

**ANNEX – 15**

**WATER CHARGE MECHANISM**

# ANNEX – 15 WATER CHARGE MECHANISM

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## **1. Objective**

An analysis on the water charge mechanism is carried out for the following objectives.

- a. To establish a full cost recovery system for PJT for operating and maintaining all the water-related facilities based on cost allocation among sectors. The costs should be recovered by water charges and government subsidy as classified below.
  - Costs for watershed management, flood protection, sabo and river maintenance flow are to be borne by government budget and not reflected in water charges.
  - Costs for power generation and irrigation, industrial and domestic water supply are to be recovered by water charges.
- b. To find out appropriate levels of raw water charges. The objectives of charging raw water at an appropriate level are the following.
  - to strengthen and expand the financial foundation of PJT so as to be able to operate and maintain the water-related facilities appropriately and adequately
  - to promote an efficient use of water in a tight water supply and demand situation

## **2. Assumptions**

The assumptions underlying the analysis are the following.

- a. The costs to be recovered by water charges include both investment cost and operation and maintenance costs of the facilities.
- b. Water charges are derived for the following two cases.
  - Water tariff for the existing facilities as of 1997
  - Water tariff for the existing and planned facilities as of 2020
- c. Water charges for raw water supply and power generation are derived. Costs include those of dams and weirs with functions of creating and supplying raw water. Costs, however, do not include those for water distribution systems such as irrigation intakes and canals, PDAMs' water purification plant and distribution systems and PLN's power station.
- d. Water charges are derived as averages for the Brantas River Basin as a whole, not for each facility or area.



- e. The present analysis would provide a framework for the methodology and appropriate water charge levels based on the data available within the scope of the study. Prior to the introduction of a new system, a detailed analysis on water charges would be recommendable.

### 3. Methodology

An analysis on water charges are carried out according to the following steps.

#### a. Derivation of investment costs of the existing facilities in 1997 price level in Rupiah (Table A15-1)

Table A15-1 presents the investment costs of the existing water-related facilities in the Brantas river Basin in 1997 price level and expressed in Rupiah. The following steps were taken.

- (i) Data on the investment costs of the existing facilities were collected from the completion reports, SAPS II report, the "The Development of the Brantas River" and other data obtained from PJT. Attachment to Annex 15 shows the original data on investment costs collected and adjusted.
- (ii) The investment costs obtained are originally expressed in local currency and foreign currency. The foreign currency portions are converted to local currency by applying the exchange rates between Rupiah and the foreign currency at the time of the investment. The foreign currency exchange rates for each year are presented at the end of Table A15-1.

*(example)*

- Facility : Karangates
- Year : 1962
- Foreign currency portion : 693 million Yen
- Exchange rate : 0.42 Rupiah / Yen
- Conversion to local currency :  
693 million Yen times 0.42 Rupiah/yen = 291 million Rupiah

- (iii) The investment costs, thus, expressed in Rupiah are those in current prices, meaning expressed in currency value of that time. The costs in current prices are converted to 1997 price level to take into account inflation, applying the consumer price index (CPI). CPI is an index of prices in respective year in proportion the the base year (1997 in this

case). CPIs are presented at the end of Table A15-1.

*(example)*

- Facility : Karangates
- Foreign currency portion converted to Rupiah in 1962 :  
291 million Rupiah in 1962 price level
- CPI :
  - 1962 : 0.7
  - 1997 : 100.0
- Foreign currency portion in 1997 price :  
291 million Rupiah divided by  $(0.7/100) = \underline{41,571 \text{ Million Rupiah}}$  in 1997 price

(iv) The local currency portion and the foreign currency portion of the investment costs, thus derived all in Rupiah and 1997 prices level, are summed at the last column of each facility, for the next step analysis.

**b. Adjustment of total investment cost of the existing facilities to the last year of investment (Table A15-2)**

Table A15-2 shows the total investment cost of all the existing facilities in Rupiah and 1997 price before discounting and after discounting. This discounting is made in order to reflect time value of money and express the investment cost appearing at different times at one point of time. The applied discount rate is 3% per year, assuming 3% as the opportunity cost of capital in Indonesia.

*(example)*

- Total investment cost before discounting :  
41,571 million Rupiah for the first year of  
investment for dams, weirs and intakes.
- Total investment cost after discounting:  
 $41,571 * (1.03)^n = 57,544$  million Rupiah discounted to the  
last year of investment

Table A15-3 shows the investment costs of the water-related facilities proposed for implementation by 2020. The investment costs of the proposed facilities were originally estimated at 1997 price level. Table A15-3 shows the total investment costs of the proposed river facilities before and after discounting. The adjustments are made in the same way as for the existing facilities.

**c. Estimate of operation and maintenance costs (Table A15-4)**

Table A15-4 shows the estimated operation and maintenance costs (OM costs) of the existing and proposed water-related facilities. Based on an analysis of the actual OM costs spent for the existing water-related facilities, OM costs are assumed to be 1% annually of the investment cost. The estimated OM costs are as follows.

(Unit : Rp. million per year)

Item	Existing	Ongoing/ proposed	Total
Dams, weirs	11,439	10,426	21,865
River improvement	13,006	8,109	21,115
Total	24,445	18,535	42,980

**d. Derivation of the allocation proportions of the river facilities (Table A15-5)**

Allocation proportions are derived based on the economic benefit produced by each sector (hereafter “Benefit-share approach”). The sectors considered are : power, irrigation water supply, domestic water supply, industrial water supply, flood control and river maintenance. The idea of “benefit share approach” is that the cost should be borne in proportion to the economic benefit received by beneficiaries such as power users, farmers, households and factories, not intermediary organizations such as PLN and PDAM. The “benefit share approach” is adopted as proxy to the “separable cost – remaining benefit approach”, which is ideal for cost allocation, but requires enormous supporting data, especially in the case of the Brantas River Basin which has a large number of water-related facilities. The separable cost – remaining benefit approach is not applied in the present analysis because of the shortage in the data available. Data collection in this regard is recommended for the future.

Table A15-5 presents assumptions applied in estimating economic benefits of power and water users. Table A15-6 shows the process by which the economic benefits for respective sector are derived. The following table shows the derived proportions for allocating costs of the water-related facilities.

### Allocation Proportions

(Unit : %)

Sector	1997	2020
Power	13.9	14.0
Irrigation water	68.3	48.5
Domestic water	1.6	15.4
Industrial water	5.0	4.5
Flood control	2.5	2.3
River maintenance	8.7	15.4
Total	100.0	100.0

**e. Allocation of investment cost to respective function (Table A15-7)**

The total investment costs and OM costs derived are allocated to respective function by applying the estimated allocation proportions. The allocation for 1997 is made for the existing facilities as of 1997. The cost allocation for 2020 is made for the facilities operating as of 2020, including both the existing facilities as of 1997 and the facilities proposed for implementation by 2020.

**f. Derivation of appropriate water charges (Table A15-8)**

Appropriate water charges are derived for power supply and water supply for irrigation, domestic and industrial water uses. Costs for flood protection and river maintenance are assumed to be covered by government expenditure and not reflected in water charges. Water charges are derived by the following formula.

$$\text{Water charge} = \frac{(\text{Investment cost annualized} + \text{annual OM cost})}{\text{annual amount of power or water supplied}}$$

The following steps are taken.

- (i) Estimate of investment cost for each sector (as described in d. above)
- (ii) Annualization of the sector-wise investment cost as follows.

$$\text{Annual investment cost} = (\text{Investment Cost}) * \text{Capital Recover Factor}$$

The capital recovery factor for a period of 50 years and 3% discount rate is 0.0389.

*(example)*

- Allocated investment cost for existing power facilities :180,810 million  
Rupiah

- Capital recovery factor : 0.0389
- Annualized investment cost for power sector :  
 $\text{Rp. } 180,224 \text{ million} * 0.0389 = \text{Rp. } 7,034 \text{ million per year}$

(iii) Derivation of the amount of power and water used

The amount of power supplied in 1996 is used as the amount of power supplied in 1997 by the existing hydropower generating facilities. The amount of power supplied in 2020 is estimated by adding the amount to be newly generated by the ongoing and proposed facilities to the amount produced by the existing facilities in 1997. The following are the derived amount of power supply.

(Existing facilities)

	(kWh)
- Karangates :	461,828,900
- Lodayo :	38,745,740
- Selorejo :	22,550,790
- Wlingi :	154,901,400
- Sengguruh :	75,781,700
sub-total:	753,808,530

(Proposed facilities)

- Wonorejo :	31,700,000
- Beng :	10,400,000
- Genteng I :	54,900,000
sub-total :	97,000,000
Total :	850,808,530

The amount of water supplied in 1997 and that to be supplied in 2020 are estimated as follows.

(Unit : million m<sup>3</sup>)

Sector	1997	2020
Irrigation	1,738	1,360
Domestic	108	849
Industry	104	146

The amount of irrigation water supplied is estimated at 1,738 million m<sup>3</sup>, for 1997 comprising 1,664 million m<sup>3</sup> actually supplied by the main Brantas River and 37 million m<sup>3</sup> each by the tributaries of the Brantas River at Selorejo and Widas. The amount of

irrigation water to be supplied in 2020 is estimated at 1,360 million m<sup>3</sup>, comprising 1,286 million m<sup>3</sup> to be actually supplied by the main Brantas plus 37 million m<sup>3</sup> each by the tributaries of the Brantas River at Selorejo and Widas.

The amount of water to be supplied for domestic and industrial uses are those to be supplied by the Main Brantas, excluding the water to be supplied by other sources.

#### 4. Results

Figure A15-1 shows a concept of water charging and subsidy based on the analysis made.

##### Cost Allocation between Water Charge Portion and Subsidy Portion

The following table shows the allocation proportions derived based on the cost allocation of the investment cost in 1997 and 2020 and the operation and maintenance costs allocated to water charge portion and subsidy portion.

**Operation and Maintenance Costs Allocated to Water Charge Portion and Subsidy Portion**

Item	1997	2020
<i>(Investment cost in Rp. 10<sup>6</sup>)</i>		
Water charge portion	1,154,923	2,483,231
Government subsidy portion	1,608,828	3,291,509
Total	2,763,751	5,774,740
<i>(%)</i>		
Water charge portion	41.8	43.0
Government subsidy portion	58.2	57.0
Total	100.0	100.0
<i>(OM cost in Rp. 10<sup>6</sup>)</i>		
Total	24,445	42,980
Water charge portion	10,218	18,481
Government subsidy portion	14,227	24,499

To operate and manage the non-chargeable facilities appropriately, 58% in 1997 and 57% in 2020 of the total OM costs, or Rp.14,227 million and Rp. 24,499 million, need to be financed by the government expenditure, while the rest should be recovered by water charges.

##### Derived Water Charges

For the water charge portion, water charges are derived at such a level as to recover investment costs and operation and maintenance costs. Table A15-8 and the following table show the derived water charges.

## Appropriate Water Charges

(Unit :Rp./m<sup>3</sup>)

Item	Present	1997			2020		
		Investment	OM	Total	Investment	OM	Total
Power (Rp./kWh)	12	9	2	11	19	4	23
Irrigation water	0	20	5	25	42	8	50
Domestic water	30	8	2	10	21	4	25
Industrial water	51	24	6	30	36	7	43
(Average of water supply)	--	(19)	(4)	(24)	(41)	(6)	(47)

### Realistic Water Charge Levels

It would be important that water consumers can afford the water charges newly introduced. In this respect, the water charges derived above are further analyzed in the light of affordability for consumers.

Table A15-9 shows the realistic water charge levels for 1997 and 2020 considering the affordability. The following table summarizes the result.

Sector	Present	1997	2020
Power	12	12	23
Irrigation	0	5	26
Domestic	30	30	30
Industrial	51	51	51

The following are the considerations.

- a. Irrigation water charges are set considering the affordability for farmers. Table A15-9 presents an analysis on the affordability for farmers. It is recommended that PJT starts charging farmers at a level to recover the OM cost portion, at Rp.5 per m<sup>3</sup>. With this water charge level, expense on water by average farmers is limited to 5.6% of their income. As of 2020, irrigation water charge can be raised to Rp.26 per m<sup>3</sup>. With this level, the expense on water is about 10% of the farmers' income, the assumed allowable level. Due to the expected rise in income level, an average farmer's income after paying the proposed realistic water charges will rise from Rp. 1.5 million per hectare in 1997 to Rp. 4.1 million hectare in 2020.
- b. The deficit in revenue, caused by irrigation water charges set artificially lower than the full cost recovery level, should be covered somehow. It is recommended that the other sectors continue cross-subsidizing the deficit as has been practiced until now. Water charge for the power sector is recommended to remain same as the present level at Rp.12 per kWh for the existing facilities in 1997. An appropriate water charge for the

power sector as of 2020 is derived at Rp.23 per kWh. This charge should be levied in 2020. Table A15-11 shows a preliminary analysis on the PLN's affordability for the proposed water charge. Even with the proposed level at Rp. 23 per kWh, hydropower generation will be able to make a profit of 69% of power sale as follows.

	(Rupiah per kWh)
- Revenue by hydropower :	139
- Cost of hydropower :	20
- Water charge :	23
- Profit :	96
	(69% of revenue)

- c. Water charges for domestic and industrial water are recommended to remain at the present levels until 2020. Theoretically, their water charge levels are lower than the existing levels both in 1997 and 2020. To partly fill the deficit caused by lower irrigation water charges, however, their water charges should be kept at the present level. The fact that domestic and industrial water users have been paying the existing water charges indicate that the present levels are affordable for them.
- d. The shortage of revenue below that to be achieved by introducing the appropriate water charges can, thus, be partly filled by cross-subsidy by power, domestic and industrial sectors to the irrigation sector. The remaining shortfall should be financed by the government. The amounts are estimated to be Rp. 29,662 million in 1997 and Rp.27,227 million in 2020 as shown in Table A15-9.

### PJT's Revenue

PJT's revenue in 1995 and 1996 were as follows.

(Unit : Rp. million)			
User	1995	1996	Average
PLN	9,673	9,898	9,786
PDAM	2,597	3,683	3,140
Industry	4,066	4,134	4,100
Farmer	0	0	0
Total	16,336	17,715	17,026

Once the realistic water charges derived above are introduced, PJT will experience an increase in revenue. The estimated revenue to PJT will be Rp. 26,282 million for 1997 and Rp. 87,849 million as of 2020 as shown in Table A15-9, an increase of about 54% and 520% respectively. This increased portion of revenue should be appropriately used for the facilities



of water charge portion for the following purposes.

- Operation and maintenance works at an adequate level
- Repayment of the fund spent for construction of the facilities

Apart from this increase in revenue, PJT should receive subsidy from the government for an appropriate operation and maintenance of the river facilities for which water charge can not levied such as flood protection works, watershed management measures and sabo works. The repayment of fund of these facilities should be made by the government.

**Table A15-1 (1/10)**  
**Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices : Dams, weirs and intakes**  
 (Unit : Rp. million)

Year	Kamangasues						Selorjo						Lingsong							
	Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)				
	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local currency	Total	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local currency	Total	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local currency	Total		
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1962	693	291	291	41,571	0	41,571	0	0	0	0	0	0	0	0	0	0	0	0		
1963	1,039	436	436	62,286	0	62,286	0	0	0	0	0	0	0	0	0	0	0	0		
1964	2,075	872	872	124,571	0	124,571	0	0	0	0	0	0	0	0	0	0	0	0		
1965	693	291	291	41,571	0	41,571	0	0	0	0	0	0	0	0	0	0	0	0		
1966	693	291	291	32,333	0	32,333	0	0	0	0	0	0	0	0	0	0	0	0		
1967	693	291	291	16,167	0	16,167	0	0	0	0	0	0	0	0	0	0	0	0		
1968	1,039	852	852	21,300	0	21,300	0	0	0	0	0	0	0	0	0	0	0	0		
1969	1,390	1,265	737	26,915	0	26,915	0	0	0	0	0	0	0	0	0	0	0	0		
1970	1,525	1,540	1,383	29,057	0	29,057	0	0	0	0	0	0	0	0	0	0	0	0		
1971	832	932	1,722	16,945	0	16,945	0	0	0	0	0	0	0	0	0	0	0	0		
1972	239	327	946	5,638	0	5,638	0	0	0	0	0	0	0	0	0	0	0	0		
1973	22	34	560	442	0	442	0	0	0	0	0	0	0	0	0	0	0	0		
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1997	10,933	7,422	5,248	418,796	0	418,796	0	0	0	0	0	0	0	0	0	0	0	0		
Total				96,667	12,770	107,150	2,335	2,057	1,888	3,945	48,008	59,142	107,150	979	1,297	1,214	2,511	20,203	17,791	37,994

Source : Data are obtained from various sources such as SAPS, completion reports of projects. " Development of the Brantas River " by KRI International Corp. and PJT. The original data and arrangements made are shown in the attachment-1 to this annex.

Table A15-1 (2/10)  
Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices : Dams, weirs and intakes  
(Unit : Rp.million)

Year	Wings						Lahor						Lodovo					
	Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)		
	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local Currency (mil. Rp.)	Total
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	17	17	0	309	309	0	130	0	130	2,364	0	2,364	2,364	0	0	0	0
1972	0	17	17	0	293	293	0	200	0	200	3,448	0	3,448	3,448	0	0	0	0
1973	0	104	104	0	1,351	1,351	0	1,152	0	1,152	14,961	0	14,961	14,961	0	0	0	0
1974	0	813	813	0	7,528	7,528	0	2,084	0	2,084	34,981	0	34,981	34,981	0	0	0	0
1975	666	932	3,595	7,281	20,805	28,098	1,193	1,694	2,753	4,926	19,296	15,685	16,977	21,508	38,485	0	0	0
1976	2,622	3,671	10,397	23,838	43,675	67,513	1,532	2,173	2,629	3,171	17,071	20,590	16,977	21,508	38,485	0	0	0
1977	2,271	3,520	8,587	20,585	29,632	50,217	387	542	4,167	4,283	25,048	233	25,048	25,048	0	0	0	0
1978	405	851	1,556	4,600	8,411	13,011	21	44	0	0	0	0	0	0	0	0	0	0
1979	180	511	329	2,377	1,530	3,907	31	88	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	168	168	0	266	266	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	2,806	2,806	0	4,126	4,126	0	0	0	0	0	0	0	0	0	0	0	0
1993	438	6,588	14,809	11,065	8,867	19,932	0	0	0	0	0	0	0	0	0	0	0	0
1994	251	5,306	5,117	6,583	6,349	12,932	0	0	0	0	0	0	0	0	0	0	0	0
1995	7	167	1,480	1,888	1,670	1,858	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	5,348	0	5,588	5,588	0	0	0	0	0	0	0	0	0	0	0	0
1997	6,840	23,179	38,799	76,517	140,400	216,917	3,259	4,657	13,115	17,772	103,016	37,506	37,506	140,522	6,897	16,767	27,426	114,322
Total	6,840	23,179	38,799	76,517	140,400	216,917	3,259	4,657	13,115	17,772	103,016	37,506	37,506	140,522	6,897	16,767	27,426	114,322

Source : Data are obtained from various sources such as SAPS, completion reports of projects, "Development of the Brantas River" by KRI International Corp. and P.T. The original data and arrangements made are shown in the attachment-I to this annex.

