APPENDIX VIII

PROJECT EVALUATION

CHAPTER 1. GENERAL

The Air Selagan Irrigation Project Primarily aims at the maximum development of potential irrigable area as rice field and peat land as oil palm field. Furthermore, it's proposed to settle the maximum number of transmigrants and to promote the increment of crop production and improvement of living standard of farmers.

The objective of the project evaluation is to assess the economic and financial feasibility of this Project.

For the economic evaluation, three measures of project worth, namely, economic internal rate of return (EIRR), benefit-cost ratio (B/C) and benefit minus cost (B-C) were examined. In addition, a sensitivity analysis in terms of EIRR was made to evaluate the economic viability of the Project against possible changes in project costs, benefits and build-up period. For the financial evaluation, the repayment capability of the Project and the capacity to pay of the farmers were analyzed. Furthermore, the effect of the Project on farm budget of farmers and their capacity to pay for irrigation water charge are analyzed in the farm budget assessment. The indirect benefits and socio-economic effects, which would impact on the regional and national economy, were also studied briefly.

CHAPTER 2. ECONOMIC EVALUATION

2.1 Basic Assumptions

The project evaluation from the view point of the national economy is made on the following basic assumptions:

a) Economic evaluation is conducted in order to assess the feasibility of the Air Selagan Irrigation Project with 8,000 ha, as plan 3, which consists of irrigated rice field of 4,700 ha, oil palm field of 2,500 ha and related area of 800 ha for upland crop field and house lot.

b) The construction period is totaled seven (7) years including for detailed design and preparation of tender documents.

c) The useful life of the Project is taken as 50 years from project implementation.

d) For the calculation of EIRR, only direct benefits are counted, and no indirect and intangible benefits are taken into account.

e) The exchange rate of Indonesian Rupiah (Rp.) to US. Dollar (US$) was taken to be Rp. 1,845 equivalent to US$ 1.00 (as of Jan., 1990).

f) Constant prices at 1990 level are used in the economic evaluation.

g) The economic conversion factors are estimated in the Guideline for Water Resources Projects PU, are used to convert financial to economic values in the economic evaluation.

2.2 Economic Prices

Since the domestic consumption of rice are still supplement by importation depending on the year, the economic farm gate price of rice is estimated at the average value of both import and export parity prices on the basis of the international market price forecasted for the year of 2000 by the world bank.

As for maize, soybean, and groundnuts, the economic farm gate prices are estimated at the import substitution on the basic of same projection with rice, which for oil palm the economic price is estimated at the export substitution. The economic price for fertilizer is also estimated at import substitution , based on the international market price projected by the world bank.

The details are shown in Table VIII-1 to VIII-6.

Non-trade goods such as, cassava, seeds, etc. are valued at financial prices estimated on the basis of current market or farm gate prices prevailing in the Project area in March 1990.

Most of the farm labour requirement are generally met by family labor at present. As for the economic labour wage, it was valued at a shadow wage rate of 0.60 to the financial labour wage.

Economic and financial prices of farm inputs and outputs used for project evaluation are elaborated in Table VIII-7.

2.3 Economic Project Costs

The project costs for economic evaluation consist of construction cost, engineering service cost, administration cost annual operation and maintenance (O&M) cost, replacement cost and transmigration cost. These economic costs can be obtained by applying economic conversion factors (ECF) to the financial costs according to the guidelines of Public Work. The ECFs are presented in Table VIII-8.

The economic construction cost for implementation of the project consist of eight (8) items and the total construction cost would amount to Rp. 39.36 billion as shown in Table VIII-9, and its annual disbursement is scheduled as shown in Table VIII-10.

The economic annual O&M cost for project facilities was estimated at Rp. 113 million and would be initially disbursed in 1997/1998 when full operation would start.

Regarding the economic replacement cost, the steel gates installed in the project facilities would be replaced once during the entire period of the project life. Their useful lives were estimated to be 30 years, and their replacement costs were estimated at Rp. 109 million in total (see Table VIII-11). The O&M equipment would be replaced every 10 years.

The economic transmigration cost consists of five items; i.e. 1) construction cost of houses, 2) construction cost of shallow wells, 3) land clearing, village roads and related facilities in village area, 4) settlement cost including traveling expenses of transmigrants and 5) government subsidy for transmigrants. Their total cost was estimated at Rp 5.4 billion (see Table VIII-12 and VIII-13).

Land acquisition costs and price contingency were excluded from the project economic costs. Since EIRR of the Project is measured at constant prices, provision for price contingency was excluded from the project costs.

2.4 Economic Benefits

The project benefits consist of irrigation benefits and drainage benefit. The irrigation benefits will accrue primarily from increased rice production owing to stable irrigation water supply. The drainage benefit will accrue from growing oil palm and upland crops in the drained peat land.

The net return per ha for each crop under the with and without project conditions was estimated as shown in Tables VIII-14 to VIII-16. Applying the net return per ha for each crop to those harvested area, the total net return to accrue from crop production was calculated on both the future with and without project conditions.

(1) Irrigation Benefits

This benefit is primarily derived from the increased paddy production attributable to following conditions:

1) Implementation of improved farming practices under irrigation throughout the year

2) Improvement of farming practices and field management in accordance with the reinforced agricultural extension services

3) Improvement of the quality and quantity of farm inputs

(2) Drainage Benefits

Out of total peat land, 2,500 ha in gross will be developed for oil palm cultivation, considering the topographic condition, peat depth, etc. In order to conduct the oil palm cultivation, new transmigrants of 1,100 families will be settled, according to the implementation schedule of the project. Drainage benefit is derived from the oil palm cultivation and some upland crop cultivation in the upland crop field and house lot of the transmigrants.

Then, annual irrigation and drainage benefit at full development stage was estimated at Rp 7,237 million, as shown below. The details are given in Table VIII-17. The benefits would start to accrue from 1995/1996, and would gradually increase up to the full benefit in 2003/2004.

(Unit: Rp.million)

Crops		Total Net Return		
		without Project	With Project	Benefits
1) Irrigation Benefit				
Paddy (Irrigated)	1st	-	1,359	1,359
	2nd	-	1,359	1,359
Paddy (Rainfed)	Lowland	14	-	14
1) Drainage Benefit				
Maize		-	216	216
Oil Palm		-	4,317	4,317
Total		14	7,251	7,237

2.5 Economic Evaluation

2.5.1 EIRR, B/C and B-C

In order to compute the EIRR, B/C and B-C, the annual economic costs and benefits flows were firstly prepared as shown in Table VIII-18. The results were also obtained as follows.

EIRR (%)	10.6
B/C	1.07
B-C (Rp. 10^6)	2,036

As shown in the above table, these results indicate that the Project is economically viable.

2.5.2 Sensitivity Analysis

Project sensitivity in terms of the EIRR was analyzed in respect of changes in project costs and benefits. The results of analysis are summarized below.

(EIRR: %)

Project Costs	Delay in commencement of construction 0 year		1 year	
	Benefit Decreased		Benefit Decreased	
increased	0%	-10%	0%	-10%
0%	10.6	9.7	9.8	8.9
10%	9.8	8.9	9.0	8.2
15%	9.4	8.5	8.7	7.9

As a result of sensitivity analysis, if project costs increase by 10% and project benefits decrease by 10%, the feasibility of the Project is economically marginal.

Furthermore, calculation of EIRR in case of the current price of milled rice instead of the forecasted price was tried as a sensitivity analysis of price increase. The current international price of milled rice in Bangkok is US$303, which is assumed to be the 1990 price in 1990 constant price. In the result, the EIRR is estimated at 12.9%.

2.6 The Assessment on the establishment of Small-Scale hydro-Power Generation

The economic and financial evaluation as conducted to assess the viability on the establishment of small-scale hydro-power generator as follows :

2.6.1 Economic Cost

The economic cost consists of the construction cost and operation and maintenance cost.

(1) Economic construction cost

The economic cost is applying the economic conversion factor (ECF). The economic construction cost is shown as follows :

	Financial	ECF	Economic
Electric equipment	5,840	0.90	5,256
Civil works	830	0.85	706
physical contingency	334	0.50	167
Total	7,004	0.5	6,129

(2) Economic Operation and Maintenance cost

The economic operation and maintenance cost was estimated, applying the economic conversion factor to the financial cost, as follows :

Labour charge : Rp. 2,040,000
Running cost : Rp. 2,252,000

2.6.2 Benefit

The power benefit of small-scale hydro-power generator is estimated by the least costly alternative method. In this study, a diesel generator with same capacity of the small-scale hydro-power generator is selected as an alternative power plant, considering the the scale of 340 KW.

The KW-value and KWH-value based on the above alternative power plant are shown in Table VIII-19.

2.6.3 Economic Analysis

The economic benefit of the project is calculated based on the economic benefit flow during the period of 50 years from the commencement of power generation, assuming a discount rate of 12%. The study result is as follows:

(Unit : Rp. 10^6)

Capitalized economic cost	5,431
Capitalized economic benefit	8,600
Net benefit (B-C)	3,169
Benefit-cost ratio (B/C)	1.6
EIRR (%)	16.4

Accordingly, the construction of small-scale hydro-power generator could be feasible.

CHAPTER 3. FINANCIAL EVALUATION

3.1 Basic Assumptions

The financial analysis of the projects is made by the analysis of the typical farm budgets and the assessment for repayment of the project construction cost. Current prices at 1990 level are used in the financial evaluation and the financial cost is estimated on the basis of the price level as of March 1990 using the exchange rate of US$1.00=Rp. 1,845=152 yen. The price contingency for foreign currency portion is included in the estimate based on the forecast of Manufacturing Unit Value (MUV) by the World Bank and recent trends of consumer price index in the country.

