(Unit:%)

Year	Foreign Currency	Local Currency
1985	8.0	45.6
1986	9.0	12.0
1987	9.0	12.0
1988	9.0	12.0
1989	7.5	12.0
1990	6.0	12.0

4.1 Project Cost Estimates

Accordingly, project cost for the original plan is estimated as presented in TABLE XI-2 and summarized below. Breakdown of project cost is presented from TABLE XI-3 to TABLE XI-19.

PROJECT COST

Unit: ₱ million

	F.C.	L.C.	Total
Financial Construction Cost	356.595	279.010	635.605
Physical Contingency	53.489	41.852	95.341
Price Contingency	205.618	446.892	652.510
Total	615.702	767.754	1,383.456

4.1.1 Unit Cost Analysis

Each unit cost is composed of materials, labor, fuel and oil, and rental fees for construction machinery, the basic costs of which were mainly quoted from current unit costs investigated at the Project site and in Manila.

The majority of costs were estimated on the contract basis except costs for on-farm development which were estimated on the force account rate. Contract cost consists of direct cost, 10% overhead, 10% profit and 3% tax on the same, while force account cost consists of direct cost and 10% overhead. Unit cost is tabulated in TABLE XI-20 to TABLE XI-23.

4.1.2 Land Acquisition

Costs of land acquisition were classified into two classes; agricultural land in the Project area and the hilly area in the Catipayan River basin, as tabulated below.

Item	Area of Acquisition (ha)	Amount ('000₱)
Agricultural land in the Project area	360	7,200
Hilly land in the Catipayan basin (including 4ha of paddy)	50	300
Total		7,500

4.1.3 O & M Equipment

O and M equipment will be procured by the Government of the Philippines for the smooth operation and maintenance of facilities after completion of the Project. Requested O & M facilities and equipment are listed in TABLE XI-24.

4.1.4 Administration and Engineering Costs

Administration costs will be prepared by the Government, and consist of staff salary, direct cost for office expenses, labor wage and others. Engineering costs include engineering services by foreign consultants required for the detailed design and construction stage, 100 M/M and 120M/M, respectively. In order to expediate project implementation, a total of 8M/M are proposed for NIA personnel training courses overseas.

The administration and engineering costs are summarized in TABLE XI-25.

4.2 Annual Operation and Maintenance Costs

Annual operation and maintenance costs consist of staff salaries, materials and labor wages for repair and maintenance of Project facilities, and operation and maintenance cost for O & M equipment. A summary of annual operation and maintenance cost is shown in TABLE XI-27.

4.3 Replacement Cost

Rubber dams, gates with accessories, and generators will be replaced once in 25 years and O & M equipment once in 10 years during a 50-years Project life. The summary of the replacement cost is tabulated in TABLE XI-28.

5. DISBURSEMENT SCHEDULE

The disbursement schedule for the original plan in accordance with the implementation schedule and Project cost is presented in TABLE XI-29.

MAIN FEATURES OF THE PROJECT

(Catipayan Dam and Reservoir & Trans-diversion Canal and Tunnel)

Item	Description
(1) Catipayan Dam and Reservoir	
1) Dam	
Type	center core rock fill
Crest elevation	EL. 129.5m
Freeboard	2.5m
Height	48.5m
Length	265.0m
Embankment volume	830,000m^3
2) Reservoir	
Catchment area	44.2km^2
Effective storage capacity	21.5MCM
Design sediment volume	6.7MCM
Gross storage capacity	28.2MCM
Design flood level	EL. 127.0m
Normal high water level	EL. 124.0m
Submerged area	2.10km^2
3) Spillway	
Type	without gate, chute
Design discharge capacity	800m^3/sec
Crest width	72m
Design overflow depth	3.0m
4) Intake Facilities	
Intake water level: High water level	EL. 124.0m
Low water level	EL. 109.0m
Type	drop inlet
Design discharge	6.0m^3/sec
5) By-pass Tunnel	
Design discharge	372m^3/sec
Type	standard horse-shoe: 2R=5.5m
(2) Trans-diversion Canal and Tunnel	
1) Canal	
Design discharge	6.0m^3/sec
Length	7.7km
Type	concrete flume
2) Tunnel	
Design discharge	5.9m^3/sec
Length	475m
Type	standard horse-shoe: 2R=2.2m

MAIN FEATURES OF THE PROJECT

(Diversion Dam)

Item	Asue Diversion Dam	Bakabak Diversion Dam	Gubaton Diversion Dam
Water Source	Asue River	Asue River	Gubaton River
Irrigable Area	4,650ha	1,000ha	520ha
Dam Length	12m	27.6m x 2	20m
Crest Elevation	EL. 33.3m	EL. 7.8m	EL. 17.8m
Dam Height	2.4m	3.0	5.0m
Type	Rubber Dam (1 span)	Rubber Dam (2 span)	Rubber Dam (1 span)
Intake Gate			
Type	Sluice Gate	Sluice Gate	Sluice Gate
Size	2.0 x 1.4 x 2nos. x 2nos.	1.5 x 1.0 1.0 x 1.0	1.5 x 1.2

MAIN FEATURES OF THE PROJECT

(Irrigation System)

Item	Asue Main Canal	Eastern Main Canal	Bakabak Main Canal	Gubaton Main Canal	Serruco Main Canal (Existing)	Diversion Canal
1) Source of Water	Asue River supplied from Catipayan	Asue River supplied from Catipayan	Asue River	Gubaton River	Serruco River	-
2) Net Irrigation Area	2,250ha	2,400ha	1,000ha	520ha	360ha	-
3) Max. Diverted Water	5.118m3/s	4.922m3/s	1.251m3/s 0.800m3/s	1.067m3/s	0.739m3/s 0.379m3/s	1.510m3/s-(1) 0.428m3/s-(2)
4) Irrigation Facilities						
Main Canal	1 nos.	1 nos.	2 nos.	1 nos.	2 nos.	2 nos.
- Type	Trapezoidal Unlined	Trapezoidal Unlined	Trapezoidal Unlined	Trapezoidal Unlined	Trapezoidal Unlined	Trapezoidal Unlined
- Side Slope	1:1.5	1:1.5	1:1.5	1:1.5	1:1.5	1:1.5
- Length	13,090m	7,280m	5,780m	2,600m	(4,880m)	3,060m (1,940m)
Lateral Canal	6 nos.	9 nos.	5 nos.	3 nos.	3 nos.	2 nos.
- Type	Trapezoidal Unlined	Trapezoidal Unlined	Trapezoidal Unlined	Trapezoidal Unlined	Trapezoidal Unlined	Trapezoidal Unlined
- Side Slope	1:1.5	1:1.5	1:1.5	1:1.5	1:1.5	1:1.5
- Length	19,090m	31,980m	7,430m	4,510m	(4,060m)	7,090m (5,230m)
Related Structures						
- Head gate and Parshall Flume	2 nos.	3 nos.	-	-	-	1 nos.
- Double Orifice	44 nos.	53 nos.	27 nos.	13 nos.	12 nos.	11 nos.
- Check	42 nos.	51 nos.	21 nos.	8 nos.	8 nos.	10 nos.
- Siphon	6 nos.	1 nos.	1 nos.	1 nos.	1 nos.	1 nos.
- Drainage Culvert	5 nos.	7 nos.	1 nos.	2 nos.	1 nos.	-
- Drainage Culvert Pipe	7 nos.	15 nos.	6 nos.	-	-	1 nos.
- Bridge	10 nos.	5 nos.	3 nos.	2 nos.	-	1 nos.
- Road Crossing	24 nos.	21 nos.	7 nos.	7 nos.	-	2 nos.
- Wasteway	2 nos.	3 nos.	3 nos.	-	-	-
- Chute	3 nos.	1 nos.	2 nos.	-	-	-
- Vertical Drop	31 nos.	54 nos.	11 nos.	7 nos.	-	14 nos.
- Fixed Proportional Divisor	1 nos.	5 nos.	-	1 nos.	-	-
- Combined Structure	-	-	-	1 nos.	-	2 nos.
- Overchute	31 nos.	22 nos.	3 nos.	7 nos.	2 nos.	-

MAIN FEATURES OF THE PROJECT
(On-Farm Development)

Item	Flat Area	Hilly Area
1) Main Farm Ditch (m/ha)	17.78 (8.47)	38.41 (18.29)
2) Supplementary Farm Ditch (m/ha)	47.15 (16.39)	76.34 (14.63)
3) Farm Drain (m/ha)	15.49 (10.07)	-
4) Applied Area (ha)	4,600	2,160

Note: Figures in parenthesis show the utilized length of existing canal.

MAIN FEATURES OF THE PROJECT
(Drainage System)

Item	Number & Description
1) Newly Constructed Canal Length	15 nos. 21,500m
2) Improvement of Existing Structures Type	6 Drainage Culvert
3) Excavation of Existing Creeks Length	6,000m
4) Removal of Privately Owned Concrete Weirs	L.S.

MAIN FEATURES OF THE PROJECT
(Road Network and Others)

Item	Number & Discription
A. Road Network	
1) Proposed roads except service road along the irrigation canal	19
Length	15,300m
2) Improvement of existing roads	12
Length	6,000m
3) Related structures	
Bridges	13
Pipe road crossings	6
4) Enlargement of 3m service roads to 4m width	11
Length	12,600m
5) Roads along the irrigation canals of existing Serruco CIS	7
Length	16,110m
B. Integrated Community Center	100
C. Dry Yard	151
D. Facilities for Domestic Water Supply	
- Pipe line	1,500m
E. Asue River Training	
- Type	Concrete lining
- Length	650m

MAIN FEATURES OF THE PROJECT
(Hydropower Plant)

Item	Description
(1) Dam Site Power Plant	
1) Turbine	
Type	Cross flow
Installed capacity/output	640kW/696kW
Maximum discharge	3.0m^3/s
Maximum intake water level	EL124.0m
Minimum intake water level	EL109.0m
Tailrace water level	EL90.0m
Turbine axis elevation	EL91.5m
2) Generator	
Type	Horizontal shaft synchronous 3 phase
Capacity/output	710kVA/640kW
3) Penstock	1,100mm dia L=30m
(2) Canal Route Power Plant	
1) Turbine	
Type	Cross flow
Installed capacity/output	740kW/814kW
Maximum discharge	3.0m^3/s
Intake water level	EL82.5m
Tailrace water level	EL42.4m
Turbine axis elevation	EL44.0m
2) Generator	
Type	Horizontal shaft synchronous 3 phase
Capacity/output	830kVA/740kW
3) Penstock	1,200mm dia, L=273m 1,100mm dia, L=155m
(3) Transmission Line	
Cables	2/0 ACSR
Insulators	Porcelain
Support	Wooden poles
Voltage	13.2kV
Total length	10.0m

FINANCIAL CONSTRUCTION COST

(Unit: ₱ '000)

	Item	Foreign Cost	Local Cost	Total
1.	Dam			
	a) Preparation works	2,040.0	1,360.0	3,400.0
	b) By-pass tunnel	21,620.6	13,933.2	35,553.8
	c) Inlet structure	283.9	181.0	464.9
	d) Cofferdam	10,360.5	4,640.5	15,001.0
	e) Excavation	34,270.5	14,069.3	48,339.8
	f) Dam foundation treatment	7,288.0	4,976.7	12,264.7
	g) Dam embankment	36,048.3	15,089.5	51,137.8
	h) Spillway	28,229.4	33,384.7	61,614.1
	i) Trans-diversion canal	31,193.6	53,607.8	84,801.4
	j) Trans-diversion tunnel	3,117.6	1,824.3	4,941.9
	k) Related facilities	16,351.7	3,545.3	19,897.0
	Subtotal	190,804.1	146,612.3	337,416.4
2.	Hydropower Station	35,951.5	6,196.0	42,147.6
3.	Domestic Water Supply	965.0	223.0	1,188.0
4.	Irrigation			
	a) Preparation works	600.0	400.0	1,000.0
	b) Diversion dam	29,340.0	13,474.0	42,814.0
	c) Irrigation canal	24,843.7	41,998.0	66,841.7
	d) Drainage	3,114.7	5,055.3	8.170.0
	e) On-Farm	572.9	7,565.4	8,138.3
	f) Structures for irrigation at power station	1,642.3	2,668.2	4,310.5
	Subtotal	60,113.6	71,160.9	131,274.5
5.	Roads	9,413.6	15,357.9	24,771.5
6.	ICC	980.2	2,531.2	3,511.4
7.	Drying Yard	1,837.4	3,208.6	5,046.0
	Total	300,065.4	245,290.0	545,355.4
8.	Land Aquisition (360 ha) (50 ha)	-	7,500.0	7,500.0
9.	O & M Facilities	12,470.0	4,820.0	17,290.0
10.	Administration and Engineering	43,600.0	21,400.0	65,00.0
11.	Agricultural Extension	460.0		460.0
	Total	356,595.4	279,010.0	635,605.4
12.	Physical Contingency	53,489.3	41,851.5	95,340.8
	Total	410,084.7	320,861.5	730,946.2
13.	Price Contingency	205,617.6	446,892.5	652,510.1
	TOTAL	615,702.3	767,754.0	1,383,456.3

COST BREAKDOWN FOR PREPARATORY WORKS

(Unit: ₱ '000)

Work Item	Q'ty	Unit	Foreign	Local	Total
Access Road for Catipayan Dam					
Construction of New Road	km	6.5	1,560.0	1,040.0	2,600.0
Existing	km	4.0	480.0	320.0	800.0
Total			2,040.0	1,360.0	3,400.0
Access Road for Diversion Dam					
Asue Diversion Dam	km	1.0	240.0	160.0	400.0
Bakabak Diversion Dam	km	1.5	360.0	240.0	600.0
Total			600.0	400.0	1,000.0

COST BREAKDOWN FOR BY-PASS TUNNEL

(Unit: ₱ '000)

Work Item	Unit	Q'ty	Unit ₱	Foreign Cost	Local Cost	Total
Access Road for Catipayan Dam						
Stripping (common)	m^3	9,320.0	33.90	231.9	84.1	316.0
Excavation (common)	m^3	37,280	33.90	927.0	336.6	1,263.8
Excavation Rock	m^3	36,600	96.00	2,457.0	1,056.6	3,531.0
Backfill	m^3	3,650	20.95	56.6	19.9	76.5
Concrete A	m^3	2,470	2,105.00	1,859.0	3,340.3	5,199.3
Tunnel Excavaion (no support)	m^3	6,510	503.80	2,263.3	1,016.3	3,279.6
Tunnel Excavation (light support)	m^3	8,160	673.00	3,568.0	1,923.6	5,491.6
Tunnel Excavation (heavy support)	m^3	840	881.00	501.5	238.5	740.0
Tunnel Concrete Lining	m^3	5,760	1,420.00	5,244.2	2,935.0	8,179.2
Reinforcing Bars	kg	203,260	10.30	1,674.9	418.7	2,093.6
Concrete Plug	m^3	1,790	1,465.00	1,111.2	1,511.2	2,622.4
Metal Work	kg	10,000	25.00	200.0	50.0	250.0
Tunnel Grouting						
Drilling	Lm	650	484.00	186.6	128.0	314.6
Grout	Lm	650	801.00	309.7	210.9	520.6
Subtotal				20,591.1	13,269.7	33,860.8
Temporary Works	L.S.			1,029.5	663.5	1,693.0
Total Cost				21,620.6	13,933.2	35,553.8

TABLE XI-5
TABLE XI-6

COST BREAKDOWN FOR DAM EXCAVATION

(Unit: ₱ '000)

Work Item	Unit	Q'ty	Unit ₱	Foreign Cost	Local Cost	Total
Excavation						
Stripping	m^3	26,260	33.90	653.3	236.9	890.2
Common	m^3	105,020	33.90	2,611.8	948.3	3,560.1
Rock	m^3	26,200	96.00	1,758.8	756.4	2,515.2
Spillway						
Stripping	m^3	15,990	33.90	397.8	144.2	542.0
Common (Out off trench)	m^3	143,910	44.00	4,701.5	1,630.5	6,332.0
Rock	m^3	335,400	96.00	22,515.4	9,683.0	32,198.4
Subtotal				32,638.6	13,399.3	46,037.9
Temporary Works	L.S			1,631.9	670.0	2,301.9
Total				34,270.5	14,069.3	48,339.8