**Table A15-1 (3/10)**  
**Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices : Dams, weirs and intakes**  
 (Unit : Rp.million)

Year	Menturus						Jatimirek						Wonokromo					
	Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)		
	Foreign currency	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local Currency (mil. Rp.)	Total (mil. Rp.)
	(million Yen)																	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	131	1,564	2,496	4,160	22	31	53	85	229	314	1,34	496
1991	92	1,332	3,900	2,568	3,900	2,108	84	1,218	1,606	2,824	2,879	4,318	7,197	29	465	1,573	684	2,313
1992	97	1,555	5,023	3,468	5,100	2,287	0	0	0	0	1,927	2,542	4,468	111	206	422	277	845
1993	31	582	3,566	2,984	4,016	783	0	0	0	0	0	0	0	46	970	1,758	1,203	3,385
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	220	3,469	9,020	12,489	13,179	5,178	216	2,894	4,119	7,013	4,828	6,891	11,719	92	1,726	3,517	2,298	7,039
Total																		

Source : Data are obtained from various sources such as SAPS, completion reports of projects, "Development of the Brantas River" by KRI International Corp. and PIT. The original data and arrangements made are shown in the attachment-1 to this annex.

**Table A15-1 (4/10)**  
**Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices : Dams, weirs and intakes**  
 (Unit: Rp.million)

Year	Jagir						Majlis						Curingpan					
	Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)		
	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local currency	Total
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	17	26	43	210	58	268	18	28	46	164	88	252	277	388	665	2,519	3,792	6,311
1978	17	36	53	46	54	100	73	153	226	827	319	1,146	277	429	706	2,509	3,415	5,924
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	34	62	96	82	112	194	109	232	341	1,228	477	1,705	1,662	3,745	5,407	17,633	17,428	35,061

Source : Data are obtained from various sources such as SAPS, completion reports of projects, "Development of the Brantas River" by KRI International Corp. and P.T. The original data and arrangements made are shown in the attachment-1 to this annex.

**Table A15-1 (5/10)**  
**Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices : Dams, weirs and intakes**

(Unit : Rp. million)

Year	Gubeng						Songarih						Bening						
	Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)			
	Foreign currency		Local currency	Foreign currency		Total (mil. Rp.)	Foreign currency		Local currency	Foreign currency		Total (mil. Rp.)	Foreign currency		Local currency	Foreign currency		Total (mil. Rp.)	
	(million Yen)	(mil. Rp.)	(mil. Rp.)	(million Yen)	(mil. Rp.)	(mil. Rp.)	(million Yen)	(mil. Rp.)	(mil. Rp.)	(million Yen)	(mil. Rp.)	(mil. Rp.)	(million Yen)	(mil. Rp.)	(mil. Rp.)	(million Yen)	(mil. Rp.)	(mil. Rp.)	
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1991	3	43	110	153	68	174	242	0	0	0	0	0	0	0	0	0	0	0	
1992	58	930	2228	3,158	1,368	3,276	4,644	0	0	0	0	0	0	0	0	0	0	0	
1993	11	206	413	619	277	556	833	0	0	0	0	0	0	0	0	0	0	0	
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	72	1,179	2,751	3,930	1,713	4,006	5,719	61	77,368	180,721	77,368	180,721	1,771	3,839	11,793	15,632	20,240	45,996	
																			66,236

Source : Data are obtained from various sources such as SAPS, completion reports of projects, "Development of the Bramas River" by KRI International Corp. and PJT. The original data and arrangements made are shown in the attachment-1 to this annex.

Table A15-1 (6/10)  
Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices  
: Dams, weirs and intakes  
(Unit : Rp.million)

Year	Current Price			1997 Price (million Rp.)			Exchange Rates		Consumer Price Index (CPI)	
	Foreign currency		Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local currency	Rp/Yen	Rp/\$	(1990 = 100)	(1997 = 100.0)
	(million Yen)	(million Rp.)								
1959	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1960	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1961	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1962	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1963	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1964	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1965	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1966	0	0	0	0	0	0	0.42	149.6	1.5	0.9
1967	0	0	0	0	0	0	0.42	149.6	3.1	1.8
1968	0	0	0	0	0	0	0.82	296.3	7.0	4.0
1969	0	0	0	0	0	0	0.91	326.0	8.1	4.7
1970	0	0	0	0	0	0	1.01	362.8	9.1	5.3
1971	0	0	0	0	0	0	1.12	391.9	9.5	5.5
1972	0	0	0	0	0	0	1.37	415.0	10.1	5.8
1973	0	0	0	0	0	0	1.53	415.0	13.3	7.7
1974	0	0	0	0	0	0	1.42	415.0	18.7	10.8
1975	0	0	0	0	0	0	1.40	415.0	22.2	12.8
1976	0	0	0	0	0	0	1.40	415.0	26.7	15.4
1977	0	0	0	0	0	0	1.55	415.0	29.6	17.1
1978	0	0	0	0	0	0	2.10	442.0	32.0	18.5
1979	0	0	0	0	0	0	2.84	623.1	37.2	21.5
1980	0	0	0	0	0	0	2.77	627.0	43.9	25.4
1981	0	0	0	0	0	0	2.86	631.8	49.3	28.5
1982	0	0	0	0	0	0	2.66	661.4	53.9	31.2
1983	0	0	0	0	0	0	3.33	909.3	60.3	34.9
1984	0	0	0	0	0	0	4.32	1,025.9	66.6	38.5
1985	0	0	0	0	0	0	4.66	1,110.6	69.8	40.3
1986	0	0	0	0	0	0	7.61	1,282.6	73.8	42.7
1987	0	0	0	0	0	0	11.56	1,643.8	80.7	46.6
1988	0	0	4,380	4,380	0	8,690	13.15	1,685.7	87.2	50.4
1989	0	0	4,380	4,380	0	8,172	12.83	1,770.1	92.8	53.6
1990	0	0	4,380	4,380	0	7,578	12.73	1,842.8	100.0	57.8
1991	0	0	4,380	4,380	0	6,920	14.48	1,950.3	109.4	63.2
1992	0	0	4,380	4,380	0	6,441	16.03	2,029.9	117.7	68.0
1993	0	0	0	0	0	0	18.77	2,087.1	128.5	74.3
1994	0	0	0	0	0	0	21.14	2,160.8	139.5	80.6
1995	0	0	0	0	0	0	23.91	2,248.6	153.2	88.6
1996	0	0	0	0	0	0	21.53	2,342.3	165.5	95.7
1997	0	0	0	0	0	0	21.40	2,446.6	173.0	100.0
Total	0	0	21,900	21,900	0	37,811	-	-	-	-

Source : Data are obtained from various sources such as SAPS, completion reports of projects, " Development of the Brantas River " by KRI International Corp. and PJT. The original data and arrangements made are shown in the attachment-1 to this annex.

**Table A15-1 (7/10)**  
**Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices : River improvement works**

Year	Porong 1						Porong 2						Brantas Middle Reach 1					
	Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)			Current Price			1997 Price (million Rp.)		
	Foreign currency (million Yen)*	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency (million Yen)	Local Currency (mil. Rp.)	Total (mil. Rp.)
1959	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	208	1,176	1,409	4,236	21,382	25,618	0	0	0	0	0	0	0	0	0	0	0	0
1972	208	1,176	1,461	4,914	20,276	25,190	0	0	0	0	0	0	0	0	0	0	0	0
1973	208	1,176	1,494	4,130	15,273	19,403	0	0	0	0	0	0	0	0	0	0	0	0
1974	208	1,176	1,471	2,731	10,389	13,620	0	0	0	0	0	0	0	0	0	0	0	0
1975	208	1,176	1,467	2,273	9,188	11,461	0	0	0	0	0	0	0	0	0	0	0	0
1976	208	1,176	1,467	1,890	7,636	9,526	0	0	0	0	0	0	0	0	0	0	0	0
1977	208	1,176	1,498	1,883	6,877	8,760	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	590	8,543	1,007	9,550	13,517	1,593	15,110	0	0	0	0	0	0	0	0
1992	0	0	0	861	13,802	1,470	15,272	20,297	2,162	22,459	0	0	0	0	0	0	0	0
1993	0	0	0	96	1,802	163	1,965	2,425	219	2,644	0	0	0	0	0	0	0	0
1994	0	0	0	47	994	82	1,076	1,233	102	1,335	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	1,594	25,141	2,722	27,863	37,472	4,076	41,548	6,280	14,943	61,405	65,672	127,077	19,550	298,348	364,020
Total	1,456	8,232	10,267	22,057	91,521	113,578	22,057	91,521	113,578	22,057	91,521	113,578	22,057	91,521	113,578	22,057	91,521	113,578

Source : Data are obtained from various sources such as SAPS, completion reports of projects, " Development of the Brantas River " by XRI International Corp. and IJFI. The original data and arrangements made are shown in the attachment-1 to this annex.

\* Porong 1/Brantas Middle Reach 1. Costs in each year do not add up to the total due to rounding.



**Table A15-1 (8/10)**  
**Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices : River improvement works**

Year	Hamma Middle Reach II										Surabaya I										Kedurus									
	Current Price					1997 Price (million Rp.)					Current Price					1997 Price (million Rp.)					Current Price					1997 Price (million Rp.)				
	Foreign currency (million Yen)		Local Currency (mil. Rp.)		Total (mil. Rp.)	Foreign currency		Local Currency (mil. Rp.)		Total (mil. Rp.)	Foreign currency (million Yen)		Local Currency (mil. Rp.)		Total (mil. Rp.)	Foreign currency		Local Currency (mil. Rp.)		Total (mil. Rp.)	Foreign currency		Local Currency (mil. Rp.)		Total (mil. Rp.)					
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Total	5,942		76,706		19,263	95,969	138,690	37,522	176,212		4,080	8,334	16,512	24,846	44,750	96,834	141,584		1,012	17,981	51,729	69,710	24,889	70,211	95,101					

Source : Data are obtained from various sources such as SAPS, completion reports of projects, "Development of the Brantas River" by KRI International Corp. and PIT. The original data and arrangements made are shown in the attachment-I to this annex.

\*\* Data on the investment cost of Surabaya II project were not available.

**Table A15-1 (9/10)**  
**Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices : River improvement works**

(Unit : Rp.million)

Year	Bewani Tunnel										Tulungagung Drainage										Wadas									
	Current Price					1997 Price (million Rp.)					Current Price					1997 Price (million Rp.)					Current Price					1997 Price (million Rp.)				
	Foreign currency (million Yen)	Local Currency (million Rp.)	Total (mil. Rp.)	Foreign currency	Local currency	Total	Foreign currency (Thousand \$)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local currency	Total	Foreign currency (Thousand \$)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local currency	Total	Foreign currency (Thousand \$)	Local Currency (mil. Rp.)	Total (mil. Rp.)	Foreign currency	Local currency	Total						
1959	237	99	41	140	14,143	5,800	19,943	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
1960	237	99	41	140	14,143	5,800	19,943	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1961	237	99	41	140	14,143	5,800	19,943	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1962	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1963	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1964	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1966	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1967	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1968	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1971	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1973	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1974	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1978	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1979	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1980	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1981	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1991	92	1,332	2568	3,900	2,108	4,063	6,171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1992	97	1,555	3,468	5,023	2,287	5,100	7,387	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1993	31	582	2,984	3,566	783	4,016	4,799	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Total	930	3,766	9,142	12,908	47,606	30,579	78,186	45,980	49,747	39,765	89,512	122,242	87,810	210,151	10,005	17,184	26,671	33,233	19,523	52,755										

Source : Data are obtained from various sources such as SAPS, completion reports of projects, " Development of the Brantas River " by KRI International Corp. and P.T. The original data and arrangements made are shown in the attachment-1 to this annex.

**Table A15-1 (10/10)**  
**Investment Cost of the Existing River Facilities in Current Prices and 1997 Prices :**  
**: River improvement works**  
 (Unit : Rp. million)

Year	Current Price				1997 Price (million Rp.)			Exchange Rates		Consumer Price Index (CPI)	
	Facility (million Yen)	Local Currency (million Rp.)		Total (mil. Rp.)	Foreign currency	Local currency	Total	Rp/Yen	Rp/\$	(1990 = 100.0)	(1997 = 100.0)
		Local Currency (million Rp.)	Total (mil. Rp.)								
1959	0	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1960	0	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1961	0	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1962	0	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1963	0	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1964	0	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1965	0	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1966	0	0	0	0	0	0	0	0.42	149.6	1.2	0.7
1967	0	0	0	0	0	0	0	0.82	296.3	3.1	1.8
1968	0	0	0	0	0	0	0	0.91	326.0	8.1	4.7
1969	0	0	0	0	0	0	0	1.01	362.8	9.1	5.3
1970	0	0	0	0	0	0	0	1.12	391.9	9.5	5.5
1971	0	0	0	0	0	0	0	1.37	415.0	10.1	5.8
1972	0	0	0	0	0	0	0	1.53	415.0	13.3	7.7
1973	0	0	0	0	0	0	0	1.42	415.0	18.7	10.8
1974	0	0	0	0	0	0	0	1.40	415.0	22.2	12.8
1975	0	0	0	0	0	0	0	1.40	415.0	26.7	15.4
1976	0	0	0	0	0	0	0	1.55	415.0	29.6	17.1
1977	17	26	10	36	152	58	211	2.10	442.0	32.0	18.5
1978	17	36	10	46	195	54	249	2.84	623.1	37.2	21.5
1979	0	0	0	0	0	0	0	2.77	627.0	43.9	25.4
1980	0	0	0	0	0	0	0	2.86	631.8	49.3	28.5
1981	0	0	0	0	0	0	0	2.66	661.4	53.9	31.2
1982	0	0	0	0	0	0	0	3.83	909.3	60.3	34.9
1983	0	0	0	0	0	0	0	4.32	1,025.9	66.6	38.5
1984	0	0	0	0	0	0	0	4.66	1,110.6	69.8	40.5
1985	0	0	0	0	0	0	0	7.61	1,282.6	73.8	42.7
1986	0	0	0	0	0	0	0	11.36	1,643.8	80.7	46.6
1987	0	0	0	0	0	0	0	13.15	1,685.7	87.2	50.4
1988	0	0	0	0	0	0	0	12.83	1,770.1	92.8	53.6
1989	415	5,324	1,493	6,817	9,933	2,785	12,718	12.73	1,842.8	100.0	57.8
1990	507	6,454	1,816	8,270	11,166	3,142	14,308	14.48	1,930.3	109.4	63.2
1991	0	0	0	0	0	0	0	16.03	2,029.9	117.7	68.0
1992	0	0	0	0	0	0	0	18.77	2,087.1	128.5	74.3
1993	0	0	0	0	0	0	0	21.14	2,160.8	139.5	80.6
1994	0	0	0	0	0	0	0	23.91	2,248.6	153.2	88.6
1995	0	0	0	0	0	0	0	21.53	2,342.3	165.5	95.7
1996	0	0	0	0	0	0	0	21.40	2,446.6	173.0	100.0
1997	0	0	0	0	0	0	0	-	-	-	-
Total	956	11,840	3,329	15,169	21,446	6,040	27,486	-	-	-	-

Source : Data are obtained from various sources such as SAPS, completion reports of projects, " Development of the Brantas River " by KRI International Corp. and PJT. The original data and arrangements made are shown in the attachment-1 to this annex.

**Table A15-2 (1/2)**  
**Investment Cost of the Existing River Facilities in 1997 Prices Discounted to the Last Year of Investment : Dams, weirs and intakes**  
 (Unit : Rp.million)

Year	Investment Cost in 1997 Prices before discounting													Total Cost discounted to last year of investment								
	Karangates	Selorejo	Longkong	Wingsi	Wingsi dredging	Lahor	Lodoyo	Lodoyo rehabilitation	Menturus	Jatimkrek	Wonokromo	Jagir	Mitlip		Gunungsa	Gubeng	Senguruh	Bening	Mrican	Ciatik	Total	
1	41,571	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41,571	57,544
2	62,286	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62,286	83,707
3	124,571	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	124,571	163,537
4	41,571	143	0	309	0	2,364	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44,387	56,228
5	32,333	1,715	0	293	0	3,448	1,877	0	0	0	0	0	0	0	0	0	0	0	0	0	39,666	48,784
6	16,167	11,000	0	1,351	0	14,961	57,616	0	0	0	0	0	0	0	0	21,199	0	0	0	0	122,294	146,025
7	21,300	18,222	1,264	7,528	266	34,981	29,242	0	0	0	0	0	0	6,311	0	10,421	0	0	0	0	129,535	150,167
8	42,596	25,800	10,182	28,086	4,126	38,485	5,323	0	0	0	0	0	0	5,924	0	15,987	1,456	8,690	0	0	186,655	210,082
9	55,151	32,766	13,509	67,513	19,932	20,590	6,558	0	0	0	496	0	0	6,303	0	16,536	21,211	8,172	0	0	268,728	293,646
10	48,254	14,887	10,013	50,217	12,932	25,046	6,407	330	6,171	53	2,313	0	252	6,376	242	30,037	7,516	7,578	0	0	228,624	242,547
11	21,948	2,600	2,926	13,011	1,858	238	1,691	2,555	7,387	7,197	845	210	1,146	5,319	4,644	56,440	13,941	6,930	2,400	2,400	153,286	157,885
12	7,715	17	109	3,907	5,588	409	605	1,231	4,759	4,469	3,385	249	307	4,828	833	30,101	22,112	6,441	2,400	2,400	99,505	99,505
Total	515,463	107,150	37,994	172,215	44,702	140,522	109,319	4,116	18,357	11,719	7,039	459	1,705	35,061	5,719	180,721	66,236	37,811	4,800	4,800	1,188,627	1,299,857

Discount rate = 5%

Table A15-2 (2/2)  
Investment Cost of the Existing River Facilities in 1997 Prices Discounted to the Last Year of Investment :  
River Improvement works  
(Unit : Rp.million)

