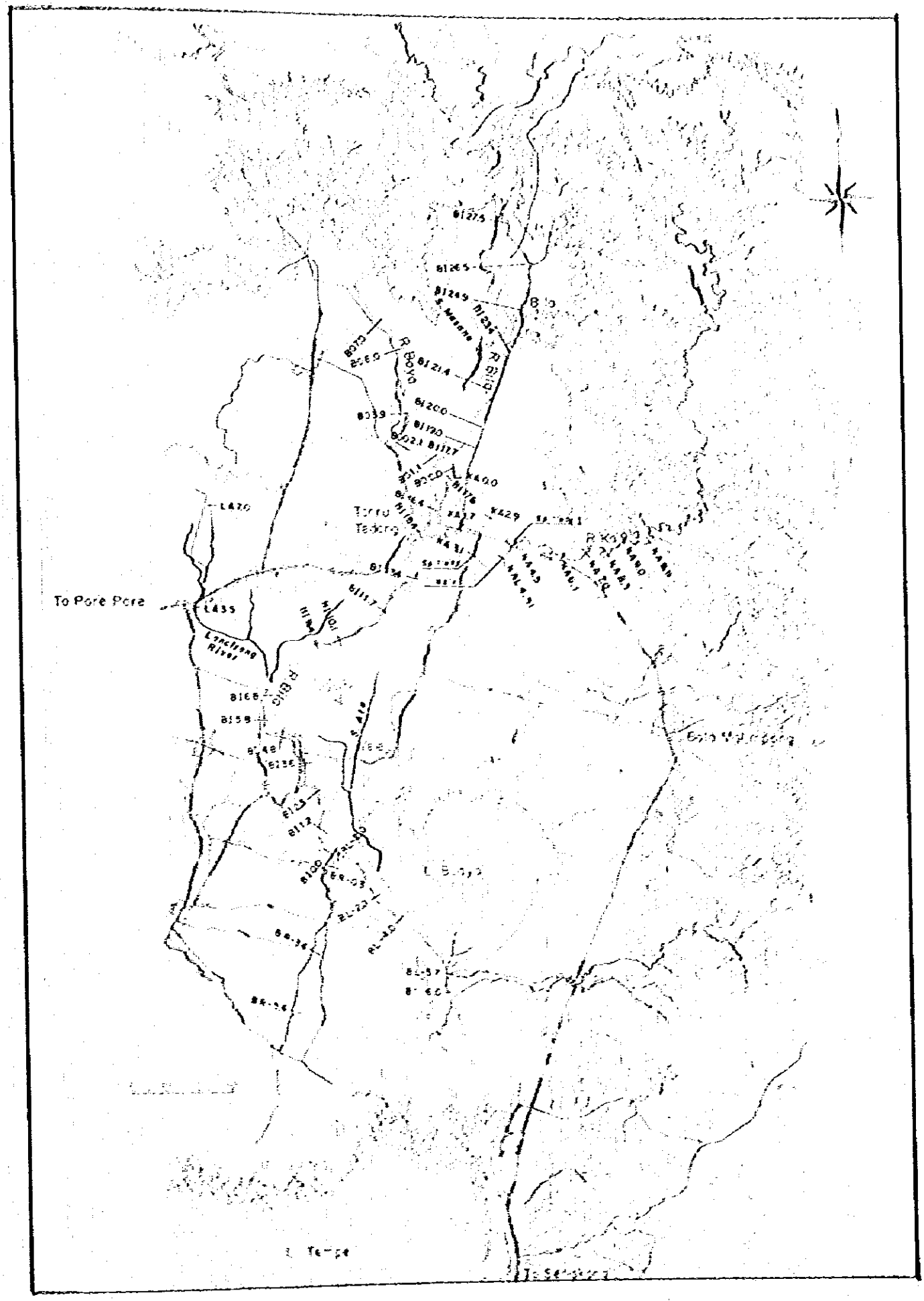


Fig. 2.1 EXISTING BILA RIVER SYSTEM

Fig. 2.2 EXISTING LONGITUDINAL PROFILE (1/2)

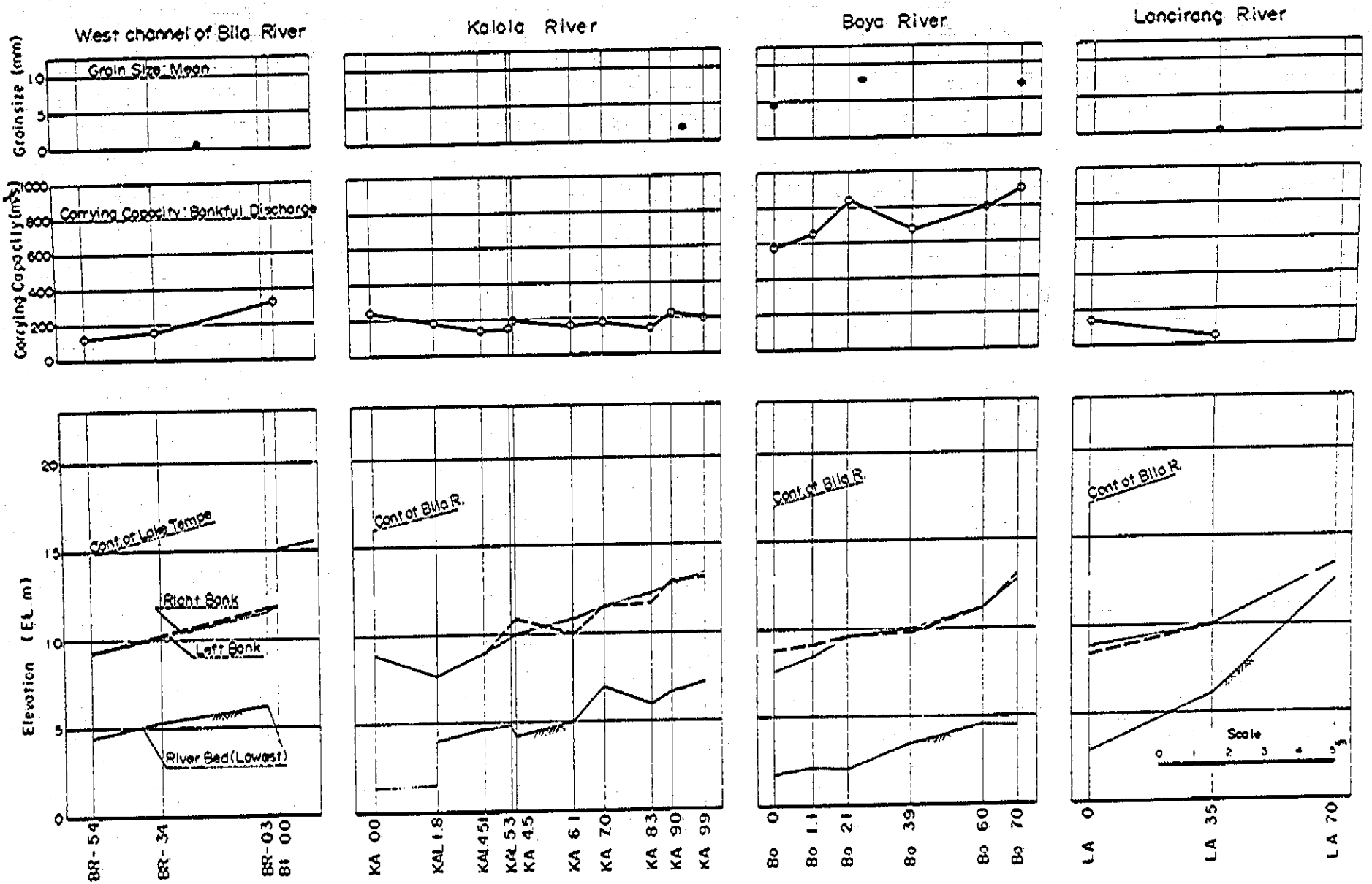


Fig. 2.2 EXISTING LONGITUDINAL PROFILE (2/2)

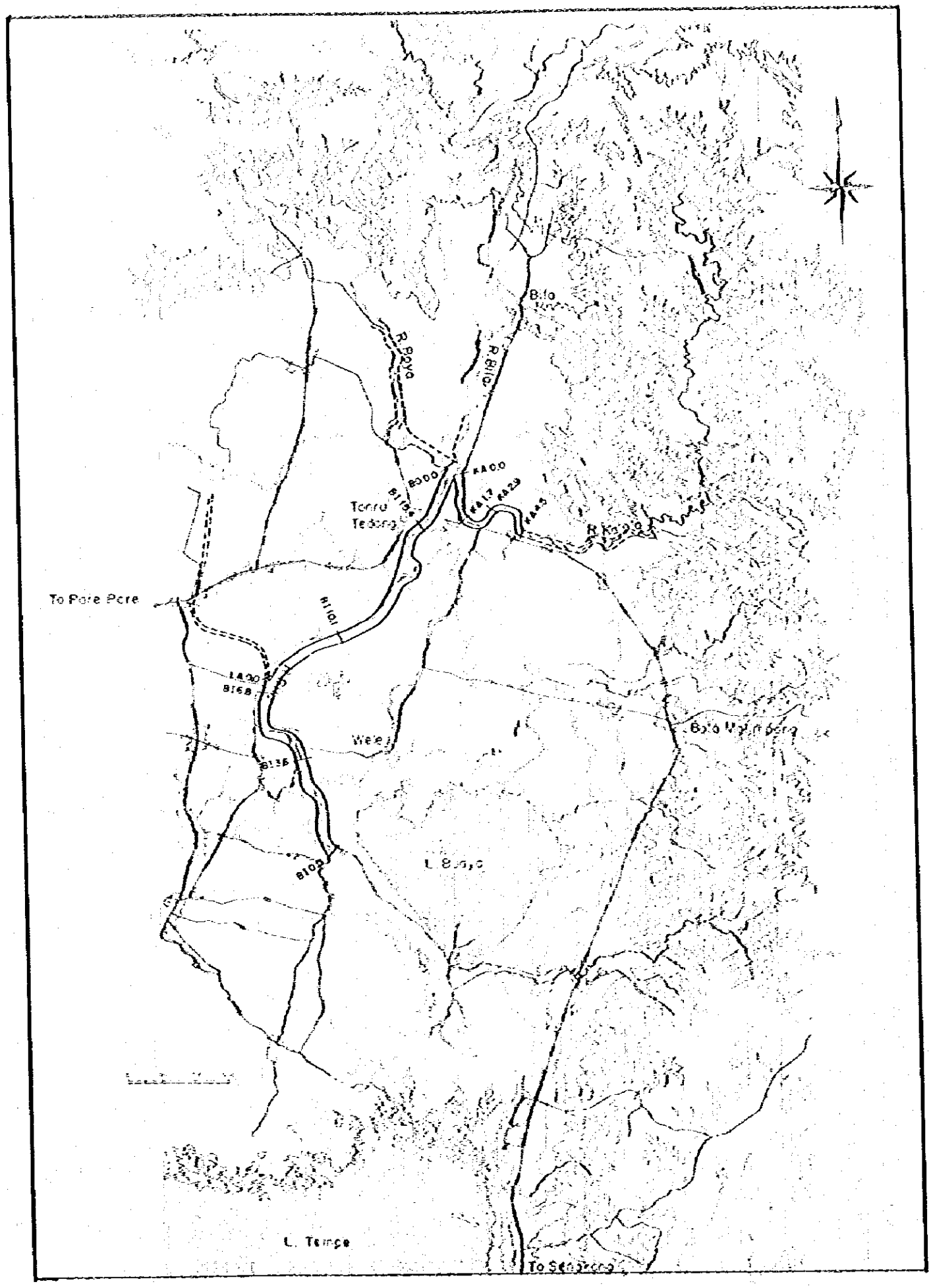


Fig. 4.1 PLAN 1 (IMPROVEMENT OF THE EXISTING RIVER CHANNEL)

