







Fig. 6.2 GENERAL LAYOUT OF ALTERNATIVE PLANS













Pig. 7.4 DESIGN STORAGE CAPACITY OF KALOLA DAM SITE



Fig. 7.5 CHOICE OF SPILLWAY DIMENSIONS



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Fig. 7.7 COMPARISON OF COMMAND AREA AND DESIGN DISCHARGE BETWEEN ORIGINAL AND REVISED CONDITIONS













ANNEX - VII

ANNEX - VII PROJECT IMPLEMENTATION SCHEDULE

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ANNEX-VII PROJECT IMPLEMENTATION SCHEDULE

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ANNEX-VII PROJECT IMPLEMENTATION SCHEDULE

1. BASIC CONSIDERATIONS

The Project implementation schedule is formulated on the following considerations:

The civil works to be executed by the Project are broadly classified into the main civil works and the tertiary development works. The civil works consist of the main project facilities such as Bila intake structure, Kalola dam, main and secondary canals, major drainage canals, construction roads. The tertiary development works include all the facilities below the tertiary outlets such as tertiary irrigation canals, tertiary drain, farm roads, farm ditches and their related structures.

The main civil works would be undertaken by a qualified civil work contractor/contractors with assistance of foreign technical services, which should be selected through competitive bidding, and the tertiary canals drains and roads, by the local contractors. The quaternary canal networks in the tertiary system would be constructed by farmers themselves under the quidasnce of the local government.

As the civil works of the Project include a large volume of earth works, the mechanized construction will principally be introduced in the main civil works. In order to increase the employment opportunity in and around the Project area, however, the manpower construction will be adopted as much as possible. The large scale civil work such as Bila intake, Kalola dam, main and secondary canals, major drainage canals and construction roads will be carried out mainly by heavy construction machinery. The tertiary development works will be carried out by manpower with minor construction equipment.

Taking into accout the large scale of the civil works, the Project would be implemented in three stages; (1) review of the existing design and detailed design of the main project facilities (2) construction of the main project facilities and (3) the detailed design and construction of tertiary development works. The tertiary development works would be initiated simultaneously with the main works, so that upon completion of the main works, immediate benefits can be envisaged.

2. IMPLEMENTATION SCHEDULE

The Project implementation schedule is as shown in Fig. 2.1. It includes the Project preparatory works and the construction works. The Project preparatory works will last 22 months including the time necessary for survey and mapping works, review of the existing design and the detailed design works, mobilization, and construction of offices and quarters. The construction works will last 68 months for the main civil works and tertiary development works. The Project mobilization which includes financing, legalization, establishment of the Project organization would have to be completed by the middle of 1983. In order to facilitate the early commencement of the construction works, the tendering should be promoted in the end of 1983.

3. CONSTRUCTION PLAN

3.1 General

In order to establish the construction time schedule, the workable days for each month are estimated based on the following assumptions:

(1) The following time lengths to suspend the work are set for respective ranges of daily rainfall.

Daily	rainfall	depth			rime	to be suspe	nđeđ
·	(ma)	1 a 2 a			** <u>*-</u>	(day)	
		1. 1. 1. <u>1</u> .					
	0 - 10	i se st	1	a se produce	. 1	Ó	
	10 - 30					0.5	
	30 - 50	na Roje				1.0	· ·
1	More th	an 50				2.0	
					· · ·		

- (2) Holidays including national holidays are excluded from the work day.
- (3) Main civil works consisting earth works and concrete works are suspended during the rainy season from April to June.

The work days are estimated to be 210 days per annum.

3.2 Construction Plan

3.2.1 Preparatory works

The preparatory works such as aerial photo mapping, detailed design, construction of office and guarters, and land acquisition will be started on March of 1983.

Aerial photo maps on a scale of 1:5,000 with a contour interval of 0.5 m would have to be prepared for the Project area of 20,000 ha. This map will be used for the design and construction of the tertiary development.

The review and improvement of the existing design of the canals and Bila intake structure will be started on March 1983. The design of the Bila intake structure will be completed by the end of October 1983, and the design of the canals, by the end of February 1984. The design of Kalola dam will be made by use of accumulated hydrological data on the Kalola river and be completed by the end of August 1984. The Project office and quarters will be completed prior to the major construction works. This will be started from the beginning of 1984 and completed by the end of 1984. The land acquisition for the Project facilities will be completed at least one year prior to the construction works.

3.2.2 Bila intake

The Bila intake structure consists of various components such as an intake weir, intake, bridge coupure channel, closure embankment, etc. The intake weir will be constructed by means of coupure channel. The time required for construction of the intake will be 57 months from the start of the preparatory works.

The construction of the weir will be carried out in the excavated site on the coupure channel in the dry condition. Since the weir consisting of mainly wet stone masonry will be constructed by labour force, the time required for completing the masonry works will be 3 years. The masonry works will be started on the beginning of March 1985 and completed by the end of February 1988.

After completing the intake weir, the excavation of coupure channel will be started and completed by the end of December 1989. Earthfilling of the closure embankment will be carried out by use of excavated material from the coupure channel, so that the embankment will be conducted in parallel with the construction of the coupure channel. Since these works involve a large volume of earthworks, the machinery works will mainly be employed.

3.2.3 Kalola dam

Time required for completing the Kalola dam will be about 56 month from the start of the preparatory works. The preparatory works consisting a coffer dam and pressure diversion tunnel will be started on the beginning of May 1985 and completed by the end of October 1986. Following to the completion of the diversion works, the main dam construction will be started on the November 1986, and it will be completed by the end of December 1989.

The concrete work of the spillway will be executed in parallel with the embankment work of the main dam, starting on the May 1987 and completing by the end of May 1989. The construction of intake and installation of gates will be executed in 7 months completing by the end of June 1989.

3.2.4 Canals, drains and construction roads

The construction of main irrigation canal including main inspection road will be carried out for 40 months from January 1985 through April 1988. In parallel with construction of the main irrigation canal, the secondary irrigation canals will be constructed in 25 mothhs, starting from June 1987. The construction of the irrigation canal will be executed from the upper reaches to the lower reaches. In the rainy season, the earthworks will be suspended and a main effort will be paid to the construction of related structures. The excavated materials from the canals will be used for embankment of canals and inspection roads.

The construction road for access of constructing the Project facilities will be started on Janaury 1985, parallel with the main canal construction. The inspection roads will also be use of access during the construction. The lack of embankment material of canals and inspection roads will be obtained from excavation in drainage canals. The major drainage canals will be executed for the period from January 1987 to the end or Pebruary 1990.

The pavement of the inspection roads and construction roads will be made at the final stages of respective construction periods. The construction roads will be transferred as the village link roads.

3.2.5 Tertiary development

The detailed design of the tertiary development will be started from September 1984 based on the aerial photo maps and field survey. The construction will be executed in stagewise. The construction will be started on October 1986 from the upper part of the Project area, and be completed by the end of February 1990.

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Fig. 2.1 PROJECT IMPLEMENTATION SCHEDULE

ANNEX - VIII

COST ESTIMATE



ANNEX-VIII COST ESTIMATE

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ANNEX-VIII COST ESTIMATE

1. CONSTRUCTION COST

1.1 General

The following considerations are taken for the cost estimate of the Project:

(1) The exchange rate used in the estimate is:

$$US$1.0 = Rp.625 = ¥220$$

- (2) The construction works would be executed on the contract basis; main civil works, such as Bila intake, Kalola dam, main and secondary canals, etc. would be constructed by contractors selected through competitive bidding and the tertiary development work, by local contractors. The construction machinery and equipment required for the construction works would be provided by the contractors themselves. Therefore depreciation cost of the machinery and equipment is considered in the estimate of the construction cost, instead of the procurement cost of machinery and equipment.
- (3) The construction cost comprises foreign currency and local currency portions. Local currency portion is estimated on the basis of the current price in South Sulawesi in 1981 and of the data obtained from the on-going and completed irrigation projects around the Project area. Foreign currency portion is estimated based on the CIF prices at Ujung Pandang. The currency is classified into local and foreign portions according to the following criteria;
 - (a) Local currency portion
 - (i) labour wage
 - (ii) sand, gravel, stone and wooden materials
 - (iii) fuel, oil, etc.
 - (iv) expenses and fees of engineering services for local consultants
 - (v) inland transportation charge
 - (vi) transfer payment for local portions, such as general expenses, taxes and levies
 - (vii) minor works

(b) Poreign currency portion

- (i) reinforcing steel bars and other structural steel
- (ii) cement
- (iii) major metal works
 - (iv) depreciation cost of construction machinery and equipment
 - (v) expenses and fees of engineering services by foreign consultants
- (4) In the estimate of the construction cost of the quaternary system, only the costs of materials necessary for the construction of the related structures are included, since such works would be executed by farmers themselves under the guidance of the Government.
- (5) The physical contingency related to the construction quantities is set at 15% of the direct cost in view of the preliminary nature of the estimate. The price contingency of 7% per annum for the foreign currency portion and 10% for the local currency portion is included in the estimate.
- (6) The associated costs to be financed by the Government, such as the cost for strengthening the extension services, facilities of the water users' association, and improvement of the social infrastructures are not included in the estimate.

1.2 Estimate of Construction Cost

The construction cost of the Project is estimated at Rp.67,823 million equivalent, comprising Rp.32,926 million of local currency and Rp.34,897 million equivalent of foreign currency. The summary and breakdown of the cost estimate are as shown in Table 1.1 and Table 1.3 through Table 1.10.

The basic prices of local materials and labour wages used in the estimate and the unit rates for major work items are as shown Table 1.12, Table 1.13 and Table 1.14, respectively.

1.3 Annual Disbursement Schedule

The annual disbursement schedule is worked out based on the construction time schedule as shown in Table 1.2. The summary is as shown below:

	<u> </u>		(Unit:	Rp. 10 ⁶)
Year	Foreign Currency	Local Currency		Total
1983	1,520	960	·	2,480
1984	1,286	3,928		5,214
1985	3,004	3,343		6,347
1986	3,771	2,836		6,607
1987	5,940	6,176		12,116
1988	10,723	7,380		18,103
1989	6,978	6,186		13,164
1990	1,675	2,117		3,792
Total	34,897	32,926		67,823

2. ANNUAL OPPRATION AND MAINTENANCE COSTS

Annual operation and maintenance costs at the full development stage is estimated at Rp.344,840 \times 10³, comprising the costs for; (1) operation and maintenance cost of the project offices including personnel cost, (2) operation and maintenance cost of the project facilities. These costs are shown in Table 2.1

3. REPLACEMENT COST

Some of the Project facilities, especially equipment and mechanical works have some shorter useful life than the civil works, and require replacement at a certain time within the Project useful life.

The replacement costs and the useful life of those facilities are listed in Table 3.1.

THE BILA IRRIGATION PROJECT

VIII-4
			(Unit:	10 ⁶ Rp.)
	Item	Total	Foreign Currency	Local Currency
1.	Preparatory Works	1,718	698	1,020
2.	Bila Intake	2,665	1,774	891
3.	Kalola Dam	7,656	5,456	2,200
4.	Irrigation Canals and Roads			
	- Trrigation canals and inspection roads	8,208	4,574	3,634
	- Drainage canals	1,343	1,063	280
	- Construction road	780	491	289
5.	Tertiary Development	4,485	444	4,041
6.	Office and Quarters	640	-	640
	<u>Sub-tótal</u>	27,495	14,500	12,995
7.	Land Acquisition	2,370	-	2,370
8.	O & M Equipment	992	942	50
9,	Administration Expenses	612	-	612
10.	Engineering Services	4,889	4,529	-360
11.	Physical Contingency	5,454	2,996	2,458
	<u>Sub-total</u>	14,317	8,467	5,850
	Total	41,812	22,967	18,845
12.	Price Contingency	26,011	11,930	14,081
•	GRAND TOTAL	67,823	34,897	32,926

Table 1.1 Summary of Construction Cost

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Table 1.2 Annual Disbursement Schedule of Construction Cost

	TOP		1983	ĥ	84	361	Ś	198	ف	198	5	1988		198		199	o
Description	P*C	3	LC LC	D 4	3	L L	ន	D 1	R	ЪĈ	3	PC L	2	U L	3	ñ	3
L. Preparatory Work	698	1,020	•	349	510	349	\$10	1.	•	,	* # ,		1	Í.	1		1
2. Bila Intake	1,774	168	•	•	3	155	216	183	254	183	254	1,245	162	œ	نە	I	1
3. Xalola Dam	5,456	2,200	•	•	•	208	76	878	303	728	222	1,540	519	1,412	565	690	515
L. Canals & Roads											:				. '		
(1) Canals & inspection roads	4,574	3,634	1	•	•	597	453	595	453	1.320	1,048	1,442.1	.170	622	210	t	ı
(2) Drainage canals	1,063	280	1 1	!	•	È.	•	1	*	340	8	340	8	340	68	4	ส
(3) Construction roads	167	289	•	•	E .	167	86	162	96	162	56	•	i I	•	."	a - 1	ł
5. Tertlary System	444	4,041	•	1	•		•	31	283	129	1,172	129.1	.172	129	172	8	242
5. Office and Quartors	ľ	640	•	•	640	•		:		•	£	1	•	1	•	•	1.
Sub-total	14,500 1	2,995	•	349	1,150	1,474	1,353	1,649	1,389	2,862	2,881	4,696 3	113	2,511 2	.341	759	768
7. Land Acquisition	•	2,370	- 570	I	1,300	ı	200	.			ľ	•	1		° ,∎°	Ĩ	1
3. O & M Equipment	942	8		ŧ		ſ	•	1	8	ŧ.	i	471	Ş.	471	25	1	1
Administration Expenses		612	- 46 -	•	69		88	•	Tot	Ľ	101	1.3 - 	tor)	97	•	2
). Engineering Service	4,529	360	1,155 74	ŞÇ	48	519	44	489	41 14 1	580	49	640	5 5	\$49	47	33	m
. Physical Contingency	2,996	2,458	173 103	137	385	299	298	351	130	546	455	871	494	230	376	119	11
Sub-total	8,467	5,850	1,328 793	104	1,801	818	930	840	372	1,096	605	1,982	674	1,550	545	អ្វ	130
Total	22,967 1	8,845	1,328 793	1,050	2,951	2,292	2,283	2,689 3	.,761	3,958	3,486	6,678 3	787	4,061 2	, 886	116	868
t. Price Contingency	1,959,11	4.081	192 167	236	977	712	1,060	1,082 1	,075	1,982	2,690	4,045 3	, 593	2,917	300	264	612.1
CRAND TOTAL	34,897	12.926	1.520 960	1,206	3,928	3,004	3,343	3,772	1,836	5,940 4	5.176	10,723 7	380	6,978 6	,186	1,675	1112

Price contingency of item 12 is calculated from the standpoint 1981 based on the annual increase rates of 7% and 10% for the foreign currency and local currency portions respectively. <u>ମ</u>