3.2 Repayment Capability of Project

The repayment capability of the Project was studied by preparing cash flow statements on the basis of an annual disbursement schedule of the construction cost, fund requirement and anticipated project revenue. The total project cost including price contingency is summarized below. The price contingency was estimated on the basis of the world manufacturing unit value index forecast by the World Bank and recent tends of consumer price index in Indonesia (see Table VIII-20). The estimated fund requirement is Rp.53,100 million divided between foreign currency portion of Rp.40,932 million equivalent and local currency portion of Rp.12,168 million. The financial inflow and outflow of the Project executing agency shown in Table VIII-21 and VIII-22. The statement indicates that repayment of the fund will have to be made by subsidy from the Government which is estimated at Rp.2,782 million on average during the repayment period with irrigation service fee. Cash flow statements of the project executing agency was prepared under with and without irrigation service fee.

(Unit: Rp. million)

Year	International Fund	Government Budget	Total
'91/'92	606	196	802
'92/'93	2,335	690	3,025
'93/'94	2,904	1,450	4,354
'94/'95	11,752	4,689	16,441
'95/'96	15,247	6,107	21,354
'96/'97	8,920	3,679	12,599
'97/'98	1,528	709	2,237

It is assumed that the capital cost required for the implementation of the project will be arranged under the following conditions:

(1) Foreign currency portion of the capital cost is financed by a loan of international organization.

(2) Interest rate of the loan is 2.5% per annum and repayment period is 30 years including 10 years grace period.

(3) Local currency portion of the capital cost is financed by the Government budget without repayment.

3.3 Capacity to pay of farmers

Assuming that water charge is imposed on rice farm and oil palm farm to recover all O & M costs according to proposed plan, the annual irrigation water fee is estimated Rp. 38,200/farm/annum for rice farmer and Rp. 17,300/ farm/annum for oil palm farmer in conformity to the principle that beneficiaries should pay for a project. The annual project revenue which accrue from the water charge will amount to Rp. 126 million, it's equal to O & M cost.

As shown in below table, the future farmer's net profit will increase remarkably to Rp.2,025 ~ 2,403 The increase net reserve would enable farmers to pay the irrigation service fee, if it is imposed to them.

(Unit: Rp. thousand)

Item	Without Project	With Project	
	Transmigrants	Rice Farmer	Oil Palm Farmer
(Farm Size)	(1.25)	(2.00)	(2.50)
1) Gross Income	876	3,550	3,700
Farm Income	780	3,550	3,700
Off-farm Income	96	-	-
2) Gross Outgoing	811	1,525	1,297
Production Cost	72	786	558
Living Expense	739	739	739
3) Net reserve/ Capacity to pay	65	2,025	2,403
4) Net Farm Income	804	2,764	3,142

As mentioned earlier, if water charge is imposed on rice farm and oil palm farm to recover all O & M costs according to proposed plan, the irrigation water fee is estimated Rp. 38,200/farm/annum for rice farmer and 17,300/farm/annum for oil palm farm in conformity to the principle that beneficiaries should pay for a project. In that case, the annual farm income of rice farm and oil palm farm will become Rp.1,987 and Rp.2,386 each, so their income differentials will extend more widely.

CHAPTER 4. INDIRECT BENEFITS AND SOCIO-ECONOMIC IMPACTS

In addition to the direct benefits counted in the economic evaluation, various secondary and intangible benefits and/or favorable socio-economic impacts are expected from the implementation of the project. Principal socio-economic impacts are described hereunder.

(1) Securing a stable food supply

The Project will contribute to sacrament of self-sufficiency in rice, which has been one of the main object of the national development plan. Sufficient supply of food will also make an important contribution to attainment of economic independence of Bengkulu province.

(2) Expansion of the willingness to work

In contrast with low productivity of the current agricultural husbandry, the farmers would find the satisfaction due to the improvement of the living standard through the increment of the crop production in future condition. In result, they will desire to gain more agricultural products and improve the living standard through the expansion of the willingness to work.

(3) Enlargement of the employment opportunity

Employment opportunity to the local people will be increased by the implementation of the Project, and a favorable impacts to the regional economy will be expected through the increased monetary movement. The employee will gain more experience, technical know-how, skillfulness in various working fields. These accumulations of working techniques would be applied to the future development in the region.

(4) Enhancement of economic and social activities

The local transportation will be improved much by the construction of the operation and maintenance road along the irrigation canals. The expanded road system will not enhance the economic activity in and around the project area but also contribute to inter-regional accessibility and communication.

(5) Enhancement of the social supporting services

Social supporting services will be enhanced according to rehabilitation of road network and establishment of the rural

development center. Road network would provide the easy access to anywhere, due to transmission of the information and activities on supporting services. Furthermore, in accordance with the creation of the close connection between the farmers and the agencies concerning the supporting services, current agricultural activities would be innovated under the future condition.

(6) Development of the regional economy

After implementation of the Project, income of farmers estimated at 2,450 households is expected to increase considerably as a direct result of the increase in crop production. Such increase in income would contribute to improving farmers' living standards. Moreover, it is expected that farmers' purchasing power would increase along with improvement of their living standards, and this increased purchasing power would benefit the development of the regional economy.

Future marketing in the area is likely expand as compared with the present condition. With anticipated higher agricultural production, more farm products could be marketed by the farmers and the proportion of sales would also increase relative to consumption. The merchants would have a larger turnover which could increase their incomes.

(7) Acquisition of foreign money after development of the Swamp area

As regards the swamp forest, there is no potential alternative. But, after completion of the project, significant increase in Oil palm production is expected in the swamp area drained. The estimated marketable production of Oil Palm is estimated at about 46,200 tons. The surplus would increase the annual amount of exports and thereby save and earn the foreign exchange.

Table VIII-1 ECONOMIC PRICE STRUCTURE (1/7)

Item		Unit		Unit price (Import parity)		Unit price (Export parity)	
Rice							
1	Thai 5% broken, FOB Bangkok	US$/ton		166		166	*1
2	Adjasted to 1990 constant	US$/ton		240		240	*2
3	Quality adjustment (discount)	US$/ton	-	216	-	216	*3
4	Freight and insurance	US$/ton	+	20	-	0	*4
5	CIF Bengkulu	US$/ton		236		216	*5
		Rp./ton		435,400		398,500	
6	Port handling, storage and lossess	Rp./ton	+	21,800	-	19,900	*6
7	Transport: port to wholesaler	Rp./ton	+	3,000	-	3,000	*7
8	Transport: mill to wholesaler	Rp./ton	-	20,000	-	20,000	*8
9	Trade margins	Rp./ton	-	13,100	-	12,000	*9
10	Ex-mill price	Rp./ton		427,100		343,600	*10
11	Conversion to paddy	Rp./ton		277,600		223,300	*11
12	Milling cost	Rp./ton	-	17,000	-	17,000	*12
13	Transport: farm to mill	Rp./ton	-	5,000	-	5,000	*13
14	Economic farm gate price	Rp./ton		255,600		201,300	
	(Rounded)			256,000		201,000	
	Average Import Parity Price and Export Parity Price					229,000	

Remarks

*1 Based on the IBRD commodity price projection, Jan. 1990. Projected price in 2000 at constant 1985 price.

*2 The IBRD figure estimated is given in 1990 constant prices, which is adjusted by a factor of 1.444 (MUV) to allow for price escalation between 1985 and 1990.

*3 Quality adjustment rate 10%

*4 Evaluasi Penyiapan Proyek Irrigasi Bengkulu

*5 Exchange rate: US$1.00 = Rp.1845

*6 Estimation rate 5%

*7 Field Survey

*8 Field Survey

*9 Estimasion Rate 3% of C.I.F. Bengkulu (Indeks Satuan Harga, UMUM Tahan 1990/91)

*10 Conversion Rate 65%, Evaluasi Penyiapan Proyek Irrigasi Bengkulu

*11 Evaluasi Penyiapan Proyek Irrigasi Bengkulu

*12 Field Survey

*13 Field Survey

Table VIII-2 ECONOMIC PRICE STRUCTURE (2/7)

Item	Unit		Unit price	
Oil Palm			(Export parity)	
1 Palm Oil (Malaysian), 5% bulk, CIF N. W. Europe	US$/ton		293	*1
2 Adjust to constant	US$/ton		423	*2
3 Freight/insurance	US$/ton	-	60	*3
4 FOB Bengkulu	US$/ton		363	
	Rp./ton		669,900	*4
5 Extraction Rate (%)				*5
6 Price (Fresh Fruit Bunch)	Rp./ton		134,000	
7 Palm Kernels (NIgerian), CIF UK	US$/ton		177	*1
8 Adjust to constant			256	*2
9 Freight/insurance	US$/ton	-	55	*3
10 FOB Bengkulu	US$/ton		201	
	Rp./ton		370,100	*4
11 Extraction Rate (%)				*6
12 Price (Fresh Fruit Bunch)	Rp./ton		22,206	
13 FOB Fresh Fruit Brunch	Rp./ton		156,206	
14 Transport charge	Rp./ton	-	20,000	*7
15 Milling charge per FFB/ton	Rp./ton	-	4,500	*8
16 Replacement cost of equipment/mill per FFB ton	Rp./ton	-	9,660	*9
17 Selling and administration cost per FFB per ton	Rp./ton	-	5,500	*9
18 Economic farm gate price	Rp./ton		116,546	
(Rounded)			117,000	

Remarks
*1 Based on the IBRD commodity price projection, Jan. 1990. Projected price in 2000 at constant 1985 price.
*2 The IBRD figures estimated is given in 1990constant prices, which have been adjusted by a factor of 1.444 (MUV) to allow for price escalation between 1985 and 1990.
*3 ADB Appraisal Report (Second Nucleus Estate and Smallholder Oil Palm Project in Indonesia, 1986)
*4 Exchange rate: US$1.00 = Rp.1845
*5 Ministry of Tree Crop, Extraction rate of Palm oil: 20%
*6 Ministry of Tree Crop, Extraction rate of Palm kernels: 6%
*7 Field Survey
*8 ADB Appraisal Report (Second Nucleus Estate and Smallholder Oil Palm Project in Indonesia, 1986)
*9 Ministry of Tree Crop
*10 Ministry of Tree Crop