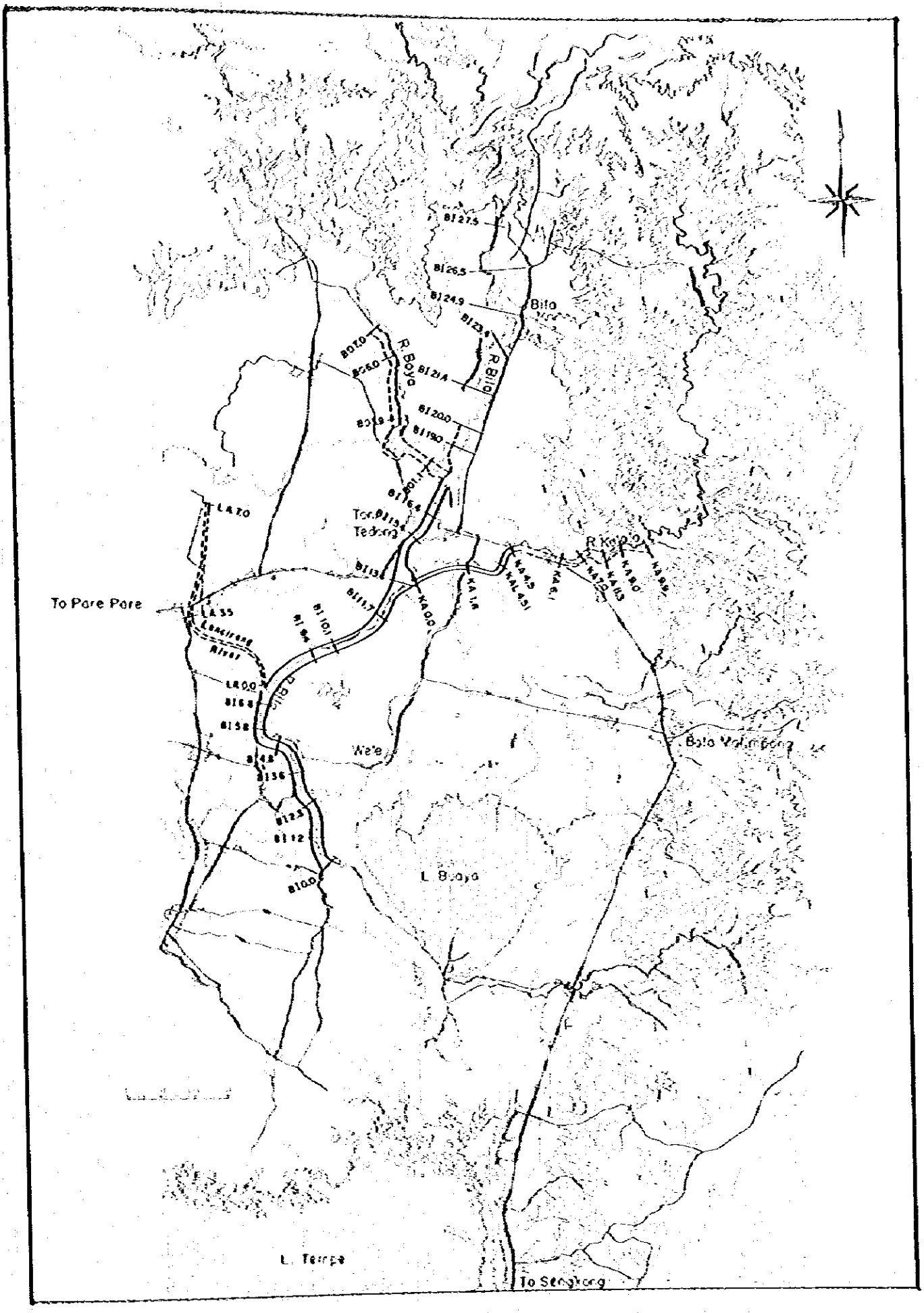


Fig. 4.2 PLAN 2 (IMPROVEMENT OF THE EXISTING RIVER CHANNEL WITH SHIFTING THE KALOLA RIVER TOWARD DOWNSTREAM OF TANRU TEDONG)

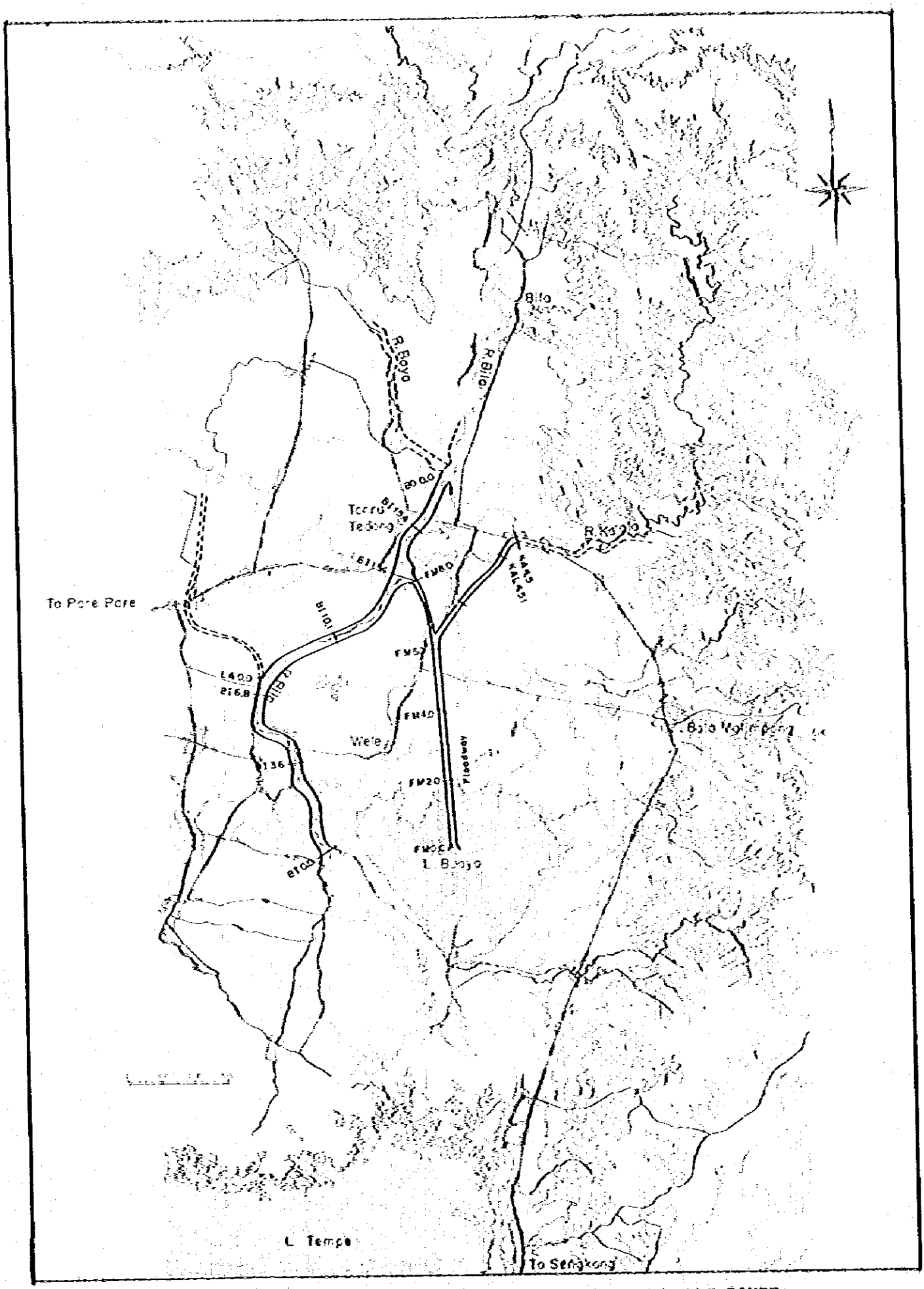


Fig. 4.3 PLAN 3 (CONSTRUCTION OF FLOODWAY ALONG THE ROUTE PROPOSED IN THE MASTER PLAN STUDY)