COST BREAKDOWN FOR DAM FOUNDATION TREATMENT

(Unit: ₱ '000)

Work Item	Unit	Q'ty	Unit ₱	Foreign Cost	Local Cost	Total
Grouting						
Drilling	L.m.	9,090	484.00	2,609.6	1,790.0	4,399.6
Grouting	L.m.	9,090	801.00	4,331.4	2,949.7	7,281.1
Subtotal				6,941.0	4,739.7	11,680.7
Temporary Works	L.S.			347.0	237.0	584.0
Total				7,288.0	4,976.7	12,264.7

COST BREAKDOWN FOR COFFERDAM

(Unit: ₱ '000)

Work Item	Unit	Q'ty	Unit ₱	Foreign Cost	Local Cost	Total
Excavation						
Stripping (common)	m^3	10,000	33.9	248.8	90.2	339.0
Common	m^3	40,000	33.9	994.8	361.2	1,356.0
Rock	m^3	3,180	96.0	213.5	91.8	305.3
Embankment						
Impervious	m^3	31,740	48.5	1,136.3	403.1	1,539.4
Rock	m^3	89,410	107.0	6,704.0	2,862.9	9,566.9
Riprap	m^3	5,990	197.0	569.8	610.3	1,180.1
				(8,410.1	3,876.3	12,286.4)
Subtotal				9,867.2	4,419.5	14,286.7
Temporary Works	L.S			493.3	221.0	714.3
Total				10,360.5	4,640.5	15,001.0

COST BREAKDOWN FOR DAM EMBANKMENT

(Unit: ₱ '000)

Work Item	Unit	Q'ty	Unit ₱	Foreign Cost	Local Cost	Total
Impervious						
From Quarry	m^3	35,520	48.5	1,271.6	451.1	1,722.7
From Excavation	m^3	70,000	40.0	2,037.7	726.3	2,800.0
Filter	m^3	40,050	172.9	4,889.3	2,035.3	6,924.6
Rock Fill						
From Quarry	m^3	141,760	107.00	10,629.2	4,539.2	15,168.3
From Excavation	m^3	170,000	52.0	6,548.4	2,291.6	8,840.0
Transition	m^3	195,880	51.15	7,380.8	2,638.5	10,019.3
Riprap	m^2	15,600	197.00	1,483.9	1,589.3	3,073.2
Gravel Bedding	m^3	400	233.5	54.2	39.2	93.4
Gravel and Surfacing	m^3	300	203.45	36.6	24.5	61.0
Subtotal				34,331.7	14,371.0	48,702.7
Temporary Works	L.S			1716.6	718.5	2,435.1
Total				36,048.3	15,089.5	51,137.8

COST BREAKDOWN FOR SPILLWAY

(Unit: ₱ '000)

Work Item	Unit	Q'ty	Unit ₱	Foreign Cost	Local Cost	Total
Excavation 1/						
Structure Backfill	m^3	6,100	20.95	94.6	33.2	126.8
Riprap	m^3	14,000	197.0	1,331.7	1,426.3	2,758.0
Class A Concrete (wall)	m^3	15,080	2,105.0	11,349.8	20,393.6	31,743.4
- do - (invert)	m^3	8,710	1,601.2	6,025.4	7,921.0	13,946.4
Reinforcing Steel Bars	kg	981,020	10.30	8,083.6	2,020.9	10,104.5
Subtotal				26,885.1	31,795.0	58,680.1
Temporary Works	L.S.			1,344.3	1,589.7	2,934.0
Total				28,229.4	33,384.7	61,614.1

Note 1/ Other excavation such as common and rock excavation are considered as Borrow and Quarry Works for Dam. (Refer to TABLE XI-5)

COST BREAKDOWN FOR TRANS-DIVERSION CANAL

(Unit: ₱ '000)

Work Item	Unit	Q'ty	Unit ₱	Foreign Cost	Local Cost	Total
Excavation	m^3	21,550	40.0	3,275.6	5,344.4	8,620.0
Compacted Fill (only)	m^3	21,550	24.0	1,655.0	3,517.0	5,172.0
Compacted Fill	m^3	30,000	49.0	5,586.0	9,114.0	14,700.0
Class A Concrete	m^3	1,685	2,978.0	19,068.1	31,111.2	50,179.3
Concrete Canal Lining	m^3	10	1,007.0	4.9	5.2	10.1
Grouted Riprap	m^3	150	524.0	32.2	46.4	78.6
Turfing	m^2	18,050	10.5	-	1,895.3	1,895.3
Subtotal				29,621.8	51,033.5	80,655.3
Tunnel						
Excavation						
No support	m^3	1,230	503.80	427.6	192.0	619.6
Light support	m^3	1,650	673.00	721.5	389.0	1,110.5
Heavy support	m^3	810	881.00	483.6	230.0	713.6
Lining	m^3	1,450	1,420.00	1,320.2	738.8	2,059.0
Reinforcing Bar	kg	19,800	10.30	16.3	187.6	203.9
Subtotal				2,969.2	1,737.4	4,706.6
Gate	m^3					
Syphon 1500mmx1500mmx4	m^3			59.68	14.92	74.6
2200mmx3000mmx2	m^3			23.04	5.76	28.8
Screen	kg	1,200		3.60	0.90	4.5
Catipayan Area	ha	100				
Subtotal				86.3	21.6	107.9
(Gate				63.3	15.8	79.1)
Subtotal				32,677.3	52,792.5	85,469.8
Temporary Works	L.S.			1,033.9	2,639.6	4,273.5
Total				34,311.2	55,432.1	89,743.3

COST BREAKDOWN FOR RELATED STRUCTURES OF DAM AND TRANS-DIVERSION CANAL

(Unit: ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
1) Related Structures of Dam					
Class "A" Concrete	300	m^3	339.5	553.9	893.4
Iron Pipe: 1,300m/m	55	t	3,520.0	880.0	4,400.0
Slide Valve: 1,300m/m	2	nos.	5,875.0	-	5,875.0
Control Instrument		L.S.	2,250.0	-	2,250.0
Subtotal			11,984.5	1,433.9	13,418.4
2) Related Structures of Trans-diversion Canal					
Excavation (indurated)	10,700	m^3	231.8	378.1	609.9
Compacted Fill	4,550	m^3	34.9	74.3	109.2
Plain Riprap	410	m^3	46.9	83.4	130.3
Grouted Riprap	20	m^3	2.7	3.9	6.6
Class "A" Concrete	650	m^3	735.6	1,200.1	1,935.7
Iron Pipe: 1,200m/m	8.3	t	531.2	132.8	664.0
Jet Flow Gate: 900m/m	1	nos.	2,625.0	-	2,625.0
Subtotal			4,208.1	1,872.6	6,080.7
Miscellaneous		L.S.	159.1	238.8	397.9
Total			16,351.7	3,545.3	19.897.0

COST BREAKDOWN FOR HYDROPOWER STATION

(Unit: P '000)

Item	Q'ty	Unit	Foreign	Local	Total
1) Dam Site Power Station					
Excavation (Indurated)	200	m^3	3.6	7.8	11.4
Compacted Fill	100	m^3	0.8	1.6	2.4
Class "A" Concrete	400	m^3	452.7	738.5	1,191.2
Steel Pipe	6.9	t	441.6	110.4	552.0
Generator	1	nos.	12,626.0	-	12,626.0
Transmission	1	nos.	500.0	-	500.0
Temporary Works		L.S.	43.3	172.4	215.7
Subtotal			14,068.0	1,030.7	15,098.7
2) Canal Route Power Station					
Excavation	6,100	m^3	128.6	219.1	347.7
Compacted Fill	100	m^3	0.8	1.6	2.4
Class "A" Concrete	800	m^3	905.3	1,477.1	2,382.4
Steel Pipe	77	t	4,928.0	1,232.0	6,160.0
Gate	7.5	t	288.0	72.0	360.0
Grouted Riprap	90	m^3	19.4	27.8	47.2
Generator	1	nos.	13,666.0	-	13,666.0
Transmission	1	nos.	600.0	-	600.0
Temporary Works		L.S.	379.2	1,516.8	1,896.0
Subtotal			20,915.3	4,546.4	25,461.7
3) Transmission Line		L.S.	968.2	619.0	1,587.2
Total			35,951.5	6,196.1	42,147.6

COST BREAKDOWN FOR DIVERSION DAM

(Unit : ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
Asue Diversion Dam					
Excavation	2,600	m^3	39.5	64.5	104.0
Compacted Fill	1,750	m^3	13.4	28.6	42.0
Filling Around Structure	340	m^3	1.4	27.2	28.6
Class "A" Concrete	550	m^3	622.4	1,015.5	1,637.9
Plain Concrete	60	m^3	24.2	43.0	67.2
Grouted Riprap	89	m^3	17.2	24.7	41.9
Gabion	360	m^2	18.8	33.4	52.2
Metalworks	12	t	94.6	23.6	118.2
Rubber Dam (12.0x2.4)	1	set	1,983.0	-	1,983.0
Sluice Gate (2.0x1.4)	4	sets	70.4	17.6	88.0
Subtotal			2,884.9	1,278.1	4,163.0
Miscellaneous		L.S.	74.1	49.9	124.0
Total			2,959.0	1,328.0	4,287.0

COST BREAKDOWN FOR DIVERSION DAM

(Unit: ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
Bakabak Diversion Dam					
Excavation	5,200	m^3	79.0	129.0	208.0
Compacted Fill	2,000	m^3	18.2	29.8	48.0
Filling Around Structure	450	m^3	1.9	35.9	37.8
Class "A" Concrete	3,170	m^3	3,587.3	5,853.0	9,440.3
Plain Concrete	320	m^3	129.0	229.4	358.4
Grouted Riprap	90	m^3	19.3	27.8	47.1
Gabion	2,400	m^2	125.4	222.6	348.0
Metalworks	40	t	315.3	78.7	394.0
Rubber Dam (27.6x3.0)	2	sets	7,626.0	-	7,626.0
Sluice Gate (1.0x1.0)	1	set	10.1	2.6	12.7
(1.5x1.0)	1	set	11.9	3.0	14.9
Subtotal			11,923.4	6,611.8	18,535.2
Miscellaneous			357.6	198.2	555.8
Total			12,281.0	6,810.0	19,091.0

COST BREAKDOWN FOR DIVERSION DAM

(Unit : ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
Gubaton Diversion Dam					
Excavation	7,900	m^3	120.1	195.9	316.0
Compacted Fill	6,800	m^3	62.0	101.2	163.2
Filling Around Structure	1,400	m^3	5.9	111.7	117.6
Class "A" Concrete	2,370	m^3	2,682.0	4,375.9	7,057.9
Plain Concrete	160	m^3	64.5	114.7	179.2
Grouted Riprap	160	m^3	34.4	49.4	83.8
Gabion	1,000	m^2	52.2	92.8	145.0
Metalwork	38	t	299.4	74.9	374.3
Rubber Dam (20.0x5.0)	1	set	10,417.0	-	10,417.0
Sluice Gate (1.5x1.2)	1	set	13.2	3.3	16.5
Subtotal			13,750.7	5,119.8	18,870.5
Miscellaneous			349.3	216.2	565.5
Total			14,100.0	5,336.0	19,436.0

COST BREAKDOWN FOR IRRIGATION SYSTEM

(Unit: P '000)

Item	Q'ty	Unit	Foreign	Local	Total
Main Canal					
Excavation	200,900	m^3	3,053.7	4,982.3	8,036.0
Compacted Fill	172,000	m^3	3,202.6	5,225.4	8,428.0
Class "A" Concrete	3,940	m^3	4,458.7	7,264.6	11,733.3
Grouted Riprap	410	m^3	88.1	126.7	214.8
RC Pipe: 42"	340	m	184.5	244.6	429.1
36"	90	m	40.5	63.3	103.8
18"	160	m	30.4	38.7	69.1
Sluice Gate (2.0x1.6)	6	nos.	109.4	27.4	136.8
(1.8x1.2)	6	nos.	89.5	22.4	111.9
(1.5x1.0)	23	nos.	274.2	68.5	342.7
(1.2x0.8)	10	nos.	101.3	25.3	126.6
(0.6x0.4)	31	nos.	63.7	16.0	79.7
18"	31	nos.	62.5	15.6	78.1
Turfing	179,200	m^2	-	1,881.6	1,881.6
Total			11,759.1	20,012.4	31,771.5

COST BREAKDOWN FOR IRRIGATION SYSTEM

(Unit : ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
Lateral Canal					
Excavation	108,000	m^3	1,641.6	2,678.4	4,320.0
Compacted Fill	228,700	m^3	4,258.4	6,947.9	11,206.3
Class "A" Concrete	4,050	m^3	4,583.1	7,477.8	12,060.9
Grouted Riprap	800	m^3	171.9	247.3	419.2
RC Pipe : 42"	1,060	m	575.2	762.5	1,337.7
36"	250	m	112.3	175.9	288.2
30"	380	m	135.8	212.3	348.1
24"	310	m	82.7	119.1	201.8
18"	830	m	153.8	204.7	358.5
Sluice Gate (1.5x1.0)	40	nos.	476.8	119.2	596.0
(1.2x0.8)	12	nos.	121.5	30.4	151.9
(1.0x0.6)	38	nos.	157.2	39.3	196.5
(0.8x0.6)	25	nos.	89.0	22.3	111.3
(0.6x0.4)	129	nos.	265.2	66.3	331.5
18"	129	nos.	260.1	65.0	325.1
Turfing	268,300	m^2	-	2,817.2	2,817.2
Total			13,084.6	21,985.6	35,070.2

COST BREAKDOWN FOR DRAINAGE SYSTEM

(Unit: ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
Excavation	96,300	m^3	1,463.8	2,388.2	3,852.0
Compacted Fill	13,100	m^3	243.9	398.0	641.9
Class "A" Concrete	750	m^3	848.7	1,384.8	2,233.5
Grouted Riprap	240	m^3	51.6	74.2	125.8
Canal Lining	990	m^3	488.5	508.4	996.9
Concrete Demolition	200	m^3	18.2	29.8	48.0
Turfing	25,900	m^2	-	271.9	271.9
Total			3,144.7	5,055.3	8,170.0

COST BREAKDOWN FOR ON-FARM DEVELOPMENT OF AREAS

(Unit: ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
Flat Area	4,600	ha	363.4	4,204.4	4,567.8
Hilly Area	2,160	ha	209.5	3,361.0	3,570.5
Total			572.9	7,565.4	8,138.3

COST BREAKDOWN FOR ON-FARM DEVELOPMENT OF HILLY AREA

Hilly Area: (Unit : ₱)

Item	Unit	Q'ty	Unit P	F.C.	L.C.	Total
MFD						
Newly cons.		1,650				
Partly rep. (1,500 x 0.2)		300				
	m	1,950	17	-	33,150	33,150
SFD						
Newly cons.		5,060				
Partly rep. (1,200 x 0.2)		240 472				
	m	5,300	16	-	84,800	84,800
FACILITIES						
Class "A" Concrete	m^3	5.15	2,427	5,750	6,749	12,499
Lumber	m^2	8.2	105	-	861	861
RC Pipe : 18"	m	12	353	2,203	2,033	4,236
Total				7,953	127,593	135,546
Cost per hectare (Total/144ha)				97	1,556	1,653

Note 1: Analysis listed above was conducted for sample area of 82ha.

Note 2: Unit cost applied above is the cost for force account work.

COST BREAKDOWN FOR ON-FARM DEVELOPMENT OF FLAT AREA

Flat Area: (Unit : ₱)

Item	Unit	Q'ty	Unit P	F.C.	L.C.	Total
MFD						
Newly cons.		1,340				
Partly rep. (1,220 x 0.2)		244				
	m	1,584	17	-	26,928	26,928
SFD						
Newly cons.		4,430				
Partly rep. (2,360 x 0.2)		472 472				
	m	4,902	16	-	78,432	78,432
FARM DRAIN						
	m	780	16	-	12,480	12,480
FACILITIES						
Class "A"	m^3	7.6	2,427	8,485	9,960	18,445
Concrete						
Lumber	m^2	9.9	105	-	1,040	1,040
RC Pipe : 18"	m	16	353	2,940	2,708	5,648
Total				11,425	131,548	142,973
Cost per hectare (Total/144ha)				79	914	993

Note 1: The above analysis above was conducted for sample area of 144ha.

