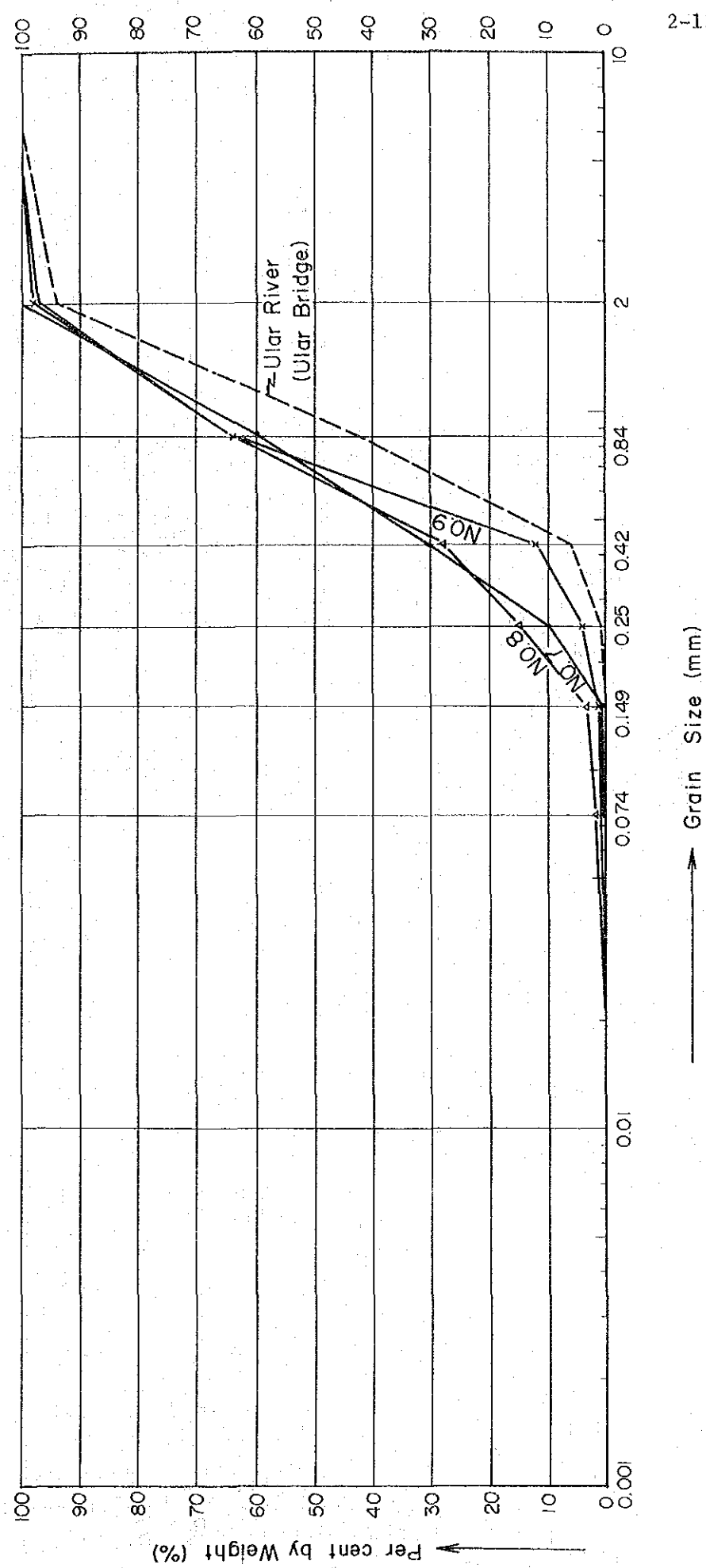
Fig. 2-1-6,(3) Grain Size Accumulation Curve

(Timbang Deli)



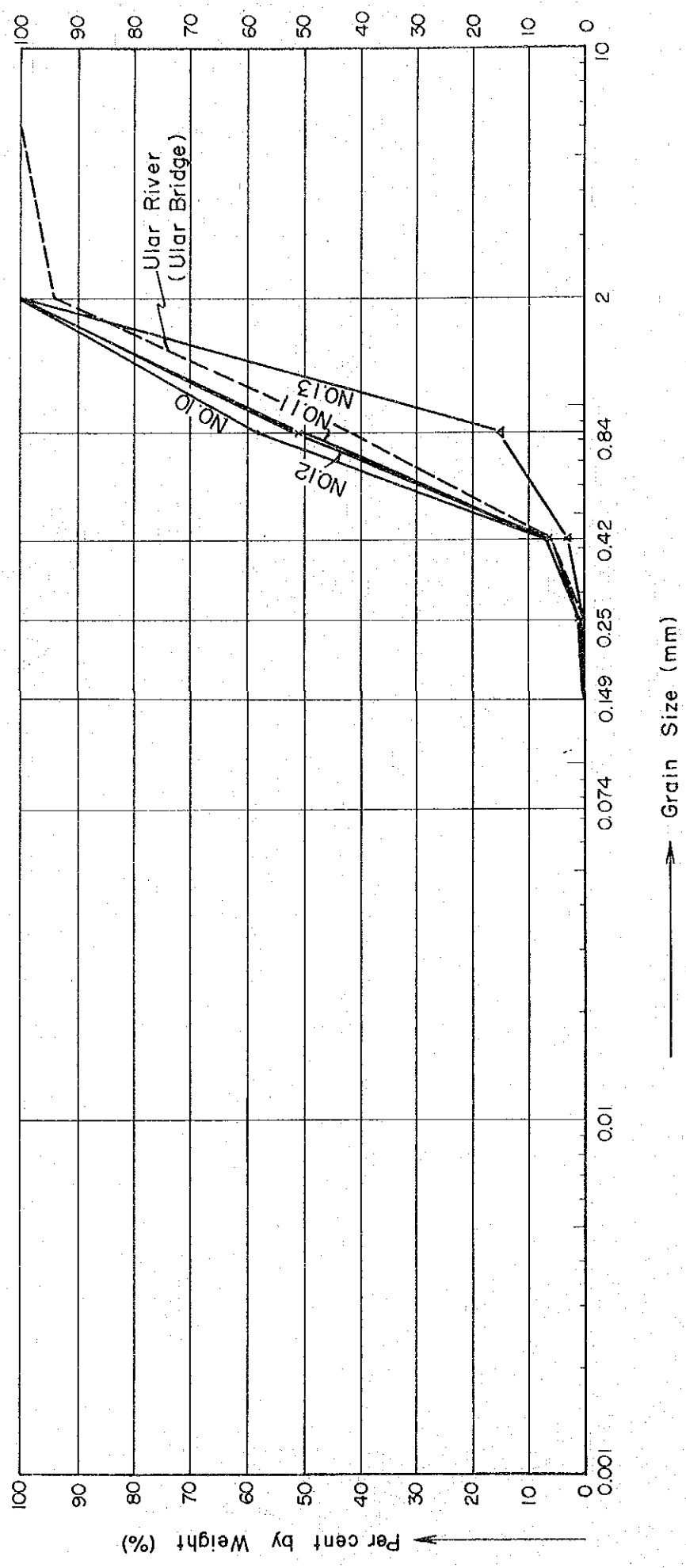
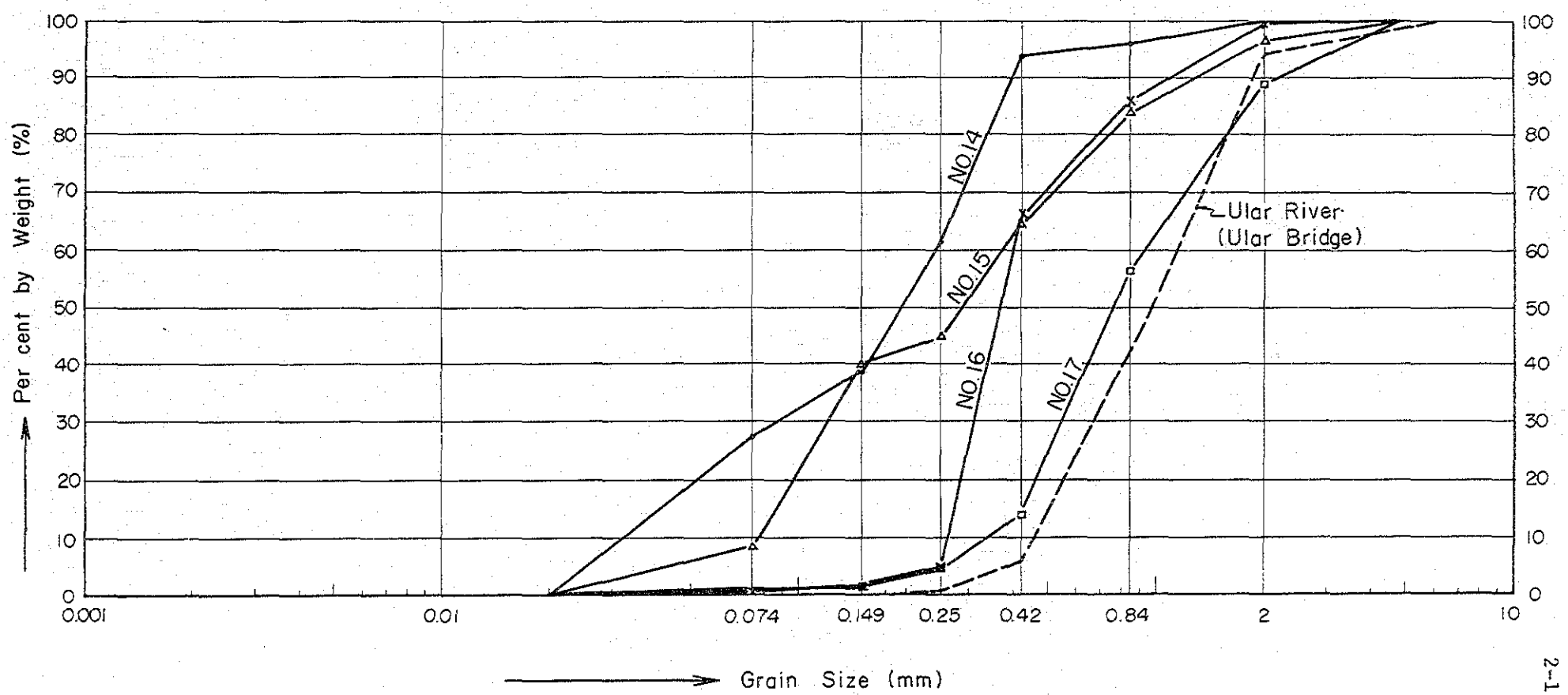


Fig. 2-1-6,(4) Grain Size Accumulation Curve

(Perbaungan)

Fig. 2-1-6,(5) Grain Size Accumulation Curve

(Sumber Rejo)



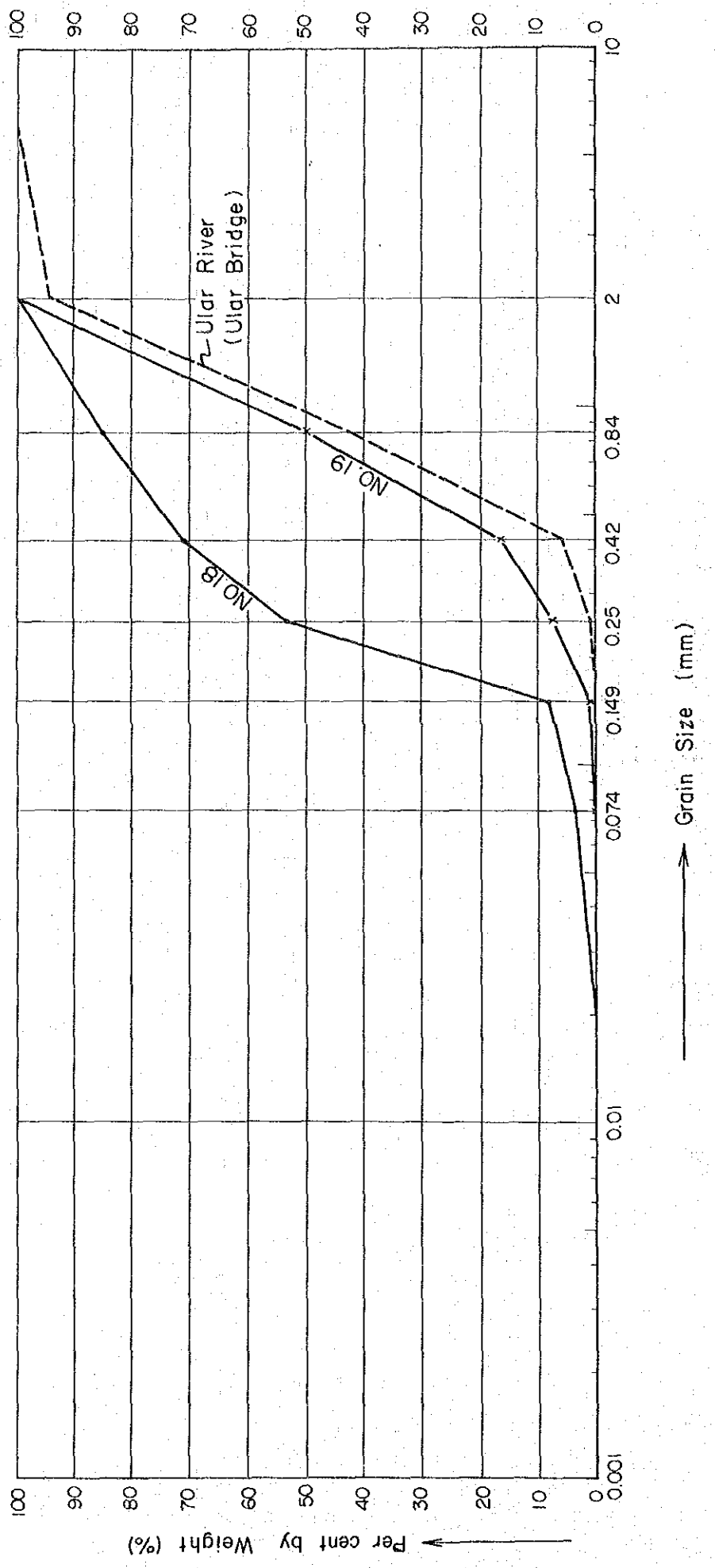


Fig. 2-1-6, (6) Grain Size Accumulation Curve

(Bendang)

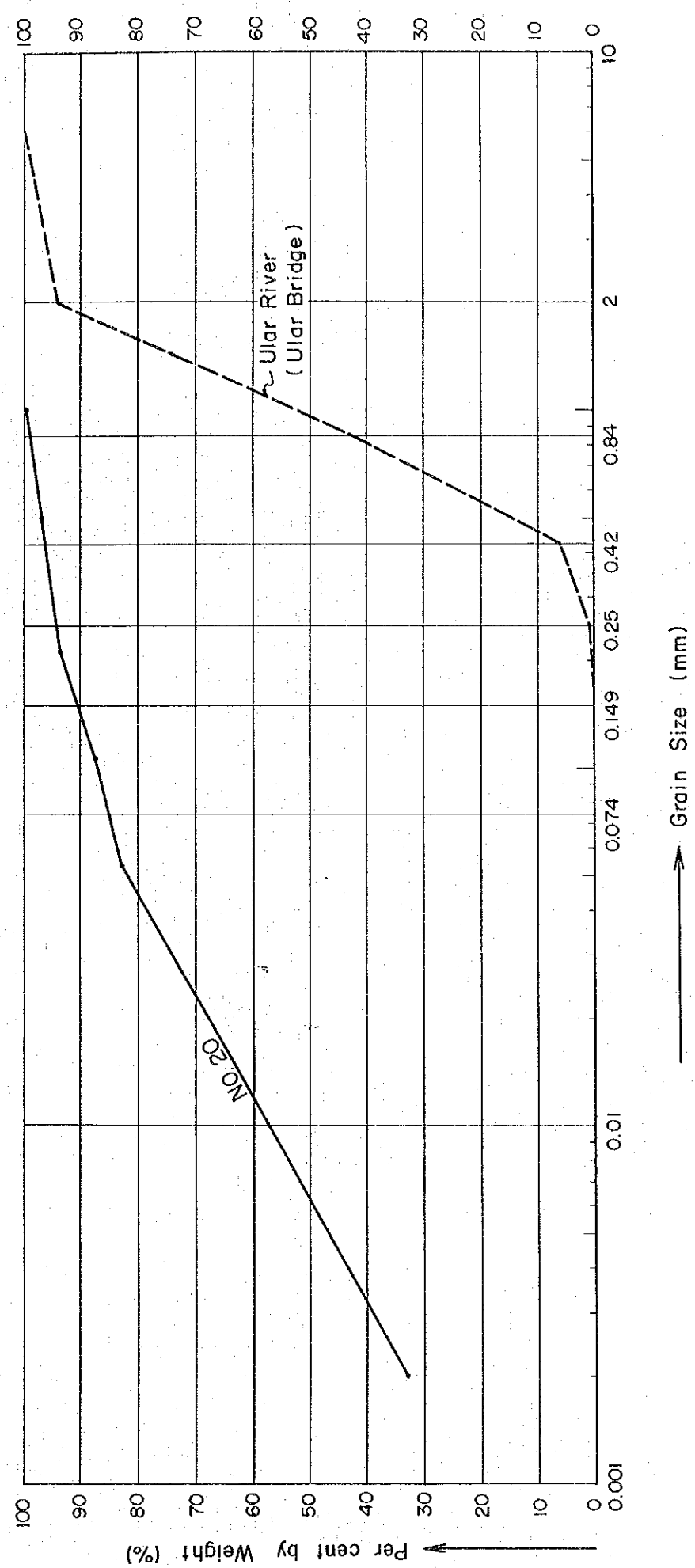


Fig. 2-1-6,(7) Grain Size Accumulation Curve

(Ramonia)

Fig. 2-2-1 Existing Irrigation System

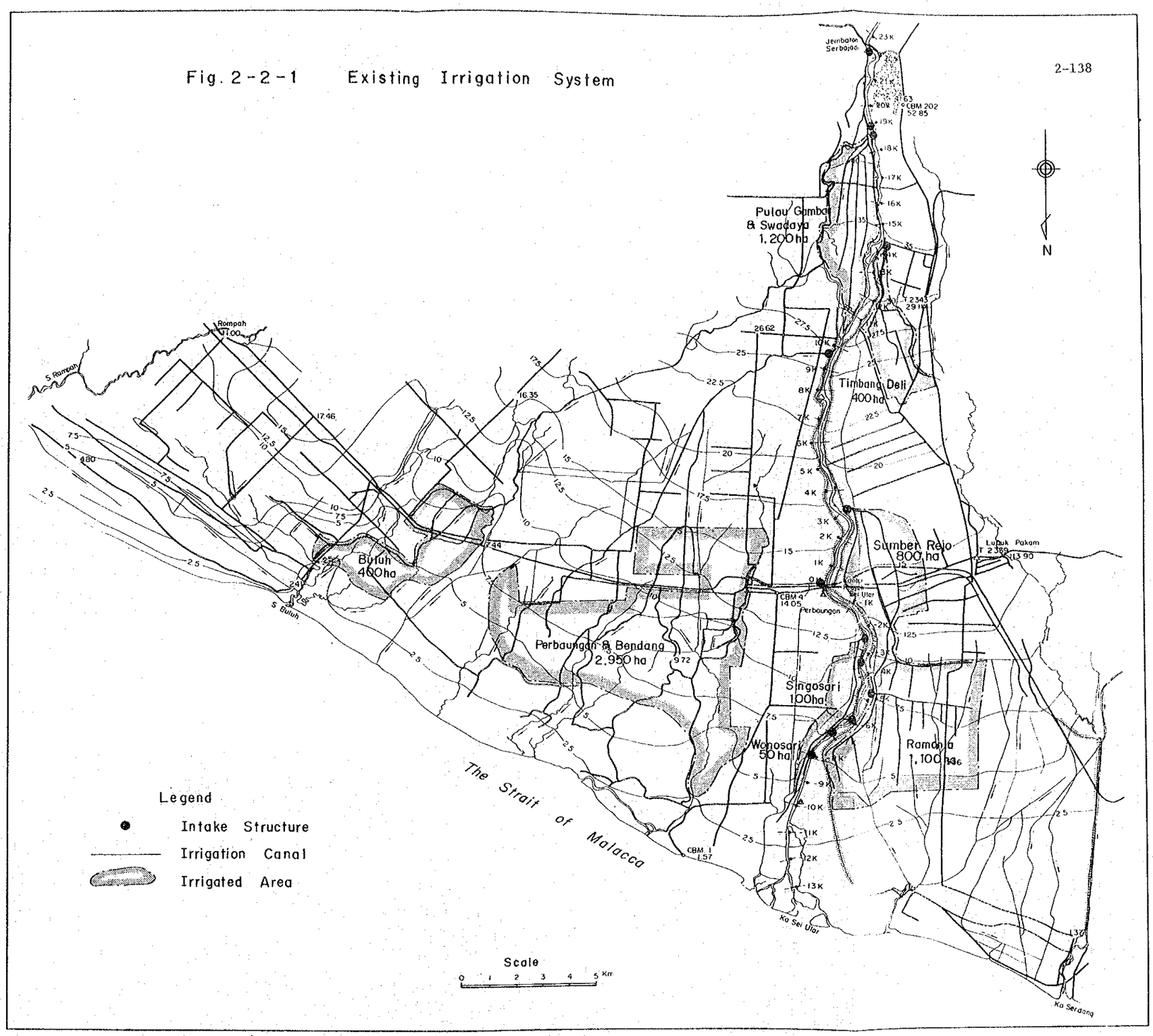
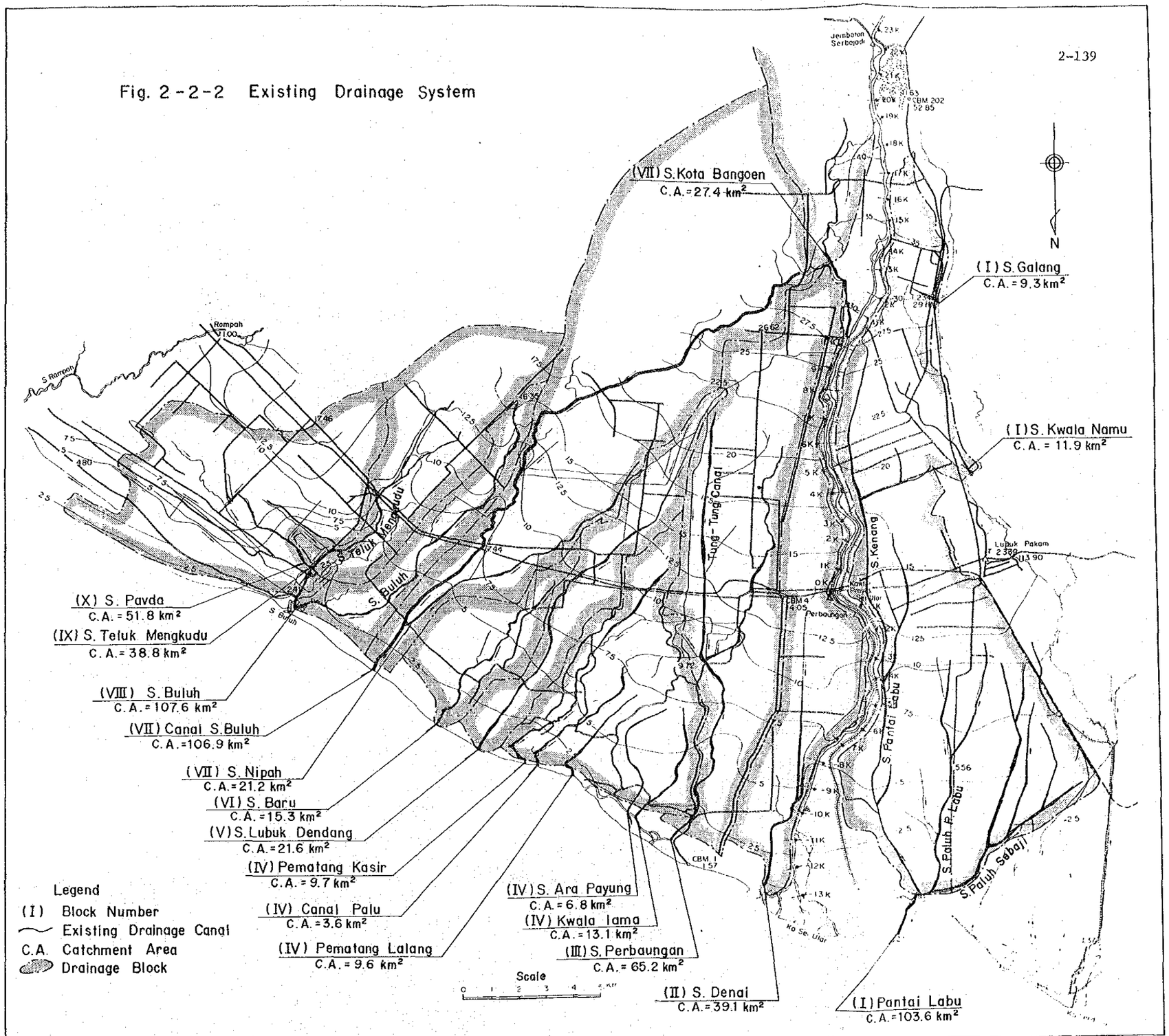


Fig. 2-2-2 Existing Drainage System



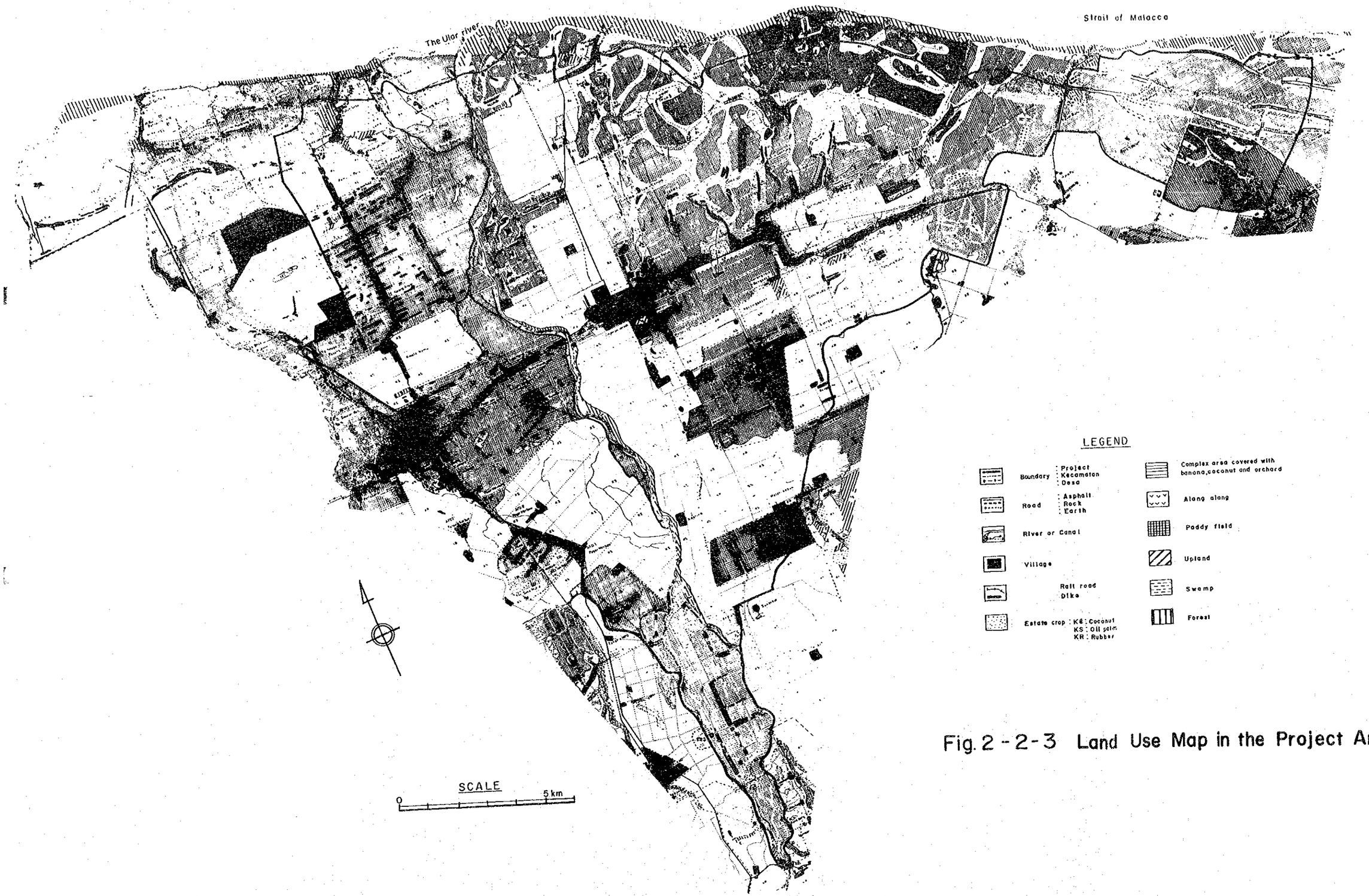


Fig. 2 - 2 - 3 Land Use Map in the Project Area

Fig. 2-2-4 Distribution System of Chemical Fertilizer in North Sumatra

1977 Dec.

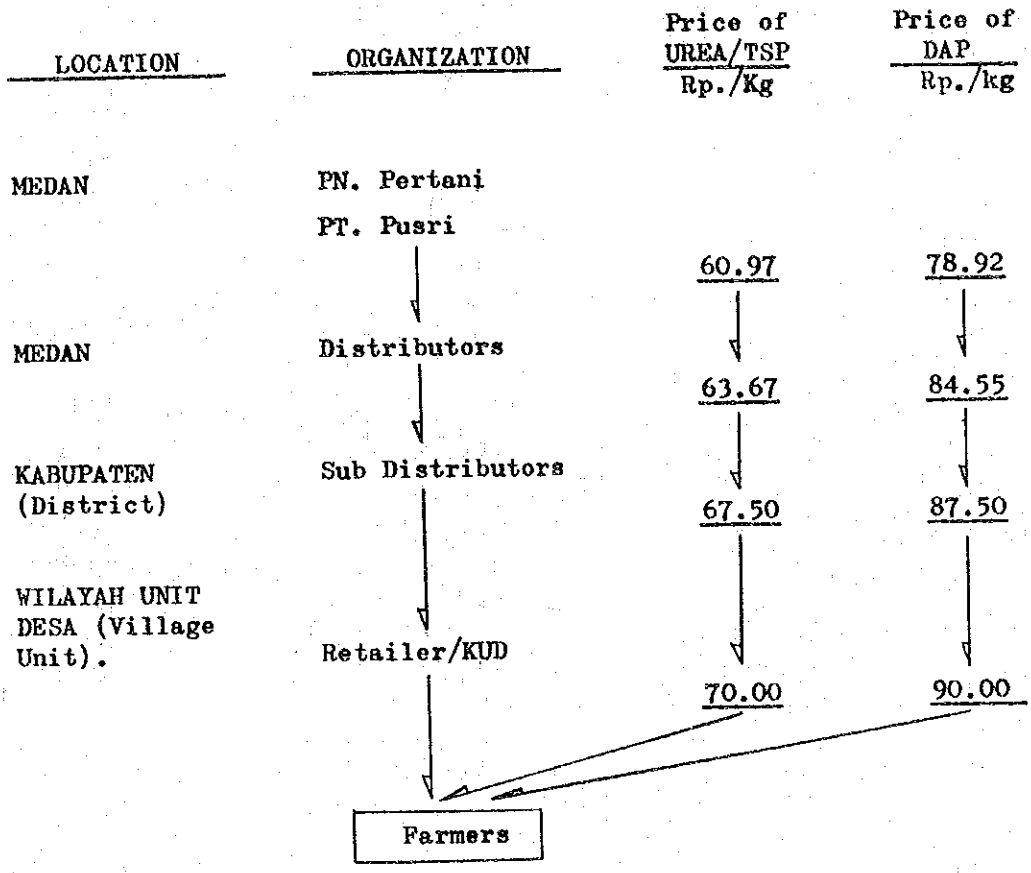


Fig. 2-2-5 Market Flow of Rice and Composition of Rice Price in Medan, 1976/1977

		Charge Rp.	Price Rp./kg.	
1.	Farm gate price (Paddy)		69.34	Farmer
2.	Village center "	0.5	69.84	↓
3.	Broker "	2.0	71.84	Broker
			72.84/	↓
4.	Rice mill gate "	1.0	121.4	Rice mill
5.	1st drying charge "	0.75	122.15	
6.	2nd drying charge "	0.75	122.9	
7.	Milling charge (Rice)	2.0	124.9	
8.	Packing charge "	0.25	125.15	
9.	Measuring charge "	0.25	125.4	
10.	Loading "	0.5	125.9	
11.	Transportation "	1.5	127.4	
12.	Package "	0.5	127.9	
13.	Middle brokers margin "	1.0	128.9	Middle broker
14.	Tax "	0.5	129.4	
15.	Unloading "	0.5	129.9	
16.	Storage loss "	0.5	130.4	↓
17.	Whole salers margin "	2.0	132.4	Wholesaler
18.	Transportation "	0.5	132.9	↓
19.	Retailers margin "	3.0	135.9	Retailer
20.	Interest of the Bank "	0.5		↓
	Consumer prices (Rice)		136.4	Consumer

* Annual monthly average price of medium quality rice is 136.4 Rp/kg in Medan in during Dec. 1976 to Nov. 1977.