Table VIII-3 ECONOMIC PRICE STRUCTURE (3/7)

Item	Unit		Unit price	
Maize			(Import parity)	
1 FOB US Gulf ports	US$/ton		73	*1
2 Adjasted to constant	US$/ton		105	*2
3 Freight and insurance	US$/ton	+	35	*3
4 CIF Bengkulu	US$/ton		140	
	Rp./ton		258,300	*4
5 Port handling, storage and opelation	Rp./ton	+	13,000	*5
6 Transport: port to wholesaler	Rp./ton	+	5,000	*6
7 Trade margins	Rp./ton	-	8,000	*7
8 Transport: farm to wholesaler	Rp./ton	-	25,000	*8
9 Economic farm gate price	Rp./ton		243,300	
(Rounded)			243,000	

Remarks
- *1 Based on the IBRD commodity price projection, Jan. 1990. Projected price in 2000 at constant 1985 price.
- *2 The IBRD figures estimated is given in 1990 constant prices, which is adjusted by a factor of 1.444 (MUV) to allow for price escalation between 1985 and 1990.
- *3 Evaluasi Penyiapan Proyek Irigasi Bengkulu
- *4 Exchange rate: US$1.00 = Rp.1845
- *5 Estimation rate 5%
- *6 Field Survey
- *7 Estimasion Rate 3% of C.I.F. Bengkulu (Indeks Satuan Harga, UMUM Tahan 1990/91)
- *8 Field Survey

Table VIII-4 ECONOMIC PRICE STRUCTURE (4/7)

Item	Unit		Unit price	
Groundnuts (Import parity)			Import parity	
1 CIF Rotterdam	US$/ton		439	*1
2 Adjasted to constant	US$/ton		634	*2
3 Extract Ratio (0.72)	US$/ton		456	*3
4 Freight and insurance	US$/ton	+	35	
5 CIF Bengkulu	US$/ton		491	
	Rp./ton		905,900	*4
6 Port handling, storage and lossess	Rp./ton	+	45,300	*5
7 Transport: port to wholesaler	Rp./ton	+	5,000	*6
8 Trade margins	Rp./ton	-	27,200	*7
9 Transport: farm to wholesaler	Rp./ton	-	25,000	*8
10 Economic farm gate price	Rp./ton		904,000	
(Rounded)			904,000	

Remarks

*1 Based on the IBRD commodity price projection, Jan. 1990. Projected price in 2000 at constant 1985 price.

*2 The IBRD figures estimated is given in 1990constant prices, which is adjusted by a factor of 1.444 (MUV) to allow for price escalation between 1985 and 1990.

*3 Irrigation Subsector Project, The World Bank, 1987

*4 Exchange rate: US$1.00 = Rp.1845

*5 Estimation rate 5%

*6 Field Survey

*7 Estimasion Rate 3% of C.I.F. Bengkulu (Indeks Satuan Harga, UMUM Tahan 1990/91)

*8 Field Survey

Table VIII-5 ECONOMIC PRICE STRUCTURE (5/7)

Item	Unit		Unit price	
Soybeans (Import parity)				
1 CIF Rotterdam	US$/ton		150	*1
2 Adjasted to constant	US$/ton		217	*2
3 Freight and insurance	US$/ton	+	35	*3
4 CIF Bengkulu	US$/ton		252	
	Rp./ton		464,900	*4
5 Port handling, storage and lossess	Rp./ton	+	23,200	*5
6 Transport: port to wholesaler	Rp./ton	+	3,000	*6
7 Trade margins	Rp./ton	-	13,900	*7
8 Transport: farm to wholesaler	Rp./ton	-	25,000	*8
9 Economic farm gate price	Rp./ton		452,200	
(Rounded)			452,000	

Remarks

*1 Based on the IBRD commodity price projection, Jan. 1990. Projected price in 2000 at constant 1985 price.

*2 The IBRD figures estimated is given in 1990constant prices, which is adjusted by a factor of 1.444(MUV) to allow for price escalation between 1985 and 1990.

*3 Evaluasi Penyiapan Proyek Irigasi Bengkulu

*4 Exchange rate: US$1.00 = Rp.1845

*5 Estimation rate 5%

*6 Field Survey

*7 Estimasion Rate 3% of C.I.F. Bengkulu (Indeks Satuan Harga, UMUM Tahan 1990/91)

*8 Field Survey

Table VIII-6 ECONOMIC PRICE STRUCTURE (6/7)

Item	Unit		Unit price	
Urea (Export parity)				
1 FOB Europe	US$/ton		125	*1
2 Adjasted to 1990 constant	US$/ton		181	*2
3 FOB Palembang	US$/ton		181	
4 Transport Premium	US$/ton		15	*3
5 Ex-factory Palembang			196	
	Rp./ton		361,600	*4
6 Transport: to wholesaler	Rp./ton	+	10,000	*5
7 Handling charge	Rp./ton	+	5,000	*6
8 Storagecost and distribution		+	15,000	*7
9 Transport: wholesaler to farm	Rp./ton	+	5,000	*8
10 Economic farm gate price	Rp./ton		396,600	
(Rounded)			397,000	
TSP (Import parity)				
1 FOB US Gulf	US$/ton		141	*1
2 Adjasted to 1990 constant	US$/ton		204	*2
3 Freight and insurance	US$/ton	+	45	*3
4 CIF Bengkulu	US$/ton		249	
	Rp./ton		459,400	*4
5 Handling Charge, Package and Transport	Rp./ton	+	20,000	*5
6 Storage and Distribution	Rp./ton	+	15,000	*6
7 Transport: wholesaler to farm	Rp./ton	+	5,000	*8
8 Economic farm gate price	Rp./ton		499,400	
(Rounded)			499,000	
KCL (Import parity)				
1 FOB Vancouver	US$/ton		73	*1
2 Adjasted to 1989 constant	US$/ton		105	*2
3 Freight and insurance	US$/ton	+	45	*3
4 CIF Bengkulu	US$/ton		150	
	Rp./ton		276,800	*4
5 Handling Charge, Package and Transport	Rp./ton	+	20,000	*5
6 Storage and Distribution	Rp./ton	+	15,000	*6
7 Transport: wholesaler to farm	Rp./ton	+	5,000	*8
8 Economic farm gate price	Rp./ton		316,800	
(Rounded)			317,000	

Remarks

*1 Based on the IBRD commodity price projection, Jan. 1990. Projected price in 1995 and 2000 at constant 1985 price.

*2 The IBRD figures estimated is given in 1990constant prices, which is adjusted by a factor of 1.444 (MUV) to allow for price escalation between 1985 and 1990.

*3 Evaluasi Penyiapan Proyek Irigasi Bengkulu

*4 Exchange rate: US$1.00 = Rp.1845

*5 Evaluasi Penyiapan Proyek Irigasi Bengkulu

*6 Evaluasi Penyiapan Proyek Irigasi Bengkulu

*7 Evaluasi Penyiapan Proyek Irigasi Bengkulu

*8 Field Survey

Table VIII-7 ECONOMIC PRICE STRUCTURE (7/7)

Item	Unit		Unit price	
Rubber (Export parity)				
1 Rubber (Malaysian), CIF N. W. Europe	US$/ton		940	*1
2 Adjust to constant	US$/ton		1,357	*2
3 Freight/insurance	US$/ton	-	60	*3
4 FOB Bengkulu	US$/ton		1,297	
	Rp./ton		2,393,600	*4
5 Conversion rate 25%	Rp./ton		598,400	*5
6 Transport charge	Rp./ton	-	20,000	*6
7 Processing cost	Rp./ton	-	9,128	*7
8 Replacement cost	Rp./ton	-	12,500	*8
9 Selling and administration cost	Rp./ton	-	15,250	*9
10 Economic farm gate price	Rp./ton		541,523	
(Rounded)			542,000	

Remarks
*1 Based on the IBRD commodity price projection, Jan. 1990. Projected price in 1995 and 2000 at consant 1985 price.
*2 The IBRD figures estimated is given in 1990constant prices, which is adjusted by a factor of 1.444 (MUV) to allow for price escalation between 1985 and 1990.
*3 ADB Appraisal Report (Second Nucleus Estate and Smallholder Oil Palm Project in Indonesia, 1986)
*4 Exchange rate: US$1.00 = Rp. 1845
*5 Ministry of Tree Crop
*6 Field Survey
*7 Ministry of Tree Crop
*8 Ministry of Tree Crop
*9 Ministry of Tree Crop

Table VIII-8 FINANCIAL AND ECONOMIC PRICES OF FARM INPUTS AND OUTPUTS

(Unit: Rp.)