Note 2: Unit cost applied above is the cost for force account work.

COST BREAKDOWN FOR IRRIGATION STRUCTURES AT CANAL ROUTE POWER STATION

(Unit: ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
Excavation	6,000	m^3	91.2	148.8	240.0
Compacted Fill	4,400	m^3	81.9	133.7	215.6
Class "A" Concrete	1,280	m^3	1,448.5	2,363.3	3,811.8
Gravel Surfacing	150	m^3	12.5	20.4	32.9
Sluice Gate (0.6x0.4)	2	sets	4.1	1.0	5.1
18"	2	sets	4.1	1.0	5.1
Total			1,642.3	2,668.2	4,310.5

COST BREAKDOWN FOR ROAD SYSTEM

(Unit: ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
Compacted Fill	102,000[1/]	m^3	1,899.2	3,098.8	4,998.0
Gravel Surfacing	78,700	m^3	6,549.4	10,685.9	17,235.3
Class "A" Concrete	840	m^3	950.6	1,550.9	2,501.5
RC Pipe 30"	40	m	14.4	22.3	36.7
Total			9,413.6	15,357.9	24,771.5

1/ Excludes works for O & M road of irrigation facilities

TABLE XI-19
(1 of 3)
(2 of 3)
(3 of 3)

COST BREAKDOWN FOR INTEGRATED COMMUNITY CENTER AND DRYING YARD

(Unit: ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
Integrated Community Center					
Pond with shallow well	100	nos.	980.2	2,531.2	3,511.4
Drying Yard					
Drying Yard	151	nos.	1,837.4	3,208.6	5,046.0

(Unit: ₱)

Item	Q'ty	Unit	Foreign	Local	Total
Integrated Community Center					
Class "A" Concrete	0.8	m^3	905	1,477	2,382
Mass Concrete	4.5	m^3	1,814	3,226	5,040
5" Pipe	5	m	572	528	1,100
Grouted Riprap	8	m^3	1,719	2,473	4,192
Fence	50	m	365	3,385	3,750
Excavation	230	m^3	3,496	5,704	9,200
Compacted Fill	50	m^3	931	1,519	2,450
Shallow Well	2	nos.	-	7,000	7,000
Total			9,802	25,312	35,114

(Unit: ₱)

Item	Q'ty	Unit	Foreign	Local	Total
Drying Yard					
Mass Concrete	28.8	m^3	11,615	20,650	32,265
Clearing & Grubbing	288.0	m^2	553	599	1,152
Total			12,168	21,249	33,417

COST BREAKDOWN FOR STRUCTURES OF DOMESTIC WATER SUPPLY

(Unit: ₱ '000)

Item	Q'ty	Unit	Foreign	Local	Total
6" Pipe (with installation)	1,500	m	654.0	163.5	817.5
Sluice Valve	3	nos.	19.4	1.0	20.4
Blow Off	2	nos.	12.9	0.7	13.6
Air Valve	3	nos.	40.5	2.1	42.6
Screen Facility	1	nos.	200.0	50.0	250.0
Check Valve	1	nos.	9.0	0.5	9.5
Subtotal			9.0	0.5	9.5
Miscellaneous			29.2	5.2	34.4
Total			965.0	223.0	1,188.0

LABOR COST (OCT. 31, 1984)

Unit: ₱/day

ITEMS	Basic Pay + 10%	Living Allowance	Incentive Allowance	Amelioration Allowance	E P S A	Earned Leave	Labor Cost
1. Laborer	16.42	25.00	1.87	1.64	7.60	1.87	54.40
2. Skilled Laborer	29.81	25.00	3.39	2.98	6.38	3.39	70.95
3. General Foreman	40.18	25.00	4.57	4.02	5.44	4.57	83.78
4. Carpenter	26.98	25.00	3.07	2.70	6.64	3.07	67.46
5. Head, Carpenter	36.37	25.00	4.13	3.64	5.78	4.13	79.05
6. Mason	24.42	25.00	2.78	2.44	6.87	2.78	64.29
7. Mason Foreman	26.98	25.00	3.07	2.70	6.64	3.07	67.46
8. Steelman	26.98	25.00	3.07	2.70	6.64	3.07	67.46
9. Head, Steelman	32.92	25.00	3.74	3.29	6.10	3.74	74.79
10. Welder	26.98	25.00	3.07	2.70	6.64	3.07	67.46
11. C.E. Aide	26.98	25.00	3.07	2.70	6.64	3.07	67.46
12. Driver, General	29.81	25.00	3.39	2.98	6.38	3.39	70.95
13. Driver, Light Eqpt.	26.98	25.00	3.07	2.70	6.64	3.07	67.46
14. Driver, Heavy Eqpt.	32.92	25.00	3.74	3.29	3.74	6.10	74.79
15. Electrical Worker	26.98	25.00	3.07	2.70	6.64	3.07	67.46
16. Electrical Worker	26.98	25.00	3.07	2.70	6.64	3.07	67.44
17. Head, Mechanical	40.18	25.00	4.57	4.02	5.44	4.57	83.78
18. Driller	32.92	25.00	3.74	3.29	6.10	3.74	74.79
19. Blaster	104.73	25.00	11.90	10.47	0.00	11.90	161.73
20. Explosive Worker	46.71	25.00	5.31	4.67	4.84	5.31	91.84
21. Watchman	22.11	25.00	2.51	2.21	7.08	2.51	61.42
22. Janitor	16.42	25.00	1.87	1.64	7.60	1.87	54.40
23. Asphalt Mixer	16.42	25.00	1.87	1.64	7.60	1.87	54.40
24. Mechanic	24.53	25.00	3.07	2.70	6.64	3.07	67.46

EQUIPMENT RENTAL RATE[1/]

Items	Rate
Bulldozer 180 HP (with ripper)	₱497.00/hr.
Bulldozer 180 HP (without ripper)	547.00/hr.
Bulldozer 160 HP	448.00
Bulldozer 140 HP D60A/D65	347.00
Bulldozer D50P/D40 P	281.00
Front End Loader	
1.15 cu.m. - 1.45m^3	156.00
1.5m^3 - 2.00m^3	200.00
3.0m^3 - 3.5m^2	352.00
Computer Spreader S.P 16t	274.00
Roller, Static 2 & 3 Drum	
5 - 10t	115.00
11 - 20t	139.00
Roller, Vibrating S.P	
1 - 3t	73.00
4 - 8t	210.00
Roller, Pneumatic	
10 - 19t	90.00
20 - 30t	150.00
Hauling Equip.	
Truck-tractor w/Trailer Low/High bfd	
Trailer (4 hours minimum)	210.00
Dump Truck	85.00
2.5 - 4.0m^2	110.00
4.5 - 6.5m^3	140.00
7.0 - 9.0m^2	
Truck-Cargo	
6 - 8t	90.00
9 -10t	115.00
6t w/3t Crane	120.00
8t w/3t "	145.00
11 - 12t	125.00
Concrete Mixer	
0.16m^3	20.00
0.30m^3	25.00
0.30m^3 & Bagger w/Charger	28.00
Vibrator, Concrete	30.00
Pump Grout	55.00
Compressor	
601 - 700 LFM	171.00
501 - 600	155.00
Rock Drill Machine (air)	40.00
Drilling Machine (air)	80.00
Generating Machine	
151 - 200 KW	130.00
101 - 150	100.00
Crushing and Screening Plant	2,300.00/mo. x rated
25 TPH (40m^3/hr.)	Capacity in m3/hr.
Washing and Screening Plant	1,500 w/mo. x rated
20 TPH (32 m3/hr.)	Capacity in m3/hr.
Mixer Truck, Mounted	
3 - 45m^3	175.00/hr.

1/ (used in the derivation of Unit Cost and based on NIA rental rates as of October, 1984).

ESTIMATE OF CONSTRUCTION UNIT COST FOR IRRIGATION FACILITIES

ITEM	UNIT	TOTAL UNIT COST		(%) PERCENTAGE OF Foreign Component	
		Force Account Work	Contract Work	Force Account Work	Contract Work
A. DIVERSION AND INTAKE WORKS					
1. Class A concrete (3000 psi)	cu.m.	2,427.00	2,978.00	46	38
2. Plain riprap	cu.m.	263.00	318.00	44	36
3. Grouted riprap	cu.m.	431.00	524.00	49	41
4. Rubble masonry	cu.m.	743.00	910.00	40	32
5. Filter drain	cu.m.	277.00	336.00	43	35
6. Structure excavation	cu.m.	25.00	30.00	26	22
7. Pipe works (furnish & install)					
a) 36"ϕ R.C. pipes	l.m.	946.00	1,153.00	48	39
b) 42"ϕ R.C. pipes	l.m.	1,028.00	1,262.00	53	43
c) 48"ϕ R.C. pipes	l.m.	1,330.00	1,658.00	50	40
8. Backfill around structures	cu.m.	73.00	84.00	06	05
9. Pipe railing	l.m.	236.00	292.00	71	57
B. DISTRIBUTION SYSTEM					
1. Clearing and grubbing	sq.m.	3.00	4.00	64	48
2. Excavation					
a) common	cu.m.	18.00	22.00	46	38
b) indurated	cu.m.	48.00	57.00	44	37
3. Compacted fill only	cu.m.	20.00	24.00	38	32
4. Compaction w/bar & overhauling	cu.m.	59.00	73.00	55	44
5. Concrete canal lining	cu.m.	814.00	1,007.00	61	49
6. Class A concrete (3000 psi)	cu.m.	2,427.00	2,978.00	46	38
7. Plain riprap	cu.m.	263.00	318.00	44	36
8. Grouted riprap	cu.m.	431.00	524.00	49	41
9. Pipe works (furnish & install)					
a) 18"ϕ R.C. pipe	l.m.	353.00	432.00	54	44
b) 24"ϕ R.C. pipe	l.m.	532.00	651.00	50	41
c) 30"ϕ R.C. pipe	l.m.	752.00	916.00	47	39

ESTIMATE OF CONSTRUCTION UNIT COST FOR IRRIGATION FACILITIES (cont'd)

ITEM	UNIT	TOTAL UNIT COST		(%) PERCENTAGE OF Foreign Component	
		Force Account Work	Contract Work	Force Account Work	Contract Work
10. Concrete demolition	cu.m.	196.00	240.00	47	38
11. Compacted fill w/hauling fr. quarry	cu.m.	74.00	91.00	56	46
12. Pipe drain (4"ø G.I. pipe)	m.	-	220.00	-	52
13. Gates w/hoisting & installation	ton	-	48,000.00	-	80
14. Miscellaneous metalworks	ton	-	24,000.00	-	80
15. Trash rack	sq.m.	-	385.00	-	80
16. Right of way and damages	ha.	-	-	-	-
C. SERVICE, ACCESS ROADS, DRAINAGE AND ON-FARM FACILITIES					
1. Excavation					
a) common	cu.m.	18.00	22.00	46	38
b) indurated	cu.m.	48.00	57.00	44	37
2. Compacting fill only	cu.m.	20.00	24.00	38	32
3. Compaction w/bar & overhauling	cu.m.	59.00	73.00	55	44
4. Gravel/selected materials surfacing	cu.m.	178.00	219.00	46	38
5. Mass concrete	cu.m.	1,028.00	1,120.00	40	36
6. Main farm ditch	m.	17.00	19.00	0	0
7. Supplementary farm ditch	m.	16.00	18.00	0	0
8. Farm drain	m.	7.00	8.00	0	0
9. Sand & gravel bedding under riprap	cu.m.	213.00	257.00	37	31
10. Gravel blanket	cu.m.	245.00	300.00	44	36

CONTRACT WORK : 1.25 (Subtotal)
25% Non-variable cost comprised of 10% Eng'ng & Supervision + 10% profit and 3% contractor's tax

FORCE ACCOUNT WORK: Subtotal 0.10 (Labor Cost)

FOREIGN COMPONENT:

Cement	= 75%
Steel Bars/Sheet Pipes	= 80%
Hardware	= 80%
Fuel & Oil	= 50%
Equipment Rental	= 75%

ESTIMATE OF CONSTRUCTION UNIT COST FOR DAM

Item	Unit	Total Unit Cost	(%) Percentage of Foreign Component
Dam Embankment			
Excavation (stripping, common)	m3	33.90	74
Cut-off-Trench (common)	m3	44.00	74
Excavation (rock)	m3	96.00	70
Drill Hole	LM	484.00	59
Grout Curtain	LM	801.00	59
Impervious Core			
a) From Quarry	m3	48.50	80
b) From Excavation	m3	40.50	73
Transition	m3	51.15	74
Rockfill			
a) From Quarry	m3	107.00	70
b) From Excavation	m3	52.00	74
Filter	m3	172.00	70
Riprap	m3	197.00	48
Gravel Bedding	m3	233.50	58
Gravel and Surfacing	m2	203.75	60
Spillway			
Excavation (common)	m3	33.90	74
Excavation (rock)	m3	96.00	70
Structure Backfill	m3	20.95	74
Rubble Masonry	m3	1'060.00	43
Class A Concrete (wall)	m3	2,105.00	36
Class A Concrete (invert)	m3	1,601.19	43
Class B Concrete	m3	1,465.00	42
Reinforcing Steel Bars	kg	10.30	80
By-pass			
Concrete Plug	m3	1,465.00	42
Tunnel Excav. (no support)	m3	503.80	69
Tunnel Excav. (light support)	m3	678.00	65
Tunnel Excav. (heavy support)	m3	881.35	67
Concrete Lining	m	1,420.00	64
Trash Rack and Misc. Metalwork	kg	25.00	80
Others			
Clearing and Grubbing	ha.	6,000.00	0
Reservoir Clearing	ha.	4,000.00	0
Right-of-Way & Damages	ha.	6,000.00	0

OPERATION AND MAINTENANCE FACILITIES COST

(Unit: ₱ '000)

Work Item	Unit	Q'ty	Rate ₱	Foreign Cost	Local Cost	Total
1. Building and Housing						
Main Project Office	m^2	1,000	3,000	1,800	1,200	3,000
Dam Operation Office	m^2	200	3,000	360	240	600
Laboratory	m^2	75	3,000	135	90	225
Housing for						
Government Staff	m^2	500	3,000	900	600	1,500
Guest	m^2	200	3,000	360	240	600
Consultant	m^2	250	3,000	450	300	750
Equipment Shed	m^2	1,000	2,000	1,200	800	2,000
Furniture	L.S.				860	860
2. Water Supply and Sewerage Installation						
Water Supply	L.S.			300	200	500
Sewerage	L.S.			360	240	600
3. Electricity						
Generator	L.S.			600		600
Distribution Facilities	L.S.			450		450
4. Equipment						
Bulldozer (11t)	nos.	1	950	950		950
Backhoe (0.35m^3)	nos.	1	925	925		925
Motor Grader (Blade 2.2m)	nos.	1	570	570		570
Dump Truck (4t)	nos.	2	235	470		470
Jeep	nos.	4	190	760		760
Motorcycle	nos.	12	10	120		120
Computor	L.S.		100	100		100
Radio Set	L.S.		160	160		160
Others	L.S.		1,000	1,000		1,000
Spare Parts	L.S.			500		500
5. Inland Transportation	L.S.				50	50
Total				12,470	4,820	17,290

TABLE XI-26
TABLE XI-27

ADMINISTRATION AND ENGINEERING COST

(Unit: ₱ '000)

Item	Foreign Cost	Local Cost	Total
1. Detail Design Stage			
1) Government Administration	-	2,400	2,400
2) Engineering Consultant	20,040	-	20,040
3) Survey Works	-	1,000	1,000
4) Training	1,250	-	1,250
2. Construction Stage			
1) Government Administration	-	18,000	18,000
2) Laboratory Equipment	600	-	600
3) Engineering Consultant	21,710	-	21,710
Total	43,600	21,400	65,000

ANNUAL OPERATION AND MAINTENANCE COST

(Unit: ₱ '000)

Description	Foreign Cost	Local Cost	Total
1. Salaries and Wages			
Staff Salaries	-	1,243	1,243
Wages (for canal clearing)	-	512	512
2. Office Expenses	-	-	240
3. Fuel for Vehicles and Equipment	48	48	96
4. Maintenance Cost			
Earthwork	-	100	100
Roads	-	250	250
Others	-	100	100
5. Miscellaneous Expenses	50	50	100
Total	98	2,543	2,641