* Source; DEPOT LOGISTIK SUMATRA UTARA.

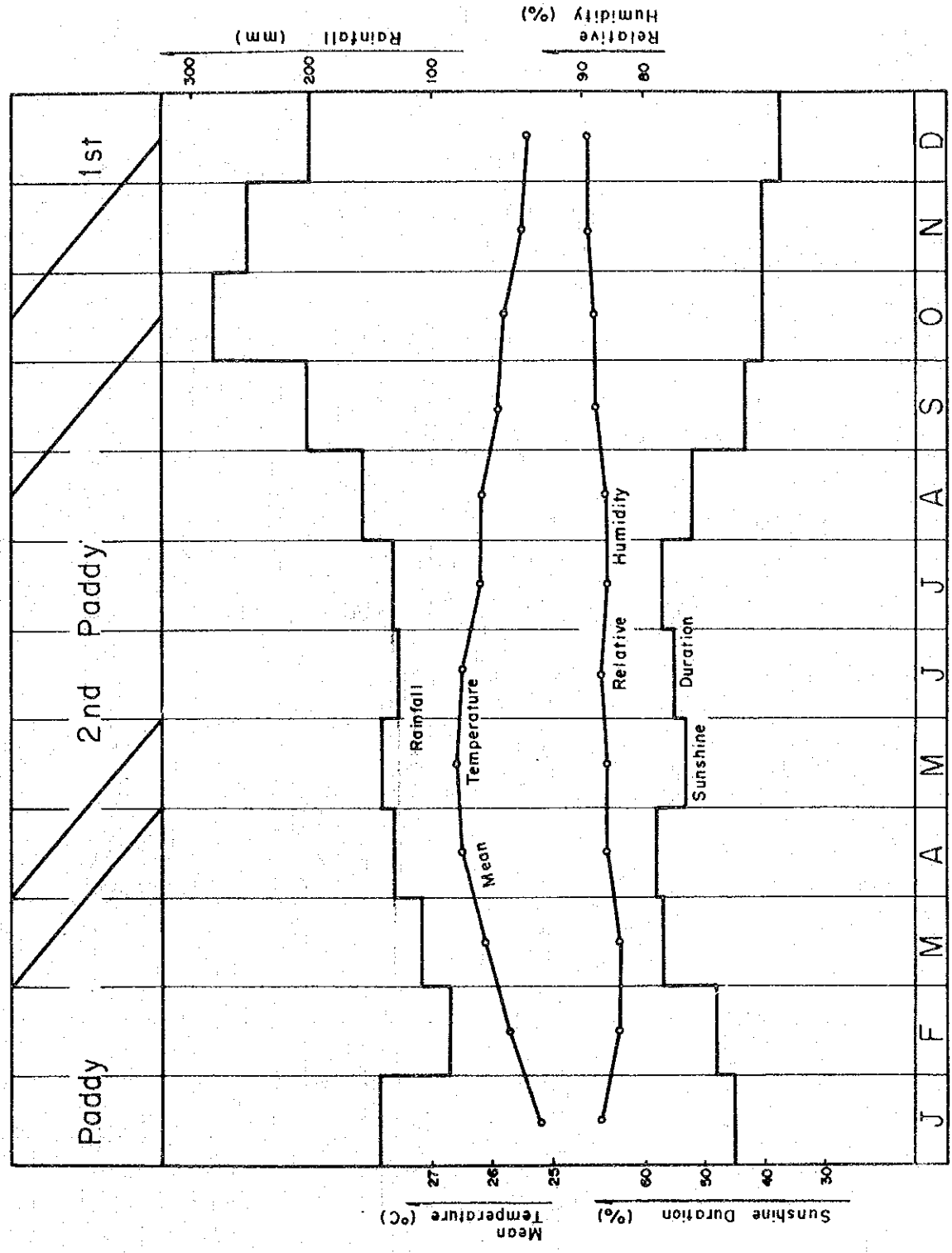
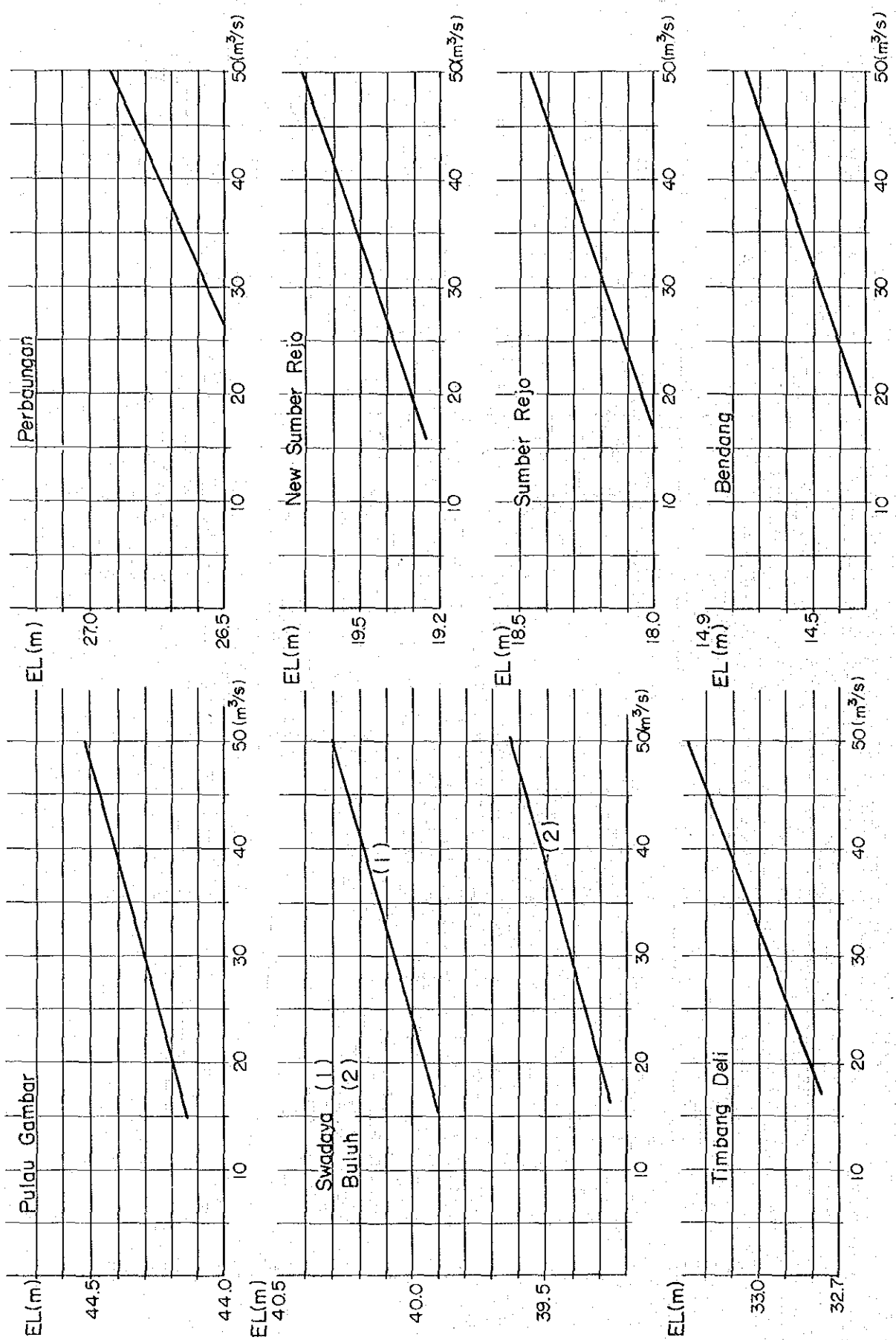
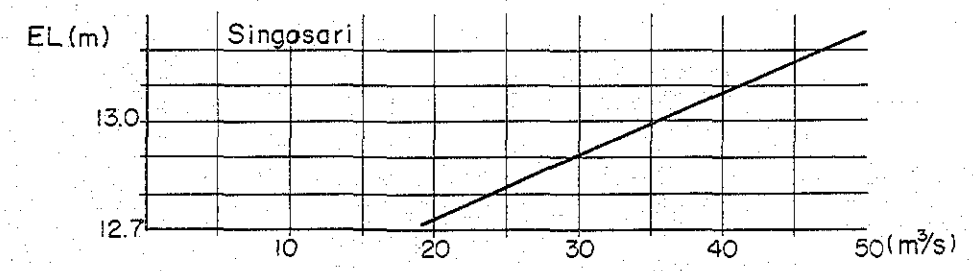


Fig. 2-3-1 Proposed Cropping Pattern

Fig.2-3-2 Small Discharge-Water Level Curve of The Ular River ($Q \leq 50 m^3/s$)




EL(m)
Singosari
13.0
12.7
10
20
30
40
50(m³/s)

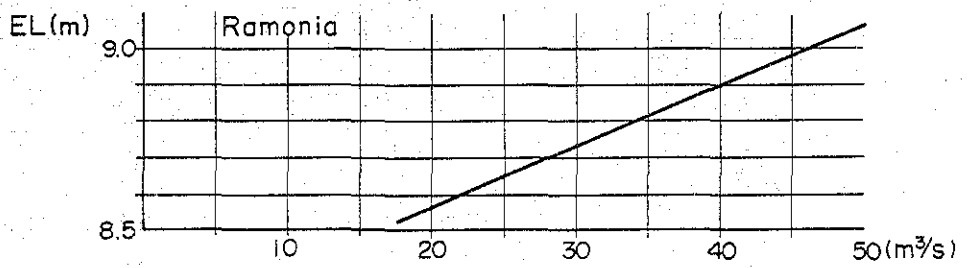
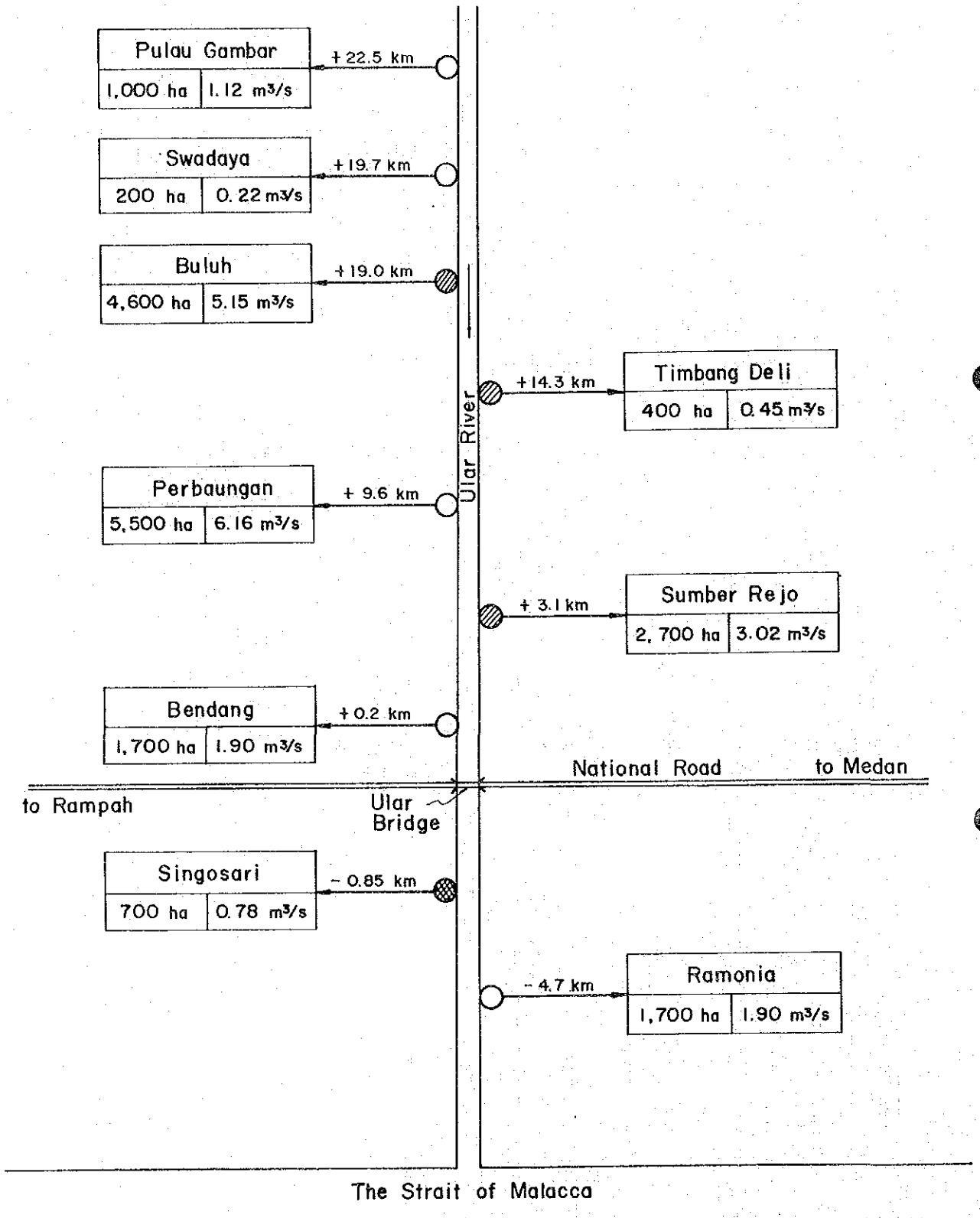

EL(m)
Ramonia
9.0
8.5
10
20
30
40
50(m³/s)

Fig. 2-3-3, (1)

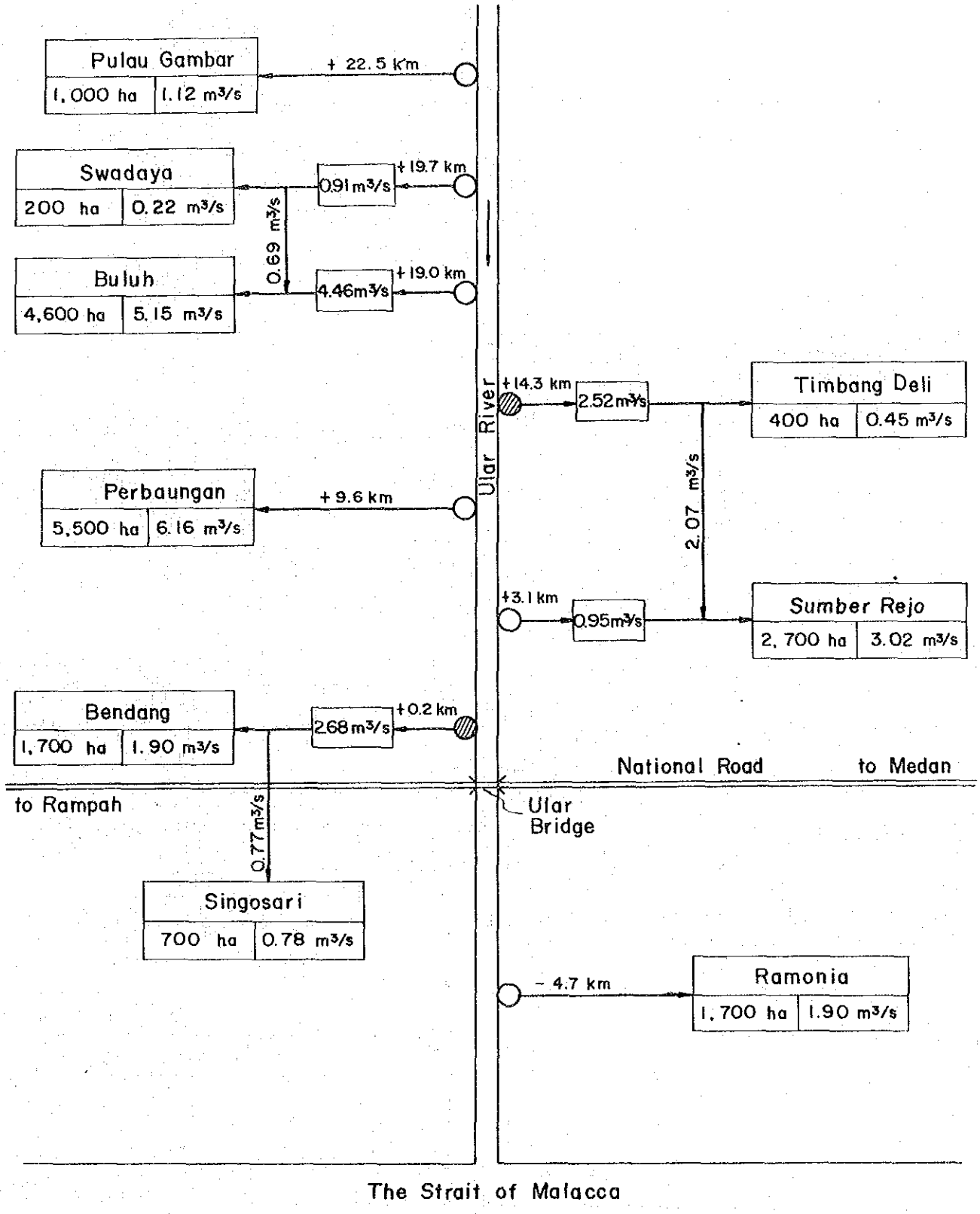
Alternative - A



Note : Improvement of the existing intake
New construction of intake

Fig. 2-3-3, (2)

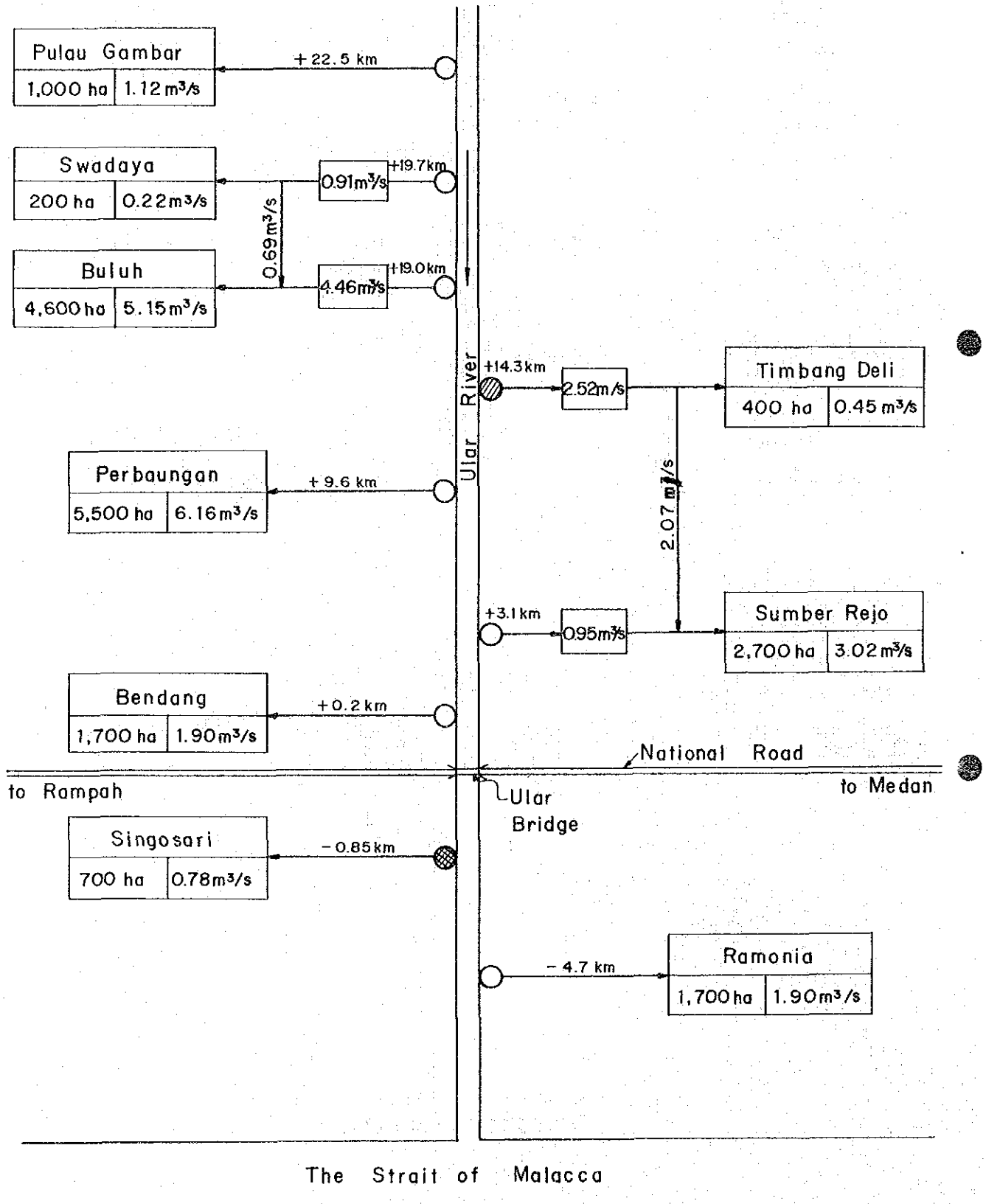
Alternative - B



Note : ◍ Improvement of the existing intake

Fig. 2-3-3,(3)

Alternative - C

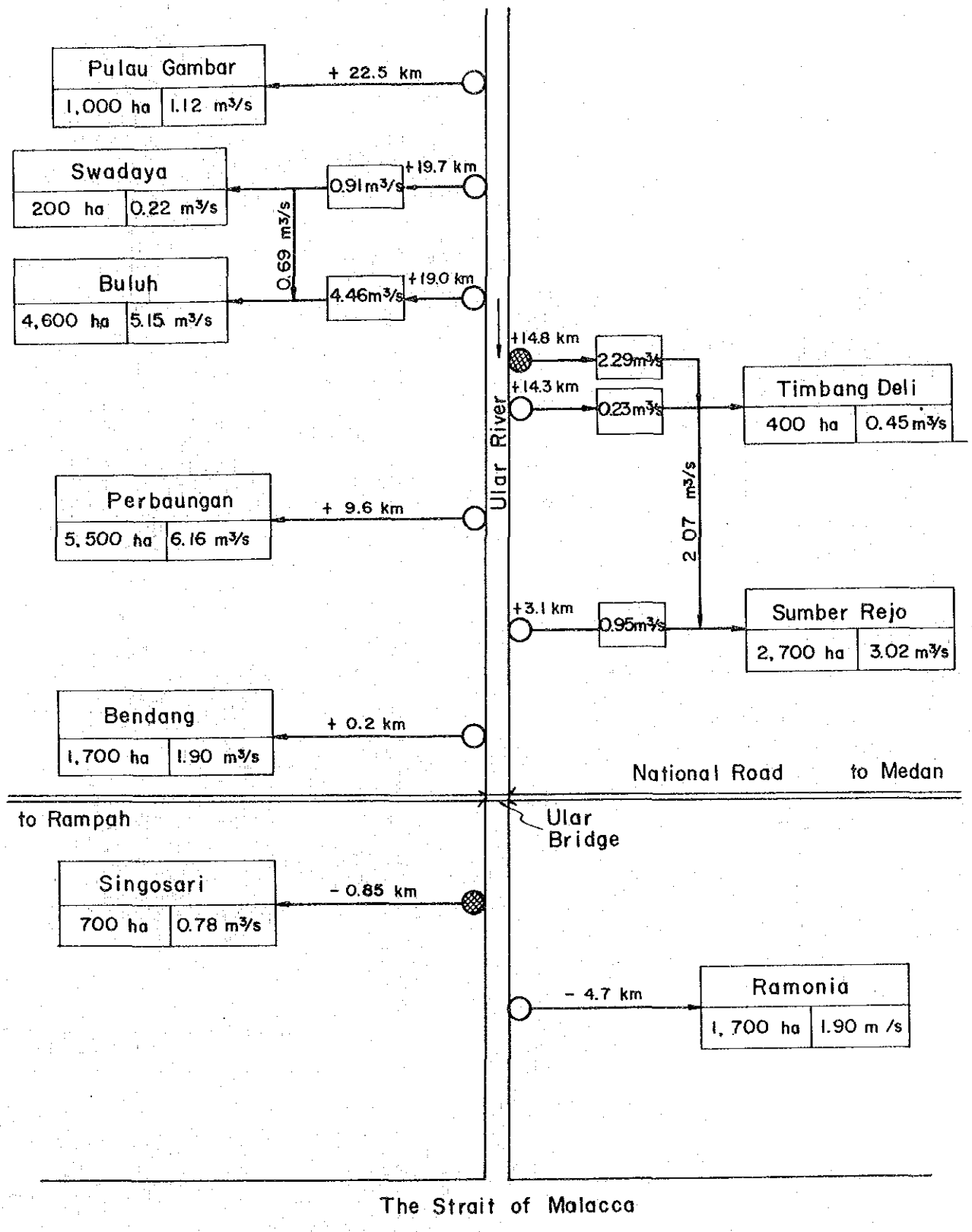


te : Improvement of the existing intake

New construction of intake

Fig. 2-3-3, (4)

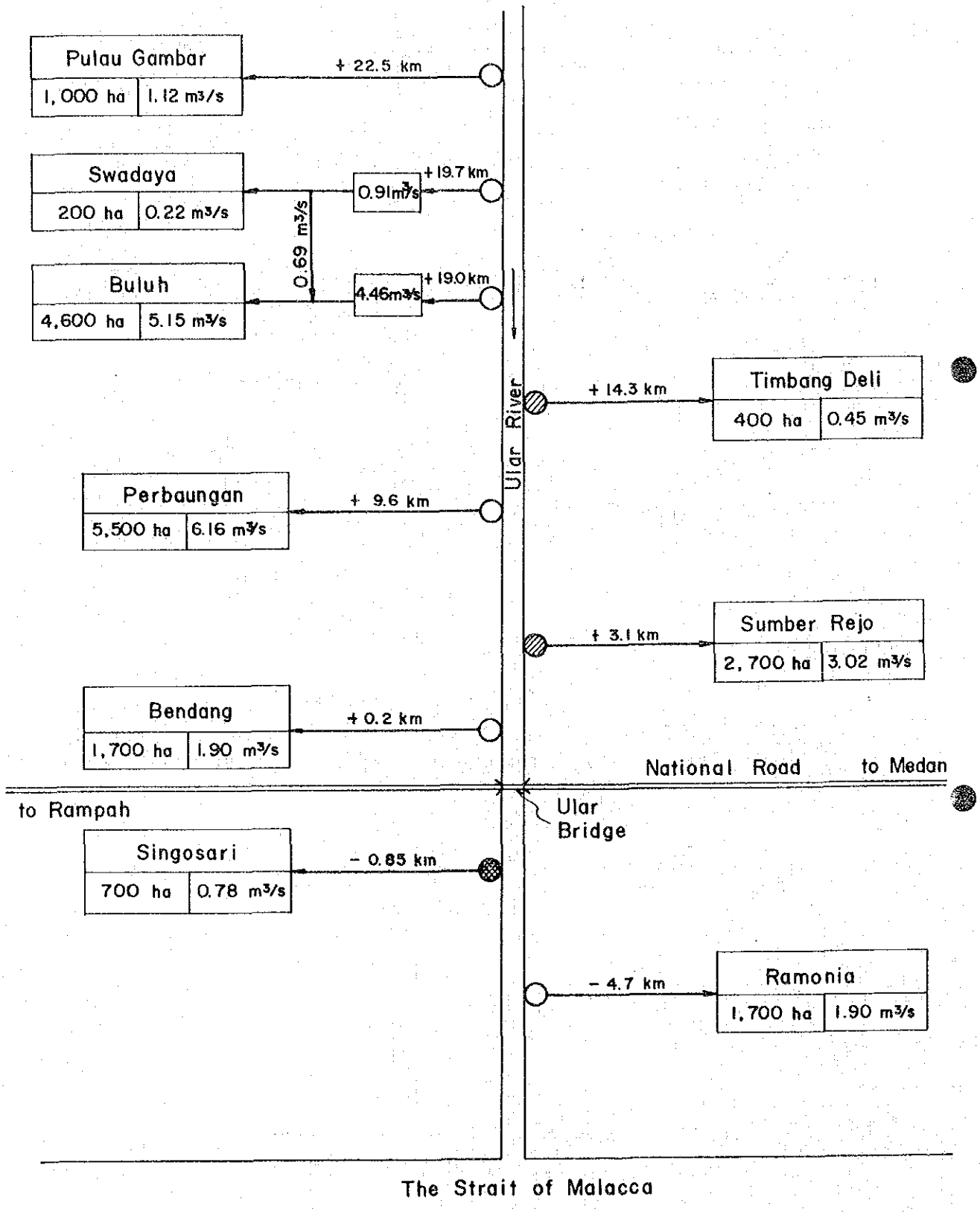
Alternative - D



Note : ◍ New construction of intake

Fig. 2-3-3, (5)

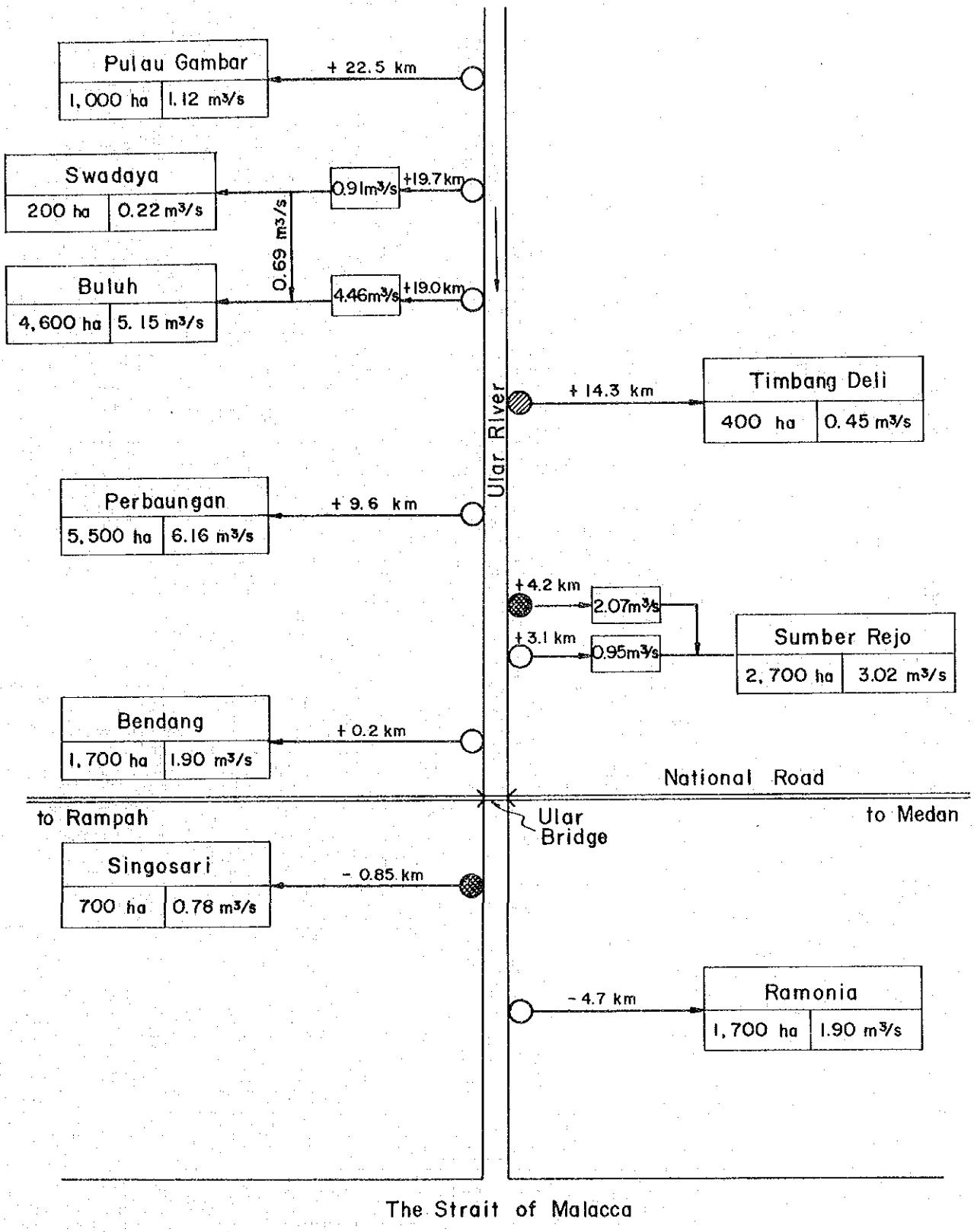
Alternative - E



Note : Improvement of the existing intake
New construction of intake

Fig. 2-3-3, (6)