Year	Investment Cost in 1997 Prices before discounting											Total Cost discounted to last year of investment		
	Porong I	Porong II	Brantas Middle Reach I	Brantas Middle Reach II	Sirabaya I	Kedurus	Neyama Tunnel (1)	Neyama Tunnel (2)	Tulungagung Drainage	Widas	Flood forecasting system (1)		Flood forecasting system (2)	Total
1	0	0	0	0	0	0	0	0	24,498	0	0	0	24,498	32,923
2	0	0	0	0	0	0	0	0	22,990	0	0	0	22,990	29,997
3	0	0	60,938	9,536	0	0	0	0	25,138	0	0	0	95,612	121,118
4	0	0	50,649	7,935	25,815	0	0	0	24,740	0	0	0	109,139	134,227
5	25,618	0	46,228	25,380	21,703	0	0	0	24,993	0	0	0	143,922	171,850
6	25,190	0	44,805	21,508	18,039	0	0	0	26,185	1,995	0	0	137,722	159,658
7	19,403	0	40,954	36,796	16,696	9,290	0	0	0	3,639	0	0	126,778	142,690
8	13,620	15,110	34,472	42,463	16,946	22,496	0	0	0	10,968	0	0	156,075	170,547
9	11,461	22,459	30,944	16,296	16,335	40,166	19,943	6,171	21,349	16,046	0	0	201,170	213,421
10	9,526	2,644	27,821	9,593	13,689	22,641	19,943	7,387	20,005	12,076	211	12,718	158,254	163,002
11	8,760	1,335	27,209	6,705	12,361	508	19,943	4,799	20,253	8,031	249	14,308	124,461	124,461
Total	113,578	41,548	364,020	176,212	141,584	95,101	59,829	18,357	210,151	52,755	460	27,026	1,300,621	1,463,894

Discount rate = 3%

**Table A15-3 (1/2)**  
**Investment Cost of the Proposed River Facilities in 1997 Prices Discounted to**  
**Last Year of Investment : Dams, weirs and intakes**  
 (Unit : Rp.million)

Year	Total Investment Cost in 1997 Prices before discounting										Total Cost discounted to last year of investment
	Wilingi dredging	Lodoyo dredging	Wilingi Bypass	Lodoyo Bypass	Sengguruh dredging	Wono-rejo	Beng	Geneng I	Irrigation canal lining	Total	
1	14,428	9215	0	0	649	0	0	0	0	24,292	45,190
2	14,428	9215	0	0	649	0	0	0	0	24,292	43,874
3	14,428	9215	0	0	649	0	0	0	0	24,292	42,596
4	14,428	9215	0	0	649	0	0	0	0	24,292	41,356
5	14,428	9215	0	0	649	0	0	0	0	24,292	40,151
6	7,679	8,993	0	0	649	0	0	0	0	17,321	27,795
7	7,679	8,993	0	0	649	0	0	0	0	17,321	26,986
8	7,679	8,993	0	0	649	0	0	0	0	17,321	26,200
9	7,679	8,993	0	0	649	0	0	0	0	17,321	25,436
10	7,679	8,993	0	0	649	0	0	0	0	17,321	24,696
11	7,679	8,993	0	0	649	0	0	0	4,719	22,040	30,509
12	7,679	8,993	0	0	649	0	0	0	1,976	19,297	25,934
13	7,679	8,993	0	0	649	0	0	0	15,691	33,012	43,073
14	7,679	8,993	0	0	649	0	0	0	15,691	33,012	41,819
15	7,679	8,993	0	0	649	0	0	0	15,691	33,012	40,601
16	7,679	8,993	0	0	649	0	1,443	3,254	15,691	37,709	45,027
17	7,679	8,993	0	0	649	30,305	2,127	7,051	15,691	72,695	84,273
18	7,679	8,993	1,032	486	649	61,011	27,603	6,536	15,691	129,680	145,956
19	7,679	8,993	10,568	4,973	649	61,011	61,010	54,006	15,691	224,580	245,405
20	7,679	8,993	10,568	4,973	649	61,011	64,032	74,745	15,691	248,341	263,465
21	7,679	8,993	10,568	4,973	649	61,011	64,032	74,745	15,691	248,341	255,791
22	7,679	8,993	10,568	4,973	649	30,305	21,410	48,270	15,691	148,738	148,738
Total	202,683	198,956	43,304	20,378	14,278	305,054	241,657	268,607	163,605	1,458,522	1,714,871

**Table A15-3 (2/2)**  
**Investment Cost of the Proposed River Facilities in**  
**1997 Prices Discounted to Last Year of Investment :**  
**River improvement works, watershed management, sabo**

Year	Total Investment Cost in 1997 Prices before discounting						Total cost discounted to last year of investment
	PPWS	Widas Flood Control	Lodayo Diversion Tunnel	Watershed management	Sabo	Total	
1	7,617	0	0	463	7,962	16,042	29,843
2	8,016	0	0	3,655	74,824	86,495	156,220
3	446	0	0	3,650	74,827	78,923	138,392
4	856	0	0	3,650	78,585	83,091	141,457
5	61	0	0	3,650	79,965	83,676	138,304
6	61	0	0	3,650	71,139	74,850	120,112
7	1,086	0	0	3,650	69,764	74,500	116,069
8	6,133	1,292	0	3,650	79,025	90,100	136,284
9	6,989	5,882	0	3,650	62,701	79,222	116,340
10	5,108	18,727	0	3,650	62,701	90,186	128,584
11	61	19,745	0	3,650	30,374	53,830	74,513
12	0	20,074	0	3,650	30,374	54,098	72,703
13	0	17,890	0	3,650	30,374	51,914	67,736
14	856	12,973	0	3,650	30,374	47,853	60,619
15	61	0	12,130	3,650	30,374	46,215	56,839
16	61	0	9,671	3,650	30,374	43,756	52,247
17	1,086	695	100,342	3,650	30,374	136,147	157,832
18	6,133	5,398	100,341	3,650	30,374	145,896	164,207
19	6,989	13,130	100,341	3,650	30,374	154,484	168,809
20	5,047	8,430	99,173	3,650	30,374	146,674	155,606
21	0	0	0	3,650	30,374	34,024	35,045
22	0	0	0	0	30,374	30,374	30,374
Total	56,667	124,236	421,998	73,468	1,025,981	810,915	1,296,118

Discount rate = 3%

**Table A15-4**  
**Operation and Maintenance Costs of the Dams and Flood Control Facilities**  
 (Unit : Rp.million)

Item	Existing dams	Existing flood control facilities	Proposed/ongoing dams	Proposed flood control, sabo watershed management
a. Total Investment Cost without discounting	1,188,627	1,300,621	1,458,522	810,915
b. Cost of Facilities requiring OM works	1,143,925	1,300,621	1,042,605	810,915
c. Other Works involving no OM (dredging work)	44,702	0	415,917	0
d. Proportion of OM cost to investment cost	1%	1%	1%	1%
e. Annual OM cost	11,439	13,006	10,426	8,109



Table A15-5  
Economic Benefits of Each Sector Estimated for Cost Allocation

Sector	1997	2020
Power	Consumer surplus of power use at Rp. 85/kWh Generation of 753 GWh by 5 dams (1) Total benefit at Rp. 64,073 million / year	Consumer surplus of power use at Rp. 94/kWh (2) Generation of 851 GWh by 8 dams (2) Total benefit at Rp. 79,906 million/year
Irrigation water supply	Net production increase of 1,018 thousand Rp./ha Irrigation area of 309 thousand ha Total benefit at Rp. 314,562 million/year	Net production increase of 1,018 thousand Rp./ha Irrigation area of 272 thousand ha Total benefit at Rp. 276,896 million/year
Domestic water supply	Consumer surplus of purified water use at Rp. 107/m <sup>3</sup> Water use at 70,319 thousand m <sup>3</sup> per year Total benefit at Rp. 7,524 million/year	Consumer surplus of purified water use at Rp. 107/m <sup>3</sup> Water use at 819 million m <sup>3</sup> /year Total benefit at Rp. 87,633 million/year
Industrial water supply	Industrial value added produced by water at Rp. 176 / m <sup>3</sup> Water use at 131 million m <sup>3</sup> per year Total benefit at Rp. 23,056 million/year	Industrial value added produced by water at Rp. 176 / m <sup>3</sup> Water use at 146 million m <sup>3</sup> /year Total benefit at Rp. 25,695 million/year
Flood control	Sutami and Selorejo dams generating benefit at Rp. 11,278 million per year	Sutami, Selorejo and Wonorejo dams generating benefit at Rp. 12,902 million per year
River maintenance flow (RMF)	Benefit per m <sup>3</sup> at Rp. 613/m <sup>3</sup> based on the cost for alternative water resources (Babadan assumed) RMF secured by dams : 4.2 m <sup>3</sup> per second Benefit at Rp. 40,046 million per year	Benefit per m <sup>3</sup> at Rp. 613/m <sup>3</sup> based on the cost for alternative water resources (Babadan assumed) RMF secured by dams : 9.2 m <sup>3</sup> per second Benefit at Rp. 87,698 million per year

(1) 753,808,530 kWh

(2) Average of economic benefits of the existing dams and planned dams for which economic benefits are estimated

Allocation Proportions Derived  
(Unit: %)

Sector	1997		2020	
	Annual Benefit (10 <sup>6</sup> Rp./yr)	(%)	Annual Benefit (10 <sup>6</sup> Rp./yr)	(%)
Power	64,073	13.91	79,906	14.00
Irrigation water	314,562	68.30	276,896	48.52
Domestic water	7,524	1.63	87,633	15.35
Industrial water	23,056	5.01	25,695	4.50
Flood control	11,278	2.45	12,902	2.26
River maintenance	40,046	8.70	87,698	15.37
Total	460,539	100.00	570,730	100.00

Table A-15.6 (1/3)  
Process of Deriving Economic Benefits for Cost Allocation

<b>1. Power supply</b>	
<b>(1997)</b>	
(1) Benefit per kWh	
Economic benefit estimated in SAPS 1985	103.5 Rp./kWh in 1985 price
Adjustment to 1997 price	2.6 times
Economic benefit in 1997	269.0 Rp./kWh in 1997 price
Payment by PLN consumers for power use	181.0 Rp./kWh in 1997 price
Average consumer surplus	85.0 Rp./kWh in 1997 price
(2) Volume of power generated	
Karangates	461,828,900 kWh in 1996
Lodoyo	38,745,740 kWh in 1996
Selorejo	22,550,790 kWh in 1996
Wlingi	154,901,400 kWh in 1996
Sengguruh	75,781,700 kWh in 1996
Total	753,808,530 kWh in 1996
(3) Economic benefit in 1997	64,073 Rp. million/year
<b>(2020)</b>	
(1) Economic benefit in 1997 (a)	64,073 Rp. million/year
(2) Economic benefit by planned dams	
Wonorejo (b)	2,695 Rp. million/year
Beng	
Gross benefit	7,649 Rp. million/year in gross
Power generated	10,400,000 kWh/year
Gross benefit per volume	735 Rp. /kWh
Same rounded	740 Rp. /kWh
Payment to PLN	184 Rp. /kWh
Consumer surplus	556 Rp. /kWh
Total economic benefit (c)	5,782 Rp. million / year
Genteng I	
Gross benefit	17,470 Rp. million/year in gross
Power generated	54,900,000 kWh/year
Gross benefit per volume	318 Rp. /kWh
Payment to PLN	184 Rp. /kWh
Consumer surplus	134 Rp. /kWh
Total economic benefit (d)	7,356 Rp. million / year
<b>Total (a + b + c + d )</b>	<b>79,906 Rp. million/year</b>
<b>2. Irrigation water supply</b>	
<b>(1997)</b>	
(1) Benefit per hectare	
Economic benefit per hectare in Delta Brantas (from SAPS)	256,000 Rp./ ha in 1985 price
Economic benefit per hectare in Widas (from SAPS)	177,000 Rp./ ha in 1985 price
Average	216,500 Rp./ ha in 1985 price
Price of rice	
1985	219 Rp./kg in Surabaya
1996	895 Rp./kg in Surabaya
Rate of increase between 1985 and 1997	4.7 times (same growth rate assumed between 1996 and 1997 )
Economic benefit in 1997	1,017,550 Rp./ ha in 1997 price
Same rounded	1,018,000 Rp./ ha in 1997 price

Table A-15.6 (2/3)  
Process of Deriving Economic Benefits for Cost Allocation

(2) Irrigation area 1997 2020	309 thousand hectare 272 thousand hectare * * projection by JICA study team
(3) Economic benefit 1997 2020	314,562 Rp. million / year 276,896 Rp. million / year
<b>3. Domestic water supply</b> Average willingness to pay for water of PDAM customers Actual payment to PDAM Average consumer surplus (a) Water use in 1997 (b) Water use in 2020 (c) Economic Benefit in 1997 (a * b) Economic Benefit in 2020 (a * c)	686 Rp / m <sup>3</sup> 579 Rp / m <sup>3</sup> 107 Rp / m <sup>3</sup> 70.3 million m <sup>3</sup> / year 819 million m <sup>3</sup> / year 7,524 Rp. million / year 87,633 Rp. million / year
<b>4. Industrial water supply</b> Proportion of expenditure on water to total production cost Same for a sugar factory in Brantas Average (contribution of water in production) : (a) Industrial value added in Brantas in 1997 (b) Industrial value added generated by water (c : a * b) Total industrial water use in 1997 (assumed same as 1996) : (d) Value of industrial water (e : c / d) Industrial water supply in 1997 by Brantas River (f) Industrial water supply in 2020 by Brantas River (g) Economic benefit in 1997 (e * f) Economic benefit in 2020 (e * g)	0.046 % (water sold by PDAM only) 0.600 % 0.323 % 11,752 Rp. billion in 1997 38 Rp. billion in 1997 215 million m <sup>3</sup> 176 Rp / m <sup>3</sup> 131 million m <sup>3</sup> / year 146 million m <sup>3</sup> / year 23,056 Rp. million / year 25,695 Rp. million / year
<b>5. Flood control</b> (1997) Selorejo dam (from SAPS) Karangkates dam (from SAPS) Total Adjustment factor to 1997 price Total benefit in 1997 price (2020) Existing dams (a) Wonorejo Flood control volume Benefit per volume Total economic benefit (b) Total benefit (a + b)	1,114 Rp. million / year ion 1985 price 3,224 Rp. million / year ion 1985 price 4,338 Rp. million / year ion 1985 price 2.6 times 11,278 Rp. million / year ion 1997 price 11,278 Rp. million / year ion 1997 price 280 m <sup>3</sup> / second 5.8 Rp. million / m <sup>3</sup> * 1,624 Rp. million / year 12,902 Rp. million / year * average of Karangkates and Selorcjo
<b>6. River Maintenauce Flow</b> (1) Economic benefit of river maintenance flow per volume *Cost of alternative water resources development saved is used as economic benefit. The development cost of Babadan dam is used. Investment cost of Babadan dam in 1997 price Annuity factor Annualized investment cost Annual water supply volume Economic benefit per volume (a)	427,454 million Rp. in 1997 price 0.1204 for 12% discount rate and 50 years 51,465 million Rp. / year 84 million m <sup>3</sup> 613 Rp / m <sup>3</sup>

Table A-15.6 (3/3)  
Process of Deriving Economic Benefits for Cost Allocation

(2) Rate of contribution of dams in supplying river maintenance flow (1997)	
Total water demand in dry season	1,280.5 million m <sup>3</sup>
Amount actually supplied	888.8 million m <sup>3</sup>
Amount of naturalized flow effectively used *	699.4 million m <sup>3</sup>
Amount supplied by Sutami/Lahor	189.4 million m <sup>3</sup>
Rate of contribution of Sutami/Lahor dams ( b )	21%
(2020)	
Total water demand in dry season	1,281.3 million m <sup>3</sup>
Amount actually supplied	1,281.3 million m <sup>3</sup>
Amount of naturalized flow effectively used *	696.0 million m <sup>3</sup>
Amount supplied by dams	585.3 million m <sup>3</sup>
Rate of contribution of Sutami/Lahor dams ( c )	46%
(3) Economic benefit of river maintenance flow (1997)	
Amount of total river maintenance flow ( d )	20 m <sup>3</sup> / second
Amount of river maintenance flow supplied by dams ( e : b * d )	4.2 m <sup>3</sup> / second
Economic benefit ( a * e )	2,575 Rp./second
	40,046 Rp./dry season (year)
(2020)	
Amount of total river maintenance flow ( f )	20 m <sup>3</sup> / second
Amount of river maintenance flow supplied by dams ( g : c * f )	9.2 m <sup>3</sup> / second
Economic benefit ( a * e )	5,639 Rp./second
	87,698 Rp./dry season (year)

Table A15-7

Allocation of Investment and OM Costs of the Existing River Facilities as of 1997

Sector	Existing dams			Existing flood control facilities		
	(%)	Investment (million Rp.)	OM (million Rp./yr)	(%)	Investment (million Rp.)	OM (million Rp./yr)
Total	100.00	1,299,857	11,439	100.0	1,463,894	13,006
Power	13.91	180,810	1,591	0.0	0	0
Irrigation	68.30	887,802	7,813	0.0	0	0
Domestic	1.63	21,188	186	0.0	0	0
Industry	5.01	65,123	573	0.0	0	0
Flood Control	2.45	31,846	280	100.0	1,463,894	13,006
River maintenance	8.70	113,088	995	0.0	0	0

Allocation of Investment and OM Costs of the Existing and Planned River Facilities as of 2020

	Existing and planned dams			Existing flood control facilities		
	(%)	Investment (million Rp.)	OM (million Rp./yr)	(%)	Investment (million Rp.)	OM (million Rp./yr)
Total	100.00	3,014,728	21,865	100.0	2,760,012	21,115
Power	14.00	422,062	3,061	0.0	0	0
Irrigation	48.52	1,462,746	10,609	0.0	0	0
Domestic	15.35	462,761	3,356	0.0	0	0
Industry	4.50	135,663	984	0.0	0	0
Flood Control	2.26	68,133	494	100.0	2,760,012	21,115
River maintenance	15.37	463,364	3,361	0.0	0	0

**Table A15-8  
Water Charges Derived by Investment and OM Cost Portions for 1997 and 2020**

**Assumptions :**

- a. Water charge is to be levied on water supply and power generation. Costs for flood control and river maintenance are to be covered by government budget.
- b. Facility life assumed: 50 years
- c. Cost recovery of 100% of investment cost
- d. Capital recovery factor: 0.0389 (3%, 50years)

Function	Investment cost allocated (10 <sup>6</sup> Rp.)	Annualized investment/OM cost (10 <sup>6</sup> Rp/yr)	Water/power supply volume (million m <sup>3</sup> )	Water charge (Rp./m <sup>3</sup> )
<b>(1997 : Existing/Investment Cost)</b>				
Power generation	180,810	7,034	753,808,530 kWh	9.3 Rp./kWh
Irrigation water supply	887,802	34,535	1,738	19.9
Domestic water supply	21,188	824	108	7.6
Industrial water supply	65,123	2,533	104	24.4
<b>(1997 : Existing/OM Cost)</b>				
Power generation	-	1,591	753,808,530 kWh	2.1 Rp./kWh
Irrigation water supply	-	7,813	1,738	4.5
Domestic water supply	-	186	108	1.7
Industrial water supply	-	573	104	5.5
<b>(2020 : Existing plus planned/Investment)</b>				
Power generation	422,062	16,418	850,808,530 kWh	19.3 Rp./kWh
Irrigation water supply	1,462,746	56,901	1,360	41.8
Domestic water supply	462,761	18,001	849	21.2
Industrial water supply	135,663	5,277	146	36.1
<b>(2020 : Existing plus planned/OM)</b>				
Power generation	-	3,061	850,808,530 kWh	3.6 Rp./kWh
Irrigation water supply	-	10,609	1,360	7.8
Domestic water supply	-	3,356	849	4.0
Industrial water supply	-	984	146	6.7