VIII - 6

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1. Initate Wir 5.			Unit	Q'LY	FC	Cost (1035p.)	fickal
Backfill spresifing a1 8,600 2,700 173 2,500 Concrete works a1 100 2,661 502 1,985 2,462 Pelnforced socrette a1 100 2,661 4,664 4,270 Pelnforced socrette a1 35,200 453,913 54,312 293,26 Gavel zetallag a1 35,200 -52,112 22,714 96,721 22,712 22,714 96,721 22,712 22,714 96,721 23,725 Gavel zetallag a1 5,900 -50,723 144,65 35,720 150,723 144,65 Stresting (75 a1 6,600 315 16 33 5,300 66,452 15,723 144,65 Stresting (75 a1 6,200 215 14 23 35	۱	Intake Veir				<u></u>	10131
compaction 5 6,000 7,700 133 2,200 Definition with al 100 2,664 1,664 4,322 Painforced bar bit 10 4,210 143 4,610 Darm work bit bit 1,110 4,112 2,232 Darm work bit bit 1,111 1,111 2,231 2,31 2,31 2,31 2,31		Backfill spreading	-1	0 6 60			
Concrete works -		coepaction		8,600	2,139	173	2,903
Pelnforced socretie al 100 2,64 1,64 4,20 Parts York al 300 - 1,116 1,111 Basony York al 300 - 1,116 1,111 Basony York al 300 - 1,116 1,111 Basony York al 300 - 22,712 22,712 22,712 22,712 22,712 22,712 22,712 22,714 35,750 5500 - 5501 5501 - 52,724 95,757 5502 - 52,714 95,757 5502 - 561,101 5503 5503 5503 5503 5503 560 315 16 333 7575 al 600 315 16 333 533 560 513 23 513 23 513 23 513 23 513 133 13 51 513 56 513 56 513 513 513 513 513		Concrete works	. –	0,000	203	1,985	2,495
Petatorces law too 10 4.13 5.13 4.116 1.11 Busony work a1 350 - 1.16 1.11 Busony work a1 35,290 453,248 514,112 232,74 Gravel laxialling a1 5,500 - 56,274 95,274 Cravel laxialling a1 5,500 - 56,274 95,275 Total (1) 664,652 16,278 144,69 Parameter laxialling a1 5,000 155 16 23 Total (1) 664,121 655,119 1,123,24 Intake Structure a1 5,000 135 16 23 Intake Structure a1 1,200 131 23 13 23 Intake Structure a1 1,200 131 23 24 24 24 24 24 24 24 24 24 24 24 24 24 24 24 24 <td></td> <td>Feinforces concrete</td> <td><u>n</u>3</td> <td>100</td> <td>2.564</td> <td>1.664</td> <td>4 328</td>		Feinforces concrete	<u>n</u> 3	100	2.564	1.664	4 328
Tota work az 300 11.11 1116 1111 Mainory Work az 300 11.11 1112 233.22 Mainory Work az 300 - 51.348 51.4112 233.22 Gravel zetalling az 5.500 - 50.412 23.412 23.412 Total (1) - - 504 55.900 - 50.413 51.90 Intake Structure - - 5.900 66.452 78.278 144.60 Dicawoody az 5.1000 66.452 78.278 144.60 Dicawoody az 5.1000 66.452 78.278 144.60 Dicawoody az 1.200 112.20 144.60 23.31 i V/R az 1.200 12.20 142 544 66 Spreading i C/S az 1.200 122 531 65 81 i C/S az 1.511 1.921 165 7.62 48 66 Spreading i C/S az 1.520 1.511 1		Peinforce3 tar	toa	10	4.210	143	4 618
Moden gate a) 55,200 633,498 513,112 232,74 Gate a) 5,500 - 56,274 95,274 Gate a) 5,500 - 56,274 95,274 Gate a) 5,500 - 56,274 95,274 Total (I) 664,452 16,278 144,69 2. Intake Structure - - 5,000 315 16 2. Intake Structure - - - 664,452 16,278 144,69 2. 1,075 - - - 1,200 313 23 53 3. 1,200 317 43 65 - 2,690 162 44 66 Spreading in G/S - 2,690 162 46 66 </td <td></td> <td>FOR WORK</td> <td>£?</td> <td>300</td> <td></td> <td>3.116</td> <td>1.116</td>		FOR WORK	£?	300		3.116	1.116
Control Section Section <t< td=""><td></td><td>Masonry Work</td><td><u></u>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</td><td>35,299</td><td>453,943</td><td>534,312</td><td>938,260</td></t<>		Masonry Work	<u></u> , , ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	35,299	453,943	534,312	938,260
Creared zetailing a) 5,999 - 96,724 96,724 Total (1) 630 - 504 50 50 50 2. Intake Structure 630 - 504 50		Gables	E 2	32	÷	22,142	22,742
Total (1) 630 - 504 550 2. Intake Structure 641,121 659,119 1,127,24 Wet store assority a3 5,300 66,652 18, 126 19 Decavation; 7/5 a3 6,00 115 16 39 i V/R a3 1,200 513 28 55 j V/R a3 1,200 513 28 55 j V/R a3 1,200 131 16 39 j V/R a3 1,200 131 28 55 spressing j C/S a3 1,200 131 28 55 spressing j C/S a3 1,514 1,521 105 2,00 spressing j Systemating to spoil arcs j T/S a3 1,514 1,521 105 2,00 j V/R a3 1,514 1,521 105 2,00 100 100 100 100 100 100 100 100 100 100 100 100 </td <td></td> <td>Gravel setaling</td> <td>n.3</td> <td>5,900</td> <td>-</td> <td>96,274</td> <td>96,274</td>		Gravel setaling	n.3	5,900	-	96,274	96,274
tell (1) colspan="2">colspan="2"colspan="2">colspan="2"colsp		viores accounty	■ ³	630	-	. 504	504
2. Intake Structure 2. Intake Structure 2. Intake Structure Net Store essentry 2. 3 5,300 66,62 78,278 144,66 Excavation; 1/5 3 6,00 315 16 33 i W/R 3 1,200 513 23 55 i W/R 3 1,200 617 43 66 Corgacition; C/S 3 2,400 142 554 65 i C/S 3 1,200 151 65 81 i C/S 3 1,514 1,921 165 2.00 i C/S 3 1,534 1,921 165 2.00 i C/S 3 1,534 1,921 165 2.00 i M/R 3 13 51 16 2.00 17.12 1.20 i M/R 3 13 51 1.65 81 1.51 1.66 66 66 66 6.0 1.53 1.60 1.53 2.00 1.16 2.01		Total (1)			454,121	659,119	1,123,249
Wet store samp #3 5,300 66,452 78,228 144,69 Decavation; 7/5 #3 6,000 315 16 33 i V/R #3 1,200 513 28 55 i V/R #3 1,200 513 28 55 i V/R #3 1,200 513 28 55 Spressing i C/S #3 2,400 162 53 65 81 Bashing to spoll area : T/S #3 1,200 131 65 21 600 131 65 21 600 131 65 81 65 81 600 131 65 81 600 131 63 131 132 131 132 131 131 131 132 131 141 141 131 <td< td=""><td>2.</td><td>Intake Structure</td><td></td><td></td><td></td><td></td><td></td></td<>	2.	Intake Structure					
Ecoustion 1/5 -3 600 135 16 135 i C/5 -3 600 136 16 135 i V/R -3 1,200 513 136 25 spressing i C/5 -3 2,400 762 43 66 Conjaction C/5 -3 2,400 762 43 66 Reading to spoil area 1 C/5 -3 2,400 762 43 66 Reading to spoil area 1 C/5 -3 1,514 1,931 65 7.60 Spressing in spoil area 1 C/5 -3 1,534 433 11 20 1.93 spressing in spoil area 1 C/5 -3 1,534 433 11 20 i K/R -3 1,534 433 11 20 20 1.93 24,60 14 24,67 Models gate -3 2,53 -2,487 24,67 13 15,15 16,253 9,000 11,44 21,21		Wet stone easonry	£3	5,300	E5_457	78.228	144.690
i C/S a) 4,200 2,204 114 2,11 i W/R a) 1,200 817 43 55 Spresting i C/S a) 2,400 762 43 56 Rauling to spoil area i 1/S a) 2,400 142 554 66 Rauling to spoil area i 1/S a) 1,531 1,921 165 2,00 i C/S a) 1,531 1,921 165 2,00 i V/R a) 1,531 1,921 165 2,00 i V/R a) 1,200 1,724 15 1,00 i V/R a) 1,200 1,21 1,00 11 10 i W/R a) 1,200 12 10 11 1		Excavation; T/S	3	600	315	16	111,050
1 W/R a3 1,200 \$13 23 53 Spreiding 1 C/S a3 2,400 762 43 56 Realing to spoil area 1/S a3 2,400 762 43 56 Realing to spoil area 1/S a3 2,400 762 43 56 Realing to spoil area 1/S a3 2,600 762 43 56 Realing to spoil area 1/S a3 1,531 1,921 165 2,600 IV/R a3 1,200 1,21 153 1,333 11 13 11 13 14 60 18 12 20 12 20 12 20 12 20 12 20 12 20 12 20 12 20 12 20 12 20 12 20 12 20 12 44 60 18 7,66 62 8,63 10 10 15 14 60 12 10 15 10 15 10 12 12		r C/S	* 3	4,200	2.204	114	2.318
j M/R a3 1,200 817 43 85 Spreadtion; C/S a3 2,400 142 554 66 Raaling to spoil area; ; T/S a3 600 751 65 81 Kaaling to spoil area; ; T/S a3 600 751 65 81 i V/R a3 1,511 1,921 165 2,600 i V/R a3 1,520 1,721 153 2,300 spreading to spoil area; rest r/S a3 1,520 1,721 153 2,403 spreading to spoil area; rest r/S a3 1,531 1,333 11 53 1,200 12 200 12 200 12 200 12 200 12 200 21 24 66 56 6,133 10,681 66 66 66 66 66 66 66 66 66 66 66 66 66 66 66 7,138 10,681 16,2453 900 12,143 16 16,163 16,163 <t< td=""><td></td><td>t ¥/R</td><td>έ<u>π</u>3</td><td>1,200</td><td>513</td><td>23</td><td>541</td></t<>		t ¥/R	έ <u>π</u> 3	1,200	513	23	541
spreading i C/S a) 2,400 762 48 81 Corgatition, C/S a) 2,000 762 48 81 Rauling to spoil area , T/S a) 600 754 65 81 i C/S a) 1,514 1,321 165 7,62 j K/R a) 1,200 1,724 155 1,535 spreading i C/S a) 1,200 1,724 155 1,200 j K/R a) 1,200 11 55 1600 162 1600 162 1600 162 1600 162 1600 162 1600 162 1600 162 1600 162 1600 162 1600 162 1600 162 1600 162 16000 16000 16000		s W/R	£3	1,200	817	43	860
Correstition, C/S a3 2,400 142 554 65 Railing to spoil area , T/S a3 1,514 1,921 155 7,6 Spreading to spoil area, T/S a3 1,514 1,921 155 7,6 Spreading to spoil area, T/S a3 1,500 1,724 152 1,931 Spreading to spoil area, T/S a3 1,501 137 11 51 Spreading to spoil area, T/S a3 1,500 137 142 600 Wooden gate a7 35 -7 24,815 24,807 146 Nooden gate a7 350 6,650 4,139 10,81 24,815 24,815 Painforced concrete a3 250 6,650 4,139 10,81 2,448 2,448 2,448 Total (2) 91,075 111,559 202,63 142,443 9,002 121,443 Loading to K/S a3 36,000 162,4453 9,002 121,433 12,535 painfor to K/S a3 36,000 120,153 10,535 135,554 12,		Spreading : C/S	- 3	2,400	762	43	810
Mailing to spoil area : 7/5 a) a) a) b)		Corraction: C/S	•	2,400	142	554	696
$ \begin{array}{c} c/5 \\ r \ \sqrt{R} \ r \ \sqrt{R} \\ r \ \sqrt{R} \ \ \sqrt{R} \\ r \ \sqrt{R} \ r \ \sqrt{R} \$		Fauling to spoil area 1 T/S	¥3	600	75t	65	816
Spreading in spoil ares; 1/5 a,3 1,200 1,724 152 1,333 spreading ate i C/S a,3 1,534 433 11 51 i U/R a,3 1,534 433 11 51 Nooten gate a,2 35 - 24,835 24,87 Peinforced coxrete a,2 35 - 24,815 24,87 Peinforced coxrete a,2 650 - 2,418 2,447 Total (2) a,2 323,000 162,459 9,002 171,44 Diversion Chancel a,3 36,000 220,164 12,603 2323,714 Losting : r/K a,3 36,000 120,151 10,131 10,313 Spreading : C/S a,3 36,000 30,475 1,933 32,46 <		1 C/S	n ³	1,534	1,921	165	2,026
Spreading in spoil area 1/5		Frankling to soll have been set to be the soll have been set to be sold	E,	1,200	1,784	152	1,936
i WR a ³ 1,534 (43) 31 51 Wooden gate a ² 35 - 24,875 24,875 Reinforced concrete a ³ 150 6,669 4,159 10,815 Pethorced bar ton 18 7,656 626 8,31 Form a ² 650 - 2,418 2,447 Total (2) 91,075 111,559 202,63 J. Diversion Charcel 91,075 111,559 202,63 Diversion Charcel 91,075 111,559 202,63 J. WR a ³ 96,000 49,823 2,328 43,21 J. WR a ³ 380,000 162,459 9,002 171,44 Loading : C/S a ³ 96,000 49,823 2,328 43,21 J. WR a ³ 380,000 120,191 10,349 133,54 J. WR a ³ 36,000 23,124 14,333 32,45 Spreading : C/S a ³ 11,000 5,772 300 6,07		spreading in spoll areas T/S	R3	650	199	15	202
Wooden gate 1 W/K n² 1,200 231 24 66 Reinforced concrete n³ 250 6,660 4,159 10,81 Peinforced bar ton n³ 250 6,660 4,159 10,81 Porm total (2) n² 650 - 2,418 2,418 2,418 Total (2) 91,075 111,559 202,63 111,559 202,63 J. Diversion Chancel n² 350,000 40,823 2,338 43,21 Loading : C/S n³ 96,000 40,823 2,338 43,22 J. W/R n³ 380,000 120,159 90,002 11,44 Loading : C/S n³ 96,000 120,159 10,133 130,55 Fealing : C/S n³ 28,000 201,124 12,003 222,70 Spreading : C/S n³ 28,600 30,415 1,933 32,46 Spreading : C/S n³ 28,600 27,935 1,772 <t< td=""><td></td><td>1 C/S</td><td>· #2</td><td>1,534</td><td>437</td><td>31</td><td>. 518</td></t<>		1 C/S	· #2	1,534	437	31	. 518
Decisiting are a ² 35 - 24,875 <td></td> <td>j K/K</td> <td>•</td> <td>1,200</td> <td>393</td> <td>24</td> <td>465</td>		j K/K	•	1,200	393	24	465
Petinforced bar ar 233 6,623 4,139 10,81 Form a? 650 - 2,418 2,418 Form a? 650 - 2,418 2,418 Total (2) 91,075 113,553 222,63 J. Diversion Channel a 95,000 40,823 2,388 43,22 J. Diversion Channel a 356,000 40,823 2,388 43,22 J. V/R a ³ 96,000 40,823 2,388 43,22 J. V/R a ³ 96,000 40,823 2,388 43,22 J. V/R a ³ 96,000 40,823 2,388 43,22 J. V/R a ³ 360,000 426,659 2,813 51,551 Faulting : C/S a ³ 96,000 120,191 10,493 130,50 J. J.R. a ³ 283,600 120,191 10,313 132,403 J. J.R. a ³ 291,600 421,283 15,919 457,20 J. J.R. a ³ 293,600 30,475 1,933 32,403 J. J.R. a ³ 293,600 5,772 300 6,03 Dital (1) j.J.J.S. j.J.J.S. 1		Palafored occursts	E ²	35		24,875	24,875
Porm Con 18 7,055 £76 9,11 Total (2) 2,418 2,428 3,212 2,248 3,121 4,321 2,418 13,559 2,217 14,31 15,551 1,331 2,427 14,31 13,556 14,318 13,556 14,318 13,556 14,318 13,556 14,318 13,556 14,318 14,314 14,314 14,314 14,314 14,314 14,214 14,214 14,214 14,214 14,214 14,214 14,214 14,214 14,214 14,214 14,214 14,214 14,214		Seinforced bar	B ²	250	6,660	4,159	10,819
Total (2) $91,075$ $111,559$ $222,63$ 3. Diversion Charcel Excavation; C/S a^3 $96,600$ $40,823$ $2,388$ $43,21$ y W/R a^2 $382,600$ $162,483$ $9,002$ $171,49$ y W/R a^3 $382,000$ $162,483$ $9,002$ $171,49$ y W/R a^3 $382,000$ $48,663$ $2,283$ $51,551$ x W/R a^3 $350,000$ $220,164$ $12,603$ $232,70$ x W/R a^3 $96,000$ $420,193$ $10,345$ $130,56$ x W/R a^3 $96,000$ $420,193$ $130,515$ 1933 $32,40$ y W/R a^3 $96,000$ $30,475$ $1,933$ $32,46$ x W/R a^3 $289,400$ $57,954$ $5,707$ $95,657$ Total (3) $1,134,007$ $80,743$ $1,214,253$ $1,214,253$ $40,000$ $5,772$ 300 $6,07$ $1,134,007$ $80,743$ $1,214,255$ $5,011$ $33,919$ $22,335$		Form	E?	650	1.055	2.418	8,312
 Diversion Charael Excavation: C/S N/R N		(5) [¢507			91,075	111,559	202,633
Excavation: C/S n^3 96,600 40,823 2,388 43,21 i W/R n^2 380,000 162,450 9,002 171,49 Lossing : C/S n^3 350,000 45,669 2,243 51,51 : W/R n^3 350,000 420,104 12,603 220,704 Faultry : C/S n^3 96,000 120,194 10,319 130,56 : W/R n^3 96,000 120,194 10,319 130,56 : W/R n^3 96,000 30,415 1,933 32,400 : W/R n^3 96,000 30,415 1,933 32,400 : W/R n^3 283,400 42,283 35,919 67,220 : W/R n^3 283,400 27,935 1,933 32,440 : W/R n^3 89,000 57,722 300 6,00 Detatlent intertext intertext intertext intertext 33,919 22,198 61,21 29,70 Co	э.	Diversion Chargel					
i WR a 33,000 162,485 9,002 171,43 tosiling i GS a 96,000 45,669 2,643 51,51 i WR a 350,000 120,124 12,603 232,70 i WR a 350,000 120,124 12,603 232,70 i WR a 350,000 120,124 10,313 133,54 i WR a 360,000 30,475 1,933 132,400 i WR a 360,000 30,475 1,933 132,400 i WR a 360,000 30,475 1,933 12,214,75 i W/R a 360,000 50,712 300 6,000 i W/R a 360,000 57,712 300 6,000 i W/R a 3 1,000 5,772 300 6,000 Delarkrent a a 11,000 5,772 300 6,000 Delarkrent a a 38,000 5,212 20,326 25,57 Coegaction a a 88,000 5,212 20,326 25,57 Coe		Excavation: C/S	.,1	96 600	40 933	7 322	A3 213
tosting : C/S n³ 36,000 43,669 2,813 51,51 r n³ 36,000 220,104 12,603 222,70 sulfrg : C/S n³ 36,000 120,194 10,349 130,54 : W/R n³ 283,600 120,194 10,349 130,54 : W/R n³ 283,600 30,475 1,933 32,40 : W/R n³ 283,650 83,964 5,707 95,61 : W/R n³ 283,650 83,964 5,707 95,61 : W/R n³ 283,650 83,964 5,707 95,61 : W/R n³ 11,000 5,772 300 6,07 Ditatlan 1,134,007 80,243 1,214,75 4. Closure Extantent 1,134,007 80,243 1,214,75 5. protal (1) n³ 68,000 27,935 1,772 29,70 Corpaction n³ 68,000 27,935 1,772 29,70 Spreashing n³ 68,000 5,212 20,326 25,53 Total (4		z W/R	2	80.000	162 483	9 00 2	171 492
r M/R m^3 $333,000$ $220,164$ $12,603$ $222,70$ Faulting r C/S m^3 $96,000$ $120,194$ $10,349$ $130,59$ s W/R m^3 $293,600$ $422,283$ $15,919$ $457,226$ s W/R m^3 $293,600$ $422,283$ $15,919$ $457,226$ s W/R m^3 $293,450$ $83,9475$ $1,933$ $32,47$ s W/R m^3 $293,450$ $83,954$ $5,707$ $95,61$ Total (1) $1,134,007$ $60,743$ $1,214,75$ $19,333$ $12,214,75$ 4. Closure Dybackment $12,214,75$ $12,935$ $1,712$ $29,77$ Spreading m^3 $83,000$ $27,935$ $1,712$ $29,77$ Cocyaction m^3 $83,000$ $27,935$ $1,712$ $29,77$ Cocyaction m^3 $83,000$ $27,935$ $1,712$ $29,77$ Cocyaction m^3 $83,000$ $27,935$ $1,712$ $27,935$		Lostico : C/S	្តា	96.000	49.663	2.543	51.512
Faultry C/S a_1^3 $96,000$ $120,194$ $10,343$ $130,54$ $2 W/R$ a_3^3 $283,400$ $421,283$ $35,919$ $457,220$ Spreading p C/S a_3^3 $96,000$ $30,415$ $1,933$ $32,42$ s w/R a_3^3 $283,450$ $87,954$ $5,107$ $95,651$ Total (1) $1,124,007$ $60,743$ $1,214,752$ 4. Closure Drbackment a_3^3 $11,000$ $5,772$ 300 $6,07$ Drbackment a_3^3 $88,000$ $27,935$ $1,772$ $29,76$ Spreading a_3^3 $88,000$ $5,2712$ $20,326$ $25,55$ Total (1) $33,919$ $22,393$ $61,31$ 5. Bridge a_3^2 400 $10,655$ $6,655$ $17,33$ form a_2^2 $1,200$ $-4,463$ $4,60$ peinforced bar a_2^2 $1,200$ $-4,463$ $4,60$ peinforced bar a_3^2 $35,500$ $-3,967$ $3,90$ f		1 W/R	5 3	383,000	223,164	12.603	232.707
$\begin{array}{c cccccc} & & & & & & & & & & & & & & & & $		Fauling ; C/S	<u>تع</u>	96,000	120,194	10,343	130,542
Spreading : C/S m^3 96,000 30,475 1,933 32,42 : M/R m^3 293,450 E3,964 5,707 95,67 Total (3) 1,134,607 E0,743 1,214,75 4. Closure Extantment m^3 11,000 5,772 300 6,07 Excavation: C/S m^3 11,000 5,772 300 6,07 Datartment m^3 E3,000 27,935 1,772 29,76 Spreading : C/S m^3 E3,000 5,212 20,326 25,53 Total (4) $33,919$ 22,338 E1,33 5. Bridge Boss. 20 14,224 - Pelanforced concrete m^3 400 10,655 6,655 Form m^2 1,200 - 4,463 4,464 Pelanforced concrete m^3 400 10,655 6,655 17,33 Form m^2 1,200 - 4,463 4,464 Pelanforced bar toon 50 21,351 1,740 23,00 Scatolding<		: ¥/R	. " 3	283,400	421,283	35, 919	457,207
; M/R m^3 $293,450$ $83,964$ $5,707$ $95,61$ Total (3) $1,134,007$ $60,743$ $1,214,75$ 4. Closure Exhankment $1,134,007$ $60,743$ $1,214,75$ Excavation; C/S m^3 $11,000$ $5,772$ 300 $6,07$ Detarkment m^3 $11,000$ $5,772$ 300 $6,07$ Spreating; m^3 $83,000$ $27,935$ $1,772$ $29,76$ Spreating; m^3 $63,000$ $27,935$ $1,772$ $29,76$ Corestruction m^3 $63,000$ $27,935$ $1,772$ $29,76$ Spreating; m^3 $63,000$ $27,935$ $1,772$ $29,76$ Total (4) m^3 $63,000$ $5,212$ $20,326$ $25,53$ Total (4) m^3 430 $10,655$ $6,655$ $17,33$ Form m^2 $1,700$ $-4,463$ $4,464$ Peinforced bar $10,655$ $6,655$ $17,33$ Form m^2 $1,700$ $-3,967$		Spreading r C/S	₽ 3	96,000	30,475	1,933	32,408
Total (3)1,134,607 $60,743$ $1,214,15$ 4. Closure ExtankrentExcavation: C/S a^3 11,0005,7723006,07DetarkrentSpreating a^3 83,00027,9351,77229,76Corpaction a^3 83,0005,21220,32625,53Total (4)33,91922,33861,335. Bridge14,224Peinforced concrete a^3 43010,6556,655Form a^2 1,200-4,4634,46Peinforced bartoon5021,3511,74023,00Scatolding a^3 3,500-3,9673,967Total (5) $46,220$ $16,825$ $63,00$ 23,6432,664,55		; %/2	a ³	283,450	83,964	5,707	95,671
4. Clossive Erkathrent Excavation: C/S m ³ 11,000 5,772 300 6,07 Driatizent Spreating m ³ 88,000 27,935 1,772 29,77 Corpaction m ³ 69,000 5,212 20,326 25,55 Total (4) <u>39,919 22,398 61,31</u> 5. Bridge Bearing shoe 805. 20 14,214 - 14,21 Peinforced concrete m ³ 400 10,655 6,655 17,33 Form m ² 1,200 - 4,463 4,46 Peinforced bar too 50 21,351 1,740 23,0 Scafolding m ³ 3,500 - 3,967 3,99 Total (5) <u>46,220 16,825 63,0</u>		Total ())			1,134,007	£9,743	1,214,750
Excavation; C/S a^3 11,000 5,772 300 6,03 Ditathent a^3 \$3,000 \$27,935 1,772 29,76 Spreating a^3 \$3,000 \$7,935 1,772 29,76 Total (4) a^3 \$3,000 \$5,212 20,326 25,53 Total (4) $39,919$ $22,398$ $61,33$ S. Bridge a^2 a^2 $14,224$ $-14,73$ Peinforced concrete a^3 400 $10,655$ $6,655$ $17,33$ Form a^2 $1,200$ $-4,463$ $4,463$ $4,463$ Peinforced bar a^3 $3,500$ $-3,967$ $3,967$ Scafolding a^3 $3,500$ $-3,967$ $3,967$ Total (5) $45,220$ $16,825$ $63,00$	4.	Closure Estantiont	· _				
Drathment x^3 \$3,000 27,935 1,772 29,75 Spreation x^3 \$3,000 5,212 20,326 25,55 Total (4) $33,919$ $22,393$ $61,31$ 5. Bridge Barlos shee Sos. 20 14,224 - 14,27 Peinforced concrete x^3 400 10,655 6,655 17,33 Form x^2 1,200 - 4,463 4,464 Peinforced concrete x^3 3,500 - 3,967 3,967 Scatolding x^3 3,500 - 3,967 3,967 Total (5) $45,220$ $16,825$ $63,00$		Excavation; C/S	▶3	11,000	5,772	300	6,072
a co,000 cr,225 1,772 27,72 Cocpaction a ³ 69,000 5,212 20,326 25,52 Total (4) 33,919 22,338 61,32 5. Bridge 805. 20 14,224 - 14,214 Peinforce3 concrete m ³ 400 10,655 6,655 17,33 Form g2 1,200 - 4,463 4,463 Peinforced bar toa 50 21,351 1,740 23,00 Scafolding x ³ 3,500 - 3,967 3,967 Total (5) 45,220 16,825 63,00 - 3,967 3,967		ereatere Franking	_3	62 AM	- 33 676	1 222	- 20 202
Total (4) 33,919 22,393 61,33 5. Bridge Sos. 20 14,224 - 14,72 Peinforce3 concrete m ³ 430 10,655 6,655 17,33 Form m ² 1,200 - 4,463 4,463 Peinforced bar ton 50 21,351 1,740 23,00 Scatolding m ³ 3,500 - 3,967 3,967 Total (5) 45,220 16,825 63,00		Correction	5 5	63,000	5,212	20, 326	25,538
5. Bridge Nos. 20 14,224 - 14,22 Peinforced concrete m3 400 10,655 6,655 17,33 Form m2 1,200 - 4,463 4,46 Peinforced bar ton 50 21,351 1,740 23,00 Scatolding m3 3,500 - 3,967 3,967 Total (5) 46,220 16,825 63,00 1,216,112 502,643 2,664,90		Total (4)			33,919	22,398	61,317
Bearing shoe Sos. 20 14,214 14,21 Peinforce3 concrete m3 400 10,655 6,655 17,33 Form m2 1,200 - 4,463 4,463 Peinforced bar ton 50 21,351 1,740 23,07 Scatolding m3 3,500 - 3,967 3,967 Total (5) 46,220 16,825 63,00 Land 12/4.112 532.641 2.664.92	s.	Bridge					
Peinforced concrete m3 400 10,655 6.655 17,33 form m2 1,200 - 4,463 4,46 Peinforced bar ton 50 21,351 1,740 23,07 Scatolding m3 3,500 - 3,967 3,96 Total (5) 46,220 16,825 63,01			line	20	14.224	-	14.214
Form m² 1,200 - 4,463 4,46 Peinforced bar ton 50 21,351 1,740 23,07 scatolding m³ 3,500 - 3,967 3,967 Total (5) 46,220 16,825 63,00 - 2644 2		Prinforcal concrete	"3	400	10.655	6.655	17,310
Mainforced bar Los S0 21,351 1,740 23,0 Scatolding x3 3,500 - 3,967 3,96 Total (5) 46,220 16,825 63,0		FARM		1.200	-	4,463	4,463
Scatolding m ³ 3,500 - 3,967 3,96 Total (5) 46,220 16,825 63,00 1,214,112 532,643 2,664, 60		Peloforcol bar	tea	50	21,351	1,745	23,031
Total (5) <u>46,225</u> <u>16,825</u> <u>63,0</u>		Scafoldina	E J	3,500	-	3,967	3,961
1 274 342 533 643 2 654 9		Total (5)		· .	46,225	16,825	63,045
		C0110 (C11)		· · · · ·	1.774.342	\$33.643	2,664,955