Alternative - F



Note : Improvement of the existing intake
New construction of intake

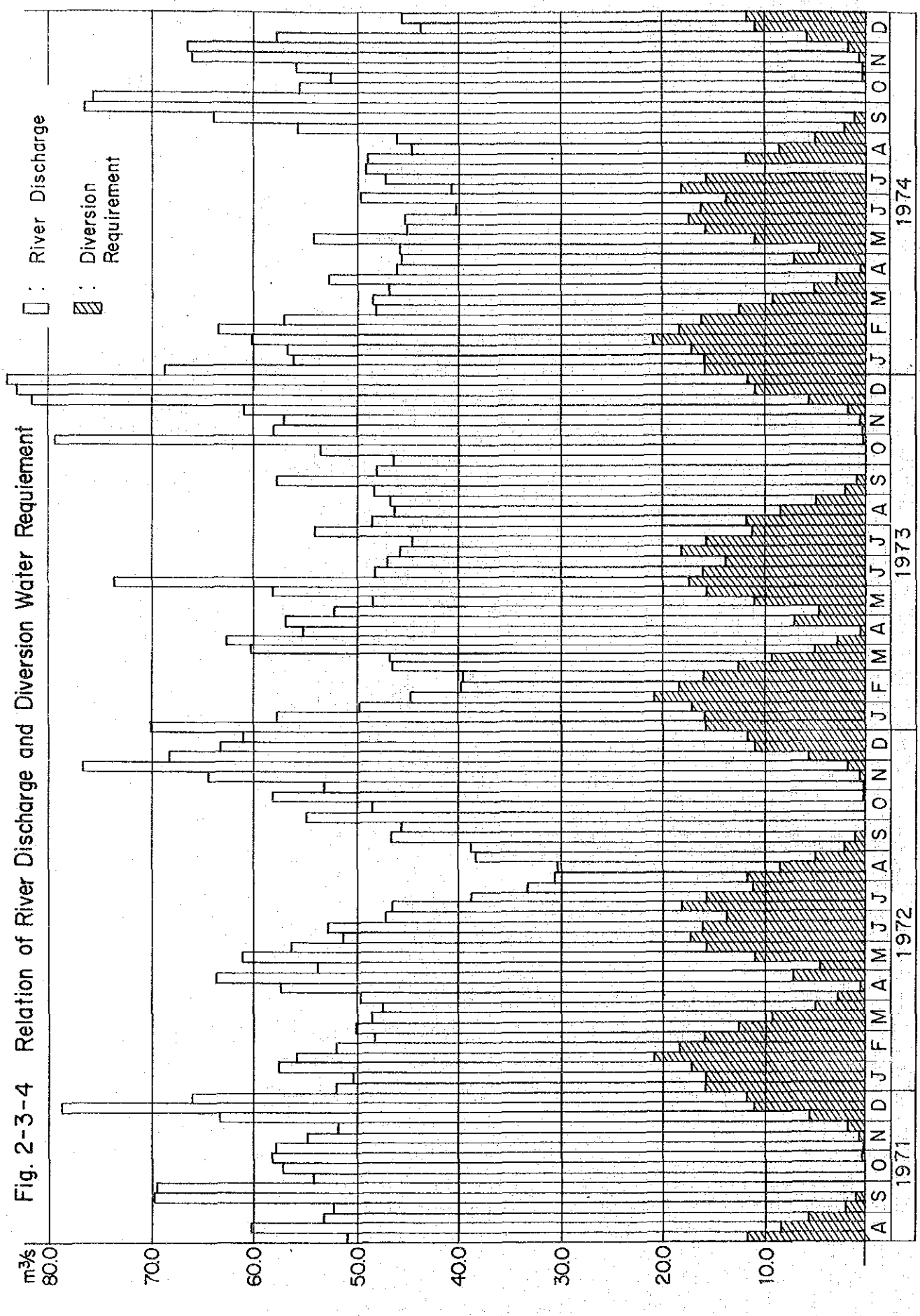


Fig. 2-3-4 Relation of River Discharge and Diversion Water Requirement

Fig. 2-3-5 ETO & Evaporation Record

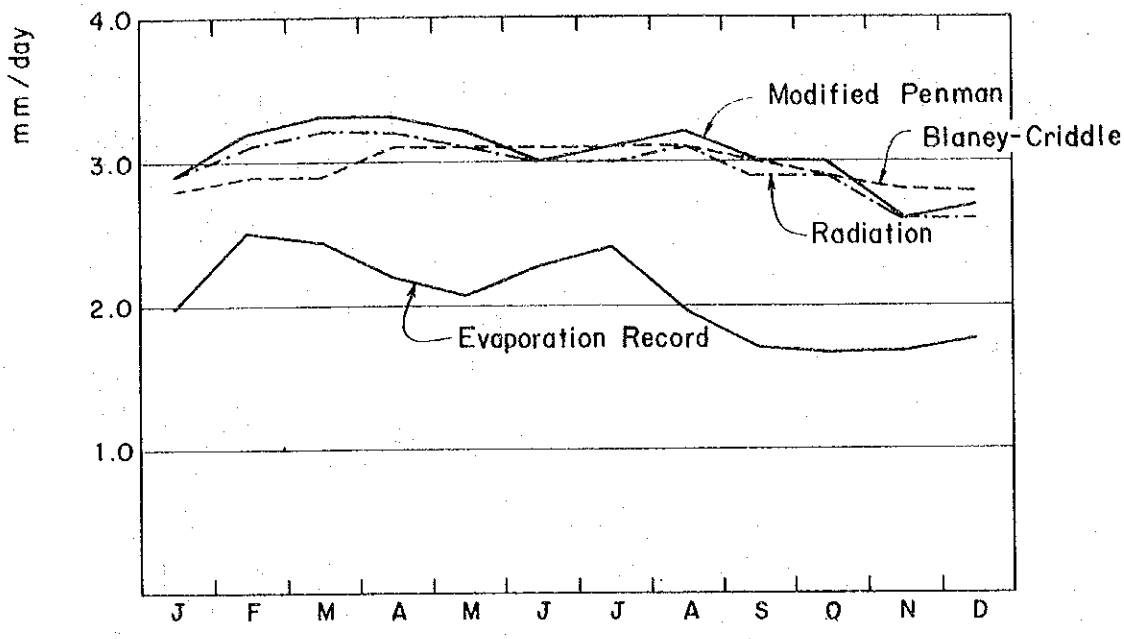


Fig. 2-3-6 Crop Factor (Kc)

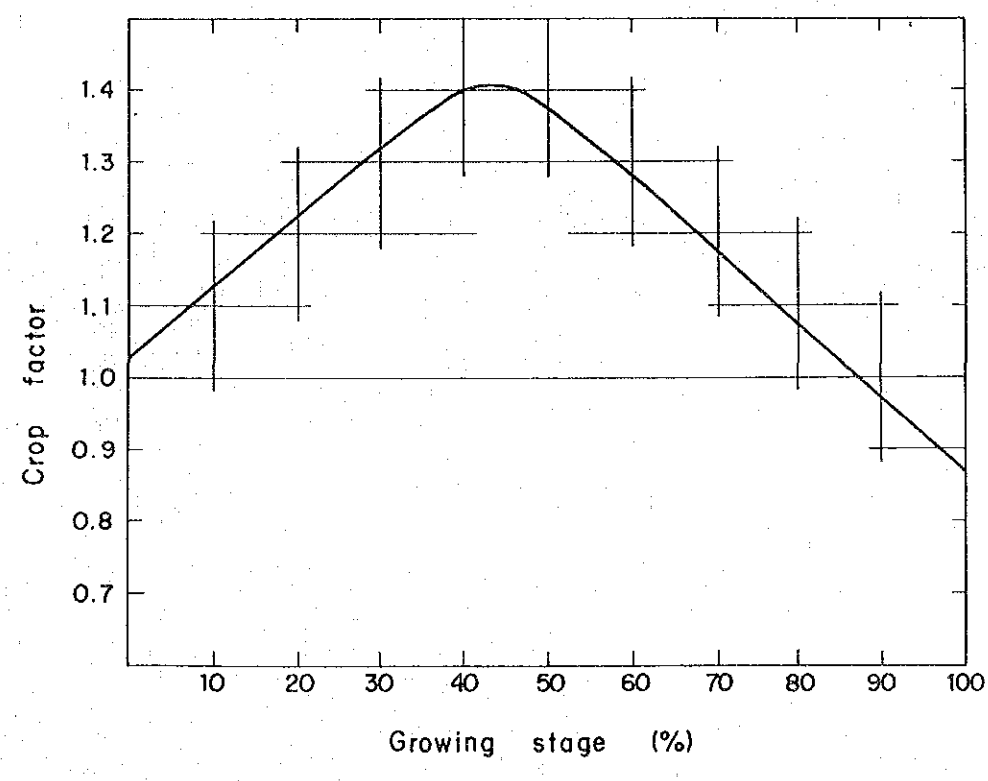


Fig. 2-3-7 Plan of Irrigation System

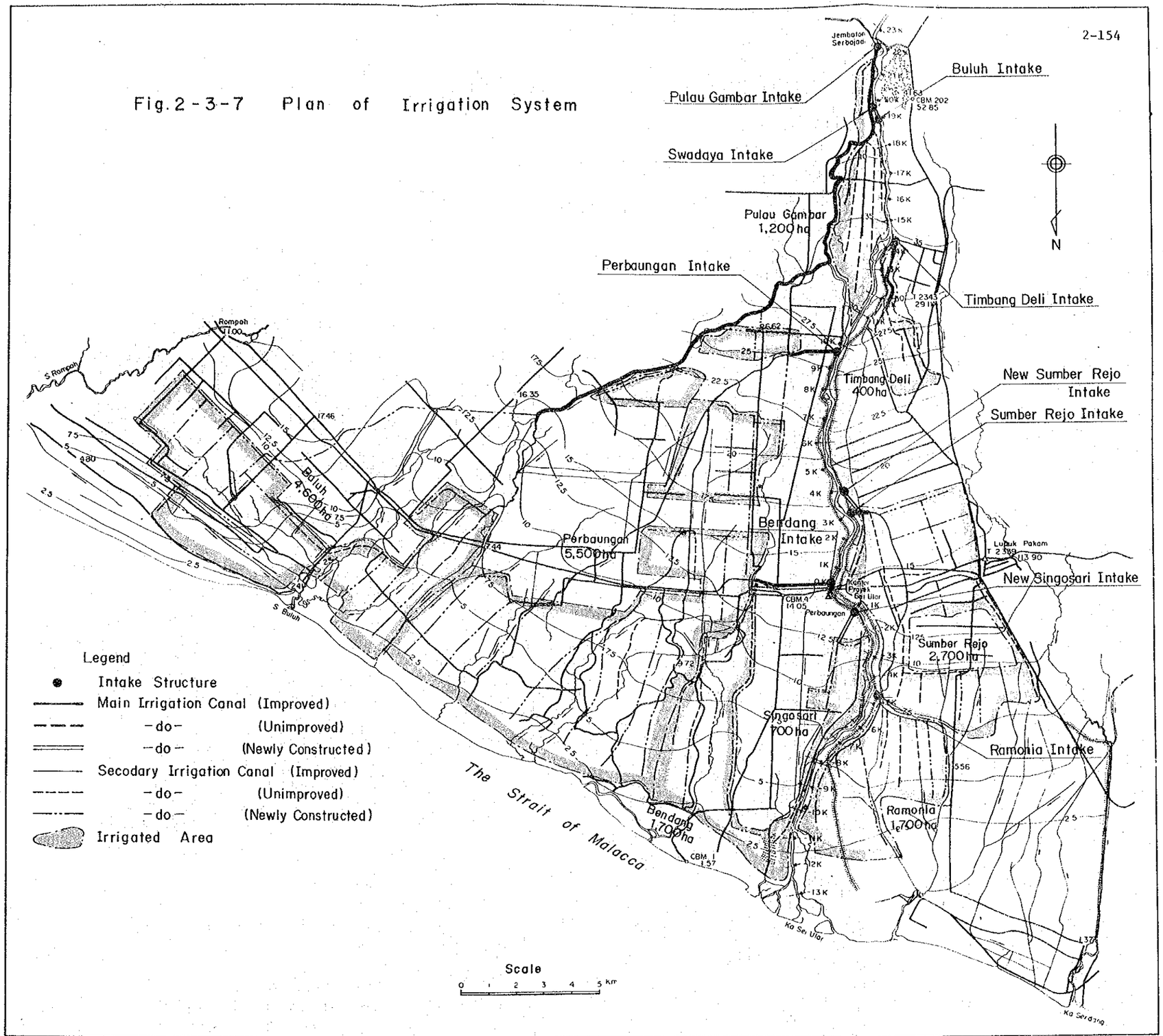
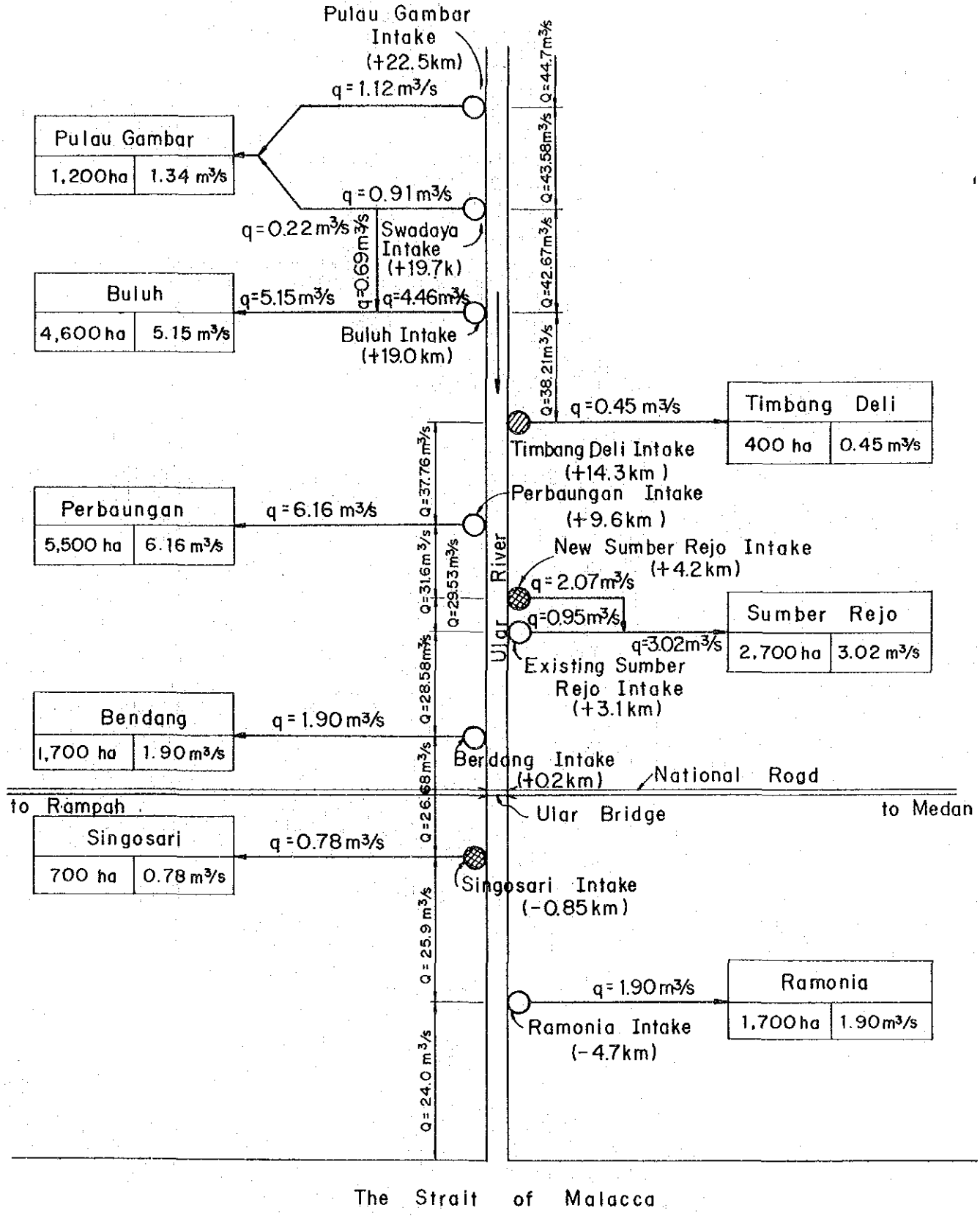


Fig. 2-3-8 Diagram of Irrigation Distribution System



Note : ○ : Intake not to be improved
◍ : Intake to be improved
⊛ : Intake to be newly constructed

Q : Planning river discharge
q : Intake discharge

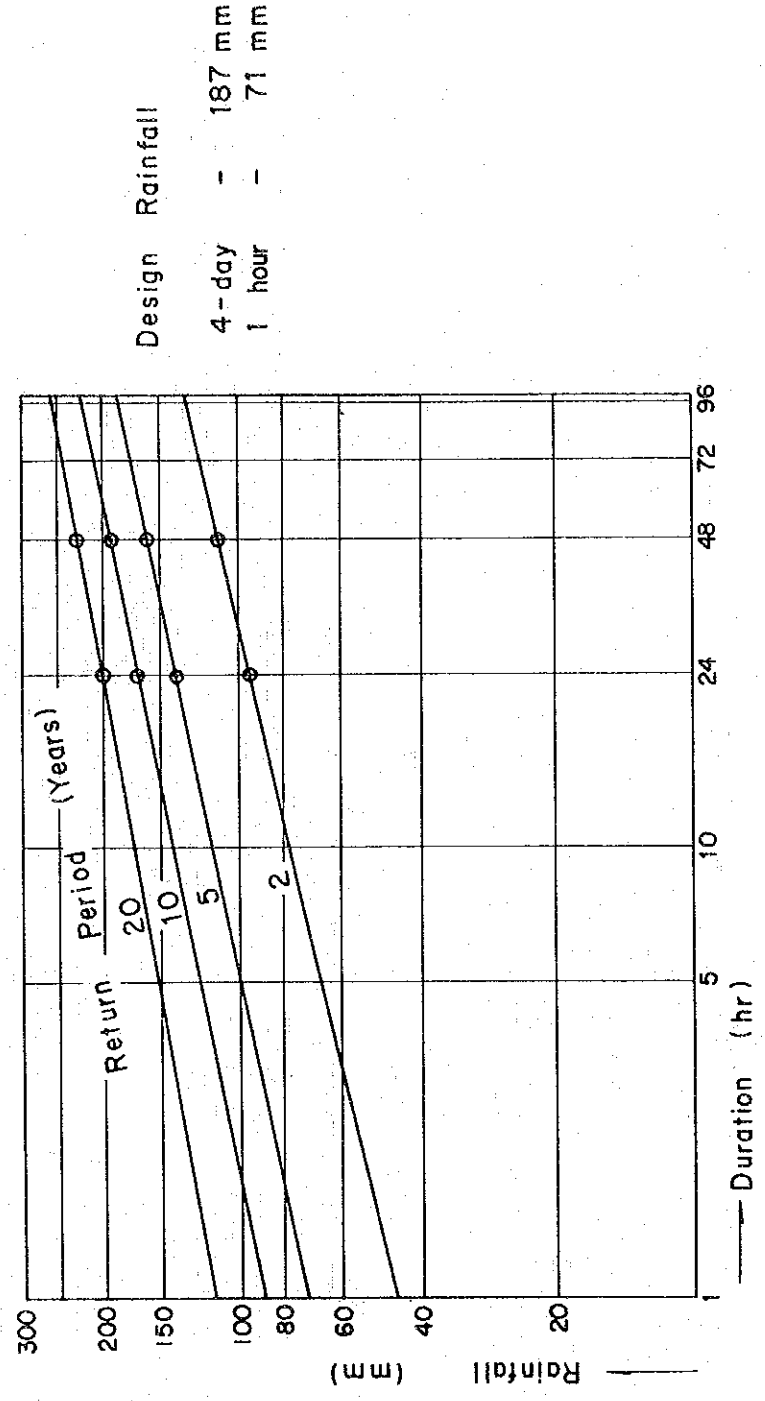


Fig. 2-3-9 Depth - Duration Frequency

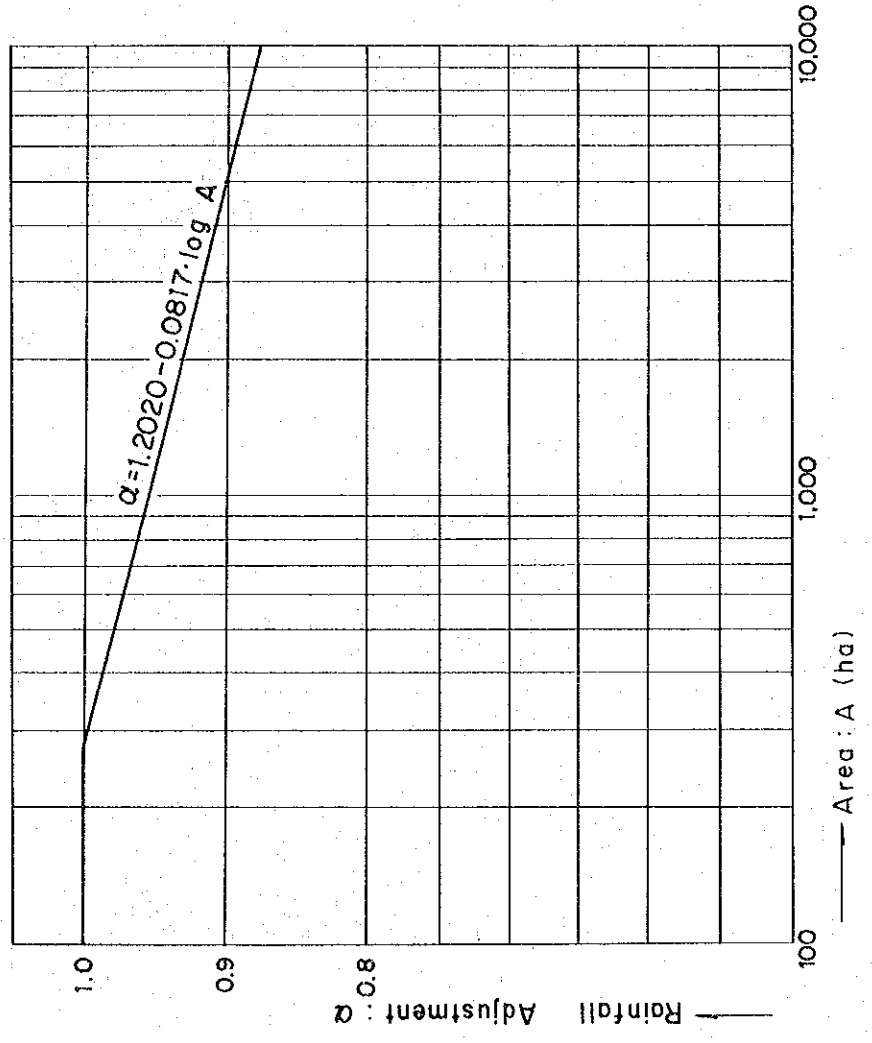


Fig. 2-3-10 Area - Depth Relation : α

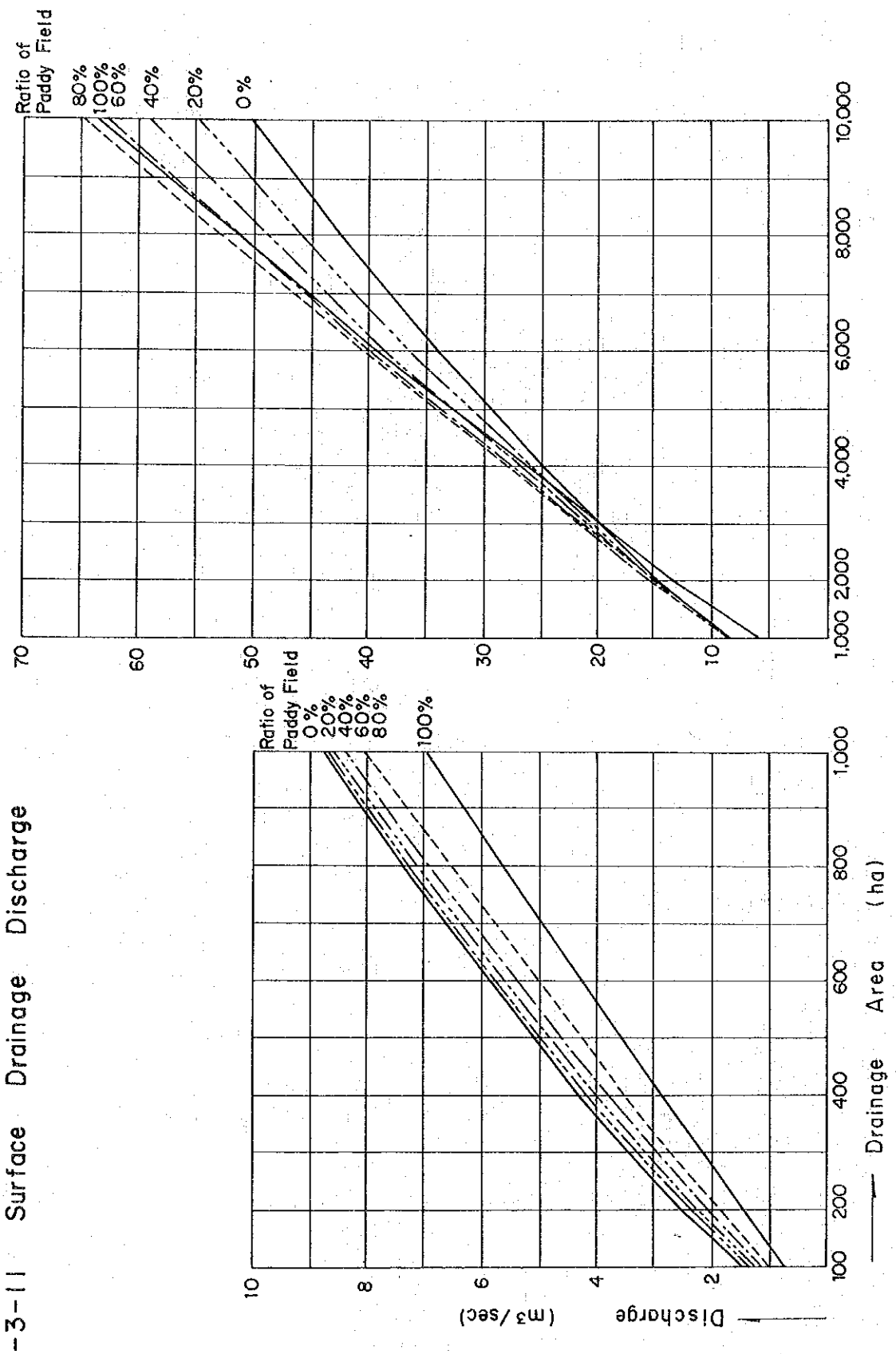


Fig. 2-3-11 Surface Drainage Discharge

Fig. 2-3-12 Plan of Drainage System

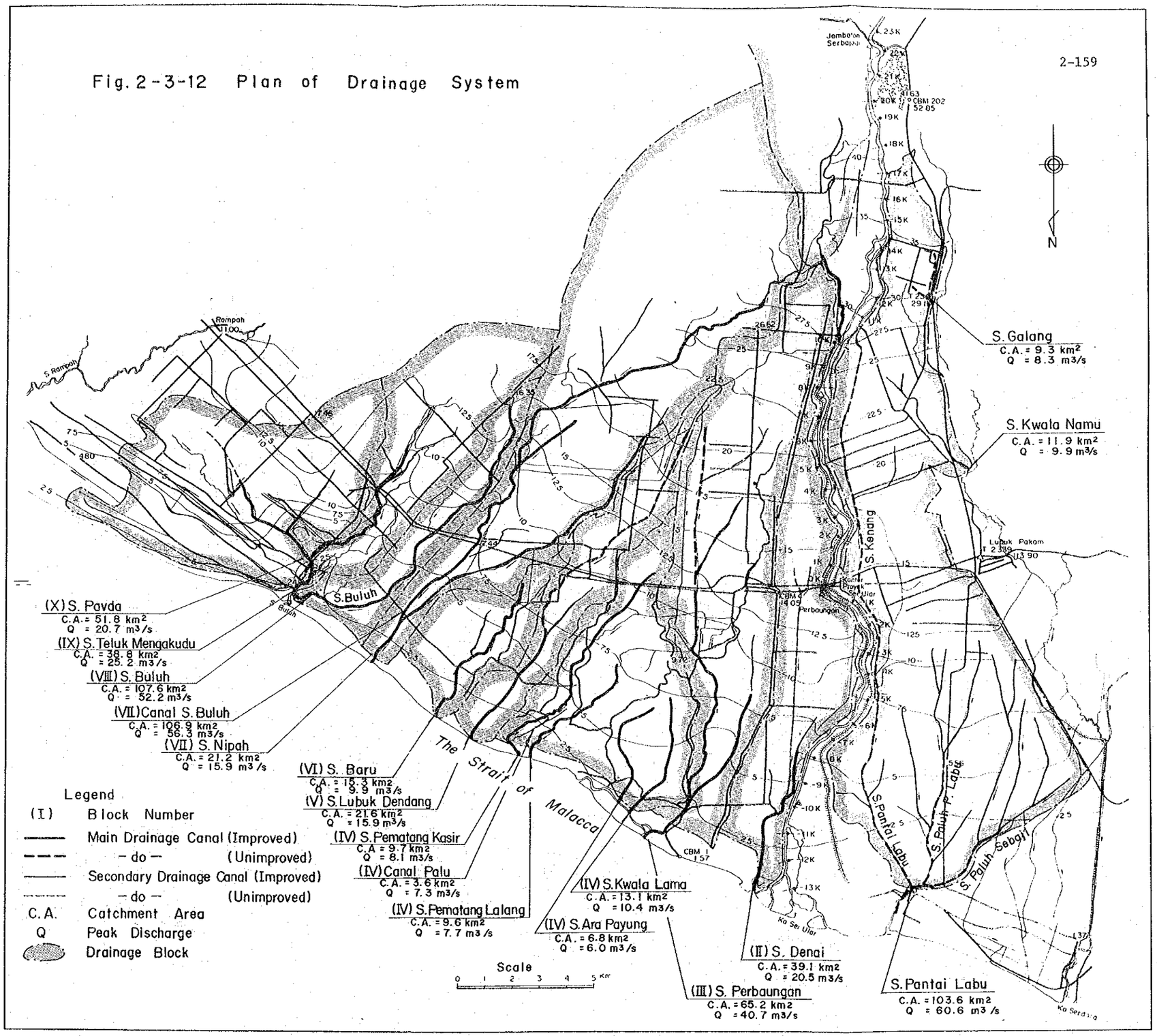


Fig. 2-3-13
Relation Between the Length of Settling Basin and Average Water Depth in the Basin

