1983			1984			1985			1986			1987		
	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.	Total	L.C.	F.C.
1. Base Cost	32,476	14.567	17.909	18.439	12.846	5.593	11,894	5,900	4,994	11,989	8,669	3,320	6,824	5,243	1,581
2. Engineering Service	1,118	48	1,070	916	38	878	800	33	767	796	32	764	193	7	186
3. Contingency	17,866	8,915	8,951	13,445	9,796	3,649	10,226	6,387	3,839	13,095	9,829	3,266	8,703	7,040	1,663
Total	51,460	23,530	27,930	32,800	22,680	10,120	22,920	13,320	9,600	25,880	18,530	7,350	15,720	12,290	3,430

Table XII-2 Economic Construction Cost (Capitalized for 1980)
(US$ 1,000)

Item	Proposed Project	Combined Gravity and Pump Irrigation Scheme
1. Base Cost	105,330	111,160
1.1 Preparatory Works	(737)	(789)
1.2 Pilot Scheme	(730)	(730)
1.3 Civil Works	(66,807)	(72,124)
1.4 Depreciation Cost of Construction Equipment	(34,006)	(34,299)
1.5 Land Acquisition	(414)	(414)
1.6 Administration	(2,636)	(2,804)
2. Engineering Service	7,190	7,390
3. Physical Contingency	17,890	19,110
Total	130,410	137,660

Table XII-3 Annual Disbursement of Economic Construction Cost
(US$ 1,000)

Item	Total	1980	1981	1982	1983	1984	1985	1986	1987
Proposed Project									
1. Base Cost	105,330	-	218	18,425	26,191	23,400	12,881	15,166	9,049
2. Engineering Service	7,190	1,025	1,242	831	1,197	980	857	851	207
3. Contingency	17,890	15	40	2,934	4,192	3,730	2,102	2,993	1,884
Total	130,410	1,040	1,500	22,190	31,580	28,110	15,840	19,010	11,140
Combined Gravity and Pump Irrigation Scheme									
1. Base Cost	111,160	-	218	18,425	26,191	23,400	12,953	16,923	13,050
2. Engineering Service	7,390	1,025	1,294	831	1,197	980	857	925	281
3. Contingency	19,110	15	48	2,934	4,182	3,720	2,120	3,372	2,719
Total	137,660	1,040	1,560	22,190	31,570	28,100	15,930	21,220	16,050

Table XII-1 Economic Price of Dry Paddy

		/1
1.	International market price (F.O.B. Bangkok)	Rp.256,250/ton (US$410/ton)
2.	Transportation Cost	
	Bangkok to Surabaya	Rp.8,100
	Surabaya to Banjarmasin	Rp.10,650
3.	Port handling charge and warehouse cost	Rp.5,000
4.	Transportation cost including handling charge	
	Banjarmasin to Banjar	Rp.2,300
5.	Selling price of rice at ex-mill gate	Rp.282,300
6.	Selling price of dry paddy	
	(value of 1-ton dry paddy)	
	Rp.282,300 x 0.68	Rp.191,960
7.	Milling charge	-Rp.12,000
8.	Handling and transportation cost	
	Farm gate to mill	-Rp.450
9.	Economic farm gate price of dry paddy	Rp.179,510
		: Rp.180,000

/1 : Projected price for 1980 to 1905 in 1978 constant US Dollars.

US$1 = Rp.625

Table XII-5 Economic Production Cost for One Crop Paddy Production per Ha

Future with-Project

Seeds	25 Kg x Rp.235/Kg	5,875
Fertilizers		
Urea	250 Kg x Rp.156/Kg	39,000
T.S.P.	100 Kg x Rp.143/Kg	14,300
KCL	60 Kg x Rp.93/Kg	5,580
Agro-Chemicals		
Insecticide	4 lit. x Rp.1,350/lit.	5,400
Fungicide	2 lit. x Rp.1,350/lit.	2,700
Rodenticide	0.2 Kg x Rp.3,450/Kg	690
Equipment		
Rotary weeder	2 sets	3,900
Threadle thresher	1 set	12,200
Winnover	1 "	2,450
Knap-sac type mist duster	1 "	36,560
Labour		
Rasing of seedling	30 man-day x 750 RP/man-day	22,500
Field preparation	50 " x 520 "	26,000
Transplanting	50 " x 750 "	37,500
Weeding	55 " x 450 "	24,750
Fertilizing & spraying	24 " x 300 "	7,200
Water management	6 " x 300 "	1,800
Harvesting	30 " x 750 "	22,500
Threshing, drying & transportation	15 " x 450 "	6,750
Miscellaneous		27,345
	Total :	305,000