Table 1.3Breakdown of Direct Construction Cost (1/4)(Bila Intake)

	5. 				
Itea	Unit	Q'ty	FC	Cost (103Pp.)	Total
Coffering Work					
Exception + #/s		1 000	3 676	145	1 464
- C/S		20,000	10,500	540	11.040
Losding T/S	្រភ្លូវ	7.000	3,549	210	3,759
1 C/S	<u>_</u> 3	20,000	10,140	600	10,740
Sauling 1/S	m ³	7,000	5,334	455	5,789
I C/S	, n 3	20,000	15,240	1,300	16,540
Spreading in spoil area	16 ³ .	27,000	8,559	540	9,093
BOITON DIE	. 1				
	_1	1,000	4/2	22	
Loading		22,000	11.154		11.814
Sauling	_1 ·	22.000	27.544	2.376	29.920
Quarry site 1					-
Excavation, T/S	<u>m</u> 3 -	7,000	2,975	175	3,150
1 R	m 3	9,000	12,322	639	12,951
leading 1 T/S	E 3	7,000	3,549	210	3,759
J R Thuling a min		9,000	13,669	828	14,697
	_3	2,000	8,701	300	9,520
Streading in scoll area		2,000	2,219	140	2,359
Streading 1 Core	_3	20.000	5.800	490	2.200
1 Filter	<u>_</u> 3	3,400	1.156	68	1.224
B. rock	<u>in</u> 3	22,000	7,490	445	7,920
/ Rock	 3	45,000	15,300	900	16,200
Cospacting : Core	m 3	20.000	5,600	280	5,680
; Filter	<u>а</u> ,	3,400	201	755	986
j K. ROCK	· 34	22,000	2,244	396	2,640
Eurobaca doct, Tilter	.	45,000	\$ 5,545	1,125	14,670
	g.,	3,4.0	· · · · -	14,030	14,030
fotal 1			209,764	29,334	239,158
Siver Diversion North		1	المجريحة المحادية		
ALLE DIVERSION WORK					
(1) Chargel	1. A. S.				•
Excavation; T/S	3	5,000	2.125	125	2.25
1 C/S	3	95.000	10, 375	2,375	42,750
i W/R	≞ 3`	5.000	2,145	120	2,25
Loading 1 1/S	"3	5,000	2,735	150	2,68
1 C/S	n ³	35,000	51,965	2,650	54,615
	2 3	\$,000	3,125	170	3,79
- C/S		5,000	5,50	13 223	337 33
5 K/R	3	\$ 60	2 600	810	8 610
Screading in scoil area		91.000	28.847	1.820	30.661
Felaforced concrete	3	5,800	154.512	96.512	251.020
Pelsforced iron bar	ton	92	39,255	3, 201	42,455
Form	n 2	8,000	-	29, 352	29, 152
Gabloo	m 3	2,700		44,059	46,059
Sub-total		· .	456.109	195.344	659.453
(3) Surial series			*******		
			· · · · · ·		
Excavation	<u>в</u> 3	9,100	132,842	23,323	156,16
Loading		9,100	5,688	3-29	5,93
Ezolieg Stranding in scoll seas	<u>#</u> /	9,100	16,195	E,4/4	12,67
forcente linico		3,100	2,633	50 752	172.60
Form	SAT	3,077	1.601	3.660	7.26
Plog concrete	2 3	519	15,185	9,435	28,67
Grouting	i 💼 🗄	559	718	3,023	3,74
Feisforced iron bar	ton	73	33,734	2,243	36,48
Sub-total		and the second second	230.101	94 563	365.CF
574a) a	•		1112111 	222322	
AV7-78. g			754,719	473,541	114.6.31
Dan Enhanksent					
Freazatica · */s		× ~~~	10 140		12
. (/2		50,000 5 AM	12,8.5	692	3 34
; ¥/R	5	35.000	<u> </u>	244	6.14
Losding : T/S		36,000	18.251	1.005	19.31
1 C/S		\$,000	2,535	145	2 63
¥/R	" 3	15,000	8,683	477	9,15
	±3 .	36,000	45,073	3 690	43,95
Easting : T/S		5.000	6,260	533	6,79
Easting 1 T/S 1 C/S	±3		22,233	1,901	24,19
Easting : T/S : C/S : V/R Creation is rout	s3 3	15,000			18.97
Easting : T/S : C/S : W/R Spreading in spolt area Borrow eit	*3 *3 *3	15,000 56,000	17,177	1,119	
Easling : T/S : C/S : W/R Spreading in spolt area Borrow pit Ercavation: Y/S	_3 _3 _3 _3	15,000 56,000	17,177	50	
Easling : T/S ; C/S ; W/R Spreading in spoil area Borrow pit Excavation; T/S C/S	23 23 23 23 23 23 23 23 23 23 23 23 23 2	15,000 56,000 2,000 69.000	17,177 850 29,341	59	90 31.65
Easling : T/S : C/S : W/R Spreading in spoll area Borrow pit Excavation; T/S C/S Coallog	23 23 23 23 24 24 24 24 24 24	15,000 56,009 2,000 69,000 69,000	17, 177 850 29, 341 34, 583	50 1,716 2,070	90 31,65 37.65
Easling : T/S : C/S : W/R Spreading in spolt area Borrow pit Excavation: T/S C/S Coading Fauling	23 23 23 23 23 23 23 23 23 23 23 23 24 23 24 24 24 24 24 24 24 24 24 24 24 24 24	15,000 56,000 89,000 69,000 69,000	17,177 850 29,341 34,583 85,383	50 1,716 2,070 7,452	90 33,65 37,65 93,84
Easting : T/S ; C/S ; W/R Spreading in spoit area Borrow pit Ercavatios; Y/S C/S Toading Fauling Coarry site 1	23 23 23 23 23 23 23 23 23 23 23 23 23 2	15,000 56,000 8,000 69,000 69,000 69,000	17,177 850 29,341 36,583 85,383	50 1,716 2,070 7,452	50 33,65 37,65 93,84
Easting : T/S : C/S : W/R Spreading in spoil area Borrow pit Ercavation: T/S C/S Coading Faulting Coading site I Excavation: T/S	23 23 23 23 23 23 23 23 23 24 23 24 23 24 24 24 24 24 24 24 24 24 24 24 24 24	15,000 56,000 89,000 69,000 69,000 29,000	17,177 850 29,341 36,563 65,383 12,332	50 1,716 2,070 7,452 721	90 33,65 37,65 93,84 13,65
Easling : T/S : C/S : W/R Spreading in spoil area Borrow pit Excavation; Y/S C/S Loading Rauling Corry site I Excavation; T/S : W/R	23 23 23 23 23 23 23 23 23 23 23 23 23 2	15,000 56,000 89,000 69,000 69,000 29,600 29,600 35,000	17,177 850 29,341 34,583 65,383 12,332 23,518	50 1,716 2,070 7,652 721 1,393	90 33,65 37,65 93,84 13,65 24,82
Easling : T/S : C/S : W/R Spreading in spoll area Borrow pit Excavation; T/S C/S Coaling Rapling Coarry site I Excavation; T/S : W/R : X : X/R : X/R : X/R : X : X/R : X/R : X/R : X/R : X/S : X/R : X/S : X/R : X/S : X/R : X/S : X/R : X/S : X/R : X/S :		15,000 55,000 7,000 69,000 69,000 69,000 73,660 55,000 28,000	17,177 850 29,341 34,583 65,383 12,332 23,518 38,304	50 1,716 2,070 7,452 721 1,303 1,988	50 33,05 37,65 93,84 13,65 24,83 40,29
Easling : T/S : C/S : W/R Spreading in spoll area Borrow pit Excavation; Y/S C/S Loading Rauling Quarry site I Excavation; T/S : W/R : X Loading : T/S	23.27 24.27 24.27	15,000 56,000 69,000 69,000 69,000 29,000 29,000 28,000 29,000	17,177 850 29,341 34,583 65,383 12,332 23,518 38,364 14,703	50 1,716 2,070 7,452 721 1,303 1,568 870	50 33,65 37,65 93,84 13,65 24,83 40,29 15,57
Easling : T/S : C/S ; W/R Spreading in spoil area Borrow pit Excavation; T/S C/S Coading Fauling Pauling Coarry site I Excavation; T/S : V/R : R Loading : T/S : V/R	23 23 23 23 23 23 23 23 23 23 23 23 23 2	15,000 56,000 69,000 69,000 69,000 79,660 35,000 78,660 28,660 29,660 29,660	17,177 850 29,341 36,583 85,383 12,332 23,518 38,304 14,703 34,375	50 1,716 2,070 7,652 721 1,303 1,988 870 8,870	50 33,65 37,65 93,84 13,65 24,83 40,29 15,57 36,24

Table 1.3 Breakdown of Direct Construction Cost (2/4) (Kalola Dam)

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Iten	Unit	0°+v	<u> </u>	Cost (10 %p.	······
Rauling 1 1/5			re	LC	Total
1 W/R	# 2 _ 1	27,000	35,308	3,132	39,440
1 W/R		27,000	18,873	1,593	20,466
1 R.	3	10 000	41,636	3,555	45,192
j R	23	19.000	9,200	790	9,930
Distensing in epoil area Quarry site IE	жэ	81,050	26,311	1,660	49,394 27,971
Excavation; 9/5 ; V/R	<u>в</u> 3	13,000	5,528	323	5,851
i R	<u>µ</u> 3	17,000	7,269	403	7,672
Loading ; W/R)	17.000	243,335	370,641	635,633
y R Navillan - seta	N 3	111,000	121.055	1,5/1	191.110
	R3	17,000	45 CE6	3,846	43,932
Spreading	R ¹	311,000	387,692	33,527	421,129
Filter	<u>#</u> 3	42,000	14,278	846	15,124
Pandom rock		20,000	6,793	.403	7,202
Sock	_3	134.000	45 554	1,343	24,126
Pişrap	<u>i</u> 3	9.000	3.060	2,020 18)	15,252
- Urain Purchase cost	ж ³	\$,000	1,700	101	1,801
filter	_3				
Grain	-3	20,000	-	82,915	82,915
Consacting		3,000	-	29,613	29,613
ingervloss core	<u>в</u> 3	42,000	11,741	597	12.332
Filter	<u>_</u>]	20,000	1,185	4,620	5,805
RATION FOCK	×3	67,000	6,825	1,190	8,015
	¥,	134,000	40,315	3,333	43,643
Total 3			1,689,023	594, 331	2,283,354
Foundation Tresteent					
Grout tole drillfra	_				
Groating		1,900	45,344	4,632	49,976
Curtain grout	-	1,750	2,457	10,455	17,945
Grout hole drilling	*	11,309	269.678	27.546	297.724
Groating		11,320	14,750	62,240	76, 993
test sole deliling	Ð	1,309	43,077	5,506	49,583
Sotal 6			375, 329	111,359	485,718
Spillvay					
Excertion : 1/5	· _3	30.000	36 743	611	16 663
1 C/S		129.600	62.948	3,269	· 10,000
; ¥/k	<u>_</u> 3	90,000	61,298	3,195	E4.696
J R	<u>.</u> 3	60,000	82,025	4 264	85,350
Easting ; T/S	8. ³	30,000	37,560	3,234	10.751
	R	36,000	21,236	1,791	23,027
2 - <u>7</u> - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 -	-1	84,000	165,163	9,651	114,223
1 ¥/R	.3	45,000	56 835	5 703	34,133
I R	<u>x</u> 3	30,000	27,611	2.351	29.932
a k	s 3	30,000	58,734	5,082	63,786
Spreading in spoll area	• •	187,000	53,937	3,605	63,833
Screation	.3	32,000	10 159	643	30.632
Corganiza	_3	32,000	1.835	7.371	9.265
Feinforced concrete	E.3	24,250	644,683	4.72,663	1,047,376
Form	*5	35,500	-	45,376	45,376
Felaforces from bar Blacket accid	tea	36-)	126,265	13,255	175,437
Presset Store deilling	- '	2.51	3 164	331	7 633
Groates	2	3623	192	1.652	2.044
Ourtain grout	-				
Groat hole deliting		720	17,183	1,755	18,933
Grouting	Þ	723	943	3,966	4 9 6
Test hole drilling	<u>_</u> ,	100	3,329	550	3,803
Gabion Back bols	16-s.	2.233	292.163	57 C41	19,201
				202,203	
Botal S			1,770,884	533,183	2,310,047
. Intate Facility	_			: .	
Felaforces concrete	<u></u>	720	19,181	11,991	31,1€2
- FORM Referent from har	tea	43	18,352	1.496	19.658
Total 6			37,543	107,670	145,213
	,				
7. Fast Road	_1	10 4-1			
Exceretics; 1/S	_3	10,000	4,620	330 212	4,920 at àsa
j C/S Dababbaat, C/C)	8.00	4.776	2.2	5.04A
Asthalt carriet	" 2	3,000	1,454	5.9.1	7.305
Gravel setalicy	»5	15.00	7,020	8,835	15,655
Total 7			63,932	17,620	78,552
. Ketal Worls	1.s.		\$58,000	450,000	1,009,000
			· · · · · · · · · · · · · · · · · · ·		
				2.162 414	· · · · · · · · · · · · · · · · · · ·

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Table 1.3 Breakdown of Direct Construction Cost (3/4) (Kalola Dam)

	·			Cost (10380.)	
Itea	Unit	Q'ty	FC	<u></u>	Tota)
. Main Canal System					
(1) Earth Works			· · ·		
Excavation, common	E ³ .	698,000	442,532	23,732	446,264
Excavation, weathered rock	. "" <u>"</u> "	127,000	104,521	5,588	110,109
Earthfill with excavated material	р3 	496,000	296,112	16,864	312,976
Sod facing	E?	529,000	261,929	614 800	787,838 634,838
Stripping of top soil	<u></u> з	134,000	136,144	11,792	147,93
Disposal of soil	₽ ³	127,000	211,201	16,510	227,711
Asphalt pavezent	<u>*</u> 2	138,500	64,818	272,430	337,248
Sab-Lotal			1,517,257	1,002,625	2,519,88
(2) Related Structures					
Keiniorced concrete	- III	1,900	50,616	31,616	87,73
Form	<u>s</u> 2	6,490	330,012	21.608	21.80
Feinforcement bar	ton	93	39,711	3,237	42,94
Base coocrete	∌3	40	938	695	1,63
Backfill	3.5	76,000	6,560	45,600	50,16
Sub-total	ton	C.	32,400	5/100 5/10 6/15	40,50
			2774122	2221212	
10(31 J		2012 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	1,981,554	1,511,250	3,492,80
. Secondary Canal System	•				
(1) Earth Works					a tha she
Excevation, common	р ³ .	350,000	211,900	11,900	233,89
Easthfill with excavated exterial		315,000	188,055	10,710	198,76
Sod facing	±2	1.025.000	1,551,250	123,831	1,675,05
Stripping of top soil	2 3	264,060	207,264	17,952	225,21
Asstalt pavenent	<mark>₽,</mark> 2	210,700	98,608	414,447	513,05
Seb-total		•	2,267,057	1,808,839	4,075,89
(2) Related Structures		11 A. 11		and a second	
Peinforced concrete	<u>p</u> 3	1,300	34,623	21,623	56,26
Form	23 2	4,490	198,132	233,208	631,34 16,36
Seinforcesent bar	top	55	23,485	1,914	25,33
Base concrete Backfill	· · · · · · · · · · · · · · · · · · ·	C8 001 00	1,876	1,390	3,26
Gate	ton	12	64,800	16,200	81,00
Sol-total			325,283	314,353	639,64
Tolal 2			2,592,346	2,123,192	4,715,53
. Draisage System					
(1) Earth Works		· · · ·			· ·
Excevation, eccoon	∎ 3	1,026,000	864,918	49,248	916,16
Earthfill with excavated paterial	£3	217,000	129,549	7,378	136,92
Stripping of top soil	5 ₂ 3	58,000	58,928	5,104	64,03
(2) Bolated Structures			119331333	01,730	i i i i i i i i i i i i i i i i i i i
Relatorces concrete Net stone pacenty	<u></u>	590	1,055	6 561	1,73
Form	2	140		521	52
Seinforcement bar	ton	2	854	20	92
(30100 Statota)	\$L ³	15*600	9 101	208,870	208,8
Solal 2			11171	200 410	1111
		÷	1,002,300	200,410	1, 3, 3, 3, 4
. Road System			· ·		
(1) Earth Works		·		a ga ga t	1.
Excavation, corners Farthfill with horses at astarial	· •	30,000	19,020	1.020	20,04
Sod facing	£2	71,000	4211124	85,200	85.20
Stripping of top soil	±3	29,000	29,464	2,552	32,01
sub-total	<u>E</u> 4	en,000	37,512 489,595	103,778	204,5
(2) Related Structures			1211112	1101013	11111
Nat stoce ascorry	_3	11Å	Ara r	3 414	1 4
Concrete pipe \$350	₽	450	1,030	£51	3,3
Sub-total			1,630	2,570	4,20
fotal 4			491,220	288,644	779,60
COLUD 2021				1 363 (6)	10 333 41
COVID TAILOR	and the second second	and the second second	0,127,708	4,203,304	. 10,331,21

Table 1.3 Breakdown of Direct Construction Cost (4/4) (Canals and Road)

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	Item	Unit	Ô'ty		Cost (10 ³ Rp	.)
			¥ •)	FC	21	Total
1,	Earth Works					
	Excavation, cornon Earthfill	x ³	1,585,000	-	2,355,310	2,355,310
		18 -	2,538,000	-	1,060,884	1,060,884
	Total (1)			- ·	3,416,194	3,416,194
2.	Related Structures	:				<u></u>
	Wet stone masonry	n ³	35,400	\$43,916	522,504	966,420
	wooden plate	. 2L ⁵	600	-	92,391	92,391
	Concrete pipe	พุ	760	-	8,244	8,244
	RackIIII	<u>в</u> ,	4,700	-	1,739	1,739
	Total (2)			443,916	624,878	1,068,794
	GRAND TOTAL			443,916	4,041,072	4,484,988

Table 1.4 Breakdown of Direct Construction Cost of Tertiary System

Table 1.5 Breakdown of Direct Construction Cost of Offices and Quarters

	<u> </u>		· ·	Unit: 10 ³ Rp.
	Description	Unit	Q'ty	Abount (Local Currency)
1.	Bain Office	" 5	890	120,000
2.	Branch Office	<mark>в</mark> 5	400	40,000
3.	Repair Shop	₽ ²	400	28,009
4.	Store House	E.5	590	35,000
5.	Quarters	<u>5</u> 2	2,400	288,000
6.	Notor Poor	5م	10,000	70,000
7.	Land Preparation for Office Yard Including Fencing, etc.	L		59,000
•••	TOTAL	<u> </u>		640,000

Table 1.6 Breakdown of Land Acquisition Cost

	Description	Vait	Q'ty	Azount (Local Currency)
				(103 _{Rp} .)
1.	Bila Intake	ha	25	50,000
2.	Kalola Dan	ha	400	800,000
3,	Canals and Road			
	(1) Main irrication canal	ha	110	330,000
	(2) Secondary irrigation canal	ha	250	750,000
	(1) Major drain	ha	60	180,000
÷	(4) Construction road	ha	30	90,000
	(5) Miscellaneous	ስ3	50	150,000
4.	Office and Quarters	hə	4	20,000
•	TOTAL			2,370,000