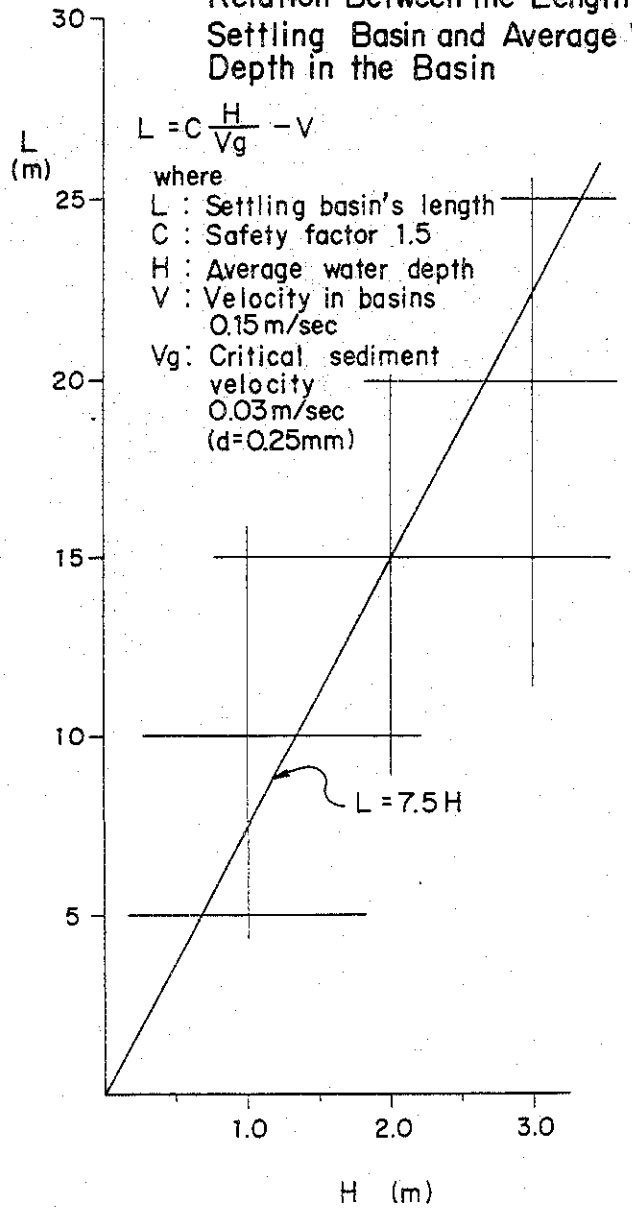
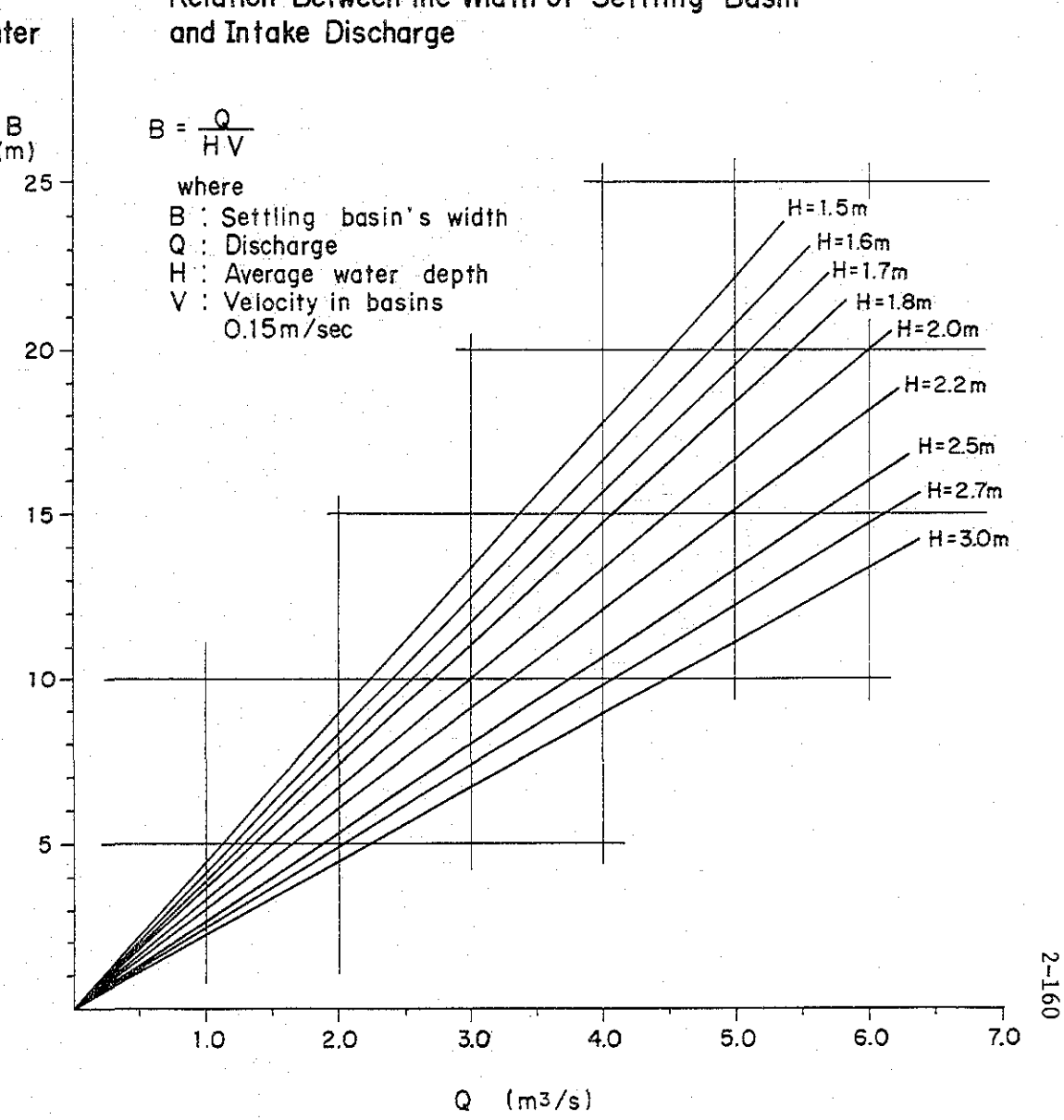


Fig. 2-3-14
Relation Between the Width of Settling Basin and Intake Discharge



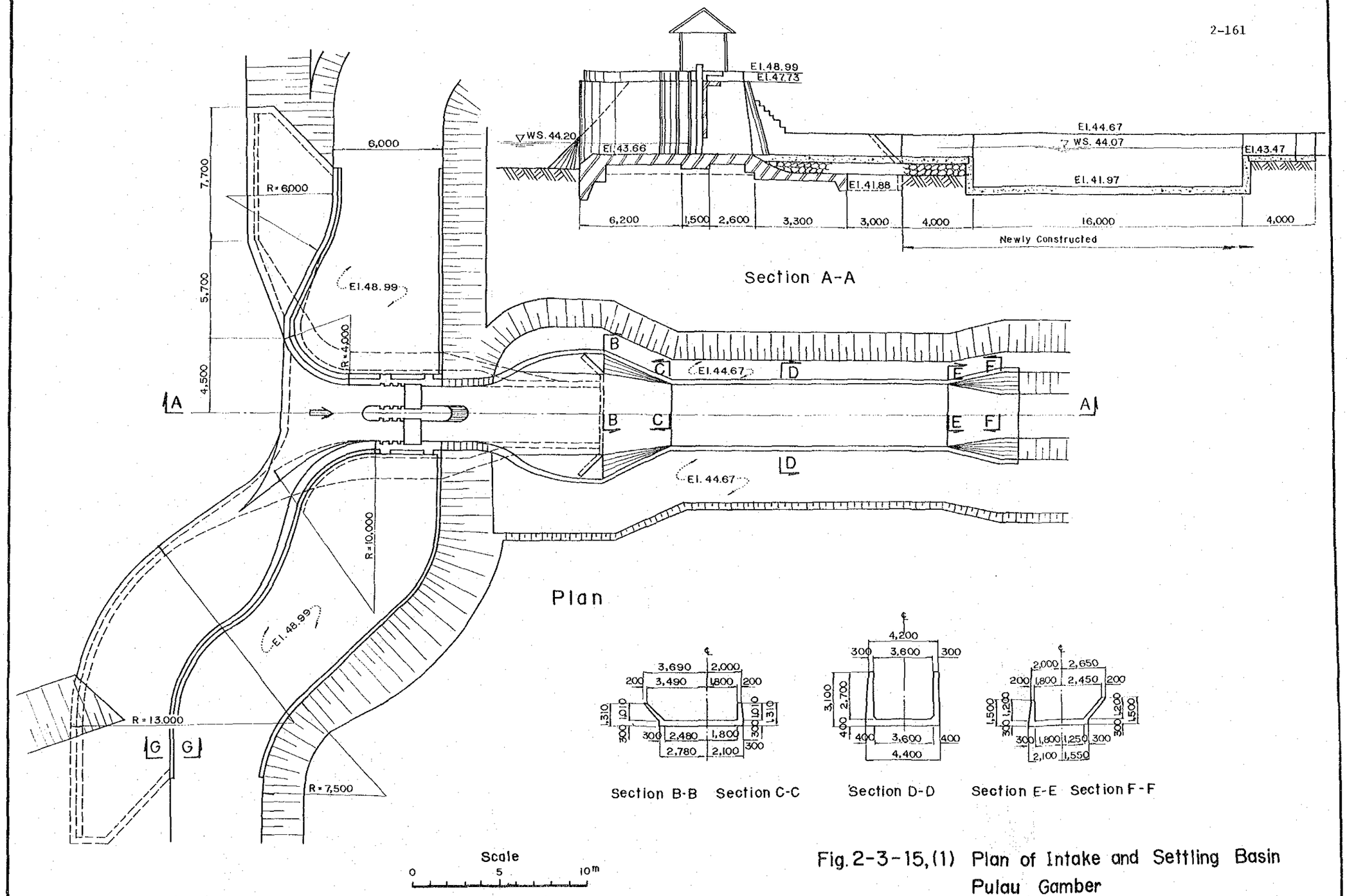
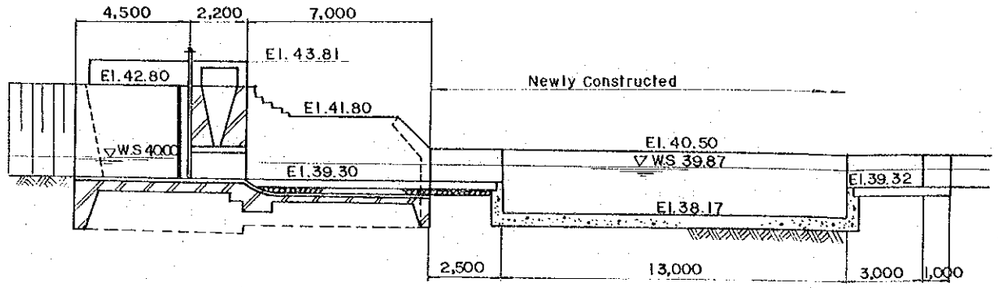
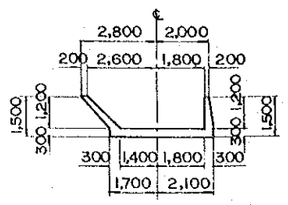


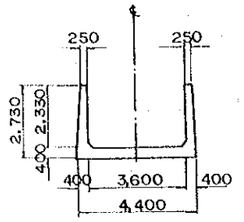
Fig. 2-3-15,(1) Plan of Intake and Settling Basin Pulau Gamber



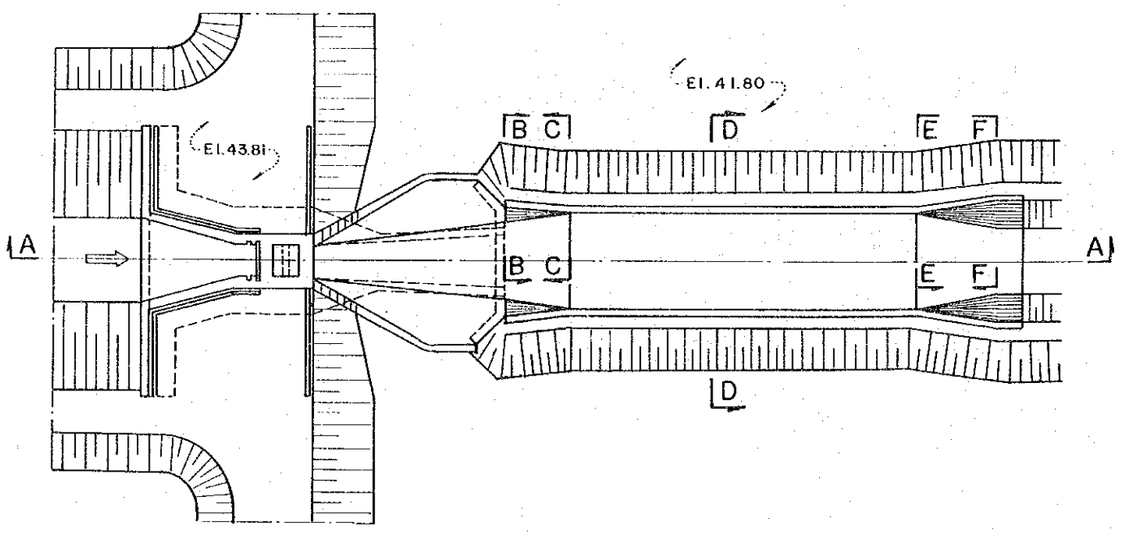
Section A-A



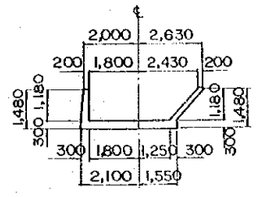
Section B-B Section C-C



Section D-D



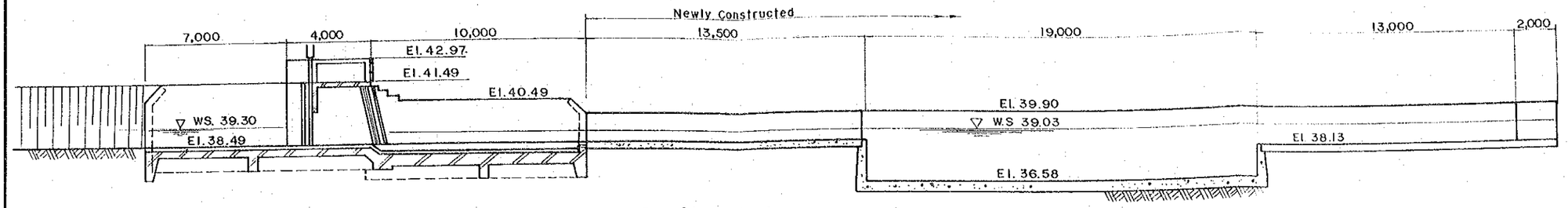
Plan



Section E-E Section F-F

Scale
0 5 10 m

Fig.2-3-15,(2) Plan of Intake and Settling Basin
Swadaya



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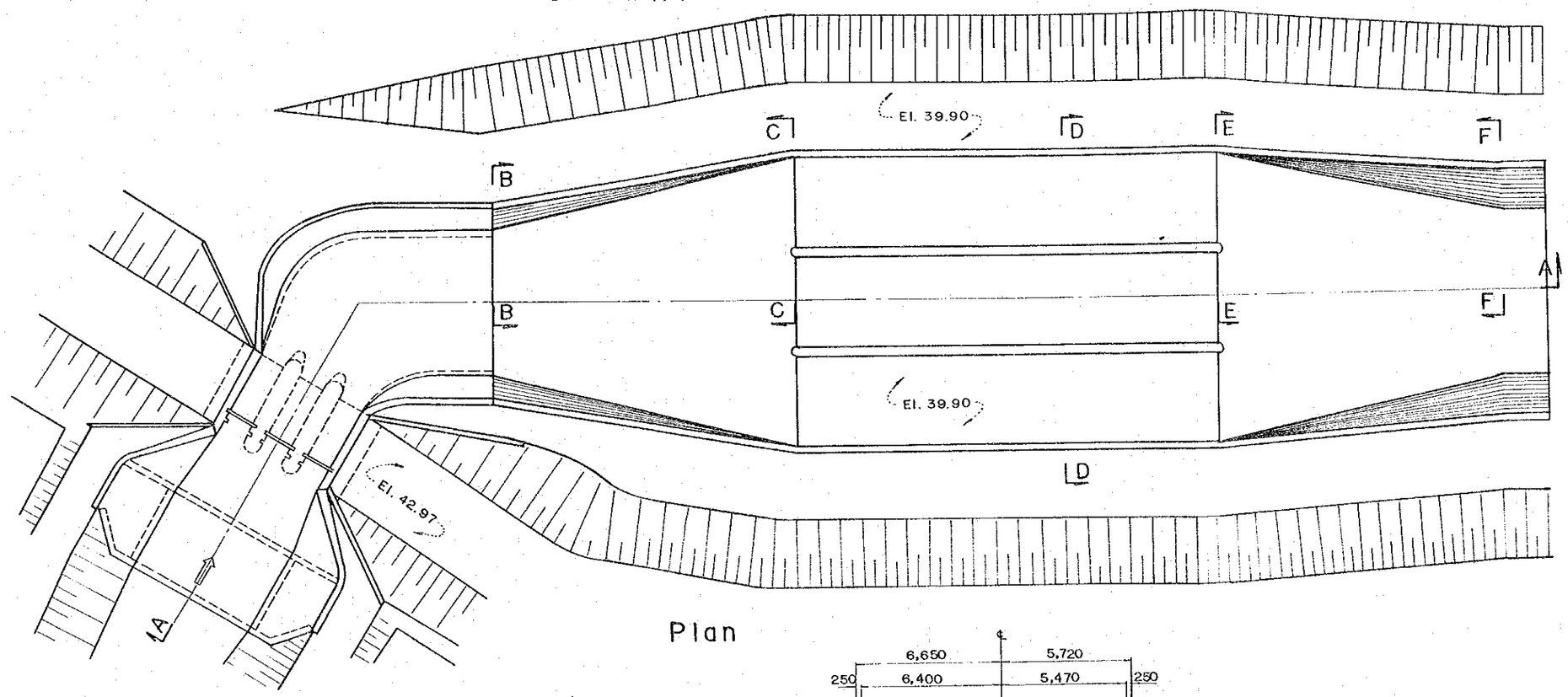
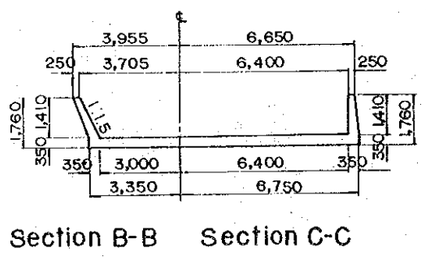
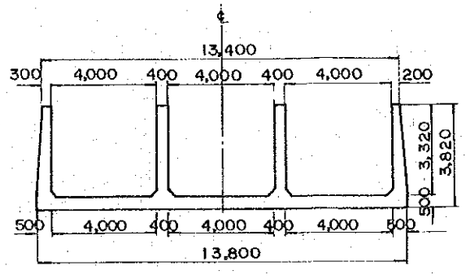


Plan



Section B-B Section C-C



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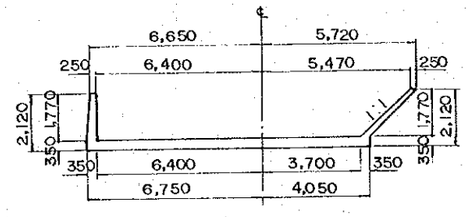
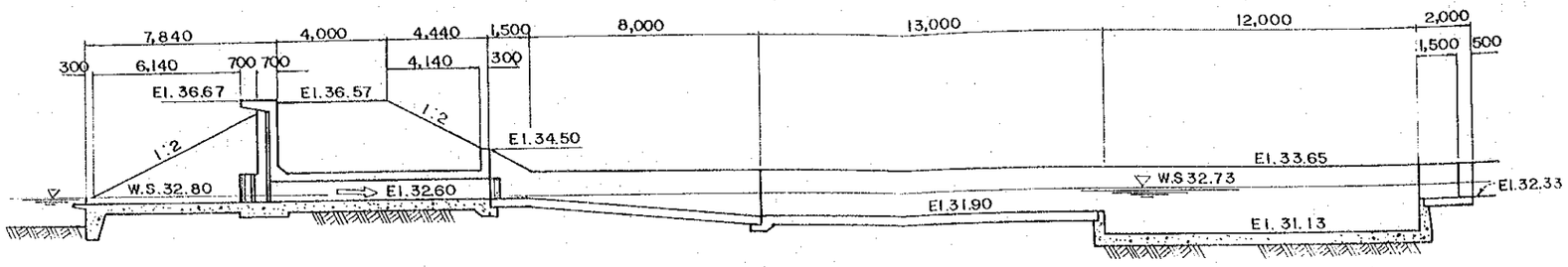


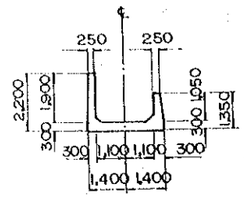
Section E-E Section F-F

Scale
0 5 10m

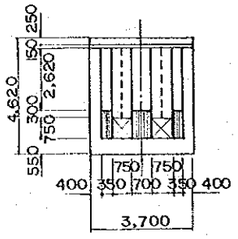
Fig.2-3-15, (3) Plan of Intake and Settling Basin Buluh



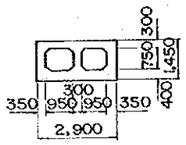
Section A-A



Section E-E Section F-F



Section C-C



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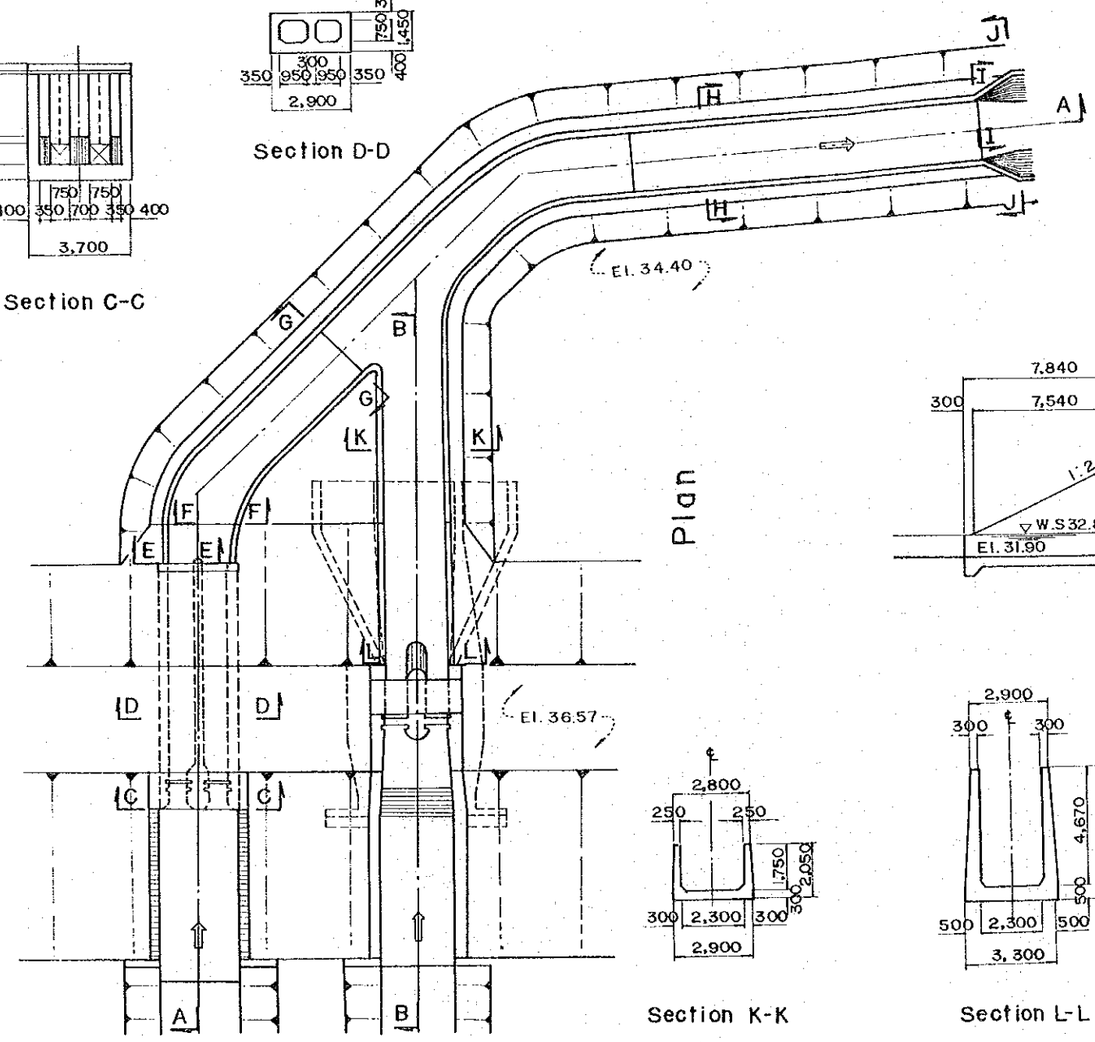
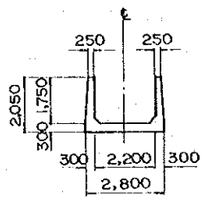


Plan



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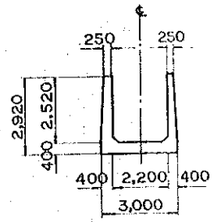

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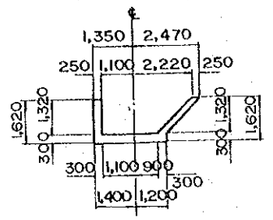
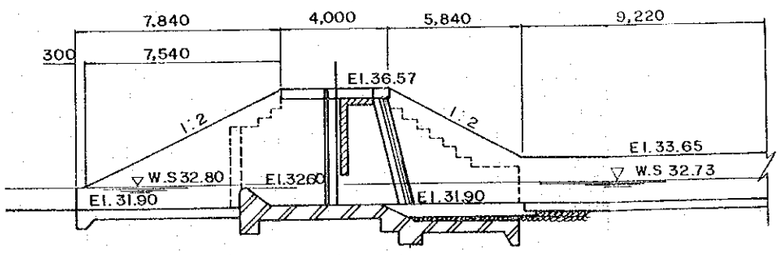
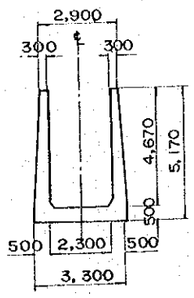


Section I-I Section J-J



Section B-B

Section K-K



Section L-L

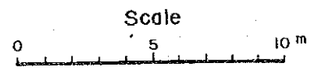
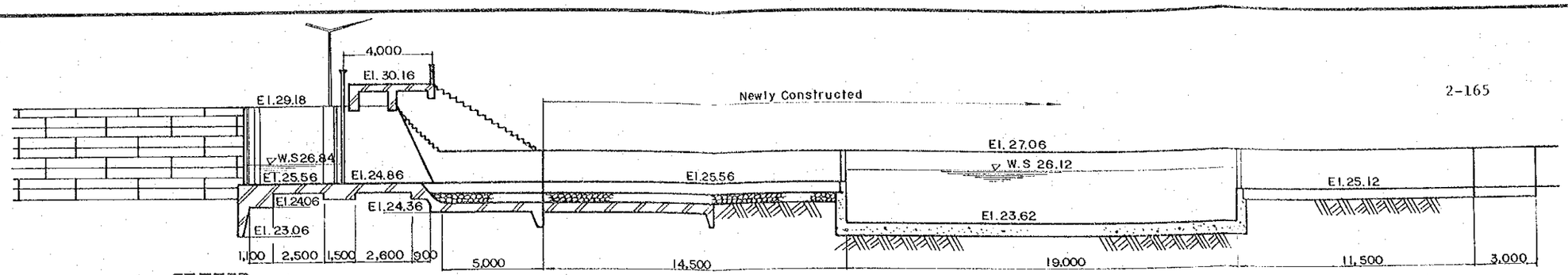
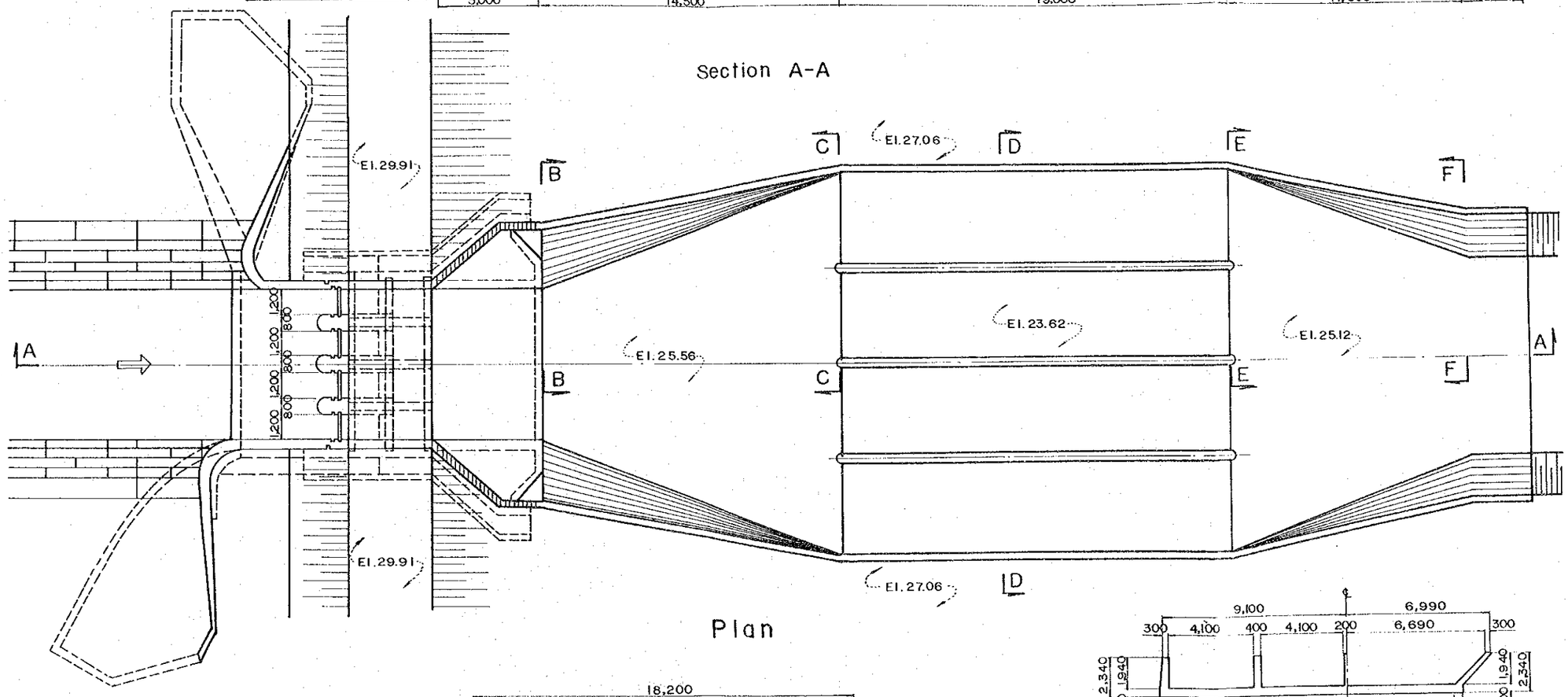


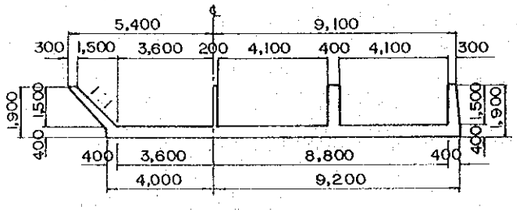
Fig. 2-3-15, (4)
Plan of Intake and Settling Basin
Timbang Deli