PERSONNEL REQUIREMENT AND SALARY FOR OPERATION & MAINTENANCE

Item	Number	Unit Annual Salary (₱)	Total (₱)
Project Engineer	1	28,500	38,500
Engineer B	1	25,800	25,800
Administrative Section			
Cashier A	1	17,300	17,300
Heavy Equipment Operator	1	17,300	17,300
Accounting Clerk B	1	15,700	15,700
Driver B	5	15,700	78,500
Security Guard B	3	14,200	42,600
Mechanic B	1	14,200	14,200
Radio Operator B	1	14,200	14,200
Clerk B	2	12,900	25,800
Messenger	1	10,500	10,500
Janitor	1	8,700	8,700
Operation and Maintenance Section			
Engineer B	1	25,800	25,800
Irrigation Technician	1	23,400	23,400
Watermaster	9	14,200	127,800
Engineer Aide B	1	11,600	11,600
Gatekeeper	12	10,500	126,000
Ditch Tender	32	9,500	304,000
Collection Service Section			
Sr. Collection Representative	1	21,100	21,100
Collection Representative B	1	17,300	17,300
Billing Clerk	2	12,900	25,800
Agricultural Development Section			
Agronomist A	1	23,400	23,400
Farm Organization Specialist	9	14,200	127,800
Dam and Reservoir Section			
Engineer B	1	25,800	25,800
Engineer Aide B	5	11,600	58,000
Total	96		1,242,600 (1,243,000)

TABLE XI-29

REPLACEMENT COST AND USEFUL LIFE

(Unit: P '000)

Item	Useful Life (year)	Foreign Cost	Local Cost	Total
1. Rubber Dam	25	20,026	-	20,026
2. Gate				
- for intake of diversion dam	25	106	26	132
- for related structures of canals	25	2,070	518	2,588
- for dam and trans-diversion structures	25	63	16	79
- for the structure at the canal route power station	25	8	2	10
Subtotal		2,247	562	2,809
3. Equipment				
- for operation and maintenance	10	5,555	-	5,555
- for agricultural extension	10	460	-	460
Subtotal		6,015	-	6,015
4. Generator	25	26,292	-	26,292.0

DISBURSEMENT SCHEDULE

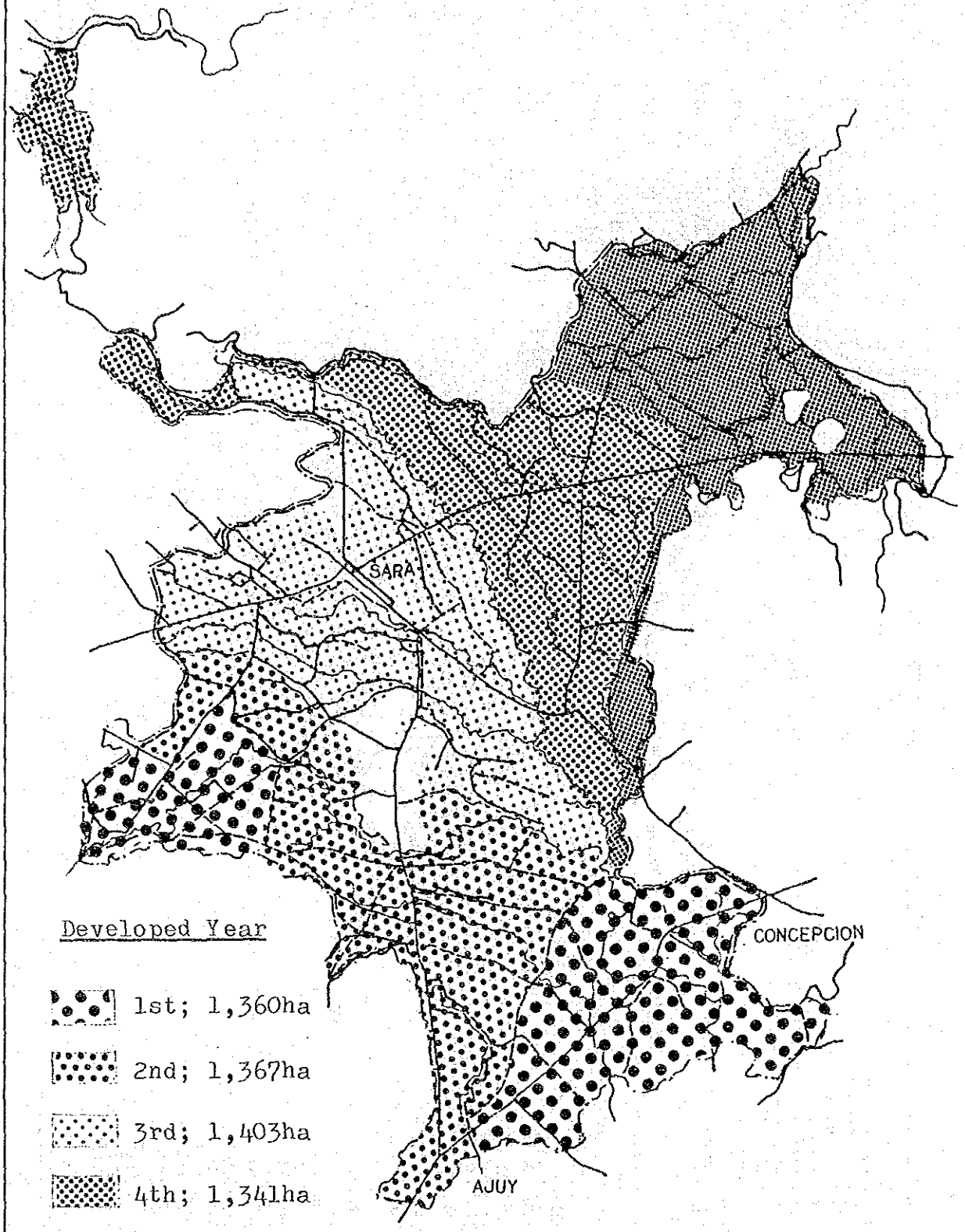
Description	1st			2nd			3rd			4th		
	F.C	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Dam												
1) Preparatory Works				2,040.0	1,360.0	3,400.0						
2) Diversion Tunnel				16,670.2	10,239.6	26,909.8	3,052.5	1,698.5	4,751.0			
3) Inlet Structure				283.9	181.0	464.9						
4) Cofferdam							10,360.5	4,640.5	15,001.0			
5) Dam Excavation							11,065.3	4,441.0	15,506.3			
6) Dam Foundation Treatment							7,288.0	4,976.7	12,264.7			
7) Dam Embankment										12,020.0	5,031.5	17,051.5
8) Spillway												
9) Trans-diversion Canal												
10) Trans-diversion Tunnel												
11) Related Facilities												
Subtotal				18,994.1	11,780.6	30,774.7	31,766.3	15,766.7	47,523.0	12,020.0	5,031.5	17,051.5
2. Hydropower Station												
3. Domestic Supply												
4. Irrigation												
1) Preparatory Works				600.0	400.0	1,000.0						
2) Diversion Dam							2,959.0	1,328.0	4,287.0	12,281.0	6,810.0	19,091.0
3) Irrigation Canal							2,767.3	4,681.7	7,449.0	4,392.0	7,525.3	11,917.3
4) Drainage							287.3	528.8	816.1	218.4	405.9	624.3
5) On-farm							108.5	1,278.3	1,386.8	113.0	1,428.0	1.541.6
6) Structures for Power Station												
Subtotal				600.0	400.0	1,000.0	6,122.1	7,816.8	13,938.9	17,004.4	16,169.8	33,174.2
5. Roads							3,859.4	6,296.2	10,155.6	1,182.1	1,928.6	3,110.7
6. ICC							196.2	506.4	702.6	196.0	506.2	702.2
7. Dry Yard							377.4	658.6	1,036.0	365.0	637.5	1,002.5
TOTAL				19,594.1	12,180.6	31,774.7	42,321.4	31,034.7	73,356.1	30,767.5	24,273.6	55,041.1
8. Land Aquisition (360 and 50ha)		300.0	300.0		7,200.0	7,200.0						
9. O & M Facilities				6,915.0	4,770.0	11,685.0						
10. Administration and Engineering	21,290.0	3,400.0	24,590.0	4,210.0	3,000.0	7,210.0	3,620.0	3,000.0	6,620.0	3,620.0	3,000.0	6,620.0
11. Agricultural Extension							460.0		460.0			
TOTAL	21,290.0	3,700.0	35,960.0	30,791.1	27,869.7	57,869.7	46,401.4	34,034.7	80,436.1	34,387.5	27,273.6	61,661.1
12. Physical Contingency	3,193.5	555.0	3,748.5	4,607.9	4,072.6	8,680.5	6,960.2	5,105.2	12,065.4	5,158.1	4,091.0	9,249.1
TOTAL	24,483.5	4,255.0	28,738.5	35,327.0	31,223.2	66,550.2	53,361.6	39,139.9	92,501.5	39,545.6	31,364.6	70,910.2
13. Price Contingency	3,158.4	2,310.5	5,468.9	8,125.1	22,761.7	30,887.8	18,186.7	36,634.9	54,831.2	17,835.1	36,633.9	54,469.0
TOTAL	27,641.9	6,565.5	34,207.4	43,984.9	53,984.9	97,437.0	71,557.9	75,774.8	147,332.7	57,380.7	67,998.5	125,379.2

DISBURSEMENT SCHEDULE

Description	5th			6th			7th			TOTAL		
	F.C	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1. Dam												
1) Preparation Works										2,040.0	1,360.0	3,400.0
2) Diversion Tunnel				1,897.9	1,995.1	3,893.0				21,620.6	13,933.2	35,553.8
3) Inlet Structure										283.9	181.0	464.9
4) Cofferdam										10,360.5	4,640.5	15,001.0
5) Dam Excavation	11,602.6	4,814.2	16,416.8	11,602.6	4,814.1	16,416.7				34,270.5	14,069.3	48,339.8
6) Dam Foundation Treatment										7,288.0	4,976.7	12,264.7
7) Dam Embankment	12,020.0	5,031.5	17,051.5	12,008.3	5,026.5	17,034.8				36,048.3	15,089.5	51,137.8
8) Spillway	14,114.7	16,692.3	30,807.0	14,114.7	16,692.4	30,807.1				28,229.4	33,384.7	61,614.1
9) Trans-diversion Canal	15,596.8	26,803.9	42,400.7	15,596.8	26,803.9	42,400.7				31,193.6	53,607.8	84,801.4
10) Trans-diversion Tunnel				3,117.6	1,824.3	4,941.9				3,117.6	1,824.3	4,941.9
11) Related Facilities				16,351.7	3,545.3	19,897.0				16,351.7	3,545.3	19,897.0
Subtotal	53,334.1	53,341.9	106,676.0	74,689.6	60,701.6	135,391.2				190,804.1	146,612.3	337,416.4
2. Hydropower Station				35,951.5	6,196.1	42,147.6				35,951.5	6,196.1	42,147.6
3. Domestic Supply				965.0	223.0	1,188.0				965.0	223.0	1,188.0
4. Irrigation												
1) Preparatory Works										600.0	400.0	1,000.0
2) Diversion Dam	14,100.0	5,336.0	19,436.0							29,340.0	13,464.0	42,814.0
3) Irrigation Canal	7,717.8	13,009.2	20,727.0	5,143.4	8,710.0	13,853.4	4,823.2	8,071.8	12,895.0	24,843.7	41,998.0	66,841.7
4) Drainage	1,096.4	1,547.5	2,643.9	1,266.6	2,123.5	3,390.1	246.0	449.6	695.6	3,114.7	5,055.3	8,170.0
5) On-farm	123.7	1,741.4	1,865.1	115.8	1,578.8	1,694.6	111.9	1,538.3	1,650.2	572.9	6,565.4	8,138.3
6) Structures for Power Station				1,642.3	2,668.2	4,310.5				1,642.3	2,668.2	4,310.5
Subtotal	23,037.9	21,634.1	44,672.0	8,168.1	15,080.5	23,248.6	5,181.1	10,059.7	15,240.8	60,113.6	71,160.9	131,274.5
5. Roads	1,602.8	2,615.0	4,217.8	1,185.4	1,933.8	3,119.2	1,583.9	2,584.3	4,168.2	9,413.6	15,357.9	24,771.5
6. ICC	196.0	506.2	702.2	196.0	506.2	702.2	196.0	506.2	702.2	980.2	2,531.2	3,511.4
7. Drying Yard	365.0	637.5	1,002.5	365.0	637.5	1,002.5	365.0	637.5	1,002.5	1,837.4	3,208.6	5,046.0
TOTAL	78,535.8	78,734.7	157,270.5	121,520.6	85,278.7	206,799.3	7,326.0	13,787.7	21,113.7	300,065.4	245,290.0	545,355.4
8. Land Aquisition (360 and 50ha)										-	7,500.0	7,500.0
9. O & M Facilities							5,555.0	50.0	5,605.0	12,470.0	4,820.0	17,290.0
10. Administration and Engineering	3,620.0	3,000.0	6,620.0	3,620.0	3,000.0	6,620.0	3,620.0	3,000.0	6,620.0	43,600.0	21,400.0	65,000.0
11. Agricultural Extension										460.0	-	460.0
TOTAL	82,155.8	81,714.7	163,890.5	125,140.6	88,278.7	213,419.3	16,501.0	16,837.7	33,338.7	356,595.4	279,010.0	635,605.4
12. Physical Contingency	12,323.3	12,260.2	24,5983.5	18,771.1	13,241.8	32,012.9	2,465.2	2,525.7	5,000.9	53,489.3	41,851.5	95,340.8
TOTAL	94,479.1	93,994.9	188,474.0	143,911.7	101,520.5	245,432.2	18,976.2	19,363.4	38,339.6	410,084.7	320,861.5	730,946.2
13. Price Contingency	51,869.0	134,318.7	186,187.7	92,391.3	174,615.3	267,006.6	14,042.4	39,617.5	53,659.9	205,617.9	446,892.5	652,510.1
TOTAL	146,348.1	228,313.6	374,661.7	236,303.0	276,135.8	512,438.8	33,018.6	58,980.9	91,999.5	615,702.3	767,754.0	1,383,456.3