... to be continued

Future without-Project

Seeds	10 Kg x 150 Rp/man-day	1,500
Labour		
Preparation of seedling	8 man-day x 750 Rp/man-day	6,000
Field preparation	35 " x 520 "	18,200
Transplanting	35 " x 750 "	26,250
Weeding	20 " x 450 "	9,000
Harvesting	35 " x 750 "	26,250
Threshing, drying & transportation	15 " x 450 "	6,750
Miscellaneous		9,050
	Total :	103,000

Economic Prices of Farm Products and Inputs

Item	Unit Price (Rp./Kg or lit.)
Rice	282
Dry paddy	180
Seed (Dry paddy)	235
Urea	156
T.S.P.	143
KCL	93
Insecticide	1,350
Fungicide	1,350
Rodenticide	3,450

Table XII-6 (1) Paddy Gross Production Value, Production Cost and Incremental Future With and Without Project

Year	Future With-Project			Future Without-Project			Increment	
	G. P. V. (Rp. 10^6)	P. C. (Rp. 10^6)	N. P. V. (Rp. 10^6)	G. P. V. (Rp. 10^6)	P. C. (Rp. 10^6)	N. P. V. (Rp. 10^6)	(Rp. 10^6)	(US$ 10^3)
1984	4.284	2,684	1.600	1,323	431	892	708	1.133
1985	10.854	6,463	4,391	2,435	793	1,642	2,749	4,398
1986	18,594	10,629	7,965	4,893	1,556	3,337	4,628	7,405
1987	27.846	15,546	12,300	8,097	2,575	5,522	6,778	10,845
1988	32.670	17,272	15,398	10,581	3,192	7.389	8.009	12,814
1989	35.280	17.272	18.008	10,538	3,181	7,357	10,651	17.042
1990	37.728	17,272	20.456	11,078	3.181	7,897	12,559	20.094
1991	40,050	17.272	22.778	11,078	3.181	7.897	14,811	23,698
1992	41.634	17.272	24,362	11,078	3.181	7,897	16,465	26,344
1993	42,534	17.272	25,262	11,078	3,181	7,897	17,365	27.784
1994	42,966	17,272	25.694	11,078	3.181	7,897	17,797	28.475

Note : G. P. V. : Gross Production Value, P. C. : Production Cost, N. P. V. : Net Production Value

Gross Production Value and Production Cost in 1,060 ha of rubber plantation under Future Without-Project are included.

Table XII-6 (2) Paddy Gross Production Value, Production Cost and Increment Future With and Without Project
(Combined Gravity and Pump Irrigation Scheme)

Year	Future With-Project			Future Without-Project			Increment	
	G. P. V. ($Rp. 10^6$)	P. C. ($Rp. 10^6$)	N. P. V. ($Rp. 10^6$)	G. P. V. ($Rp. 10^6$)	P. C. ($Rp. 10^6$)	N. P. V. ($Rp. 10^6$)	($Rp. 10^6$)	(US 10^3)
1984	4,284	2,684	1,600	1,323	431	892	708	1,133
1985	10,854	6,463	4,391	2,435	793	1,642	2,749	4,398
1986	18,594	10,629	7,965	4,893	1,556	3,337	4,628	7,405
1987	27,846	15,546	12,300	8,097	2,575	5,522	6,778	10,845
1988	34,722	18,327	16,395	10,581	3,192	7,389	9,006	14,410
1989	37,512	18,327	19,185	10,538	3,181	7,357	11,828	18,925
1990	40,122	18,327	21,795	11,078	3,181	7,897	13,898	22,237
1991	42,588	18,327	24,261	11,078	3,181	7,897	16,364	26,182
1992	44,316	18,327	25,989	11,078	3,181	7,897	18,092	28,947
1993	45,270	18,327	26,943	11,078	3,181	7,897	19,046	30,474
1994	45,756	18,327	27,429	11,078	3,181	7,897	19,532	31,251

Note : G. P. V. : Gross Production Value, P. C. : Production Cost, N. P. V. : Net Production Value

Gross Production Value and Production Cost in 1,060 ha of rubber plantation under Future Without-Project are included.