	:		<u> </u>
Item No. Equipment	Unit Price (10 ³ Rp)	Required No.	Amount (10 ³ Rp)
L. VEHICLE AND EQUIPMENT			
(1) Dragline, 0.8 m ³	88,940	1	88,940
(2) Backhoe, 0.6 m ³	64,870	2	129,740
(3) Backhoe, 0.3 m^3	30,090	1	30,090
(4) Bulldozer, 11 ton	48,150	2	96,300
(5) Dozer shovel, 1.4 m ³	22,070	1	22,070
(6) Wheel loader, 1.0 m ³	27,420	1	27,420
(7) Motor grader, 11 ton	53,500	1	53,500
(8) Water tanker, 5 m ³	29,420	1	29,420
(9) Tire roller, 8 - 10 ton	23,400	1	23,400
(10) Tamper, 80 kg	870	3	2,610
(11) Soil compactor, 90 kg	800	3	2,400
(12) Portable concrete mixer, 0.2 m	² 870	1	870
(13) Concrete vibrator, Ø 45	330	2	660
(14) Submersible pump, 9150	1,070	2	2,140
(15) Generator, 10 kw	330	1	330
(16) Trailer truck, 30 ton	44,100	1	44,100
(17) Dump truck, 11 ton	28,760	2	57,540
(18) Dump truck, 2 ton	6,550	2 .	13,100
(19) Cargo truck w/crane, 8 ton	28,800	1	28,800
(20) Cargo truck w/crane, 2 ton	8,690	2	17,380
(21) Truck, Iton pick-up type	4,350	2	8,700
(22) Jeep, four wheel drive	8,000	5	40,000
(23) Sedan, 6 persons	8,700	1	8,700
(24) Repair shop tools		L.S.	30,000
(25) Spare parts (20% of the above)	•	L.S.	151,700
2. TELECOMUNICATION SYSTEM		l set	233.600
TOTAL			991,790

Table 1.7 Procurement Cost of Major Equipment for Operation and Maintenance

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Year	Staff Salary	Labour Wage	Office	Equipment Running Cost	(Unit: Other Related Cost	<u>10³Rp.)</u> Total
1983	32 000	1 000	2 200	2 660	Actuted cost	
1984	44.000	3 /000	2,200	7,000	3,800	46,000
1985	59,000	1 600	5,500	11,000	6,300	68,000
1986	69,000	6 500	5,500	11,000	7,900	88,000
1987	69.000	6.500	5,500	11,000	9,000	
1988	69,000	6.500	5,500	11,000	9,000	
1989	78,000	2,400	5,500	11,000	10,100	107,000
Total	420,000	30,900	33,000	73,000	55,100	612,000

Table 1.8 Administration Expenses

Table 1.9Cost Estimate of Engineering Service(1981 Price Level)

	Thom	<u></u>	Atiou	nt (106	Rp.)
		<u><u></u> </u>	FC	LC	Total
Ľ,	Aerial Photo Mapping	350 km ²	278	0	278
2.	Detailed Design				
	(1) Remuneration	194 м/м <u>/1</u>	958	0	958
	(2) Direct Cost	L.S.	94	50	144
	(3) Equipment Cost	L.S.	45	0	45
	(4) Other Related Cost	L.S.	124	59	183
	Sub-total		1,221	109	1,330
3.	Construction Stage				
	(1) Remuneration	514 M/H/2	2,418	0	2,418
	(2) Direct Cost	L.S.	220	116	336
÷	(3) Equipment Cost	L.S.	104	· O	104
	(4) Other Related Cost	L.S.	288	135	423
	Sub-total	. •	3,030	251	3,281
	Total		4,529	360	4,889

Remarks:

/1; Including 34 M/M of local consultants

/2; Including 114 M/M of local consultants

			1.1								
	Gr	ade I	Gra	de II	Gra	de III	Gr	ade IV	Gr	ade V	Potal
Year	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	IOCAL
									e Geologia	· · · · ·	(Rp.)
1983	1	2,160	2	2,880	4	4,560	10	8,400	20	13,200	31,200
		•		-						•	(32,000)
1984	1	2.160	3	4.320	6	6,840	20	16,800	20	13,200	43,320
				•		-					(44,000)
1985	1	2.160	4	5.760	. 8	9,120	. 26	21,840	30	19,800	58,680
	-			-•		-	14 	-			(59,000)
1986	3	2.160	5	7.200	12	13.680	26	21,840	36	23,760	68,640
	-							· · · ·	·	•	(69,000)
1987	1	2,160	5	7.200	12	13,680	26	21,840	36	23,760	68,640
			· :			•				-	(69,000)
1988	1	2.160	5	7.200	12	13.680	26	21,840	36	23,760	68,640
	-							·			(69,000)
1989	1	2.160	5	7.200	10	11.400	28	23,520	51	33,660	77,940
1745	-	-,						•	•		{78,000}
1990	ı	2.160	5	7.200	· · 8·	9.120	30	25,200	66	43,560	87,240
1750		27200	•		-						(88,000)

Table 1.10 Staff Numbers and Staff Salary of the Project Office

Remarks: (1): Number of required staff (person)

(2): Staff salary (10³Rp.)

Annual salary for respective grades is based on the following,

I	;	180,000	Rp./conth,	Project Manager
II	;	120,000	- n	Division Chief
III	į	95,000	10	Engineer, Branch
				Office Chief
1V	;	70,000	81	Assistant Engineer
	-			Assistant Officer
V.	;	55,000	FI	Draftman, Typist
	-	•		Gate Keeper
	I II III JV V	I; II; III; IV; V;	I ; 180,000 II ; 120,000 III ; 95,000 IV ; 70,000 V ; 55,000	I ; 180,000 Rp./eonth, II ; 120,000 " III; 95,000 " IV ; 70,000 " V ; 55,000 "

Table 1.11	Assignment Schedule of Poreign Consultants
------------	--

:	Design stage

Speciality	Kan-Honth				
	General	Irrigation Facilities	Kalola Dan	Bila Intake	
Project Director	2				
Tean Leader	18				
Sr. Ireligation Engineer		10			
Terlgation Dusign Engineer (1)		10			
• (2)		10			
Drainage Design Engineer		10			
Hydraulic Design Engineer		6			
Dem Engineer		•			
Dam Structural Engineer			13	•	
Rydrologist			10		
Geologist			• •	2	
Soil Mechanical Engineer		3.		•	
Construction Planer		. 3	,	,	
Topographic Surveyor (1)		6	-	2	
* (2)		6		-	
s, * (3)		4	2		
Specialist as required	6				
Liaison Engineer	6				
	······	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	
Total	32	76	40	17	

Secark: Addition to the above, local consultants 34 N/X will be needed.

Construction stage

Speciality	Kan-Konth				
	General	Irrigation Facilities	Falola Can	Bila Istate	
Project Director	ı				
Team Leader (Sr. Construction Engineer)	76				
Irrigation Construction Engineer		68			
Irrigation Design Engineer		56			
Dam Construction Engineer			65	·	
Dam Design Engineer			45	6	
Geologist		2	20	2	
Soll Mechanical Engineer		•	24		
0 6 H Expert	4				
Specialist as required	12				
Home Support	12				
		_•	<u> </u>		
Total	107	130	155	8	

Fensik: Addition to the above, local consultants, 114 M/M will be needed.

			(Unit: Rp
	Item	Unit	Unit Price
. Mate	erials .		
(1)	Masonry stone (for structure)	F 3	6,000
(2)	Masonry stone (for lining)	rg 3	5,000
(3)	Stone for gabion	m ³	5,000
(4)	Gravel	m ³	7,000
(5)	Sand for concrete	т ³	3,000
(6)	Sand for dump	m ³	2,500
(7)	Timber, board, 1st class	FT ³	185,000
	2nd class	⊒ 3	90,000
	3rd class	m ³	55,000
	beam, 1st class	<mark>в3</mark>	170,000
	2nd cláss	n ³	85,000
	3rd class	ra ³	50,000
(8)	Nai 1	kg	750
(9)	Asphalt	kg	400
2. Fue	l and Lubricant		
(1)	Gasoline	1	150
(2)	Diesel oil	, t	52.5
3. Lab	our Wages		
(1)	Labour	Man-day	750
(2)	Foreman	Man-day	1,000
(3)	Carpenter	Man-day	1,500
(4)	Head of Carpenter	Kan-day	1,750
(5)	Stone-Worker	Han-day	1,500
(6)	Head of Stone-Worker	Kan-day	1,750
(7)) Steel-Worker	Kan-day	1,500
(8)	Head of Steel-Worker	Man-day	1,750
(9)	Painter	Man-day	1,500
(10)) Head of Painter	Ban-day	1,750
{11]) Asphalt-Mix Worker	Kan-day	1,500
(12) Driver	Kan-day	1,500
(13) Operator	Han-day	2,000
(14) Mechanical	Han-day	2,250
(15) Kead of Operator & Mechanical	Han-day	2,750

Table 1.12 Price of Local Materials and Labour Wages

VIII + 16

			·	· · · · · · · · · · · · · · · · · · ·		(Units Ap.)
		Works	Unit	Foreign Currency	Local Currency	Total
1.	Bart	hvorks by Kanpover				
	(1)	Excavation by Manpover				
		(a) Sormal	₂₂ 3	-	696	
		(b) Hard soit	_3	_	927	977
		(c) Soil Incl. stone	" 3	•	1.392	1,392
		(d) Kolsoll	£.3	-	1, 392	1, 392
		ter Rocky \$011	<mark>в</mark> 3	-	1,855	1,855
	(2)	Habling by, Kaspover				
		(a) Distance 30 m	"3	-	304	304
		(b) Distance 50 m	E.3	•	404	404
		100 m	P 2	-	566	566
		200 -	_3	-	727	727
		250 m	-3	-	- 890	870
		300 m	<u>_</u>)	-	1,213	1,951
	(m	Realing by Trails				
	())	estilled by Holly				· ·
		Uistance L = 50	- -	-	165	105
		5 × 100 j		-	119	118
		L = 200			131	131
		L = 250	3		155	143
		L = 300 g	n _3	-	171	171
		L = 500 (∎ <u>∎</u> }	•	223	223
		L = 1,000	n 2 ³	-	353	353
	(4)	Gathering Aggregates at Si	te			
		(a) Gravel	• ³	-	1,675	1,675
		(b) Sand	• *	-	1,256	1,256
	(5)	Rock Breaking				
		(a) Fick-Surger	<u>"</u> 3	3,888	1,354	5,242
		(b) Blasting	" 3	2,216	3, 333	5,555
	(6)	Filling 4 Pulling out of				
		Foot by Manpover	are	-	5,533	5,593
	ŧ7)	Excluding Sandries,				
		Stoce from Soil	8Te	•	1,755	1,755
	(8)	Spoothing of Face excavate	đ			
		or filled up	<mark>_2</mark>	-	420	420
	(9)	Filling up or Back filling				
		fal Compation by Parcous		_	170	120
		(b) Coopacting by Coopact	or 1 m ³	59	231	290
2.	Fari	bunche by Kachina				
		Excavation by II ton Bullo	3			· · · · · · · · · · · · · · · · · · ·
		(a) Sahd	_3	401	13	432
				441	50 15	553
		(d) Gravel	. D	553	36	583
		(e) Blasted rock)	791	51	842
. •	(2)	Excavation by 21 ton Bull-	dozer .			
		tal sand	<u>=3</u>	366	21	387
		(b) Soreal soil	A 3	425	25	450
		(c) Clay	»2	512	11 1	543
		(d) Gravel	5	214 213	41	213
		(e) blasted rock	R-	* <i>**</i> *	•••	
					{ to be	continued)

Table 1.13List of Unit Rates of Works for Kalola Dam and
Bila Intake Weir (1/3)

·

	Works	Unit	Foreign Currency	Local Currency	Total
(3)	Ripping by 21 ton Ripper-d	ozer	· .		· · · · · · · · · · · · · · · · · · ·
•-•	fal Waathawad wash	1		· · · ·	
	(a) meathered fock	A * .	428	24	452
(4)	Excavation by 0.6 m ³ Back-hoe shovel	•			
	(a) Sand	-3	403		· · · · · · ·
	(b) Normal soil	 3	525	20	513
	(c) Clay	a 3	651	12	693
	(d) Gravel	_3	681	36	717
	(e) Blasted-rock	⊈ 3	1,368	ท	1,439
(5)	Excavation by 1.2 g ³ Back-hoe shovel			 	•
	(a) Sand	_3	630	34	
	(b) Normal soil	3	593	- 18	557
	(c) Clay	<u>3</u>	687	21	210
	(d) Gravel	2 3	756	25	781
	(e) Blasted-rock	<u>≂</u> 3 ′	1,511	50	1,561
(6)	Excavation by 0.6 m ³				· ·
				·	· · · · · · · · · · · · · · · · · · ·
(7)	Excavation by 1.2 m ³	¥3	1,541	92	1,633
	Fover-shovel	- 3	3 344		ан. Ал
	tes prester-tock	F 2	1,708	45	1,753
(8)	Loading by 1.2 m ³ Tractor-shovel				
	(4) \$254	_3	643		
	(b) Norral soil	3	547	30 10	577
	(c) Clay	3 3	547	50 X)	517
	(d) Gravel	3	625	14	377
	(e) Blasted rock	* 3	625	34	660
(9)	toading by 1.8 m ³ Tractor-shovel			•	
	(a) Sand	_3	507		
	(b) Normal soll	_3	507	10	537
	(c) Clay		507	30	537
	(d) Gravel	3	573		512
	(e) Blasted rock	a 3	573	33	512
10)	Babling by 6 ton Dzp-trod	L .	·		
	(a) Sandy loam	. m ³	0.267 x L + 562	0.027 # L + 55	0.234 9 7. 1 6
	(b) Sand	2,	0.284 x L + 533	0.030 x 1 + 62	0.314 x L + G
	(c) Clay	a,	0.301 x L + 632	0.031 x £ # £5	0.332 x L 4 6
	(a) Gravel (a) Blasted took	<u>*</u> 3	0.317 x & + 658	0.033 x L + 63	0.35 x L + 7
			U.418 X L + 8/3	0.013 x L + 91	0.451 x L + 9
- 1 P	saming by II ton Dap-true	A	and the second second		
	(a) Sandy loan	- <u>A</u>	0.255 x E + 536	0.022 x L + 46	0.277 + 1. + 4
	(b) Sand	- -	0.271 x L + 570	0.023 x L + 49	0.234 2 1 + 6
	CE CHY		0.287 x L + 603	0,025 x L + 52	0.312 x L + 6
	(a) Plastad	•	. 0.333 x L + 636	0.026 x L + 54	0.323 x L + 6
23	Spreading by Bull-Assar	• •	0.333 x L + 8)7	0.034 ± £ 4 73	0.433 x L + 9
-		2	and the second second		1
· · .	(b) Using 21 ton Bull-doze (b) Using 21 ton Bull-doze	ra fa	318 340	20 20	338 369
[3]	Corpacting by 3t Double tar	plag			
	(a) Ispervicus sole	- .	280	34	221

Table 1.13 List of Unit Rates of Works for Kalola Dam and Bila Intake Weir (2/3)

VIII ~ 18

Vorks	Unit	Foreign Currency	Local Currency	Total
pacting by 8-20t Tire-roll	ler			
Fandos zone	_)	tes	••	
racting by 6-7t	-	102	18	120
Rock poce	_3	303		
cavation 0.35 m ³ gack-		331	0	326
Sand	ູງ	552		620
Borral soll	23	634	34	620
r Clay		247	40	787
Blasted-rock	5	823 1.638	44	867
Caratico of Arrest	-	.,		1,720
CONSTRUCT OF CONST	8	14,538	2,563	17,161
Morts				
screte placed by hand				
) Reinforced	n 3	26,177	16, 790	42.967
} Plain	, m 1	24,607	16,958	41,563
/ Pase plain [1:2:4]	"	22,924	17,547	49,521
screte mixed by mixer	_			
Feinforces	»)	26,638	16,637	43,275
) flain	. =3	25,068	16,8)3	41,871
i Base plain	b j	23,445	17, 384	40,829
acrete for veir	" 3,	35,239	12,213	47,452
rtar (1:4)	a ³	21,983	3,779	25,768
inforcing bars	ton	427,012	34,795	451,807
ra for concrete				
) for common structure	- 2	-	2,234	2,234
) for scall structure	»,	-	3,719	3,719
J for welr	*	4,835	2,833	7,638
oden scaffolding	m ³	-	1,134	1,134
nnel .				
) Concrete lining	a3 a2	31,678	18,684	50,562
) Steel fora	ສ້	43, 353	42,654	86,007
t stone assonry				
) for lising	" 2	¥6	2,394	2,760
) for velr and structure	້	12,539	14,754	27,293
3	•			•
out hole drilling				
f 45 ma/a	° . 🖷	23,855	2,439	26,303
st hole drilling				
\$ 66 pc/a	8	33,063	5,005	38,034
out hole driffing		33 334	3 756	
∲ 100 m/a		23,394	1,193	ы, 191
outing of cement		6,260	553	6,813
outing of cepent				
# 100 m/a	n	12,062	637	12,693
				:
Sion		÷	16,318	16, 318
d fictor		•	1,201	1,201
بر جا	on facing	on facing	on facing	on - 16,318 facing - 1,201

Table 1.13 List of Unit Rates of Works for Kalola Dam and Bila Intake Weir (3/3)

	· · · · · · · · · · · · · · · · · · ·				(Unit: Rp.)
	Work Item	Unit	Foreign Currency	Local Currency	Total
1.	Earth works				
	Stripping of top soil	п ³	1,016	88	1,104
	Excavation in canal, common	13 ³	634	34	668
	Excavation in drain, common	m ³	843	48	891
	Excavation, weathered rock	m ³	823	44	867
	Barthfill with excavated material	E ³	597	34	631
	Earthfill with borrowed material	m ³	2,543	203	2,746
	Disposal of soil	6m	1,663	130	1,793
	Sod facing	# 2	_	1,200	1,200
	Asphalt pavement	" 2	468	1,967	2,435
2.	Concrete works			-	
	Reinforced concrete	<mark>т</mark> 3	26,640	16,640	43,280
	Reinforcement bar	ton	427,000	34,800	461,800
	Form for concrete	ъ 2	· · · · · · · · · · · · · · · · · · ·	3,720	3,720
	Plain concrete	r3	23,450	17,380	40,830
	Wet stone masonry	۳ <u>3</u>	12,540	14,760	27,300
·	Sluice gate	ton	5,400,000	1,350,000	6,750,000
	Concrete pipe Ø1000	n	n an	10,848	10,848
	Ø 300	a		1,447	1,447
. ·	Gabion	<u>д</u> З	. -	16,318	16,318
	Backfill for structure	٤ _m	60	600	660
		1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -			· -

Table 1.14 List of Unit Prices of Major Work of Canal and Road

VIII - 20

-

Itea	Алоц	int
	Total	Unit Cost
	(10 ³ Rp.)	(Rp./ha)
l. Salaries and Wages		
(1) Staff salaries	88,000	8,980
(2) Labour wages	2,400	244
2. Office Expenses	5,500	561
3. Operation Cost	11,000	1,122
 Maintenance Cost (1.0% of direct cost) 		
(1) Bila intake	26,640	2,718
(2) Kalola dam	76,550	7,811
(3) Canals and road	103,400	10,551
5. Miscellaneous L.S. (10% of the above)	31,350	3,199
Total	344,840 (= U\$\$551,750)	35,186 (= US\$/ha 56

Table 2.1 Annual Operation and Maintenance Cost

Table 3.1 Replacement Cost

	Itea	Useful Life	Replacement Cost	
		(year)	(10 ³ Rp.)	
1.	O & M Equipment	10	991,790	
2.	Project Facilities			
2. 2	(1) Bila intake, gate	25	47,620	
	(2) Kalola dan, gate	25	1,008,000	
	(3) Irrigation canals, gate	25	121,500	

ANNEX - IX

FLOOD CONTROL PLAN

ANNEX-IX FLOOD CONTROL PLAN

.

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ANNEX-IX PLOOD CONTROL PLAN

1. GENERAL

This report entitled ANNEX-IX "PLOOD CONTROL PLAN" presents the results of the pre-feasibility study on the flood control plan of the Bila, Boya, Kalola and Lancirang rivers.

The study was mainly carried out from the following aspects:

- (1) distribution of the design flood discharges of the main stream and other flood control facilities including the study of a floodway
- (2) establishment of the general features of a prospective flood control plan

2. PRESENT CONDITIONS OF RIVERS

2.1 River System

The Bila river originates in Mt. Tallu (Bl. 3018 m) and runs southward passing through the extensive fertile cultivated land via Tenru Tedong. It finally pours into Lake Tempe, gathering water from such tributaries as the Boya, Kalola and Lancirang rivers. The river system is shown in Fig. 1.1 of ANNEX I and Fig. 2.1.

The river length and catchment area of the Bila river and its tributaries are shown below:

Name of River	Catchment Area	River Length	
	(km2)	(ka)	
Bila River	485	80	
Kalola River	167	50	
Boya River	536	90	
Lancirang River	180	50	
Total	1,368	-	

2.2 Topography

The downstream area of the Bila river is an alluvial zone formed by sediment from the Bila and other rivers. The elevation of the Bila river basin ranges from 8 m near Lake Tempe to 30 m near the Bila gaging station which is located at the upper end of the alluvial plain. The alluvial plain area has a flat topography sloping from north to south with gradients ranging from 1/1,000 at the upper basin to 1/3,500 near Lake Tempe and Lake Buaya.

1X - 1

2.3 Carrying Capacity of the Existing River Channels

In order to estimate the carrying capacity of the river channel, cross sections were surveyed by the Team in the stretches shown in Fig. 2.2 during the period from August to October, 1981.

For calculation of the carrying capacity, coefficients of roughness were adopted at the following values:

Name of River	Stretch		<u>Manning's n</u>
Bila River	Downstream of conf	of Boya	0.025
	Conf. of Boya to B	ila AWLR	0.030
Boya River			0.030
Kalola River			0.030
Lancirang River			0.030

Applying uniform flow calculation method, bankful carrying capacity of river channels was estimated as shown in Table 2.1 and Fig. 2.2.

2.4 Ploods in the Past

According to the results of hydrological data described in ANNEX I "METEOROLOGY AND HYDROLOGY", the discharges of more than 500 m3/sec at Tanru Tedong were estimated as shown in Table 2.2.

3. DESIGN CRITERIA

3.1 Design Discharge

3.1.1 Scale of design discharge

(1) Bila and Boya rivers

The flood control plan is executed with two scales of the design discharges. One is adopted at the design discharge of 20-year return period for a future stage plan and another is adopted at the discharge of 5-year return period for a first stage plan.