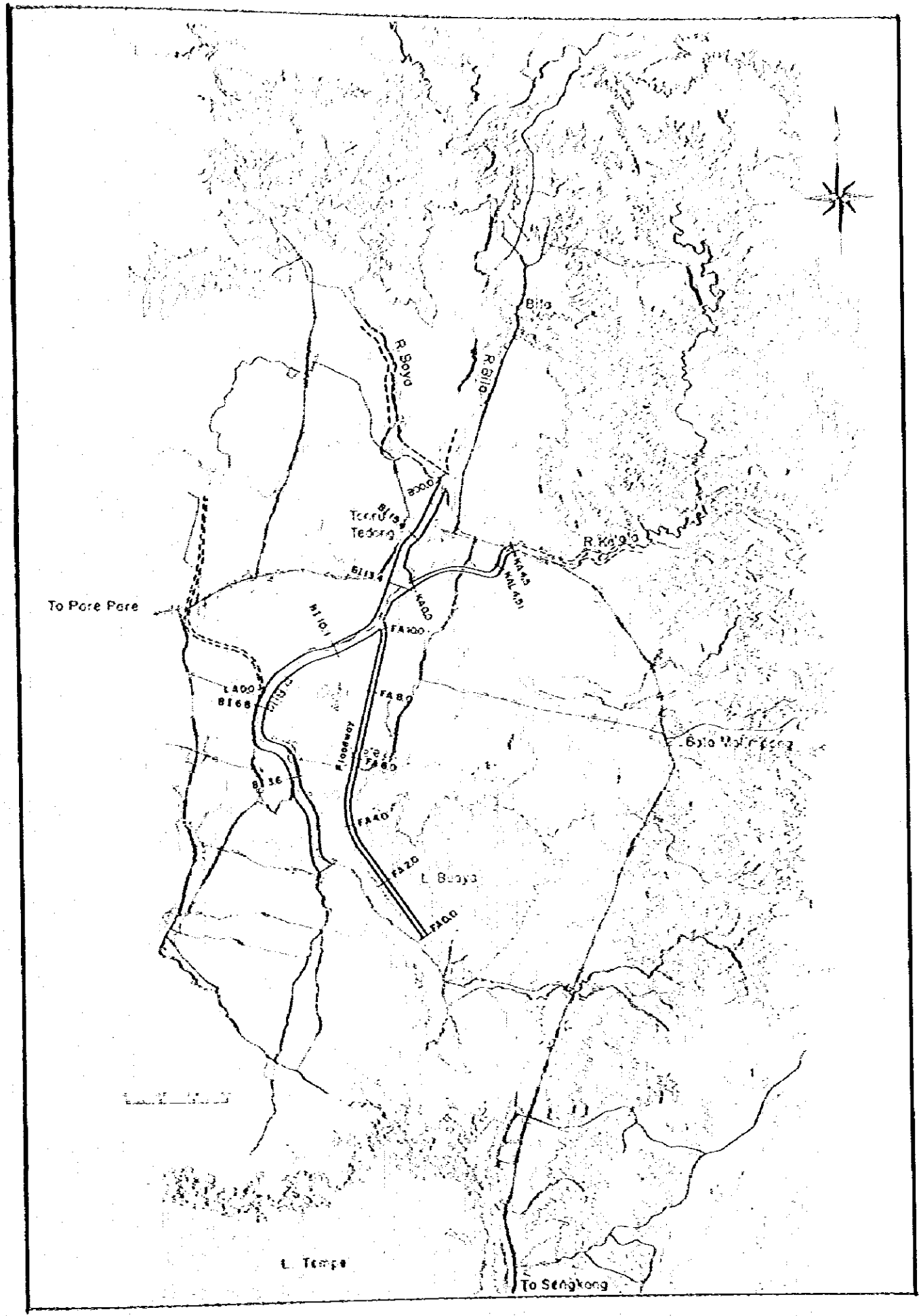


Fig. 4.4 PLAN 4 (CONSTRUCTION OF FLOODWAY ALONG THE ATE DRAINAGE CHANNEL)

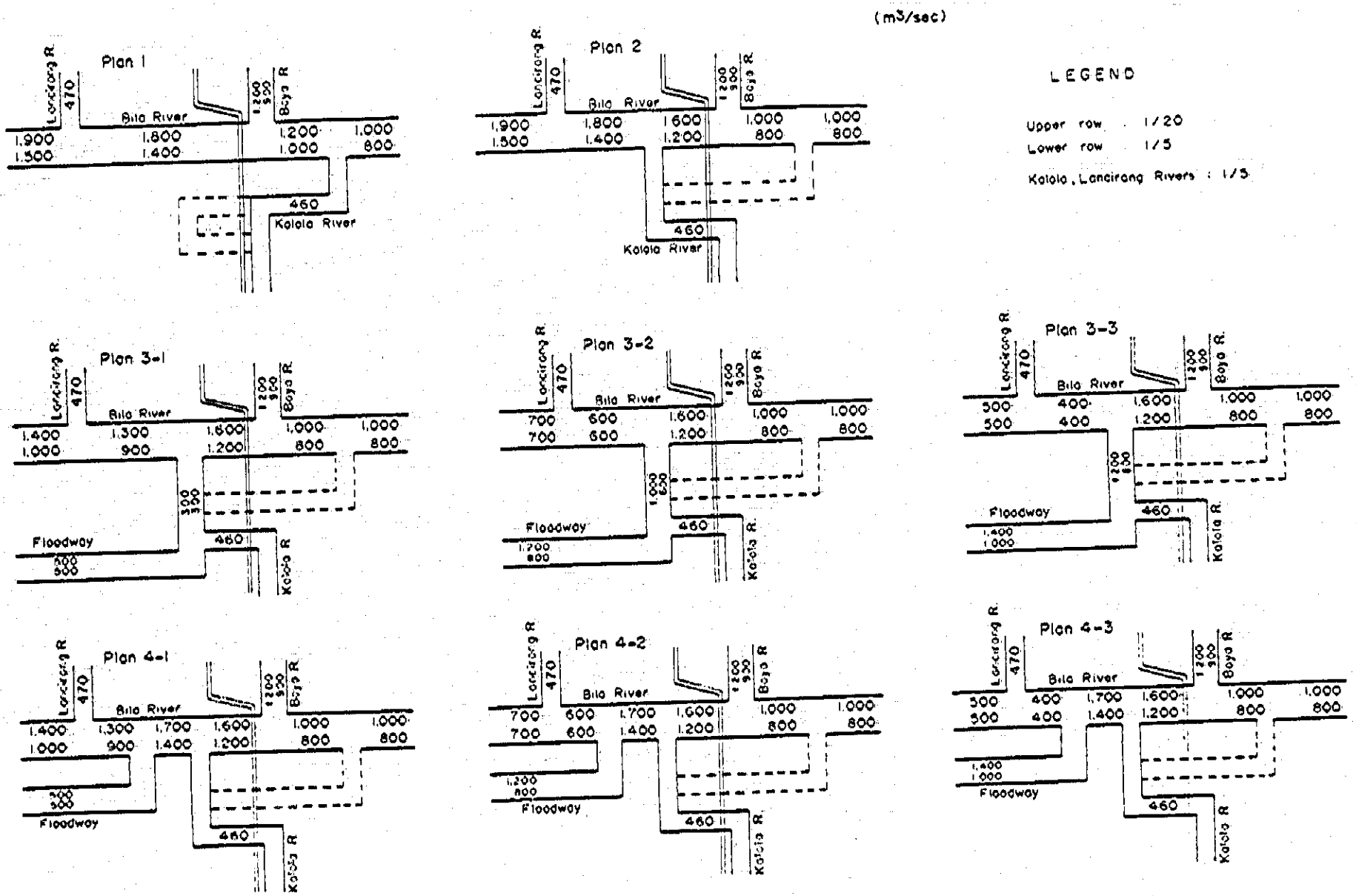
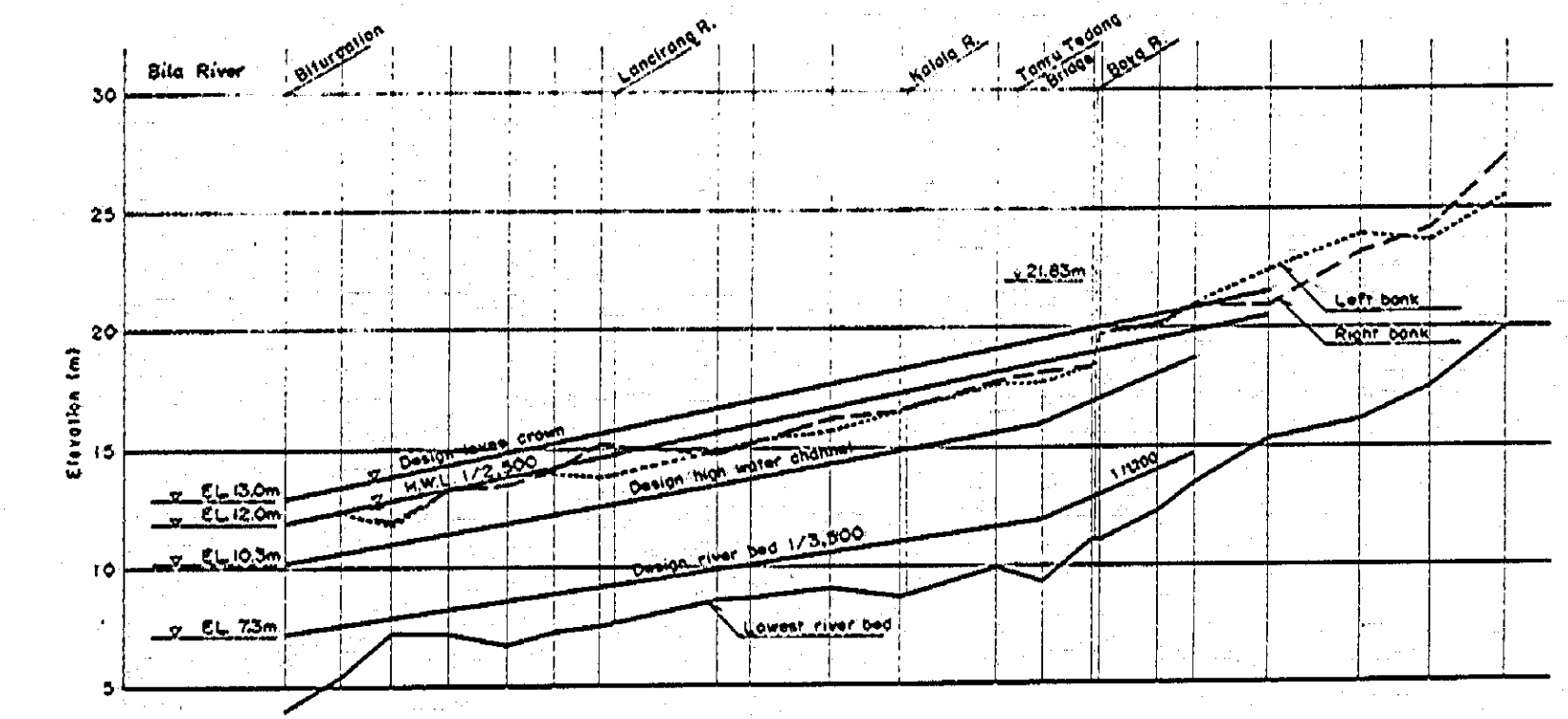


Fig. 4.5 DISCHARGE DISTRIBUTION OF BILA RIVER



Section No.	Distance (m) Between two sections	Accumulative
0	0	0
81 1.2	1 200	1 200
81 2.3	1 100	2 300
81 3.6	1 250	3 550
81 4.8	1 250	4 800
81 5.8	1 000	5 800
81 6.8	1 000	6 800
81 9.4	2 550	9 350
81 10.1	750	10 100
81 11.7	1 750	11 850
81 13.4	1 500	13 350
81 15.4	2 100	15 450
81 16.4	1 000	16 450
81 17.6	1 100	17 550
81 17.7	150	17 700
81 19.0	1 250	18 950
81 20.0	800	19 750
81 21.4	1 600	21 350
81 23.4	2 000	23 350
81 24.9	1 500	24 850
26.5	1 650	26 500