Item		Unit	Financial Price	ECF	Economic Price
1 Farm Outputs					
Paddy		(kg)	250 *1	- *4	229
Maize		(kg)	150 *1	- *4	243
Groundnuts		(kg)	500 *1	- *4	904
Soybeans		(kg)	600 *1	- *4	452
Cassava		(kg)	100 *1	1.00 *5	100
Oil palm		(kg)	75 *1	- *4	117
Rubber		(kg)	450 *1	- *4	542
2 Farm Inputs					
1 Seed					
Paddy	Local	(kg)	250 *1	1.00 *5	250
	Improved	"	450 *1	" *5	450
Maize	Local	(kg)	350 *1	" *5	350
	Improved	"	1,500 *1	" *5	1,500
Groundnuts	Local	(kg)	900 *1	" *5	900
	Improved	"	1,500 *1	" *5	1,500
Soybeans	Local	(kg)	800 *1	" *5	800
	Improved	"	1,300 *1	" *5	1,300
Green beans		(kg)	1,300 *1	" *5	1,300
Cassava		(per/ha)	7,000 *1	" *5	7,000
			10,000 *1	" *5	10,000
Oil palm		(pieces)	2,000 *2	" *5	2,000
Rubber		(pieces)	350 *3	" *5	350
2 Fertilizers					
Urea		(kg)	185 *1	- *4	397
T.S.P.		(kg)	210 *1	- *4	499
KCl		(kg)	210 *1	- *4	317
Magnesium		(kg)	90 *1	1.50 *6	135
3 Agro-chemicals					
- Insecticide					
Diasinon 60 EC		(liter)	7,500 *1	1.50 *6	11,250
Dursban		(liter)	7,700 *1	" *6	11,550
Lannate L		(liter)	9,500 *1	" *6	14,250
Mipcin		(liter)	6,200 *1	" *6	9,300
Sevin		(kg)	6,000 *1	" *6	9,000
- Fungicide					
Dithane M. 45		(kg)	4,300 *1	" *6	6,450
- Rodenticide					
Klerat RM/RMB		(kg)	2,100 *1	" *6	3,150
- Pesticide					
Temic 10 G		(kg)	6,100 *1	" *6	9,150
4 Hired Labor		(man/day)	2,500	0.60 *7	1,500

Remarks
*1 : Field Survey
*2 : Lower Asahan River Basin Development Project
*3 : Batang Kumu Irrigation Project
*4 : Table of Economic Price Structure
*5 : Non-trade goods valued at financial prices.
*6 : Appraisal Report (Studi Appraisal Proyek Proyek Pengairan Dalam Rangka Sertifikasi Proyek, 1990)
*7 : Subdirector Project Evaluation

Table VIII-9 ECONOMIC CONVERSION FACTORS

Item	Coefficient used to convert financial into economic value
1 Preparatory Works	0.85
2 Design and Survey	0.90
3 Administration	0.90
4 Access Road	0.85
5 Dam and Weir	0.85
6 Irrigation System	0.85
7 Drainage System	0.85
8 Un-skilled Labor	0.60
9 Skilled Labor	0.85
10 On-farm Development	0.90
11 Land Clearing	0.90
12 Operation and Maintenance Cost	0.90
13 O & M Equipment	0.90
14 Office Building	0.85

Source : Subdirector Project Evaluation

Table VIII-10 ECONOMIC CONSTRUCTION COST

(Unit: Rp. Million)

Item	Financial Cost F.C*1	L.C*2	Total	ECF	Economic Cost
1 Preparatory Works	1,451	622	2,073	0.85	1,762
2 Irrigation & Drainage Construction*3	25,879	7,909	33,788	0.85	28,720
2-1 Work Division-I	4,324	1,662	5,986	0.85	5,088
2-2 Work Division-II	7,102	2,172	9,274	0.85	7,883
2-3 Work Division-III	6,533	1,847	8,380	0.85	7,123
2-4 Work Division-IV	2,323	602	2,925	0.85	2,486
2-5 Work Division-V	5,597	1,626	7,223	0.85	6,140
3 Small-scale Hydro-power Generation	6,323	887	7,210		6,448
3-1 Electric Equipment	5,742	638	6,380	0.90	5,742
3-2 Civil Works	581	249	830	0.85	706
4 O & M Facilities	735	245	980	0.90	882
5 Land Acquisition	0	237	237	-	
6 Administration	0	880	880	0.90	792
7 Engineeing Service	4,342	482	4,824	0.90	4,342
6-1 Detailed Design	1,737	193	1,930	0.90	1,737
6-2 Construction S/V	2,605	289	2,894	0.90	2,605
Sub Total (1 - 7)	38,730	11,262	49,992		42,946
8 Physicxal Contingency	1,937	563	2,500	-	2,147
Sub Total	40,667	11,825	52,492		45,093
9 Price Contingency	10,038	6,334	16,372	-	-
Total	50,705	18,159	68,864		45,093

Note)
1US$=Rp.1845=·153

Remarks)
*1 Foreign Portion
*2 Local Portion
*3 2-1 Head Works, Main & Secondary System and Tertiary System
2-2 Main & Secondary System and Tertiary System
2-3 Main & Secondary System and Tertiary System
2-4 Secondary System and Tertiary System
2-5 Main & Secondary System and Tertiary System

Table VIII-11 ANNUAL DISBURSEMENT SCHEDULE OF ECONOMIC CONSTRUCTION COST

(Unit: Rp. Million)

Item	Financial Cost	ECF	Economic Cost	1991/1992	1992/1993	1993/1994	1994/1995	1995/1996	1996/1997
1 Preparatory Works	2,073	0.85	1,762	264	529	353	353	263	
2 Irrigation & Drainage Construction	33,788	0.85	28,720			2,005	9,429	12,861	4,425
2-1 Work Division-I	5,986	0.85	5,088			1,374	2,188	1,476	50
2-2 Work Division-II	9,274	0.85	7,883			631	2,759	3,232	1,261
2-3 Work Division-III	8,380	0.85	7,123				2,350	3,704	1,069
2-4 Work Division-IV	2,925	0.85	2,486				597	1,318	572
2-5 Work Division-V	7,223	0.85	6,140				1,535	3,131	1,473
3 Small-schale Hydro-power Generation	7,210		6,448				177	3,224	3,047
3-1 Electric Equipment	6,380	0.90	5,742					2,871	2,871
3-2 Civil Works	830	0.85	706				177	353	176
4 O & M Facilities	980	0.90	882						882
5 Land Acquisition	237	-	-		-	-	-	-	-
6 Administration	880	0.90	792	79	119	158	158	158	120
7 Engineeing Service	4,824	0.90	4,342	348	1,650	521	651	651	521
6-1 D/D	1,930	0.90	1,737	348	1,389				
6-2 S/V	2,894	0.90	2,605		261	521	651	651	521
8 Physicxal Contingency	2,500	-	2,148	35	115	152	538	858	450
Total	52,492		45,094	726	2,413	3,189	11,306	18,015	9,445

1US$ = Rp. 1845
Price Index (1990=100)

Table VIII-12 O & M AND REPLACEMENT COSTS

Item	Financial Cost (Rp. Million)	ECF	Economic Cost (Rp. Million)
1 O & M Cost	126	0.90	113
1) Irrigation and Drainage Facilities			
2) Small-scale Hydro-power Generation	5	-	4
2 Replacement Cost*1			
1) Steel gates of weir	500	0.90	450
2) Steel gates of irrigation facilities	621	0.90	559
3) Genrtator	6,380	0.90	5742
4) O & M Equipment	980	0.90	882

*1 Useful Life

1) Steel gates of weir	30years
2) Steel gates of irrigation facilities	30years
3) O & M Equipment	10years
4) Generator	20years

Table VIII-13 GOVERNMENT SUBSIDY FOR TRANSMIGRANTS

Item*1	Unit	Q'ty	Financial Cost Unit Price (Rp.)	Financial Cost Amount (Rp. / Family)	Economic Cost Unit Price*3 (Rp.)	Economic Cost Amount (Rp. / Family)
Paket A (1st year)						
1 Foodstaff						
1) Rice	(kg)	510	550	280,500	385	196,529
3) Cooking oil	(kg)	36	1,000	36,000	1,000	36,000
4) Salt and sug	(kg)			36,000		36,000
2 Seed						
1) Paddy	(kg)	20	250	5,000	250	5,000
2) Maise	(kg)	10	350	3,500	350	3,500
3) Soybeans	(kg)	15	800	12,000	900	13,500
4) Vegetables	(kg)	12	680	8,160	680	8,160
5) Cassaba and fruit tree				5,000		5,000
3 Fertilizers and agro-chemicals						
1) Urea	(kg)	100	185	18,500	397	39,700
2) TSP	(kg)	50	210	10,500	499	24,950
3) KCl	(kg)	50	210	10,500	317	15,850
4) Pesticides	(Lit)	5	4,675	23,375	7,013	35,065
4 Others*2				75,000		67,500
Total of Paket A				524,035		486,754
Paket B (2nd year)						
1 Seed						
1) Paddy	(kg)	10	250	2,500	250	2,500
2) Maise	(kg)	5	350	1,750	350	1,750
2 Fertilizers and agro-chemicals						
1) Urea	(kg)	75	185	13,875	397	29,775
2) TSP	(kg)	50	210	10,500	499	24,950
3) KCl	(kg)	25	210	5,250	317	7,925
4) Pesticides	(Lit)	4	4,675	18,700	7,013	28,052
3 Others*2						
Total of Paket B				52,575		94,952
Paket C (3rd year)						
1 Fertilizers and agro-chemicals						
1) Urea	(kg)	100	185	18,500	397	39,700
2) TSP	(kg)	75	210	15,750	499	37,425
3) KCl	(kg)	25	210	5,250	317	7,925
4) Pesticides	(Lit)	4	4,675	18,700	7,013	28,052
Total of Paket C				58,200		113,102
Ground Total				634,810		694,808

*1 See Table IV-43 and 44
*2 Include cost for farm tools, equipment
*3 See Table VIII-8

Table VIII-14 DISBURSMENT SCHEDULE OF ECONOMIC TRANSMIGRANT COSTS

Item	Q'ty	Unit Price (Rp.)	Financial Cost (Rp. Million)	ECF	Economic Cost (Rp. Million)	'91/'92	'92/'93	'93/'94	'94/'95	'95/'96	'96/'97	'97/'98	'98/'99	'99/'00
(1) Houses	2,450	850,000	2,083	0.90	1,874	260	230	230	153	161	420	420		
(2) Shallow Wells	613	350,000	214	0.90	193	26	24	24	16	17	43	43		
(3) Land Clearing, road and related facilities in village area			1,010	0.90	909	127	111	111	74	78	204	204		
(4) Settlement Cost (per family)	2,450	48,000	118	1.00	118	16	14	14	10	10	27	27		
(5) Government Subsidy (per family)														
Paket A			1,284		1,171	162	143	143	96	100	263	263		
Paket B			129		233		33	28	28	19	20	52	52	
Paket C			143		277			38	34	34	23	24	62	62
(6) Physical contingency			171		239	29	28	29	21	21	49	51	6	3
Total			5,151		5,014	620	583	617	432	440	1,049	1,084	120	65
No. of Familys					2,450	340	300	300	200	210	550	550		