The design discharge of 20-year return period was proposed in the Master Plan Study for the following reasons.

(a) The optimum B/C ratio was found to be that for a 20-year return period under the conditions of the proposed irrigation projects in the Bila and Boya areas:

	Return Period of Discharge			
Discount Rate	10-year	20-year	50-year	
8 %	1.31	1.32	1.21	
10 %	1.06	1.07	0.98	
12 %	0.89	0.89	0.82	

(b) A scale of 20 to 50-year return period is actually applied to the flood control project in Indonesia as shown in Table 3.1.

On the other hand, the design discharge of 5-year return period was proposed for the following reasons.

- (a) In respect to implementation of flood control project, the Indonesian Government recently adopted at a two phase system in some rivers in Java Island such as the Solo, Madium and Brantas rivers. For the first-phase the design discharge of 10-year return period was adopted.
- (b) The economic importance in the objective area of the Study seems to be behind that of river basins in Java Island.

(2) Kalola and Lancirang rivers

With regard to the tributaries, a scale of 5-year return period was adopted for the following reasons.

- (a) The inundation area caused by the tributaries is locally limited.
- (b) No tributaries flow through the towns such as Tanru Tedong.

3.1.2 Probable flood discharge

The probable flood discharges are estimated by the hydrological study described in ANNEX-I "METEOROLOGY AND HYDROLOGY". The outline is described as follows.

The equation is given by the correlation between specific discharge and catchment area.

 $q = X A^{C}$

where,		q	1	Specific discharge in m3/sec/km2	
		A	1	Catchment area in km2	
	X,	с	:	Constant	

In the Bila river basin, there is data available for estimating discharge recorded at the Bila water level station. Annual maximum discharge at the station is obtained as follows:

Year	Month	Date	Water Level	Discharge	Data Collection
			(m)	(m3/sec)	
1974	Sep.	12	3.98	680	Master Plan
1975	Jul.	28	4.07	705	- do -
1976	Mar.	13	2.95	430	- do -
1977	Jun.	18	3.14	50.5	- do -
1978	May	14	4.10	750	- 06 -
1979	Sép.	11	3.48	590	the study
1980	Мау	4	2.81	430	- do -
1981	Мау	15	3.38	565	- dò -
	ang sa désar sa	1			

Using these data, the discharges corresponding to the return period of 2-year, 5-year and 10-year were estimated as follows:

	Peak Dischar	ge (m3/sec)	Specific Discharge (m3/sec/	
Period	M/S	F/S	H/S	P/S
2-year	580	570	1.53	1.50
5-year	700	710	1.85	1.87
10-year	790	800	2.08	2,11

These values estimated in the study are almost the same as the values in the Master Plan Study. Accordingly, the same values of K and c are applied to the study. The discharge formulae for each return period are as follows:

Patura Pariod	Discharge Formula
2-vear	$q = 21.744 A^{-0.451}$
5-year	$q = 26.214 A^{-0.444}$
10-year	$\dot{q} = 33.176 \ A^{-0.462}$
20-year	$q = 41,308 A^{-0.474}$
- 50-year	q = 53.634 A-0.495

Remark: q : Specific discharge in m3/sec/km2 A : Catchment area in km2

The probable flood discharges are calculated as shown in Table 3.2.

3.2 Design Criteria for River Channel

3.2.1 Survey results for design

In planning the improvement of the river channel the following data are used:

- The topographical maps on a scale of 1/25,000 provided by the JICA are used for planning the alignment of levees.
- In designing cross sections of river channel, 66 cross sections which have been surveyed by the Team are used.
- The results of soil survey are used for the design of river channel and the construction plan.

3.2.2 Manning's coefficient of roughness

Manning's coefficient of roughness for the Bila river and its tributaries are adopted at following values:

· · · · · · · · · · · · · · · · · · ·	Stretch	Coefficient of roughness		
Name of River		Low-water channel	High-water channel	
Bila River	Downstream from the confluence of Boya river	0.025	0.040	
Bila River	Upstream from the confluence of Boya river	0.030	0.045	
Boya River	Whole stretch	0.030	0.045	
Kalola River	Whole stretch	0.030	-	
Lancirang River	Whole stretch	0.030		
Ploodway		0.030	· _	

3.2.3 Alignment of river channel

In planning the alignment of levees, the following items will be considered.

(1) On the route of the improved river channel, the alignment of levees is planned along the existing river channel, taking maintenance after the improvement works into consideration. (2) On the plan for floodway, the alignment of levees is planned taking the irrigation and drainage system into consideration.

3.2.4 Longitudinal profile

The longitudinal profile of river channel is planned in consideration of the following items.

- (1) The slope of the river bed is planned to make a gradual change from steep one to gentle one in the descending course so as to balance with the tractive force to protect the river channel from the occurrences of scour and deposition.
- (2) The design bed height is planned in relation to the design bed slope and design cross-sectional form, taking into account the usage for ship transportation and fishing.
- (3) In the backwater section affected by the lake, the height of levee is planned taking the following water levels into consideration.
 - (a) Maximum water level of Lake Tempe : EL 9.6 m
 - (b) Kean water level of Lake Tempe : KL 5,6 m
 - (c) Lowest water level of Lake Tempe : EL 3.2 m
- (4) The design high water level is planned in relation to the design discharge and the cross sectional form and longitudinal sectional form of the river channel. The water level is estimated by means of uniform flow and/or non-uniform flow calculation.

3.2.5 Cross sectional form

The cross sectional form is planned in consideration of the following items.

- (1) The design cross sectional form of the Bila and Boya rivers is planned to be a compound cross-section.
- (2) The river width of the Bila and Boya rivers is planned to provide the necessary width in a scale of the discharge of 20-year return period.
- (3) A scale of the low water channel for a 20-year return period is planned to have the carrying capacity to three times of flooding per year.
- (4) The slope gradient of low water channel is adopted at 1 : 2.

3.2.6 Levee

The crown width and the freeboard of levces are adopted at the following values:

Design Discharge	Freeboard	Crown Width	
(m3/sec)	(៣)	(B)	
200 to less than 500	0.8	4	
500 to less than 2,000	1.0	4	

The slope gradient of levee is adopted at 1 : 2. The critical height of levees is 5 meters in accordance with the soil mechanical study.

3.2.7 Stability of embankment

On the proposed routes of embankment of levees along the existing river channel and the proposed floodway, the critical height of embankment is studied applying Taylor's method in case of frictionless material.

The factor of safety of the slope of embankment is estimated by the following equation.

FS = NC	rt.H	
where,	PS 1	Pactor of Safety
•	No. 1	Stability Pactor
	C 1	Cohesion in t/m2
	rt :	Ket density of soil in t/m3, and
. :	H :	Height of embankment in m.

The values for the calculation are estimated on the basis of results of the soil investigation on typical samples of foundation soil and borrow pits. The values of C and rt are estimated at 2.5 t/m2 and 1.85 t/m3, respectively and it is assumed that firm soil is located at a depth of 15 m below the original ground surface.

The slope of embankment is adopted at 1 : 2 and also a cut is to be excavated in soft clay to depths of 1, 2, 3 and 4 m.

Assuming the factor of safety at 1.5, the critical height of embankment is estimated as follows:



4. FLOOD CONTROL PLAN

4.1 General

The southern part of the Bila area as well as the Boya area, which extends over both sides of the Bila river are presently affected by flooding in the rainy season.

In the Master Plan, two (2) comparative plans are studied for the improvement of mainstream of the Bila river. One is the improvement of the existing river channel and the other is the plan of the floodway passing through the center of the Bila area to minimize the improvement of the existing river channel. The master plan recommended the floodway plan because the construction cost of the floodway was slightly behind that of the improvement of the existing channel.

In this study, the flood control plan is carefully reviewed using newly obtained data.

4.2 Study on Route Selection of River Channel

4.2.1 Route of river channel

In planning the improvement route, the following four routes are selected.

- (1) Plan 1 : Improvement of the existing river channel
- (2) Plan 2 : Improvement of the existing river channel with shift of the Kalola river toward downstream of Tanru Tedong
- (3) Plan 3 : Construction of floodway along the route proposed in the Master Plan Study
- (4) Plan 4 1 Construction of floodway along the Ate drainage canal

These routes are shown in Fig. 4.1 to 4.4. The design discharges for each plan are adopted at two scales of discharge for 20-year and 5-year return periods. The design discharge distributions for each plan are shown in Fig. 4.5.

4.2.2 Extent of river channel for improvement

The extent of channel improvement for each plan is as follows:

		(Unit:	km)
Plan	Name of River	Section	Lèngth
Plan 1	Bila river	Near bifurcation to near confluence of Boya	17.9
· · ·	Kalola river	Confluence of Bila to spillway	4.5
Plan 2	Bila river	Near bifurcation to near confluence of Boya	17.9
-	Kalola river	Confluence of Bila to spillway	4.1
Plan 3	Bila river	Near bifurcation to near confluence of Boya	17.9
	Kalola river	Ploodway to spillway	4.4
	Ploodway	Lake Buaya to bifurcation of Bila	8.0
Plan 4	Bila river	Near bifurcation to near confluence of Boya	17.9
	Kalola river	Confluence of Bila to spillway	4.1
	Ploodway	Lake Buaya to bifurcation of Bila	10.0

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4.2.3 Comparison of plans

The design longitudinal profiles and the dimensions of cross-sections for each plan are shown in Fig. 4.6, 4.7 and 4.8 and Table 4.1, respectively.

The construction costs of river improvement works for each plan are estimated for selecting the best improvement route. The components of construction costs are composed of those for the land acquisition and civil works. The construction costs for each plan are estimated as shown in Table 4.2 and 4.3.

Comparing the construction costs for each plan, Plan 2 (Improvement of the existing river channel with shifting the Kalola river toward downstream of Tanru Tedong) is recommendable from the following points of view.

- (1) Comparing the construction costs of Plan 1 with Plan 2, Plan 2 is economically profitable.
- (2) Although the construction cost of Plan 2 is almost the same as other plans, Plan 3 and Plan 4 will increase the construction costs to establish agricultural facilities across the floodway in case that the Bila Irrigation Project will be ahead of the Plood Control Project.

4.3 Proposed Plood Control Plan

4.3.1 General principles in planning

In this study, planning for improvement is made in the whole stretches including the Bila, Boya, Kalola and Lancirang rivers. The channel improvement route is adopted at Plan 2.

General principles to be taken in planning of river channel improvement are as follows.

- (1) The design discharge for the improving route of Plan 2 was adopted at two (2) kinds of discharge with scales of 5-year return period and 20-year return period.
- (2) The river width for 5-year return period will be set at the same as that for a 20-year return period.
- (3) Necessary carrying capacity will be secured by excavation and/or dredging works together with building new levees.
- (4) In the improvement plan for a 20-year return period, carrying capacity of the low water channel is adopted at 600 m3/sec in the stretch of the Bila river from the bifurcation to the confluence of the Boya. This discharge of 600 m3/sec is evaluated at three times as big as flooding per year.

4.3.2 Design longitudinal profile and cross-section

The extent of river channel improvement is shown below:

		(Unit: km)
Name of River	Section	Length
Bila river	Near bifurcation to about 2 km upstream from confluence of Boya river	20
Boya river	Confluence of Bila to hilly districts	7
Kalola river	Confluence of Bila to hilly districts	10
Lancirang river	Confluence of Bila to Desa Ajubissue	8
Total	· · · · · · · · · · · · · · · · · · ·	45

The design high water level and the dimensions of design cross section are adopted as shown in Table 4.4 and Table 4.5 respectively. The design longitudinal profiles for each river are shown in Fig. 4.9 and 4.10 and some typical cross-sections are shown in Fig. 4.11 and 4.12.

4.3.3 Work quantity

(1) Work quantity for whole stretches

The main works for the whole stretches are summarized below:

<u>.</u>	Item	Unit	QQ	Q'ty		
			20-year	5-year		
1.	Land Acquition					
	and Compensation		40	40		
	(1) Paddy field	na	10	17		
	(2) Cultivable	na	10	10		
	(3) Un-cultivable	ha	/65	765		
	(4) Residential	ha	44	44		
	(5) House	Nos.	599	599		
2.	Dredging	$10^3 m^3$	20	20		
3.	Excavation	10 ³ m ³	12,340	8,510		
4.	Enbankment	$10^3 m^3$	1,910	1,910		
5.	Surplus soil	10 ³ m ³	10,430	6,600		
6.	Revetment	n,	6,000	6,000		
7.	Outlet	Nos.	3	3		
8.	Briðge	Nos.	6	6		
	A STATE OF A					

(2) Work quantity for Kalola river

The Kalola river is only a river which flows entirely through the Project area among the Bila and its tributaries. In case that the Kalola river is planned to be improved, the downstream area in the Project will be prevented from floods. The discharge of the Bila downstream from the confluence of the Kalola, however, will increase as compared with that in the present condition. Since the water level will be caused to rise by the increased discharge, the excavation works for the Bila river will be needed to keep the water level as it is.

The work quantities of the Kalola river including the excavation work of the Bila area are summarized as follows:

	Itéa	Un	it		Q'ty	
1.	Land Acquisition and Compensation		· .			
	(1) Paddy field	ħ	a -	:	17	:
	(2) Cultivable	}	a	: - 7	2	
	(3) Un-cultivable	1	ia -		58	
			to t	bè còn	tinued	
 .	Item	Unit	Q'ty			
-----------	-----------------	--------------------	-------			
	(4) Residential	ha	1			
	(5) House	Nos.	31			
2.	Excavation	103 m ³	1.720			
3.	Embankment	103 m ³	300			
4.	Surplus sóil	103 m ³	1.420			
5.	Outlet	Nos.	1			
6.	Bridge	Nos.	3			

4.3.4 Construction plan

(1) Period of construction works and execution system

The period of construction is adopted at 5-year plan including the period of detailed design.

The execution system is applied to full-contracting system.

(2) Preparatory works

Preparatory works comprise construction and maintenance of temporary access roads, offices, stores, workshops, guarters and labour camps, and topographic survey.

(3) Construction work

Dredging works will be executed using amphibious dredgers. Dredging materials will be used for filling up the low place near the working site.

Bxcavation will be executed by use of swamp bulldozers and backhoes. Excavated soil will be transported to embankment sites or spoil bank by use of swamp bulldozers or backhoes and dump trucks.

Embankment of levees will be made by use of the materials hauled from excavation sites nearby. Compacting and forming of embankment will be made by use of bulldozers, tamping rollers and manpowers.

Surplus soil after supplying to embankment will be heaped up near the embankment sites by use of bulldozers.

4.3.5 Cost estimate

(1) Unit price

The estimated unit costs used here are mentioned in ANNEX-VIII COST ESTIMATE. The unit prices for each work item are summarized as follows:

		وأرجع مرجع مرجع مستعر المستعر		······································	(Uniti Rp)
No.	Work Item	Unit	L.C.	P.C.	Total
1.	Dredging	m3	900	1,850	2,750
2.	Excavatión	ra 3	75	1,025	1,100
3.	Embankment	· m3	996	504	1,500
4.	Surplus soil	m3	17	268	285
5.	Revetment	m	25,000	· `	25,000
6.	Outlet	Nos.	38,000,000	11,300,000	50,000,000
7.	Bridge A /1	FÅ	800,000	1,200,000	2,000,000
	Briðge B <u>/2</u>	m	300,000	200,000	500,000

.....

Remark:

 $\frac{1}{2}$; Bridge A: for provincial road $\frac{1}{2}$; Bridge B: for village road

(2) Cost estimate

(a) Cost estimate for the whole stretches

The cost for the whole stretches is estimated as shown in Table 4.6 and 4.7 and summarized as follows:

			•			(Unit:	10 ⁶ Rp)
	Item		20-year			5-year	
	· · · · · · · · · · · · · · · · · · ·	L.C.	P.C.	Total	L.C.	F.C.	Total
1.	Land Acquisition and Compensation	2,290		2,290	2,290	-	2,290
2.	Civil Works	3,843	18,017	21,860	3,471	12,759	16,230
	(1) Preparatory	129	601	730	120	440	560
	(2) Dredging	18	37	55	18	37	55
	(3) Excavation	926	12,648	13,574	638	8,723	9,361
	(4) Embánkment	1,902	963	2,865	1,902	963	2,865
	(5) Surplus soil	178	2,795	2,973	113	1,768	1,881
	(6) Revetment	150		150	150	· · · · · · · · · · · · · · · · · · ·	150
	(7) Outlet	116	34	150	116	34	150
	(8) Bridge	317	439	756	317	439	,756
	(9) Miscellaneous	107	500	607	97	355	452
3.	Overhead & Others	950	2,220	3,170	700	1,640	2,340
4.	Contingency	1,067	3,013	4,080	989	2,151	3,140
5,	Bngineering and Administration	1,050	2,450	3,500	1,050	2,450	3,500
	Total	9,200	25,700	34,900	8,500	19,000	27,500

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(b) Cost estimate for the Kalola river

The cost for the Kalola river is estimated as shown in Table 4.8 and summarized as follows:

			(Unit:	10 ⁶ Rp)
	Item		5-year	
	· · · · · · · · · · · · · · · · · · ·	L.C.	F.C.	Total
1.	Land Acquisition	200		200
2.	Civil Works	630	2,570	3,200
	(1) Preparatory	22	88	110
	(2) Dredging	-	-	_
	(3) Excavation	129	1,763	1,892
	(4) Embankment	299	151	450
	(5) Surplus soil	25	380	405
	(6) Revetment	-	-	-
	(7) Outlet	39	11	50
	(8) Bridge	101	115	216
	(9) Miscellaneous	15	62	77
3.	Overhead & Others	140	320	460
4.	Contingency	140	430	570
5.	Engineering and Administration	150	340	490
	Total	1,260	3,660	4,920

4.3.6 Economic evaluation

(1) Plood damage

(a) Plood damage survey

In order to estimate flood control benefits, the field investigation by means of interview was carried out over the inundation area caused by the Bila river and its tributaries.

Surveyed items for this field investigation are as follows:

- (i) Occurrence date of past floods.
- (ii) Water depth, duration and direction of flow in the past floods.
- (111) Annual frequency and duration of inundation.
 - (iv) Ground height from the paddy field.

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			and the second	
Province (Propinsi)	District (Kabupaten)	Sub-district (Kecamatan)	Village (Desa)	Surveyed Number
Sulawesi	Sidrap	Dua Pitue	Tantu Tedong	20
Selatan			Bila	10
	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -		Lancirang	10
			Otting	l
	10-10	Belava	Belawa	8
	najo	002000	Wele	14
		Tanasitolo	Lowa	2
		Maniang Paio	Anabanua	2
	•		Kalola	2
· · ·		· ·		
Sotal				69

Sites of the field investigation are as follows:

Considering the topography, inundation depth and inundation period in affected areas by flood in each river, and the inundation area is divided into twenty-two (22) blocks in the whole area caused by the Bila and its tributaries. The delineation of inundation area is shown in Fig. 5.8 of ANNEX I.

(b) Plood damage to paddy and others

Plood damages consist of those to agricultural crops, houses, house-hold effects, public utility facilities, etc.

According to the flood damage report at Kantor Kepala Desa Tanru Tedong-Kecamatan Dua Pitue and Kantor Kepala Desa Kele-Kecamatan Belawa, the proportions of the paddy to others in the total flood damages are estimated as shown in Table 4.9 and 4.10, and these results are summarized as follows:

· · ·			(Unit: 8)
Item Tanru Tedong	Year	Percentag Paddy	e of damage Others
Tanru Tedong	1978	71	29
Wele	1980	68	32

In the inundation area, almost all the areas are of paddy field and the houses are built with the high floor type. The other flood damages except paddy, therefore, account only about 30% in the total damages.

Amount of total flood damages will be estimated on the assumption that the proportion of paddy to others is 70% to 30%.

(c) Estimation of damage to paddy

In estimating flood damage to paddy, the unit price of paddy is adopted at Rp. 200 per kg, and the following yield of paddy are applied:

- (1) 2.97 ton/ha under present condition
- (11) 5.0 ton/ha under proposed condition

The flood damage to paddy are estimated by use of the following data as described in ANNEX-I METEOROLOGY AND HYDROLOGY.

- (i) Probable flood inundation depth and duration.
 - (11) Estimated flood inundation depth and duration for each flood during a period from 1974 to 1981.
- (111) Rate of damage to paddy due to submergence prepared by the Ministry of Agriculture and Porestry, Japan.

Stage	Days after Transplanting	Plant Keight	Réparks	
	(day)	(cà)		
Tillering	0 tó 40	0 to 59	May & Nov.	
Booting	41 to 60	60 to 76	Jun. & Dec.	
Heading	61 to 75	77 to 79	Jul. & Jan.	
Ripening	75 to 90	80 to 100	Aug. & Feb.	

The rate of damage for each stage is shown in Fig. 4.13.

Using data mentioned above, the flood damage for each year are estimated in percentage and amount as shown in Table 4.11 to 4.16 respectively.

(d) Average annual decrease in flood damages

The probable flood damages are estimated as shown in Fig. 4.14, 4.15 and Table 4.17 and 4.18. The average annual decrease in flood damages are estimated as shown in Table 4.19 to 4.22. These results are summarized as follows:

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			(Unit)	10 Rp.}				
a de la construcción de la constru Construcción de la construcción de l	Amount of a	Amount of average annual decrease in damages						
Flood	Whole	area	Kaloia ar	ea				
discharge level	Present condition	Irrigated condition	Present condition	condition				
1/2	640	1,590	120	230				
1/5	1,280	3,380	240	490				
1/10	1,540	4,160	290	610				
1/20	1,680	4,610	320	680				
1/50	1,770	4,910	340	730				
			············					

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4.3.7 Cost-benefit Analysis

(1) Benefit

Benefit that will arise from the flood control is represented as effect of decrease in damages to be caused by floods. This benefit will be estimated as the average annual decrease of damages. This benefit will accrue every year throughout the project life of 50 years after the completion of construction. The partial benefits arised during the construction period are estimated assuming that they may be given in a ratio of the invested construction cost to the total construction cost.