Table XII-7 Reduction of Benefit due to Increase of River Maintenance Discharge

Reduction of area to be irrigated in the dry season:

4,000 lit./1.37 lit./sec/ha = 2,920 ha

The reduction of benefit is estimated as follows:

Year	Production of Paddy (Net)	Gross Production Value (US$ 103)	Production Cost (US$ 103)	Net Production Value (US$ 103)
1987	8,200	2,360	1,420	940
1988	9,300	2,680	1,420	1,260
1989	9,900	2,850	1,420	1,430
1990	10,500	3,020	1,420	1,600
1991	12,000	3,460	1,420	2,040
1992	12,300	3,540	1,420	2,120
1993	13,100	3,770	1,420	2,350

Table XII-8 Cost of Wet Masonry Lining in Upper Reaches of the Main Canal

The additional construction cost for the wet masonry lining in the upper reaches of the main canal (Beginning point to turnout No.5) is given as the difference between the cost of wet masonry works and the cost of earthworks to be decreased due to the reduction of the area of canal section.

(1) Cost of Wet Masonry Works /1 (Capitalized for 1980)

Work	Unit	Quantity	Total (US$ 1,000)	L.C (US$ 1,000)	F.C (US$ 1,000)
Wet masonry	m^3	143,700	4,237	2,700	1,537
Miscellaneous	L.S		634	406	228
Contingency			729	464	265
Total			5,600	3,570	2,030

(2) Cost of Earthworks to be decreased /1 (Capitalized for 1980)

Work	Unit	Quantity	Total (US$ 1,000)	L.C (US$ 1,000)	F.C (US$ 1,000)
Excavaltion	m^3	360,000	484	214	270
Embankment	"	151,000	311	149	162
Miscellaneous	L.S		119	54	65
Contingency			136	63	73
Total			1,050	480	570

Additional cost: US$5,600 x 10^3-US$1,050 x 10^3= US$4,550 x 10^3

/1 Depreciation cost of the construction equipment is included.