FIG. XI-1

IMPLEMENTATION SCHEDULE OF ON-FARM DEVELOPMENT

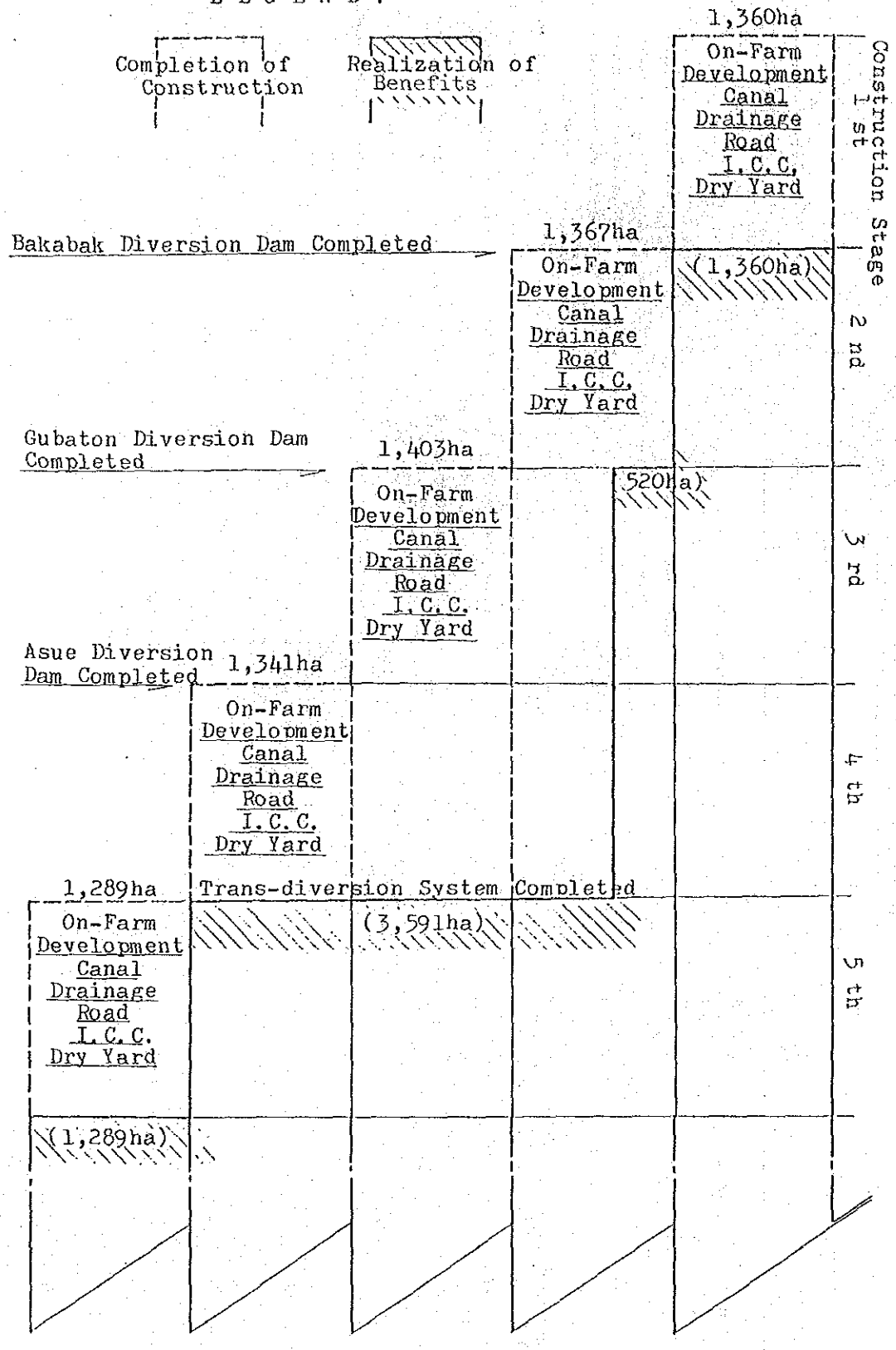


IMPLEMENTATION SCHEDULE FOR CONSTRUCTION

Item	Pre - Project Stage		Construction - Stage				
	1 st year	2 nd year	3 rd year	4 th year	5 th year	6 th year	7 th year
1) Dam							
Diversion Tunnel							
Coffer Dam							
Excavation							
Embankment							
Spillway							
Trans-diversion Canal							
Tunnel							
2) Hydropower Station							
3) Domestic Water Supply							
4) Irrigation and Drainage							
Diversion Dam			Bakabak D.D.	Gubaton D.D.	Asue D.D.		
Irrigation Canal							
Main Canal	Detail Design	Preparation Works	5,780 m	8,430 m	8,380 m	6,160 m	1,120 m
Lateral Canal			7,430 m	10,820 m	14,640 m	11,870 m	20,110 m
Drainage							
New Drainage Canal			6,400 m	5,300 m	2,500 m	2,100 m	5,200 m
Excavation of Creeks					1,500 m	4,500 m	
Drainage Structure					2 nos.	4 nos.	
Rehabil. for Up. of Asue R.					650 m		
Removal of Ex. Wiers							
On-Farm Development			1,360 ha	1,367 ha	1,403 ha	1,341 ha	1,289 ha
Facilities at H.P. Station							
5) Road (Excluding Service Road)							
New Road			6,750 m	1,350 m	900 m	2,400 m	3,900 m
Rehabil. for Ex. Road			3,700 m	800 m	1,400 m	100 m	
Related Structures			11 nos.	1 nos.	2 nos.	2 nos.	3 nos.
Enlargement of S. Road			2,160 m	1,910 m	5,620 m	2,910 m	
Along the Serruco CIS Canal			16,110 m				
6) Integrated Community Center			20 nos.	20 nos.	20 nos.	20 nos.	20 nos.
7) Dry Yard			31 nos.	30 nos.	30 nos.	30 nos.	30 nos.

FIG. XI-2

AGRICULTURAL BENEFIT REALIZATION



APPENDIX XII

PROJECT EVALUATION

APPENDIX XII

PROJECT EVALUAITON

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

Table 6-1-1 Estimation of Conversion Factor for Construction Works

(Unit: ₱/m³)

Items	1.Class "A" Concrete		2. Excavation		3. Compacted Fill	
	Financial	Economic	Financial	Economic	Financial	Economic
I. Foreign Currency						
1. Materials	892.34	892.34	-	-	-	-
- Cement	324.34	324.34	-	-	-	-
- Steel Bar	520.00	520.00	-	-	-	-
- Hardware	48.00	48.00	-	-	-	-
2. Fuel	57.68	57.68	2.42	2.42	3.31	3.31
3. Machinery (Rental)	172.97	172.97	12.27	12.27	16.76	16.76
Subtotal	1,122.99	1,122.99	14.69	14.69	20.07	20.07
II. Local Currency						
1. Materials	450.77	389.92	-	-	-	-
- Lumber *1	420.00	363.30	-	-	-	-
- Sand *1	1.18	1.02	-	-	-	-
- Gravel *1	29.59	25.60	-	-	-	-
2. Unskilled Labor *2	183.65	154.27	8.69	7.30	7.05	5.92
3. Skilled Labor *3	259.74	214.80	2.03	1.68	2.55	2.11
4. Engineering *3	238.26	197.04	3.19	2.64	3.86	3.19
5. Others *3	238.26	197.04	3.17	2.62	3.84	3.18
6. Tariff	365.45	-	5.49	-	7.50	-
- Materials	250.11	-	-	-	-	-
• Cement	108.11	-	-	-	-	-
• Steel Bar	130.00	-	-	-	-	-
• Hardware	12.00	-	-	-	-	-
- Fuel	57.69	-	2.42	-	3.31	-
- Machinery (Rental)	57.65	-	3.07	-	4.19	-
7. Other Tax	118.88	-	2.24	-	3.63	-
	(F1)	(E1)	(F2)	(E2)	(F3)	(E3)
Subtotal	1,855.01	1,153.07	24.81	14.24	28.43	14.40
TOTAL	2,978.00	2,276.06	39.50	28.93	48.50	34.47
Conversion Factor for Construction Works	E1/F1 = 0.622		E2/F2 = 0.574		E3/F3 = 0.507	

Note: Following conversion factors are applied to convert economic value.
*1 ... 0.865(capital good) *2... 0.840(consumption) *3... 0.827(construction)

Table 6-1-2 Financial and Economic Project Cost

(Unit: 000₱)

Items	Foreign Currency	Local Currency		Total Cost	
		Finan.	Econo.	Finan.	Econo.
1. Dam					
- Class "A" Concrete	38,340	62,834	39,083*1	101,174	77,423
- Excavation	45,337	23,276	13,361*2	68,613	58,698
- Compacted Fill	51,409	32,338	16,395*3	83,747	67,804
- Others	55,718	28,165	15,997*4	83,883	71,715
Subtotal	190,804	146,612	84,836	337,416	275,640
2. Hydropower Station	35,951	6,196	3,519*4	42,147	39,470
3. Sara Waterworks	965	223	127*4	1,188	1,092
4. Irrigation					
- Class "A" Concrete	18,231	29,745	18,501*1	47,976	36,732
- Excavation	6,489	10,587	6,077*2	17,076	12,566
- Compacted Fill	7,880	12,865	6,523*3	20,745	14,403
- Others	27,514	17,964	10,204*4	45,478	37,718
Subtotal	60,114	71,161	41,305	131,275	101,419
5. Road	9,414	15,358	8,723*4	24,772	18,137
6. Integrated Community Center	980	2,531	1,438*4	3,511	2,418
7. Dry Yard	1,837	3,209	1,823*4	5,046	3,660
8. Land Acquisition	-	7,500	-*5	7,500	-
9. Facilities for O & M	12,470	4,820	2,738*4	17,290	15,208
10. Administration & Engineering	43,600	21,400	12,155*4	65,000	55,755
11. Facilities for Agricultural Extension	460	-	-	460	460
12. Contingency	53,489	41,852	23,772*4	95,341	77,261
Total	410,084	320,862	180,436	730,946	590,520

Note: Following conversion factors are applied to convert economic value.

*1 .... 0.622 (Class "A" concrete)

*2 .... 0.574 (Excavation)

*3 .... 0.507 (Compacted Fill)

*4 .... 0.568 (Average of conversion factor for construction works)

*5 .... Economic value of farmland to be compensated is estimated as the net production value without Project.

Table 6-1-3 Financial and Economic Project Cost Stream

(Unit: 000$)

Items	1986	1987	1988	1989	1990	1991	1992	Total
A. Financial Cost								
1. Dam	-	30,775	47,523	17,051	106,676	135,391	-	337,416
2. Hydropower Station	-	-	-	-	-	42,147	-	42,147
3. Sara Waterworks	-	-	-	-	-	1,188	-	1,188
4. Irrigation	-	1,000	13,939	33,174	44,672	23,248	15,241	131,275
5. Road	-	-	10,156	3,111	4,218	3,119	4,168	24,772
6. Integrated Community Center	-	-	703	702	702	702	702	3,511
7. Dry Yard	-	-	1,036	1,003	1,002	1,003	1,002	5,046
8. Land Acquisition	300	7,200	-	-	-	-	-	7,500
9. Facilities for O & M	-	11,685	-	-	-	-	5,605	17,290
10. Administration & Engineering	24,690	7,210	6,620	6,620	6,620	6,620	6,620	65,000
11. Facilities for Agri-Extension	-	-	460	-	-	-	-	460
12. Contingency	3,749	8,680	12,065	9,249	24,584	32,013	5,001	95,341
Total	28,739	66,550	92,502	70,910	188,474	245,432	38,339	730,946
B. Economic Cost								
1. Dam	-	25,810	40,883	14,932	84,198	109,817	-	275,640
2. Hydropower Station	-	-	-	-	-	39,470	-	39,470
3. Sara Waterworks	-	-	-	-	-	1,092	-	1,092
4. Irrigation	-	832	10,659	26,389	35,594	16,921	11,024	101,419
5. Roads	-	-	7,435	2,278	3,088	2,284	3,052	18,137
6. Integrated Community Center	-	-	483	483	483	483	486	2,418
7. Dry Yard	-	-	751	727	727	727	728	3,660
8. Land Acquisition	-	-	-	-	-	-	-	-
9. Facilities for O & M	-	9,624	-	-	-	-	5,584	15,208
10. Administration & Engineering	23,221	5,914	5,324	5,324	5,324	5,324	5,324	55,755
11. Facilities for Agri-Extension	-	-	460	-	-	-	-	460
12. Contingency	3,509	6,921	9,860	7,482	19,287	26,292	3,910	77,261
Total	26,730	49,101	75,855	57,615	148,701	202,410	30,108	590,520

1.2 Operation and Maintenance Cost

Table 6-1-4 Financial and Economic Cost of Operation and Maintenance

(Unit: 000₱)

Items	Foreign Currency	Local Currency		Total	
		Financial	Economic	Financial	Economic
A. Without Project (Costs in the Existing Irrigation Area*1)					
1. Annual Cost	328	745	616*2	1,073	944
[Unit: ₱/ha]				[1,014]	[892]
2. Replacement Cost (useful year)					
a. Pump, 290 unit (25)	2,668	-	-	2,668	2,668
b. Engine, 290 unit(10)	957	-	-	957	957
B. With Project (Cost in 6,760 ha of Target Area)					
1. Annual Cost	98	2,543	2,103*2	2,641	2,201
[Unit: ₱/ha]				[391]	[326]
2. Replacement Cost (useful year)					
a. Facilities for Irrigation (25)	22,273	562	465*2	22,835	22,738
b. Equipment for Irrigation & Agriculture (10)	6,015	-	-	6,015	6,015
c. Facilities for Hydropower (25)	26,292	-	-	262,292	26,292

Note: *1 .... 1,058 ha of ordinary service are

*2 .... 0.827 of construction conversion factor is applied.

Table 6-1-5 Financial and Economic Cost Stream of Operation and Maintenance

(Unit: 000₱)

Year	Without Project				With Project						Incremental Cost
	O & M				O & M		Replacement Cost				
	Area (ha)	Cost	Replacement Cost	Total	Area (ha)	Cost	Facilities	Equipment	Power Plant	Total	
A. Financial											
1987	-	-	-	-	-	-	-	-	-	-	-
1988	1,058	1,073	202	1,275	1,360	531	-	-	-	531	-744
1989	1,058	1,073	202	1,275	1,880	734	-	-	-	734	-541
1990	1,058	1,073	202	1,275	1,880	734	-	-	-	734	-541
1991	1,058	1,073	202	1,275	5,471	2,137	-	-	-	2,137	862
1992 ~2035	1,058	1,073	202	1,275	6,760	2,641	-	-	-	2,641	1,366
1997	1,058	1,073	202	1,275	6,760	2,641	-	6,015	-	8,656	7,381
(Every 10 years) 2012	1,058	1,073	202	1,275	6,760	2,641	22,835	-	26,292	51,768	50,493
B. Economic											
1987	-	-	-	-	-	-	-	-	-	-	-
1988	1,058	944	202	1,146	1,360	443	-	-	-	443	-703
1989	1,058	944	202	1,146	1,880	613	-	-	-	613	-533
1990	1,058	944	202	1,146	1,880	613	-	-	-	613	-533
1991	1,058	944	202	1,146	5,471	1,784	-	-	-	1,784	638
1992 ~2035	1,058	944	202	1,146	6,760	2,201	-	-	-	2,201	1,055
1997	1,058	944	202	1,146	6,760	2,201	-	6,015	-	8,216	7,070
(Every 10 years) 2012	1,058	944	202	1,146	6,760	2,201	22,738	-	26,292	51,231	50,085

2. Project Benefits

2.1 Agricultural Benefits

2.1.1 Crop Benefit

Table 6-2-1 Farm-gate Prices of Agricultural Inputs and Outputs

Items	Unit	Financial	Economic
1. Wage Rate			
a. Without Project	₱/man-day	30.0	11.0
b. With Project	"	36.0	14.8
2. Crops			
a. Without Project			
- Paddy	₱/ton	2,650	2,835
- Sugarcane	"	301	473
- Coconut	"	6,000	5,040
b. With Project			
- Paddy	₱/ton	2,780	2,985
- Corn	"	3,340	2,806
- Vegetable(Tomato)	"	2,000	1,680
- Mungbean	"	8,000	6,720
3. Fertilizer			
- Urea	₱/ton	-	6,651
- Dap	"	-	8,301
- Potassium Choloride	"	-	3,021

Table 6-2-2 Economic Price of Paddy

Item	Unit	Economic Price
1) IBRD projection price in 1995 in 1983 constant price (5% broken white rice, FOB Bangkok)	US$/ton	327
2) Converted to 1984 constant price (x 1.035*1)	"	338
3) Converted to Philippines Pesos ($1= ₱20)	₱/ton	6,760
4) Average export price*2 (= FOB, Iloilo)	"	4,732
5) Shadow rate*3 of ₱120 for handling charge and others	"	-98
6) Shadow rate*4 of ₱80 for transportation charge from rice mill in the Project Area to Iloilo Port	"	-62
7) Shadow rate*3 of ₱85 for milling cost	"	-70
8) Shadow rate*3 of ₱130 for milling by-products	"	+107
9) Milled price of rice	"	4,609
10) Ex-milled price of rice	"	2,996
11) Shadow rate*4 of ₱15 for transportation cost	"	-11
12) Farm-gate price of paddy	" (US$/ton)	2,985 (149)

Note: *1 ... IBRD International Price Index

*2 ... Grade differential of average rice price from non-glutinous white rice 5% broken (FOB Bangkok) is estimated at 30%.

*3 ... 0.82 of standard conversion factor is applied to convert to economic price.

*4 ... 0.777 of conversion factor for transportation is applied to convert to economic price.

Table 6-2-3 Economic Price of Sugarcane

Items	Unit	Economic Price
1) IBRD projection price in 1995 in 1983 constant price	US$/ton	315
2) Converted to 1984 constant price (x 1.035 *1)	"	326
3) Converted to Philippines Pesos (US$1 = ₱20) (= FOB, Iloilo)	₱/ton	6,520
4) Shadow rate*2 of ₱120 for handling charge and others	"	-98
5) Shadow rate*2 of ₱960 for milling cost	"	-787
6) Shadow rate*3 of ₱200 for milling by-products (molasses)	"	+164
7) Sugar price at mill	"	5,799
8) Ex-milled price of sugarcane at mill *4	"	551
9) Shadow rate*3 of P100 for transportation cost	"	-78
10) Farm-gate price of sugercane	"	473

Note: *1 ... IBRD International Price Index.