(2) Economic cost

The economic cost is given by deducting transfer costs such as sales tax, income tax, duty, subsidy, etc. from the construction costs in local portion (Labour: 7%, Material: 5%), and the annual operation and maintenance costs. The OM costs of flood control are estimated at 0.5% of civil works throughout the project life after the completion of construction.

(3) Comparison of cost and benefit

The cost-benefit analysis is made for each of a 5-year and a 20-year river channel improvement works in the whole stretches, and Kalola river improvement works. These results are summarized as follows:

laì	Under	present	condi	ion

	· · ·		4		Unit:]	10 ⁶ Rp.)
River impro-	2	8		1 8	61	
vement plan	Cost	Benefit	Cost	Benefit	Cost	Benefit
20-year river channel	34,580	47,030	31,400	30,590	28,870	21,230
S-year river channel	27,010	35,830	24,570	23,310	22,620	16,170
Kalola river	4,990	7,000	4,500	4,550	4,120	3,160
		1X - 18				

(b) Under irrigated condition

· · · · · · · · · · · · · · · · · · ·		: · ·	*	(Ünit:	10 ⁶ Rp.)
River impro-	10) 8	1	28	14 %	
vement plan	Cost	Benefit	Cost	Benefit	Cost	Benèfit
20-year river channel	24,920	32,230	23,290	25,410	21,840	20,550
5-year river channel	19,550	23,550	18,280	18,570	17,140	15,020
Xalola river	3,530	3,450	3,300	2,720	3,090	2,200

(4) Benefit-Cost Analyses

(a) Under present condition

					(U	nit: 1	0 ⁶ Rp.)
River impro-	IRR		B/C			B-C	
vement plan		2 %	4 8	6 %	28	4 8	6 %
	(8)	·					
20-year							
river channel	3.8	1.36	0.97	0.74	12,450	-810	-7,64(
5-year			·				
river channel	3.7	1.33	0.95	0.72	8,820	1,260	-6,450
Kalola river	4.2	1.40	1.01	0.77	2,010	50	-96

(b) Under irrigated condition

	:				(ប	nit: l	0 ⁶ Rp.)
River impro-	IRR		B/C			B-C	
vement plan	<u>.</u>	10 8	12 %	14 8	10 %	12 %	14 8
	(8)		1				
20-year river channel	13.1	1.29	1.09	0,94	7,310	2,120	-1,290
5-year river channel	12.2	1.21	1.02	0.88	4,000	290	-2,120
Kalola river	9.9	0.98	0.82	0.71	-80	- 580	-890

5. CONCLUSION

The comparative study on the alternative flood control measures has been made on the basis of preliminary designs and cost estimates of the alternatives, and it is concluded that the following river improvement plans are most applicable to the Bila - Boya area:

(Unit: km) Length Section Name of river 20 Near bifurcation to about Bila river 2 km upstream from confluence of Boya river Confluence of Bila to hilly 7 Boya river districts 10 Confluence of Bila to hilly Kalola river districts Confluence of Bila to Desa 8 Lancirang Ajubissue river 45 (whole stretches) Totál

The construction costs of plans for 20-year and 5-year return periods were estimated as follows:

				(Unit:	10 ⁶ Rp.)
Scale of River channel	Bila river	Boya river	Kalola river	Lancirang river	Total
20 - year	24,940	3,960	3,630	2,370	34,900
5 - year	19,040	2,460	3,630	2,370	29,500
	<u></u>				

These river improvement plans are not economically feasible under present situation of low agricultual production in the area. The selected plans are, therefore, not incorporated in the Bila irrigation project. After completion of irrigation projects in the Bila-Boya area, however, the agricultural production would increase and the economic values to be protected by the flood control measures would become large. Under such a future situation, these river improvement plans would become economically justifiable as the Master Plan Team concluded.

Table 2.1 Carrying Capacity of Existing River Channel

		Between	211.5	1	~ 1	· • •	Carr	vina
Sec. 1	on in	tvo	Accumu-	Lovest	E1. 01	t Bank	¢apa	city
		sections	lative	river bed	Left	Right	Left	Right
		· (m)	(13)	(EL.m)	(EL.m)	(EL.D)	(m ³ /sec)	(m ³ /sec)
ь ÷	6.0	500	-5,900	5.61	8.6	• •	141	100
56 -	5.7	1,400	-5,400	4.85	8.9	0.7	171	100
Б. +	4.0	2,000	-4.000	5.06	9.4	3 A	1/1	100
st	2.0	1,800	-2.000	5.07	10.2	10 6	170	100
1	0.2	200	200	5 27	11 6	10.0	102	200
8R -	5.4	2.000	-5 400	4 (9	11.0	11.7	193	203
8R -	3.4	3.100	+1 400	9.90 t ic	9.3	9.4	123	129
kR	0.3	300	- 300	5.35	11.6	11.9	161	174
-	<u>.</u>							
51 5 T	0.0	1. 200	0	3.98	11.9	11.9	498	498
• <u>-</u>	1.2	1,200	1,200	5.40	12.4	12.4	486	486
) <u>+</u>	2.3	1,100	2,309	7.25	11.8	11.9	450	467
51	3.5	1,250	3,550	7.20	13.3	13.3	604	604
31	4.8	1,250	4,800	6.74	13.9	13.5	693	616
31	5.8	1,000	5,890	7.25	14.0	14.1	631	702
31	6.8	1,000	6,800	7.54	13.8	15.2	606	910
3 Í	9.4	2.550	à 25A	\$ ZA	14.0	14.0	504	tar
AT .	10.1	260	7,330	8.60	19.7 16 5	14.8	592	212
	17-1	139	10,100	8./1	12.3	15.2	/41	120
9 L 5 T	12 4	1,700	11,650	9.05	15.7	16.2	668	178
DI DI	13.9 16 J	1,000	* 5 , 500	8.65	10.5	16.5	1,036	1,096
51	15.4	2,100	15,450	9.98	17.6	17.7	653	674
81	10.9	1,000	16,450	9.35	17.7	18.1	1,080	1,210
81	17.8	1,100	17,550	11.07	18.4	18.4	1,151	1,151
BI	17.7	150	17.700	11.02	19.8	19.8	1.611	1.611
BI	19.0	1.250	18.950	12.37	20.0	20.2	1.129	1.196
81 81	20.0	800	19 750	13.53	21 0	20.9	1.143	1,120
вт	21.4	1.600	21 350	15 29	22 4	20.1	5.380	2.178
81	21.4	2,000	23,350	16.05	23.9	20.2	3,300	622
BI	24 9	1 500	24 850	17 41	23.6	22.0	2 811	1.191
BI	26.5	1,650	26,500	19.93	25.5	27.2	1,052	3,390
				•				
Boya Bo			Ó	11 27	17.6	19.9	571	830
~	3.0	1 100	1 100	12.02	19.0	19.1	654	879
50 63	1.1	1,100	2,100	12.02	19.6	19.6	844	844
80	2.1	1,000	2,100	12.02	20.0	10 9	726	695
BO	3.9	1,800	3,900	13.43	20.0	13-0	914	914
80	6.0	2,100	6,000	14.49	21.2	23.2	898	1.012
80	1.0	1,000	1,000	.4	••••	2372		
Falo	la			÷				
(tior	thern co	urse)	-	12.10	10 0	10 0	244	344
KA	0.0	0	0 ^-	11.17	19.7	10.7	249	101
KA	1.7	1,700	1,100	11.40	17.0	10.0	204 22	1)2 20
KA	2.9	1,200	2,900	11.84	14.3	10.0	40 40	
XA	4.40	1,500	4,400	15.85	24.0	20.0	10	
KY .	4.41	2	4,402	18.37	20.4	20.7	100	25
KA	4.5	98	4,500	14.37	ζΨ.ζ 2) Δ	20.3	107	222
KA	6.1	1,600	6,100	15.14	21.0	20.2	103	103
KA –	7.0	900	7,000	17.07	21.3	· 21.7	104	104
KA	8.3	1,300	8,300	16.04	22.4	21.9	170	191
KA	9.0	700	9,000	16.86	25.0	23.2	221	293 201
KA -	9.9	900	9,900	17.41	23.6	23.9	244	20
(Sou	ithern co	urse)	1 763	11.46	17.8	17.6	204	19
KA	1.7	1,700	1 100 1 100	14 50	18.2	18.2	87	8
KAL	3.10	1,400	100126	14.00	17.5	17.5	18	14
KAL	3.11	2	5,102	13.33 36 AA	19.9	19.1	25	1
XAL	4.50	1,393	4,500	10.40	10.0	10_1	147	14
KAL	4.51	10	4,510	14.03	17.9	27.7	165	15
KAL	5.3	795	5,300	L4.98	14 1	31 0	120	25
KA	4.5	150	5,450	14.37	44.6	£1.V	4 47 #	23
* * * *							•	
Land IA	cirang 0.0	: 0	0	7.90	13.8	13.4	164	14

			Tánru	Tedong	Bil	a
lear	Month	Date	W.L	Qmax	W.L	Qmax
			(m)	(m ³ /sec)	(m)	(m ³ /sec)
		•	· · · ·			
974	Jul.	15	· .	629	e.,	
	Sep.	12-17	7.06	924*	3,98	680*
	Oct.	16-17	· · ·	710	· · ·	
	Nov.	10	1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -	541		·
	Dec.	25		659		
975	Jun.	19	·	678		e de la composición d
	Jul .	28-30	1	831*	4.07	705*
	Aug.	12-14		804		
	Aug.	31		732		
	Ôct	8	•	531		
	····	\mathbf{v}			аў. — с.	•
976	Mar.	4~ 5		767		
	Mar.	13	2	÷	2.95	430*
	Хау	4-6	6.88	878*		
	May	27		508		
	Jun.	12		576		·
977	Apr.	2		627	· · ·	
	Apr.	17	· · ·	647		
	Jun.	14-15		657		
	Jun.	18-20	6.00	672*	3.14	505*
	Aug.	13		524		: · ·
	Dec.	14-15		577		
				· · · · · · · · · · · · · · · · · · ·		
1978	Mar.	30		503	~ ~~	
	Apr.	28-30	6.82	863*	5.76	060
	Мау	1-2		814	3.04	485
	May	14			4.10	150*
	Jún.	26		772	2.44	345
	Jul.	17		612	2.96	465
	Jul.	23-24		810	2.94	460
	Aug.	8		553	2.50	360
1979	Jun.	9-10	6.86	873	3.36	555
	Jun.	19-20	5.79	627	2.50	360
	Sep.	11	6.93	891*	3.48	590*
1980	Vav	4- 5	-	<u> </u>	2.81	430*
1000	Mav	27	· · · · · ·	1 	2.55	370
1981	Mar.	27-29	6.15	705	2.17	285
	Apr.	1-2	5.26	520	2.10	270
	May	5	5.26	520	1.74	195
	May	11-12	5.66	600	1.87	220
	May	14-18	6.96	898*	3.38	565*
	Jul.	15-17	5.50	567	2.05	260
1 . T	Jul .	19	5.56	579	1.56	160
	Jul	22-26	6.34	748	2.74	410

Table 2.2 List of Past Floods

Remark : * ; Annual maximum

- ; No data

Peak discharge more than 500 m^3 /sec at Tanru Tedong were selected.

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• .

No.	Name of River	Provínce	Catchment	Design Flood	Return Period	Remarks
			(km ²)	(m ³ /s)	(yr)	
1.	Sungai Cimanuk	West Jawa	3,006	1,440	25	
2.	Kali Serang	Central Jawa	937	900	25	
3.	Sungai Citanduy	West Jawa	3,680	1,900	25	
4.	Sungai Ular	North Sumatera	1,080	800	25	
5.	Kali Pemali	Central Jawa	1,228	1,300	25	
6.	Sungai Cipanas	West Jawa	220	385	25	
7.	Bengawan Solo	Central/East	3,400	1,500	10	lst stage
		Jawa		2,000	40	2nd stage
8.	Kali Madium	East Jawa	2,400	1,100	10	lst stage
				2,300	40	2nd stage
9.	Sungai Wampu	North Sumatera	3,840	1,320	20	
10.	Sungai Arakundo	Aceh	5,495	1,800	20	
11.	Sungai Kring Aceh	Aceh	1,775	1,300	20	
12.	Kali Brantas	East Jawa	10,000	1,350	10	lst stage
			· .	1,500	50	2nd stage
13.	Sungai Bah Bolon	North Sumater	a 2,776	1,220	20	· · · ·