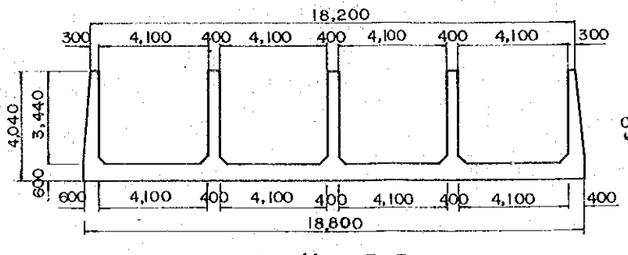
Section A-A



Plan



Section B-B Section C-C



Section D-D

Scale
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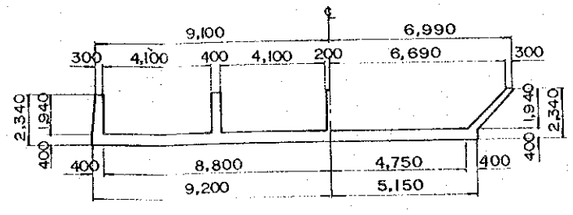
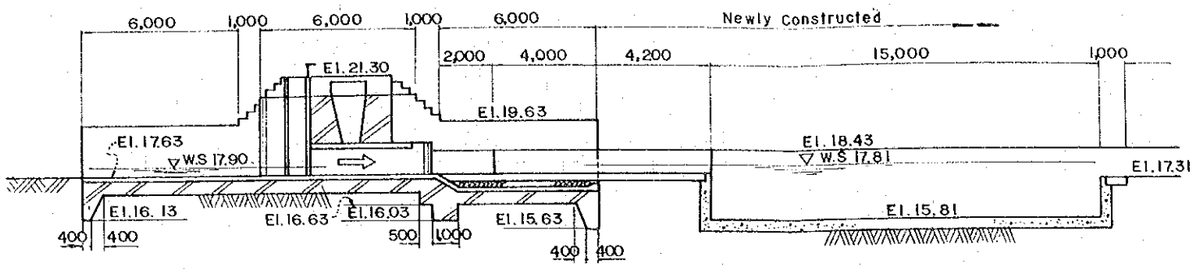
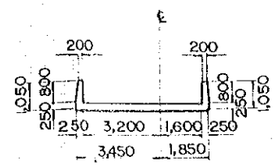


Section E-E Section F-F

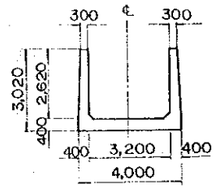
Fig. 2-3-15,(5) Plan of Intake and Settling Basin Perbaungan



Section A-A



Section B-B Section C-C



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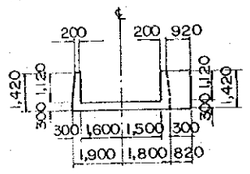
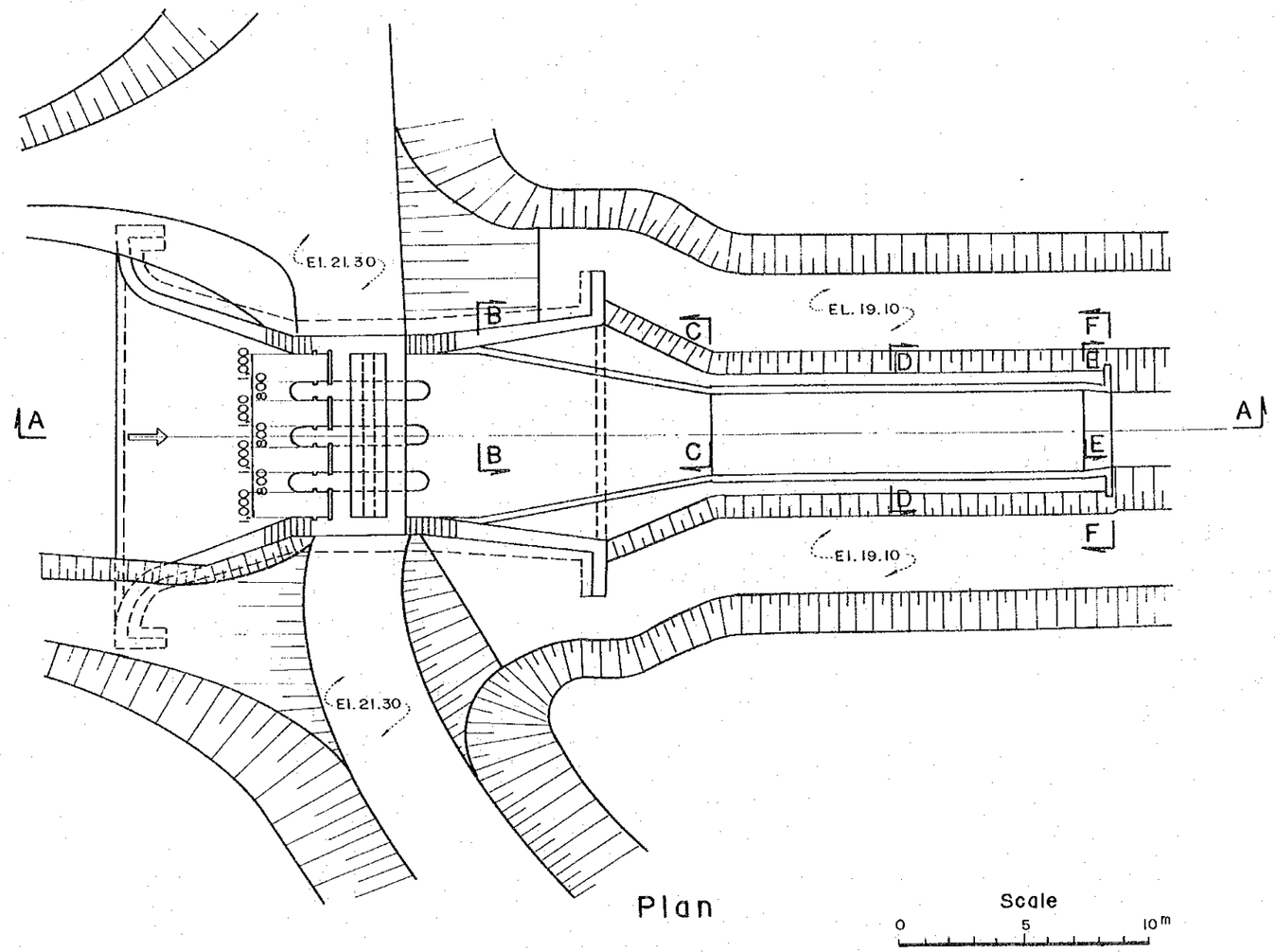


Section E-E Section F-F



Plan

Scale
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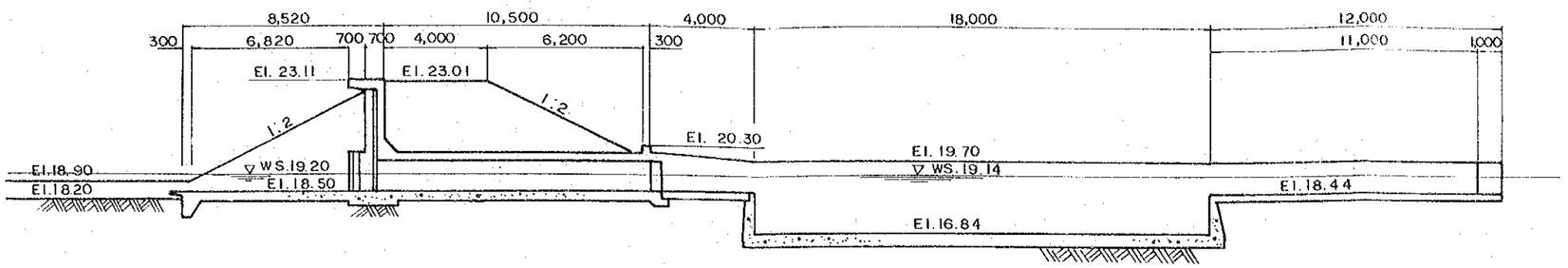
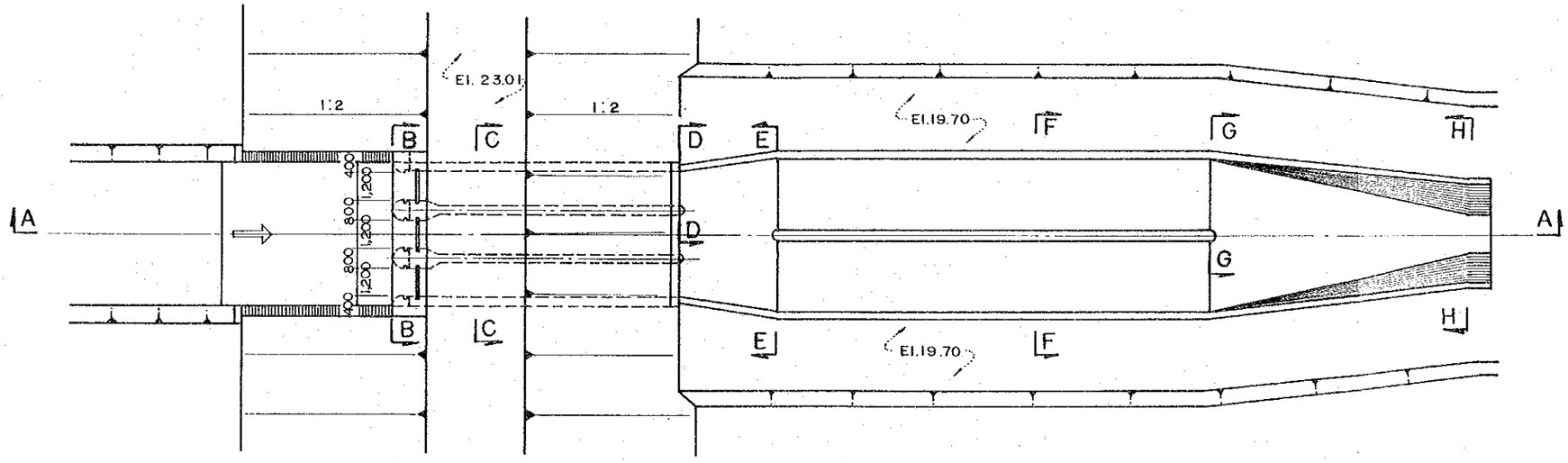
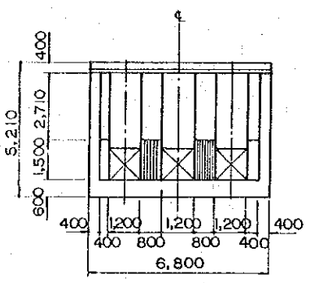
Fig. 2-3-15, (6)
Plan of Intake and Settling Basin
Sumber Rejo



Section A-A



Plan



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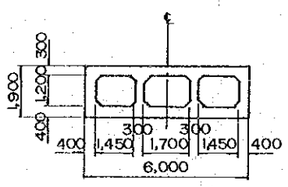

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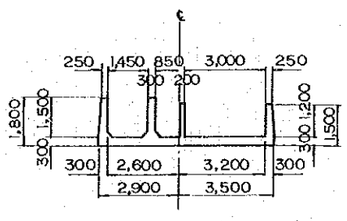
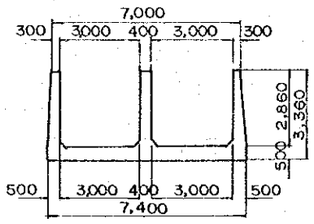


Section D-D Section E-E



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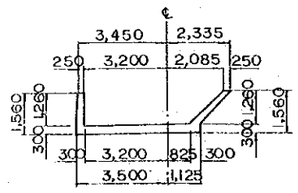

Section G-G Section H-H

Scale
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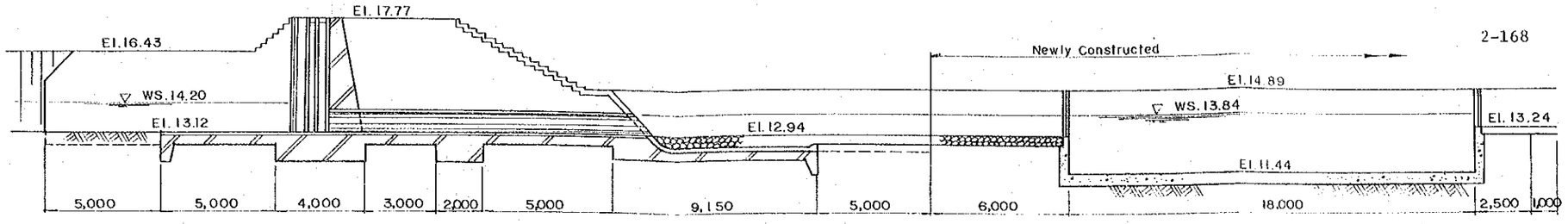
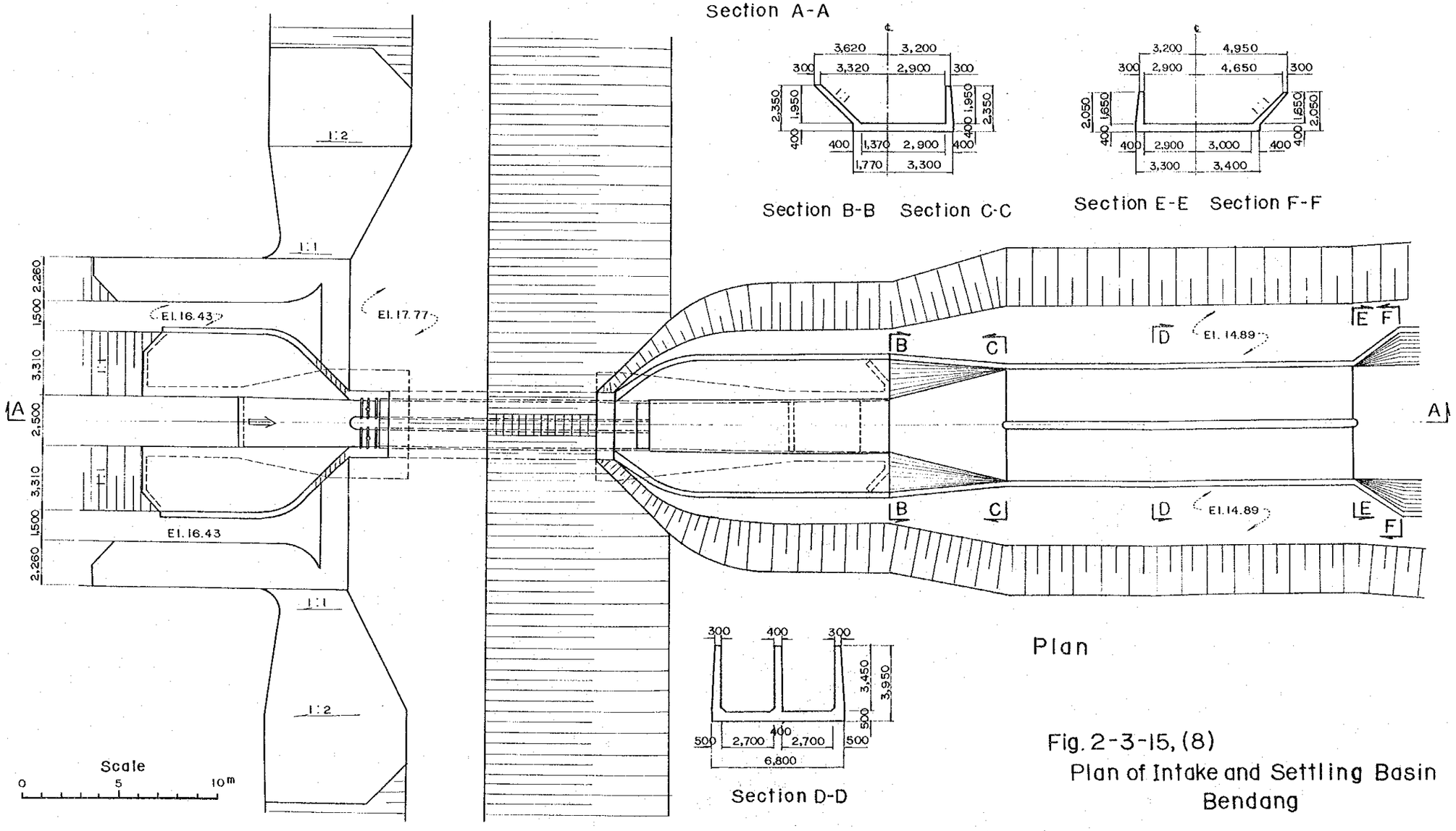
Fig.2-3-15,(7) Plan of Intake and Settling Basin
New Sumber Rejo



Section A-A

Section B-B Section C-C

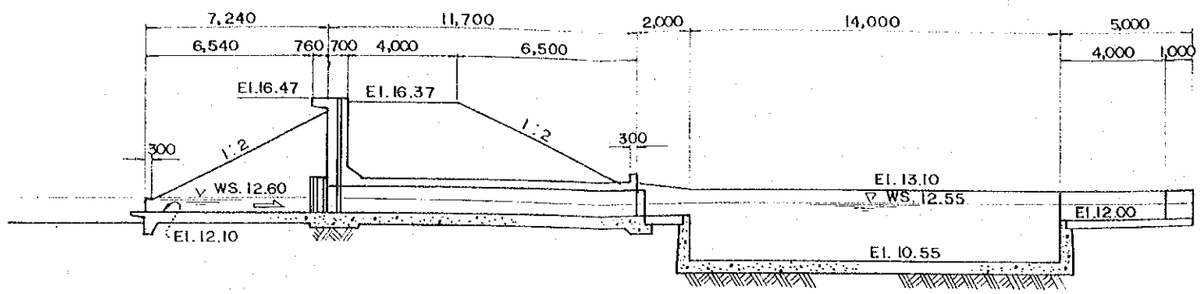
Section E-E Section F-F



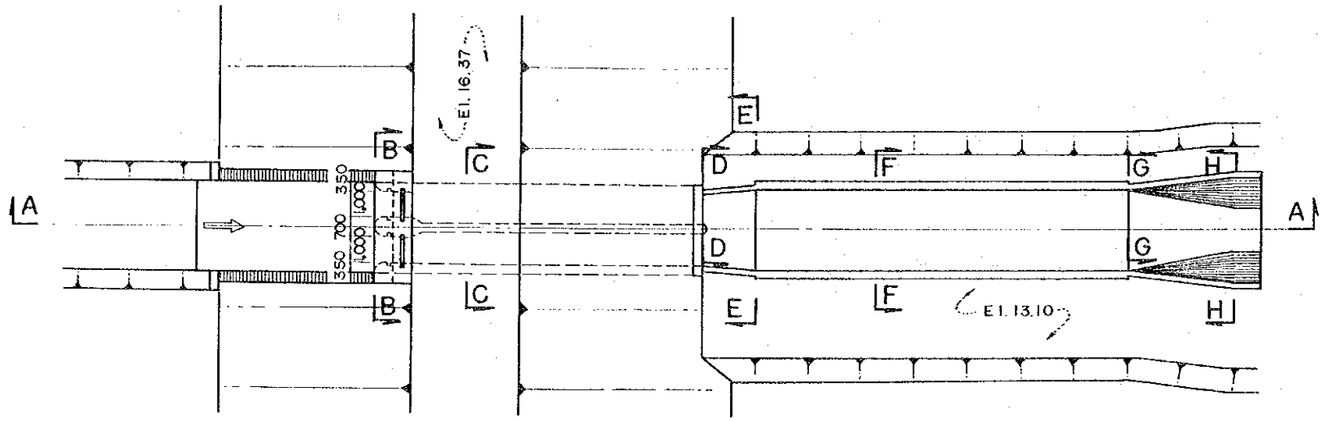
Plan

Section D-D

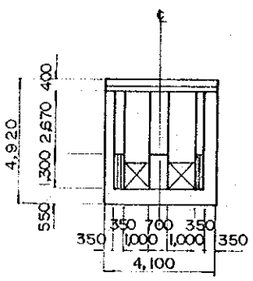
Fig. 2-3-15, (8)
Plan of Intake and Settling Basin
Bendang



Section A-A



Plan



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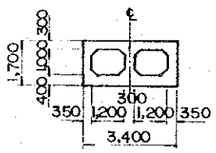

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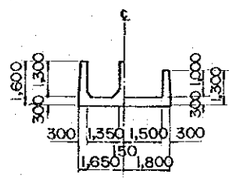
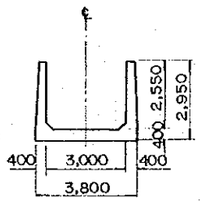


Section D-D Section E-E



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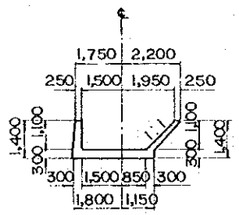
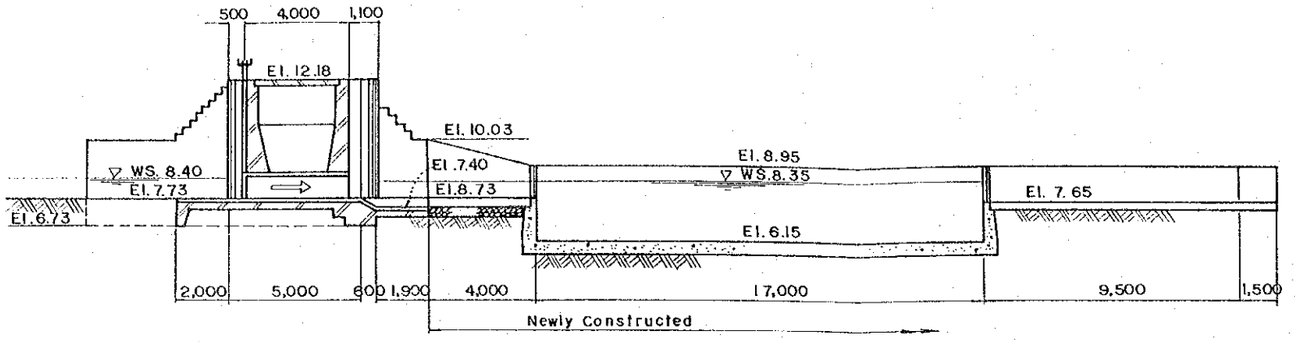


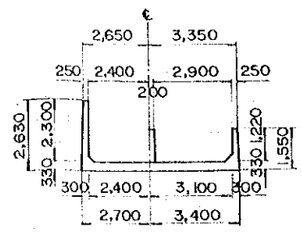
Section G-G Section H-H

Scale
0 5 10m

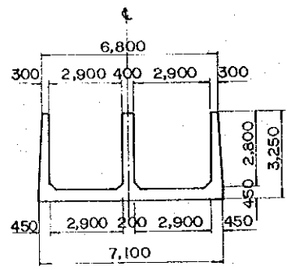
Fig.2-3-15,(9) Plan of Intake and Settling Basin
New Singosari



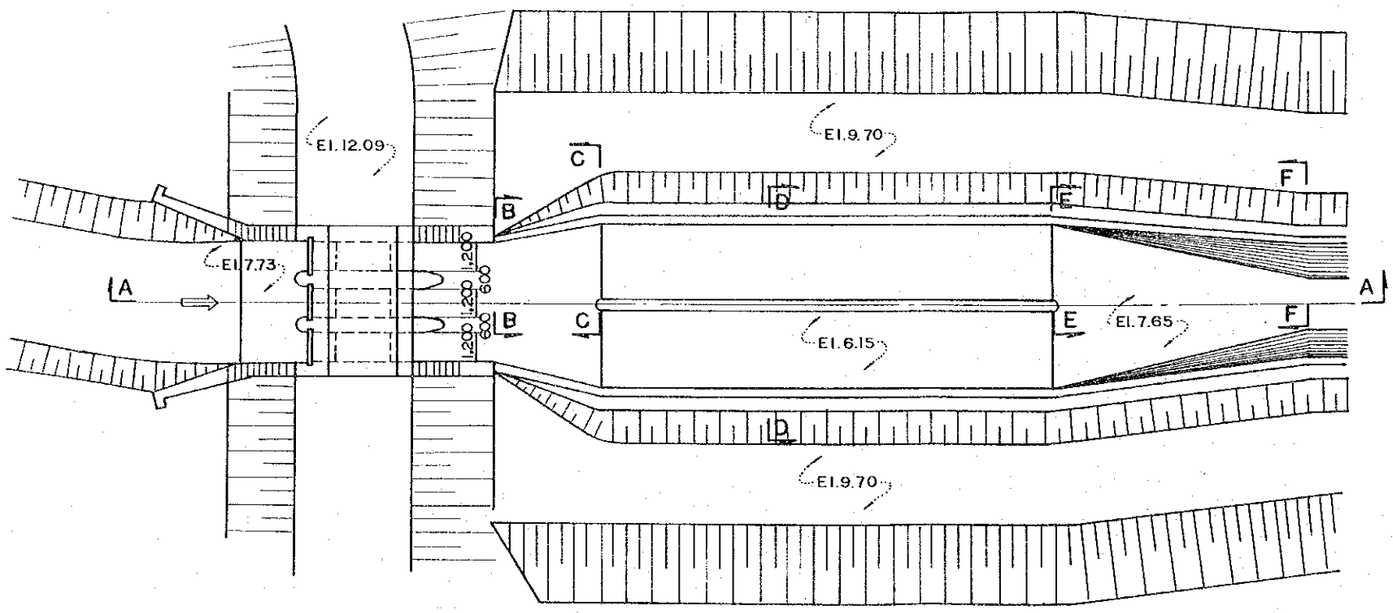
Section A-A



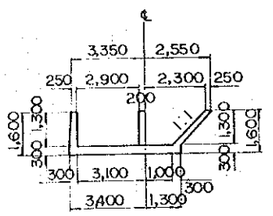
Section B-B Section C-C



Section D-D



Plan



Section E-E Section F-F

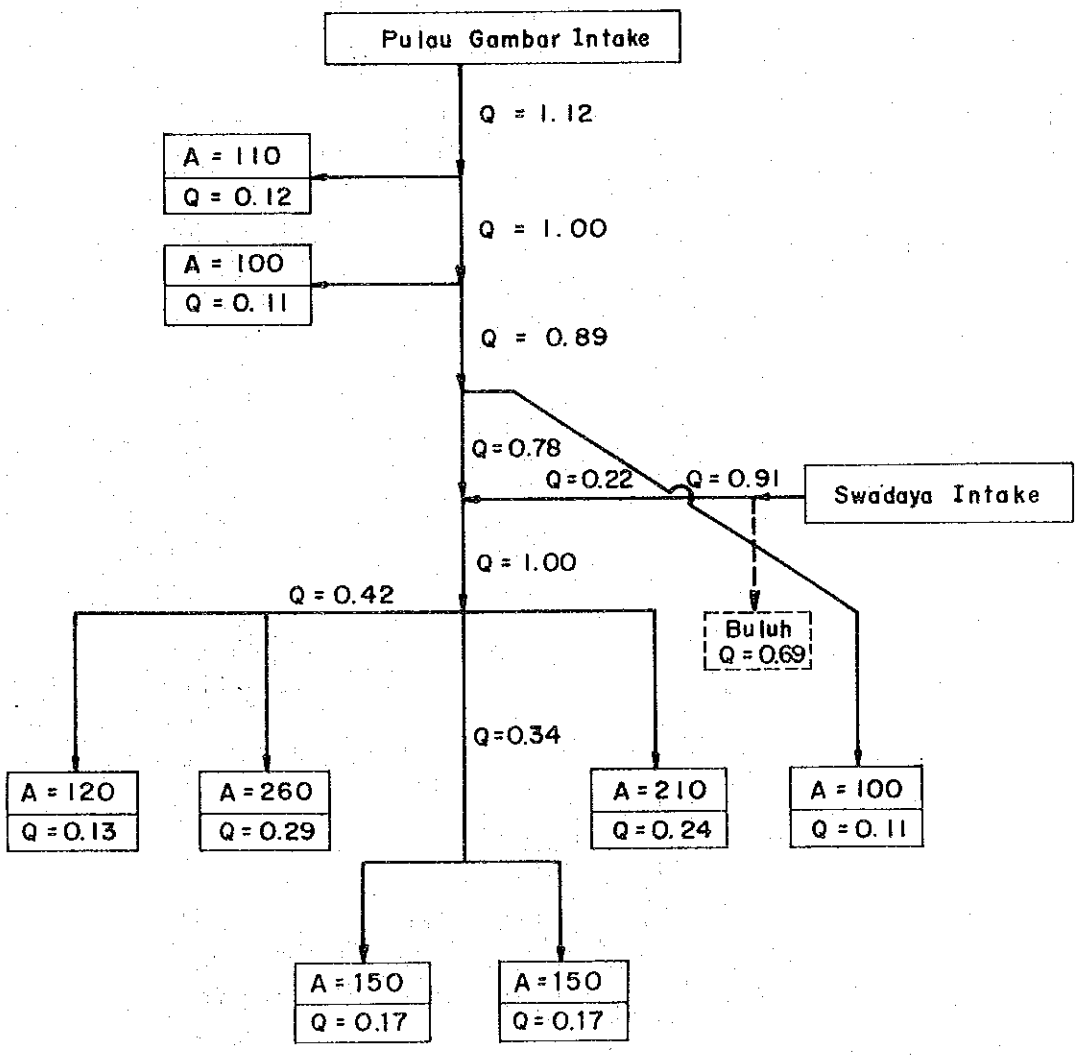
Scale
0 5 10 m

Fig.2-3-15,(10) Plan of Intake and Settling Basin
Ramonia

Fig. 2-3-16 (1) Canal Network and Discharge Assignment.

Pulau Gambar

A = 1,200 ha Qmax = 1.34 m3/s



Note :

A : Irrigation area (ha)

Q : Canal discharge (m3/s)

Fig. 2-3-16,(2) Canal Network and Discharge Assignment.