*2 ... 0.820 of standard conversion factor is applied to convert to economic price.

*3 ... 0.777 of conversion factor for transportation is applied to convert to economic price.

*4 ... Recovery rate from sugarcane to sugar is estimated at 9.5%

Table 6-2-4 Economic Price of Fertilizer

Item	Unit	1. Urea	2. DAP	3. Potassium chloride
1. IBRD projection price in 1995 in 1984 constant price	US$/ton	260	294	100
2. Converted to 1984 constant price (x 1.035)	"	269	304	104
3. International transport and handling charge	"	30	70	30
4. CIF price, Iloilo port	"	299	394	134
5. Convert to Philippines Pesos (US$ 1 = ₱ 20)	₱/ton	5,980	7,480	2,680
6. Shadow rate*1 for handling charge and others (10% of CIF price)	"	598	748	268
7. Shadow rate*2 of ₱80 of transportation charge from Iloilo to the Project Area	"	62	62	62
8. Shadow rate*2 of ₱ 15 for transportation and handling charge to the farms	"	11	11	11
9. Farm-gate price of fertilizer	"	6,651	8,301	3,021
10. Farm-gate price per nutrient	₱/kg	14.46*3	12.39*4	5.04*5

Note: *1 ... 0.820 of standard conversion factor is applied to convert to economic price.

*2 ... 0.777 of conversion factor for transportation is applied to convert to economic price.

*3 ... Nutrient price of Nitrogen (46% of N)

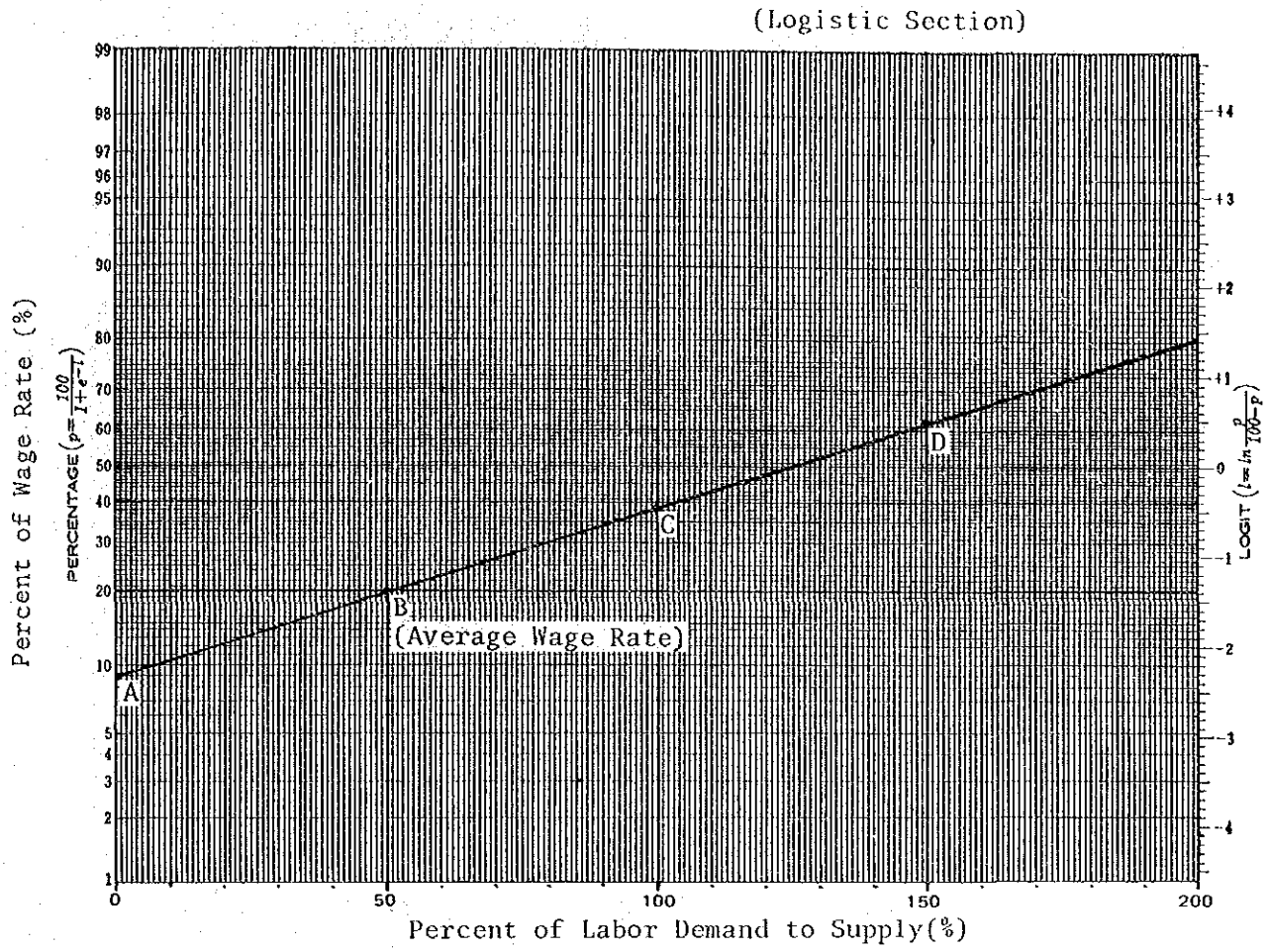
*4 ... Nutrient price of Phosphorous (N.P.K. ratio is 18-46-0)

*5 ... Nutrient price of Potassium (60% of P2O5)

Table 6-2-5 Estimation of Economic Wage Rate

Month	Percent of Potential Full Employment (supply = 100)		Economic Wage Rate (₱/man-day)		Weight of Labor Requirement (requirement = 100)	
	Present & W.O.P.	With Project	Present & W.O.P.	With Profect	Present & W.O.P.	With Project
Jan.	18.7	38.0	10	13	6.3	9.8
Feb.	19.0	67.9	10	19	6.4	17.5
Mar.	2.6	11.5	8	9	0.9	3.0
Apr.	7.6	6.4	9	9	2.6	1.6
May	20.6	15.1	10	10	6.9	3.9
Jun.	37.3	35.8	13	13	12.5	9.3
Jul.	31.8	33.0	12	12	10.7	8.5
Aug.	34.8	6.4	12	9	11.7	1.7
Sep.	40.0	48.1	13	15	13.4	12.4
Oct.	47.8	71.4	15	19	16.1	18.4
Nov.	19.3	38.4	10	13	6.5	9.9
Dec.	17.8	15.5	10	10	6.0	4.0
Total	-	-	-	-	100.0	100.0
Average Economic Wage Rate (₱/man-day) (Weighted average)					11.0	14.8

Figure 6-2-1 Opportunity Cost of Labor



Note: Appling the logistic curve, the opportunity cost of labor is estimate as follows:

Points	Wage Rate Surveyed ₱/man-day	Revised Wage Rate Percent	Revised Wage Rate ₱/man-day
A. Wage rate of off-farm employment	(around) 7	9.0	7.0
B. Average wage rate of farm works	15	19.4	15.0
C. Wage rate of farm works at the peak farming season	30	38.8	30.0
D. Maximum wage rate	(around) 45	58.1	47.0
Limitation Calculated	-	100.0	77.4

Table 6-2-6 Crop Budgets per Hectare - Present -

Items	Paddy																Sugarcane		Coconut	
	1st Crop								2nd & 3rd Crop											
	Irrigated				Rainfed				Irrigated				Rainfed							
	Direct Seeding		Transplant		Direct Seeding		Transplant		Direct Seeding		Transplant		Direct Seeding		Transplant					
	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.
1. Yield (ton/ha)	....2.59...		....2.59...		....2.17...		....2.17...		....2.24..		....2.24...		....1.80...		....1.80...		....56.93...		....0.11...	
2. Farm-gate Price (₱/ton)	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	301	473	6,000	5,040
3. GPV (₱/ha)	6,864	7,343	6,864	7,343	5,751	6,152	5,751	6,152	5,936	6,350	5,936	6,350	4,770	5,103	4,770	5,103	17,135	26,928	640	539
4. Production Cost (₱/ha)																				
a) Seed	477	413 *1	212	183	464	401	252	218	477	413	212	183	464	401	252	218	85	74	-	-
b) Fertilizer	677	746	645	698	623	726	611	662	611	732	679	715	548	643	504	436	3,431	4,044	-	-
c) Pesticide	277	240 *1	277	240	189	163	382	330	251	217	309	267	162	140	317	274	62	54	-	-
d) Animal & Machinery	882	762 *1	1,021	883	747	646	555	481	865	748	1,001	866	779	674	495	428	4,697	4,063	96	83
e) Labor	(51.2) *2	(61.0) *3	(57.2)	(68.1)	(45.0)	(53.9)	(63.4)	(71.2)	(41.4)	(48.2)	(46.4)	(54.5)	(33.7)	(39.7)	(49.3)	(56.4)	(75.0)	(75.0)	(9.6)	(9.6)
	1,623	671	1,761	749	1,364	593	1,626	783	1,351	530	1,500	600	1,073	437	1,306	620	1,125	825	176	106
f) Others	1,278	577 *1,*4	1,292	589	1,118	126	1,131	138	1,173	558	1,221	599	999	167	948	123	5,043	4,362	127	110
Subtotal	5,214	3,409	5,208	3,342	4,505	2,655	4,557	2,612	4,728	3,198	4,922	3,230	4,025	2,462	3,822	2,099	14,443	13,422	399	299
5. NPV (₱/ha)	1,650	3,934	1,656	4,001	1,246	3,497	1,194	3,540	1,208	3,152	1,014	3,120	745	2,641	948	3,004	2,692	13,506	240	240
Percent of NPV (GPV = 100)	24.0	53.6	24.1	54.5	21.7	56.8	20.8	57.5	20.4	49.6	17.1	49.1	15.6	51.8	19.9	58.9	15.7	50.2	37.7	44.5

Note: *1 ..... Conversion factor of capital goods (0.865) is applied to convert economic value.
*2 ..... Total man-days of hired labor.
*3 ..... Total man-days of family and hired labor.
*4 ..... Land charge is excluded.

Table 6-2-7 Crop Budgets per Hectare - Without Project -

Items	Paddy																			
	1st Crop								2nd & 3rd Crop											
	Irrigated				Rainfed				Irrigated				Rainfed							
	Direct Seeding		Transplant		Direct Seeding		Transplant		Direct Seeding		Transplant		Direct Seeding		Transplant		Sugarcane		Coconut	
	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.
A. Present																				
1. Yield (ton/ha)	2.59		2.59		2.17		2.17		2.24		2.24		1.80		1.80		56.93		0.11	
2. Farm-gate Price (₱/ton)	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	301	473	6,000	5,040
3. GPV (₱/ha)	6,864	7,343	6,864	7,343	5,751	6,152	5,751	6,152	5,936	6,350	5,936	6,350	4,770	5,103	4,770	5,103	17,135	26,928	640	539
4. Production Cost (₱/ha)	5,214	3,409	5,208	3,342	4,505	2,655	4,557	2,612	4,728	3,198	4,922	3,230	4,025	2,462	3,822	2,099	14,443	13,422	399	299
5. NPV (₱/ha)	1,650	3,934	1,656	4,001	1,246	3,497	1,194	3,540	1,208	3,152	1,014	3,120	745	2,641	948	3,004	2,692	13,506	240	240
B. Without Project(1997)																				
B-1 Ordinary Service Area																				
1. Yield (ton/ha)	2.90		2.90		2.30		2.30		2.40		2.40		1.90		1.90		56.93		0.11	
2. Farm-gate Price (₱/ton)	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	2,650	2,835	301	473	6,000	5,040
3. GPV (₱/ha)	7,685	8,222	7,685	8,222	6,095	6,521	6,095	6,521	6,360	6,804	6,360	6,804	5,035	5,387	5,035	5,387	17,135	26,928	640	539
4. Production Cost (₱/ha)	5,841	3,815	5,833	3,741	4,772	2,817	4,827	2,771	5,063	3,429	5,272	3,463	4,250	2,597	4,033	2,214	14,443	13,422	399	299
5. NPV (₱/ha)	1,844	4,407	1,852	4,481	1,323	3,704	1,268	3,750	1,297	3,375	1,088	3,341	785	2,790	1,002	3,173	2,692	13,506	240	240
B-2 Serruco Area																				
1. Yield (ton/ha)	3.70		3.70						5.00		5.00									
2. Farm-gate Price (₱/ton)	2,650	2,835	2,650	2,835					2,650	2,835	2,650	2,835								
3. GPV (₱/ha)	9,805	10,490	9,805	10,490					13,250	14,175	13,250	14,175								
4. Production Cost (₱/ha)	7,040	4,853	6,748	4,633					8,964	5,775	8,640	5,825								
5. NPV (₱/ha)	2,765	5,637	3,057	5,857					4,286	8,400	4,610	8,350								
B-3 Kabsaka Area																				
1. Yield (ton/ha)	4.60		4.60						5.00		5.00									
2. Farm-gate Price (₱/ton)	2,650	2,835	2,650	2,835					2,650	2,835	2,650	2,835								
3. GPV (₱/ha)	12,190	13,041	12,190	13,041					13,250	14,175	13,250	14,175								
4. Production Cost (₱/ha)	8,753	6,033	8,389	5,760					8,964	5,775	8,640	5,825								
5. NPV (₱/ha)	3,437	7,008	3,801	7,281					4,286	8,400	4,610	8,350								

Table 6-2-8 Crop Budgets per Hectare - With Project -

Items		Paddy								Corn		Tomato		Mungbean	
		1st Crop				2nd & 3rd Crop									
		Direct Seeding		Transplant		Direct Seeding		Transplant							
		Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.	Fi.	Eco.
1. Yield	(ton/ha)	.....4.60....		.....4.60....		.....5.00....		.....5.00....		.....3.50....		.....17.3....		.....1.00....	
2. Farm-gate Price	(₱/ton)	2,780	2,985	2,780	2,985	2,780	2,985	2,780	2,985	3,340	2,806	2,000	1,680	8,000	6,720
3. GPV	(₱/ha)	12,788	13,731	12,788	13,731	13,900	14,925	13,900	14,925	11,690	9,821	34,600	29,064	8,000	6,720
4. Production Cost	(₱/ha)														
a) Seed		567	490 *1	166	144	567	490	166	144	162	140	100	87	300	260
b) Fertilizer		1,619	1,780	1,619	1,795	1,703	1,608	1,703	1,911	1,321	1,391	2,319	2,801	989	957
c) Agro-chemicals		663	575 *1	663	573	663	573	663	573	534	461	948	820	316	273
d) Animal & Machinery		1,021	883 *1	1,021	883	1,001	866	1,001	866	1,300	1,125	1,300	1,125	1,300	1,125
e) Labor		(73.1) *2	(86.7) *3	(81.7)	(96.1)	(69.7)	(84.3)	(81.2)	(95.5)	(33.0)	(48.0)	(75.0)	(157.0)	(23.0)	(36.0)
		2,614	1,283	2,745	1,422	2,706	1,248	2,867	1,413	495	710	1,125	2,324	345	533
f) Others		2,269	1,024 *1·*4	2,175	943	2,324	990	2,240	918	1,586	433	3,591	2,168	1,845	307
Subtotal		8,753	6,033	8,389	5,760	8,964	5,775	8,640	5,825	5,398	4,260	9,383	9,325	5,095	3,740
5. NPV	(₱/ha)	4,035	7,698	4,399	7,971	4,936	9,150	5,260	9,100	6,292	5,561	25,217	19,739	2,905	2,980
Percent of NPV (GPV = 100)		31.6	56.1	34.4	58.1	35.5	61.3	37.8	61.0	53.8	56.6	72.9	67.9	36.3	44.3

Note: *1 ..... Conversion factor of capital goods (0.865) is applied to convert economic value.

*2 ..... Total man-days of hired labor

*3 ..... Total man-days of family and hired labor.

*4 ..... Land charge is excluded.