Table 3.1Design Plood Discharge of the Riversin Indonesia

Toint for discharge calculation Catchment area Probable flood discharge Yoint for discharge calculation area 2-year 10-year 20-year 50-year 1. Main stream (Km ²) (Km ²) 5 711 809 938 1,0 3ila NMLR station 379 566 711 809 938 1,0 confluence of Kalola R. (upstream) 420 599 753 855 999 1,1 confluence of Kalola R. (upstream) 597 720 908 1,024 1,181 1,3 Tanru Tedong 1,123 1,023 1,453 1,456 1,43 1,3 confluence of Lancirang R. (upstream) 1,184 1,060 1,453 1,662 1,843 2,0 confluence of Lake Tempe 1,184 1,050 1,453 1,615 1,843 2,0 confluence of Lake Tempe 1,368 1,146 1,453 1,615 1,843 2,0 rathutaries 1,136 1,456 1,496 1,716 1,9 1,843 2,0 rathutaries 1,146 1,453 1,615 1,843 2,0 7 Subutaries 1,56 1,56 1,665 1,843 1,610 <t< th=""><th>Point for discharge calculationCatchment areaPrebable flood discharge discharge calculation1. Main stream(Nm⁴)(Nm⁴)1. Main stream3795667118099381,01Bila AWTR station3795667118099381,01confluence of Kalola R. (upstream)4205991,131,231,0221,4521,6621,84confluence of Boya R. (upstream)1,1231,0281,0221,4521,6621,842,03confluence of Lancirang R. (upstream)1,1231,0281,4361,4461,4332,03confluence of Lake Tempe1,3681,1461,4531,6621,8432,03confluence of Lake Tempe1,3681,1461,4531,6151,8432,03confluence of Lake Tempe1,3681,1461,4531,6161,261,26confluence of the Sila)5366858639751,1261,26Soya river (confluence of the Sila)5366858639751,1261,26Boya river (confluence of the Sila)5366858639751,1261,26Lancirang river (confluence of the Sila)5366858639751,261,26Lancirang river (confluence of the Sila)18037647054263Lancirang river (confluence of the Sila)18037647054477</th><th>Point for discharge calculationCatchmont areaPrebable floced discharge construct1. Main stream(Mmf)3795667112099381,07sila AWLR station3795667112099381,07sila AWLR station3795667112099381,07confluence of Soya R. (upstream)4205997538559991,13confluence of Soya R. (upstream)1,1231,0281,0241,1811,9431,034confluence of Internation1,11881,0601,3431,4431,9432,05confluence of Internation1,3681,1461,4531,6151,8432,05confluence of the Sila)1,3631,1461,4531,6151,8432,05subta river (proposed dam site)12230437944051766kalola river (confluence of the Bila)5366858639751,1261,22Boya river (confluence of the Bila)5366858639751,1261,22Lancirang river (confluence of the Bila)18037647054263477</th><th>Point for discharge calculationCatchmentPrebable floadPoint for discharge calculationarea2-year5-year10-year1. Wain stream379566711809sila AWLR station379566711809confluence of Kalola R. (upstream)420599753855confluence of Sola R. (upstream)1,1231,0061,4451,452Taxu Tedong1,1281,0601,4451,456Taxu Tedong1,1281,0601,4451,456Confluence of Lancirung R. (upstream)1,1281,0601,445Confluence of Lancirung R. (upstream)1,1281,0601,445Confluence of Lancirung R. (upstream)1,1281,0601,445Confluence of Lancirung R. (upstream)1,1261,4451,445Confluence of Lancirung R. 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1. Main stream 379 566 711 809 938 1,0 Bila AWIR station 379 566 711 809 938 1,1 confluence of Kalola R. (upstream) 420 599 753 855 999 1,1 confluence of Boya R. (upstream) 420 597 720 908 1,024 1,181 1,3 Tannu Tedong 1,123 1,028 1,302 1,452 1,662 1,8 Tannu Tedong 1,188 1,060 1,343 1,496 1,716 1,9 confluence of Lake Tempe 1,368 1,146 1,452 1,662 1,8 2. Tributaries 1,368 1,146 1,456 1,716 1,9 2. Tributaries 1,368 1,146 1,456 1,943 2,0 3. Aslola river (proposed dam site) 1,368 1,146 1,745 1,943 2,0 3. Ralola river (proposed dam site) 1,368 1,146 1,435 1,843 2,0 3. Ralola river (proposed dam site) 1,26 3,04 379 440 521 <	1. Main stream (mm ⁴) 1. Main stream 379 566 711 809 938 1,07 sila AWLK station 379 566 711 809 938 1,13 confluence of Xalola R. (upstream) 420 599 753 855 999 1,13 confluence of Salola R. (upstream) 1,123 1,028 1,024 1,131 1,302 Tanru Tadong 1,123 1,028 1,022 1,452 1,612 1,913 Tanru Tadong 1,188 1,060 1,453 1,466 1,452 1,662 1,913 Tanru Tadong 0.01fluence of Lake Tempe 1,188 1,060 1,496 1,716 1,91 Confluence of Lake Tempe 1,269 1,146 1,453 1,615 1,93 2,05 Confluence of Lake Tempe 1,269 1,146 1,496 1,716 1,93 2,05 Ralola river (propresed dam site) 1,268 1,146 1,495 1,716 1,28 1,22 Ralola river (confluence of the Bila) 536 685 61 440 51	1. Main stream (unt) (unt) (unt) 1. Main stream 379 566 711 809 938 1,07 sila AWER station 379 566 711 809 938 1,07 confluence of Kulola R. (upstream) 587 720 908 1,024 1,131 1,343 confluence of Lucitang R. (upstream) 1,123 1,028 1,302 1,455 1,465 1,416 1,451 1,31 confluence of Lucitang R. (upstream) 1,188 1,060 1,343 1,466 1,716 1,91 2,05 confluence of Lake Tempe 1,368 1,166 1,453 1,615 1,943 2,05 confluence of Lake Tempe 1,368 1,146 1,495 1,716 1,91 2,05 confluence of Lake Tempe 1,368 1,165 1,843 1,615 1,843 2,05 confluence of take Tempe 1,368 1,456 1,440 1,746 1,745 1,943 2,05 kalola river (confluence of the Bila) 167 361 420 3,126 1,726 1,234	 1. Main stream 2. La AMLR station 3.79 566 711 809 confluence of Kalola R. (upstream) 3.79 566 711 809 confluence of Kalola R. (upstream) 5.87 720 908 1,024 confluence of Earcirang R. (upstream) 1,123 1,028 1,302 1,455 confluence of Lake Tempe 1,188 1,060 1,343 1,496 confluence of Lake Tempe 1,368 1,146 1,453 1,496 confluence of the Bila) S36 635 863 975 Saya river (confluence of the Bila) Lancirang river (confluence of the Bila) Lancirang river (confluence of the Bila) Lancirang river (confluence of the Bila) 	Probable flood d v 5-vcar 10-vcar 2	flood discharge
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Tanru Tedong 1,123 1,028 1,452 1,662 1,8 confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,456 1,716 1,9 confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,966 1,716 1,9 confluence of Lancirang R. (upstream) 1,188 1,060 1,453 1,456 1,716 1,9 2. Tributaries 1,368 1,146 1,453 1,615 1,843 2,0 2. Tributaries 1,368 1,146 1,453 1,615 1,843 2,0 2. Tributaries 1,268 1,368 1,146 1,453 1,615 1,943 2,0 2. Tributaries 122 304 379 440 517 6 xalola river (confluence of the Bila) 167 361 451 521 610 7 Boya river (confluence of the Bila) 180 376 470 542 634 7 Lancirang river (confluence of the Bila) 180 376 470 542 634 7	Tanru Tedong 1,123 1,028 1,452 1,662 1,86 confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,496 1,716 1,91 confluence of Lake Tempe 1,368 1,146 1,453 1,496 1,716 1,93 2. Tributaries 1,368 1,146 1,453 1,615 1,943 2,05 3. Tributaries 1,368 1,146 1,453 1,615 1,943 2,05 2. Tributaries 1,368 1,146 1,453 1,615 1,943 2,05 3. Malola river (proposed dam site) 122 304 379 440 517 60 Xalola river (confluence of the Bila) 167 361 451 521 610 72 Boya river (confluence of the Bila) 536 635 863 975 1,126 1,26 1,28 Lancirang river (confluence of the Bila) 180 376 470 542 634 73 Lancirang river (confluence of the Bila) 180 376 470 542 634 73 <td>Tanru Tedong 1,123 1,028 1,302 1,452 1,662 1,86 confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,496 1,716 1,93 confluence of Lake Tempe 1,188 1,060 1,453 1,416 1,453 1,615 1,843 2,05 confluence of Lake Tempe 1,368 1,146 1,453 1,615 1,843 2,06 relota river (proposed dam site) 1,22 304 379 440 517 66 Kalola river (confluence of the Bila) 167 361 451 521 610 73 Boya river (confluence of the Bila) 536 685 863 975 1,126 1,23 Lancirang river (confluence of the Bila) 180 376 470 542 634 77</td> <td>Tauru Tedong Confluence of Lancirang R. (upstream) 1,123 1,028 1,302 1,455 confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,496 confluence of Lake Tempe 1,368 1,146 1,453 1,455 2. Tributaries Kalola river (proposed dam site) 1,368 1,146 1,453 1,615 Kalola river (proposed dam site) 122 304 379 440 Kalola river (confluence of the Bila) 122 304 379 451 521 Boya river (confluence of the Bila) 167 361 451 521 Lancirang river (confluence of the Bila) 180 376 470 542</td> <td>908 1,024</td> <td>024 1,181</td>	Tanru Tedong 1,123 1,028 1,302 1,452 1,662 1,86 confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,496 1,716 1,93 confluence of Lake Tempe 1,188 1,060 1,453 1,416 1,453 1,615 1,843 2,05 confluence of Lake Tempe 1,368 1,146 1,453 1,615 1,843 2,06 relota river (proposed dam site) 1,22 304 379 440 517 66 Kalola river (confluence of the Bila) 167 361 451 521 610 73 Boya river (confluence of the Bila) 536 685 863 975 1,126 1,23 Lancirang river (confluence of the Bila) 180 376 470 542 634 77	Tauru Tedong Confluence of Lancirang R. (upstream) 1,123 1,028 1,302 1,455 confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,496 confluence of Lake Tempe 1,368 1,146 1,453 1,455 2. Tributaries Kalola river (proposed dam site) 1,368 1,146 1,453 1,615 Kalola river (proposed dam site) 122 304 379 440 Kalola river (confluence of the Bila) 122 304 379 451 521 Boya river (confluence of the Bila) 167 361 451 521 Lancirang river (confluence of the Bila) 180 376 470 542	908 1,024	024 1,181
confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,496 1,716 1,9 confluence of Lake Tempe 1,368 1,146 1,453 1,615 1,843 2,0 confluence of Lake Tempe 1,368 1,146 1,453 1,615 1,843 2,0 kalola river (proposed dam site) 122 304 379 440 517 6 kalola river (confluence of the Bila) 167 361 451 521 610 7 Boya river (confluence of the Bila) 536 685 863 975 1,126 1,2 Lancirang river (confluence of the Bila) 180 376 470 542 634 7	confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,496 1,716 1,91 confluence of Lake Tempe 1,368 1,146 1,453 1,615 1,843 2,05 2. Tributaries 1,368 1,146 1,453 1,615 1,843 2,05 2. Tributaries 1,203 304 379 440 517 66 7. Kalola river (proposed dam site) 122 304 379 440 517 67 7. Kalola river (confluence of the Bila) 536 685 863 975 1,126 1,28 Boya river (confluence of the Bila) 536 685 863 975 1,126 1,28 Lancirang river (confluence of the Bila) 180 376 470 542 634 7	2. Tributaries 1,188 1,060 1,343 1,456 1,716 1,91 2. Tributaries 1,368 1,146 1,453 1,615 1,843 2,06 2. Tributaries 1,368 1,146 1,453 1,615 1,843 2,06 2. Tributaries 1,368 1,146 1,453 1,615 1,843 2,06 2. Tributaries 1,22 304 379 440 517 66 Kalola river (proposed dam site) 122 364 351 451 521 610 73 Boya river (confluence of the Bila) 536 685 863 975 1,126 1,25 Iancirang river (confluence of the Bila) 180 376 470 542 634 77	confluence of Lancirang R. (upstream) 1,188 1,060 1,343 1,496 confluence of Lake Tempe 1,368 1,146 1,453 1,615 confluences 1,453 1,615 2. Tributaries 122 304 379 440 kalola river (proposed dam site) 122 304 379 440 kalola river (confluence of the Bila) 536 685 863 975 Boya river (confluence of the Bila) 180 376 470 542 Lancirang river (confluence of the Bila) 180 376 470 542	1,302 1,452	452 1,662
2. Tributaries1,3681,1461,4531,6151,8432,02. Tributaries2. Tributaries1,223043794405176Kalola river (proposed dam site)1223614515216107Kalola river (confluence of the Bila)1673614515216107Boya river (confluence of the Bila)5366858639751,1261,2Lancirang river (confluence of the Bila)1803764705426347	confluence of Lake Tempe 1,368 1,146 1,453 1,615 1,843 2,09 2. Tributaries 122 304 379 440 517 66 kalola river (proposed dam site) 122 304 379 440 517 66 kalola river (confluence of the Bila) 167 361 451 521 610 73 Boya river (confluence of the Bila) 180 376 470 542 634 73 Lancirang river (confluence of the Bila) 180 376 470 542 634 73	2. Tributaries 1,368 1,146 1,453 1,615 1,843 2,03 2. Tributaries 1.100 122 304 379 440 517 66 Xalola river (proposed dam site) 122 304 379 440 517 66 Xalola river (proposed dam site) 167 361 451 521 610 73 Ralola river (confluence of the Bila) 167 361 451 521 610 73 Boya river (confluence of the Bila) 536 685 863 975 1,126 1,26 Lancirang river (confluence of the Bila) 180 376 470 542 634 73	confluence of Lake Tempe 1,368 1,146 1,453 1,615 2. Tributaries 122 304 379 440 Kalola river (proposed dam site) 122 304 379 440 Kalola river (confluence of the Bila) 167 361 451 521 Boya river (confluence of the Bila) 536 685 863 975 Lancirang river (confluence of the Bila) 180 376 470 542	1,343 1,496	496 1,716
 2. Tributaries 2. Tributaries 2. Kalola river (proposed dam site) 122 304 379 440 517 6 kalola river (confluence of the Bila) 167 361 451 521 610 7 Boya river (confluence of the Bila) 180 376 470 542 634 7 	2. Tributaries2. Tributaries2. TributariesKalola river (proposed dam site)1223043614515216071Kalola river (confluence of the Bila)5366858639751,1261,22Lancirang river (confluence of the Bila)18037647054263473	 Tributaries Kalola river (proposed dam site) I22 304 379 440 517 66 Kalola river (confluence of the Bila) I67 361 451 521 610 72 Boya river (confluence of the Bila) S36 685 863 975 1,126 1,25 Lancirang river (confluence of the Bila) I80 376 470 542 634 77 	2. Tributaries2. TributariesKalola river (proposed dam site)122304379440Kalola river (confluence of the Bila)167361451536685863975Lancirang river (confluence of the Bila)180376470542	1,453 1,615	615 1,843
 2. Tributaries 2. Tributaries 304 379 440 517 6 5.17 Kalola river (proposed dam site) 167 361 451 521 610 7 76 soya river (confluence of the Bila) 536 685 863 975 1,126 1,2 1.22 Boya river (confluence of the Bila) 180 376 470 542 634 7 	 Tributaries Kalola river (proposed dam site) 122 304 379 440 517 66 kalola river (confluence of the Bila) 167 361 451 521 610 73 Boya river (confluence of the Bila) 536 685 863 975 1,126 1,25 Lancirang river (confluence of the Bila) 180 376 470 542 634 73 	2. Tributaries2. TributariesKalola river (proposed dam site)1223043794405176071Kalola river (confluence of the Bila)5366858639751,1261,22Boya river (confluence of the Bila)18037647054263473	 2. Tributaries 2. Tributaries kalola river (proposed dam site) 122 304 379 440 kalola river (confluence of the Bila) 167 361 451 521 536 685 863 975 boya river (confluence of the Bila) 180 376 470 542 	· · · · ·	
Kalola river (proposed dam site)1223043794405176Kalola river (confluence of the Bila)1673614515216107Boya river (confluence of the Bila)5366858639751,1261,2Inneirang river (confluence of the Bila)1803764705426347	Kalola river (proposed dam site)12230437944051760Kalola river (confluence of the Bila)16736145152161071Boya river (confluence of the Bila)5366858639751.1261.25Lancirang river (confluence of the Bila)1803764705426347	Kalola river (proposed dam site)12230437944051766Kalola river (confluence of the Bila)16736145152161071Boya river (confluence of the Bila)5366858639751.1261.23Lancirang river (confluence of the Bila)18037647054263473	Kalola river (proposed dam site)122304379440Kalola river (confluence of the Bila)167361451521Boya river (confluence of the Bila)536685863975Lancirang river (confluence of the Bila)180376470542		
Kalola river (confluence of the Bila)1673614515216107Boya river (confluence of the Bila)5366858639751.1261.2Lancirang river (confluence of the Bila)1803764705426347	Kalola river (confluence of the Bila) 167 361 451 521 610 73 Boya river (confluence of the Bila) 536 685 863 975 1,126 1,28 Lancirang river (confluence of the Bila) 180 376 470 542 634 73	Kalola river (confluence of the Bila) 167 361 451 521 610 73 Boya river (confluence of the Bila) 536 685 863 975 1,126 1,28 Lancirang river (confluence of the Bila) 180 376 470 542 634 73	Kalola river (confluence of the Bila) 167 361 451 521 Boya river (confluence of the Bila) 536 685 863 975 Lancirang river (confluence of the Bila) 180 376 470 542	379 440	440 517
Boya river (confluence of the Bila) 536 685 863 975 1,126 1,2 Lancirang river (confluence of the Bila) 180 376 470 542 634 7	Boya river (confluence of the Bila) 536 685 863 975 1,126 1,28 Lancirang river (confluence of the Bila) 180 376 470 542 634 7	Boya river (confluence of the Bila) 536 685 863 975 1,126 1,28 Lancirang river (confluence of the Bila) 180 376 470 542 634 7	Boya river (confluence of the Bila) 536 685 863 975 Lancirang river (confluence of the Bila) 180 376 470 542	451 521	521 610
Lancirang river (confluence of the Bila) 180 376 470 542 634 7	Lancirang river (confluence of the Bila) 180 376 470 542 634	Confluence of the Bila) 376 470 542 634	Lancirang river (confluence of the Bila) 180 376 470 542	863 975	975 1,126
				470 542	542 634

Section	Plan	0	111							
· · ·		(m ³ /sec)	(71)	<u> </u>	81	82	Bh	83	<u></u>	<u>72</u>
	· .		1	[41]	សោ	(m)	(B)	(n) (n	wsec) (r	(sec)
Bila	1 and 2	1,900	3 to 3.4	1.7 to 2.1	148	160	10	240	3 30	0 76
BI 0.0 km	and 2	1,500	3 to 3.4	1.7 to 2.1	118	1 10	44 44	240	2.27	0.70
to 7.13 km	3-1, 4-1	1,400	3 to 3.4	1.7 to 2.1	108	120	30	180	2.27	d 76
	3-1, 4-1	1,000	3 to 3.4	1.7 to 2.1	78	90.	45	180	2.25	0.77
	3-2, 4-2	700	3 to 3.4	1.7 to 2.1	55	67	10	87	2.22	0.76
	3-3, 4-3	500	Existing	River Channe	:1	•••		•••		
211.		a								
0114 91 7 13 km		1,800	3.4 to 3.7	2.1 to 2.3	115.2	130	40	210	2.50	0.79
to 11 85 5m	J-J A I	1,400	3.4 to 3.7	2.1 to 2.3	95.2	110	50	210	2.43	0.79
	3-1, 4-1	1,300	3.4 to 3.7	2.1 to 2.3	75.2	- 90	30	150	2.46	0.78
	3-1, 4-1	900	3.4 to 3.7	2.1 to 2.3	55.2	70	40	150	2.42	0.79
4	2.2 4.4	600	Existing	River Channe	2					
		400	Existing	River Channe	-1			:		
8ila -	1 and 2	1,800	17 10 18	2 3 10 2 4	104 4	120	20		1 61	à 20
BI 11.85 km	land 2	1,400	3.7 16 3 8	2.3 to 2.4	104.4 74 A	120	- 30 - 45	100	2.71	0.79
to 13.5 km	3-1	1,300	3.7 to 3.8	23 to 24	74.4	: 0Ó	- 20	150	2.54	0.90
1993 (B)	3-1	900	3.7 to 3.8	2.7 00 2.4	44.4 44 A	50	45	150	2.54	0.60
1	3~2	600	Existica	River Chashe				1.75	6.41	0.01
	3-3	400	Existing	River Chaose	21					
	4-1 to 3	1,700	3.7 to 3.8	2.3 to 2.4	94.4	110	30	170	2 56	0.20
	4-1 to 3	1,400	3.7 to 3.8	2.3 to 2.4	74.4	90	40	170	2.54	0.81
n an										
Bila	1	1,800	3.8 to 4.9	2.1 to 2.6	84	160	35	170	2.66	0.87
BI 13.5 ka	1	1,490	3.8 to 4.0	2.1 to 2.6	64	89	45	170	2.63	0.88
to 17.6 km	2, 3 and 4	1,600	3.8 to 4.0	2.1 to 2.6	74	90	30	150	2.65	0.87
	2.3 and 4	1,200	3.8 to 4.0	2.1 to 2.6	54	-70	40	150	2.61	0.88
Bila	1	1.200	4.0	2.1	59	100	30	160	2 57	0.83
8T 17.6 kg	3	1.000	4.0	2.1	44	80	40	160	2 52	0.95
to 17.85 km	2.3 and 4	1.000	4.0	2.1	54	90	30	150	2.55	0.82
	2, 3 and 4	800	4.0	2.1	34	50	50	150	2.43	0.83
•										
Xalola	1	469	3.0	2.5	34	46	15	76	1.55	-
	2 and 4	460	3.0	2.5	20	35	15	62	1.90	-
· · ·	3	460	3.0	1.8	33	45	15	- 75	1.81	
C1	• •	\$ 600	3.0	1 9	22	40	30	100	1 40	
r toogvay	3 - 1		2.0	1.0	32	20	20	100	1.40	-
	3 * 1	1 200	2.0	1.0	112	120	20	100	1.30	_
	3 - 2	200	2.0	1.0	62	70	30	135	1.05	_
	3 - 2	1 000	2.0	1.0	97	100	30	160	1.50	
	3 = 2	1,000	2.0	1.8	47	50	30	110	1.50	_
	3 = 2	1 400	2.0	1.8	132	140	้งกั	200	1.67	_
	3 - 3	1.000	2.0	1.8	92	100	30	160	1.62	-
	2 - 3	1,200	2.0	1.8	112	120	30	180	1.65	
	3 - 3	200	2.0	1.8	62	70	30	130	1.56	-
		503	2.0	1.8	32	40	30	100	1.46	-
	4 - 7	1.200	2.0	1.8	112	120	30	180	1.65	-
31.1 -	4 - 2	8:0	2.0	1.8	62	70	30	130	1.56	. –
	4 - 3	1.400	2.0	1.8	132	149	30	200	1.67	-
	4 - 3	1.000	2.0	1.8	92	100	30	160	1.62	-
	· -									

Table 4.1 Dimension of Design River Channel for Study on Selection of Improving Route



								(Unit)	10 ⁶ Pp.)
	Description	Plan -1	Plan -2_	Plan 3-1	Plan 3-2	Plan 3-3	Plan 4-1	Plan 4-2	Plan 4-3
1.	Land acquisition and compensation	1,390	1,300	1,740	1,740	1,870	1,760	1,850	1,920
2.	Civil Works	19,650	18,690	17,500	21,970	23,970	17,580	22,470	23,820
	a. Preparatory	1,790	1,700	1,590	2,000	2,180	1,600	2,040	2,170
	b. Oredging	55	55	550	2,750	3,300	550	2,750	3,300
	c. Excavation	11,077	10,636	7,493	8,559	9,229	7,033	8,166	8,647
	d. Enbankment	1,724	1,614	2.043	2,019	1,805	2,669	2,658	2,444
	e. Surplus soil	2,543	2,292	1,553	1,834	2,049	1,315	1,611	1,776
	f. Revetment	150	150	150	150	150	150	150	150
	g. Outlet	150	150	150	150	150	150	150	150
	h. Bridge	544	556	629	699	779	666	746	766
	i. Ground sill	. <u> </u>		1,900	2,000	2,350	2,000	2,350	2,450
	j. Hiscellaneous	1,617	1,537	1,442	1,809	1,978	1,447	1,849	1,967
•	Total	21,040 (4)	19,990 (3)	19,240 (1)	23,710 (5)	25,840 (8)	19,340 (2)	24, 320 (6)	25,740 (7)

Table 4.2 Comparison of Construction Cost (T=1/20)

Table 4.3 Comparison of Construction Cost (T=1/5)

							Unit : 10	6 Sp.)
Description	Plan -1	Plan -2	Plan 3-1	Plan 3-2	91an 3-3	Plan 4-1	Plan 4-2	Plan 4-3
1. Land acquisition and cospensation	1,390	1,300	1,740	1,740	1,870	1,760	1,850	1,920
2. Čivil Works	14,150	13,900	14,220	15,470	18,550	14,300	16,090	18,820
a. Freparatory	1,290	1,260	1,290	1,410	1,690	1,300	1,460	1,710
b. Dredging	55	55	550	1,375	2,200	550	1,375	2,200
c. Excavation	7,462	7,369	5,341	5,382	6,\$41	4,882	5,066	6,244
d. Erbanksent	1,724	1,614	2,043	2,019	1,805	2,669	2,658	2,445
e. Surplus soil	1,606	1,603	995	1,011	1,352	758	808	1,154
f. Revelsent	150	150	150	150	150	150	150	150
a. Oxtlet	150	150	150	150	150	150	150	150
h. Bridce	544	556	629	699	779	666	746	766
i. Ground sill	÷	1 1 4	1,900	2,000	2,350	2,000	2,350	2,450
j. Kiscellaneous	1,169	1,143	1,172	1,274	1,533	1,175	1,327	1,551
Total	15,540 (4)	15,200 (1)	15,960 (2)	17,210	20,420	16,060 (3)	17,940 (6)	20,740 (8)

<u> </u>			······································	· · · · · · · · · · · · · · · · · · ·	(Unit : m)
Sectio	on No,	River Bed	High water Channel	H.W.L.	Levce Crown
Bila I	R.				······································
BI	0.0	7.30	10.30	12 00	13.00
BI	1.2	7.64	10.72	12.00	13.00
BI	2.3	7.96	11.10	12.92	13.90
BI	3.6	8.31	11.53	13.42	14 .72
BI	4.8	8.67	11.96	13.92	14 92
BI	5.8	8.96	12.31	14.32	15.32
BI	6.8	9.24	12.66	14.72	15.72
Lancin	rang	9.34	12.77	14.85	15.85
BI	9.4	9.97	13.54	15 74	16 74
BI	10.1	10.19	13.80	16.04	17.04
BI	11.7	10.69	14.41	16.74	17.04
BI	13.4	11.11	14.93	17.34	18.34
Kalol	a	11.16	14.98	17.40	18.40
BI	15.4	11.21	15 65	10 10	10.10
BI	16.4	2.00	16 00	10.10	13.10
BI	17.6	12.92	16.92	19.02	20.02
Boya		12.96	16.96	19.02	20.02
ът	17 7	12.04	12.04	10.00	20.09
TQ .	10.0	14.09	17.04	19.08	20.08
DI DI	20.0	14.00	10.00	13128	20,58
BI	21.4	-	10.75	20.54	20.90
Воуа					
BO	0.0	13.00	17.09	19.00	20.00
BO	1.1	13.44	17.44	19.44	20.44
BÓ	2.1	13.84	17.84	19.84	20.84
BO	3.9	14.56	18.56	20.56	21.56
во	6.0	15.40	19.40	21.40	22.40
Kalol	a				
KA	0.0	12.10	-	17.60	18.40
KA	1.8	13.30	-	18.80	19.60
KA	4.50	14.20	-	19.70	20,50
KA	4.51	14.21	~	19.71	20.51
XA	4.52	14.21	-	19.71	20.51
KA	5.3	14.73	-	20.23	21.03
KA	4.5	14,83	-	20,33	21.13
KA	6.1	15.90	-	21.40	22.20
KA	7.0	16.50	-	22.00	22.80
KA	8.3	17.37	· - .	22.87	23.67
KA	9.0	17.83	· 🕶	23.33	24.13
KA	9,9	18,43	-	23.93	24.73
Lanci	rang			н н н	
LA	0.0	9.40	-	14.90	15.90
LA	3.5	12.58	· <u> </u>	16.78	17.58
.LA	7.0	15.76	-	19.96	20.76

Table 4.4 Dimension of Design Longitudinal Profile

i.....