**Summary of Water Charges Derived**

(power : Rp./kWh, water : Rp./m<sup>3</sup>)

	Proposed			Present Tariff
	Investment	OM	Total	
<b>(1997)</b>				
Power generation	9	2	11	12
Irrigation water supply	20	5	25	0
Domestic water supply	8	2	10	30
Industrial water supply	24	6	30	51
(Average of water supply)	19	4	24	
<b>(2020)</b>				
Power generation	19	4	23	-
Irrigation water supply	42	8	50	-
Domestic water supply	21	4	25	-
Industrial water supply	36	7	43	-
(Average of water supply)	41	6	47	

**Table A15-9  
Realistic Water Charge Levels in 1997 and 2020**

Beneficiary	Amount (GWh for power, 106 m <sup>3</sup> for water)	Full cost recovery		Realistic Cost Recovery		Difference in PJT's revenue (Rp.10 <sup>6</sup> )	Remarks
		Present Water charge (Rp./kWh or /m <sup>3</sup> )	PJT's revenue (Rp.10 <sup>6</sup> )	Water charge (Rp./kWh or /m <sup>3</sup> )	PJT's revenue (Rp.10 <sup>6</sup> )		
PLN	754	12	8,294	12	9,048	754	Present charge level judged as affordable
PDAM	108	30	1,080	30	3,240	2,160	Present charge level judged as affordable
Industries	104	51	3,120	51	5,304	2,184	Present charge level judged as affordable
Farmers	1,738	0	43,450	5	8,690	-34,760	only OM cost to be recovered
Total	-	-	55,944	-	26,282	-29,662	

Subsidy needed

total  
cross subsidy by PLN, domestic and industries to farmers  
government subsidy required

34,760 million Rupiah  
5,098 million Rupiah  
29,662 million Rupiah

Beneficiary	Amount (GWh for power, 106 m <sup>3</sup> for water)	Full cost recovery		Realistic Cost Recovery		Difference in PJT's revenue (Rp.10 <sup>6</sup> )	Remarks
		Present Water charge (Rp./kWh or /m <sup>3</sup> )	PJT's revenue (Rp.10 <sup>6</sup> )	Water charge (Rp./kWh or /m <sup>3</sup> )	PJT's revenue (Rp.10 <sup>6</sup> )		
PLN	851	12	19,573	23	19,573	0	Rp.23 judged affordable for PLN
PDAM	849	30	21,225	30	25,470	4,245	Present charge level judged as affordable
Industries	146	51	6,278	51	7,446	1,168	Present charge level judged as affordable
Farmers	1,360	0	68,000	26	35,360	-32,640	51% level of full cost recovery charge
Total	-	-	115,076	-	87,849	-27,227	

Subsidy needed

total  
cross subsidy by domestic and industries to farmers  
government subsidy required

32,640 million Rupiah  
5,413 million Rupiah  
27,227 million Rupiah

**Table A15-10**  
**Affordability Analysis on Irrigation Water Charge**

<b>1997</b>	
<i>(Full cost recovery)</i>	
1 Irrigation water requirement	18,000 m <sup>3</sup> /ha/year *
2 Irrigation water charge	25 Rp./m <sup>3</sup> for investment cost and OM cost
3 Payment for water	450,000 Rp./ha/year
4 Annual income	1,595,000 Rp./ha/year **
5 Proportion of payment for water to income	28% of income ---> impossible to pay
<i>(OM cost recovery)</i>	
6 Irrigation water charge	5 Rp./m <sup>3</sup> for investment cost and OM cost
7 Payment for water	90,000 Rp./ha/year
8 Proportion of payment for water to income	5.6% of income ---> recommended
<b>2020</b>	
<i>(Full cost recovery)</i>	
9 Irrigation water requirement	18,000 m <sup>3</sup> /ha/year
10 Irrigation water charge	50 Rp./m <sup>3</sup> for investment cost and OM cost
11 Payment for water	900,000 Rp./ha/year
12 Productivity increase	4.7% per year until 2020 ***
13 Annual income	4,587,000 Rp./ha/year in 2020 as a result of productivity increase
14 Proportion of payment for water to income	20% of income ---> impossible to pay
<i>(Partial cost recovery)</i>	
15 Portion to be recovered	51% of Investment and OM costs
16 Irrigation water charge	26 Rp./m <sup>3</sup> for investment cost and OM cost
17 Payment for water	459,000 Rp./ha/year
18 Proportion of payment for water to income	10.0% of income ---> manageable. (within 10% of income)
<i>(OM cost recovery)</i>	
19 Irrigation water charge	8 Rp./m <sup>3</sup> for investment cost and OM cost
20 Payment for water	144,000 Rp./ha/year
21 Proportion of payment for water to income	3.1% of income ---> no problem

\* assumed based on the actual amounts of irrigation water taken at irrigation areas in Brantas

\*\* Rp. 2,138,555/ha (revenue) - Rp. 725,828/ha (production cost) in 1995 adjusted to 1997 price by multiplying 1.129

\*\*\* assumed in the "Socio-Economic Framework"



**Table A15-11**  
**PLN's Affordability for the Proposed Water Tariff in 2020**

Item	Value
a. Power generation cost by hydropower	20.13 Rupiah per kWh (1995) *
b. PLN's total power revenue	8,109,711 million Rupiah (1995)
c. PLN's energy production	
Hydro	7,529 GWh (1995)
Others	50,682 GWh (1995)
Total	58,211 GWh (1995)
Hydro	12.9 %
Others	87.1 %
Total	100.0 %
d. Power sale by hydro	1,046,153 million Rupiah (b * c)
e. Revenue per kWh by hydro	139 Rupiah/kWh (d / c)
f. Present profit structure of hydro	(Rp./kWh)
Revenue by hydro	139
Cost of hydro	20
Profit of hydro	119
Profit-revenue ratio	86%
g. Profit Structure under proposed water tariff	(Rp./kWh)
Revenue by hydro	139
Cost of hydro	20
Proposed water tariff for 2020	23
Profit of hydro	96
Profit-revenue ratio	69% profit-revenue ratio
h. Conclusion	
PLN can afford the proposed water tariff at Rp. 23 per kWh in 2020.	

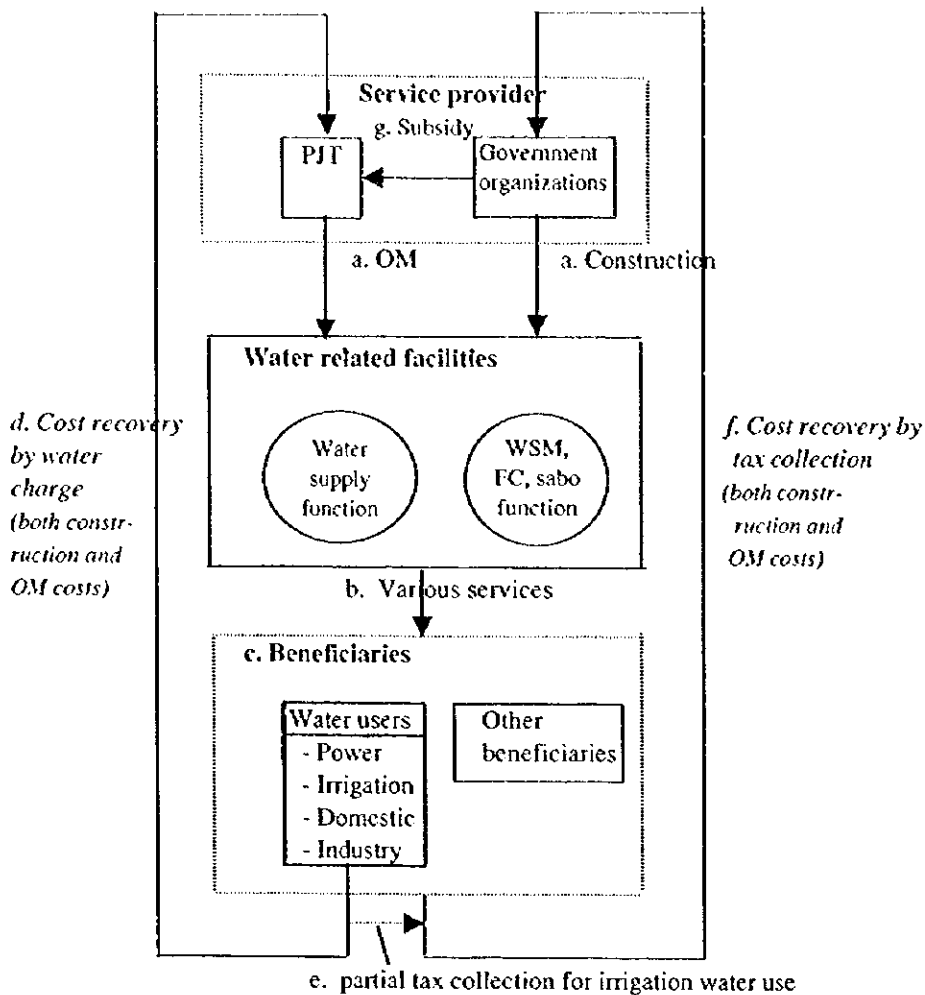
Source : PLN Statistics 1995, PLN (Persero)

Note \*

Fuel and lubricant :	1.31
Depreciation :	14.47
Other expenses :	0.89
Personnel :	3.46
Total :	20.13 Rp/kWh

**Table A15-12**  
**Operation and Maintenance Costs Allocated to Water**  
**Charge Portion and Subsidy Portion**

Item	1997	2020
<i>(Investment cost in Rp. 10<sup>6</sup>)</i>		
Water charge portion	1,151,180	2,479,761
Government subsidy portion	1,608,358	3,290,766
Total	2,759,538	5,770,527
<i>(%)</i>		
Water charge portion	41.7	43.0
Government subsidy portion	58.3	57.0
Total	100.0	100.0
<i>(OM cost in Rp. 10<sup>6</sup>)</i>		
Total	24,404	42,939
Water charge portion	10,180	18,452
Government subsidy portion	14,224	24,487



Note :

WSM : watershed management, FC : flood control, OM : operation and maintenance

- a. PJT's main work is operation and maintenance of the water-related facilities, whereas the government is engaged in construction of the facilities.
- b. Various services are provided by water-related facilities such as water supply, WSM, FC and sabo.
- c. There are beneficiaries of these water services including water users and others.
- d. For water supply function, the costs for construction and OM are recovered by collecting water charge.
- e. However, irrigation water charge is set lower than the full cost recovery level, considering the farmers' affordability. The shortfall in revenue should be met by tax collection.
- f. Tax is collected to recover costs, both construction and OM costs, for such services as WSM, FC and sabo, for which water charge can not be collected due to difficulty in specifying the beneficiaries.
- g. PJT recovers all the costs, both construction and OM costs, by water charge and government subsidy. PJT may pay the construction cost portion to the government under a PJT-government arrangement.

**Figure A15-1**  
**Concept of Water Charging and Subsidy**

**Attachment  
to  
Annex 15**

This attachment provides the data collected on the investment costs of the existing river facilities in the Brantas River Basin. The collected data are inputted into Table A.15.1. Those data appearing in Table A.15.1, but not presented in this attachment were collected from various sources and directly inputted into Table A.15.1.

**Table 1**  
**Construction Cost of Karangates Dam in Current Prices**

Year	Yen portion (million yen)				Rupiah portion (million rupiah)		
	Dam	P/S	War repatriation	Total	Dam	P/S	Total
1962	0	0	693	693	0	0	0
1963	0	0	1,039	1,039	0	0	0
1964	0	0	2,075	2,075	0	0	0
1965	0	0	693	693	0	0	0
1966	0	0	693	693	0	0	0
1967	0	0	693	693	0	0	0
1968	0	0	1,039	1,039	0	0	0
1969	1,390	218	0	1,608	737	280	1,017
1970	1,525	1,710	0	3,235	1,383	775	2,158
1971	832	1,478	0	2,310	1,722	684	2,406
1972	239	211	0	450	946	939	1,885
1973	22	0	0	22	560	580	1,140
1974	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0
1978	0	86	0	0	0	0	0
Total	4,008	3,703	6,925	14,550	5,348	3,258	8,606

Source : SAPS

**Table 2**  
**Construction Cost of Selorejo Dam in Current Prices**

Year	Yen portion (million yen)				Rupiah portion (million rupiah)		
	Dam	P/S	War repatriation	Total	Dam	P/S	Total
1964	0	0	1	1	1	0	1
1965	0	0	6	6	9	0	9
1966	0	0	51	51	78	0	78
1967	0	0	169	169	257	0	257
1968	71	0	415	486	633	0	633
1969	401	0	483	884	736	0	736
1970	495	39	114	648	174	38	212
1971	128	204	0	332	0	197	197
1972	1	210	0	211	0	203	203
1973	0	43	0	43	0	42	42
1974	0	9	0	9	0	9	9
1975	0	2	0	2	0	2	2
Total	1,096	507	1,239	2,842	1,888	491	2,379

Source : SAPS

**Table 3**  
**Construction Cost of New Lengkong**  
**Dam in Current Prices**

Year	Million Yen	Million Rupiah
1970	0	67
1971	357	160
1972	289	387
1973	260	373
1974	63	227
1975	10	0
Total	979	1,214

Source : SAPS

**Table 4**  
**Construction Cost of Wlingi Dam**  
**in Current Prices**

Year	Million Yen	Million Rupiah
1971	0	17
1972	0	17
1973	0	104
1974	0	813
1975	666	2,663
1976	2,622	6,726
1977	2,271	5,067
1978	405	1,556
1979	180	329
Total	6,144	17,292

Source : SAPS

**Table 4**  
**Dredging and Rehabilitation Costs of Wlingi Dam and Reservoir**  
**in Current Prices**

Year	Dredging		Rehabilitation		Consulting service		Total	
	Million Yen	Million Rupiah	Million Yen	Million Rupiah	Million Yen	Million Rupiah	Million Yen	Million Rupiah
1991	0	150	0	0	0	18	0	168
1992	0	2,509	0	0	0	297	0	2,806
1993	355	5,847	0	44	83	697	438	6,588
1994	203	3,341	0	1,234	48	542	251	5,117
1995	6	398	0	925	1	157	7	1,480
1996	0	4,782	0	0	0	566	0	5,348
Total	564	12,245	0	2,203	132	1,711	696	16,159

Source : Project Completion Report, The Brantas River Rehabilitation Project

**Table 5**  
**Construction Cost of Lahor Dam**  
**in Current Prices**

Year	Million Yen	Million Rupiah
1971	0	130
1972	0	200
1973	0	1,152
1974	1,193	2,084
1975	1,552	2,753
1976	387	2,629
1977	75	4,167
1978	21	0
1979	31	0
Total	3,259	13,115

Source : SAPS

**Table 6**  
**Construction Cost of Lodoyo Dam**  
**in Current Prices**

Year	Million Yen	Million Rupiah
1977	0	321
1978	3,976	2,309
1979	1,845	1,047
1980	110	1,047
1981	164	1,400
1982	594	419
1983	154	0
1984	54	0
Total	6,897	6,543

Source : SAPS

Note : including #2 (?)

**Table 6**  
**Rehabilitation Cost of Lodoyo Dam**  
**in Current Prices**

Year	Rehabilitation		Engineering service	
	Million Yen	Million Rupiah	Million Yen	Million Rupiah
1993	0	321	0	9
1994	0	2,309	0	246
1995	0	1,047	0	184
Total	0	3,677	0	439

Source : Project Completion Report, The Brantas River Rehabilitation Project

**Table 7**  
**Construction Cost of Sengguruh Dam**  
**in Current Prices by Item**

Year	Million US\$	Function	Annual disbursement (thousand US\$)									
			1982	1983	1984	1985	1986	1987	1988			
Land compensation	3,423,205.33	dam	3,423	0	0	0	0	0	0	0	0	0
Civil work	33,700,308.37	dam	3,707	2,359	3,707	3,370	5,729	9,436	5,392	9,436	5,392	5,392
Generating equipment	11,802,339.14	power	1,298	826	1,298	1,180	2,006	3,305	1,888	3,305	1,888	1,888
Metal works	3,170,526.90	dam	349	222	349	317	539	888	507	888	507	507
Transmission line	252,522.99	power	28	18	28	25	43	71	40	71	40	40
Construction equipment	10,990,089.85	all	1,209	769	1,209	1,099	1,868	3,077	1,758	3,077	1,758	1,758
Engineering service	9,271,495.87	all	1,020	649	1,020	927	1,576	2,596	1,483	2,596	1,483	1,483
Total	72,610,488.45	-	11,034	4,843	7,611	6,919	11,762	19,372	11,070	19,372	11,070	11,070
Dam only *	9,708	-	9,708	3,999	6,285	5,713	9,713	15,997	9,141	15,997	9,141	9,141

Source : Completion Report on Sengguruh Hydropower Project.

March 1989, PLN

Note : Annual disbursement values were estimated according to the following work progress.

- 1982 : 11%
- 1983 : 18%
- 1984 : 29%
- 1985 : 39%
- 1986 : 56%
- 1987 : 84%
- 1988 : 100%

\* excluding power generation and transmission line

**Construction Cost of Sengguruh Dam**  
**in Current Prices**

Year	Million US\$	Million Rupiah
1982	9,708	
1983	3,999	
1984	6,285	
1985	5,713	
1986	9,713	
1987	15,997	
1988	9,141	
Total	19,992	0

Note : Costs in various currencies are converted to US\$ using exchange rates of each year.