Fig. XII-1 Sensitivity Analysis

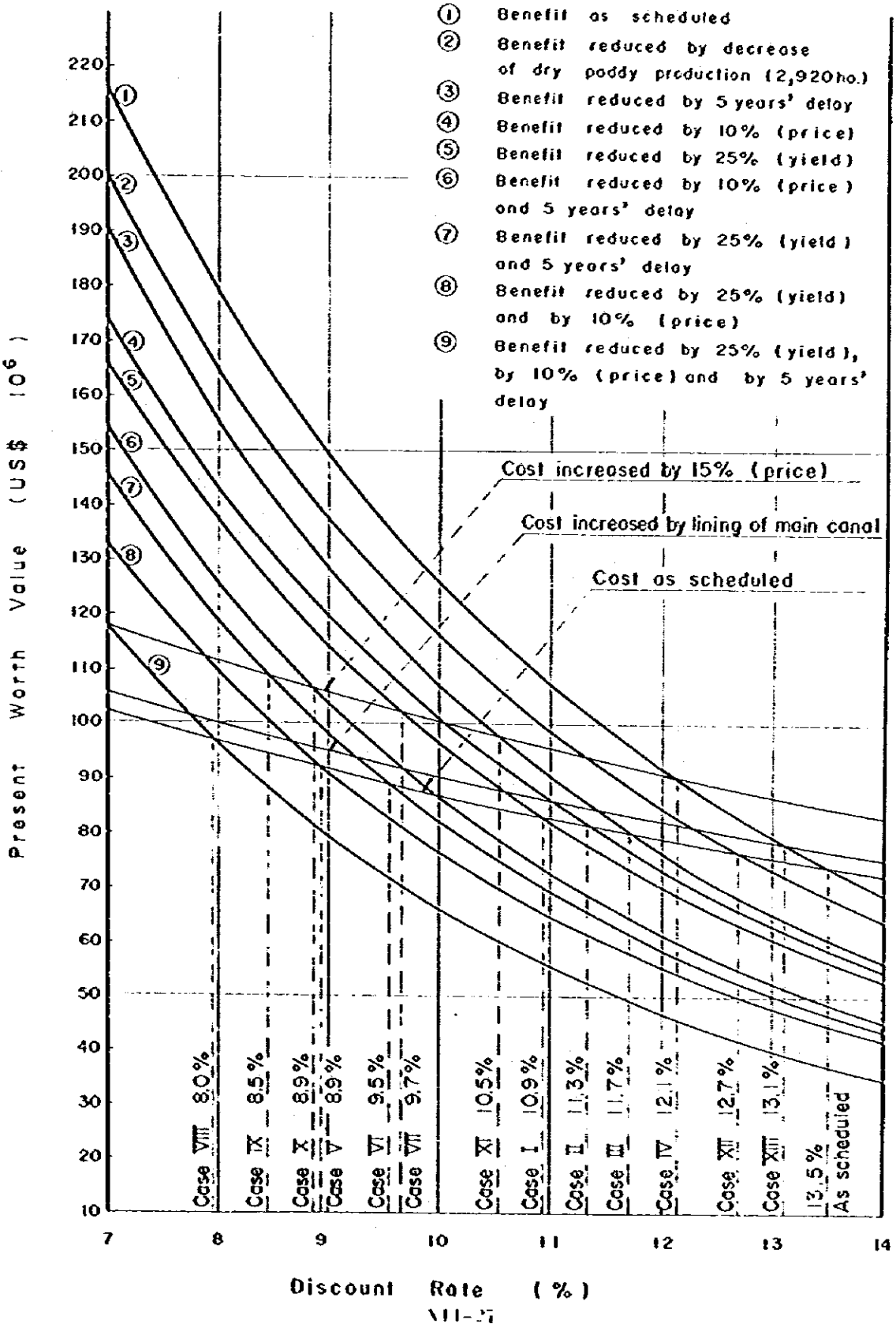

Table XII-9 Financial Prices of Farm Products
(Average of Semi-Annual)

Crop	Market	Year 1975 Jan. - June (Rp/kg)	1975 July - Dec. (Rp/kg)	1976 Jan. - June (Rp/kg)	1976 July - Dec. (Rp/kg)	1977 Jan. - June (Rp/kg)	1977 July - Dec. (Rp/kg)	Average of 1975 - 1977 (Rp/kg)
Rice	Banjarmasin	99.9	100.2	156.4	125.0	157.0	131.5	
	Banjarbaru	99.1	101.4	152.5	125.3	128.8	124.8	
	Average	99.5	100.8	154.5	125.2	142.9	128.2	125
Dry Paddy	Banjarmasin	60.0	59.2	108.7	79.8	*	*	
	Banjarbaru	59.7	57.8	98.8	82.3	98.3	98.3	
	Average	59.9	58.5	103.8	81.1	98.3	98.3	83
Maize	Banjarmasin	78.9	82.2	123.9	107.3	120.2	92.5	
	Banjarbaru	80.5	82.5	128.9	123.3	101.3	75.4	
	Average	79.7	82.4	126.4	115.3	110.8	84.0	100
Soybean	Banjarmasin	246.0	273.5	237.5	180.5	270.5	192.5	
	Banjarbaru	173.3	238.2	252.7	247.5	291.7	329.2	
	Average	209.7	255.9	245.1	214.0	281.1	260.9	245
Peanuts	Banjarmasin	271.5	269.7	323.0	287.7	315.0	355.3	
	Banjarbaru	252.2	275.5	348.3	335.8	325.0	350.0	
	Average	261.9	272.6	335.7	311.8	320.0	352.7	309
Cassava	Banjarmasin	23.0	22.5	36.0	39.2	49.7	41.7	
	Banjarbaru	16.5	28.3	41.2	41.7	31.7	40.0	
	Average	19.8	25.4	38.6	40.5	40.7	40.9	34
Green bean	Banjarmasin	229.8	232.3	268.8	275.5	286.8	241.3	
	Banjarbaru	221.3	233.2	298.3	293.3	257.5	273.3	
	Average	225.6	232.8	283.6	284.4	272.2	257.3	259

* : No data are available.