Table VIII-15 ECONOMIC NET PRODUCTION VALUE OF MAJOR CROPS UNDER WITHOUT PROJECT CONDITION

Description	Unit	Unit Price (Rp.)	Wet Paddy Amount (per ha)	Wet Paddy Value (Rp./ha)	Dry Paddy Amount (per ha)	Dry Paddy Value (Rp./ha)	Maize Amount (per ha)	Maize Value (Rp./ha)	Groundnuts Amount (per ha)	Groundnuts Value (Rp./ha)	Soybeans Amount (per ha)	Soybeans Value (Rp./ha)	Cassaba Amount (per ha)	Cassaba Value (Rp./ha)
1. Gross Production Valu														
1) Unit Yield	(ton/ha)		1.5		1.0		1.5		0.8		0.5		7.0	
2) Unit Price	(Rp./ton)			218,000		244,000		243,000		838,000		452,000		100,000
3) Unit Value	(Rp./ha)			327,000		244,000		364,500		670,400		226,000		700,000
2. Production Cost														
1) Seed*1	(kg)		30	7,500	40	10,000	30	10,500	50	45,000	20	16,000	-	7,000
2) Fertilizers														
Urea	(kg)	397	0	0	0	0	0		0		0		0	
T.S.P.	(kg)	499	0	0	0	0	0		0		0		0	
KCl	(kg)	317	0	0	0	0	0		0		0		0	
3) Agro-chemicals														
Insecticides	(ltr)	12000	2	24,000	2	24,000	2	24,000	2	24,000	2	24,000	0	0
4) Labor	(man-day)													
Land Preparation		1500	25	37,500	25	37,500	25	37,500	25	37,500	25	37,500	25	37,500
Nursery		1500	3	4,500	0	0	0	0	0	0	0	0	0	0
Seedling		1500	0	0	20	30,000	10	15,000	15	22,500	15	22,500	15	22,500
Transplanting		1500	30	45,000	0	0	0	0	0	0	0	0	0	0
Fertilizing		1500	0	0	0	0	0	0	0	0	0	0	0	0
Weeding		1500	25	37,500	25	37,500	20	30,000	20	30,000	20	30,000	20	30,000
Spraying		1500	2	3,000	2	3,000	2	3,000	2	3,000	2	3,000	0	0
Harvesting		1500	30	45,000	30	45,000	25	37,500	25	37,500	25	37,500	30	45,000
Threshing/Drying/ Transporting		1500	10	15,000	10	15,000	10	15,000	20	30,000	10	15,000	10	15,000
Water Management		1500	0	0	0	0	0	0	0	0	0	0	0	0
Total			125	187,500	112	168,000	92	138,000	107	160,500	97	145,500	100	150,000
5) Animal Power	(animal-day)	6000												
6) Others (5% of (1)-(5))				10,950		10,100		8,625		11,475		9,275		7,850
Unit Production Cost				229,950		212,100		181,125		240,975		194,775		164,850
3. Net Production Value (per ha)				97,050		31,900		183,375		429,425		31,225		535,150

*1 Unit Price of Seed (Rp/kg)

Paddy	250
Maize	350
Groundnuts	900
Soybeans	800
Cassaba (per ha)	7,000

Table VIII-16 ECONOMIC NET PRODUCTION VALUE OF MAJOR CROPS UNDER WITH PROJECT CONDITION

Description	Unit	Unit Price (Rp.)	Irrigated Paddy Amount /ha	Irrigated Paddy Rp. /ha	Maise Amount /ha	Maise Rp. /ha	Groundnuts Amount /ha	Groundnuts Rp. /ha	Soybeans Amount /ha	Soybeans Rp. /ha
1. Gross Production Value										
1) Unit Yield	(ton/ha)		4.0		3.0		1.2		1.0	
2) Unit Price	(Rp./ton)			218,000		243,000		838,000		452,000
3) Unit Value	(Rp./ha)			872,000		729,000		1,005,600		452,000
2. Production Cost										
1) Seed*1	(kg)		30	13,500	35	52,500	70	105,000	40	52,000
2) Fertilizers										
Urea	(kg)	397	250	99,250	200	79,400	50	19,850	75	29,775
T.S.P.	(kg)	499	100	49,900	100	49,900	100	49,900	100	49,900
KCl	(kg)	317	75	23,775	50	15,850	50	15,850	50	15,850
3) Agro-chemicals										
Insecticides*1	(ltr)		4	49,600	2	30,800	2	38,000	7	105,000
Rodenticides	(ltr)	4200	2	8,400	0	0	0	0	0	0
4) Labor	(man-day)									
Land Preparation		1500	25	37,500	25	37,500	25	37,500	25	37,500
Nursery		1500	3	4,500	0	0	0	0	0	0
Seedling		1500	0	0	10	15,000	15	22,500	10	15,000
Transplanting		1500	30	45,000	0	0	0	0	0	0
Fertilizing		1500	6	9,000	6	9,000	6	9,000	6	9,000
Weeding		1500	25	37,500	20	30,000	20	30,000	20	30,000
Spraying		1500	4	6,000	2	3,000	2	3,000	10	15,000
Harvesting		1500	35	52,500	30	45,000	35	52,500	30	45,000
Threshing/Drying/						0		0		0
Transporting		1500	10	15,000	10	15,000	15	22,500	15	22,500
Water Management		1500	5	7,500	5	7,500	0	0	5	7,500
Total			143	214,500	108	162,000	118	177,000	121	181,500
5) Animal Power	(animal-day)	6000	13	78,000		0		0		0
6) Others (5% of (1)-(5))				26,846		19,523		20,280		21,701
Unit Production Cost				563,771		409,973		425,880		455,726
3. Net Production Value (per ha)				308,229		319,028		579,720		-3,726

*1 Unit Price of Seed and Insecticide (Rp/kg)

	Seed	Insecticide
Paddy	450	12,400
Maize	1,500	15,400
Groundnuts	1,500	19,000
Soybeans	1,300	15,000
Cassaba (per ha)	10,000	

Table VIII-17 ECONOMIC NET PRODUCTION VALUE OF OIL PALM UNDER WITH PROJECT CONDITION

Description	Unit	Unit Price (Rp.)	1st year Amount (per ha)	1st year Value (Rp./ha)	2nd year Amount (per ha)	2nd year Value (Rp./ha)	3rd year Amount (per ha)	3rd year Value (Rp./ha)	4th year Amount (per ha)	4th year Value (Rp./ha)	5th year Amount (per ha)	5th year Value (Rp./ha)
1. Gross Production Value												
1) Unit Yield	(ton/ha)		0.0		0.0		2.0		7.0		16.0	
2) Unit Price	ton			0		0		117,000		117,000		117,000
3) Unit Value	(Rp./ton)			0		0		234,000		819,000		1,872,000
2. Production Cost												
1) Seed	(Kg)	2000	160	320,000	0	0	0	0	0	0	0	0
2) Fertilizers												
Urea	(Kg)	397	90	35,730	143	56,771	143	56,771	286	113,542	286	113,542
T.S.P.	(Kg)	499	60	29,940	143	71,357	143	71,357	215	107,285	215	107,285
KCl	(Kg)	317	90	28,530	143	45,331	143	45,331	286	90,662	286	90,662
Dolomite	(Kg)	180	70	12,600	10	1,800	10	1,800	215	38,700	215	38,700
3) Agro-chemicals												
Insecticides (Sevin)	(ltr)	12000	5	60,000	0	0	1	12,000	1	12,000	1	12,000
Fungicides (Klerat)	(ltr)	4200	6	25,200	6	25,200	0.5	2,100	0.5	2,100	0.5	2,100
Rodenticides (Temic)	(Kg)	12200	2	24,400	1	12,200	1	12,200	1	12,200	1	12,200
4) Labor	(man-day)	1500	113	169,500	75	112,500	64	96,000	55	82,500	66	99,000
5) Animal Power	(animal-day)											
6) Others (5% of (1)-(5))				35,295		16,258		14,878		22,949		23,774
Unit Production Cost				741,195		341,417		312,437		481,938		499,263
3. Net Production Value (per ha)				-741,195		-341,417		-78,437		337,062		1,372,737

	Unit	Unit Price	6th year Amount (per ha)	6th year Value (Rp./ha)	7th year Amount (per ha)	7th year Value (Rp./ha)	8-16th year Amount (per ha)	8-16th year Value (Rp./ha)	17-24th year Amount (per ha)	17-24th year Value (Rp./ha)
1. Gross Production Value										
1) Unit Yield	(ton/ha)		20.0		21.0		21.0		19.0	
2) Unit Price	ton			117,000		117,000		117,000		117,000
3) Unit Value	(Rp./ton)			2,340,000		2,457,000		2,457,000		2,223,000
2. Production Cost										
1) Seed	(Kg)		0	0	0	0	0	0	0	0
2) Fertilizers										
Urea	(Kg)	397	286	113,542	286	113,542	286	113,542	286	113,542
T.S.P.	(Kg)	499	215	107,285	215	107,285	215	107,285	215	107,285
KCl	(Kg)	317	286	90,662	286	90,662	286	90,662	286	90,662
Dolomite	(Kg)	180	215	38,700	215	38,700	215	38,700	215	38,700
3) Agro-chemicals										
Insecticides (Sevin)	(ltr)	12000	1	12,000	1	12,000	1	12,000	1	12,000
Fungicides (Klerat)	(ltr)	4200	0.5	2,100	0.5	2,100	0.5	2,100	0.5	2,100
Rodenticides (Temic)	(Kg)	12200	1	12,200	1	12,200	1	12,200	1	12,200
4) Labor	(man-day)	1500	73	109,500	74	111,000	69	103,500	66	99,000
5) Animal Power	(animal-day)									
6) Others (5% of (1)-(5))				24,299		24,374		23,999		23,774
Unit Production Cost				510,288		511,863		503,988		499,263
3. Net Production Value (per ha)				1,829,712		1,945,137		1,953,012		1,723,737