	Table 4.5	Dimension	of Design Cros	s Section				
						Ð	nit : m)	
Name of River	Section	Ø	Ţ	H2	Вl	2 8	Bh	B ₃
		(m3/sec)						
811a	BI 0.00 km to BI 7.13 km	1,900 1,500	3.0 to 3.4 - do 4	1.7 to 2.1 - do -	1 1	160 130	40 55	1 240 1 2
	BI 7.13 km to BI 11.85 km	1,800 1,400	3.4 to 3.7 - do -	2.1 to 2.3 - do - 3.3	1	110	4 v 0 0	1 210 do 1
	BI 11.85 km to BI 13.50 km	1,800	3.7 to 3.8 - do -	2.3 to 2.4 - do -	1 1	750 30	0 X 4 Q	1 90 1 1 1
	BI 13.50 km to BI 17.60 km	1,600	3.8 to 4.0	2.1 to 2.6 - do -	1	82	м 4 0 0	1 720 1 720 1
	BI 17.60 km to BI 17.85 km	1,000	1 4 0 4 0 1	- 2.1 do г	5 4 N	လို လို လို လို	လို လို	1 20 1 20 1 1 20 1
	BI 17.85 km to BI 20.00 km	1,000 800	4 • 4 0 0	2.1 to 1.2 - do -	5 8 2 4	40 40 40	0 0 0 0	1 900 120
Boya	BO 0.00 km to BO 6.00 km	1,200	4 1 0 0 1		20 22 24 24	100	30 45	1 160 1
Kalola	xa 0.00 km to xa 9.90 km	460	3.0	2.5	50	32	15	6 7
Lancirang	LA 0.00 km to LA 8.00 km	470	2.5	1.7	ရို	4	OR N	100

IX - 28

	# 1/20)
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	Table

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Item Unit Cast of ty Amount Oty Descended of the set of the s								V. C. C. V.	Town -	LANCL	rand river	Ц Ц Ц	ytal .
. Live is the frequencies of the frequencies	Item	Unit	Unit Price	B113 0.ty	Amount	0.ty	Amount	0.tV 2	Amount	۲. ۲	Amount	<u>۲</u> , ۵	Amount
Letter	Land Acquisition	L.S.	1	1	1,520	•	290	1	200	ı	280	I	2,290
. C.NV.1. WOXE 520 80 80 80 5 (1) Preparatory I.S. 520 55 80 80 5 (2) Dredging $10^3 m^3$ $1,100$ 9,410 $10,351$ $1,120$ $1,232$ 400 44 (3) Excavation $10^3 m^3$ $1,500$ 960 $1,440$ 250 375 300 450 400 60 (5) Surplus soil $10^3 m^3$ $2,550$ $2,408$ $1,160$ 331 820 234 - 20 (6) Revetment L.S. - 150 - - 20 1 50 </td <td></td> <td></td> <td></td> <td></td> <td>012-11</td> <td></td> <td>2,450</td> <td></td> <td>2,320</td> <td></td> <td>1,380</td> <td></td> <td>21,860</td>					012-11		2,450		2,320		1,380		21,860
<pre>(1) Freparatory 1</pre>	2. CIVIL WORKS			1	520	11	80	ı	ŝ	ı	SO	I	730
 (2) Excendation 10³m³ 1,100 9,410 10,351 1,410 1,551 1,120 1,232 400 44 (3) Excavation 10³m³ 1,500 960 1,440 250 375 300 450 400 60 (5) Surplus soil 10³m³ 285 8,450 2,408 1,160 331 820 234 7 (6) Reverment L.S 150 - 20 (7) Outlet NOS 150 - 250 1 50 1 50 1 50 (8) Bridge L.S 2466 - 63 - 250 1 50 1 50 1 50 (9) Miscellaneous L.S 2,280 - 356 - 350 - 226 3. Overhead & Others - 2,280 - 356 - 350 - 20 4. Contingency L.S 2,930 - 460 - 460 - 330 - 20 5. Enginecring and L.S 2,500 - 400 - 3,60 - 3,630 - 2,37 	(1) Preparatory	103m3	2.750	20	2 5 7 5 7		I	1	.1	I.	ı	50	55
 (4) Embankmont 10³m³ (5) Surplus soil 10³m³ (5) Surplus soil 10³m³ (6) Reverment L.S 150 (7) Outlet Nos 150 (8) Bridge L.S 2446 (9) Miscellancous L.S 2,280 (9) Miscellancous L.S 2,280 (10) Miscellancous L.S 2,280 (11) 56 (12) 0.0000 (13) 0.0000 (140) 0.000 (150) 0.0000 			001.1	012.6	10,351	1,410	1,551	1,120	1,232	400	440	2,340	13,574
<pre>(5) Surplus soil 10^{3m³} 285 8,450 2,408 1,160 331 820 234 - (6) Revetment L.S 1 50 1 50 1 50 (7) Outlet Nos 1 1 50 1 50 1 50 (9) Miscellancous L.S 446 - 63 - 216 - 200 (9) Miscellancous L.S 2 2,280 - 360 - 330 - 200 3.0verhead & Others - 2 2,930 - 460 - 420 - 200 4.Contingency L.S 2,500 - 460 - 360 - 360 - 240 Administration - 2 2,940 - 3,960 - 3,630 - 2,370 TOTAL - 2 2,940 - 3,960 - 3,630 - 2,370 </pre>	(4) Embankment	10 ^{3m3}	1,500	960	1,440	250	375	300	450	400	600	1,910	2,865
(6) Reventment L.S. - - 150 - - - - 50 1 50 (7) Outlet Nos. - - 1 50 1 50 1 50 (8) Bridge L.S. - - 340 - - 216 - 206 (9) Miscellaneous L.S. - - 446 - 63 - 216 - 206 3. Overhead & Others - - - 2 - 350 - 206 3. Overhead & Others - - - 2 - 460 - 460 - 206 4. Contingency L.S. - - 2 - 240 - 240 - 240 5. Engineering and L.S. - - 2 - 2 -	(5) Surplus soil	10 ² m ³	285	8,450	2,408	1,160	331	820	234		н 1	0,430	2,973
(7) Outlet Nos. - - 1 50 1 50 1 50 (8) Bridge L.S. - - 340 - - 206 - 206 (9) Miscellancous L.S. - - 446 - 63 - 58 - 46 3. Overhead & Others - - - 2,280 - 360 - 200 3. Overhead & Others - - - 2,280 - 360 - 200 4. Contingency L.S. - - 2,930 - 460 - 420 - 24 5. Encinecring and L.S. - - 2,500 - 400 - 360 - 24 7 - - - 2,500 - 240 - 24 - 24 5. Encinecring and L.S. - - 2,500 - 400 - 360 - 24 70ministration - - <	(6) Revetment	с. С.	. 1	;	150	ŧ	ł	ı	1	1 ^{- 1}	t	1	150
(8) Bridge L.S 340 216 - 200 (9) Miscellancous L.S 2,280 - 63 - 58 - 40 3. Overhead & Others 2,280 - 360 - 330 - 200 4. Contingency L.S 2,930 - 460 - 420 - 200 5. Enginecring and L.S 2,500 - 400 - 360 - 240 Administration 24,940 - 3,960 - 3,630 - 2,370 norw			ŧ	1	I	rł	ò	н	50	н	505	ო	150
(9) Miscellancous L.S. - 446 - 63 - 58 - 4 3.Overhead & Others - - - 2,280 - 350 - 20 3.Overhead & Others - - - 2,280 - 350 - 20 4.Contingency L.S. - - 2,930 - 450 - 420 - 27 5.Engineering and L.S. - - 2,500 - 400 - 360 - 24 Administration - - - 24,940 - 3,630 - 2,37		V	I	I	340	.'	ł	ľ	216	ı	200	l ,	756
3. <u>Overhead & Others</u> 2,280 - 360 - 330 - 20 4. <u>Contingency</u> L.S 2,930 - 460 - 420 - 27 5. <u>Enginecring and</u> L.S 2,500 - 400 - 360 - 24 <u>Administration</u> TOTML 24,940 - 3,960 - 3,630 - 2,37	(e) Briuge (9) Miscellaneous	о 1	I	I	446	ł	63	I	58	I	40	I	607
4.Contingency L.S. - 2,930 - 450 - 420 - 27 5.Enginecring and L.S. - - 2,500 - 400 - 360 - 24 Administration - - - 24,940 - 3,630 - 2,37	3. Overhead & Others	1	ì	I	2,280	I	360	ł	330	3	200	ı	3,170
5. <u>Enginecring and</u> L.S 2,500 - 400 - 360 - 24 <u>Administration</u> TOTAL 24,940 - 3,960 - 3,630 - 2,37	4. Contingency	ר. מייל	E	I	2,930	I	460	ı	420		270	1	4,080
TOTAL 24,940 - 3,960 - 3,630 - 2,37	5. Enginecring and Administration	г. s.	2	∎	2,500	•	400	1	360	I	240	· 1	3,500
	TOTAL	•	I F	ľ	24,940	E E	3,960	I	3,630	2	2,370	;	34,900

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Table 4.7 Construction Cost of Whole Stretches (T = 1/5)

16,230 3,140 150 156 452 2,340 3,500 0000 150 Anount 2,290 2,865 1,881 27,500 ហ 195,9 (Unit : 106 Rp.) Total 0.t I 8,510 1,910 6,600 20 Lancirang river Q'ty Amount 280 200 9 200 240 2,370 1,380 270 440 ŝ 000 လ္ပ \$ 84 80 **4**00 Amount Kalola river Q'ty Amount 360 200 2,320 L,232 216 တ လ 330 420 3,630 80 450 234 ပ္ပ လ 1,120 t go 820 2,460 1,310 869 375 40 40 00 290 108 190 270 о S Boya river Q'ty Amount S š 2 630 250 380 1 1,520 11,220 380 1,539 150 0.55 320 1,620 2,500 6,996 1,440 2,180 19,040 ູ່ ເ Amount Bila river 6,360 960 5,400 I R Prico 00111 1,500 285 2,750 Chit г. N н.S. s i н. С. г. С n on 3 10³m³ 5 Unit 10³m³ 103m3 10^{3m3} (9) Miscellaneous 3. Overhead & Others I. Land Acquisition and Compensation (S) Surplus soil 5. Engineering and (1) Preparatory Administration (4) Embankment (3) Excavation (6) Revetment (2) Dredging 2. Civil Works 4. Contingency (7) Outlet (S) Bridge Htem Teror Table 4.8 Construction Cost of Kalola River

	-									(Uni	€_::10 ⁶	RD.)
Item	Unit	Unit Price	Bila Cty	river Amount	Boya 0 ty	<u>river</u> Amount	Kalol?	Amount	Lancir O'ty	ang river Amount	10	All
1. Land Acquisition	۲.S.	1		r	,	е.	- 1	800 80	€.	1		500 5
and Carrier 2. Civil Works	·	ı	1	088 088	3	•	ſ	2,320	1	. 1	•	3.200
(1) Preparatory	יא אין	1	I	000	2	, I ,	1	80	ı	• \$)	011
(2) Dredging	10 ^{3m3}	• 1	J	ı	ł		'	I	ı	1	I	ł
(3) Excavation	LO ^{3m3}	1,100	600	660	,	ı	1,120	1,232	ł	9	1,720	1,892
(4) Embankment	10 ³ m ³	1,500	ł	t	ı	ı	300	450	1	i	300	450
(5) Surplus soil	20 ^{3m3}	285	600	171	ı	•	820	234	I,	ŧ	1,420	405
(6) Revetment	L.S.	1	ł	I	I	I	ļ, I,		ı	• 1	I	
<pre>(7) Outlet</pre>	Nos.	I	J	•	ł.	ı	ч	50	I	L	I	50
(8) Bridge	г.s.	E ·	ı	5	1	ı	J	216	, I	1	ı	216
(9) Miscellancous	ť.s.	ł	3	6T	•	I	1	80 20	I		ł	77
3. Overhead & Others		ı	ı	081 130	ſ	I	J	330	ŧ	ı	ł	460
4.Contingency (20%)	Ľ.S.	ı	1	150	ſ,	1	J	420		9	8	570
S.Engineering and Administration (10	8) L.S.	. 1	•	130	ı	•	ı	360	ı	1	I	490
Total				1,290				3,630				4,920
Remark : Bila River	Excavati	ton 4	15 m2 x	13,500 ė	600,000	ы ³ .						

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				· .			(Unit : 10 ³	Rp.)
	Iteл	Unit	Quan- tity	Unit Price	Arount	Rate of Damage	Estimated Flood Darage	Remarks
. Padd 160	y 3.1 ton/ha, Rp./kg	ha	1,500	558	837,000	0.20	167,400	715
Hous	es						32,740	143
· · (ì)	Parmer	Nos.	1,982	2,000	3,964,000	0.003	11,890	
(2)	Mosque	Nos.	3	10,000	30,000	0.03	900	
(3)	School .	Nos.	20	17,000	340,000	0.03	10,200	
(4)	Others	Nos.	25	13,000	325,000	0.03	9,750	i .
. Livé	stock		· .				21,940	91
(1)	Bufallo	Nos.	400	150	60,000	0.Ò1	600	
(2)	Cow	Nos.	3,351	200	670,200	0.03	20,110	
(3)	Horse	Nos.	230	150	34,500	· -	-	
(4)	Goat	tos.	165	35	5,775	0.03	170	
(5)	Chicken	los.	17,591	2	35,182	0.03	1,060	
. Fubl	ic	· · ·	·. ·		· · · ·	· · ·	13,700	61
(1)	Kabupatén Posd	ka	5	11,600	58,000	0.05	2,900	
(5)	Desă Road	ΧR	9	2,400	21,690	0.50	10,800	
	Total	÷		· · · · · · · · · · · · · · · · · · ·		··	235,780	

Table 4.9 <u>Plood Damages in Past Plood</u> (Tanru-Tedong, 1978)

Table 4.10Plood Damages in Past Flood
(Kelle, 1980)

	1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -					(Unit : 10	³ γρ.)
Itea	Unit	Quan- tity	Unit Price	Azount	Rate òf Dazage	Estimated Plood Canage	Penarks
1. Paddy 3.1 ton/ha, 180 Rp./kg	ha	1,919	558	1,070,802	0.10	107,080	681
2. Bouses		÷ .				20,650	135
(1) Parser	Nos.	1,494	3,000	4,482,000	0.001	4,460	
(2) Mosque	Nos.	4.	11,000	44,000	0.03	1,320	· .
(3) School	Nos.	9	20,000	180,000	0.03	5,400	•
(4) Others	tos.	21	15,000	315,000	0.03	9,450	
3. Livestock		· · · ·		. •		10,760	71
(1) Bufallo	Nos.	51	150	7,650	0.01	80	
(2) Cost	Nos.	1,798	200	359,600	0.02	7,190	
(3) Borse	Nos.	77	LSO	11,550	· - '		
(4) Goat	Nos.	135	35	4,725		-	
(5) Chicken	tios.	17,458	2	34,916	0.1	3,490	
4. Public			. :			18,720	125
(1) Kabupatén Roa	d ka	•	-	1	÷	-	
(2) Desa Road	ka	25	2,400	60,000	0.3	18,000	
(3) Bridge	Nos.	9	600	7,200	0.1	720	
Total	<u>.</u>					157,210	

Table 4.11 Estimated Percentage of Flood Damages to Paddy for Each Area (Under Present Condition)

<u>в</u> т	La Area		· . . · .			•			•			(Unit: %)
Year	BI - 1 220 ha	BI - 2 420 ha	BI - 3 630 ha	KA - 1 100 ha	KA - 2 10 ha	KA - 3 780 ha	KA - 4 290 ha	BK - 1 360 ha	BK - 2 250 ha	BK - 3 280 ha	80 - 1 90 ha	Ave. 3,430 ha
1974	ω	Ø	26	1	00	26	23-	ដ	œ	26	n	18
1975	31	27	32	0°	23	3F	ц Е	1 2	He	31	23	0 M
1976	23	53	23	23	23	23	5 S S S S S S S S S S S S S S S S S S S	ទ	23	23	201	25 25
1977	35	0	35	Ó	Ö	с С С	SE	34	94 24	S S S S S S S S S S S S S S S S S S S	ò	28
1978	37	37	26	37	0	37	. 37	37	37	37	0	34
1979	26	26	28.	45	ហ ተ	28	Q 4	04	28	28	ú Л	30
1980	10	0	2	0	0	50	о Н	0	50	о н	0	ø
1981	27	27	27	27	o	27	27	27	27	27	0	26
Ave.	25	19.	26	22	6	27	30	28	. 25	27	9	25
				1			-		:		· · ·	·
йI ~	oya Area				•					*		
Year	BO - 2 280 ha	BO - 3 520 ha	BO - 4 200 ha	BB - 1 770 ha	88 - 2 190 ha	LA 1 730 ha	LA = 2 680 ha	140 ha	LA - 4 450 ha	LA - 5 280 ha	BL - 1 860 ha	Ave. 5,100 ha
1974	6	26	24	77	24	23	ю	29	29	21	29-	20 20
1975	2.9	15	34	18	34	46 S	29	46	46	45	60	ထို
1976	0	0 T	ហ	ы М	5 S	ហ្គួ	50	35	45	35	25	31
1977	0	35	36	46 -	о С	5 C	0	36	36	37	36	29
1978	0	37	37	50	57	37	37	40	46	46	61,	41
6791	Ч Ч	24	លំ ហំ	26	5 G	40	25	40	41	ů V	л S	36
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	8 <u>0</u>)	BO - 1 90 ha 3	m m Q O N H	ဝရဝထ			BL - 1 1,290 ha	6 4 % 8 0 %	201 S 1	83 83 80
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2		BX = 2 250 ha	8 7 N 8	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	9 1 1 1 1 1 1		LA - 4 450 ha	4 4 4 W Ø N	9 9 H 9 9 9 H 9	83 83
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Ldar		BI - 2 420 ha	8 7 8 7 7 8	ဝဂွ်ဖွဲ့ဝင္	24		BO - 3 520 ha	8 m 6 8 m 6	55 4 3 2 4 3 1 2 4 3 1	5 % 2
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Flood Damages to	
Annual	
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(Under Present Condition)

106Rp. Total

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Ter		· ·	B.T 2	420 ha	34	113	97	0	252	601	00	210	815					BQ - 3	520 23	146	Ъ Ч	25	182	244		7 5		666
		A Area	т – 18	220 ha	22	89	ដ	77	132	57	22	77	506			ya Area		20 20 20	280 ha	Ø	4	5 8	0	0	42	o ç	77	164
		1.8.1		Year	074	1975	1976	1971	1978	1979	1980	1981	Total			2. BO				1974	1975	1976	1977	1978	1979	1980	796I	Total

Table 4.15 Estimated Annual Flood Damages to Paddy, Whole Area

	Under	r Present Cond:	itions	Under	r Proposed Cond	litions
YOAK	Bila Aroa	Boya Area	Whole Area	Bila Area	Boya Area	Whole Area
1974	375	607	982	673	2,895	2,568
1975	620	1,148	1,768	1,045	2,486	3,531
1976	507	945	1,452	856	2,311	3,167
1977	580	871	1,451	978	2,034	3,012
1978	691	1,228	1,919	2,055	4,340	6,395
1979	614	7,090	1,704	1,029	2,591	3,620
1980	166	336	502	281	816	1,097
1981	\$34	772	1,305	1,625	4,419	6,044
Total	4,087	6,996	11,083	8,542	20,892	29,434

Table 4.16 Estimated Annual Flood Damages to Paddy, Bila Area

	Under F	resent Conditi	uo vo	Unde	r Proposed Con	ditions
Year	Kalola Area	Other Area	Bila Area	Kalola Area	Other Area	Bila Area
1974	193	182	375	346	327	673
1975	271	349	620	456	589	1,045
1976	231	276	507	389	467	856
1977	282	298	580	477	201	978
1978	323	368	691	880	1,175	2,055
1979	285	329	614	478	551	1,029
1980	81	85	166	137	144	281
1981	236	298	534	719	906	1,625
Total	1,902	2,185	4,087	3,832	4,660	8,542

					(Unit	: 106Rp.)
	ThRey	Present Condi	tions	Under	Proposed Cond	1 tlons
Neturn		Others	Total	Paddy	OCDOLS	
Poliod	racty			001.1	470	1,570
1 - Year	500				1,440	4,790
2 - YOAK	1,300	000			2,140	7,140
	1,700	730	2,4,00		2.530	8,430
10 - Vear	1,900	810	2,710		2.830	9,430
20 - 1001	2.050	880	2,930			10.640
SO - Vear	2,250	960	3,210	7,450	50.75.0	
	[den	le 4.18 Probe	thie Flood Da	mages in Kalola Ar		
				Unde	Proposed Cond	litions
Return	Chdex	Present Cond	11015	Paddy	Others	Total
Period	Paddy	ocners			¥0	200
	80	õ	110		210	690
2 - 2022	250	110	360	7 C	320	1,060
S - Vear	310	130	440	Č Č Č	370	1,240
10 - Yoar	340	150	4 7 0 0	066	420	1,410
20 - year	370		000	1,110	480	1,590
SO - VOAY	400	2	>			

20 - Year SO - year

						(Unit: 10 ⁶ Rp.)
rlood Aischarge	Average annual probability of exceedance for	Average annual probability	Amount of assumed damages at applicable discharge level	Average amount of assumed damages	Average annual amount of damages	Amount of average annual decrease of damages
Lovel	TOADT BERGUDETD		(rt			
てん	1.0	1	07/	1.285	640	640
7/2	9 0		2.430	2,145	640	1,280
7/2	0.2			2.570	260	1,540
01/1	0.1			2.820	140	1,680
1/20	0-05)	3.070	06	1.,770
1/50	0.02	0.03	A+4×0			
	Averace annual		Amount of	Average	Average	Amount of appual
rlood discharge	probability of exceedance for	Average annual	assumed damages at applicable discharde level	amount of assumed damages	annua. anount of damages	docrease of damages
level	GISCNATGE LEVEL	74 04 04 04 04 07 07 07 07 07 07 07 07 07 07 07 07 07			1	
オノオ	0.1	3		3.180	1,590	1,590
1/2	0.5	0.50	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.790	3,380
1/5	0.2	0.30		7 785	780	4,160
1/10	1 O	0.10			450.	4.610
1/20	0°02 0	90°0 0°0	4 . 4 S C	10,035	300	4,910
1/50	20-0					

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		•				(Unit: 10°Rp.
Flood discharge	Average annual probability of exceedance for discharge level	Average annual probability	Amount of assumed damages at applicable discharge level	Average amount of assumed damages	Average annual amount of damages	Amount of average annua decrease of damages
1/20 1/20 1/20 1/20	1.0 0.5 0.05 0.05 0.02	0-03 0-10 0-10 0-05 0-05 0-05	110 360 530 570	- 235 235 550 550 550	50000 7500 751 751	1 1 2 2 0 0 3 2 0 5 0 0 3 2 0 5
	Table 4.22 Estimat	ed Average Annual	Flood Damages, Under	Irrigated Cor	dition in Kal	ola Area
Flood discharge	Average annual probability of exceedance for discharge level	Average annual probability	Amount of assumed damages at applicable discharge level	Average amount of assumed damages	Average annual amount of damages	Amount of average annue decrease of damages
220 27 27 27 27 27 27 27 27 27 27 27 27 27	000 00 00 00 00 00 00 00 00 00 00 00 00		200 1,2600 1,240 5,540 5,500 1,240 5,500	- 450 880 1,150 1,330 1,500	200 70 200 200 200 200 200 200 200 200 2	- 230 610 680 6810 730