TABLE 6-2-9 AGRICULTURAL BENEFIT BY SUB-PROJECTS

- 1997 -

Sub-Projects & Crops	Cropping Area (ha)	Financial (Unit: 000₱) GPV	Production Cost	NPV	Benefit	Economic (Unit: 000₱) GPV	Production Cost	NPV	Benefit
A. Ordinary Service Area									
1. Without Project									
a. Paddy - Irrigated I*1	985	7,570	5,754	1,816		8,099	3,758	4,341	
(1st crop) - " II*2	73	561	426	135		600	273	327	
- Rainfed I	4,120	25,111	19,660	5,451		26,867	11,607	15,260	
- " II	310	1,889	1,496	393		2,022	859	1,163	
b. Paddy - Irrigated I	1,015	6,455	5,139	1,316		6,906	3,480	3,426	
(2nd & 3rd)- " II	80	509	422	87		544	277	267	
- Rainfed I	2,140	10,775	9,095	1,680		11,528	5,557	5,971	
- " II	160	805	645	160		862	354	508	
(total)	8,883	53,675	42,637	11,038		57,428	26,165	31,263	
c. Sugarcane	380	6,511	5,488	1,023		10,233	5,101	5,132	
d. Coconut	200	128	80	48		108	60	48	
Sub-total	9,463	60,314	48,205	12,109		67,769	31,326	36,443	
2. With Project									
a. Paddy - Irrigated I	3,325	42,520	29,104	13,416		45,657	20,061	25,596	
(1st Crop) - " II	2,220	28,389	18,623	9,766		30,483	12,787	17,696	
b. Paddy - " I	3,625	50,388	32,495	17,893		54,103	20,934	33,169	
(2nd & 3rd)- " II	2,420	33,638	20,909	12,729		36,119	14,097	22,022	
(total)	11,590	154,935	101,131	53,804		166,362	67,879	98,483	
c. Tomato	718	24,843	6,737	18,106		20,868	6,695	14,173	
d. Corn	205	2,396	1,106	1,290		2,013	873	1,140	
e. Mungbeans	205	1,640	1,044	596		1,378	767	611	
Sub-total	12,718	183,814	110,018	73,796	61,687	190,621	76,214	114,407	77,964
B. Serruco Area									
1. Without Project									
a. Paddy - Irrigated I	650	6,373	4,576	1,797		6,819	3,155	3,664	
(1st Crop) - " II	50	490	338	152		525	233	292	
b. Paddy - " I	335	4,439	2,869	1,570		4,749	1,935	2,814	
(2nd Crop) - " II	25	331	216	115		354	145	209	
Sub-total	1,060	11,633	7,999	3,634		12,447	5,468	6,979	
2. With Project									
a. Paddy - Irrigated I	410	5,243	3,589	1,654		5,630	2,474	3,156	
(1st Crop) - " II	270	3,453	2,265	1,188		3,707	1,555	2,152	
b. Paddy - " I	410	5,699	3,675	2,024		6,119	2,367	3,752	
(2nd Crop) - " II	270	3,753	2,333	1,420		4,030	1,573	2,457	
Sub-total	1,360	18,148	11,862	6,286	2,652	19,486	7,969	11,517	4,538
C. Kabsaka Area									
1. Without Project									
a. Paddy - Irrigated I	122	1,487	1,068	419		1,591	736	855	
(1st Crop) - " II	10	122	84	38		130	57	73	
b. Paddy - " I	74	981	631	347		1,049	427	622	
(2nd Crop) - " II	6	80	52	28		85	35	50	
Sub-total	212	2,670	1,838	832		2,855	1,255	1,600	
2. With Project									
a. Paddy - Irrigated I	75	959	656	303		1,030	453	577	
(1st Crop) - " II	50	639	419	220		687	288	399	
b. Paddy - " I	75	1,043	673	370		1,119	433	686	
(2nd Crop) - " II	50	695	432	263		746	291	455	
Sub-total	250	3,336	2,180	1,156	324	3,582	1,465	2,117	517
D. Katipayan Dam Reservoir									
1. Without Project									
a. Paddy (1st)- Rainfed I	4	24	19	5		26	11	15	
b. Paddy (2nd)- Rainfed II	2	10	8	2		11	5	6	
Sub-total	6	34	27	7		37	16	21	
2. With Project	-	-	-	-	-7	-	-	-	-21
TOTAL									
1. Without Project	10,741	74,651	58,069	16,582		83,108	38,065	45,043	
2. With Project	14,328	205,298	124,060	81,238	64,656	213,689	85,648	128,041	82,998

Note: *1 ..... Direct seedling

*2 ..... Transplant

Table 6-2-10 Trend of Farmland With Project

(Unit: ha)

Sub-Projects	Crops	1985	1986	1987	1988	1989	1990	1991	1992	1993~
I. With Project										
I-1 Areas not yet unedr construction										
A. Ordinary Service Area	- Paddy	5,488	5,488	5,488	5,488	4,473	3,949	3,949	1,185	-
	- Others	580	580	580	580	576	573	570	-	-
	(total)	6,068	6,068	6,068	6,068	5,049	4,522	4,519	1,185	-
B. Serruco Area	- Paddy	700	700	700	700	330	330	330	330	-
C. Kabsaka Area	- Paddy	132	132	132	132	132	132	132	132	132
D. Catipayan Dam Area	- Paddy	4	-	-	-	-	-	-	-	-
Subtotal		6,904	6,900	6,900	6,900	5,511	4,984	4,981	1,647	-
I-2 Areas where is in-progress										
A. Ordinary Service Area	- Paddy	-	-	-	-	1,000	1,520	1,520	4,381	5,545
	- Others	-	-	-	-	-	-	-	410	410
	(total)	-	-	-	-	1,000	1,520	1,520	4,791	5,955
B. Serruco Area	- Paddy	-	-	-	-	360	360	360	680	680
C. Kabsaka Area	- Paddy	-	-	-	-	-	-	-	-	125
Subtotal		-	-	-	-	1,360	1,880	1,880	5,471	6,760
Total		6,904	6,900	6,900	6,900	6,871	6,864	6,861	7,118	6,760

TABLE 6-2-11

CROP BENEFIT STREAM

(Unit: 000P)

Sub-Projects	Crops	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997^
A. Financial Benefit														
I. Net Production Value With Project														
I-1 Areas not yet under construction														
A. Ordinary Service Area	- Paddy	10,360	10,416	10,475	10,529	8,628	7,658	7,699	2,322	-	-	-	-	-
	- Others	1,071	1,071	1,071	1,071	1,064	1,058	1,053	-	-	-	-	-	-
	(total)	11,431	11,487	11,544	11,600	9,692	8,716	8,752	2,322	-	-	-	-	-
B. Serruco Area	- Paddy	1,755	1,911	2,068	2,224	1,122	1,196	1,270	1,344	-	-	-	-	-
C. Kabsaka Area	- Paddy	297	342	386	432	475	520	563	610	-	-	-	-	-
D. Catipayan Dam Area	- Paddy	-*	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total		13,483	13,740	13,988	14,256	11,289	10,432	10,585	4,276	-	-	-	-	-
I-2 Areas where construction is in-progress														
A. Ordinary Service Area	- Paddy	-	-	-	-	6,656	11,902	15,656	33,439	46,382	50,882	52,689	53,580	53,804
	- Others	-	-	-	-	-	-	-	6,437	9,894	11,785	12,430	12,684	19,992
	(total)	-	-	-	-	6,656	11,902	15,656	39,786	56,276	62,665	65,119	66,264	73,796
B. Serruco Area	- Paddy	-	-	-	-	2,283	2,872	3,161	5,290	5,880	6,138	6,227	6,286	6,286
C. Kabsaka Area	- Paddy	-	-	-	-	-	-	-	-	793	998	1,098	1,135	1,156
Sub-total		-	-	-	-	8,939	14,774	16,817	45,076	62,949	69,801	72,444	73,685	81,238
Total		13,483	13,740	13,998	14,256	20,228	25,206	27,402	49,352	62,949	69,801	72,444	73,685	81,238
II. Net Production Value Without Project		13,483	13,740	13,998	14,256	14,513	14,771	15,027	15,287	15,544	15,802	16,060	16,317	16,575
Benefit		0	0	0	0	5,715	10,435	12,375	34,065	47,405	53,999	56,384	57,366	64,663
B. Economic Benefit														
I. Net Production Value With Project														
I-1 Areas not yet under construction														
A. Ordinary Service Area	- Paddy	29,429	29,563	29,717	29,872	24,474	21,717	21,829	6,584	-	-	-	-	-
	- Others	5,180	5,180	5,180	5,180	5,144	5,117	5,091	-	-	-	-	-	-
	(total)	34,609	34,743	34,897	35,052	29,618	26,834	26,920	6,584	-	-	-	-	-
B. Serruco Area	- Paddy	4,128	4,366	4,604	4,841	2,394	2,506	2,609	2,730	-	-	-	-	-
C. Kabsaka Area	- Paddy	836	899	963	1,027	1,090	1,154	1,218	1,282	-	-	-	-	-
D. Catipayan Dam Area	- Paddy	19	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total		39,592	40,008	40,464	40,920	33,102	30,494	30,747	10,596	-	-	-	-	-
I-2 Areas where construction is in-progress														
A. Ordinary Service Area	- Paddy	-	-	-	-	12,183	21,785	24,996	61,206	84,898	93,134	96,442	98,075	98,485
	- Others	-	-	-	-	-	-	-	7,968	12,421	14,793	15,605	15,924	15,924
	(total)	-	-	-	-	12,184	21,785	24,996	69,174	97,319	107,927	112,047	113,997	114,407
B. Serruco Area	- Paddy	-	-	-	-	4,183	5,262	5,792	9,693	10,774	11,246	11,409	11,517	11,517
C. Kabsaka Area	- Paddy	-	-	-	-	-	-	-	-	1,452	1,827	2,011	2,075	2,117
Sub-total		-	-	-	-	16,367	27,047	30,788	78,867	109,545	121,000	125,467	127,589	128,041
Total		39,592	40,008	40,464	40,920	49,469	57,541	61,535	89,463	109,545	120,000	125,467	127,589	128,041
II. Net Production Value Without Project		39,592	40,028	40,484	40,940	41,396	41,852	42,307	42,763	43,219	43,675	44,131	44,599	45,043
Benefit		0	-20	-20	-20	8,073	15,689	19,228	46,700	66,326	77,325	81,536	82,990	82,998

Note: * ..... NPV in the Catipayan dam reservoir is counted in the financial project cost as land acquisition.

2.1.2 Benefit of Integrated Community Center

Table 6-2-12 Benefit of Water Supply in the Integrated Community Center(ICC)

Year	Number of ICC Constructed *1	Benefitted Households*2	Willingness to Pay*3 (=Benefit) 000₱ Financial	Economic
∿1988	-	-	-	-
1989	20	1,000	108	84
1990	28	1,400	151	118
1991	28	1,400	151	118
1992	75	3,750	405	315
1993∿	100	5,000	540	420

Note: *1 .... Construction of ICC would be done at the same time as on-farm works.

*2 .... Each ICC covers around fifty families.

*3 .... "Willingness to pay for domestic water" per a month is considered as ₱9 of financial and ₱7 of economic value in the same way of the benefit estimation of Sara Water-works.

2.1.3 Farm Road Benefit

Table 6-2-13 Transportation Means of Farm Products at the Farm Level

(Unit: Farms)

Means	Ajuy	Concep-tion	San Dionisio	Sara	Total
A. Total Number by Municipality					
1. Foot	1,112	168	847	2,044	4,171
2. Animal	221	49	179	3	452
3. Cart or Sled	62	83	119	104	368
4. Tricycle	13	234	12	11	270
5. Power Tiller or Tractor	1	-	1	-	2
6. Motor Vehicle	21	66	2	1	90
7. Boat or Banca	-	190	-	-	190
8. Others	-	-	-	-	-
Total	1,430	790	1,160	2,163	5,543
B. Numbers in the Project Area*2					
1. Foot	367	18	161	1,186	1,732(86%)
2. Animal	73	5	35	2	115(6%)
3. Cart or Sled	20	9	23	60	112(5%)
4. Tricycle	4	26	2	6	38(2%)
5. Power Tiller or Tractor	0	-	0	-	0(-)
6. Motor Vehicle	7	7	0	1	15(1%)
7. Boat or Banca	-	-	-	-	-(-)
8. Others	-	-	-	-	-(-)
Total	471	65	221	1,255	2,012(100%)

Data Source: *1 .... Municipal level data of Agricultural Census in 1980, NCSO, NEDA.

Note : *2 .... Percent of farmland in the Project Area for each municipality is considered as follows:

Percent of Farmland in the Project Area

Municipality	Ajuy	Conception	San Dionisio	Sara
Total Farmland = 100	33	11	19	58

Figure 6-2-2 Beneficial Paddy Field and Drying Yard of Farm Road

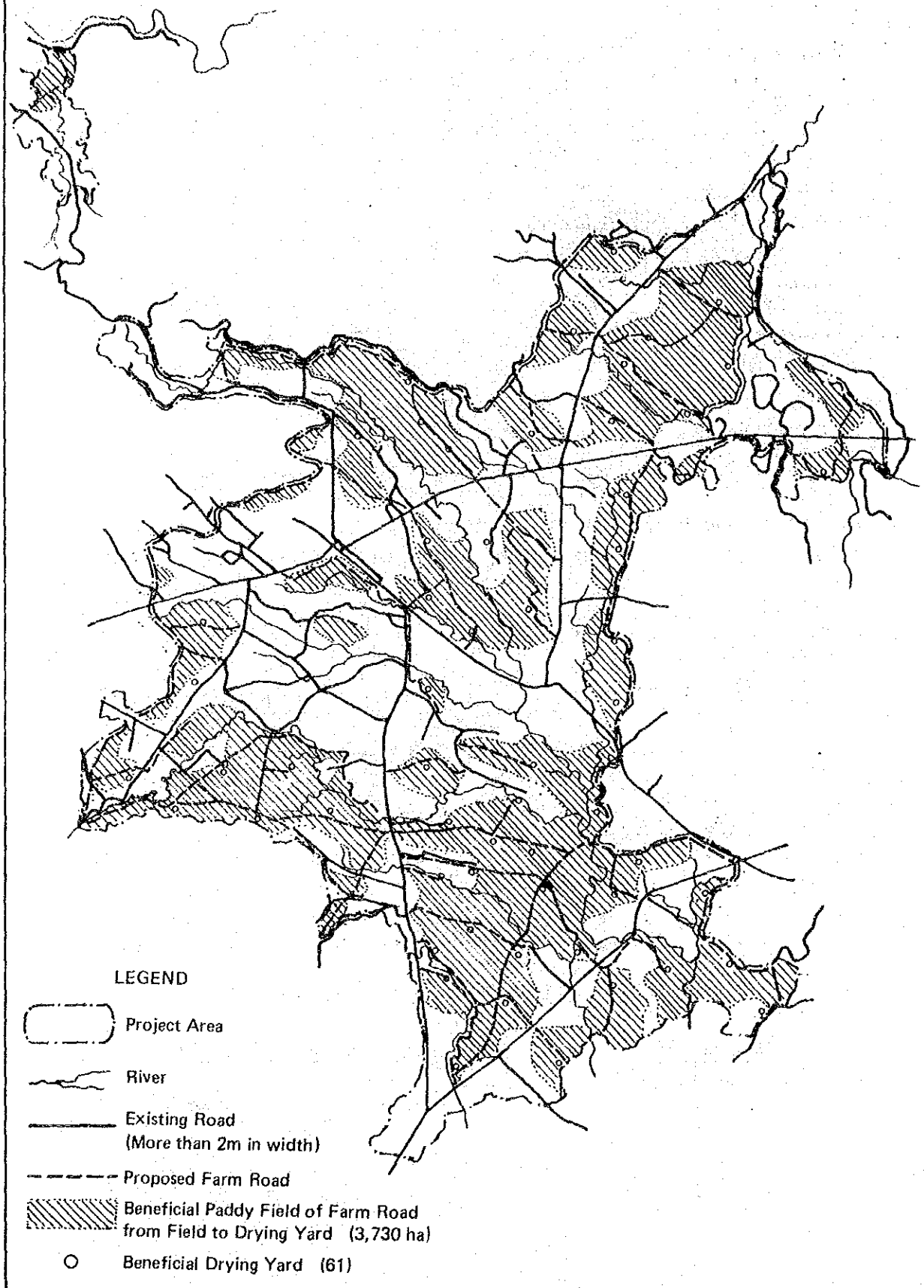


Table 6-2-14 Transportation Volume for Road Benefit Estimation

Items	Paddy (1st Crop)	Paddy (2nd Crop)	Total
1. Production Yield (tons/ha)	4.60	5.0	
2. Transportation Volume between Field and Drying Yard			
- Area (ha)	3,730*1	4,024	7,754
- Production (tons) (= Transportation volume in the peak farming season)	17,158	20,120	37,278
3. Transportation Volume between Drying Yard and Existing Main Road			
- Area (ha)	3,050*2	3,290	6,340
- Production (tons)	14,030	16,450	30,480
- Transportation volume in the Peak Farming Season *3	10,901	12,782	23,683

Note: *1 .... Benefit area was estimated based on the 1:20,000 map and the proposed farm road network.