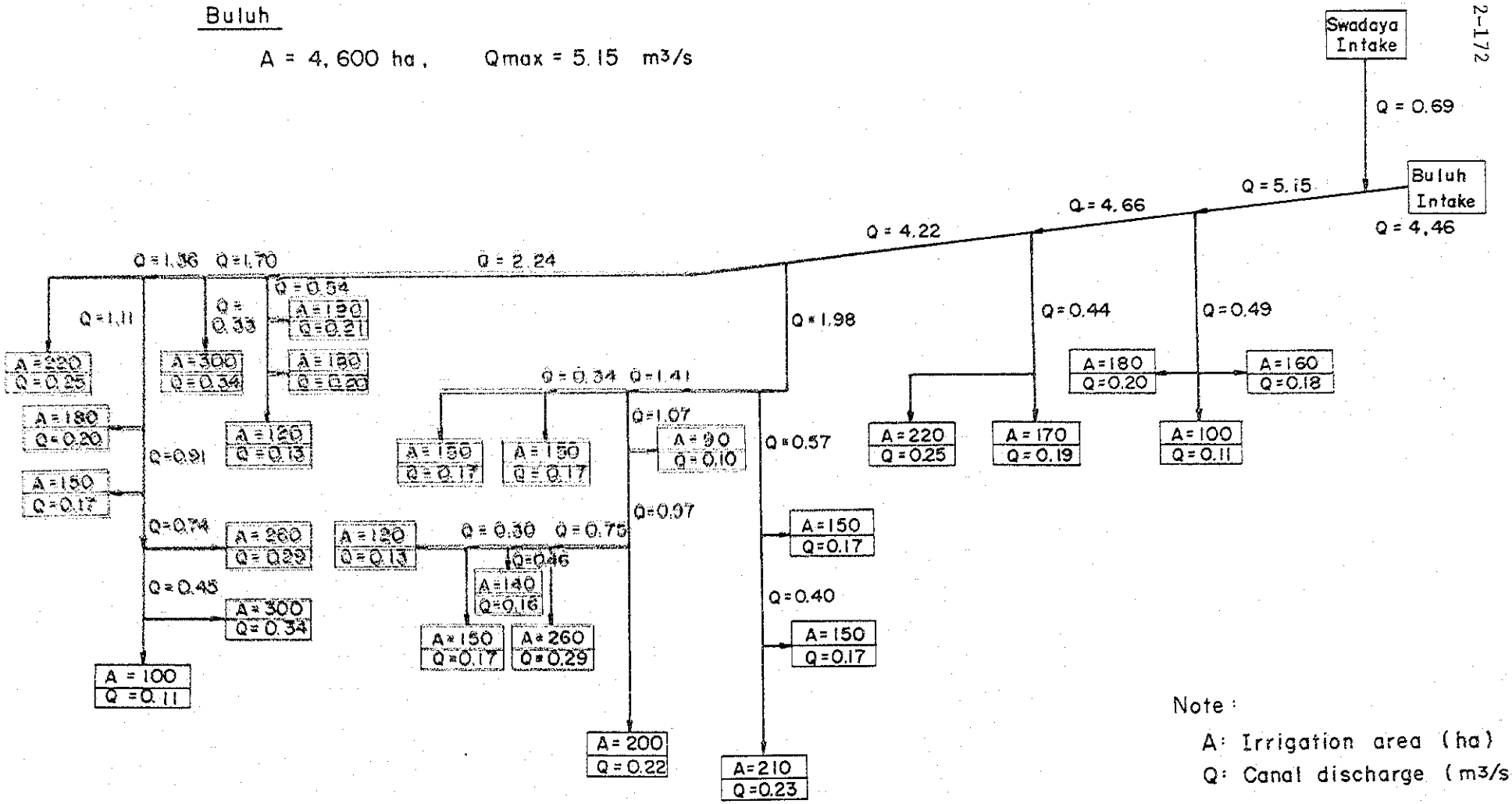
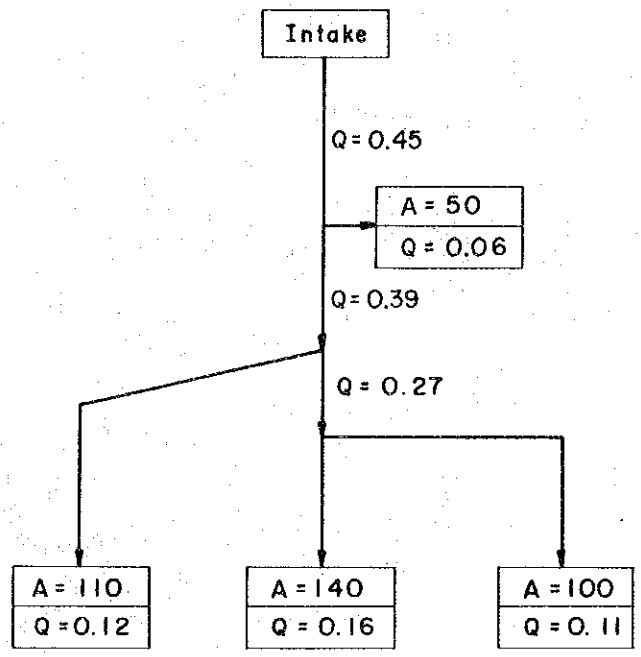


Fig. 2-3-16,(3) Canal Network and Discharge Assignment.

Timbang Deli

A = 400 ha Qmax = 0.45 m^3/s



Note :

A: Irrigation area (ha)

Q: Canal discharge (m3/s)

Fig. 2-3-16,(4) Canal Network and Discharge Assignment

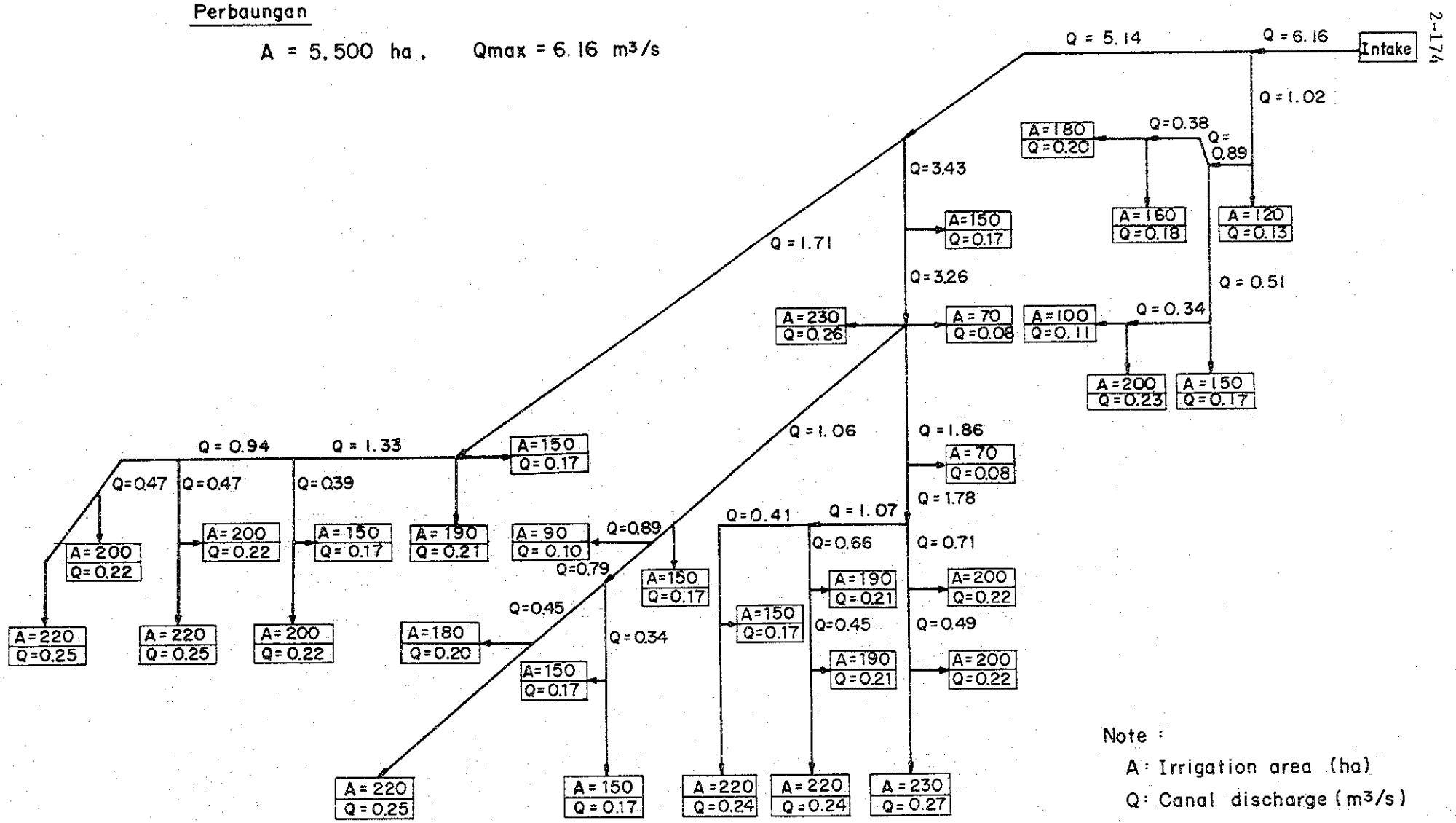
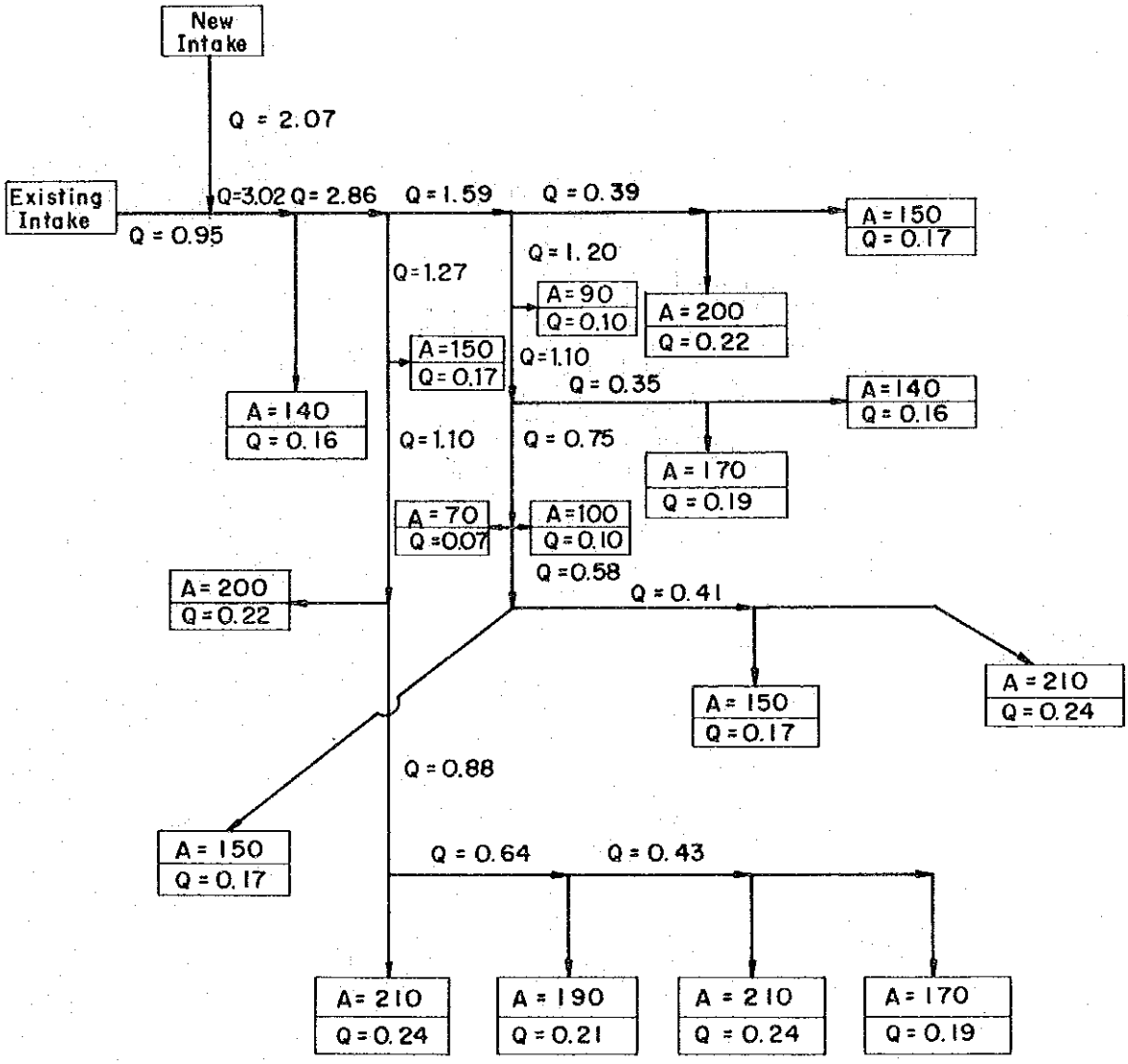


Fig. 2-3-16,(5) Canal Network and Discharge Assignment.

Sumber Rejo

A = 2,700 ha Q max = 3.02 m³/s



Note :

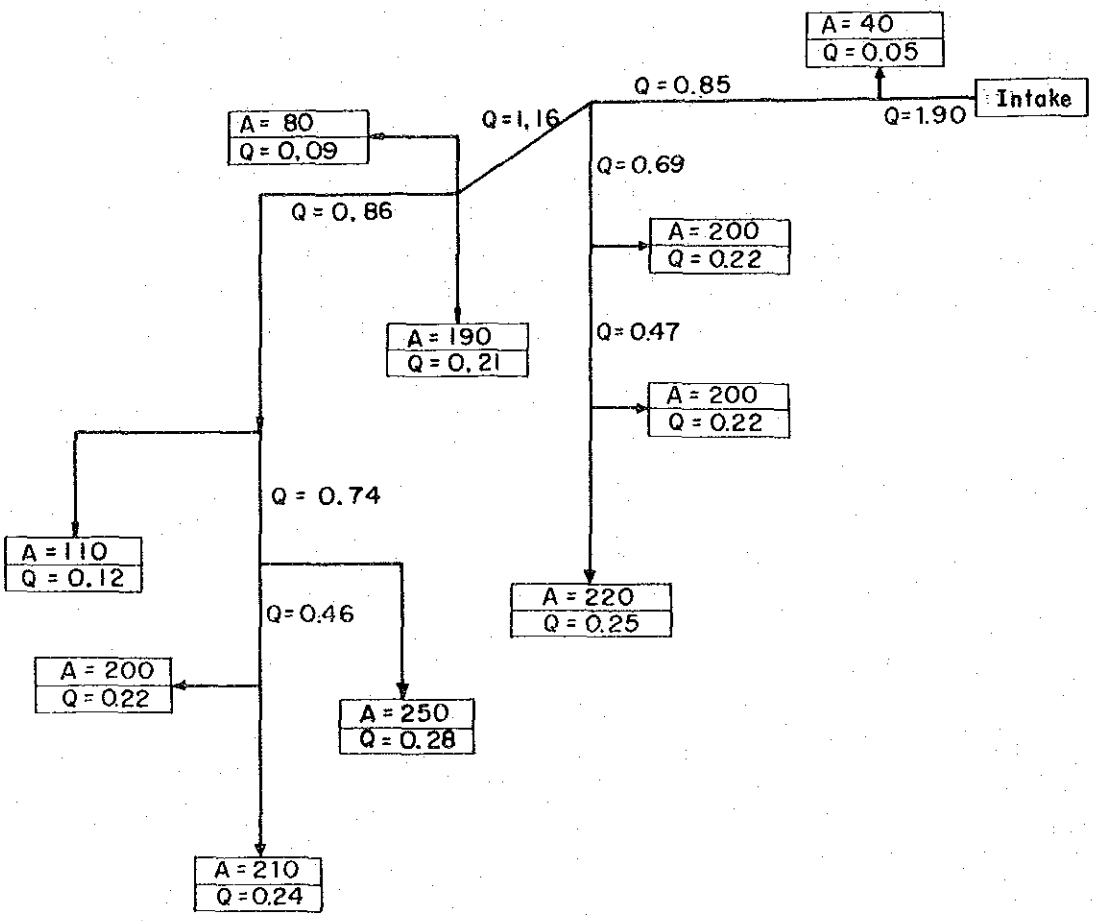
A: Irrigation area (ha)

Q: Canal discharge (m³/s)

Fig. 2-3-16,(6) Canal Network and Discharge Assignment.

Bendang

A = 1, 700 ha, Qmax = 1.90 m³/s



Note :

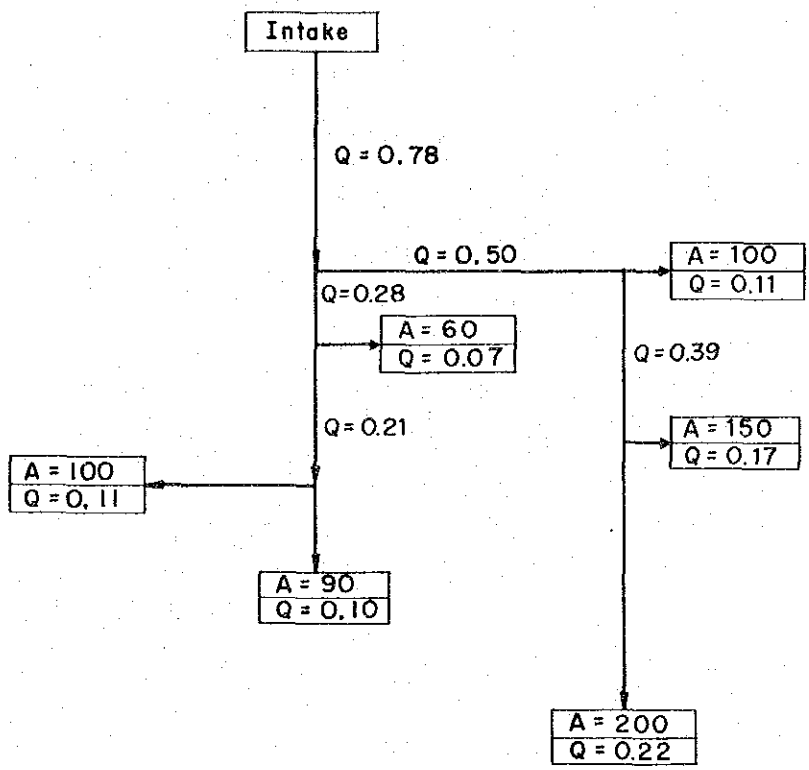
A : Irrigation area (ha)

Q : Canal discharge (m³/s)

Fig. 2-3-16,(7) Canal Network and Discharge Assignment.

Singosari

A = 700 ha, Qmax = 0.78 m^3/s



Note:

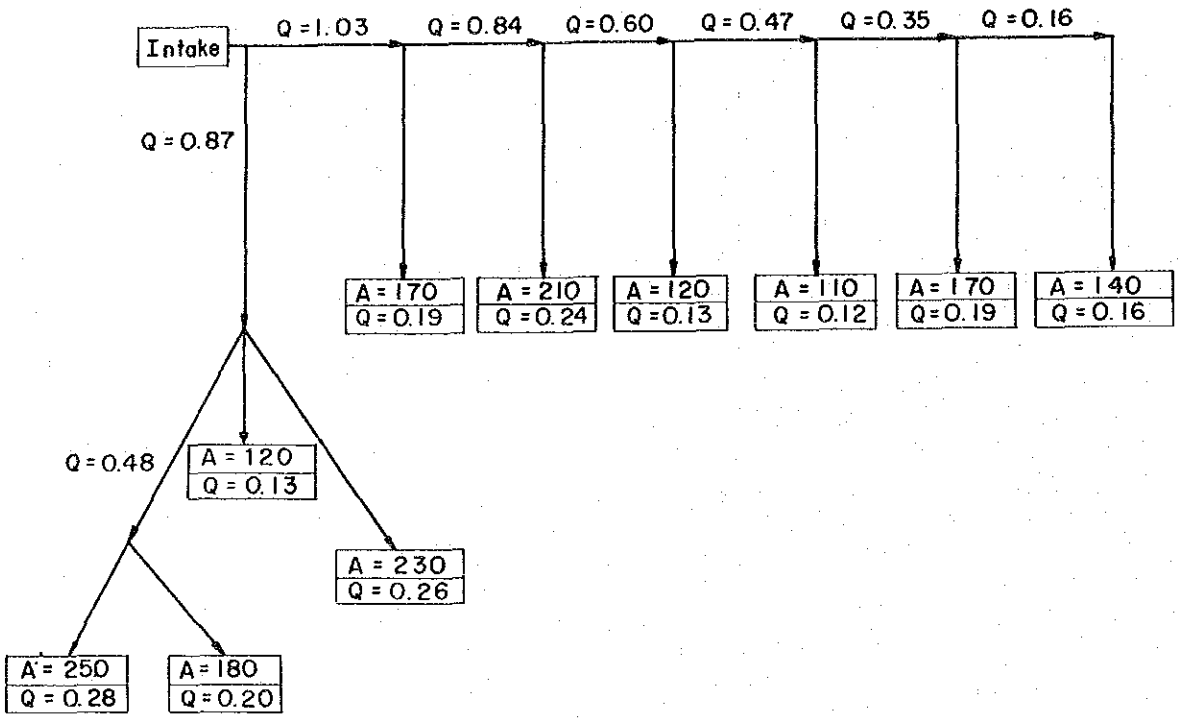
A: Irrigation area (ha)

Q: Canal discharge (m^3/s)

Fig. 2-3-16,(8) Canal Network and Discharge Assignment.

Ramonia

A = 1, 700 ha Qmax = 1.90 m³/s



Note :

A : Irrigation area (ha)

Q : Canal discharge (m³/s)

Fig. 2-3-17 Standard Cross-Section of Irrigation Canal

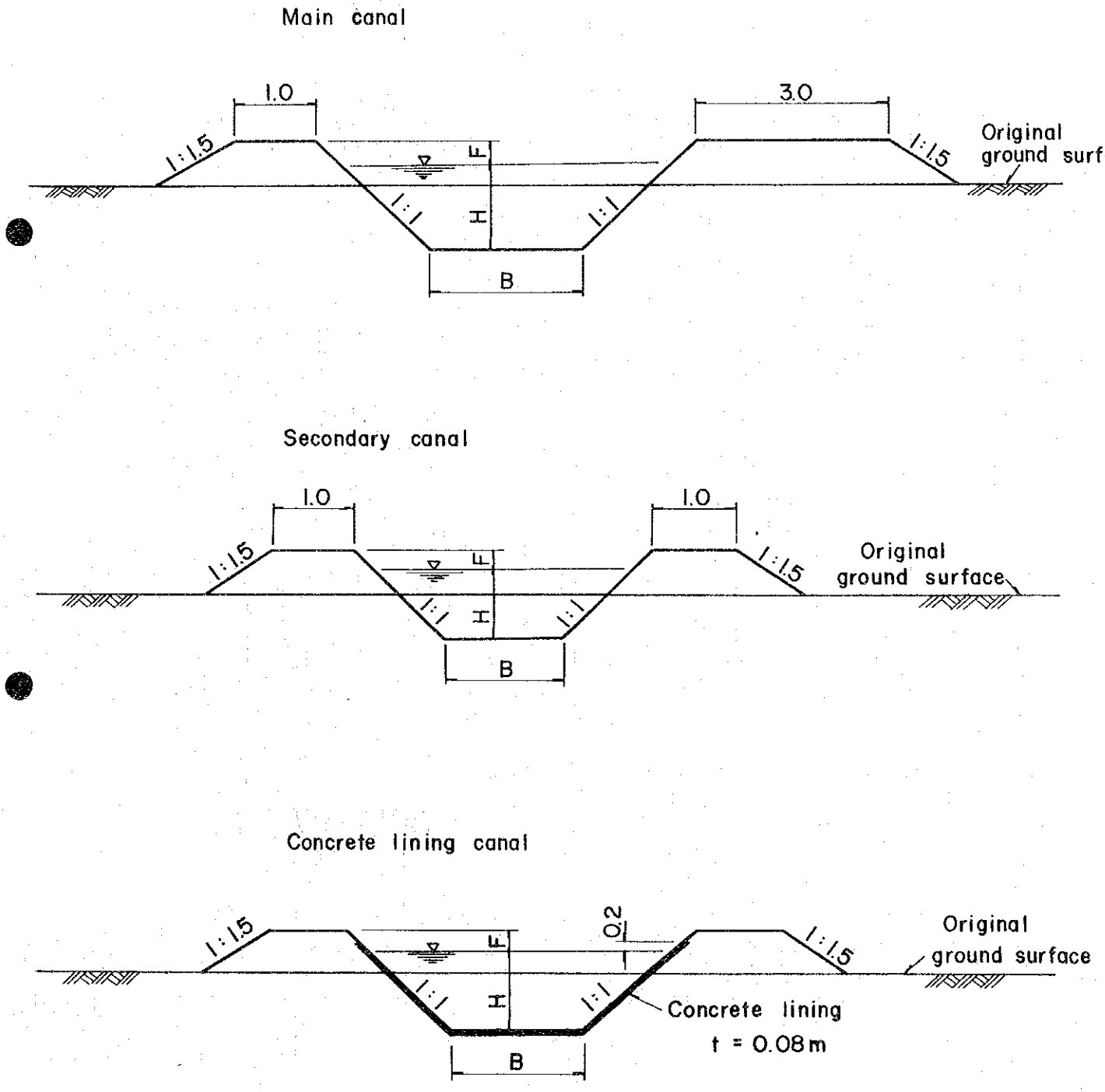
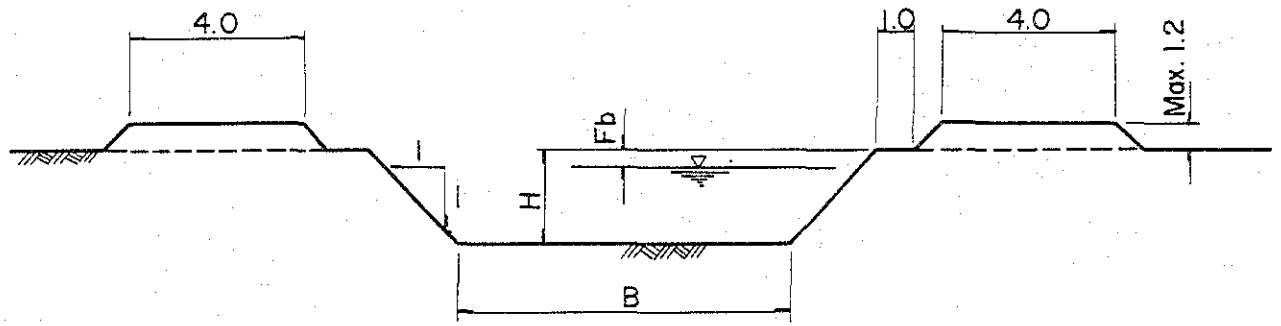
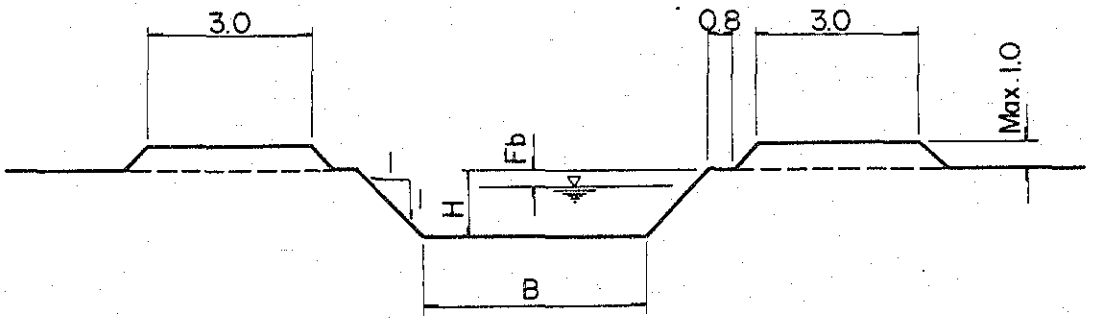


Fig. 2 - 3 -18 Standard Cross-Section of Drainage Canal



Main canal



Secondary canal

in meter

TYPE	B	H
I	2.0	2.0
II	3.0	1.2 - 2.5
III	5.0	1.2 - 2.5
IV	7.0	1.2 - 2.7
V	10.0	1.3 - 3.0
VI	15.0	1.4 - 3.0
VII	20.0	1.5 - 3.0
VIII	25.0	1.7 - 2.5
IX	30.0	1.7 - 2.5
X	35.0	1.8 - 2.5
XI	40.0	1.8 - 2.0
XII	50.0	1.8 - 2.2

CHAPTER III

CONSTRUCTION PLAN

3.1. Basic Line of Construction Plan.

3.1.1. Execution System and Period of Construction Works.

In the present study, two alternative plans were studied for executing the construction works. One is a plan that the Government procures the required equipment other than the existing ones avilable for this project and lends all of them to contractors, and the contractors carry out the works by use of them. The other one is a plan that the Government lends to contractors some existing equipment available for this project and the contractors carry out the works by use of the borrowed equipment and other major equipment procured by themselves. For the sake of simplicity, we call the former "equipment-lending system" and the latter "full-contracting system". These two systems were studied and compared.

As for the period of construction, two plans were taken into consideration; one is a 7-year plan that consists of five years for execution of main civil works and more than one year for preparation prior to the execution of works, and the other one is a 5-year plan that consists of three years for execution of works and more than one year for preparation.

3.1.2. Workable Days and Working Hours.

It was assumed that the construction works would be commenced at the beginning of April in 1980, continued without suspension even in the rainy season, completed by the end of March in 1983 in the case of the 5-year plan.

Workable days within a year for executing earth work were, taking account of the fact that earth work is affected by rainfall, assumed based on the rainfall records obtained at the Sungai Putih and Kwala Namu stations. In this case, those days which had rainfall of more than 10 mm/day were regarded as waiting days for earth work. Workable days are shown by month in the following table.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Waiting days	5	7	6	5	7	9	7	9	16	16	12	7	106
Sundays and holidays	6	5	6	5	5	5	4	5	6	4	6	6	63
Total non-workable days	11	12	12	10	12	14	11	14	22	20	18	13	169
Workable days	20	16	19	20	19	16	20	17	8	11	12	18	196

Working hours were assumed as follows.

a. Two 8-hour shifts per day will be adopted for civil works, and net operation hour of equipment for the civil works will be 10 hours in a day except excavation and dredging works in the low-water channel.

b. Two 8-hour shifts per day will be adopted for excavation works in the low-water channel and net operation hour of equipment for the works will be 14 hours in a day.

c. Two 8-hour shifts per day will be adopted for dredging works in the low-water channel. Net operation hour of equipment for dredging works will be 12 hours of equipment for dredging works will be 12 hours in a day in the case of 7-year construction plan and 15 hours in a day in the case of 5-year construction plan.

3.1.3. Existing Equipment Available.

It was confirmed that the existing equipment available for this project are those shown in Table 3-1-1, by checking the year of purchase and the operation hours in the past of the existing equipment procured on the occasion of the Urgent Flood Control Porject and by examining their life times and operation hours to be considered until March 1980.

3.2. Preparatory Works.

3.2.1. Transportation Road and Access Roads.

The existing asphalt-paved road with a width of about 6 m which starts from Belawan, runs through the city of Medan and the town of Lubuk Pakam and across the project area will serve for transportation. This is a trunk road for the project. The existing non-paved road except some parts such as Pulau Gambar area and upper reaches from No.19 km is also available to this project as an access road to the work area branching from the trunk road. It is required, however, that small bridges built on these existing roads are improved so as to enable the transportation and some new access roads are built to secure the transportation of equipment and regular traffic.

3.2.2. Offices and Quarters.

The existing offices located in Medan and the project site should be provided for designing and supervision of construction works. Temporary branch offices are required to be set at several places for supervision of the works. The yard of the existing site office is required to be extended for storing and handling the equipment to be newly procured in the case of the execution

of works by equipment-lending system. Construction quarters for supervision personnel are required to be built in the yard of the site office according to the stage of construction. Repair shop on a small scale will have to be provided attached to the site office in the case of equipment-lending system.

Power supply and water supply to work sites and quarters must be provided in addition to the existing ones in the case of equipment-lending system, but these will be needed only for quarters in the case of full-contracting system. Communication measures to be used exclusively for the project must be provided during the period of construction.

3.2.3. Topographic Survey.

Topographic survey and soil survey are required for carrying out the detailed design and the supervision.

3.2.4. Clearing and Other Works.

Clearing works must be executed at the sites of embankment and excavation, and some other temporary works will be needed.

3.3. Flood Control Works.

3.3.1. Construction Plan for the Ular river.

The main works for flood control of the Ular river excluding Pulau Gambar Canal were shown in Fig.1-4-22 and are summarized as below.

Dredging	:	727,400 m^3
Excavation	:	934,700 m^3
Embankment	:	1,243,400 m^3
Drains	:	135,000 m^3
Revetment	:	1,800 m
Sluice	:	1 place

Dredging works will be executed by using amphibious dredgers and amphibious soft-terrain excavators. Dredged materials will be used for embankment which will be carried out by means of building small dikes or temporarily storing them in a spoil bank. The soil stored in the temporary spoil bank will be moved to the final spoil place, embankment sites, depressions as are located at the foot of levee or inspection road by use of backhoes and dump trucks or swamp bulldozers at need.

Excavation will be executed by use of swamp bulldozers and backhoes to form high-water channel bed. Excavated soils will

be transported and dumped to embankment sites nearby, depressions or inspection-road sites by use of swamp bulldozers or backhoes and dump trucks.

Embankment will be made with the materials hauled from excavation sites nearby, transported from the temporary spoil banks or excated in borrow pits and transported. Forming of dikes will be executed by use of bulldozers, vibrating rollers, vibrating plate compactors and manpower. Excess soil after supply to embankment will be used for filling depressions or banking inspection road.

For revetment works, vibrating pile driver attached to amphibious excavator will be employed.

The drainage canal to be built on the landside of embankment will be executed by manpower.

3.3.2. Construction Plan for Pulau Gambar Canal (S. Kotabangun).

The main works for improvement of Pulau Gambar Canal (S. Kotabangun) are as follows.