Data source : Agricultural Extension Services in Kabupaten Banjar

Table XII-10 Financial Prices of Farm Inputs

Item	Price
Seed (dry paddy)	150 Rp/kg
Fertilizers	
Urea	70 Rp/kg
T.S.P.	70 "
K.C.L	185 "
Agro-chemicals	
Insecticide	900 Rp/lit.
Fungicide	900 "
Rodenticide	2,300 Rp/kg
Labour	
Preparation of seedling	750 Rp/man-day
Field preparation	520 "
Transplanting	750 "
Weeding	450 "
Fertilizing and spraying	300 "
Water management	300 "
Harvesting	750 "
Processing, drying & transportation	450 "

Table XII-11 Annual Budget on Typical Owner-farmer (future with-project)

Farm size : 1.0 ha
Family size : 6 persons

1. Gross Income		
Farm income		
Rainy season paddy		332,000
Dry season paddy		280,120
Miscellaneous income		30,000
Total :		642,120
2. Outgo		
Farming expenses		
Seeds		6,600
Fertilizers	Urea	30,600
	T.S.P.	12,300
	KCL	19,400
Insecticides		6,300
Pungicides		3,200
Rodenticides		800
Farm equipment		29,400
Labour cost		70,000
Miscellaneous		17,400
Sub-Total :		196,000
IPEDA tax, etc.		12,500
Family living expenses		323,500
Total :		532,000
3. Balance or Capacity to Pay		Rp. 110,120 or US$176.2

Table XII-12 Annual Budget on Typical Owner-farmer
(future without-project)

Farm size : 1.0 ha
Family size : 6 persons

1. Gross Income

Farm income

Paddy	166,000
Miscellaneous	82,720
Total :	248,720

2. Outgo

Farming expenses

Seeds	1,500
Miscellaneous	1,800
IPEDA tax, etc.	2,800
Family living expenses	241,000
Total :	247,170

3. Balance or Capacity to Pay Rp.1,550 or US$2.5

Table XII-13 Annual Equivalent to the Repayment

Year	Project Capital (US$ 1,000) Local Currency	Foreign Currency	Total
1980	80	900	980
1981	340	1,130	1,470
1982	16,110	23,330	39,440
1983	23,530	27,930	51,460
1984	22,680	10,120	32,800
1985	13,320	9,600	22,920
1986	18,530	7,350	25,880
1987	12,290	3,430	15,720
1988	-	-5,950/1	-5,950/1
Total :	106,880	77,840	184,720
	126,700/2	95,500/2	222,200/2

/1 : Salvage value of construction equipment

/2 : Total cost capitalized for 1989 in calendar year by 3% per annum of interest

1) Annual equivalent to the repayment of foreign currency (3%, 30 years including 10 years of grace period)

$$US\$95,500 \times 10^3 \times \frac{0.03}{1-(1+0.03)^{-20}} = US\$6,420 \times 10^3$$

$$US\$6,420 \times 10^3 \times 1/32,610 \text{ ha} = \underline{US\$197/ha/annum}$$

2) Annual equivalent to the replacement cost for local currency (3%, 50 years including 10 years grace period)

$$US\$126,700 \times 10^3 \times \frac{0.03}{1-(1+0.03)^{-40}} = US\$5,480 \times 10^3$$

$$US\$5,480 \times 10^3 \times 1/32,610 \text{ ha} = \underline{US\$168/ha/annum}$$

Table XII-14 Financial Cash Flow Table

(US$1,000)