**Table 8**  
**Construction Cost of Menturus Rubber Dam**  
**in Current Prices**

Year	Million Yen	Million Rupiah
1991	92	2,568
1992	97	3,468
1993	31	2,984
Total	220	9,020

Source : Completion report on Menturus Rubber gates including Watudakon Syphon

**Table 9**  
**Construction Cost of Jatimlerek Rubber Gates**  
**in Current Prices**

Year	Million Yen	Million Rupiah
1991	0.9	16.5
1992	130.7	2,495.9
1993	84.1	1,606.3
Total	215.7	4,118.7

Source : Completion Report on Jatimelerek Rubber gates

**Table 10**  
**Construction Cost of Wonokromo Sluice in Current Prices**

Year	Civil work		Consulting service		Total	
	Million Yen	Million Rupiah	Million Yen	Million Rupiah	Million Yen	Million Rupiah
1991	4.8	204.4	1.1	24.2	5.9	228.6
1992	23.5	990.5	5.5	117.3	29.0	1,107.8
1993	8.9	377.3	2.1	44.7	11.0	422.0
Total	37.2	1,572.2	8.7	186.2	45.9	1,758.4

Source : Project Completion Report, The Brantas River Rehabilitation Project

**Table 11**  
**Repair Cost of Gubeng Dam**  
**in Current Prices**

Year	Repair		Engineering service	
	Million Yen	Million Rupiah	Million Yen	Million Rupiah
1991	2.3	98	0.5	12
1992	47.2	1,992	11.1	236
1993	8.7	369	2.1	44
Total	58.2	2,459	13.7	292

Source : Project Completion Report, The Brantas River Rehabilitation Project

**Table 12**  
**Construction Cost of Gunungsari Dam**  
**in Current Prices (1/2)**

Year	Thousand Yen	Thousand Rupiah
Preparatory work	234,000	592,000
Main work	1,005,000	1,137,000
Others	15,400	122,500
Administration cost	255,600	370,500
Contingency	150,000	1,282,003
Total	1,660,000	3,504,003

Source :Final Report on Consulting Engineer's Services for the Kali Surabaya River Improvement Project Main Report, March 1981

**Table 12**  
**Construction Cost of Gunungsari Dam**  
**in Current Prices (2/2)**

Year	Thousand Yen	Thousand Rupiah
1976	276,667	584,001
1977	276,667	584,001
1978	276,667	584,001
1979	276,667	584,001
1980	276,667	584,001
1981	276,667	584,001
Total	1,660,000	3,504,003

Source :Final Report on Consulting Engineer's Services for the Kali Surabaya River Improvement Project Main Report, March 1981

Note : Annual disbursement was estimated assuming equal amounts in each year.

**Table 13**  
**Construction Cost of Mlirip Gate**  
**in Current Prices (1/2)**

Year	Thousand Yen	Thousand Rupiah
Preparatory work	18,000	20,600
Main work	65,110	21,814
Others	0	0
Administration cost	16,890	8,586
Contingency	10,000	37,000
Total	110,000	88,000

Source :Final Report on Consulting Engineer's Services for the  
 Kali Surabaya River Improvement Project Main Report, March 1981

**Table 13**  
**Construction Cost of Mlirip Gate**  
**in Current Prices (2/2)**

Year	Thousand Yen	Thousand Rupiah
1977	18,333	14,667
1978	73,333	58,667
1979	18,333	14,667
Total	110,000	88,000

Source :Final Report on Consulting Engineer's Services for the Kali Surabaya  
 River Improvement Project Main Report, March 1981

Note : Annual disbursement was estimated assuming a cost allocation by  
 16.6% in 1977, 66.8% in 1978 and 16.6% in 1979.

**Table 14**  
**Construction Cost of Jagir dam**  
**in Current Prices (1/2)**

Year	Thousand Yen	Thousand Rupiah
Preparatory work	0	0
Main work	25,515	9,500
Others	0	0
Administration cost	5,185	2,000
Contingency	3,300	8,500
Total	34,000	20,000

Source :Final Report on Consulting Engineer's Services for the Kali Surabaya River Improvement Project Main Report, March 1981

**Table 14**  
**Construction Cost of Jagir Gate**  
**in Current Prices (2/2)**

Year	Thousand Yen	Thousand Rupiah
1977	17,000	10,000
1978	17,000	10,000
Total	34,000	20,000

Source :Final Report on Consulting Engineer's Services for the Kali Surabaya River Improvement Project Main Report, March 1981

Note : Annual disbursement was estimated assuming a cost allocation by 50% each in 1977 and 1978.

**Table 15**  
**Construction Cost of Tulungagung Drainage Project**  
**in Current Prices (1/2)**

Total construction cost :  
 Local currency : 17,435,586,460 Rupiah  
 Foreign currency : 38,712,796 US\$

Construction period :  
 Start : 1981  
 Completion : 1986

**Table 15**  
**Construction Cost of Tulungagung Drainage Project**  
**in Current Prices (2/2)**

Year	Thousand US\$	Million Rupiah
1981	6,452	2,906
1982	6,452	2,906
1983	6,452	2,906
1984	6,452	2,906
1985	6,452	2,906
1986	6,452	2,906
Total	38,713	17,436

Source : "Tulungagung Drainage" (Ministry of Public Works booklet)

Note : Annual disbursement was estimated assuming equal amounts in each year.

**Table 16**  
**Cost of Porong River Rehabilitation**  
**in Current Prices**

Year	Million Yen	Million Rupiah
1991	590	1,007
1992	861	1,470
1993	96	163
1994	47	82
Total	1,594	2,722

Source : Porong River Rehabilitation Project  
 Completion Report, March 1994

**Table 17**  
**Cost of Brantas Middle Reaches River Improvement**  
**in Current Prices**

Year	Million Yen	Million Rupiah
1985/86	0	3,843
1986/87	304	1,075
1987/88	789	2,864
1988/89	779	596
1989/90	1,267	3,467
1990/91	1,711	2,763
1991/92	615	1,394
1992/93	259	2,371
1993/94	218	890
Total	5,942	19,263

Source : Brantas Middle Reaches River Improvement Project (II)  
 Completion Report on River Improvement Works, December 1993

**Table 18**  
**Cost of Kedurus River Improvement**  
**in Current Prices**

Year	Million Yen	Million Rupiah
1992	230	2,541
1993	209	11,947
1994	358	23,123
1995	202	13,979
1996	13	139
Total	1,012	51,729

Source : Completion Report on the construction Works  
 of the kedurus River Improvement Project, October 1996

**Table 19**  
**Cost of Widas Flood Control Project**  
**in Current Prices**

Year	Thousand US\$	Million Rupiah
1986/87	0	804
1987/88	456	969
1988/89	2,205	1,486
1989/90	2,346	4,132
1990/91	2,637	1,805
1991/92	2,361	291
Total	10,005	9,487

Source : Brantas Lower Reach Project, Final Report for Project  
 Completion Report of Widas Flood Control Project,  
 September 1992

**Table 20**  
**Cost of Flood Forecast and Warning System**  
**in Current Prices**

Year	Million Yen	Million Rupiah
1989	415	1,493
1990	507	1,816
Total	922	3,309

Source : Brantas Middle reaches River Improvement Project (II),  
 Completion Report on Flood Forecasting and Warning System,  
 December 1990

**Table 21**  
**Cost of Widas Irrigation Project**  
**in Current Prices**

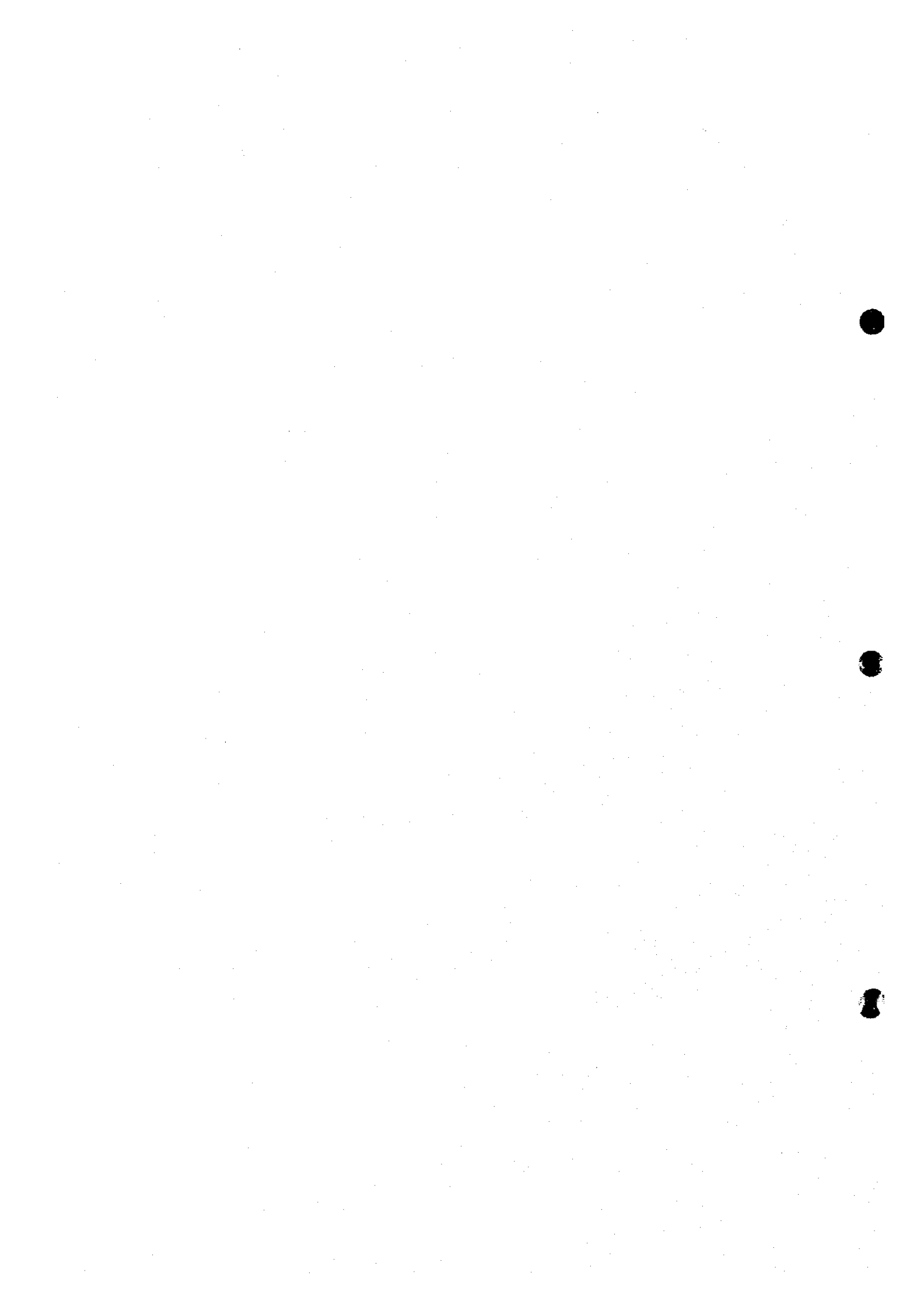
Year	Million Yen	Million Rupiah
1977/78	0	249
1978/79	1,601	562
1979/80	93	1,352
1980/81	77	3,328
1981/82	0	6,302
Total	1,771	11,793

Source : Completion Report on the Widas Irrigation Project  
 for Dam and Appurtenant Structures, March 1982

**ANNEX - 16**

**ECONOMIC EVALUATION**





# ANNEX - 16 ECONOMIC EVALUATION

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## **1 Objective and Target Area of Economic Evaluation**

An economic evaluation is carried out for a set of measures proposed as the components of the water resources management plan. The objective of an economic evaluation is to analyze the magnitude of economic feasibility of the measures proposed. The following measures are analyzed by quantitative method deriving such indices as IRR, B/C ratio and cost comparison and in a qualitative manner for the measures for which monetary valuation of benefit is difficult. Table A16-1 presents a summary of the results of the economic evaluation.

### **Water supply :**

- Dams (Beng, Kedungwarak, Genteng I)
- Dredging work and sediment diversion channel
- Water saving measures (irrigation canal lining and industrial water saving)

### **Flood mitigation :**

- Widas River
- Lodoyo diversion tunnel
- Improvement of FFWS

### **Watershed management and sabo**

### **Water quality :**

- Monitoring system
- Wastewater treatment systems

### **River environment**

### **Others :**

- Inter-agency information system
- Human resource development

## **2 Water Supply**

### **2.1 Dams**

Economic feasibility of the three dams proposed is analyzed by deriving economic internal rate of returns (EIRR) for each project based on the following assumptions.

- Investment cost is divided into local and foreign currency portions and a standard conversion factor at 0.8 is applied to the local currency portion.
- The amounts of water for domestic and industrial uses are allocated according to the demand forecast in 2020 considering saving as follows.

Domestic water : 86 %

Industrial water : 14 %

Based on these proportions, the following amounts are assumed for the three dam projects.

**Amount of Water for Domestic and Industrial Uses**

(Unit: 10<sup>6</sup> m<sup>3</sup>)

Project	Domestic water	Industrial Water
Beng	126	21
Kedungwarak	46	8
Genteng I	60	10

- Agriculture production foregone is calculated as the cost of land. Paddy is assumed as the crop. The value added of paddy production is assumed to be Rp.1,595 thousand per hectare. The following values of the production foregone are derived.

**Production Foregone in Inundation Areas**

Project	Inundation Area (ha)	Production foregone (Rp.10 <sup>6</sup> /year)
Beng	650	1,037
Kedungwarak	330	526
Genteng I	40	64

- Economic benefit of domestic water supply is derived based on Rp. 790 / m<sup>3</sup>, which is the average willingness-to-pay of PDAM and non-PDAM customers surveyed by the JICA study team. Table A16-2 shows the result of the survey. Since this value is for purified water reaching customers, the portion for raw water is derived based on the proportions of costs of dams for domestic water portion and water purification and distribution systems. The costs for water purification and distribution systems is estimated based on Rp. 4,100 per m<sup>3</sup> for investment cost and 3% of the investment cost for OM cost. Rp. 4,100 per m<sup>3</sup> is derived by processing the data of the integrated urban development projects in Surabaya and East Java financed by the World Bank. The following proportions and raw water benefits are derived.

**Raw Water Benefit for Domestic Use**

Dam	Proportion (%)		Raw water benefit (Rp/m <sup>3</sup> )
	Raw water supply	Purification/distribution	
Beng	27	73	216
Kedungwarak	34	66	265
Genteng I	41	59	326

Based on the values above, the following annual benefits by domestic water supply are derived.

	(Rp. million/year)
- Beng :	27,216
- Kedungwrak :	12,190
- Genteng I :	19,560

- Economic benefit of industrial water supply is derived based on Rp. 176 / m<sup>3</sup>, obtained from the contribution of industrial water supply to the industrial value added assumed at 0.32%, based on the East Java Input-Output table and interview surveys with factories. This value is derived by the following sequence.

a. Proportion of expenditure on water in total production cost in East Java :	0.046 % *
b. Same of a sugar factory in Brantas :	0.600 %
c. Average (contribution of water) :	0.323 %
d. Industrial value added in Brantas in 1997 :	Rp. 11,752 billion
e. Industrial value added produced by water (d. times c) :	Rp. 38.0 billion
f. Total industrial water use in 1997 (assumed same as 1996) :	215 million m <sup>3</sup>
g. Value of industrial water (e / f) :	Rp. 176 per m <sup>3</sup>

\* Water sold by PDAM only

Based on this value and amounts of water for industrial use, the following annual benefits are derived.

	(Rp. million/year)
- Beng :	3,696
- Kedungwarak :	1,408
- Genteng I :	1,760

- Power supply benefit is derived based on a concept of alternative thermal power generation as follows. The alternative thermal types are assumed taking into consideration the capacity and possibility of peak power generation. Table A16-3 shows the process of deriving the power supply benefits below.

Beng dam : diesel assumed, Rp. 7,649 million per year

Genteng I dam : gas turbine assumed, Rp. 17,470 million per year

EIRRs are derived as follows. Table A16-4 presents flows of costs and economic benefits for the three dam projects.

- Beng dam :	18.6 %
- Kedungwarak dam :	10.0 %
- Genteng I dam :	13.3 %

## 2.2 Water Saving

### Irrigation canal lining

The amount of irrigation water to be saved by canal lining is 123.2 million m<sup>3</sup> per year in 2020. EIRR is derived with the assumption that the saved water be used for irrigation, domestic and industrial uses in the proportions projected for 2020 considering saving. The following table summarizes the amount of water, benefit per volume and total benefit for respective use. Benefits per volume of water for domestic and irrigation uses are derived as shown in Table A16-5. Industrial water supply benefit per m<sup>3</sup> is as explained for the dam projects.

#### **Benefit of Irrigation Canal Lining**

Water use	Amount of water		Benefit per volume (Rp./m <sup>3</sup> )	Total benefit (Rp.10 <sup>6</sup> /yr)
	(%)	volume (10 <sup>6</sup> m <sup>3</sup> /yr)		
Irrigation	54.4	66.0	136	8,976
Domestic	39.4	48.5	356	17,266
Industrial	6.2	7.6	176	1,338
Total	100.0	123.2	-	27,920

For the calculation of an EIRR, investment, planned to be disbursed over a ten-year period, is assumed to take place in a year. An EIRR is derived at 19.3 %.

### Industrial water saving

The present study proposes promotion of industrial water saving. The water demand forecast assumes the target of 48% reduction in industrial water demand by saving. The cost for industrial water saving is to be borne by each industry with a set of government support measures in technical and financial aspects. The cost needed for achieving this saving target is difficult to estimate with little information on cost in a standardized form, reflecting the fact that there is a wide variety in pattern of industrial water use, applied technology and cost. To show a magnitude of cost needed, a previous JICA study in Thailand was referred to. (" Final Report for the Study on the Effective Use of Industrial Water in the Kingdom of Thailand ", JICA, March 1989). The costs analyzed here, therefore, is an indicative one.

The average cost for industrial water saving was estimated to be 4.7 Baht per m<sup>3</sup> including reclamation of industrial water (reuse of industrial effluent after treatment) and 1.4 Baht per m<sup>3</sup> excluding the reclaimed water in 1989. These are annualized costs per m<sup>3</sup> estimated with a 15-year facility life and 12% as discount rate, for a suburban area of Bangkok with 59 factories surveyed. In the present analysis, the latter value 1.4 Baht per m<sup>3</sup> is used on the basis that the cost for reclaiming industrial effluent is included in the cost estimated for industrial effluent treatment presented in Chapter V.3 " Water Quality ". This can be divided into investment cost (72%,) and OM cost (28%). Converting this value to Indonesia in 1997, total of Rp.200 Rupiah per m<sup>3</sup> divided into Rp. 144 per m<sup>3</sup> for investment and Rp.56 per m<sup>3</sup> for operation and maintenance derived. To make a comparison with dam costs, present values of investment and OM costs for 50 years were derived. The following compares the costs

for industrial water saving with those of water resources development. Table A16-7 shows a detail.

### Cost per Volume for Industrial Water Saving and Dams

(Unit : Rp./m<sup>3</sup>)

Project	Investment	OM	Total
Saving	1,199	521	1,720
Beng	1,651	249	1,900
Kedungwarak	2,664	764	3,428
Genteng I	3,837	17	3,854

- a. Present values of construction and OM costs per m<sup>3</sup>  
(50 years, 12%)  
b. Power portion of Beng and Genteng I excluded  
c. 1% of investment cost as OM cost

The cost needed for industrial water saving is lower than the costs for water resources development. Industrial water saving, therefore, should be promoted in parallel with water resources development.

### 2.3 Dredging Works and Sediment Diversion Channel

The present study proposes dredging works for the Wlingi, Lodoyo, and Sengguruh dams. Dredging works at these dams would result in maintaining the present functions of these dams in water supply and power generation. Extension of the sediment bypass channel would help reducing the sediment discharge into the Wlingi and Lodoyo reservoirs, thus contributing to maintaining the existing functions of these dams.