Fig. 4.6 DESIGN LONGITUDINAL PROFILE OF BILA RIVER

Section No	Between two sections	Accumulative	Distance (m)
FA 0.0	0	0	
FA 2.0	2 000	2 000	
FA 4.0	2 000	4 000	
FA 6.0	2 000	6 000	
FA 8.0	2 000	8 000	
FA 10.0	2 000	10 000	

Section No	Between two sections	Accumulative	Distance (m)
FM 0.0	0	0	
FM 2.0	2 000	2 000	
FM 4.0	2 000	4 000	
FM 6.0	2 000	6 000	
FM 8.0	2 000	8 000	

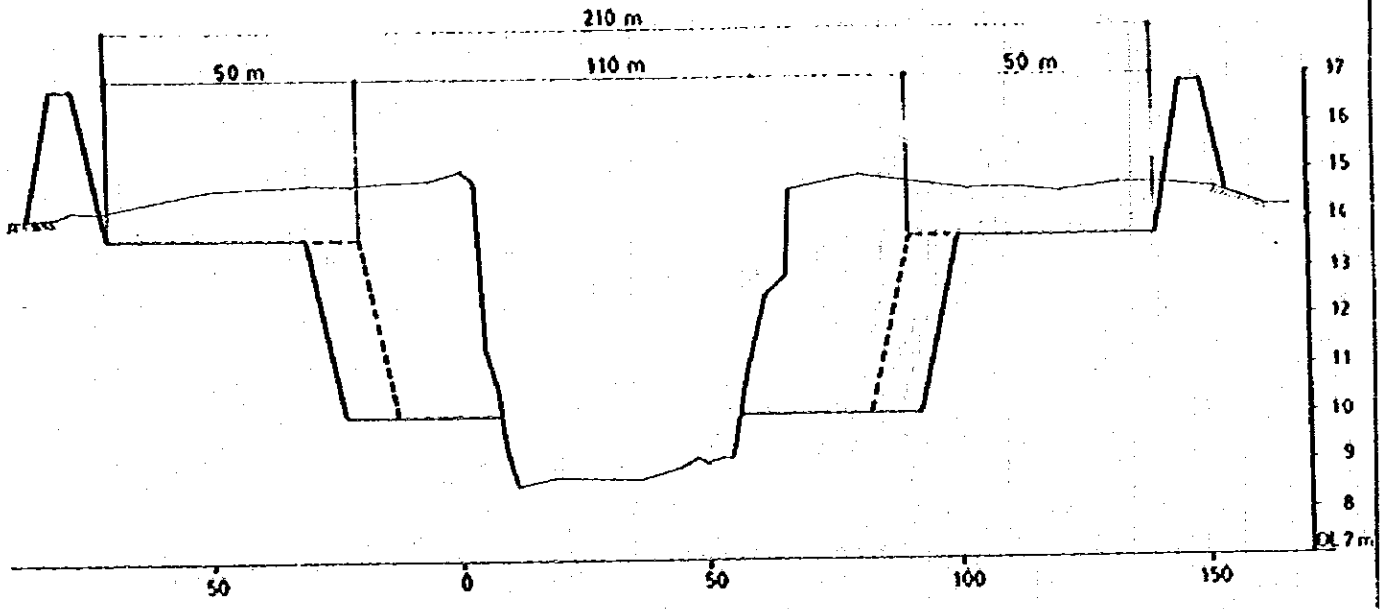
Fig- 4.7 DESIGN LONGITUDINAL PROFILES OF FLOODWAY

Fig. 4.8 DESIGN LONGITUDINAL PROFILES OF KALOLA

Fig. 4.9 DESIGN LONGITUDINAL PROFILE OF KALOLA

Fig. 4.10 DESIGN LONGITUDINAL PROFILES OF BOYA AND LANGIRANG

BILA RIVER (BI 10.1 Km)



KALOLA RIVER (KA 8.3 Km)

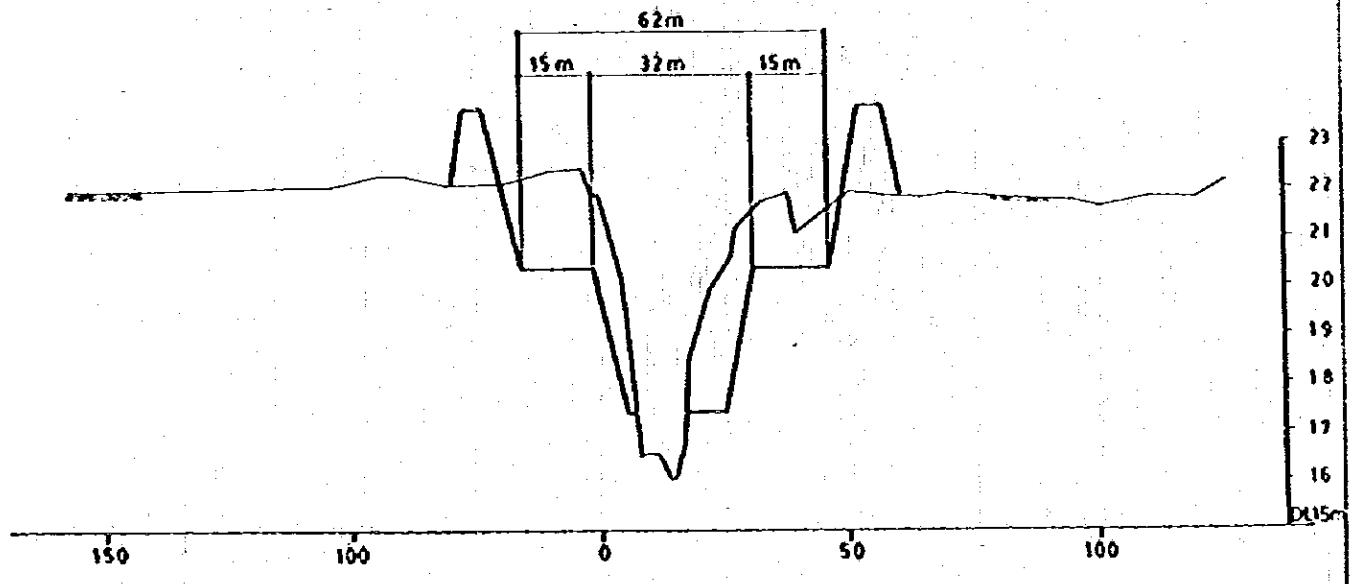
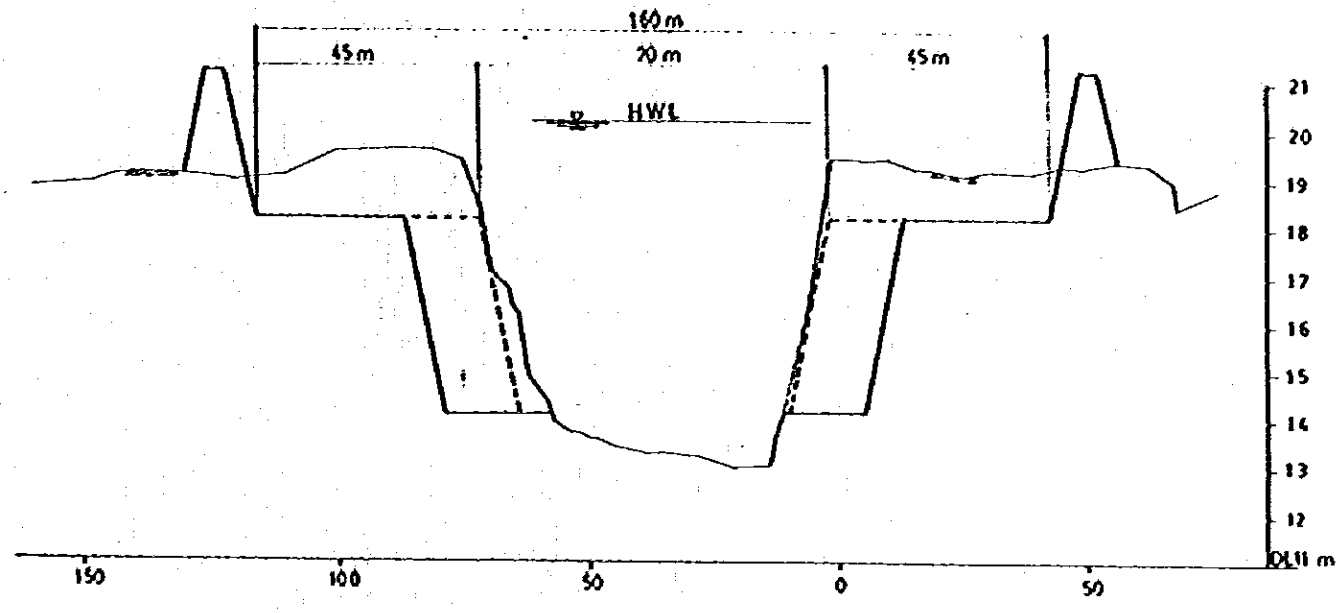


Fig. 4.11 TYPICAL CROSS SECTIONS OF BILA AND KALOLA

BOYA RIVER (3.9 Km)



LANCIRANG RIVER (3.5 Km)