Year	Project Capital Arrangement (Foreign Currency)	Cash Outflow: Loan Repayment	Cash Outflow: O&M Cost	Cash Outflow: Total Outflow (A)	Cash Inflow: Project Revenue	Cash Inflow: Salvage Value of Equipment	Cash Inflow: Government Subsidy	Cash Inflow: Total Inflow (B)	Balance of Payment (B) - (A)
1980	900	-	-	-	-	-	-	-	-
1981	1,130	-	-	-	-	-	-	-	-
1982	23,330	-	-	-	-	-	-	-	-
1983	27,930	-	-	-	-	-	-	-	-
1984	10,120	-	124	124	124	-	-	124	0
1985	9,600	-	295	295	295	-	-	295	0
1986	7,350	-	480	480	480	-	-	480	0
1987	3,430	-	733	733	733	-	-	733	0
1988	:	-	886	886	886	5,950	-	6,836	5,950
1989	101,820 /2	-	886	886	886	-	-	886	0
1990		6,850	886	7,736	886	-	6,850	7,736	0
1991		6,850	886	7,736	886	-	6,850	7,736	0
1992		6,850	886	7,736	886	-	6,850	7,736	0
1993		6,850	886	7,736	886	-	6,850	7,736	0
1994		6,850	886	7,736	886	-	6,850	7,736	0
1995		6,850	886	7,736	886	-	6,850	7,736	0
1996		6,850	886	7,736	886	-	6,850	7,736	0
1997		6,850	886	7,736	886	-	6,850	7,736	0
1998		6,850	886	7,736	886	-	6,850	7,736	0
1999		6,850	886	7,736	886	-	6,850	7,736	0
2000		6,850	886	7,736	886	-	6,850	7,736	0
2001		6,850	886	7,736	886	-	6,850	7,736	0
2002		6,850	886	7,736	886	-	6,850	7,736	0
2003		6,850	886	7,736	886	-	6,850	7,736	0
2004		6,850	886	7,736	886	-	6,850	7,736	0
2005		6,850	886	7,736	886	-	6,850	7,736	0
2006		6,850	886	7,736	886	-	6,850	7,736	0
2007		6,850	886	7,736	886	-	6,850	7,736	0
2008		6,850	886	7,736	886	-	6,850	7,736	0
2009		6,850	886	7,736	886	-	6,850	7,736	0

/1: Government subsidy to be allocated for the repayment

/2: Accumulated capital cost including 3% of interest per annum within 10 years of grace period

ANNEX XIII

PILOT DEMONSTRATION SCHEME

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ANNEX XIII PILOT DEMONSTRATION SCHEME

XIII.1 GENERAL

As explained in detail in the previous Annex, the present agricultural setting has been exploited with the traditional paddy rice cultivation using the local varieties of paddy under the seasonal floodings in the rainy season. Practically, the present farming practices and crop-soil-water management are still primitive for further increase of the agricultural production. In order to realize the future agricultural development in the project area, modification and improvement of the present agricultural conditions should be made as early as possible, prior to the project execution.

For this purpose, it is recommended to organize the Pilot Demonstration Scheme (the Scheme).

XIII.2 OBJECTIVES

In the proposed agricultural development for the Riam Kanan Irrigation Project, actual prime-task-force of the crop production is the farmers, and hence, their experience, incentives or motivation and technical skills for increasing production are the most important factors for successful development. Besides, strong efforts by the institutional organizations for supporting the agricultural production are of another importance for promoting the development.

In due consideration of the above and further taking into account the present situation of the agricultural settings in the project area, the following programs are considered as the basic objectives of the Pilot Demonstration Scheme so as to sufficiently enhance the farmers' association.

(1) Tertiary and quaternary development providing proper irrigation cum drainage facilities as well as farm road network, as one of the typical model for the future development in the Project,

(2) Organization of the systematic water and crop management system as well as the water user's association,

(3) Crop demonstration including the technical training and guidance,

(4) Seed multiplication for smooth propagation of suitable varieties of paddy rice, and

(5) Agronomic cum irrigation engineering experiments particularly for practical approach to the future agricultural extension.

In the above programs, the main objectives would be the extension of the profitable irrigation farming over the whole project area.

XIII.3 SELECTION OF AREA

For the selection of the proposed Pilot Demonstration area, the following would be the essential factors, in due consideration of the objectives, the present agricultural conditions and the future conditions to be improved under the Project.

(1) Water availability : The proposed site should be located as near the water source as possible so as to supply irrigation water easily with temporary facilities.

(2) Representative soil conditions.

(3) Drainability : So as to control the drainage water without the construction of large-scale system, the area should be located in the individual small drainage basin.

(4) Tertiary arrangement : In order to arrange the on-farm facilities for the systematic operations of crop-water management, the existing land ownership and tenure system should be simple.

(5) Good accessibility for smooth transportation and communication.

Considering the above factors, the Sungai Tabuk area in the sub-area C will be recommendable for this purpose as shown in Fig. XIII-1. The area covers about 1,800 ha of land in gross and is used as paddy field. Out of the total area, about 500 ha to 600 ha in net would be taken up for the Scheme. This size is based on the proposed unit size for organizing a farmer's association (water user's association).

XIII.4 THE SCHEME AREA

The area selected for the Scheme is administratively located at Desa Sungai Tabuk in Kabupaten Banjar, about 8 km east from Banjarmasin. The access to the river Martapura is only 1.5 km from the area. The area is also linked with the national road with asphalt pavement and the provincial roads with gravel pavement.