### 3 Flood Protection

The proposed flood mitigation projects include those for the Widas River Basin and the Lodoyo Diversion Tunnel. Flood protection works in the Widas River Basin were included in the 1985 master plan. So far about 66% of the proposed works in terms of construction cost is completed. The project proposed in the present study corresponds to the remaining 34% portion. The Lodoyo Diversion Tunnel is also a project proposed in the 1985 Widas master plan, but not committed yet. This project is also included in the present study. The 1985 master plan calculated the following EIRRs for the two projects.

Widas River flood control :	14.1 %
Lodoyo flood diversion tunnel :	11.9 -14.5 % for a number of cases

Since no major changes in socio-economic conditions are observed in the project areas since the time of the 1985 master plan, these results in economic analysis are considered still valid.

The improvement of the existing Flood Forecasting and Warning System (FFWS) aims at a better low flow management. With the improvement completed, low flow conditions can be monitored more accurately, thus providing more reliable data for water allocation during dry



season. Coordination and decisions among parties concerned can be made quickly and based on the actual conditions of river flow.

#### 4 Watershed Management and Sabo

##### Watershed Management

Watershed management by reforestation and terracing would contribute to reducing sediment discharge into the Brantas River. Economic benefit of reduced sediment discharge is derived in terms of reduction in river excavation cost to be incurred under the without-project condition as follows.

- a. Reduction in river excavation volume : 6.92 million m<sup>3</sup> per year
- b. Wash load : 56 %
- c. Excavation cost : Rp. 10,793 per m<sup>3</sup>
- d. Economic benefit (a.\*(1-b)\*c): Rp. 32,863 million per year
- e. Total investment cost : Rp.162,294 million

An EIRR is derived at 23.7 %. Table A16-8 show the costs and benefits of the project. The investment is assumed to take place in one year in the table for the purpose of EIRR derivation, though disbursement is planned over a 20-year period between 2001 and 2020.

##### Sabo

Economic benefits of the proposed sabo works are measured by the saving of river excavation cost.

- (Lesti Basin)
  - Total volume of sediment volume to discharge into river under no-project condition : 15.09 million m<sup>3</sup>
  - Excavation cost : Rp. 10,793 per m<sup>3</sup>
  - Total cost saved : Rp.162,866 million
- (Kelud Basin)
  - Total volume of sediment volume to discharge into river under no-project condition : 52.0 million m<sup>3</sup>
  - Excavation cost : Rp. 10,793 per m<sup>3</sup>
  - Total cost saved : Rp. 561,236 million

Since the costs of these projects occur over 15-year and 7-year periods, corresponding benefits are allocated to each year in proportion to the construction costs. Costs and benefits thus estimated are compared by benefit-cost ratio and net present value (NPV) applying 12% discount rate as summarized below. B/C ratio and NPV are applied in stead of an EIRR, since costs and benefits will occur in parallel. Table A16-9 shows costs and benefits of the two sabo projects.

	BC ratio	NPV (million Rp.)
Lesti	1.80	51,271
Kelud	1.46	69,522

## Experimental research

Watershed management experimental research aims at clarifying co-relations between watershed management activities such as reforestation and terracing and effects in sediment discharge and flood discharge reflecting the conditions in the Brantas river Basin. The result of experiments would provide basic data that could be used as the basis for the planning and implementation of watershed management works suited to the Brantas River Basin.

## **5 Water Quality**

### Water Quality Monitoring

The study proposes the enhancement of the existing PJT's water quality monitoring system. A better monitoring system is an important component of the water quality management system that generates benefit indirectly. With a monitoring system covering a larger area and clarifying the water quality condition more accurately, the effectiveness of counter measures and pollution control plan will be significantly improved. The improvement in water quality, thus, will be achieved through various direct measures such as waste water treatment facilities and river maintenance flow on the basis of a better monitoring system.

### Waste water treatment

Treatment of domestic waste water and industrial effluent as well as agriculture waste water is an indispensable measure in the Brantas River Basin where the remaining room for water resources development is limited. By maintaining the water quality of the Brantas River at an appropriate level, less than 6 mg per liter on average by 2020, various benefits are envisaged such as reduction in water purification cost, preserving natural species and maintaining existence and recreational value of Brantas.

## **6 River Environment**

The present study proposes the following measures.

- Biological diversity monitoring and laboratory :	Rp. 480 million
- Creation of wetland and fish ponds :	Rp. 44 million
- Recreation development program :	Rp. 648 million
Total :	Rp. 1,172 million

An economic analysis of river environment preservation is carried out applying simplified travel cost approach. By this method, economic benefit is measured by the cost visitors spend for visiting and spending their time at the place. Costs include transportation cost, time cost, admission fee etc. The idea is that visitors' actual expense reflects the minimum level of satisfaction they feel by visiting the place. In the present analysis, travel cost for the Selorejo Reservoir and Sutmai Reservoir are estimated as proxy to the recreational development proposed in the study. Table A16-10 summarizes the result of estimating economic benefit of Selorejo and Sutmai in the recreational aspect. It is estimated that economic benefits of Selorejo and Sutmai for recreational purpose are Rp. 979 million and Rp. 715 million per year respectively. Assuming that the same level of economic benefit realized as Sutmai, which

would be likely, the proposed environmental preservation program would give an BIRR at 60%, showing extremely high economic viability. Table A16-11 shows costs and benefits of the environmental preservation program.

## 7 Other Measures

### Inter-agency Information System

The idea of an inter-agency information system is to create an environment in which various water-related organizations, both public and private, can share the information on water resources and related issues through linking by a computer system. By being able to collect needed information quickly, beneficiary organizations will enjoy making timely and right decisions in addition to saving in various administrative costs for communication and data processing.

### Human Resource Development

Various measures for water resources management of Brantas proposed in the present study could be implemented effectively and efficiently with qualified manpower taking responsibility in the proposed works. The proposed human resource development program in technical and managerial aspects would be a prerequisite for PJT proposed to merge with PKB and PGKS in 2003 and transfer to a Persero in the year 2005.

Table A16-1 Summary of Results of Economic Analysis

Measure	Indices	Benefit
<b>Dams</b>		
Beng dam	IRR : 18.6 %	Domestic and industrial water supply, power generation
Genteng II	IRR : 13.3 %	Domestic and industrial water supply, power generation
Kedungwarak	IRR : 10.0 %	Domestic and industrial water supply
Dredging of Wlingi, Lodoyo, Sengguruh		Maintain the existing functions
Sediment diversion channel	-	Sediment reduction in Wlingi and Lodoyo dams
<b>Water saving</b>		
Irrigation canal lining	IRR : 19.3 %	Saving in irrigation water demand and partial conversion to industrial/domestic uses
Industrial water saving	-	Most economical measure for limiting demand (creating water)
<b>Flood Control</b>		
Widas	IRR : 14.1 %	Flood damage mitigation
Lodoyo diversion tunnel	IRR : 14.5 %	Flood damage mitigation, reduction in sediment in Wlingi/Lodoyo reservoirs
Improvement of FFWS	-	Better low flow management
<b>Water shed management</b>		
Reforestation and terracing	IRR : 23.7 %	Reduction in sediment discharge into river
Experimental research	-	Clarification of reforestation effects
<b>Sabo</b>		
Mt. Kelud	B/C : 1.46	Reduction in sediment discharge into river
Lesti/Brantas	B/C : 1.80	Reduction in sediment discharge into river
Water quality monitoring	-	Prerequisite for water quality improvement
River environment	IRR : 59.6 %	Creation of recreation opportunities
Inter-agency Information system	-	Improved efficiency in data collection and decision making
Human resource development	-	Prerequisite for an appropriate water resources management

\* B/C ratio is derived in stead of FIRR, since costs and benefits appear in parallel. Discount rate of 12% is applied.

Table A16-2(1/2) Expenditure on Water and Willingness-to-Pay for Domestic Water (surveyed in Surabaya)

No.	Information collected by interview survey							Data processed				
	Number of household member	Amount of water used (liter/day)	Source of water 1)	Monthly income (Rp.)	Expenditure for water used (Rp./month)			WTP for water 2)	Water use per capita (led)	Payment for water as % to income 5) = 4)/1)	Average cost of water purchased (Rp./m <sup>3</sup> )	WTP for water in value (Rp./m <sup>3</sup> )
					PDAM 2)	Others 3)	Total 4) = 2)+3)					
1	7	240	b&d	250,000	0	27,000	27,000	-	34	10.8	3,750	-
2	5	300	b&d	300,000	0	3,000	3,000	-	60	1.0	333	-
3	3	250	b&d	300,000	0	3,000	3,000	-	83	1.0	400	-
4	9	560	b&d	300,000	0	24,000	24,000	-	62	8.0	1,429	-
5	3	800	a&d	250,000	6,000	11,000	17,000	100	267	6.8	708	1,417
6	4	4,320	a&d	250,000	5,000	12,000	17,000	100	1,080	6.8	131	262
7	3	720	a&d	300,000	5,000	10,000	15,000	100	240	5.0	694	1,389
8	3	660	a&d	500,000	5,000	10,000	15,000	100	220	3.0	758	1,515
9	4	870	a&d	300,000	7,000	13,500	20,500	50	218	6.8	785	1,178
10	3	120	d	250,000	0	13,500	13,500	-	40	5.4	3,750	-
11	6	1,420	a&d	400,000	14,000	20,000	34,000	-	237	8.5	798	-
12	2	240	d	150,000	0	10,000	10,000	-	120	6.7	1,389	-
13	5	320	d	200,000	0	12,000	12,000	-	64	6.0	1,250	-
14	6	210	d	120,000	0	18,000	18,000	-	35	15.0	2,857	-
15	7	640	d	450,000	0	24,000	24,000	-	91	5.3	1,250	-
16	3	640	d	300,000	0	2,400	2,400	-	213	0.8	125	-
17	5	1,000	a	500,000	14,000	0	14,000	50	200	2.8	467	700
18	5	1,240	a&d	500,000	13,000	10,000	23,000	50	248	4.6	618	927
19	4	500	a	300,000	5,000	0	5,000	100	125	1.7	333	667
20	5	2,600	a	300,000	14,000	0	14,000	100	520	4.7	179	359
21	5	1,000	b&f	300,000	0	13,000	13,000	20	200	4.3	433	520
22	4	1,000	b&f	300,000	0	12,000	12,000	10	250	4.0	400	440
23	4	1,200	b&f	400,000	0	13,000	13,000	10	300	3.3	361	397
24	4	1,000	a	300,000	12,500	0	12,500	20	250	4.2	417	500
25	6	1,000	b&f	650,000	0	12,000	12,000	20	167	1.8	400	480
26	4	100	f	300,000	0	12,000	12,000	-	25	4.0	4,000	-
27	5	1,000	b&f	300,000	0	12,000	12,000	-	200	4.0	400	-
28	6	1,500	f	450,000	0	14,000	14,000	-	250	3.1	311	-
29	5	1,200	a&b	300,000	13,000	0	13,000	-	240	4.3	361	-
30	5	1,000	b&f	350,000	0	25,000	25,000	10	200	7.1	833	917
31	6	420	d&f	400,000	0	70,000	70,000	-	70	17.5	5,556	-
32	4	450	d&f	300,000	0	55,000	55,000	-	113	18.3	4,074	-
33	5	350	b&f	400,000	0	45,000	45,000	-	70	11.3	4,286	-
34	4	200	b&f	250,000	0	40,000	40,000	-	50	16.0	6,667	-
35	5	250	b&f	300,000	0	50,000	50,000	-	50	16.7	6,667	-
36	3	350	d&f	350,000	0	37,500	37,500	-	117	10.7	3,571	-
37	6	450	d&f	250,000	0	70,000	70,000	-	75	28.0	5,185	-
38	6	500	b&f	400,000	0	65,000	65,000	-	83	16.3	4,333	-
39	4	320	b&f	450,000	0	45,000	45,000	-	80	10.0	4,688	-
40	7	500	b,d&f	500,000	0	80,000	80,000	-	71	16.0	5,333	-
41	5	1,700	a&d	550,000	25,000	7,000	32,000	30	340	5.8	627	816
42	5	2,100	a&d	900,000	30,000	7,000	37,000	50	420	4.1	587	881
43	6	2,200	a&b	550,000	40,000	0	40,000	-	367	7.3	606	-
44	6	2,300	a	750,000	35,000	0	35,000	-	383	4.7	507	-
45	4	1,800	a	400,000	27,000	0	27,000	10	450	6.8	500	550
46	4	1,720	a&d	600,000	25,000	8,000	33,000	20	430	5.5	640	767
47	6	3,000	a&b	1,100,000	45,000	0	45,000	50	500	4.1	500	750
48	4	1,420	a&d	450,000	20,000	8,000	28,000	50	355	6.2	657	986
49	5	1,500	a&d	500,000	22,000	7,000	29,000	50	300	5.8	644	967
50	2	1,300	a	400,000	20,000	0	20,000	20	650	5.0	513	615
51	2	1,300	a&b	500,000	28,000	0	28,000	20	650	5.6	718	862
52	4	2,200	a&d	450,000	32,000	7,000	39,000	10	550	8.7	591	650
53	5	2,300	a	600,000	35,000	0	35,000	20	460	5.8	507	609

Note: 1) Source of water: a. PDAM, b. well, c. river, d. vendor, e. rain, f. public outlet

2) WTP: Willingness-to-pay for water measured in % increase allowed above the present tariff level

Table A16-2(2/2) Expenditure on Water and Willingness-to-Pay for Domestic Water (surveyed in Surabaya)

No.	Information collected by interview survey							Data processed					
	Number of household member	Amount of water used (liter/day)	Source of water	Monthly income (Rp.)	for water used (Rp./month)			WTP for water * (%)	Water use per capita (l/cd)	Payment for water as % to income $\text{⑤} = \text{④}/\text{①}$	Average cost of water purchased (Rp./m <sup>3</sup> )	WTP for water in value (Rp./m <sup>3</sup> )	
					PDAM	Others	Total						
				①	②	③	④ = ②+③						
54	4	2,000	a	650,000	30,000	0	30,000	-	500	4.6	500	-	
55	4	1,900	a,b&d	600,000	27,000	8,000	35,000	-	475	5.8	614	-	
56	3	590	a&d	500,000	16,000	10,000	26,000	50	197	5.2	1,469	2,203	
57	6	560	a	500,000	18,000	0	18,000	-	93	3.6	1,071	-	
58	5	1,500	a	750,000	37,000	0	37,000	20	300	4.9	822	987	
59	3	350	a	450,000	13,000	0	13,000	20	117	2.9	1,238	1,486	
60	5	2,300	a	800,000	35,000	0	35,000	50	460	4.4	507	761	
61	4	1,000	a	600,000	17,500	0	17,500	20	250	2.9	583	700	
62	4	1,200	a	1,200,000	25,000	0	25,000	50	300	2.1	694	1,042	
63	7	2,000	a	350,000	38,000	0	38,000	20	286	10.9	633	760	
64	6	1,300	a	400,000	25,000	0	25,000	-	217	6.3	641	-	
65	4	1,500	a&d	600,000	18,500	8,000	26,500	-	375	4.4	589	-	
66	5	1,330	a&d	850,000	19,500	12,000	31,500	10	266	3.7	789	868	
67	4	1,300	a&d	850,000	17,000	10,000	27,000	100	325	3.2	692	1,385	
68	3	1,000	a	800,000	22,000	0	22,000	20	333	2.8	733	880	
69	5	1,380	a&d	450,000	20,000	12,000	32,000	100	276	7.1	773	1,546	
70	7	1,720	a&d	750,000	24,000	14,000	38,000	-	246	5.1	736	-	
71	9	1,960	a	2,000,000	40,000	0	40,000	-	218	2.0	680	-	
72	6	2,200	a	1,500,000	50,000	0	50,000	-	367	3.3	758	-	
73	6	2,000	a	2,000,000	40,000	0	40,000	20	333	2.0	667	800	
74	5	1,300	a	1,200,000	20,000	0	20,000	10	260	1.7	513	564	
75	3	1,660	a	1,400,000	28,000	0	28,000	10	553	2.0	562	618	
76	4	1,500	a	1,500,000	25,000	0	25,000	10	375	1.7	556	611	
77	4	1,760	a	1,500,000	32,000	0	32,000	10	440	2.1	606	657	
78	5	2,000	a	2,000,000	40,000	0	40,000	10	400	2.0	667	733	
79	3	1,300	a	1,500,000	20,000	0	20,000	10	433	1.3	513	564	
80	4	1,700	a	1,800,000	30,000	0	30,000	20	425	1.7	588	706	
81	5	2,100	a	2,000,000	45,000	0	45,000	-	420	2.3	714	-	
82	4	1,530	a	1,500,000	25,000	0	25,000	10	383	1.7	545	599	
83	3	1,530	a	1,500,000	25,000	0	25,000	20	510	1.7	545	654	
84	4	1,800	a	2,000,000	35,000	0	35,000	10	450	1.8	648	713	
85	5	1,900	a	1,700,000	40,000	0	40,000	10	380	2.4	702	772	
86	4	1,830	a	1,000,000	35,000	0	35,000	10	458	3.5	638	701	
87	3	1,500	a	1,200,000	24,000	0	24,000	-	500	2.0	533	-	
88	4	1,530	a	1,000,000	25,000	0	25,000	10	383	2.5	545	599	
89	3	1,300	a	1,700,000	20,000	0	20,000	20	433	1.2	513	615	
90	5	2,000	a	2,000,000	40,000	0	40,000	20	400	2.0	667	800	
91	4	1,900	a	1,700,000	38,000	0	38,000	10	475	2.2	667	733	
92	4	1,530	a	1,500,000	25,000	0	25,000	10	383	1.7	545	599	
93	4	1,830	a	2,000,000	35,000	0	35,000	10	458	1.8	638	701	
94	5	1,830	a	2,000,000	35,000	0	35,000	10	366	1.8	638	701	
95	3	1,430	a	1,800,000	23,000	0	23,000	20	477	1.3	536	643	
96	5	1,530	a	2,000,000	25,000	0	25,000	20	306	1.3	545	654	
97	3	1,300	a	1,000,000	2,000	0	2,000	10	433	0.2	51	56	
98	4	1,800	a	1,500,000	33,000	0	33,000	10	450	2.2	611	672	
99	4	1,830	a	2,000,000	35,000	0	35,000	10	458	1.8	638	701	
100	4	1,600	a	1,500,000	27,000	0	27,000	20	400	1.8	563	675	
Total	456	130,190		81,320,000			2,828,900		286	3.5	724	787	
Note : 1) Source of water : a. PDAM, b. well, c. river, d. vendor, e. ASH rain, f. public outlet										Average of those answering WTP :		601	787

2) WTP : Willingness to pay for water measured in % increase allowed above the present tariff level