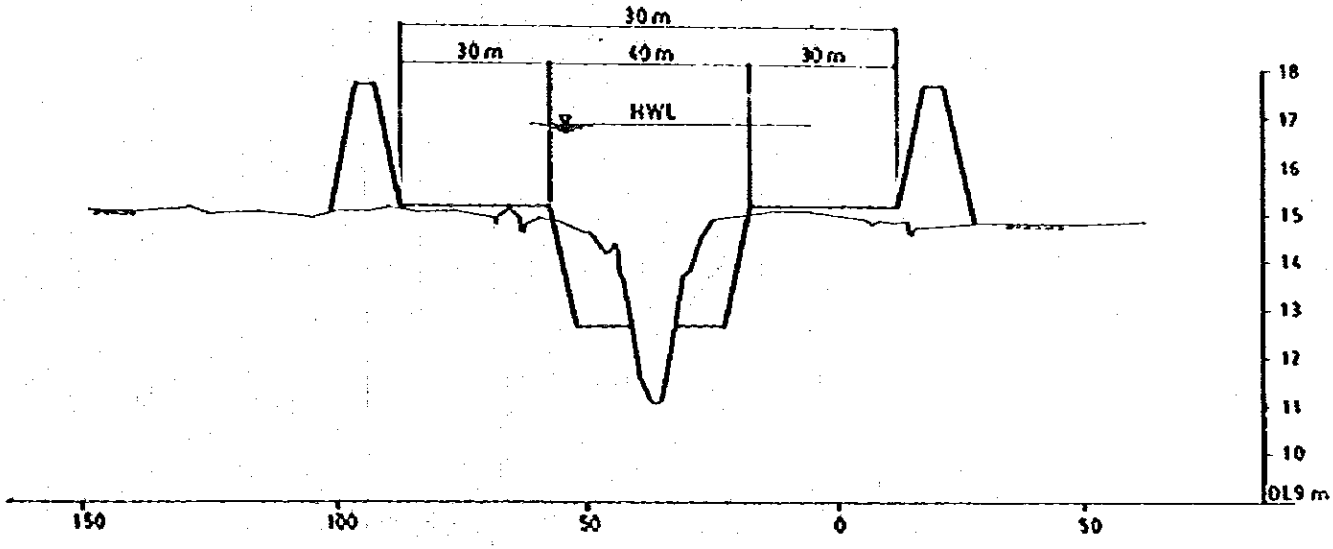
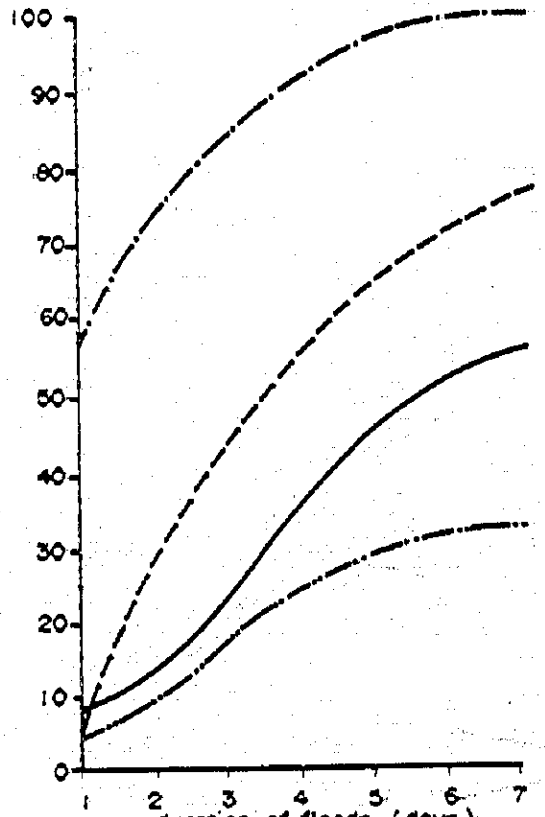


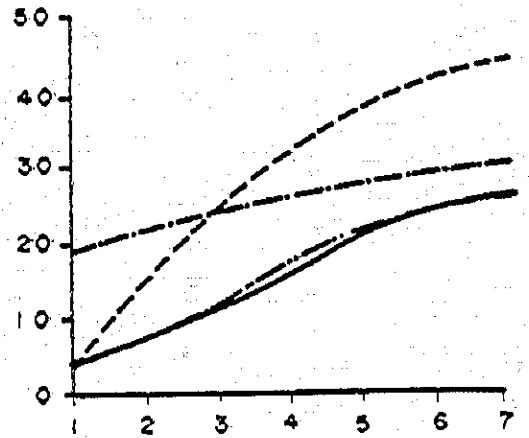
Fig. 4.12 TYPICAL CROSS SECTIONS OF BOYA AND LANCIRANG

Item	Stage	D.A.T. (day)	Point Height (cm)
———	Tillering	0 - 40	0 - 59
- - - - -	Booting	41 - 60	60 - 76
—·—·—	Heading	61 - 75	77 - 79
—··—··—	Ripening	76 - 90	80 - 100

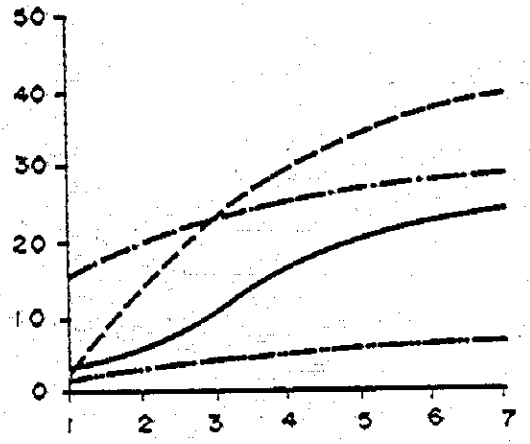
Days after Transplan Ting ⟶



Over Head Flooding



Flooding up to 75% Plant Height



Flooding up to 50% Plant Height

Source : Ministry of Agriculture and Forestry, Japan

Fig. 4.13 FLOOD DAMAGE RATE OF PADDY

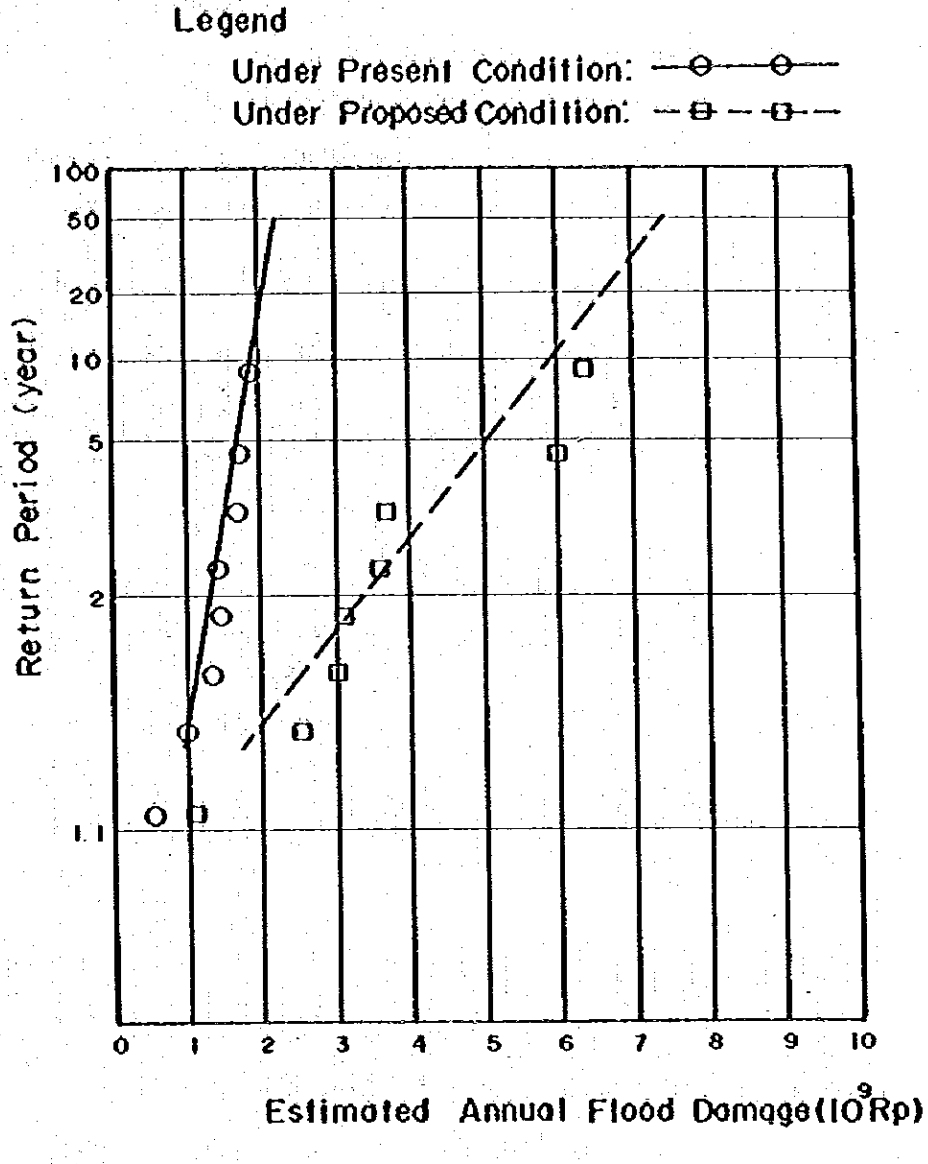


Fig. 4.14 RELATION BETWEEN RETURN PERIOD AND ESTIMATED ANNUAL FLOOD DAMAGES IN WHOLE AREA

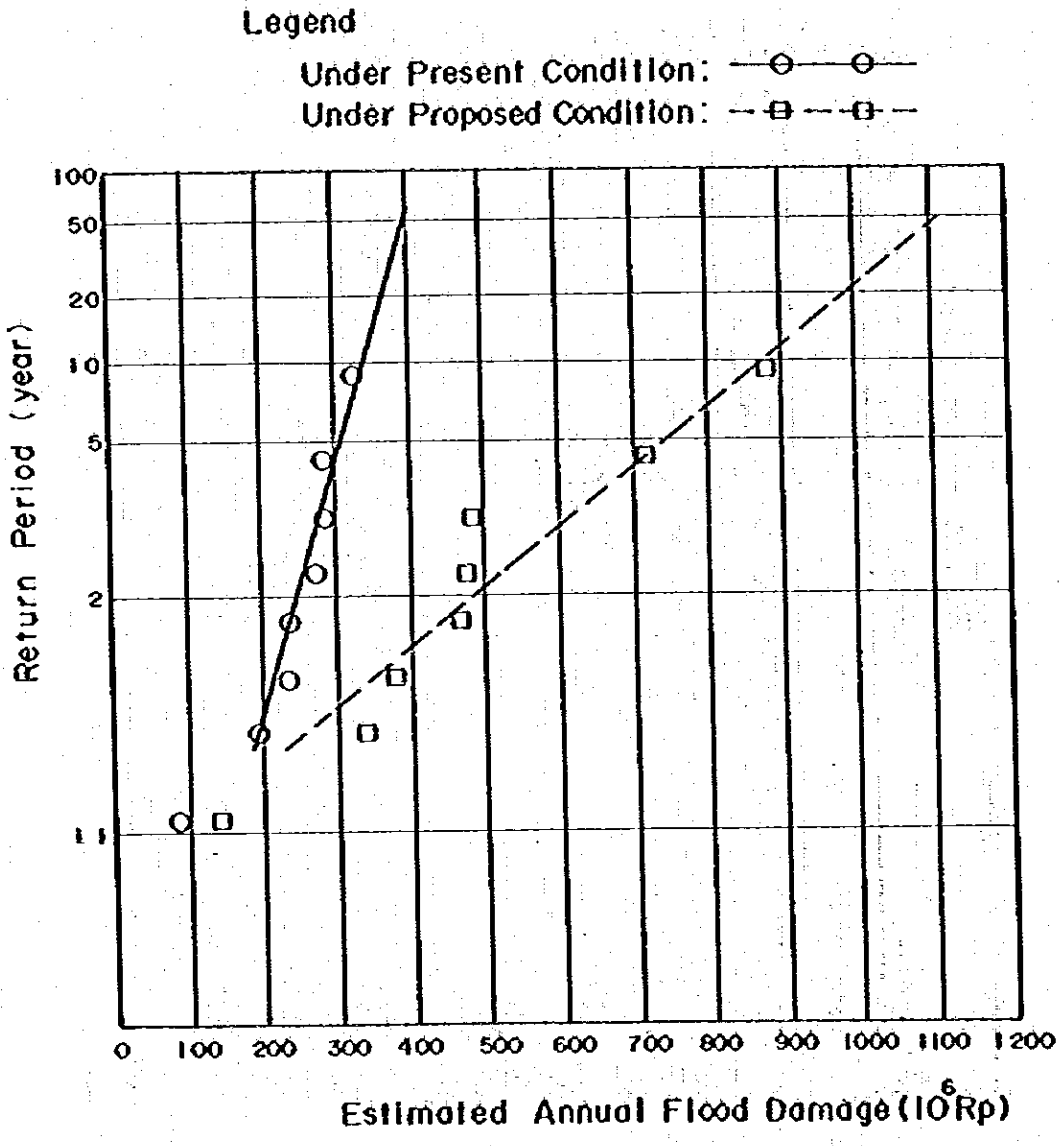


Fig. 4.15 RELATION BETWEEN RETURN PERIOD AND ESTIMATED ANNUAL FLOOD DAMAGES IN AREA AFFECTED BY KALOLA

ANNEX - X

WATERSHED MANAGEMENT

ANNEX-X WATERSHED MANAGEMENT

CONTENTS

ANNEX-X WATERSHED MANAGEMENT

1. GENERAL

The water sources for the Bila irrigation project would depend on the Bila and Kalola rivers. The catchment areas of these rivers are:

(Unit: ha)

Rivers	Catchment Area
Bila river	37,900
Kalola river	12,200
Total	50,100

The major objectives of the present study are (1) to clarify the existing condition of relevant watershed and present landuse and (2) to prepare a recommendation on the measures for land conservation in each watershed of the rivers relevant to the project.

The present status of the said catchment areas has been studied mainly on the basis of aerial photoes and topographic maps scaled 1:25,000. Field inspection has also been made to check the preliminary results of photo interpretation and data on afforestation, land conservation, etc. have been collected mainly from the Department of Forestry, South Sulawesi Province.

1.1 Present Condition of Watershed

(1) Bila river

The Bila river originates in Mr. Tallu and flows into Lake Tempe. The river collects three main tributaries, i.e., the Boya, the Kalola and the Lancirang rivers. They run across the flat alluvial plain and join to the downstream reaches of the Bila river. The river basin stretches over two Kabupatens of Wajo and Sidrap. The Bila river system has a catchment area of 1,368 km^2 in total at the river mouth. River length of the Bila is about 87 km from the headwaters to the river mouth. The elevation of the alluvial plain formed by the mainstream of the Bila ranges from about 6 m near Lake Tempe to about 30 m near the Bila water level gauging station. The alluvial plain has a flat topography sloping from north to south with a gradient ranging from 1/1,000 at the upper to 1/3,500 near Lake Buaya.

About 77% of the watershed of the Bila main stream are covered with forest and bush. The present land use in the watershed area is summarized as follows:

Land use category	Area	Proportional extent
	(ha)	(%)
Forest	24,200	63.9
Bush and scrub	5,700	15.0
Grassland	6,500	17.2
Paddy fields	1,000	2.6
Others (upland & villages)	500	1.3
Total	37,900	100.0

(2) Kalola river

The Kalola river originates from Mt. Bottolingerang with elevation of 262 m and meanders into the alluvial plain, passing through the narrow valley. Catchment area at the foothill is 122 km^2 and total catchment area at the confluence of the Bila river is 167 km^2. The present land use in the Kalola watershed is summarized as shown below:

Land use category	Area	Proportional extent
	(ha)	(%)
Forest	3,900	32.0
Bushes and scrub	1,700	13.9
Grassland	6,100	50.0
Paddy fields	400	3.3
Others (upland/villages)	500	0.8
Total	12,200	100.0

2. WATERSHED MANAGEMENT PLAN

2.1 Basic Concept

In the watershed, forests play an important role in conservation of soil and water resources. The forests generally fix the soils on the sloping land and control the excess percolation and surface run-off. As a result, the forests lower the maximum flood run-off and also stabilize the minimum discharge of the rivers. The forests prevent the watershed from soil erosion, therefore, the run-off water would be kept clean with good water quality. The forest areas in each watershed are:

Watershed	Catchment area	Forest area	Proportional extend
	(ha)	(ha)	(%)
Bila	37,900	24,200	63.9
Kalola	12,200	3,900	32.0
Total	50,100	28,100	56.1

About 65% of the Bila river watershed are covered with forest. The forest resources are, however, gradually depleted because of cutting of trees for planting cengkeh (clove tree) especially in the upper reaches of the Bila river. Grassland is dominant in the Kalola watershed and only 32% is covered with forest. With this in view, the basic concept for watershed management would be as follows:

(1) Soil and water conservation will have to be made through overall watershed management including reforestation and erosion control works.

(2) In due consideration of existing conditions of watershed areas the first priority must be given to reforestation.

(3) The present unrestricted cutting of trees in the forest areas will have to be controlled by the Department of Forestry. In particular, the trees on the ridges will have to be maintained. Once such trees are cut, natural regeneration is very difficult because of limited availability of soil moisture.

(4) Since over-grazing of livestock animals in the bush and grassland will cause damage to the newly-planted trees, animal grazing should also be controlled by the government officials.

(5) The erosion control works will be necessary in the seriously affected areas. The establishment of sand prevention forest and hillside wicker work will be recommendable for this purpose.

2.2 Reforestation

On the basis of basic concept mentioned above the following reforestation plan is considered:

(1) Tree species

Tree species for reforestation will have to be those which can improve the hydrological condition, assure high economic value and ecological fitness and be conform with the planning purpose.

Based on climate and topographic conditions of the Bila and Kalola river watersheds which have a range of elevation between 100 and 1,000 m, it is considered that the following tree species can be grown in this area:

(a) *Eucalyptus* sp.
(b) *Acasia auriculiformis*
(c) *Pinus merkusii*
(d) *Swetenia macrophycla*
(e) *Anthocephalus cadamba*

(f) Albizzia falcata
(g) Callophyllum sp

But the species of trees for reforestation have to fulfil the following conditions at least.

(a) Seedlings are easily multiplicated and low costed
(b) Seedlings are multiplicated in short term and
(c) Seedlings are easily growable under unfavourable natural conditions

In due consideration of these basic condition, Eucalyptus sp, Acasia auriculiformis, and Pinus merkusii would be selected for the reforestation in the Bila and Kalola watershed area.

(2) Areas for reforestation

The reforestation work will be necessary both in the Bila and Kalola river watershed. The Government is already aware of this matter and has paid attention to the Bila - Walanae watershed management.

Since PELITA I reforestation areas so far covered are about 15,200 ha in the Bila and Kalola river watersheds and the cost amounted to about Rp.180,000,000 as shown below:

Description	Reforestation area		Cost	
	Planning	Actual	Planning	Actual
	(ha)	(ha)	(10^3Rp.)	(10^3Rp.)
Before PELITA	-	57	-	-
PELITA I	350	270	-	-
PELITA II	9,100	7,900	146,320	106,240
PELITA III (Until 1980/1981)	5,769	5,619	78,713	72,803

Remark: -: No data
Source: Department of Forestry, South Sulawesi Province.

Although this reforestation has been progressed upto the present condition, the forest area both in the Bila and Kalola watersheds is still less than 60% of the entire watersheds. It is proposed that the forest area should be expanded of the total watersheds. Therefore the total area to be envisaged for reforestation will be about 14,400 ha as shown below:

(Unit: ha)

Rivers	Area
Bila river	6,100
Kalola river	8,300
Total	14,400

For reforestation works, the main problem is the shortage of labour for transplanting. Transplanting time generally takes place on the beginning of wet season and it is the same time for farmers to transplant the paddy seedlings.

(3) Preliminary cost estimate for reforestation

(a) Nursery requirement

Seedlings will be grown in the nursery for six months generally from April/May and transplanted in the beginning of wet season. The nursery will have to possibly be irrigated, though permanent irrigation facilities are not required. Nursery also needs fertilizer and chemical application, weeding and replanting.

One unit nursery; about 1 ha can produce about 400,000 seedlings. Based on planting density 3 m x 2 m and considering the survival rate, the nursery has to be established at the rate of one unit nursery per about 200 ha of reforestation area. Therefore, about 72 nurseries will be needed for 14,400 ha of reforestation area. According to the past experience of the Ministry of Forestry as the executor for implementation of the reforestation work, the total cost per unit nursery amounts to Rp.3,585,000 per ha as mentioned below:

(Unit: Rp.)

Nursery works	Amount
1. Preparation (Seed bed preparation, fertilizer, equipment, chemicals, foreman payment, roof etc.)	2,351,700
2. Sowing	825,000
3. Maintenance (Irrigation, weeding, replanting, fertilizer application, etc.)	408,000
Total	3,584,700

(b) Transplanting works

Since reforestation area generally has steep slopes, in transplanting works transportation of seedlings is laborious. Transportation and planting of seedlings will need 16.5 man-day/ha and 7.5 man-day/ha respectively. One labourer can carry and transplant about 100-200 seedlings in a day according to the field condition. The unit cost for transplanting work per ha is given below:

(Unit: Rp.)

Transplanting works	Amount
1. Field preparation	16,635
2. Controlling (payment for foreman)	5,760
3. Planting	
(1) Seedlings transportation	8,250
(2) Transplanting	3,750
4. Maintenance	5,610
Total	40,050

On the basis of such information, the cost required for the envisaged reforestation covering 14,400 ha is roughly estimated as follows:

(Unit: 10^3Rp.)

Item	Amount
Establishment of 72 nurseries	258,000
Transplanting Cost	577,000
Total	835,000

(4) Organization for reforestation

All the reforestation plan will have to be carried out by the Project for Planning and Establishment of Reforestation in watershed area (P3RPDAS) which was enforced by Presidential Degree No.8 in 1976. In 1981/1982 this project aims at reforestation of about 968,100 ha all over the country in 35 watershed areas as mentioned in Table 2.1. In South Sulawesi Province, there are 3 branch offices of the P3RPDAS, i.e. Jeneberang - Kelara, Saddang and Bila - Walanae. The total area of reforestation envisaged by these branch offices are about 51,000 ha of which 11,000 ha belong to Bila - Walanae branch office. The watershed areas under present study is managed by the P3RPDAS Bila - Walanae branch office. The office of the Bila - Walanae Watershed Project is located in Soppeng and has an implementation leader in each Kabupaten under the project. Organizational Structure of Reforestation Project in South Sulawesi is shown in Fig. 2.1.