Table VIII-18 ECONOMIC PROJECT BENEFIT

Crops	Harvested Area (ha)	Net Return per Hectare (Rp. 1,000)	Total Value (Rp. million)
Paddy Field			
I. With project			
1) Paddy			
1st	4,200	323	1,358
2nd	4,200	323	1,358
Total	8,400		2,716
II. Without Project			
1) Lowland Paddy	140	103	14
Total	140		14
Benefit			2,702
Peat Land			
1) Oil Palm	2,200	1,962	4,317
Maise	1,100	196	216
Total	3,300		4,533
Total Benefit			7,235

Table VIII-19 BENEFIT FOR SMALL-SCALE HYDRO-POWER GENERATOR

1. Alternative power plant	Diesel generator			
2. Installed capacity				
3. Unit construction cost (Rp./kW)	Rp. 10,294,000			
Construction cost	Rp 3,500,000,000			
Generated output	340 kW			
4. Service life of the alernative plant	20 years			
5. Annual O&M cost	3%			
6. Adjustment factor	kW-adjustment		kWh-adjustment	
	Hydro	Thermal	Hydro	Thermal
Transmission loss	0.040	0.015	0.050	0.012
Forced outage	0.005	0.050	0.005	0.025
Auxiliary power use	0.011	0.030	0.007	0.044
Overhaul	0.004	0.100	0.004	0.16
(a) kW-adjustment =	1.152			
(b) kWh-adjustment =	0.999			
7. kW-value				
Discount rate	12%			
Capital recovery factor (Project life : 20 years)	0.13388			
kW-value (Rp. 1,000,000/kW)	1.94			
8. kWh-value				
Annual possible generated energy (1,000 kWh)	2,540			
Annual fuel consumptionuel (1,000 liter)	1,051			
Annual fuel consumption rate(lit./kWh)	0.414			
Fuel cost (Rp./lit)	240			
kWh-value (Rp./kWh)	99.18			
9. Capacity benefit (1,000 Rp.) 340 kW x 1,940,000 Rp./kW	659,600			
10. Energy benefit (1,000Rp.) 2,540,000 kWh x 99.18 Rp./kWh	251,917			
11. Total power benefit (Rp.1,000)	911,517			

Table VIII-20 PROJECT COSTS AND BENEFITS FLOWS

(Unit:Rp.million)

No	Year	Costs				Gross Benefit (B)	Balance (B-C)
		Capital	O&M	Replace & Transm.	Total (C)		
1	1991	665	0	620	1,285	0	-1,285
2	1992	2,328	0	583	2,911	0	-2,911
3	1993	3,034	0	617	3,651	0	-3,651
4	1994	10,981	0	432	11,413	0	-11,413
5	1995	13,435	0	440	13,875	-697	-14,572
6	1996	7,586	74	1,049	8,709	-263	-8,972
7	1997	1,295	113	1,084	2,492	1,353	-1,139
8	1998		113	120	233	2,652	2,419
9	1999		113	65	178	4,799	4,621
10	2000		113		113	6,461	6,348
11	2001		113		113	7,091	6,978
12	2002		113		113	7,227	7,114
13	2003		113		113	7,235	7,122
14	2004		113		113	7,235	7,122
15	2005		113		113	7,235	7,122
16	2006		113		113	7,235	7,122
17	2007		113		113	7,235	7,122
18	2008		113		113	7,235	7,122
19	2009		113		113	7,235	7,122
20	2010		113		113	7,235	7,122
21	2011		113	441	554	6,983	6,429
22	2012		113	441	554	6,731	6,177
23	2013		113		113	6,731	6,618
24	2014		113		113	6,731	6,618
25	2015		113		113	6,731	6,618
26	2016		113		113	6,731	6,618
27	2017		113		113	6,731	6,618
28	2018		113		113	6,731	6,618
29	2019		113		113	6,189	6,076
30	2020		113		113	5,190	5,077
31	2021		113		113	4,334	4,221
32	2022		113		113	3,631	3,518
33	2023		113		113	3,248	3,135
34	2024		113		113	3,737	3,624
35	2025		113	450	563	4,808	4,245
36	2026		113	1,000	1,113	5,762	4,649
37	2027		113	441	554	6,567	6,013
38	2028		113		113	7,050	6,937
39	2029		113		113	7,205	7,092
40	2030		113		113	7,233	7,120
41	2031		113		113	7,235	7,122
42	2032		113		113	7,235	7,122
43	2033		113		113	7,235	7,122
44	2034		113		113	7,235	7,122
45	2035		113		113	7,185	7,072
46	2036		113		113	7,084	6,971
47	2037		113		113	6,983	6,870
48	2038		113		113	6,882	6,769
49	2039		113		113	6,781	6,668
50	2040		113		113	6,731	6,618
				NPV(10%) =	29,751	31,745	1,994

EIRR (%)	10.6%

Sensitivity data:

Cost up (%)	Benefit Down (%)	
	0	10
0	10.6%	9.7%
5	10.1%	9.3%
10	9.7%	8.9%
15	9.4%	8.5%

Table VIII-21 PRICE CONTINGENCY

Year	World Manufacturing Unit Value Index*1 (1985=100)	(%)	Price Contingency for F.C.*2 (1990=100)	(%)	Combined Consumer Price Index*3 (1978=100)	(%)	Price Contingency for L.C.*4 (1990=100)	(%)
1979	95.10	13.26			132.40			
1980	104.31	9.68			156.30	18.10		
1981	104.86	0.53			175.50	12.30		
1982	103.41	-1.38			192.10	9.50		
1983	100.71	-2.61			214.70	11.80		
1984	98.96	-1.74			237.20	10.50		
1985	100.00	1.05			248.40	4.70		
1986	117.38	17.38			262.90	5.80		
1987	128.73	9.68			287.30	9.30		
1988	138.08	7.27			310.40	8.00		
1989	137.60	-0.35						
1990	144.39	4.93	100.00				100.00	
1991	151.51	4.93	104.90	4.93			109.90	9.90
1992	158.98	4.93	110.10	4.93			120.80	9.90
1993	166.82	4.93	115.50	4.93			132.80	9.90
1994	175.05	4.93	121.20	4.93			145.90	9.90
1995	183.69	4.93	127.20	4.93			160.30	9.90
1996	190.46	3.68	131.90	3.68			176.20	9.90
1997	197.47	3.68	136.80	3.68			193.60	9.90
1998	204.75	3.68	141.80	3.68			212.80	9.90
1999	212.29	3.68	147.00	3.68			233.90	9.90
2000	220.11	3.68	152.40	3.68			257.10	9.90

*1 Half Yearly Revision of Commodity Price Forecasts, The World Bank, October 6, 1989

*2 Apply the manufactyring unit value index to the price contingency for foreign currency

*3 Statistik Indonesia 1985 - 1988, Biro Pusat Statisti

*4 Price contingency for local currency was estimated at 9.9% per annum on the basis of an average consumer price index from 1980 to 198

F.C.: Foreign Currency Portion
L.C.: Local Currency Portion

Table VIII-22 CASH FLOW STATEMENT WITH IRRIGATION SERVICE FEE

(Unit: Rp. million)

Year in Order	Year	Capital Cost		Cash Outflow					Cash Inflow				Balance
				Loan Repayment		O & M Cost	Replacement Tmansmigrants Cost	Total	Fund		Revenue	Total	
		FC	LC	Interest	Principal				FC	LC			
1	1991 - 1992	606	196	15	0	0	620	1,437	606	196	0	802	-635
2	1992 - 1993	2,335	690	74	0	0	583	3,682	2,335	690	0	3,025	-657
3	1993 - 1994	2,904	1,450	146	0	0	617	5,117	2,904	1,450	0	4,354	-763
4	1994 - 1995	11,752	4,689	440	0	0	432	17,313	11,752	4,689	0	16,441	-872
5	1995 - 1996	15,247	6,107	763	0	0	440	22,557	15,247	6,107	0	21,354	-1,203
6	1996 - 1997	8,920	3,679	1,044	0	74	1,049	14,766	8,920	3,679	74	12,673	-2,093
7	1997 - 1998	1,528	709	1,082	0	126	1,084	4,529	1,528	709	126	2,363	-2,166
8	1998 - 1999	0	0	1,082	0	126	120	1,328	0	0	126	126	-1,202
9	1999 - 2000	0	0	1,082	0	126	65	1,273	0	0	126	126	-1,147
10	2000 - 2001	0	0	1,082	0	126	0	1,208	0	0	126	126	-1,082
11	2001 - 2002	0	0	1,028	2,165	126	0	3,319	0	0	126	126	-3,193
12	2002 - 2003	0	0	974	2,165	126	0	3,265	0	0	126	126	-3,139
13	2003 - 2004	0	0	920	2,165	126	0	3,211	0	0	126	126	-3,085
14	2004 - 2005	0	0	866	2,165	126	0	3,156	0	0	126	126	-3,030
15	2005 - 2006	0	0	812	2,165	126	0	3,102	0	0	126	126	-2,976
16	2006 - 2007	0	0	758	2,165	126	0	3,048	0	0	126	126	-2,922
17	2007 - 2008	0	0	703	2,165	126	0	2,994	0	0	126	126	-2,868
18	2008 - 2009	0	0	649	2,165	126	0	2,940	0	0	126	126	-2,814
19	2009 - 2010	0	0	595	2,165	126	0	2,886	0	0	126	126	-2,760
20	2010 - 2011	0	0	541	2,165	126	0	2,832	0	0	126	126	-2,706
21	2011 - 2012	0	0	487	2,165	126	490	3,268	0	0	126	126	-3,142
22	2012 - 2013	0	0	433	2,165	126	490	3,214	0	0	126	126	-3,088
23	2013 - 2014	0	0	379	2,165	126	0	2,669	0	0	126	126	-2,543
24	2014 - 2015	0	0	325	2,165	126	0	2,615	0	0	126	126	-2,489
25	2015 - 2016	0	0	271	2,165	126	0	2,561	0	0	126	126	-2,435
26	2016 - 2017	0	0	216	2,165	126	0	2,507	0	0	126	126	-2,381
27	2017 - 2018	0	0	162	2,165	126	0	2,453	0	0	126	126	-2,327
28	2018 - 2019	0	0	108	2,165	126	0	2,399	0	0	126	126	-2,273
29	2019 - 2020	0	0	54	2,165	126	0	2,345	0	0	126	126	-2,219
30	2020 - 2021	0	0	0	2,165	126	0	2,291	0	0	126	126	-2,165