Source: compiled by the JICA study team

**Table A16-3(1/2) Economic Benefit by Hydropower Supply (Beng Dam)**

<b>(Conditions)</b>	
Basic conditions :	
Installed capacity of planned facility	12.0 MW
Planned amount of power generation	10,400,000 kWh per year
Conditions for benefit estimate :	
Type of alternative thermal power generation :	diesel
Facility life :	20 years
Installed capacity assumed for cost assumptions :	20.0 MW
Construction cost	1,000 \$/kW
Fixed OM cost	3.0% annually of investment cost
Adjustment factor (kW value)	1.1615
Fuel cost	80.79 mills/kWh
Variable OM cost	2.8 mills/kWh
Adjustment factor (kWh value)	0.9863
Other conditions :	
Discount rate :	12%
Annuity factor	0.1339
Exchange rate :	2,446.6 Rp/\$
<b>(Result)</b>	
<b>(kW value)</b>	
Construction cost	12.0 million \$ in every 20 years 29,359 million Rp. in every 20 years
Annualized construction cost	3,899 million Rp. per year for 50-year period (1)
Fixed OM cost	881 million Rp per year
kW value benefit before adjustment	4,780 million Rp per year
kW value benefit after adjustment	5,552 million Rp per year
<b>(kWh value)</b>	
Fuel cost	840 thousand \$ per year 2,056 million Rp. per year
Variable OM cost	29 thousand \$ per year 71 million Rp. per year
kWh value benefit before adjustment	2,127 million Rp. per year
kWh value benefit after adjustment	2,098 million Rp. per year
Total economic benefit	7,649 million Rp per year

Note :

(1) Derived by assuming the replacement of facilities every 20 years within 50-year period

**Table A16-3(2/2) Economic Benefit by Hydropower Supply (Genteng I Dam)**

<b>(Conditions)</b>	
Basic conditions :	
Installed capacity of planned facility	18.6 MW
Planned amount of power generation	54,900,000 kWh per year
Conditions for benefit estimate :	
Type of alternative thermal power generation :	Gas turbine
Facility life :	20 years
Installed capacity assumed for cost assumptions :	30.0 MW
Construction cost	600 \$/kW
Fixed OM cost	2.5% annually of investment cost
Adjustment factor (kW value)	1.1258
Fuel cost	93.22 mills/kWh
Variable OM cost	4.0 mills/kWh
Adjustment factor (kWh value)	0.9664
Other conditions :	
Discount rate :	12%
Annuity factor	0.1339
Exchange rate :	2,446.6 Rp/\$
<b>(Result)</b>	
<b>(kW value)</b>	
Construction cost	11.2 million \$ in every 20 years 27,304 million Rp. in every 20 years
Annualized construction cost	3,626 million Rp. per year for 50-year period (1)
Fixed OM cost	683 million Rp per year
kW value benefit before adjustment	4,309 million Rp per year
kW value benefit after adjustment	4,851 million Rp per year
<b>(kWh value)</b>	
Fuel cost	5,118 thousand \$ per year 12,521 million Rp. per year
Variable OM cost	220 thousand \$ per year 537 million Rp. per year
kWh value benefit before adjustment	13,058 million Rp. per year
kWh value benefit after adjustment	12,620 million Rp. per year
<b>Total economic benefit</b>	<b>17,470 million Rp per year</b>

Note :

(1) Derived by assuming the replacement of facilities every 20 years within 50-year period



Table A16-4(1/3) Costs and Economic Benefits of the Dam Projects (Beng)

IRR = 18.6%

(Unit : million Rp.)

Year	Production foregone	Cost					OM cost	Total	Benefit				Net Benefit
		Investment cost				Domestic water supply			Industrial water supply	Power generation	Total		
		Data	Power generation	Pump-up facilities	Sub-total								
2003	0	840	297	603	1,740	0	1,740	0	0	0	0	-1,740	
2004	0	1,819	642	1,308	3,769	0	3,769	0	0	0	0	-3,769	
2005	0	700	247	503	1,450	0	1,450	0	0	0	0	-1,450	
2006	0	12,455	4,400	8,955	25,810	0	25,810	0	0	0	0	-25,810	
2007	0	18,053	6,377	12,979	37,409	0	37,409	0	0	0	0	-37,409	
2008	0	18,053	6,377	12,979	37,409	0	37,409	0	0	0	0	-37,409	
2009	0	12,455	4,400	8,955	25,810	0	25,810	0	0	0	0	-25,810	
2010	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2011	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2012	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2013	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2014	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2015	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2016	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2017	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2018	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2019	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2020	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2021	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2022	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2023	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2024	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2025	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2026	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2027	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2028	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2029	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2030	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2031	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2032	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2033	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2034	1,037	0	17,796	36,220	54,016	3,551	58,604	27,216	3,696	7,649	38,561	-20,043	
2035	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2036	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2037	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2038	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2039	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2040	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2041	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2042	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2043	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2044	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2045	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2046	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2047	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2048	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2049	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2050	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2051	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2052	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2053	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2054	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2055	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2056	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2057	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2058	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
2059	1,037	0	0	0	0	3,551	4,588	27,216	3,696	7,649	38,561	33,973	
Total	51,850	64,375	40,536	82,502	187,413	177,560	416,823	1,360,800	184,800	382,450	1,928,050	1,511,227	

Note : Replacement costs are assumed to be 90% of investment costs of the power station and pump-up facilities with a facility life of 25 years.

Standard conversion factor for local currency portion 0.8

Table A16-4(2/3) Costs and Economic Benefits of the Dam Projects (Kedung Warak)

IRR = 10.0%

(Unit : million Rp.)

Year	Production foregone	Cost					OM cost	Total	Benefit			Total	Net Benefit
		Investment cost				Sub-total			Domestic water supply	Industrial water supply	Power generation		
		Dam	Power generation	Pump-up facilities	Sub-total								
2013	0	241	0	814	1,055	0	1,055	0	0	0	0	-1,055	
2014	0	523	0	1,764	2,287	0	2,287	0	0	0	0	-2,287	
2015	0	201	0	678	879	0	879	0	0	0	0	-879	
2016	0	3,002	0	10,994	13,997	0	13,997	0	0	0	0	-13,997	
2017	0	4,322	0	15,881	20,203	0	20,203	0	0	0	0	-20,203	
2018	0	4,322	0	15,881	20,203	0	20,203	0	0	0	0	-20,203	
2019	0	3,002	0	10,994	13,997	0	13,997	0	0	0	0	-13,997	
2020	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2021	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2022	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2023	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2024	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2025	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2026	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2027	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2028	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2029	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2030	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2031	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2032	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2033	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2034	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2035	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2036	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2037	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2038	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2039	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2040	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2041	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2042	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2043	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2044	526	0	0	43,980	43,980	3,974	48,480	12,190	1,408	0	13,598	-34,882	
2045	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2046	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2047	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2048	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2049	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2050	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2051	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2052	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2053	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2054	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2055	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2056	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2057	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2058	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2059	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2060	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2061	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2062	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2063	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2064	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2065	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2066	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2067	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2068	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
2069	526	0	0	0	0	3,974	4,500	12,190	1,408	0	13,598	9,098	
Total	26,300	15,613	0	100,986	116,600	198,720	341,620	609,500	70,400	0	679,900	338,280	

Note : Replacement costs are assumed to be 90% of investment costs of the power station and pump-up facilities with a facility life of 25 years.

Standard conversion factor for local currency portion is 0.8

Table A16-4(3/3) Costs and Economic Benefits of the Dam Projects (Genteng I)

IRR = 13.3%

(Unit : million Rp.)

Year	Production foregone	Cost				OM cost	Total	Benefit			Net Benefit	
		Investment cost						Domestic water supply	Industrial water supply	Power generation		Total
		Dam	Power generation	Pump-up facilities	Sub-total							
2009	0	3,254	288	0	3,542	0	3,542	0	0	0	0	-3,542
2010	0	7,051	623	0	7,674	0	7,674	0	0	0	0	-7,674
2011	0	2,712	240	0	2,952	0	2,952	0	0	0	0	-2,952
2012	0	40,460	3,884	0	44,343	0	44,343	0	0	0	0	-44,343
2013	0	58,250	5,610	0	63,860	0	63,860	0	0	0	0	-63,860
2014	0	58,250	5,610	0	63,860	0	63,860	0	0	0	0	-63,860
2015	0	40,460	3,884	0	44,343	0	44,343	0	0	0	0	-44,343
2016	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2017	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2018	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2019	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2020	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2021	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2022	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2023	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2024	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2025	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2026	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2027	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2028	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2029	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2030	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2031	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2032	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2033	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2034	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2035	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2036	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2037	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2038	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2039	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2040	64	0	17,796	0	17,796	99	17,959	19,560	1,760	17,470	38,790	20,831
2041	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2042	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2043	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2044	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2045	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2046	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2047	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2048	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2049	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2050	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2051	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2052	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2053	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2054	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2055	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2056	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2057	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2058	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2059	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2060	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2061	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2062	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2063	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2064	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
2065	64	0	0	0	0	99	163	19,560	1,760	17,470	38,790	38,627
<b>Total</b>	<b>3,200</b>	<b>210,437</b>	<b>37,933</b>	<b>0</b>	<b>248,370</b>	<b>4,960</b>	<b>256,530</b>	<b>978,000</b>	<b>88,000</b>	<b>873,500</b>	<b>1,939,500</b>	<b>1,682,970</b>

Note : Replacement costs are assumed to be 90% of investment costs of the power station and pump-up facilities with a facility life of 25 years.

Standard conversion factor for local currency portion is 0.8

**Table A16-5 Derivation of Irrigation and Domestic Water Supply Benefits**

**(Irrigation water)**

Item	Unit	Delta Brantas	Widas
a. Amount of water used during dry season	million m <sup>3</sup>	404	37
b. Economic benefit in 1985 price*	Rp.million	4,030	421
c. Benefit per volume in 1985 price (b/a)	Rp./m <sup>3</sup>	10	11
d. Average benefit in 1985 price	Rp./m <sup>3</sup>	10	
e. Rate of price increase of rice between 1985 and 1997	times	4.7	
f. Average benefit in 1997 price (d*e)	Rp./m <sup>3</sup>	47	
g. Increase in productivity until 2020	%/year	4.71 **	
	times	2.9	
h. Economic benefit in 2020 in 1997 price (f*g)	Rp./m <sup>3</sup>	136	

\* Taken from SAPS I study

\*\* Assumed in the Socio-Economic Framework by the JICA study team

**(Domestic water)**

Item	Values
a. Amount of domestic water to be supplied	48.5 million m <sup>3</sup> per year
b. Cost for purification and distribution facilities	4,100 Rp./m <sup>3</sup>
c. Total cost for purification and distribution facilities (a * b)	198,850 million Rp.
d. Canal lining cost	163,605 million Rp.
e. Total benefit of domestic water supply	790 Rp./m <sup>3</sup>
f. Contribution of canal lining (d / (c+d))	45 %
g. Economic benefit of canal lining (e * f)	356 Rp./m <sup>3</sup>

Table A16-6 EIRR of Irrigation Water Saving by Canal Lining

IRR : 19.3%

(Unit : Rp.million)

No.	Cost			Benefit				Net benefit
	Investment	OM	Total	Irrigation	Industry	Domestic	total	
0	134,156	0	134,156	0	0	0	0	-134,156
1	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
2	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
3	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
4	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
5	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
6	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
7	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
8	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
9	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
10	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
11	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
12	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
13	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
14	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
15	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
16	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
17	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
18	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
19	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
20	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
21	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
22	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
23	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
24	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
25	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
26	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
27	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
28	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
29	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
30	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
31	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
32	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
33	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
34	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
35	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
36	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
37	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
38	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
39	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
40	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
41	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
42	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
43	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
44	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
45	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
46	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
47	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
48	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
49	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
50	0	1,646	1,646	8,976	1,338	17,266	27,580	25,934
Total	134,156	82,280	216,436	448,800	66,900	863,300	1,379,000	1,162,564

(Rp. million)

Total investment cost	163,605	
Foreign currency	16,361	10%
Local currency	147,245	90%
conversion factor	0.8	
Adjusted investment cost		
Total	134,156	
Foreign currency	16,361	
Local currency	117,796	
Annual OM cost	2,057	Rp. million per year

**Table A16-7 Costs per Volume of Industrial Water Saving Compared with those of Dam Construction**

Item	Unit	Saving	Beag	Kedung-warak	Genteng I
a. Life of facility	years	15	50	50	50
b. Total investment cost *	Rp. million	237,402	242,657	143,847	268,607
c. Amount of water to be saved/supplied	million m <sup>3</sup> /year	242	147	54	70
d. Operation and maintenance cost	Rp. million/year	56	30	92	2
e. Investment cost per volume (b / c)	Rp. /m <sup>3</sup>	981	1,651	2,664	3,837
f. Total investment cost per volume in 50 years	Rp. /m <sup>3</sup>	3,924	1,651	2,664	3,837
g. Present value of investment cost per volume	Rp. /m <sup>3</sup>	1,199	1,651	2,664	3,837
h. Present value of operation and maintenance cost per volume	Rp. /m <sup>3</sup>	521	249	764	17
I. Present value of total cost per volume	Rp. /m <sup>3</sup>	1,720	1,900	3,428	3,854

Notes :

\* excluding cost of power station

\*\* For the sake of comparison, all the investments for saving and dams are assumed to occur in one year. In reality, investments will be made over a number of years as assumed in the investment program. The assumption in this analysis has no effect on the comparison purpose.

**Table A16-8 EIRR of Watershed Management Project**

IRR : 23.7%

(Unit: million Rp. in 1997 price level)

Year	Investment Cost	OM cost	Benefit	Net Benefit
0	133,081	0	0	-133,081
1	0	1,331	32,863	31,532
2	0	1,331	32,863	31,532
3	0	1,331	32,863	31,532
4	0	1,331	32,863	31,532
5	0	1,331	32,863	31,532
6	0	1,331	32,863	31,532
7	0	1,331	32,863	31,532
8	0	1,331	32,863	31,532
9	0	1,331	32,863	31,532
10	0	1,331	32,863	31,532
11	0	1,331	32,863	31,532
12	0	1,331	32,863	31,532
13	0	1,331	32,863	31,532
14	0	1,331	32,863	31,532
15	0	1,331	32,863	31,532
16	0	1,331	32,863	31,532
17	0	1,331	32,863	31,532
18	0	1,331	32,863	31,532
19	0	1,331	32,863	31,532
20	0	1,331	32,863	31,532
21	0	1,331	32,863	31,532
22	0	1,331	32,863	31,532
23	0	1,331	32,863	31,532
24	0	1,331	32,863	31,532
25	0	1,331	32,863	31,532
26	0	1,331	32,863	31,532
27	0	1,331	32,863	31,532
28	0	1,331	32,863	31,532
29	0	1,331	32,863	31,532
30	0	1,331	32,863	31,532
31	0	1,331	32,863	31,532
32	0	1,331	32,863	31,532
33	0	1,331	32,863	31,532
34	0	1,331	32,863	31,532
35	0	1,331	32,863	31,532
36	0	1,331	32,863	31,532
37	0	1,331	32,863	31,532
38	0	1,331	32,863	31,532
39	0	1,331	32,863	31,532
40	0	1,331	32,863	31,532
41	0	1,331	32,863	31,532
42	0	1,331	32,863	31,532
43	0	1,331	32,863	31,532
44	0	1,331	32,863	31,532
45	0	1,331	32,863	31,532
46	0	1,331	32,863	31,532
47	0	1,331	32,863	31,532
48	0	1,331	32,863	31,532
49	0	1,331	32,863	31,532
50	0	1,331	32,863	31,532
Total	133,081	55,894	1,380,246	1,191,271

**Investment cost**

(million Rp.)

Total	162,294
FC	16,229
LC	146,065

Portion of local currency :	90%
Standard conversion factor for local currency	0.8
Proportion of OM cost to investment cost :	1%

**Table A16-9 Net Present Values and Benefit-Cost Ratios of the Proposed Sabo Projects**

**Mt. Kelud Portion (after 2005 Portion)**

B/C 1.46

NPV :

69,522

million Rp.

(Unit : million Rp. in 1997 price level)

Year	1997 price			Present Value		
	Investment Cost	OM cost	Benefit	Investment Cost	OM cost	Benefit
2000	2,248	0	0	2,248	0	0
2001	2,470	0	0	2,205	0	0
2002	15,159	0	23,680	12,085	0	18,878
2003	15,160	127	23,681	10,791	90	16,856
2004	38,909	254	60,779	24,727	162	38,626
2005	38,909	380	60,779	22,078	216	34,488
2006	38,909	508	60,779	19,713	257	30,792
2007	15,160	635	23,681	6,858	287	10,712
2008	15,160	762	23,681	6,123	308	9,564
2009	15,160	888	23,681	5,467	320	8,540
2010	15,160	1,052	23,681	4,881	339	7,625
2011	15,160	1,142	23,681	4,358	328	6,808
2012	15,160	1,269	23,681	3,891	326	6,078
2013	15,160	1,396	23,681	3,474	320	5,427
2014	15,160	1,523	23,681	3,102	312	4,846
2015	15,160	1,650	23,681	2,770	301	4,326
2016	15,160	1,777	23,681	2,473	290	3,863
2017	15,160	1,904	23,681	2,208	277	3,449
2018	15,160	2,031	23,681	1,971	264	3,080
2019	15,160	2,157	23,681	1,760	250	2,750
2020	15,160	2,285	23,681	1,572	237	2,455
Total	364,007	21,741	561,236	144,756	4,885	219,162

Foreign currency 10% standard conversion factor : 0.8  
Local currency 90%

**Brantas / Lesti Portion**

B/C 1.80

NPV :

51,271

million Rp.