Table 2.1 Planned Reforestation Work under P3RPDAS for the year of 1981/1982

(Unit: ha)

No.	Branch offices of P3RPDAS	Forest conservation work in existing forest area	New reforestation work	Total
1.	Krueng Aceng	5,500	3,000	8,500
2.	Wampu Sei Ular	-	16,000	16,000
3.	Asahan Barumun	9,000	50,000	59,000
4.	Inderagiri	3,000	13,000	16,000
5.	Agam Kuantan	5,000	20,000	25,000
6.	Batanghari	2,500	12,500	15,000
7.	Musi	50,000	100,000	150,000
8.	Ketahun	-	-	-
9.	Way Seputih	6,600	-	6,600
10.	Way Sekampung	10,000	4,000	14,000
11.	Ciujung Tl. Lada	11,500	4,000	15,500
12.	Ciliwung, Csd, Cnd	9,500	12,500	22,000
13.	Citarum	-	-	-
14.	Cimanuk	-	10,000	10,000
15.	Citanduy, Csgg.	-	20,000	20,000
16.	Serayu Luk Ulo	-	25,000	25,000
17.	Pemali Comal	-	9,000	9,000
18.	Jeratun Seluna	-	25,000	25,000
19.	Solo	-	48,000	48,000
20.	Gunung Kidul	2,000	25,000	27,000
21.	Pakis baru	-	12,500	12,500
22.	Brantas	-	25,000	25,000
23.	Sanpean	-	10,000	10,000
24.	Madura	-	21,000	21,000
25.	Riaukanan	-	-	-
26.	Kapuas	-	-	-
27.	Gorontalo Tondano	-	30,000	30,000
28.	Palu Ds	11,500	17,500	29,000
29.	Jeneberang Kelara	15,000	36,000	51,000
30.	Saddang	25,000	40,000	65,000
31.	Bila Walanae	11,000	-	11,000
32.	Sulavesi Tenggara	20,000	20,000	40,000
33.	Bali	-	20,000	20,000
34.	Dodokan	12,000	65,000	77,000
35.	Benain Noelaina	15,000	50,000	65,000
	Total	224,100	744,000	968,100

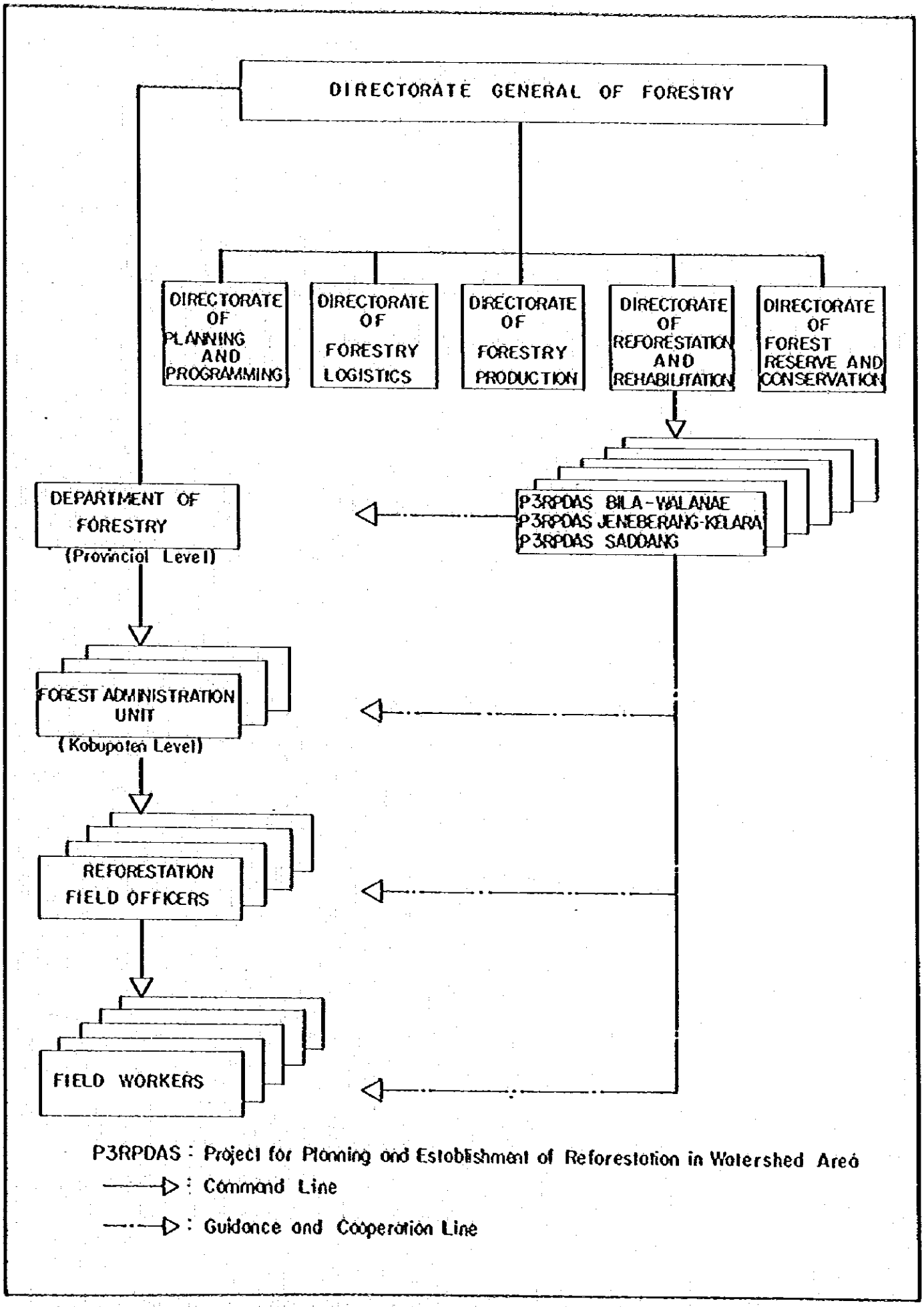


Fig. 2.1 ORGANIZATIONAL STRUCTURE OF REFORESTATION PROJECT IN SOUTH SULAWESI

ANNEX - XI

PROJECT EVALUATION

ANNEX-XI PROJECT EVALUATION

CONTENTS

ANNEX-XI PROJECT EVALUATION

1. GENERAL

The economic feasibility of the Bila Irrigation Project is evaluated by internal rate of return (IRR). Sensitivity analysis is also made corresponding to changes in accrued benefits, build-up period and project costs. The financial evaluation is also carried out by analyzing typical farm budget of average size farmer and by preparing financial statement of the project as a whole. The farm budget analysis is made for assessment of the net reserve of the average size farm. The analysis of financial statement of the project is made to evaluate the repayment capacity on the basis of the estimated fund requirement with assumed financial terms of the anticipated loan and the expected revenue from the project. The socio-economic impacts from the implementation of the project which would give the effects on the regional development also studied briefly.

2. ECONOMIC EVALUATION

2.1 Irrigation Benefits

The irrigation benefits of the Bila Irrigation Project primarily accure from the increased crop production due to stable irrigation water supplies. These benefits are estimated as the difference of the annual net production values under future with and without project conditions as mentioned in ANNEX-V.

The crop production gradually increases after commencement of the partial operation of the project. The construction work for the whole project area will be completed in 1990. After 5 years of build-up period, the full development stage will be attained in 1994.

The gross direct benefits are estimated at Rp.9,709 million per annum.

The production losses for 400 ha of paddy field due to submargence by the reservoir of Kalola dam are estimated at approximately Rp.157 million per annum, and the losses of farmland for project facilities total about 500 ha. These losses or negative benefits are counted in the estimate of the primary incremental production value by deducting these values from the net production value under future with project condition.

The net direct benefits amount to about Rp.9,552 million at the full development stage.

According to the proposed construction plan, the benefits will initially accrue in 1989 with the completion of the Bila intake weir and canals, and will gradually increase up to the full benefits. The build-up period for full development of paddy production is assumed to

be five (5) years after completion of the construction works. The annual benefits during the build-up period are considered to be linearly increased to the full benefits amount, as shown in Table 2.1.

2.2 Economic Cost

The financial costs for construction works, replacement of various equipment, and operation/maintenance of the project are estimated at 1981 price level as mentioned in ANNEX-VIII; these include some amount of transfer payment such as direct/indirect taxes and levies. The transfer payment is assumed to be equivalent to 10% of the direct construction cost. The economic cost of the project is obtained by deducting the transfer payment from the financial costs. Price contingency would not be incorporated in the economic cost. The land acquisition cost is not also included in the economic cost.

The total economic cost of the project is estimated to be Rp.35,178 million, consisting of Rp.20,670 million of foreign currency component and Rp.14,508 million of local currency component.

The engineering work for the project will commence in the middle of 1983 and be completed by the beginning of 1990; whole the project works are implemented within 7 years. According to the construction schedule proposed in ANNEX-VII and the work quantities, the flows of the project costs, O/M cost and replacement cost are estimated as shown in Table 2.2.

2.3 Economic Evaluation

(1) Internal rate of return

The project life is assumed to be 50 years from 1983 to 2032. The construction period will be 5.5 years from late 1984 excluding about one year and half for the detailed design. The project benefits will accrue in 1989 and increase year by year to attain the maximum level in 1994.

The O/M cost of the project will be initially disbursed in 1989 when the partial operation will commence. The O/M cost will increase linearly year by year and will reach the full amount in 1990 when the full operation will start for the whole project area of 9,800 ha. The gates and their attachments will be replaced once during the entire period of the project life and the O & M equipment for the irrigation system are replaced every ten years.

The economic internal rate of return (IRR) is calculated based on the economic benefit and cost flows given in Table 2.2. The economic IRR thus calculated is 15.3%. The result shows that the project is economically feasible.

(2) Sensitivity analysis

Sensitivity analysis is also made in respect to changes in annual irrigation benefits, project costs and over-run of build-up period. The following five cases to be anticipated are tested:

(a) Case-1: 20% cost increase and benefit as scheduled.

(b) Case-2: 20% benefit decrease and cost as scheduled.

(c) Case-3: 20% cost increase and 20% benefit decrease.

(d) Case-4: 2 year over-run of build-up period.

(e) Case-5: 2 year over-run of build-up period and 20% cost increase.

The results can be summarized below:

(Unit: %)

Item	IRR
Case-1	13.4
Case-2	13.0
Case-3	11.2
Case-4	14.1
Case-5	12.4

The Case-3 (20% increase of cost and 20% decrease of total benefit) indicates the lowest economic internal rate of return but still maintain economical feasibility. The project is insensitive against the anticipated changes.

3. FINANCIAL EVALUATION

3.1 General

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

3.2 Financial Cost

Based on the current market prices and costs as of the end of 1981, the financial cost of the project is estimated to be Rp.67,823 million comprising Rp.32,926 million for the local currency and Rp.34,897 million for the foreign currency as shown in ANNEX-VIII. In this estimate, the physical contingencies of 15%, and the price

contingency of 10% per annum for the local currency and 7% per annum for the foreign currency are considered to the direct cost. Table 1.2 in ANNEX-VIII shows the annual disbursement schedule of the said financial cost.