Remarks: FC = Foreign Currency, LC = Local Currency
Condition of Loan Repayment of Foreign Currency;
Interrest (%) : 2.5
Grace Period : 10 years
Repayment Period : 30 years (including grace period)

TAble VIII-23 CASH FLOW STATEMENT WITHOUT IRRIGATION SERVICE FEE

(Unit: Rp. million)

Year in Order	Year	Capital Cost		Cash Outflow					Cash Inflow			Balance
				Loan Repayment		O & M Cost	Replacement Tmansmigrants Cost	Total	Fund		Total	
		FC	LC	Interest	Principal				FC	LC		
1	1991 - 1992	606	196	15	0	0	620	1,437	606	196	802	-635
2	1992 - 1993	2,335	690	74	0	0	583	3,682	2,335	690	3,025	-657
3	1993 - 1994	2,904	1,450	146	0	0	617	5,117	2,904	1,450	4,354	-763
4	1994 - 1995	11,752	4,689	440	0	0	432	17,313	11,752	4,689	16,441	-872
5	1995 - 1996	15,247	6,107	763	0	0	440	22,557	15,247	6,107	21,354	-1,203
6	1996 - 1997	8,920	3,679	1,044	0	74	1,049	14,766	8,920	3,679	12,599	-2,167
7	1997 - 1998	1,528	709	1,082	0	126	1,084	4,529	1,528	709	2,237	-2,292
8	1998 - 1999	0	0	1,082	0	126	120	1,328	0	0	0	-1,328
9	1999 - 2000	0	0	1,082	0	126	65	1,273	0	0	0	-1,273
10	2000 - 2001	0	0	1,082	0	126	0	1,208	0	0	0	-1,208
11	2001 - 2002	0	0	1,028	2,165	126	0	3,319	0	0	0	-3,319
12	2002 - 2003	0	0	974	2,165	126	0	3,265	0	0	0	-3,265
13	2003 - 2004	0	0	920	2,165	126	0	3,211	0	0	0	-3,211
14	2004 - 2005	0	0	866	2,165	126	0	3,156	0	0	0	-3,156
15	2005 - 2006	0	0	812	2,165	126	0	3,102	0	0	0	-3,102
16	2006 - 2007	0	0	758	2,165	126	0	3,048	0	0	0	-3,048
17	2007 - 2008	0	0	703	2,165	126	0	2,994	0	0	0	-2,994
18	2008 - 2009	0	0	649	2,165	126	0	2,940	0	0	0	-2,940
19	2009 - 2010	0	0	595	2,165	126	0	2,886	0	0	0	-2,886
20	2010 - 2011	0	0	541	2,165	126	0	2,832	0	0	0	-2,832
21	2011 - 2012	0	0	487	2,165	126	490	3,268	0	0	0	-3,268
22	2012 - 2013	0	0	433	2,165	126	490	3,214	0	0	0	-3,214
23	2013 - 2014	0	0	379	2,165	126	0	2,669	0	0	0	-2,669
24	2014 - 2015	0	0	325	2,165	126	0	2,615	0	0	0	-2,615
25	2015 - 2016	0	0	271	2,165	126	0	2,561	0	0	0	-2,561
26	2016 - 2017	0	0	216	2,165	126	0	2,507	0	0	0	-2,507
27	2017 - 2018	0	0	162	2,165	126	0	2,453	0	0	0	-2,453
28	2018 - 2019	0	0	108	2,165	126	0	2,399	0	0	0	-2,399
29	2019 - 2020	0	0	54	2,165	126	0	2,345	0	0	0	-2,345
30	2020 - 2021	0	0	0	2,165	126	0	2,291	0	0	0	-2,291

Remarks: FC = Foreign Currency, LC = Local Currency
Condition of Loan Repayment of Foreign Currency;
Interrest (%) : 2.5
Grace Period : 10 years
Repayment Period : 30 years (including grace period)

CHAPTER 5 ENVIRONMENTAL IMPACT ASSESSMENT

(1) Influence on Environment

This area will be newly developed for agriculture composing irrigation and plantation, and the development should be performed without affecting the environmental condition of the Air Selagan river basin. From the view points of environmental protection, the following items are required to keep in mind.

a. The conversion of the least forest to farmland is inevitable for agricultural development.

b. Since the project area belongs to the transmigration area, the transmigrant people should live together with native people. Therefore, farm land should be supplied to both of them. The paddy field is allocated to 75% for transmigrant people, and 25% for native people, based on the policy of the provincial government, while the distribution of the plantation is to be 50% for the settlers from conservation area in the mountainous region, and 50% for the transmigrant people supported by the government.

c. As for the area to be used for paddy cultivation, the existing area for the village and the roads is allotted to the native people as much as possible to prevent conflict with transmigrants concerning location of the area to be distributed.

d. Irrigation water is to be derived from the Air Selagan by constructing a diversion weir. Few backwater can be expected unless a high weir is constructed.

e. Water to be supplied from the weir will not cause troubles both for irrigation and for drinking because the proposed weir site is located 50 km upstream from the estuary. Water analysis, however, should be made from time to time after development.

f. Since the ratio of the catchment area to the irrigable area is high, adequate irrigation water can be expected at the weir site, and river maintenance flow is also abundant at the lower reach of the river (Q = 0.5 - 10 $m^3/sec/100\ km^2$).

g. To the extent over about 23 Km from the estuary, the river is used for lumber carriers, and the draw-down of water level can be expected due to taking water at the weir site. However, the establishment of the weir may not affect navigation because the catchment area is stretching over 300 Km^2 downstream from the weir, and irrigation water with 1/5 non-exceedance probability is to be supplied.

h. A fish way should be installed not to prevent fish for going upstream.

i. Living water for Muko^2 is lifled with a pump at Pondok Batu located about 8 Km upstream from the estuary of the Air Selagan. After development, the use of fertilizer, and agricultural chemicals are surely increased. To prevent excessive use of them, agricultural extension services may be required. Water analysis should be performed continually after development. In addition, the improvement of the existing water purification facilities may be necessary according to water quality.

j. In the case of the paddy field, good water circulation resulting from the establishment of both irrigation and drainage facilities prevents soil acidification, while in plantation and in farm land, the establishment of drainage canals may result in over-drainage which causes change in soil texture. Subsequently, the sprinkling of lime may be required.

k. The establishment of new drainage canals not only accelerates draining the area but also reduces flood damage to Muko^2.

l. In order to prevent the influence of waste water produced in the process of oil-palm, a sewage disposal site is desirable where the drainage canal leading to the downstream part of Muko^2 can be used.

(2) Environmental Impact Assessment

Environmental impact assessment for the Air Selagan region has been made preliminary to development as agency contract on the basis of the criteria formulated by Directorate General of Water Resources Development, Ministry of Public Works.

In assessment, the effect on the region has been judged, combining environmental factors consisting of 23 items such as meteorology, hydrology, geology, fauna, flora, social economy, culture, etc. with activity factors composing 19 items such as sort of construction works, management, maintenance, administration, etc., the evaluation of each factor is divided into three grades according to the degree of influence, and the result is shown in Table ____. Zero (0) in the table means no or little effect on environment, one (1) injurious, and 0.5 neutral. The total and that for activity factor are positioned respectively according to the following three grades:

a. Evaluation of effect on environmental facts

Table of evaluation mark	Degree of Influence	Percentage
0 - 8	Light impact	100%
0 - 18	Medium impact	0%
> 19	Heavy impact	0%

b. Evaluation of effect on activity factors

Table of evaluation mark	Degree of Influence	Percentage
0 - 6	Monitoring is not necessary	89.5%
7 - 14	Monitoring is necessary	10.5%
> 15	Detailed monitoring is necessary	0%

In the above a., each item has a small evaluation mark, and the degree of little influence account for 100 percent.

In the above b., 89.5% does not give impact and these activity factors are not necessary to be monitored.

After 10.5% in the medium impact shall be monitored. Mainly they consist of rice field development and oil palm development.