(Unit : million Rp. in 1997 price level)

Year	1997 price			Present Value		
	Investment Cost	OM cost	Benefit	Investment Cost	OM cost	Benefit
1999	1,550	0	0	1,550	0	0
2000	13,377	0	23,267	11,943	0	20,774
2001	13,377	118	23,267	10,664	94	18,548
2002	13,377	236	23,267	9,521	168	16,561
2003	13,377	355	23,267	8,501	226	14,786
2004	13,377	473	23,267	7,590	268	13,202
2005	13,377	591	23,267	6,777	300	11,788
2006	13,377	709	23,267	6,051	321	10,525
2007	0	827	23,267	0	334	9,397
Total	95,186	3,310	162,866	62,598	1,711	115,580

Discount rate : 12%



**Table A16-10 Recreational Benefits of Selorejo and Sutami Reservoirs**

Item	Unit	Selorejo	Sutami
<b>(Conditions)</b>			
Number of visitor	person/year	126,000	92,000
Number of income earners	person/year	42,000	30,667
Travel cost	Rp./person	1,200	1,200
Time value	Rp./person/day	16,700	16,700
Admission fee	Rp./person	1,000	1,000
<b>(Result)</b>			
Travel cost	million Rp.	151	110
Time value	million Rp.	701	512
Admission revenue	million Rp.	126	92
Total	million Rp./year	979	715

**Table A16-11 EIRR of Environmental Preservation Program**

EIRR : 59.6%

Unit : Rp.million

No.	Cost			Benefit	Net benefit
	Investment	OM	Total		
0	1,172	0	1,172	0	-1,172
1	0	16	16	715	699
2	0	16	16	715	699
3	0	16	16	715	699
4	0	16	16	715	699
5	0	16	16	715	699
6	0	16	16	715	699
7	0	16	16	715	699
8	0	16	16	715	699
9	0	16	16	715	699
10	0	16	16	715	699
11	0	16	16	715	699
12	0	16	16	715	699
13	0	16	16	715	699
14	0	16	16	715	699
15	0	16	16	715	699
16	0	16	16	715	699
17	0	16	16	715	699
18	0	16	16	715	699
19	0	16	16	715	699
20	0	16	16	715	699
21	0	16	16	715	699
22	0	16	16	715	699
23	0	16	16	715	699
24	0	16	16	715	699
25	0	16	16	715	699
26	0	16	16	715	699
27	0	16	16	715	699
28	0	16	16	715	699
29	0	16	16	715	699
30	0	16	16	715	699
31	0	16	16	715	699
32	0	16	16	715	699
33	0	16	16	715	699
34	0	16	16	715	699
35	0	16	16	715	699
36	0	16	16	715	699
37	0	16	16	715	699
38	0	16	16	715	699
39	0	16	16	715	699
40	0	16	16	715	699
41	0	16	16	715	699
42	0	16	16	715	699
43	0	16	16	715	699
44	0	16	16	715	699
45	0	16	16	715	699
46	0	16	16	715	699
47	0	16	16	715	699
48	0	16	16	715	699
49	0	16	16	715	699
50	0	16	16	715	699
Total	1,172	800	1,972	35,750	33,778

Note : Investment is assumed to take place in a year for the EIRR derivation purpose.

**ANNEX - 17**

**SOCIO-ECONOMIC FRAMEWORK**

# ANNEX - 17 SOCIO-ECONOMIC FRAMEWORK

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## 1 Objective

A socio-economic framework is established to provide a prospect of the socio-economic conditions of the Brantas River Basin in the year 2020. It will also prepare the basic conditions for a water demand projection for domestic and industrial uses. The socio-economic framework comprises the population in Brantas in 2020 and growth targets for GRDP, agriculture, industrial and service sectors by 2020.

## 2 Population Projection

In making a population projection of the Brantas River Basin area, the following aspects were analyzed.

- projection made by East Java Provincial Plan
- projection made by REPELITA VI
- past trends

The following are the major findings of the analysis on these aspects.

- (a) The East Java Provincial Plan made a population projection for the year 2008. This projection was made based on the growth rates between 1980 and 1990. According to this projection, the following growth rates are assumed for the Brantas River Basin.

- high case : 1.32 % per year
- low case : 1.05 % per year

These rates are higher than the most recent growth rates : 0.88% in 1993 and 0.77% in 1994 or 0.94% per year between 1988 and 1994. At regency and municipality level as well, assumed growth rates are significantly higher than the actual trends.

- (b) REPELITA VI sets targets for population growth for Indonesia for respective REPELITA until the 10th REPELITA (2013/14 to 2018/19) as shown in Section II.2 of the Main Report. Based on the declining birth rate, annual population growth rate is set to decline from 1.66 % per year during REPELITA V to 0.88 % per year in REPELITA X. The focus of these targets, however, is on declining natural growth rather than social change of population.

- (c) Based on the figures in Section II.2 of the Main Report, the past trends of population change in the Brantas River Basin area can be summarized as follows.

- Population growth rates of most regencies were almost constant during 1988-1994 period. Those of municipalities showed fluctuations from year to year. The Brantas population as a whole was growing at almost constant rates between 0.8 to 0.9 % per year since 1988 except in 1991, showing no sign of declining growth rates.
- Growth rates of the Brantas areas was higher than those of the East Java Province.

Based on the discussion held between PJF and the JICA study team during the third survey in Indonesia in November 1997, it was agreed that the low case projection by the East Java Provincial Plan be adopted as the basis for water demand projection. It is judged that the low case projection would be within a reasonable range compared with the past trend.

Population of the Brantas area is thus projected as shown in Table A-17.1 and summarized as follows.

Area	Assumed growth rates (%/year)	Population in 1994 (thousand)	Population in 2020 (thousand)
Municipality	1.43	3,448	4,987
Regency	0.89	10,086	12,710
Total	1.04	13,534	17,697

### 3 Economic Growth Targets

#### (1) Methodology

Three scenarios are conceived as follows.

- Scenario 1 : " Low growth due to slow industrial development "
- Scenario 2 : " Moderate growth due to sound industrial development "
- Scenario 3 : " Fast growth due to rapid industrial development "

For each of the three scenarios, a set of conditions were assumed for the following factors as detailed in Table A17-2.

- Economic growth rate
- Growth of agriculture sector
- Share of manufacturing sector production in 2020
- Growth of total labor force
- Composition of labor force in 2020

#### Economic growth

GRDP growth rates are assumed at 6.0 %, 7.6% and 9.0 % per year for Scenario 1 (low case), Scenario 2 (medium case) and Scenario 3 (high case) based on the past experience in Brantas. GRDP growth rate in Brantas ranged from 5.8 % per year in 1985 to 9.7% per year in 1995 with an average at 7.6 % per year between 1983 and 1995.

#### Growth of agriculture production

For all the three scenarios, growth in agriculture production is assumed at 4.2% per year. This rate is higher than the national target in the 25-Year Plan at 3.5 % per year until year 2018. The idea is as follows:

- (i) In order to achieve this national target, areas like Brantas will need play a leading role in promoting increase in agriculture productivity both through yield increase and crop diversification.
- (ii) Following the policy direction of the Second 25-Year Plan which stresses enhancing equitable development throughout the country, this macro framework aims at reducing the income disparity between agriculture and industry. To attain this objective, the growth of agriculture sector is required to be as high as 4.2% per year. From this point of view, this is of more target nature than projection.

#### Share of manufacturing sector production

The share of the manufacturing sector was about 30% in Brantas in 1994. Scenario 1 assumes that the share remains unchanged at 30%, while Scenario 3 assumes 40 % based on the



experience of Asian NIES countries (Hong Kong, Taiwan Korea and Singapore) as a case in which industrialization accelerated. Scenario 2 applies the intermediate ratio at 35%.

#### Growth rate of total labor force

Growth rate of the total labor force is assumed to be 1.3 % per year based on the experience of upper middle income countries with GDP or GNP per capita between US\$ 2,970 (Brazil) and US\$ 8,260 (Korea) in 1994. GRDP per capita in Brantas is anticipated to reach about 6,000 US\$ in 2020 with a GRDP growth at 7.6% per year and a population growth at 0.97 % per year. Growth rates of the labor force in these countries averaged 2.2 % per year between 1990 and 1994, equivalent to 1.3 times of the average population growth rate in the same period at 1.7 % per year. Applying this coefficient of 1.3 to the projected population growth rate at 0.97 % per year in Brantas, a growth rate of the labor force is derived at 1.3% per year for Brantas.

#### Composition of labor force

A composition of the labor force in 2020 is assumed for Scenario 2 based on the experience of the upper middle income countries in 1994 : agriculture 21%, manufacturing 27% and service 52%. Compositions for Scenario 1 and 3 are set by adjusting agriculture and manufacturing sectors by 5% respectively.

In addition to the assumptions above, the value of GRDP and the number of labor force in Brantas were estimated in order to prepare for a forecast of the change in productivity of each sector. Table A7-4 presents estimated GRDP and the number of labor force in Brantas by sector. The following method was applied.

#### GRDP of Brantas

Sector-wise GRDP for Brantas was derived based on the data taken from statistical yearbook of each regency and municipality. For regencies of Blitar, Nganjuk and Jombang, however, no data were available concerning sector distribution of GRDP. The ratio of each sector of other regencies with similar economic structure were applied to the total GRDP of these regencies, which were available, for estimating sector distribution.

#### Number of sector-wise labor force in Brantas

The labor force statistics were available only for East Java Province. Therefore, the number of labor force in the Brantas was estimated by dividing sector GRDP by labor productivity, production per labor, of each sector, which was derived based on the productivity of the East Java Province and assumed difference in productivity between Brantas and East Java (Table A17-3). Based on the fact that GRDP per capita in Brantas is 45% higher than that of East Java, and also assuming that the differences in labor productivity between Brantas and East Java are constant among sectors, a 15% difference in labor productivity is derived for each sector of agriculture, manufacturing and others.

## (2) Result

The result of a forecast of production, labor force and productivity in the three scenarios are presented in Table A17-4 and summarized as follows.

Socio-economic Framework for Brantas

Item	Unit	Case 1	Case 2	Case 3
Production growth				
Agriculture *	%/year	4.2	4.2	4.2
Industry	%/year	6.1	8.3	9.3
Service	%/year	6.2	7.6	9.3
GRDP *	%/year	6.0	7.6	9.0
Relative productivity (Agriculture/Industry)				
1994	Ind. = 1.0	0.14	0.14	0.14
2020	Ind. = 1.0	0.16	0.15	0.18

\* assumptions

Three economic growth scenarios are compared and the following observation made.

### Scenario 1

A GRDP growth set at 6% is close to the lowest GRDP growth experienced in Brantas in 1985. The growth of the manufacturing sector at 6.1 % per year is significantly lower than the past achievement in East Java with an average at 11% per year. These levels of growth might take place in some years when economic conditions worsen. This scenario could represent low growth years until 2020.

### Scenario 2

A GRDP growth at 7.6% per year which is higher than the national target of 7.3% for the Second 25-Year Plan. The manufacturing sector is targeted to grow at 8.3% per year which is lower than the national growth rate of 9.8% in the said long term plan. A shift of industrial location to the northern part of East Java Province, outside the Brantas area, such as Gresik, Lamongan, Tuban and Bangkalan in the Madura Island would be envisaged. The key for success of this scenario is the high growth of agriculture sector. Mechanization of farming, integration of segment field, diversification of crops and efficient use of labor will be required for attaining the high productivity in this sector. The role of service sector including commerce, trade and tourism activities will expand centering in Surabaya. This scenario is considered to represent the most likely average picture of the Brantas area until the year 2020.

### Scenario 3

A GRDP growth at 9.0 % is assumed with the industrial sector projected to grow at 9.3% per year. It seems difficult to maintain this level of rapid industrial growth throughout all the 24 years considering constraint in industrial land provision and the increasing need for environmental preservation. Industrial water supply may become a critical pass for the high growth of industry. This scenario would entail possible negative effects to environment of the Brantas.

Based on the consideration above, Scenario 2, summarized as " Moderate economic growth with sound industrial development ", is selected. The following are the major indicators of Scenario 2.

#### Economic growth :

GRDP : 7.6 % per year

Agriculture : 4.0 % per year

Manufacturing : 8.3 % per year

Service : 7.6 % per year

#### Disparity in productivity :

Labor productivity of the agriculture sector, which is 14% of the manufacturing sector, will rise to 15% in 2020.

#### 4 Economic Evaluation

An economic evaluation will be carried out for a set of measures to be proposed by the comprehensive management plan of the Brantas River Basin. Target areas of an economic analysis is to be determined in accordance with the establishment of the river basin management measures later in the present study. Possible areas of economic analysis considered likely at this point are shown in Table A17-5. The economic analysis will be carried out based on the following principles.

- a. The basic approach of economic analysis is to measure economic impacts of a measure from an economy's point of view rather than from an entity's point of view such as PJT. In this regard, impacts such as an increase in regional production and welfare of the population will be the main issue.
- b. An effort will be made to quantify positive economic impacts of the measures. The possibility of quantifying benefits, however, will depend on the extent to which the target of a measure is expressed in a measurable manner. Quantification of economic benefits, therefore, will be made for the measures with targets clearly defined in value. Non-quantifiable benefits will be explained qualitatively.
- c. Both non-structural and structural measures will be evaluated. Conventional cost-benefit approach will be applied to measures with heavy investment followed by continuous generation of benefits in small amount in later years such as structural measures. For measures imposing no big initial investment, but expenditure and benefit occurring on an annual basis such as most non-structural measures, economic benefits would be estimated on an annual basis. For this type of benefits, possible benefits would include net saving of annual expenditure in economic term and annual water supply benefit for alternative use achieved by increased efficiency in water use.

**Table A17-1 Projected Population of the Brantas River Basin for Year 2020**

Area	1994		2020		Growth rate (%/year)
	(thousand)	(%)	(thousand)	(%)	
(Regency)					
Sidoarjo	1,079	8.0	1,955	11.0	2.31
Mojokerto	818	6.0	1,060	6.0	1.00
Malang	2,232	16.5	2,782	15.7	0.85
Blitar	1,060	7.8	1,141	6.4	0.28
Kediri	1,316	9.7	1,546	8.7	0.62
Nganjuk	958	7.1	1,091	6.2	0.50
Jombang	1,065	7.9	1,314	7.4	0.81
Tulungagung	917	6.8	1,043	5.9	0.50
Trenggalek	641	4.7	778	4.4	0.75
Sub-total	10,086	74.5	12,710	71.8	0.89
(Municipality)					
Surabaya	2,294	16.9	3,360	19.0	1.48
Mojokerto	102	0.8	139	0.8	1.20
Malang	700	5.2	1,059	6.0	1.61
Kediri	233	1.7	288	1.6	0.82
Blitar	119	0.9	141	0.8	0.65
Sub-total	3,448	25.5	4,987	28.2	1.43
Total (Brantas)	13,534	100.0	17,697	100.0	1.04

Table A17-2 Assumptions for Socio-Economic Framework for Three Scenarios

Item	Unit	Scenario 1			Scenario 2			Scenario 3			Past achievements (Brantas, 1983-95) (East Java, 1984-95) (Brantas, 1994)	Idea behind assumptions 7.6%/year as the average in Brantas between 1983 and 1995 Set at higher range in past achievement and higher than Indonesia's target at 4.5%/year in 25-Year Plan to lead national agriculture production increase. Maximum is set at 40% based on other Asian country's experience. Population growth rate at 0.97%/year times "labor force growth rate - population growth rate coefficient" at 1.3 based on experience of upper-middle income countries Case-2 composition is the average of higher-middle income country's (GDP per capita between 2,970 US\$ and 8,260 US\$ in 1994) composition in 1990. Compositions in Case 1 and 3 are set with 5% differences in agriculture and industry sectors.
		6.0 %/year	4.2 %/year	7.6 %/year	4.2 %/year	9.0 %/year	4.2 %/year	5.8 to 9.7 0.0 to 4.6				
Economic growth	%	6.0	4.2	7.6	4.2	9.0	4.2	5.8 to 9.7	7.6	7.6	7.6	
Growth of agriculture production	%	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	
Share of industrial production	%	30	30	35	35	40	40	30	30	30	30	
Growth of total labor force	%	1.3	1.3	1.3	1.3	1.3	1.3	n.a.	n.a.	n.a.	n.a.	
Composition of labor force	%	26	26	21	21	16	16	33	33	33	33	
	Industry	22	22	27	27	32	32	14	14	14	14	
	Service	52	52	52	52	52	52	53	53	53	53	

**Table A17-3 Labor Productivity in East Java and Brantas in 1994**

Item	Production		Labor force		Productivity (thousand Rp. /labor)
	(billion Rp.)	(%)	(thousand)	(%)	
<b>East Java</b>					
Agriculture	10,302	18.0	8,979	52.5	1,147
Manufacturing	15,587	27.3	1,920	11.2	8,117
Service	31,257	54.7	6,216	36.3	5,028
GRDP	57,146	100.0	17,116	100.0	3,339
<b>Brantas</b>					
Agriculture	3,092	9.1	2,343	36.2	1,319
Manufacturing	10,020	29.5	1,073	14.6	9,335
Service	20,852	61.4	3,606	49.2	5,782
GRDP	33,964	100.0	7,023	100.0	4,836

**Note :**

labor force numbers in Brantas are derived based on productivity figures in East Java and production in Brantas, assuming productivities in East Java and Brantas are same. Difference in labor productivity between East Java and Brantas

Agriculture :                   15% higher in Brantas  
 Industry :                     15% higher in Brantas  
 Service :                      15% higher in Brantas  
 GRDP :                         45% higher in Brantas (same as gap in GRDP per capita)

Table A17-4 Socio-Economic Framework for Brantas in 2020

Item	1994				Assumptions for 2020				2020			Relative productivity (Industry=1.00)		Growth of productivity (%/year)	
	Production		Labor force		Share of production in 2020 (%)	Growth rate of production (%/year)	Share of labor force (%)	Growth rate of labor force (%/year)	Production (billion Rp.)	Labor Force (thousand)	Productivity (thousand Rp./labor)	1994			2020
	(billion Rp.)	(%)	(thousand)	(%)								1994	2020		
(Case 1)															
Agriculture	3,092	9.1	2,343	33.4	5.8	4.2	26.0	0.3	9,012	2,555	3,527	0.14	0.16	3.85	
Industry	10,020	29.5	1,073	15.3	30.0	6.1	22.0	2.7	46,355	2,162	21,444	1.00	1.00	3.25	
Service	20,852	61.4	3,606	51.3	64.2	6.2	52.0	1.3	99,149	5,109	19,405	0.62	0.90	4.77	
Total	33,964	100.0	7,023	100.0	100.0	6.0	100.0	1.3	154,515	9,826	15,725	0.52	0.73	4.64	
(Case 2)															
Agriculture	3,092	9.1	2,343	33.4	4.0	4.2	21.0	-0.5	9,012	2,063	4,367	0.14	0.15	4.71	
Industry	10,020	29.5	1,073	15.3	35.0	8.3	27.0	3.5	79,837	2,653	30,094	1.00	1.00	4.61	
Service	20,852	61.4	3,606	51.3	61.0	7.6	52.0	1.3	139,258	5,109	27,255	0.62	0.91	6.14	
Total	33,964	100.0	7,023	100.0	100.0	7.6	100.0	1.3	228,107	9,826	23,215	0.52	0.77	6.22	
(Case 3)															
Agriculture	3,092	9.1	2,343	33.4	2.8	4.2	16.0	-1.5	9,012	1,572	5,732	0.14	0.18	5.81	
Industry	10,020	29.5	1,073	15.3	40.0	9.3	32.0	4.2	102,155	3,144	32,489	1.00	1.00	4.91	
Service	20,852	61.4	3,606	51.3	57.2	9.3	52.0	1.3	208,067	5,109	40,722	0.62	1.25	7.80	
Total	33,964	100.0	7,023	100.0	100.0	9.0	100.0	1.3	319,233	9,826	32,489	0.52	1.00	7.60	











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