3.3 Capacity to Pay

For evaluating the project feasibility from the financial aspect of farmers, average farm budget analyses are made under both the future with project and the future without project conditions as shown in Table 6.2 in ANNEX-V.

The capacity to pay of average size farmer expected under the future with project condition would be Rp.302,810 in 1.54 ha area of average farm.

3.4 Water Charge

When the project facilities are completed and water is released to the farmers, but if the water charge is not to be collected, all the costs of the project will have to be born by the Government, and such expenditure will become a heavy burden to the Government. It is generally understood that the water charge is imposed to the water users, and the water charges thus collected is spent for the payment of O/M expenditures incurred to the project and for the repayment of the capital cost of the project. In Indonesia, however, the farmers traditionally do not pay any water charge directly, but contribute indirectly by paying the IPEDA tax.

The recent Government's decree and agreements made with the international lending institutions provide the conditions that the Government shall collect the water charges from the water users and recover the entire O/M cost, and that the rate of water charge shall be reviewed and possibly increased to recover a portion of the capital cost of the project.

As seen in Table 3.1, the annual O/M cost required for the project is estimated at Rp.345 million which is equivalent to about Rp.35,200/ha. This corresponds to about 15% of the capacity to pay aforementioned. On the other hand, the annual scale of amount for the repayment of the capital cost is estimated at about Rp.2,700 million for the foreign currency portion and Rp.2,556 million equivalent for the local currency portion, which are equivalent to Rp.275,500/ha and Rp.260,800/ha respectively. These repayments 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. With this view, the prospective water charge is recommended to be Rp.35,200/ha/annum, i.e., the required O/M cost. This prospective water charge would be the project revenue in the financial evaluation on the project.

3.5 Repayment of Project Cost

The financial evaluation of the project is made by examining the repayment capability for the capital cost of the project. For the examination, the cash flow table using the anticipated project revenue and fund requirement.

In the examination of repayment capability, it is assumed that the capital required for the project implementation will be arranged under the following conditions:

(1) For the foreign currency portion plus about 46% of the local currency portion (equivalence to 30% of total loan amount), the capital is financed by bilateral or international organizations with an interest of 3% per annum for a repayment period of 30 years including 10-year grace period.

(2) For the remaining local currency portion, the capital is financed by the budget allocation of the Government with no repayment.

Based on the above conditions, the repayment schedule for the foreign currency portion is prepared as shown in Table 3.1. This table indicates that the direct revenue from the water charge can not cover the annual repayment of the fund, except for the O/M cost, and the repayment of the fund has to be made by the subsidy of the Government.

4. SOCIO-ECONOMIC IMPACTS

Various socio-economic impacts are expected from the implementation of the project. They are:

(1) Foreign exchange saving

The rice production in Indonesia is still insufficient to meet the demand. It is reported that annual average import of rice has reached about 1.5 million tons in recent 5 years. With the Project, paddy production would increase to about 98,000 tons of dried paddy per annum from present annual production of about 34,000 tons. The expected annual increment of paddy production would be about 64,000 tons. Out of this increased production, it is expected that the marketable rice would be about 38,000 tons per annum after deducting the increased local consumption of rice. The estimated foreign exchange saving would amount to about US$12 million per annum for substitution of imported rice.

(2) Demonstration effects

With the completion of the project, the farmers in the surrounding areas, as well as those in the project area, become familiar with modern irrigation practices and their incentives for irrigation practices are much enhanced. In the succeeding projects, therefore, the build-up period is possibly shortened.

(3) Increase of employment opportunity

It is expected that the present unemployment in and around the project area is much improved by the project implementation. After completion of the project, the more intensive land use, resulting from a new year-round irrigation system, surely increases the employment opportunity. In addition, the people gains more experience, technical knowhow and skillfulness in the various working fields. These up-graded human resources provide motive power for the future development in the South Sulawesi region.

(4) Improvement of farm products

The quality of rice is improved through sufficient irrigation water supplies which make the crop damages minimum and assure the even maturing of rice. Such improved quality would increase the marketability of farm products.

(5) Environmental effects

The implementation of the project works would certainly lead to changes in rural economy. The domestic water supplies would be much improved through year-round supply of fresh water from the irrigation canals. The local transportation system would also be improved. This would contribute to the improvement of rural economic activities. For land and water conservation, it is recommended that reforestation work should be promoted in the relevant watersheds. The effects of reforestation would be manifold. It would contribute to stabilization of river flow, control of seasonal floods, prevention of soil erosion, etc. The increased crop production in the project area would stimulate the improvement of marketing system and also of agricultural support services.

Table 2.1 Economic Benefits Flow

	1989	1990	1991	1992	1993	1994
Planted Area (ha)						
Wet season paddy	4,600	9,800	9,800	9,800	9,800	9,800
Dry season paddy	2,600	9,800	9,800	9,800	9,800	9,800
Direct Benefit by Crop (10^6Rp)						
Wet season paddy	387	932	1,614	2,296	2,977	3,272
Dry season paddy	365	1,604	2,864	4,125	5,385	6,280
Annual Direct Benefits (10^6Rp)	752	2,536	4,478	6,421	8,362	9,552

Remark: The direct benefit during the build-up period is calculated to be linearly increased from 1989 to 1994. From 1994, the direct economic benefit continues constantly.

Table 2.2 Annual Costs and Benefits Flow

(Unit: 10^6Pp.)

Year	Year in Order	Cost			Benefit
		Capital	Replacement	O & M	
1983	1	1,320	0	0	0
1984	2	2,255	0	0	0
1985	3	3,600	0	0	0
1986	4	4,004	0	0	0
1987	5	6,700	0	0	0
1988	6	9,419	0	0	0
1989	7	6,252	0	168	752
1990	8	1,628	0	345	2,536
1991	9	0	0	345	4,478
1992	10	0	0	345	6,421
1993	11	0	0	345	8,362
1994	12	0	0	345	9,552
1995	13	0	0	345	9,552
1996	14	0	0	345	9,552
1997	15	0	0	345	9,552
1998	16	0	445	345	9,552
1999	17	0	445	345	9,552
2000	18	0	0	345	9,552
2001	19	0	0	345	9,552
2002	20	0	0	345	9,552
2003	21	0	0	345	9,552
2004	22	0	0	345	9,552
2005	23	0	0	345	9,552
2006	24	0	0	345	9,552
2007	25	0	0	345	9,552
2008	26	0	445	345	9,552
2009	27	0	445	345	9,552
2010	28	0	0	345	9,552
2011	29	0	0	345	9,552
2012	30	0	43	345	9,552
2013	31	0	55	345	9,552
2014	32	0	962	345	9,552
2015	33	0	0	345	9,552
2016	34	0	0	345	9,552
2017	35	0	0	345	9,552
2018	36	0	445	345	9,552
2019	37	0	445	345	9,552
2020	38	0	0	345	9,552
2021	39	0	0	345	9,552
2022	40	0	0	345	9,552
2023	41	0	0	345	9,552
2024	42	0	0	345	9,552
2025	43	0	0	345	9,552
2026	44	0	0	345	9,552
2027	45	0	0	345	9,552
2028	46	0	445	345	9,552
2029	47	0	445	345	9,552
2030	48	0	0	345	9,552
2031	49	0	0	345	9,552
2032	50	0	0	345	9,552

Present Worth

Interest (%)	Cost	Benefit
4	35,778	136,858
6	30,758	87,954
8	27,038	59,272
10	24,120	41,540
12	21,738	30,058
14	19,733	22,324
16	18,026	16,937
18	16,539	13,080
20	15,235	10,253

IRR: 15.3%

Table 3.1 Financial Cashflow Statement

(Unit: 10^6Rp.)

Year	Cash Outflow					Cash Inflow					
	Project Cost	O/M Cost	Replacement Cost	Loan Repayment	Total Outflow (A)	F/Loan	Government Budget	Water Charge	Government Subsidy	Total Inflow (B)	Balance (B) - (A)
1983	2,480	-	-	-	2,480	2,180	300	-	-	2,480	0
84	5,214	-	-	-	5,214	1,844	3,370	-	-	5,214	0
85	6,347	-	-	-	6,347	4,308	2,039	-	-	6,347	0
86	6,607	-	-	-	6,607	5,408	1,199	-	-	6,607	0
87	12,116	-	-	-	12,116	8,518	3,598	-	-	12,116	0
88	18,103	-	-	-	18,103	15,377	2,726	-	-	18,103	0
89	13,164	168	-	-	13,332	10,006	3,158	168	-	13,332	0
90	3,792	345	-	-	4,137	2,402	1,390	345	-	4,137	0
91	0	345	-	-	345	-	-	345	-	345	0
92	0	345	-	-	345	-	-	345	-	345	0
93	0	345	-	-	345	-	-	345	-	345	0
94	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
95	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
96	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
97	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
98	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
99	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
2000	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
01	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
02	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
03	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
04	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
05	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
06	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
07	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
08	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
09	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
10	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
11	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
12	0	345	43	4,142	4,530	-	-	388	4,142	4,530	0
13	0	345	55	4,140	4,540	-	-	400	4,140	4,540	0
14	0	345	962	-	1,307	-	-	1,307	-	1,307	0
15	0	345	-	-	345	-	-	345	-	345	0

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2020	38	0	0	345	9,552
2021	39	0	0	345	9,552
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2024	42	0	0	345	9,552
2025	43	0	0	345	9,552
2026	44	0	0	345	9,552
2027	45	0	0	345	9,552
2028	46	0	445	345	9,552
2029	47	0	445	345	9,552
2030	48	0	0	345	9,552
2031	49	0	0	345	9,552
2032	50	0	0	345	9,552

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87	12,116	-	-	-	12,116	8,518	3,598	-	-	12,116	0
88	18,103	-	-	-	18,103	15,377	2,726	-	-	18,103	0
89	13,164	168	-	-	13,332	10,006	3,158	168	-	13,332	0
90	3,792	345	-	-	4,137	2,402	1,390	345	-	4,137	0
91	0	345	-	-	345	-	-	345	-	345	0
92	0	345	-	-	345	-	-	345	-	345	0
93	0	345	-	-	345	-	-	345	-	345	0
94	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
95	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
96	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
97	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
98	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
99	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
2000	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
01	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
02	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
03	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
04	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
05	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
06	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
07	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
08	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
09	0	345	445	4,142	4,932	-	-	790	4,142	4,932	0
10	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
11	0	345	-	4,142	4,487	-	-	345	4,142	4,487	0
12	0	345	43	4,142	4,530	-	-	388	4,142	4,530	0
13	0	345	55	4,140	4,540	-	-	400	4,140	4,540	0
14	0	345	962	-	1,307	-	-	1,307	-	1,307	0
15	0	345	-	-	345	-	-	345	-	345	0