Table VIII-24 MATRIX OF IMPACT ANALYSIS

SENSIBLE ENVIRONMENT COMPONENT	DOMINANT ACTIVITY COMPONENT	CONSTRUCTION											OPERATION								TOTAL WEIGHT
		LAND ABANDON	BASE CAMP	MODIFICATION OF WATER FLOW	EROTION CONTROL	MATERIAL EXPLORATION	MATERIAL REPLECEMENT	COVER DAM	WEIR	INTAKE	CONVE YANCE CANAL	DRAINAGE CANAL	REFORES TATION	FLUSH GATE OPERATION	CONTROL	GUARD	MAIN-FENANCE	MONI-TORING	RICEFIELD DEVELOP MENT	FARM INPUT USAGE	
I. HYDROLOGY	GROUND WATER	0	1	0.5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5
	SURFACE WATER	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
	WATER QUALITY	0	1	0.5	0	1	1	0	0	0.5	0.5	0	0	0	0	0	0	0	0	1	5
	WATER QUANTITY	0	1	0	0	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0	0	1	0	3.5
	BACK WATER	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	SEDIMENT	0	0	1	0	1	0	0	0	0	0	0	0	0.5	0	0	0	0	1	0	3.5
II. CLIMATE	AIR CONDITION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TEMPERATURE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
III. GEOLOGY	ROCKS	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4
	SOIL	0	0	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	1	0	8
	LAND FORM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
IV. FLORA & FAUNA	TREES	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	6
	SCHRUBS	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	6
	FARMLAND	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0.5	2
	BIRD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LAND ANIMAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0.5
	WATER ANIMAL	0	0	1	0	0	0	0	0.5	0	0	0	0	0.5	0.5	0.5	0	0	0	0	2
V. SOCIO-ECONOMIC	THE CHANCE OF EMPLOYMENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	EDUCATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	POPULATION MIGRATION	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	1
	INCOME	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0.5	1
VI. SOCIO-CULTURAL	TOURISM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	HEALTH	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	1
	TOTAL WEIGHT	3	8	7	2	6	3	1	1.5	1.5	1	1	0	2.5	0.5	0.5	0	0	10	2.5	51

NOTE :

PERCENTAGE RESULTING FROM :

$$\frac{\text{THE TOTAL OF COMPONENT INCLUDED IN GROUP}}{\text{THE TOTAL OF ALL COMPONENTS}} \times 100\%$$

Weight to activity component

Weight	Classification	Percentage
0 - 6	the activity which is not necessary to be monitored	89.5
7 - 14	the activity which is necessary to be monitored	10.5
>15	the activity which is necessary to be monitored tightly	0

Weight to the environment component

Weight	Classification	Percentage
0 - 8	Light effect	100
9 - 18	Medium effect	0
>19	Heavy effect	0

Source : Final Report / Environmental Assessment Study on the Air Selagan Irrigation Project in Bengkulu Province, Dec. 1989, JICA

Table VIII-25 THE IMPACT PREDICTION OF THE ENVIRONMENT MANAGEMENT PLANNING (RKL) AND THE ENVIRONMENT MONITORING PLANNING (RPL).

(1/6)

NO	THE SENSIBLE ENVIRONMENT COMPONENT	THE DOMINANT ACTIVITY COMPONENT	THE IMPACT PREDICTION	R K L		R P L	
				THE IMPACT PREVENTION (-)	THE IMPACT DEVELOPMENT (+)	MECHANISM	IMPLEMENTATION
I	HIDROLOGY						
1	Ground Water	Base Camp	The decrease of ground water level because of the well drilling and the excessive use	The limitation of well utilization	-	Local Government Regulation	Local Government
		Modified of Water Flow	The decrease of ground water source at the operation stage	-	-	-	-
		Erosion Control	The river slope stability reduction	Strenghtening the slope	-	Local environ-metal regulation	Local Government
2	Surface Water	Base Camp	The greater run off	-	-	-	-
		Ricefield Development		Formation of rice path & terracering	-	-	-
3	Water Quality	Base Camp	The pollution of household waste and heavy workshop items	Water treatment	-	Local environ-mental regulation	Local Government
		- Modified of water flow by diversion canal	<-- The pollution occurs at construction stage.	-	-	-	-
		- Material exploration - Material placement	<--				
		- Intake	The pollution due to the uses of fertilizer and pesticide/ insecticide.	The use in confirmity with the need and in an integrated way	-	Local environ-mental regulation Service = BPP	Agricultural Extension

R K L : ENVIRONMENTAL ACTIVITY PLAN R P L : ENVIRONMENTAL MONITORING PLAN

Source: Final Report/Environmental Assessment Study on the Air Selagan Irrigation Project in Bengkulu Province, Dec. 1989, JICA

NO	THE SENSIBLE ENVIRONMENT COMPONENT	THE DOMINANT ACTIVITY COMPONENT	THE IMPACT PREDICTION	R K L		R P L	
				THE IMPACT PREVENTION (-)	THE IMPACT DEVELOPMENT (+)	MECHANISM	IMPLEMENTATION
4	Water quantity	Base Camp	The excessive use	The limitation of water use	-	Local Government Regulation	Local Government
		Flush gate operation	Discharge reduction in the downstream but it can be used for irrigation.	-	-	Operation and Maintenance.	Irrigation observer.
		Guard control	Unsuitable with the plan.	E & P course for the staff.	-	The planning of water use	Local Department of Irrigation.
		Ricefield development	Total water reduction	-	-	-	-
5	Back Water	Flush gate operation (Starting weir operation)	The back water occurred will reduce river slope stability of slope.	-	-	-	-
6	Sediment	Modified of water flow (Diversion Canal Construction).	Due to the diversion canal construction (soil excavation) it will increase erosion, and the sedimentation in the downstream.	-	-	-	-
		Material Exploration	Instability of the location	-	-	-	-
		Flush gate operation	Sedimentation of the front weir.	Flush gate using under sluice.	-	-	-

R K L : ENVIRONMENTAL ACTIVITY PLAN

R P L : ENVIRONMENTAL MONITORING PLAN

NO	THE SENSIBLE ENVIRONMENT COMPONENT	THE DOMINANT ACTIVITY COMPONENT	THE IMPACT PREDICTION	R K L		R P L	
				THE IMPACT PREVENTION (-)	THE IMPACT DEVELOPMENT (+)	MECHANISM	IMPLEMENTATION
III	GEOLOGY						
1	Rocks	- Base Camp - Modified of water flow	Environmental destruction.	-	-	Local Government Regulation	Local Government
		- Material Exploration	Unstability occurred at that site.	-	-	Local Government Regulation	Local Government
		- Ricefield development.	Environmental destruction	-	-	-	-
2	Soil	- Base Camp - Modified of water flow - Erosion control - Coverdam - Weir - Intake - Conveyance canal	←-- Construction stage will destroy soil structure.	-	-	-	-
		- Canal drainage	←--				
		Ricefield development	The change of soil structure.	-	-	-	-
3	Land Form	Material Excavation	The hook occurs because of the excavation.	-	-	-	-
		Ricefield development	The erosion increasing	Terrace forming in the hilly area.	-	-	-

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NO	THE SENSIBLE ENVIRONMENT COMPONENT	THE DOMINANT ACTIVITY COMPONENT	THE IMPACT PREDICTION	R K L		R P L	
				THE IMPACT PREVENTION (-)	THE IMPACT DEVELOPMENT (+)	MECHANISM	IMPLEMENTATION
IV	FLORAN AND FAUNA						
1 2	Trees Shrubs	- Land Abandon - Base Camp - Modified of water flow - Material Exploration - Ricefield	Trees and Shrubs cutting in unboard area, open, easy to erode and gives some disadvantage if it is an economical crops.	- The reboisation for the needed. - Compensation should be deliberated.	- -	Local environmental regulation -	Local Department of Irrigation. - Local Government
3	Land forming	Land abandon	Cause social impact, and the claim of compensation.	- Compensation should be deliberated.			Local Government
		Ricefield development	The change on land use will cause disadvantage and will increase.	Information, Formation of rice path, terracering	The increase productivity and income		BPP
		Paddies production facilities utilization	The use farm input	Intergrated dosage usage in accordance with the land capability	The use of farm input should be in balance condition and its application to the plant.	The agriculture regulation	BPP
4	Land Animal	Ricefield development	Plant distribution and livestock uses.	Pest control	The efficiency of employment	Local & Agriculture regulation	BPP

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				THE IMPACT PREVENTION (-)	THE IMPACT DEVELOPMENT (+)	MECHANISM	IMPLEMENTATION
5	Water Animal	- Modified of water flow - Weir	The expansion of water animal is obstructed.	-	-	-	-
		Flush gate operation.	The expansion of water animal is obstructed and join in the weir.	-	Fish breeding	-	Irrigation observer
V	SOCIAL ECONOMY						
1	Population Migration	Base Camp	The base camp placement by the labour from outside (employment), the increase of income and other social matters.	The information and control given by the authority, the environment improvement.	The increase of income and environment.	Local government regulation and environment.	Local Government
		Ricefield development	Inviting people to join the job, cause the problem of land property and other social problem.	The information and control given by the authority, the environment improvement.	Employment, the increase of cropping patent and cropping intensity, the increase of production.	Local government regulation and environment.	Local Government and BPP
2	Income	Ricefield development	If the land use is productive plant, it will give disadvantage when the owner does not want to.	The information and the utilization of the intensive land.	If the land is not productive. it will increase the land productivity and farmers income.	Local Government Regulation	Local Government and BPP

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NO	THE SENSIBLE ENVIRONMENT COMPONENT	THE DOMINANT ACTIVITY COMPONENT	THE IMPACT PREDICTION	RKL		RPL	
				THE IMPACT PREVENTION (-)	THE IMPACT DEVELOPMENT (+)	MECHANISM	IMPLEMENTATION
		The use of farm input	When the uses is over dosage, the income will decrease.	The use of farm input should be in the right dosage and time, and the information increase.	The use of optimum dosage can increase the the production.	-	BPP
VII	SOCIAL-CULTURE						
1	Health	Base Camp	If the base camp environment is not sufficient for health, it will cause disease.	Information and sanitation of environment.	-	The environment regulation	The local government and health department.
		The use of farm input	The uses is done out of the rule and the storage, it will cause disease.	Information and following the rule of usage and storage.	-	-	BPP

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