Dredging : 5,600 m^3

Embankment : 95,200 m^3

Excavation will be executed by use of amphibious soft terrain excavators. Embankment will be executed with soils hauled from borrow pits nearby or transported from temporary spoil bank of the Ular river flood control works, and the works will be carried out by bulldozers, vibrating rollers, vibrating compactors and manpower.

3.3.3. Construction Schedule.

(1) Seven-year construction schedule.

The proposed construction schedule for flood control works is given in Fig.3-3-1. This was planned based on the following assumptions.

a. Detailed design will be commenced in January 1979 and completed by the end of March 1980.

b. In the case of the equipment-lending system, the project proposal and a part of procurement of construction equipment will be started in January 1980, and the first arrival of construction equipment will be in July 1980.

c. Immediately after completion of the detailed design, the construction works will be started, and they shall be completed in five years by March 1985.

The proposed sequence of flood control works of 7-year plan is as follows from the technical and economic point of view.

1980/81 A half of the stretch from -7.5 km to -2.5 km.

1981/82 A half of the stretch from -7.5 km to -2.5 km and one-third of the stretch from 10.0 km to 15.0 km.

1982/83 Two-thirds of the stretch from 10.0 km to 15.0 km and the stretch from -2.5 km to 0.0 km.

1983/84 The stretch from -11.25 km to -7.5 km and the stretch from 0.0 km to 10.0 km.

1984/85 The stretch from -12.25 km to -11.25 km, the stretch from 15.0 km to 22.65 km, Pulau Gambar Canal and revetment works of 1,800 m in length.

(2) Five-year construction schedule.

The quantity of works and other data required for planning the construction schedule are the same as those described in 3.3.1 and 3.3.2.

The proposed construction schedule for flood control works is given in Fig.3-3-2. This was planned based on the following assumptions.

a. Detailed design will be commenced at the beginning of January of 1979 and completed by the end of March of 1980.

b. In parallel with the detailed design, project proposal and partial procurement of construction equipment will be started in January 1980, and the major construction equipment shall be arranged for mobilization by July 1980.

c. Immediately after completion of the detailed design, the construction works will be started and completed in three years by March of 1983.

The sequence of the construction works for river improvement is as follows.

The proposed sequence of flood control works of 5-year plan is as follows from the technical and economic point of view.

1980/81 The stretch from -7.5 km to -2.5 km.

1981/82 The stretch from -11.25 km to -7.5 km and the stretch from -2.5 km to 10.0 km.

1982/83 The stretch from -12.25 km to -11.25 km, the stretch from 10.0 km to 22.65 km, Pulau Gambar Canal and revetment works of 1,800 m in length.

3.4. Irrigation/Drainage Improvement Works.

3.4.1. Construction Plan for Irrigation/Drainage Improvement Works.

In irrigation/drainage improvement works, major construction works consist of those of intakes, settling basins, irrigation and drainage canals, farm ditches and farm roads. Quantity of the works are as follows.

(1) Intakes.

a. Construction of new intakes	: 2 places
b. Improvement of the existing intakes	: 1 place
c. Construction of settling basins	: 10 places
d. Excavation	: 12,240 m^3
e. Embankment	: 4,980 m^3
f. Reinforced concrete works	: 2,280 m^3

(2) Irrigation canals.

a. Improvement of the existing canals	
Main canals	: 20.4 km
Secondary canals	: 51.5 km
b. Construction of new canals	
Main canals	: 2.6 km
Secondary canals	: 158.5 km
c. Excavation	: 391.920 m^3
d. Embankment	: 244,340 m^3
e. Lining concrete works	: 6,310 m^3

(3) Drainage canals.

a. Improvement of the existing canals	
Main canals	: 125 km
Secondary canals	: 136 km
Collector drains	: 18 km
b. Excavation	
Main canals	: 1,900,000 m^3
Secondary canals	: 499,000 m^3
Collector drains	: 70,000 m^3

(4) On-farm works.

a. Farm ditches	:	600 km
b. Farm drains	:	600 km
c. Farm roads	:	450 km

Allocation of construction power or machinery power and manpower was assumed as follows in consideration of

(1) Irrigation improvement works.

a. Intakes, settling basins, main canals and new canals in plantation area.

Excavation and embankment : 70 % by machinery and 30 % by manpower

b. Secondary cansls

Excavation and embankment : 25 % by machinery and 75 % by manpower

c. Farm ditches, farm drains and farm roads : 100 % by manpower

(2) Drainage improvement works.

a. Main drainage canals

Excavation : 60 % by machinery 40 % by manpower

b. Secondary drainage canals

Excavation : 100 % by manpower

Excavation of canals by machinery will be executed by using draglines, backhoes and amphibious soft terrain excavators. Embankment of irrigation canals will be carried out with materials excavated from canals by use of bulldozers, vibrating rollers, slope compactors and manpower. Excavated materials from drainage canals will be stored in spoil bank along the both sides of canals by using swamp bulldozers and manpower.

3.4.2. Construction schedule.

(1) Seven-year construction schedule.

The proposed construction schedule for irrigation/drainage improvement works is given in Fig.3-4-1. This was planned based on the following assumptions.

a. The detailed design will be commenced in January 1979 and finished by the end of March 1980.

b. In the case of the equipment-lending system, a part of procurement of construction machinery will be started in January 1980 in parallel with the detailed design and the major construction equipment will be arranged for mobilization by July 1980.

c. Immediately after the completion of detailed design, construction works will be started and completed in five years by the end of March 1985.

The area 18,500 ha proposed for irrigation improvement is divided into eight areas, and the construction schedule for the eight areas was fixed from the economical point of view.

In the first year (1980/81), the Sumber Rejo and Ramonia areas shall be dealt with and the Bendang and Pulau Gambar areas and one-third of the Perbaungan area shall be dealt with in the second year (1981/82). The remaining area of Perbaungan shall be completed in the third year (1982/83). In the fourth year (1983/84), two-third of the Buluh area shall be dealt with and the remaining area of Buluh and the Singosari and Timbang Deli areas shall be dealt with in the fifth year (1984/85). Table 3-4-1 shows the sequence of areas for irrigation improvement work according to the construction schedule mentioned above.

The proposed sequence of drainage improvement works is as follows from the economic point of view.

1980/81 Pantai Labu canal, Sungai Denai and a half of Sungai Perbaungan.

1981/82 a half of Sungai Perbaungan, Kuala Lama canal, one-fifth of Lubuk Bendang, one-fifth of Sungai Baru and one-tenth of Canal S. Buluh.

1982/83 Four-fifths of Lubuk Bendung, four-fifths of Sungai Baru and four-tenths of Canal S. Buluh.

1983/84 Four-tenths of Canal S. Buluh, three-tenths of Sungai Buluh and two-tenths of Sungai Telukmengkudu.

1984/85 One-tenth of Canal S. Buluh, Sungai Pavda, seven-tenths of Sungai Buluh and eight-tenths of Sungai Terukmengkudu.

(2) Five-year construction schedule.

The proposed construction schedule for irrigation/drainage improvement works is given in Fig.3-4-2. This was planned based on the following assumptions.

a. The detailed design will be commenced in January 1979 and

finished by the end of March 1980.

b. In the case of the equipment-lending system, a part of procurement of construction machinery will be started in January 1980 in parallel with the detailed design and major construction equipment will be arranged for mobilization by July 1980.

c. Immediately after the completion of the detailed design, construction works will be started and completed in three years by the end of March 1983.

The area 18,500 ha proposed for irrigation improvement is divided into eight areas, and the sequence construction works for the eight areas was fixed from the economical point of view.

In the first year (1980/81), the Pulau Gambar, Sumber Rejo, Bandang and Ramonia areas will be dealt with and the Perbaungan area and one-third of the Buluh area will be dealt with in the second year (1981/82). In the third year (1982/83), the remaining area of Buluh and the Singosari and Timbang Deli areas will be dealt with. Table 3-4-2 shows the sequence of areas to be dealt with according to the construction schedule.

The proposed sequence of drainage improvement works is as follows from the economical point of view.

1980/81 Pantai Labu, Sungai Denai, Sungai Perbaungan, Kuala Lama, Lubuk Bendang and Sungai Baru.

1981/82 Four-fifth of Canal S. Buluh.

1982/83 One-fifth of Canal S. Buluh, Sungai Buluh, Sungai Telukmengkudo and Sungai Pavda.

Table 3-1-1 List of Existing Equipment Available for the Project

No.	Name of Equipment	Capacity	Q'ty	Remaining Estimated Workable Hour (in total)	Transfer	Year of purchase
1.	Swamp Bulldozer	12^{t}	2	1,493^{hr}	Flood Control	1974
2.	- do -	7^{t}	3	4,655	- do -	1975
3.	Loader (Dragshovel)	1.3 m^3	3	7,433	- do -	1974
4.	Dragline	0.6 m^3	1	2,787	- do -	1974
5.	Back hoe	0.3 m^3	2	4,687	- do -	1974
6.	Amphibious Dredger	40 m^3/hr	1	4,027	- do -	1974
7.	Dump Truck	6^{t}	12	10,866	- do -	1974
8.	Ordinary Truck	4.5^{t}	3	4,034	2-Flood Control 1-Irrigation	1974
9.	Grease Car	6^{t}	1	5,400	Irrigation	1974
10.	Hydraulic Truck Crane	10^{t}	1	5,285	Flood Control	1974
11.	Service Car	1^{t}	3	3,596	2-Flood Control 1-Irrigation	1974
12.	Jeep	6 persons	4	10,589	3-Flood Control 1-Irrigation	1977
13.	Diesel Generator	45 KVA	1	2,966	Flood Control	1974
14.	- do -	30 KVA	1	510	- do -	1974

Table 3-4-1 Sequence of Construction by Area

Construction Year	Area	Existing condition First cropping Irrigated	Existing condition First cropping Rain-fed	Existing condition Second cropping	Develop Double cropping
		ha	ha	ha	ha
1980/81	Sumber Rejo	800	1,900	100	2,700
	Ramonia	1,100	600	500	1,700
	Sub-total	1,900	2,500	600	4,400
1981/82	Bendang	1,000	700	900	1,700
	Pulau Gambar	1,200	-	800	1,200
	Perbaungan (1/3)	650	1,180	600	1,830
	Sub-total	2,850	1,880	2,300	4,730
1982/83	Perbaungan (2/3)	1,300	2,370	1,200	3,670
1983/84	Buluh (2/3)	270	2,800	-	3,070
1984/85	Buluh (1/3)	130	1,400	-	1,530
	Singosari	150	550	-	700
	Timbang Deli	400	-	400	400
	Sub-total	680	1,950	400	2,630
	T o t a l	7,000	11,500	4,500	18,500

Table 3-4-2 Sequence of Construction by Area

Construction Year	Area	Existing condition: First cropping Irrigated	Existing condition: First cropping Rain-fed	Existing condition: Second cropping	Develop Double cropping
	Pubau Gambar	1,200 ha	- ha	800 ha	1,200 ha
	Sumber Rejo	800	1,900	100	2,700
1980/81	Bendang	1,000	700	900	1,700
	Ramonia	1,000	600	500	1,700
	Sub-total	4,100	3,200	2,300	7,300
	Perbaungan	1,950	3,550	1,800	5,500
1981/82	Buluh ($\frac{1}{3}$)	130	1,400	-	1,530
	Sub-total	2,080	4,950	1,800	7,030
	Buluh ($\frac{2}{3}$)	270	2,800	-	3,070
	Timbang Deli	400	-	400	400
1982/83	Singosari	150	550	-	700
	Sub-total	820	3,350	400	4,170
	T o t a l	7,000	11,500	4,500	18,000

Fig.3-3-1 Construction Schedule for Flood Control Component (7-Year Plan)

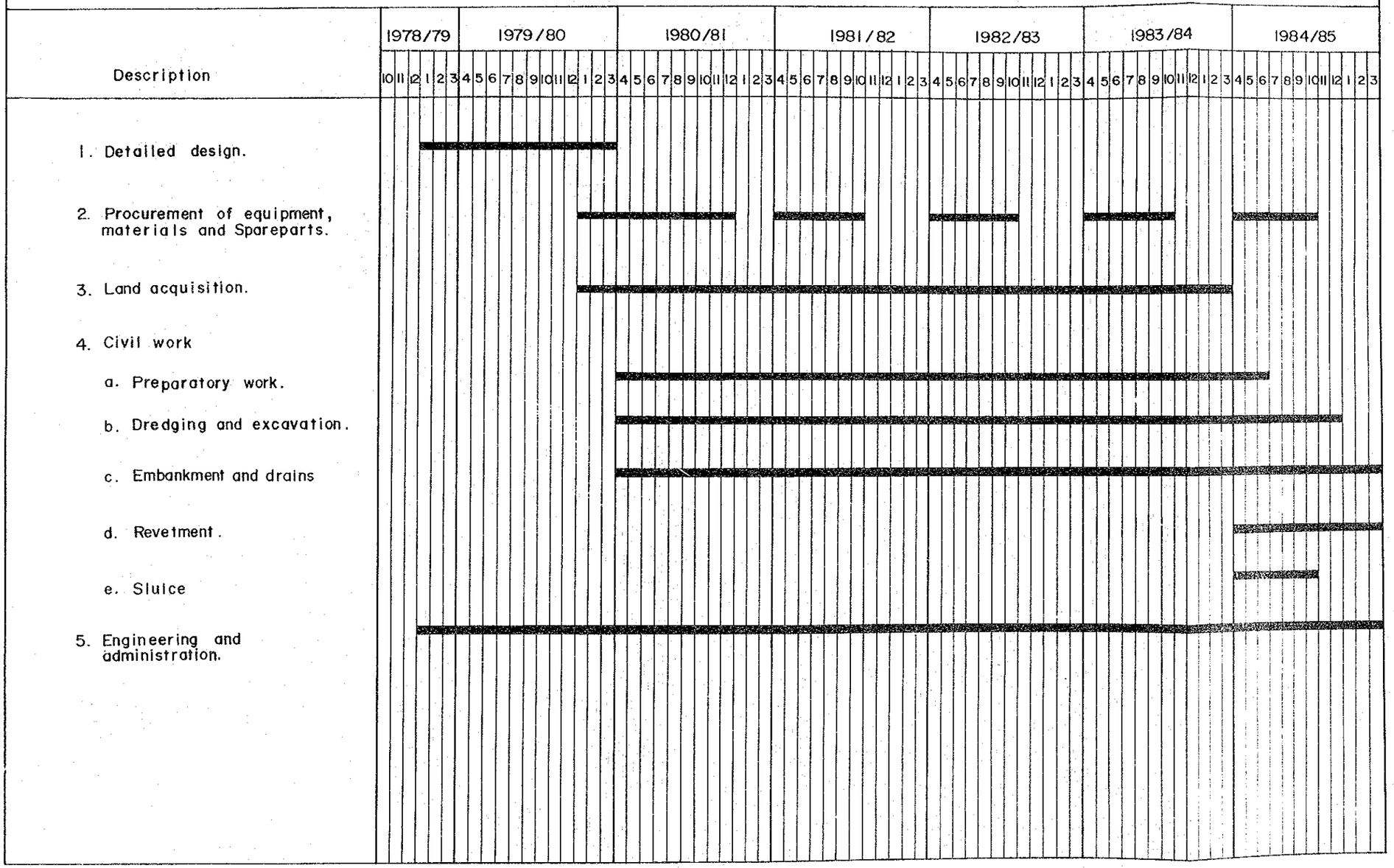


Fig. 3-3-2 Construction Schedule for Flood Control (5-Year Plan)

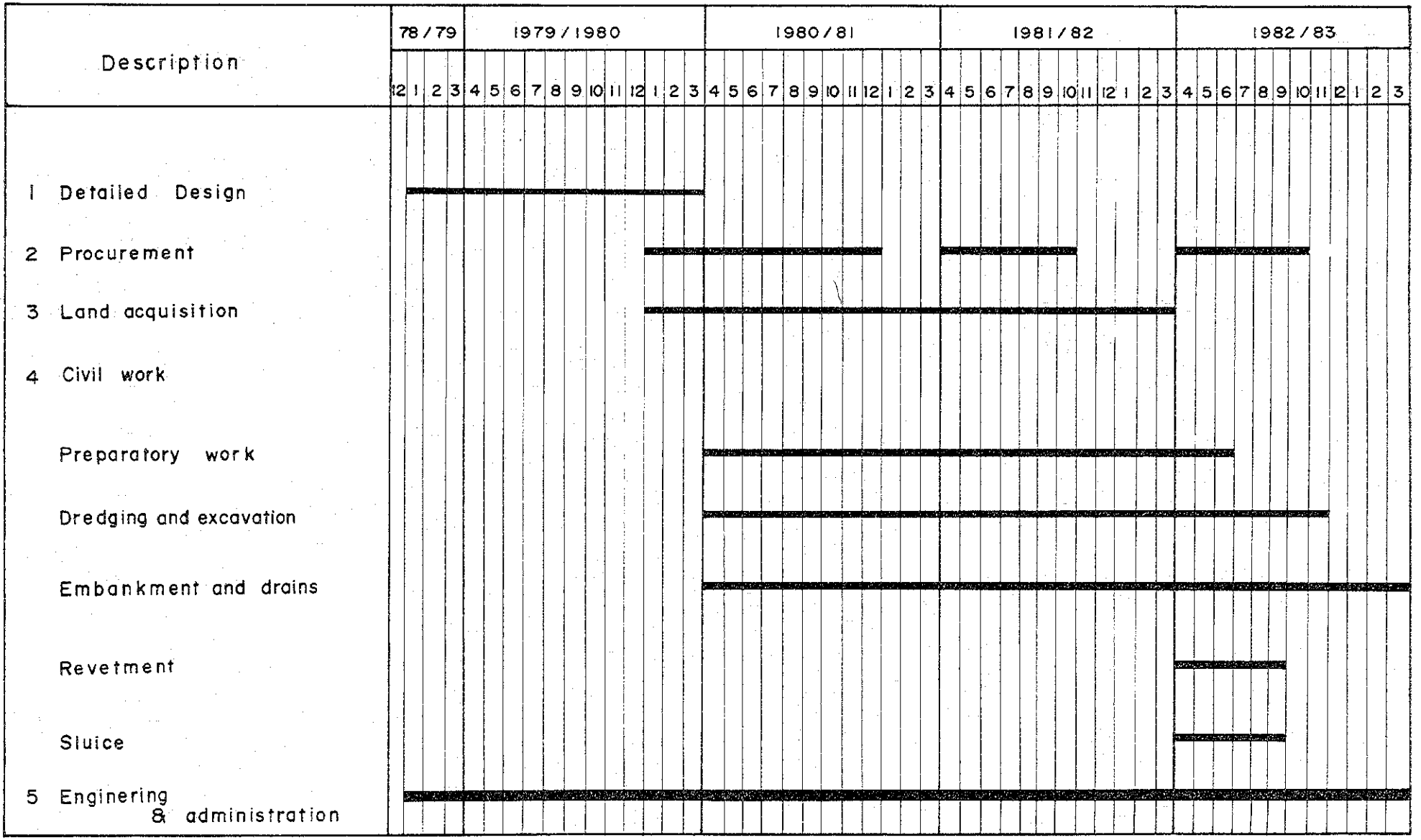


Fig. 3-4-1 Construction Schedule for Irrigation and Drainage Component (7-Year Plan)

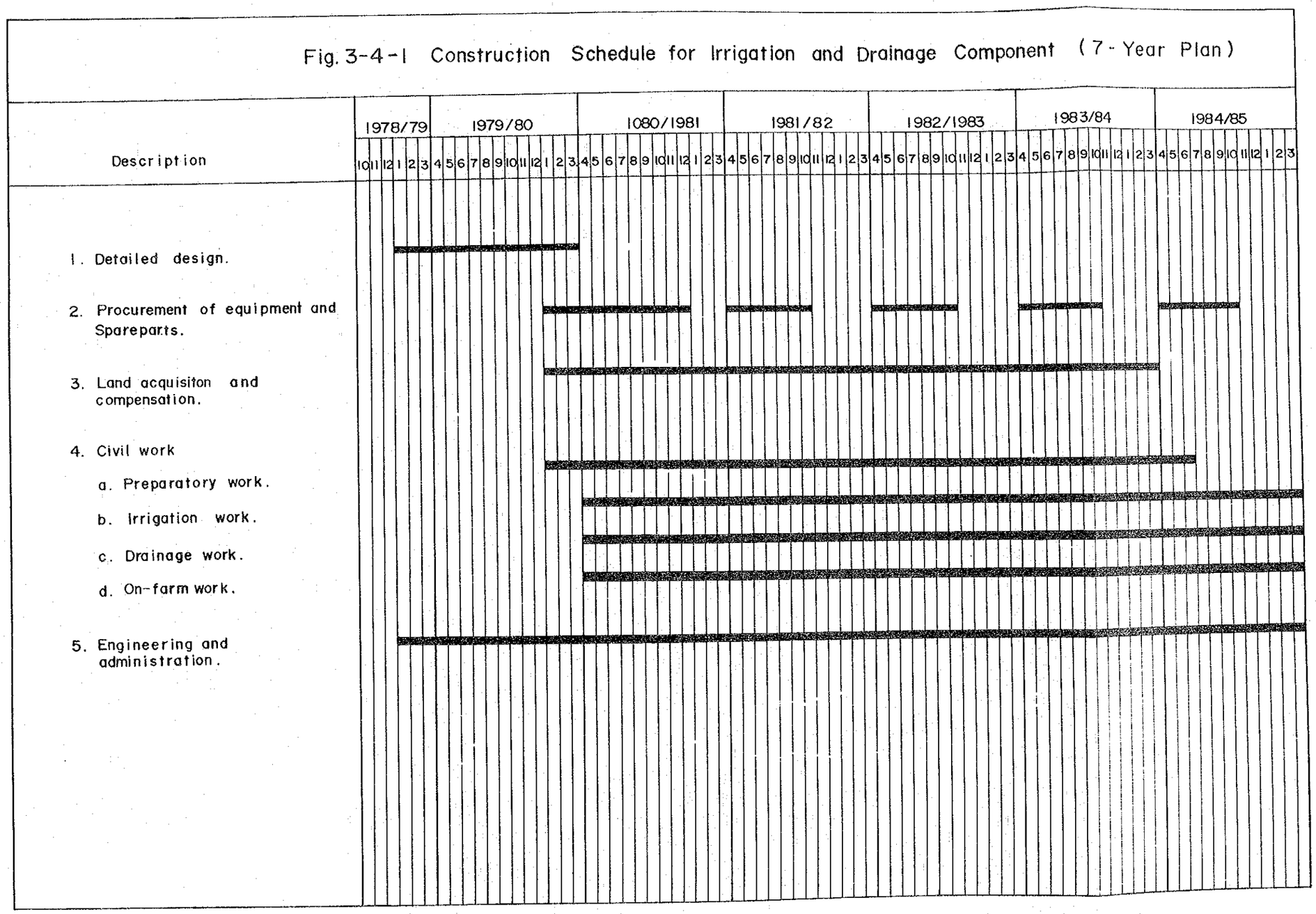
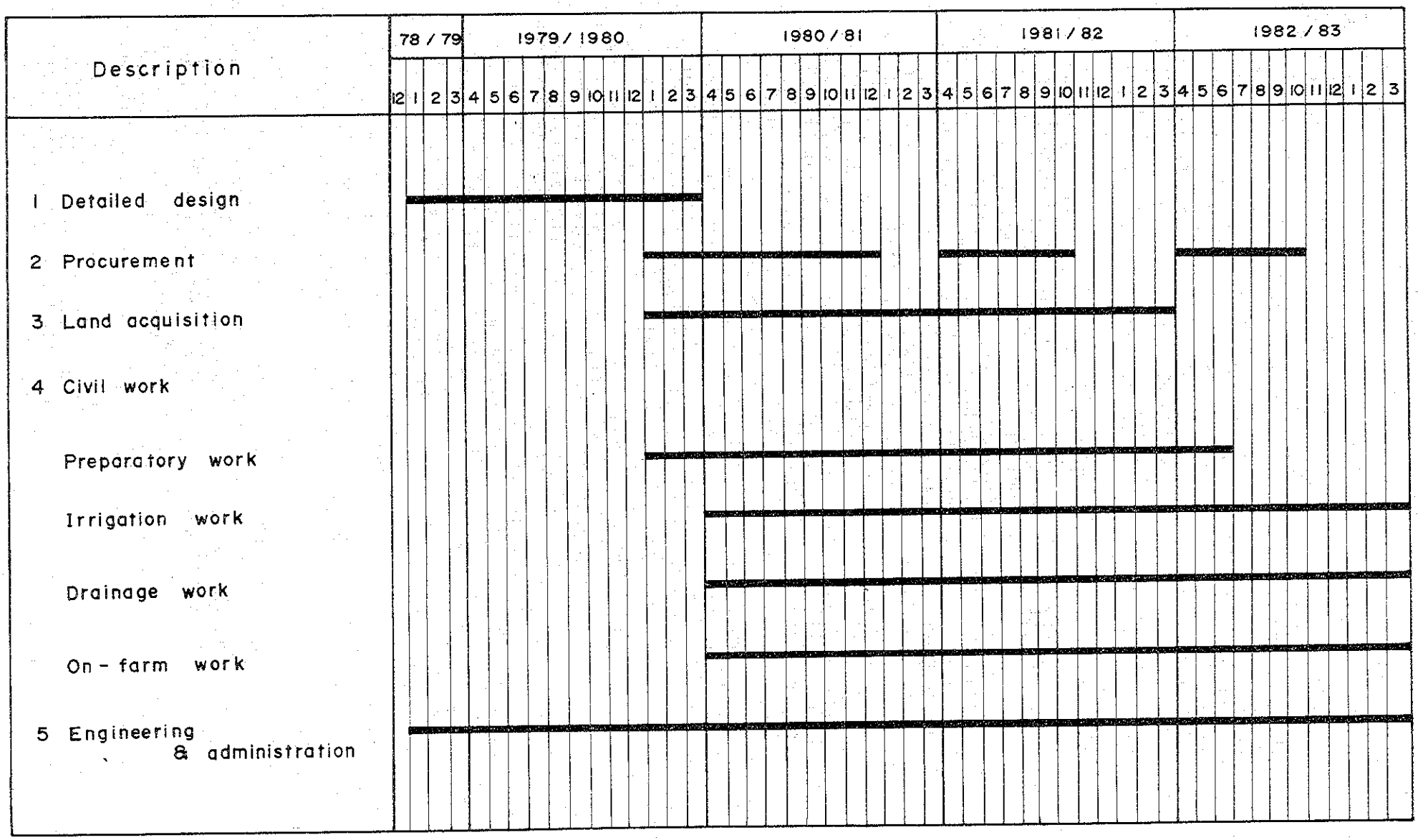


Fig. 3-4-2 Construction Schedule for Irrigation and Drainage (5-Year Plan)



CHAPTER IV

ORGANIZATION AND MANAGEMENT

4.1. Present Organization.

4.1.1. Flood Control Sector.

The flood control works of the Ular river are at present managed under an organization which was established as Urgent Flood Control Project on the occasion of commencement of the Ular River Urgent Flood Control Project (hereinafter referred to as Urgent Project). This organization is shown in Fig.4-1-1. The office of the Urgent Project was located in Medan for management of implementation of the project, and the site office was located in Perbaungan near the Ular highway bridge for supervision of construction works.

At present, however, the Urgent Project deals with not only the construction works for urgent flood control but also the maintenance of completed part of the river channel under the Urgent Project and flood information as mentioned in paragraph 1.3.4. of Chapter I.

The existing river structures on the Ular have been operated and managed by three organizations; one is the Urgent Project, another is Deli/Serdang District Servise (Seksi Deli/Serdang) under the control of the Public Works Service of North Sumatra Province and the other is the PNP as shown in Fig.4-1-3. Also the existing levees are being maintained under the management of the organizations mentioned above being divided into three sections as shown in Fig.4-1-2. As a part of maintenance work for the river channel, the Urgent Project has been trying to plant low-height vegetation on the major beds because usual plant regrows very rapidly if they are left as they are after they were once cut.

4.1.2. Irrigation and Drainage Sector.

The existing irrigation facilities in the project area have been operated and managed by two organizations; one is Public Works Service of North Sumatra Province and the other is the District administration. The organizations are illustrated in Fig.4-1-3.

The Public Works Service of North Sumatra Province is responsible for giving services of operation and maintenance to the areas commanded by Pulau Gambar, Perbaungan and Timbang Deli Intakes through the Subdivisions under the control of the Public Works Service and to the areas commanded by Sumber Rejo,

Bendang and Ramonia Intakes through Deli/Serdang District Service (Seksi Deli/Serdang).

The District administration is responsible for the operation and maintenance of the areas commanded by Swadaya and Buluh Intakes. Besides, for the operation of irrigation facilities, Irrigation Committees have been organized respectively at the levels of District, Subdistrict and the tertiary irrigation block. The organizations of the irrigation committees are indicated in Table 4-1-1.

4.2. Organization at the Stage of Implementation.

The Ministry of Public Works and Electric Power will entirely be responsible for the implementation of the project, and necessary consultations will be made to the organizations concerned. The present organization for the Ular River Urgent Flood Control Project will be developed to the Ular River Flood Control and Improvement of Irrigation Project for implementing the new project as shown in Fig.4-2-1.

The Directorate General of Water Resources Development will be the executing agency for the new porject. The Directorate of Rivers under the control of the Directorate General of Water Resources Development will take charge of coordination with all the relevant government agencies and regional administrative organizations in implementing the project.

The project manager will be appointed by the Ministry to take all the responsibility to the Ministry for the proper implementation of the project.

The vice-project manager will be appointed for implementation of the project to support the project manager, and the site manager will be appointed to take charge of supervision of the execution of works.

The staffs as shown in Fig.4-2-1 will also appointed to support the project manager and the vice-project manager. They will support execution of detailed survey, design and planning, preparation of tender documents and specifications for civil works, preparation of tender documents and specifications for equipment including materials and spareparts if necessary and land acquisition.

The site engineers and the project staffs as shown in Fig. 4-2-1 will be appointed to supervise construction works supporting the site manager.

As the staffs of the Urgent Project are experienced in river improvement field, this function must be utilized efficiently in executing the improvement works. As for the irrigation

and drainage field, not only the existing function of the Urgent Project will be utilized as much as possible, but also the function in the irrigation/drainage field will have to be strengthened in the organization.

In case the major equipment are purchased by the Ministry and they are lent to contractors, the then organization for procurement of them including spareparts will be as shown in Fig.4-2-3.

Foreign consultants will have to be employed to assist the implementation of the project including the field of detailed design and supervision. This organization is also shown in Figs. 4 and 5.

4.3. Operation and Maintenance.

The organization for managing the facilities constructed or improved by the project is proposed as shown in Fig.4-3-1.

The management of the flood control facilities will be entrusted by the Ministry to the provincial government. For maintaining the carrying capacity of the high-water channel, special attention will be needed because plants will grow very rapidly.

In connection with the operation and maintenance of the irrigation and drainage facilities, the organization of irrigation committees in the project area would be maintained.

4.4. Agricultural Support System.

It is strongly recommended to establish the Agricultural Development Center (ADC) in and around the project area as early as possible. The existing Provincial Seed Center located at Tanjung Morawa in Deli/Serdang District would be proposed to reorganize into ADC having the functions of experiment and training at the provincial level in addition to the current function of seed multiplication with additional necessary buildings and apparatus.

On the proposed ADC, at least three subject-matter specialists will be appointed to assist, advise and train the Field Extension Workers (PPL) as well as undertake the adaption tests and/or trials of recommended varieties, new irrigation farming and plant protection methods in and around the project area.

The present number of 7 Rural Extension Centers in the project area would be reasonable but not sufficient in facilities. The necessary supplemental facilities would also be supplied in order to facilitate extension activities effectively and efficiently for the successful implementation of the project.

Other organizations of agricultural support system such as BRI, P.N. Pertani and P.T. Pusri could be improved by themselves following the development stages of the project.

Table 4-1-1 Organization of the Irrigation Committee in the Project Area

	Chairman	Secretary	Members
District Irrigation Committee	Chief of District (Bupati)	Chief of District Office of Public Works (Kepala Seksi)	District Agricultural Service Office. (DPR Kabupaten) District Agrarian Office. District Police Office.
Sub-District Irrigation Committee	Chief of Sub-District (Camat)	Chief of Sector	Sub-District Agricultural Office. Sub-District Agrarian Office Sub District Police Office.
Tertiary Irrigation Committee	Chief of village (Kepala Kampung)	Foreman	Field Extension (PPL) Representatives community (Pengetua).