These roads are well maintained. In the paddy field in this area, however, no functional farm roads exist, and all of the farm inputs and outputs are carried by using narrow field ridges. In the area, there are small drainage channels with a total length of about 15 km constructed by farmers themselves, which need rehabilitation.

Seasonal floodings occur during the months from early December to March, and its maximum inundation depth is about 30 cm at the peak time (January). The land has an elevation of 1 m and very flat topography. The soils in this area are derived from silty clay to clay textured alluvium deposited in the quaternary land formation stage. The soils are typical gley hydromorphic soils being predominant in the project area.

The average land holding per farm household including tenant and cultivation right is estimated at about 1.0 ha. Most of paddy field is occupied by the farmers, while several percents of total land by tenant or cultivation right. Since no irrigation facilities exist at present, single monoculture of paddy rice using local varieties is being practiced in the rainy season. The unit yield is about 1.8 ton/ha of dry paddy on an average. Since the area is located near to the Handil Manarap sub-station of the experimental farm of the Central Research Institute for Agriculture in Kalimantan, it seems that most of the farmers in this area have relatively high interest for increased crop production with the introduction of high-yielding varieties of paddy rice. Since no irrigation water is available, however, the BIMAS support is not arranged yet.

XIII.5 THE PILOT DEMONSTRATION SCHEME

As stated in Section XIII.2, the main objectives of this Scheme are to develop the irrigation cum drainage facilities and to arrange the most suitable on-farm conditions and to make guidance and on-farm training of both farmers and the field extension workers who will be stationed in the project area in the future.

With these main objectives, the approach to the Scheme is studied as presented below.

XIII.5.1 Tertiary Development with Irrigation and Drainage Facilities

The tertiary development, which should be typical model for the future development of the Project, would be executed with the irrigation and drainage facilities as well as farm roads in order to achieve the objectives in success.

In this context, it is considered that the on-farm facilities will be directly connected with the main project system in the future as one of the tertiary unit of the overall network.

XIII.5.3 Systematic Water Management

Even distribution of irrigation water to each plot and proper drainage control are essential for profitable agricultural production.

The farmers in the project area are familiar with traditional water use in paddy rice cultivation under rain-fed and/or seasonal flooding conditions. However, all of them are not yet familiar with irrigation farming. Much effort should be made for the training of the farmers as well as the field extension workers through demonstration of systematic operations of the irrigation and drainage practices.

In the operations of the Scheme, therefore, it would be planned to establish a systematic operation system of the water management at farm level to use the available irrigation water effectively and to maximize the irrigation and drainage benefits. In this connection, a farmer's association would be organized under the full guidance of all government agencies concerned.

XIII.5.4 Crop Demonstration

Crop demonstration including the technical training and guidance is the most effective program for propagation of the improved farming practices such as land preparation, fertilization, plant protection, etc. which are still new to the farmers. Such crop demonstration would be included in the operation programs of the Scheme. This program would be operated by farmers themselves together with the field extension workers under the full technical guidance of the agricultural experts.

In addition, the training and guidance programs would be operated for systematic plant protection by farmers themselves.

Details of the works for this Pilot Demonstration Scheme, the operation cost and the staff required will be studied through further field investigations.

XIII.6 IMPLEMENTATION SCHEDULE AND COST ESTIMATE

XIII6.1 Implementation Schedule

The guidance and on-farm training for both farmers and field extension workers would have to be made before the commencement of project operation. For this, it is recommended to complete the construction of facilities for the Scheme within 1982, in which the main civil works of the Project would be started, as shown in Fix. X-1. The activities would be commenced in the beginning of wet season in 1982.

XIII.6.2 Cost Estimate

The works necessary to set up the Scheme are as follows :

- Construction of the inlet channel from the Martapura river and pump station,
- Construction of the irrigation and drainage networks,
- Construction of buildings such as offices, laboratory, garage, etc., and
- Supply of the experimental apparatus and agricultural equipment.

The total cost required for the above works except the construction of the irrigation and drainage networks, which is included in the construction costs for the sub-area C, is estimated at US$700,000. This cost is included in the projects cost. The detailed breakdown of the cost for the Scheme is given in Table XI-2.

Fig.XIII-1 General Layout of the Scheme