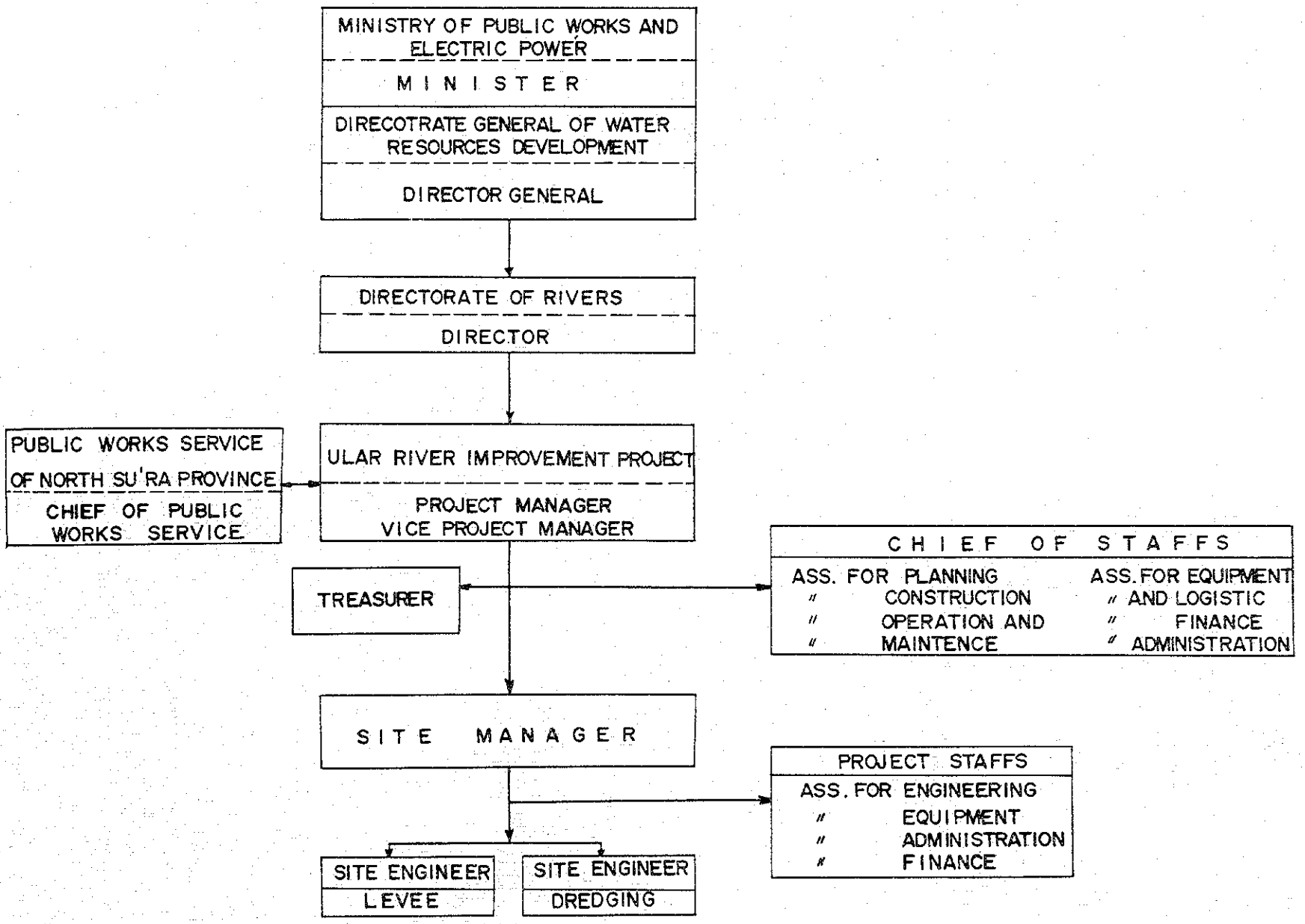
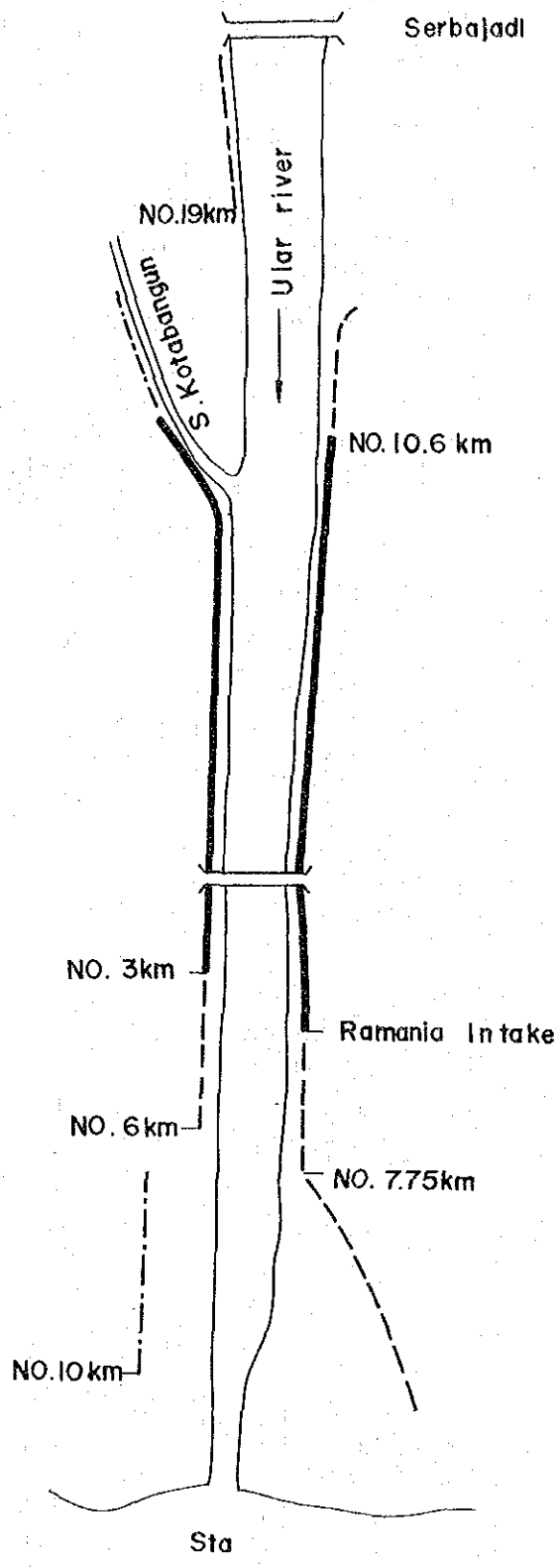

MINISTRY OF PUBLIC WORKS AND ELECTRIC POWER
MINISTER
DIRECOTRATE GENERAL OF WATER RESOURCES DEVELOPMENT
DIRECTOR GENERAL
DIRECTORATE OF RIVERS
DIRECTOR
PUBLIC WORKS SERVICE OF NORTH SU'RA PROVINCE
CHIEF OF PUBLIC WORKS SERVICE
ULAR RIVER IMPROVEMENT PROJECT
PROJECT MANAGER
VICE PROJECT MANAGER
TREASURER
CHIEF OF STAFFS
ASS. FOR PLANNING
" CONSTRUCTION
" OPERATION AND
" MAINTENCE
ASS. FOR EQUIPMENT
" AND LOGISTIC
" FINANCE
" ADMINISTRATION
SITE MANAGER
PROJECT STAFFS
ASS. FOR ENGINEERING
" EQUIPMENT
" ADMINISTRATION
" FINANCE
SITE ENGINEER
LEVEE
SITE ENGINEER
DREDGING

Fig.4-1-2 Division of Managment of Levees of the Ular



Legend

Managedent by the Project

Management by the Seksi

Management by Plantation

Fig.4-1-3 Present Organization Chart (Irrigation and Drainage)

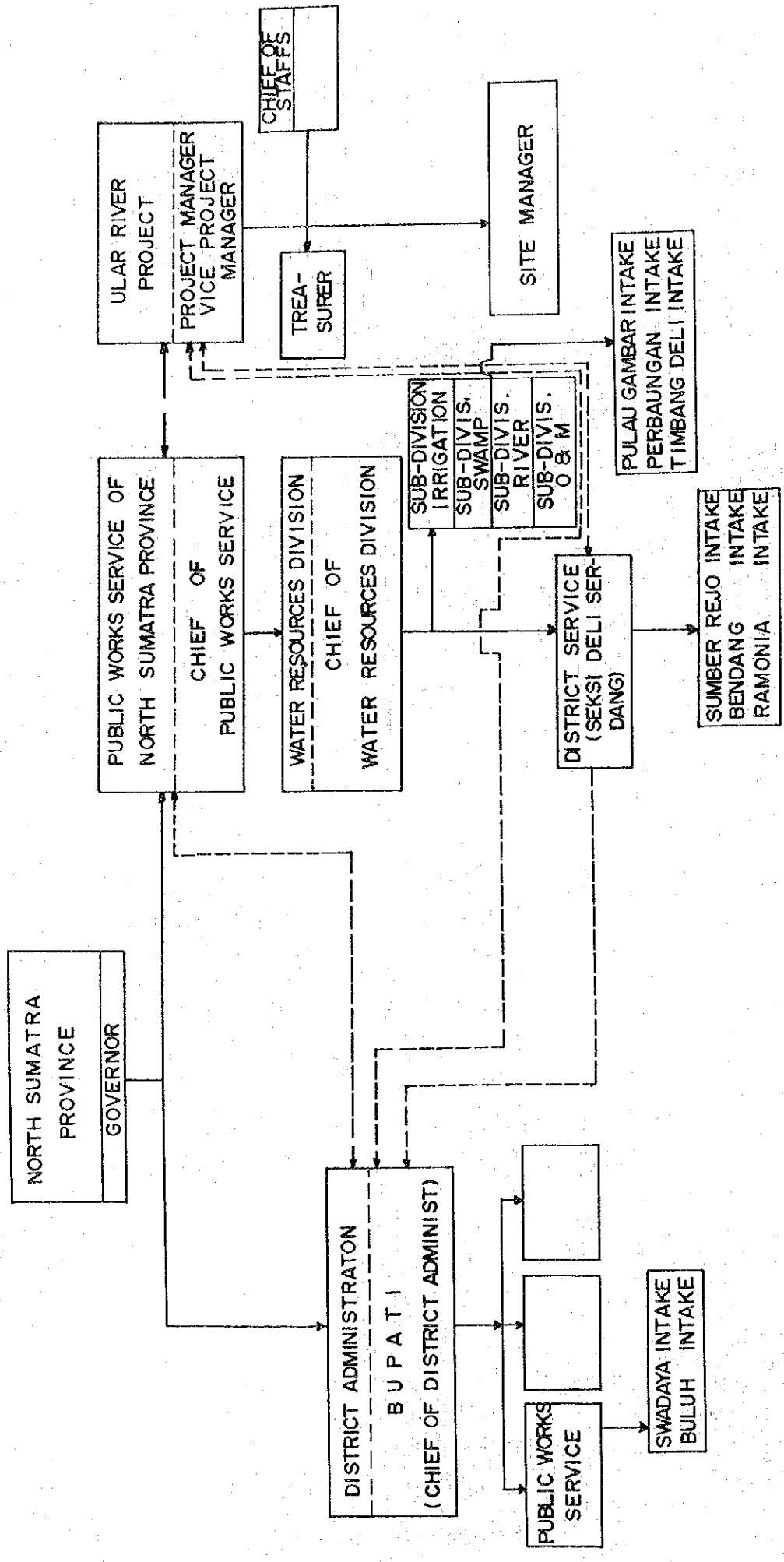


Fig.4-2-1 Organiation Chart for Implementation of the Project

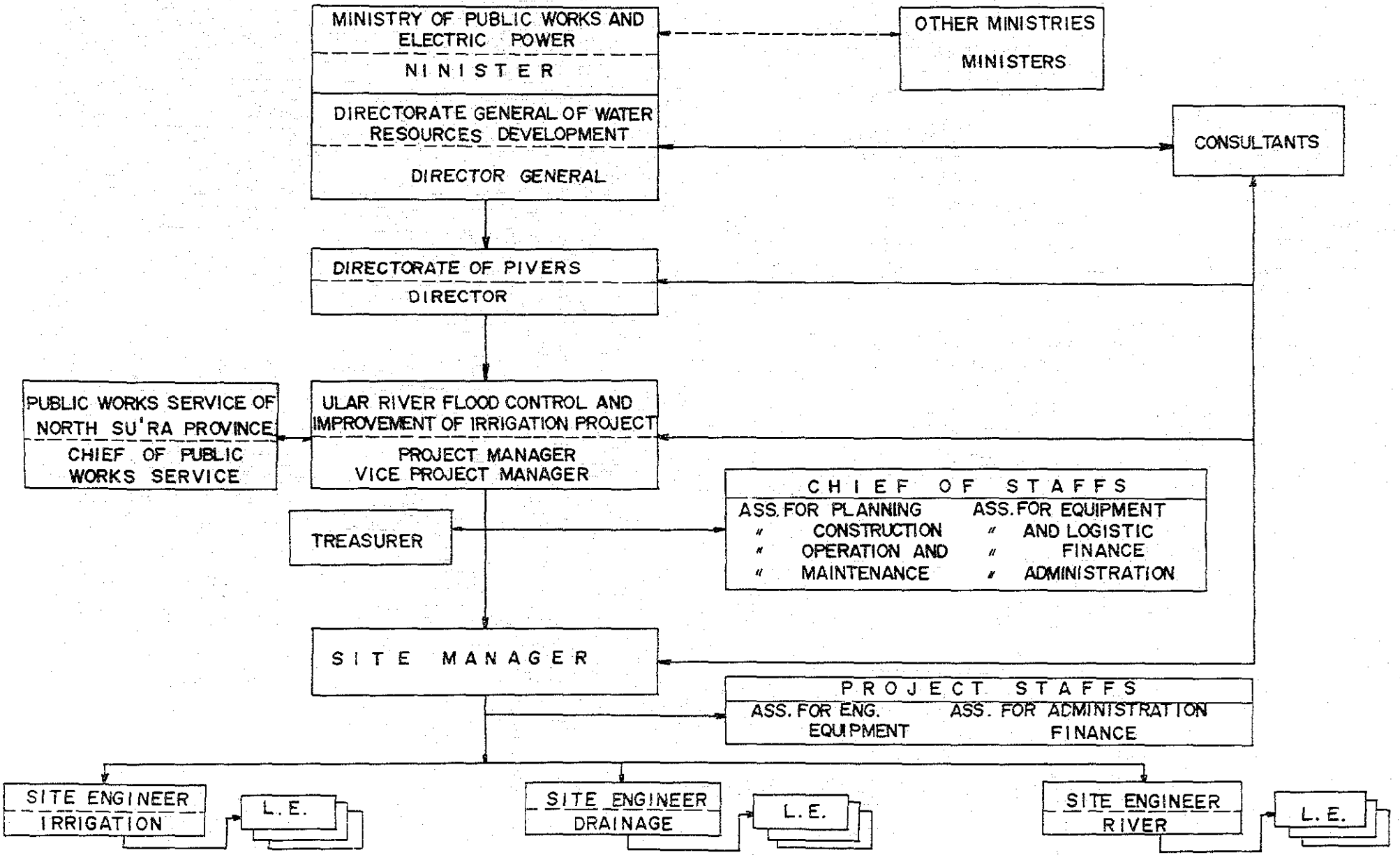


Fig.4-2-2 Organization Chart for Contract Work

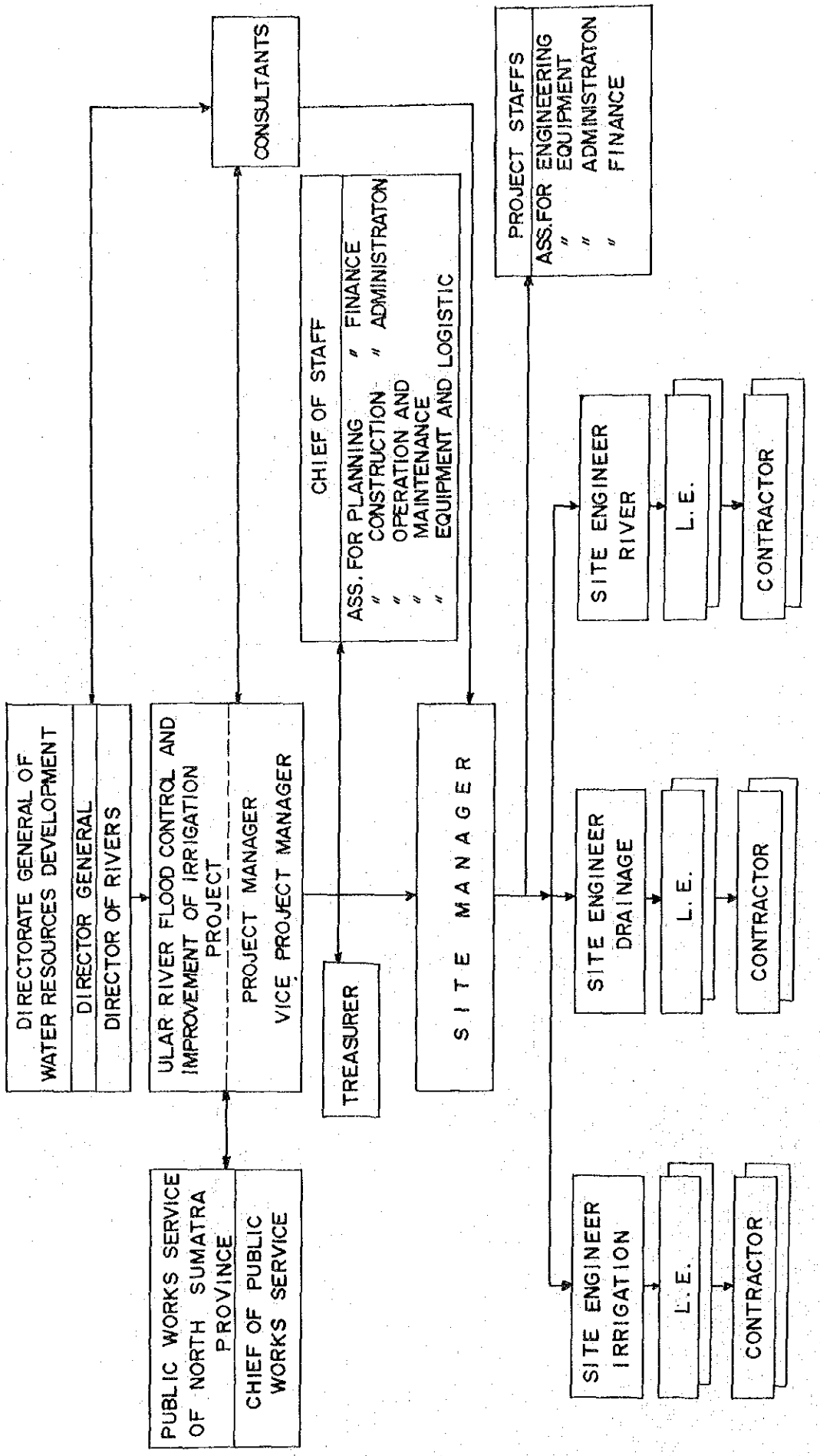


Fig.4-2-3 Organization Chart for Procurement by Foreign Currency

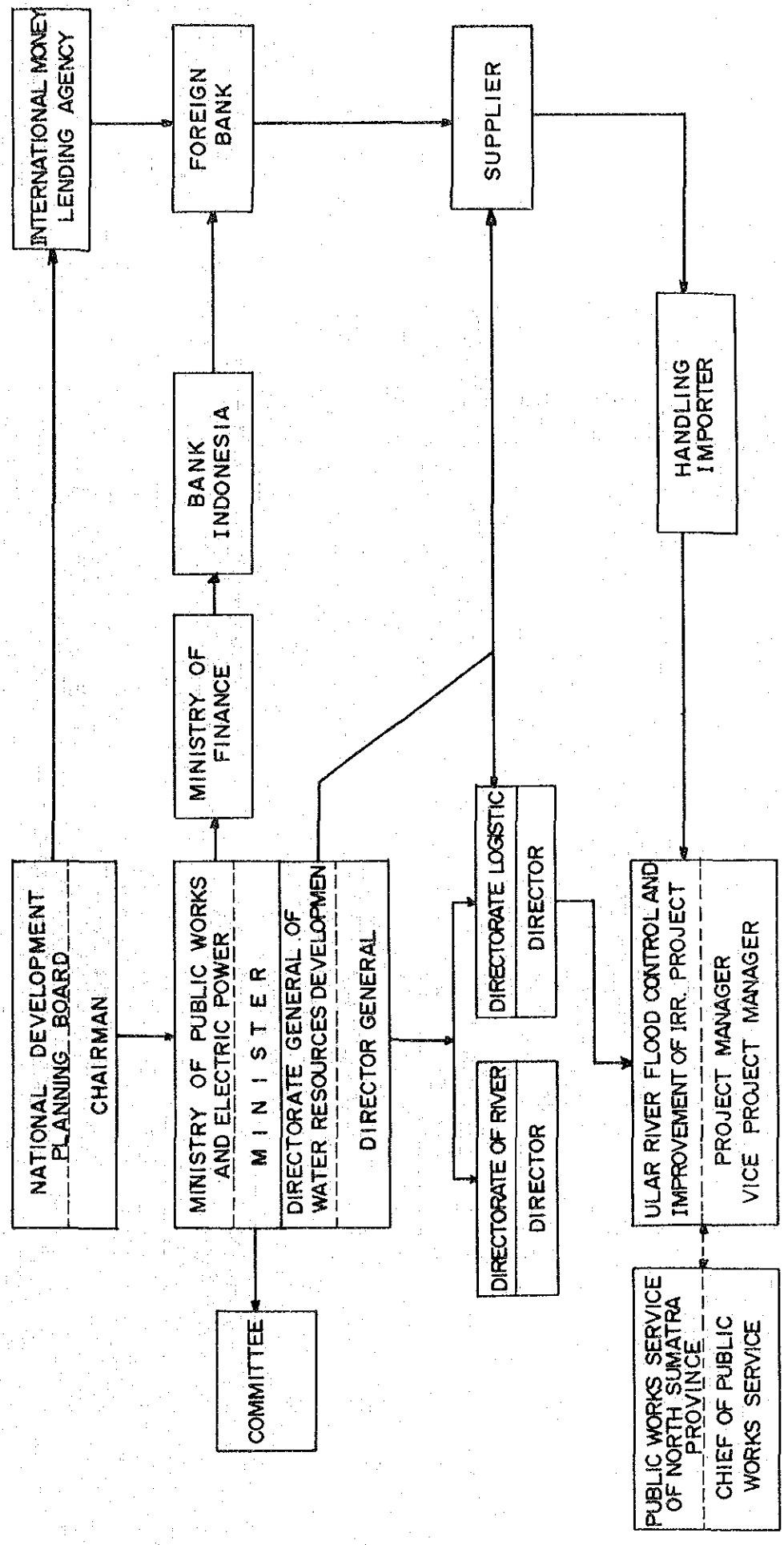
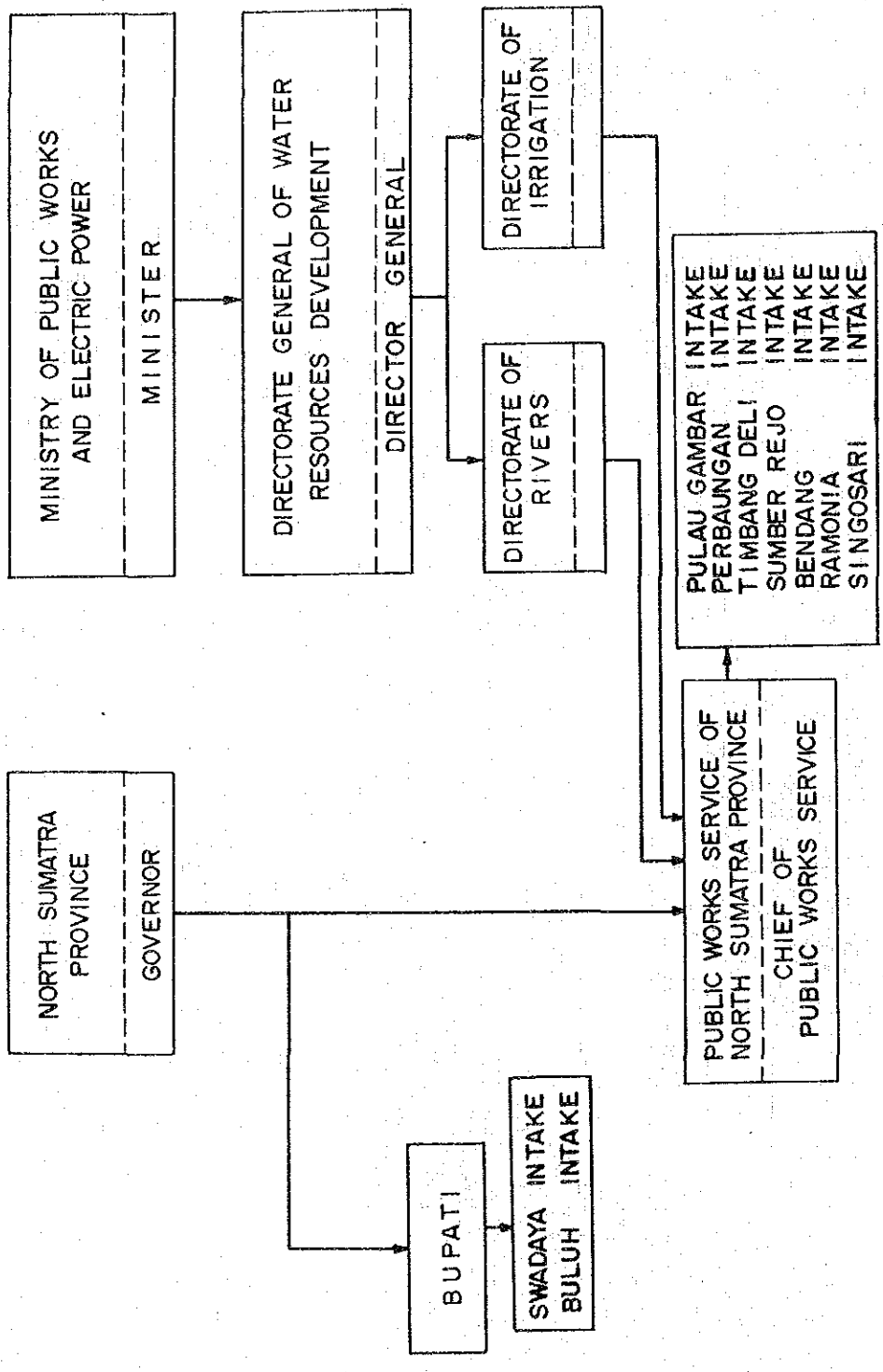


Fig. 4-3-1 Organization Chart for Administration and Operation after Completion of Project



CHAPTER V

COST ESTIMATE FOR SEVEN YEAR PLAN (EQUIPMENT-LENDING SYSTEM)

5.1. Composition of Construction Cost.

The construction cost of the project was estimated by dividing the project into the flood control component and the irrigation/drainage improvement component. The costs were calculated at the 1977-price and on the following assumptions.

a. The construction works are executed by equipment-lending system.

b. The construction schedules are as mentioned in the previous paragraphs.

c. The civil works are carried out by local contractors.

d. The major part of construction equipment except the existing ones available for this project and spare parts required for them including those for the existing ones available are procured by the Government on the occasion of implementation of this project and they are lent to the contractors during the period of execution of the works.

The construction cost given as Total in Tables 5-6-1 and 5-6-2 is composed of the costs required for land acquisition and compensation, civil works (which are composed of labor cost, materials cost, purchase cost of equipment, cost for spare parts including for the existing equipment to be used in this project), engineering and administration cost including that for foreign consultants, and contingency.

The field costs used in the equipment lending system shall be defined as the cost estimated based on the depreciation costs of equipment for civil works, while the construction cost is estimated based on the purchase cost of equipment for civil works.

The costs required for civil works were calculated by multiplying work quantity by unit cost. The work quantities have already been obtained by the study mentioned previously.

Unit costs were estimated on the basis of costs required for labor, materials, depreciation of equipment (using purchase cost and life), spare parts and operation of equipment including operator, fuel and consumables.

Cost for land acquisition and compensation was estimated based on the unit prices required for similar works in this area.

Engineering and administration cost was assumed at about 20%

of the total of the field costs.

Construction costs were classified into two portions of local currency and foreign currency. The local currency portion is composed of domesitc labor cost, cost of materials and spare parts to be procured locally, cost for land acquisition and compensation and other costs such as maintenance cost of equipment and contractors' costs. Engineering and administration cost of the executing agency, including costs of per diem and general expenses in the site for foreign consultants, was classified into the local currency portion.

Construction materials except raingages, water level gages and radio telephones were considered to be purchased at local markets.

About 20% of required spare parts for construction equipment were considered to be purchased at local markets.

The unit prices of labor and materials to be procured locally are shown in Tables 5-1-1 and 5-1-2.

The foreign currency portion comprizes the costs required for procurement of major construction equipment and spare parts including those for the existing equipment available (about 80% of the total), purchase of instruments for surveying and laboratory use, observation instruments such as rain gages and water-level gages, communication instruments such as radio telephones and the cost required for retaining foreign consultants including the costs for procuring cars and instruments for surveying and laboratory use. The cost for procurement of construction equipment was estimated based on CIF price at Belawan Harbor.

The costs for foreign consultants' services consist of those for remunerations and out-of-pocket expenses for the leader of consultants, surveying engineers, civil engineers, hydrologists, design engineers for river and irrigation/drainage, equipment engineers, construction engineers and staff for general affairs.

The contingency was estimated at 15% of the sum of the field cost.

The conversion rates of Rp to US$ and Japanese Yen used in the cost estimation are as follows, where the average middle rate of conversion in Tokyo in December 1977

Rp 415 = US$ 1 = ¥ 241

was employed in converting US$ to ¥.

5.2. Construction Equipment.

Required construction equipment were estimated based on the proposed machinery works, construction period and capacity and

life of the equipment. The standard capacities of equipment which were applied in this study are as follows.

Amphibious dredger	30 m^3/hr
Amphibious soft terrain excavator	25 m^3/hr
Bulldozer (swamp) for excavation	50 m^3/hr
Bulldozer (swamp) for excavation in long distance	35 to 50 m^3/hr
Bulldozer (swamp) for spreading	70 m^3/hr
Vibration roller, for compaction	13 m^3/hr & 20 m^3/hr
Back hoe, for excavation/loading	30 m^3/hr
Truck for transportation (5 to 1 km)	2.5 to 8 m^3/hr

The required equipment, spare parts and other instruments are shown in Table 5-2-1 for the flood control component and in Table 5-2-2 for the irrigation/drainage component. Among the required equipment, it was planned to transfer some existing and available equipment to this project instead of purchasing them from abroad. These are also shown in Tables 5-2-1 and 5-2-2. Other equipment were planned to be purchased from abroad and shown in the said tables as new equipment. Among spare parts for the existing equipment as well as the new ones, those which are difficult to procure in Indonesia shall be purchased from abroad. If there are some materials which are difficult to procure in Indonesia, they shall also be purchased from abroad.

5.3. Field Cost for Flood Control Component.

5.3.1. Unit Cost.

The unit costs for different types of flood control works were estimated on the basis of depreciation cost of the equipment, costs for spare parts, cost for operation (consumable materials and labor cost) including profits and overhead of the contractor.

Hourly depreciation cost of equipment was estimated based on CIF Belawan.

$$\text{Depreciation Cost} = \frac{\text{CIF Belawan} \times (1 - 0.1)}{\text{Life of equipment}}$$

The estimated depreciation cost of major equipment and the cost of spare parts were estimated as shown in Table 5-3-1.

The unit costs for those different types of works which are shown in Table 5-3-2 were estimated by use of the unit operation costs given in Table 5-3-3. The estimated unit costs are shown in Table 5-3-2.