*2 .... 61 of the irrigation blocks which have their own drying yard are considered recipients of road benefit.
(61 brocks x 50 ha/brock = 3,050 ha)

*3 .... Home consumption (13.0%0)
seeds (2.2%) and waste (7.1%) are excluded.
(Total production = 100%).

Table 6-2-15 Estimation of Transportation Distance

(Unit: in)

Sample Number	Distance: Paddy Field → Drying Yard	Distance: Drying Yard → Existing Main Road
1. Sample Area A		
A-1	750	400
-2	570	1,000
-3	650	1,050
-4	600	450
-5	375	600
-6	375	1,100
-7	450	1,500
Subtotal	3,770	6,100
2. Sample Area B		
B-1	550	400
-2	400	400
-3	650	350
Subtotal	1,600	1,150
3. Sample Area C		
C-1	650	600
-2	700	900
Subtotal	1,350	1,500
4. Sample Area D		
D-1	400	800
-2	175	2,200
-3	625	1,550
-4	325	0
-5	400	450
-6	350	1,200
-7	950	1,650
-8	700	550
-9	650	0
-10	400	500
-11	900	750
Subtotal	5,875	9,650
Total	12,595	18,400
Average	548	800

Figure 6-2-3 Location of Sample Area for Estimation of Transportation Distance

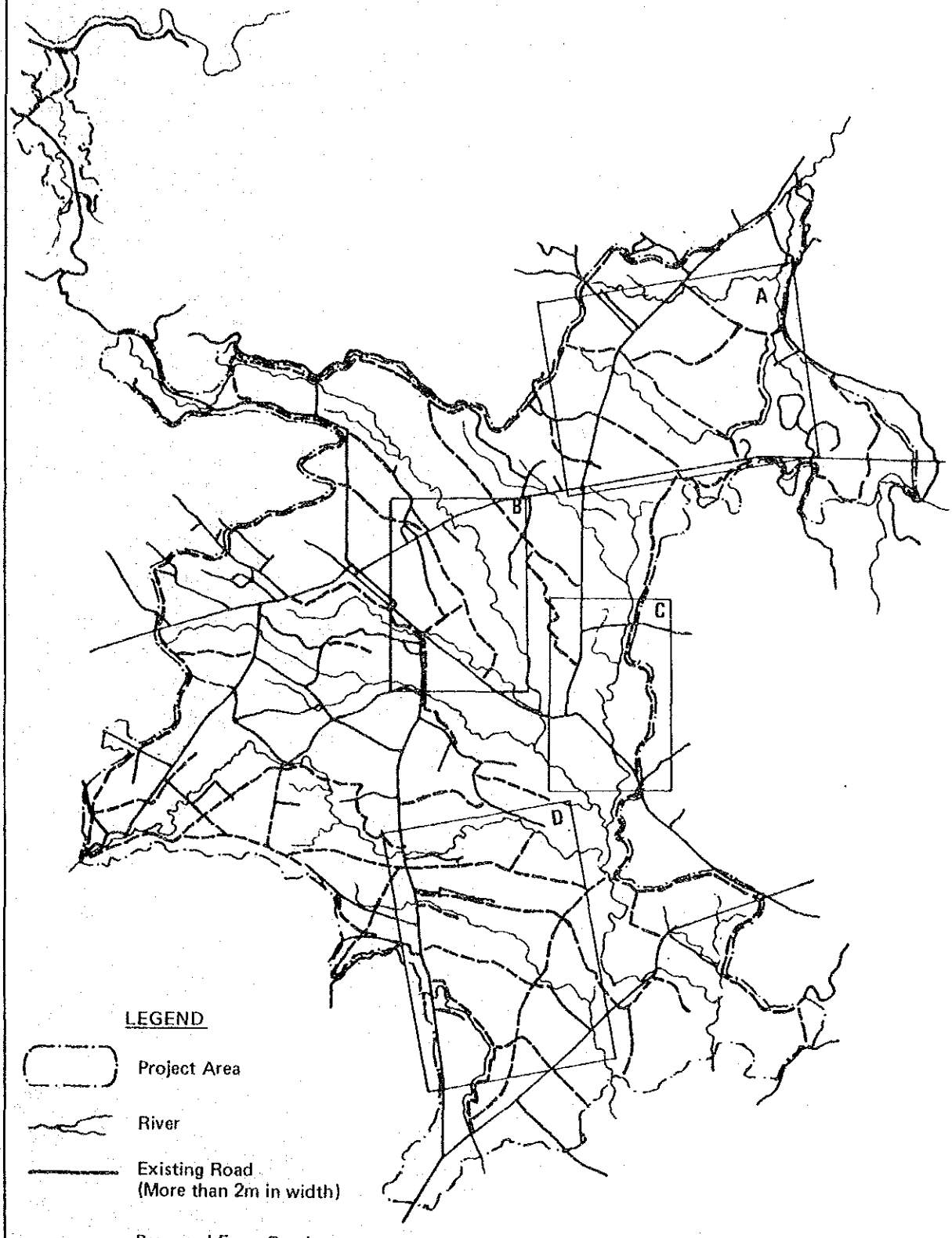


Figure 6-2-4 Sample Area for Estimation of Transportation Distance
— Sample Area A —

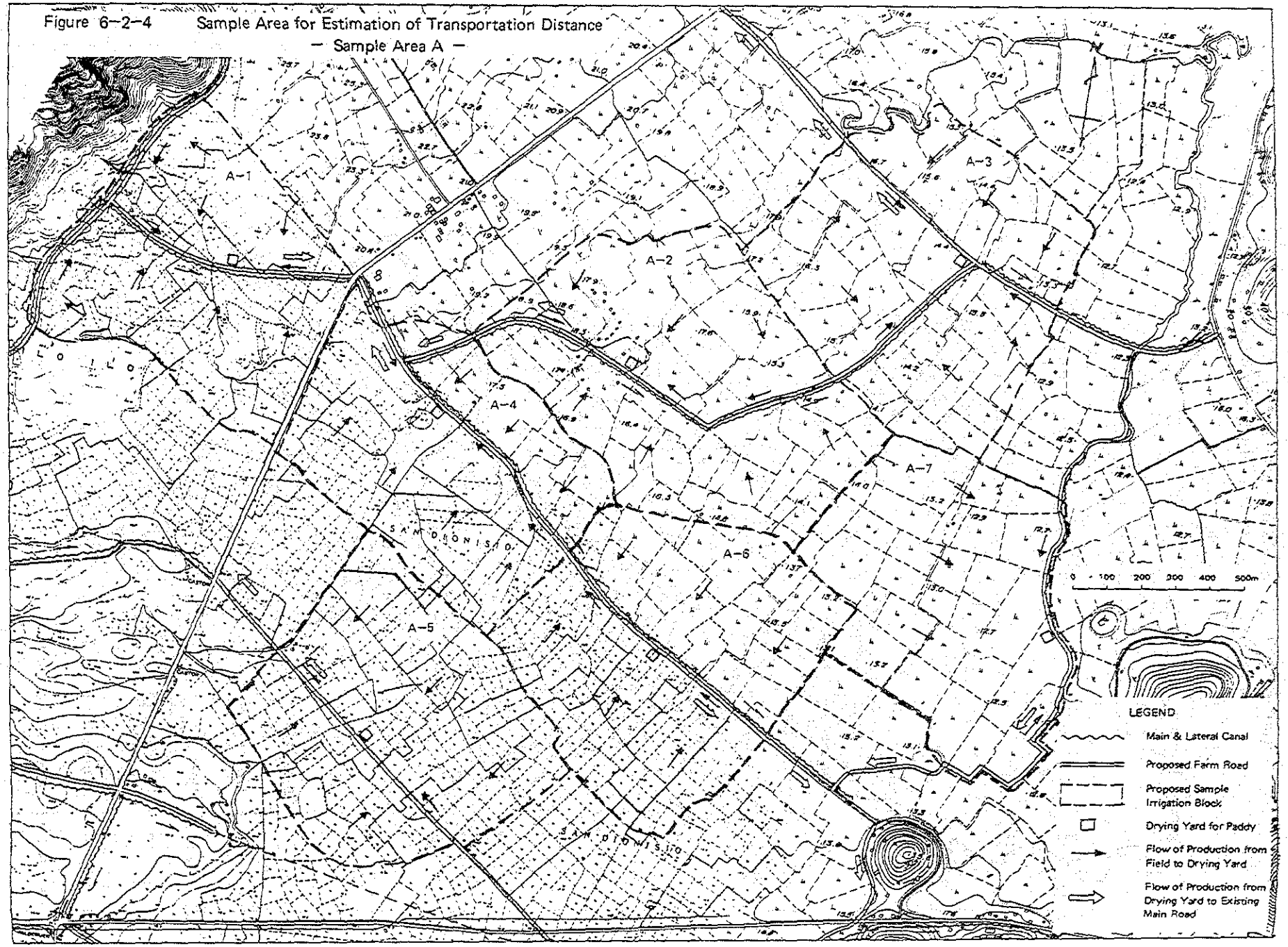


Figure 6-2-5 Sample Area for Estimation of Transportation Distance
— Sample Area B —

Figure 6-2-6 Sample Area for Estimation of Transportation Distance
— Sample Area C —

Figure 6-2-7 Sample Area for Estimation of Transportation Distance

— Sample Area D —

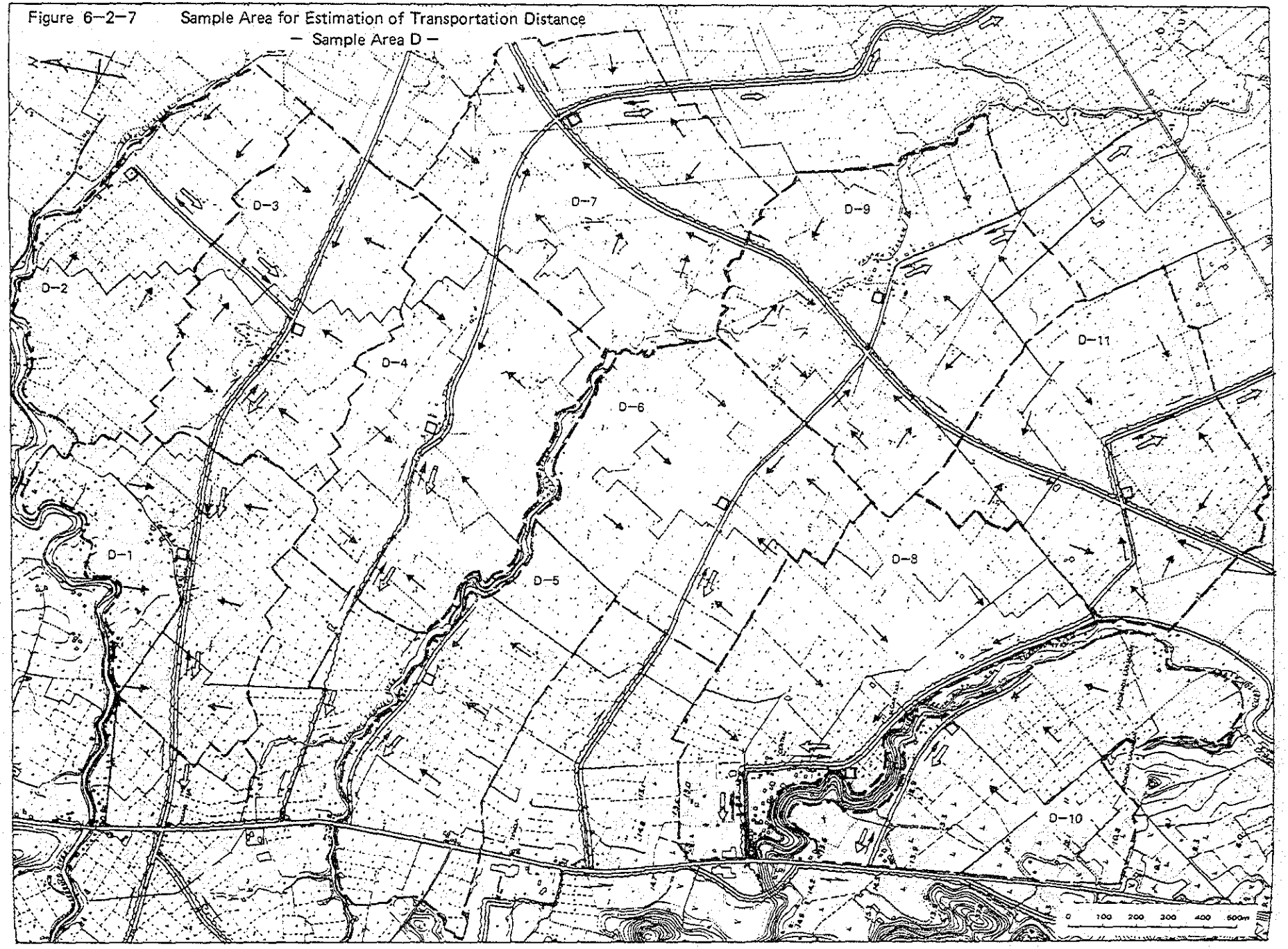


TABLE 6-2-16 **ESTIMATION OF FARM ROAD BENEFIT**

Means of Transportation	Transportation: Transportation Volume % (1)	Transportation: Transportation Volume tons (2)	Transportation: Capacity *2 kg/unit (3)	Transportation: Distance *3 km (4)	Transportation: Speed *2 km/hr (5)	Transportation: Working Hour *4 hr (6)	Transportation: Working Days *5 man-days (7)	Transportation: Cost *6 000₱ (8) Finan.	Transportation: Cost *6 000₱ (8) Econo.	Loading & Unloading: Persons per unit (9)	Loading & Unloading: Working Days man-days (10)	Loading & Unloading: Cost *6 000₱ (11) Finan.	Loading & Unloading: Cost *6 000₱ (11) Econo.	Total Cost 000₱ (8) + (11) Finan.	Total Cost 000₱ (8) + (11) Econo.
A. Without Project															
1. Field to Drying Yard (Total Transportation Volume = 37,278 tons of paddy)															
- Human	90*1	33,732	20	0.55	1.0	927,630	185,526	6,679	2,738	-	-	-	-	6,857	2,860
- Buffalo	10*1	3,546	120	0.55	2.0	8,126	1,625	119	98	1	1,625	59	24		
2. Drying Yard to Existing Main Road (Total Transportation Volume = 23,683 tons of paddy)															
- Human	90*1	21,315	20	0.80	1.0	852,600	170,520	6,139	2,524	-	-	-	-	6,311	2,642
- Buffalo	10*1	2,368	120	0.80	2.0	7,895	1,579	115	95	1	1,579	57	23		
B. With Project															
1. Field to Drying Yard															
- Human	10	3,546	20	0.55	1.5	65,010	13,002	468	192	-	-	-	-	1,591	963
- Buffalo	90	33,732	120	0.55	3.0	51,535	10,307	752	618	1	10,307	371	153		
2. Drying Yard to Existing Main Road															
- Human	10	2,368	20	0.80	1.5	63,147	12,629	455	187	-	-	-	-	1,488	895
- Buffalo	90	21,315	120	0.80	3.0	47,367	9,473	692	568	1	9,473	341	140		

Benefit (= Retrench of Transportation Cost With Project) - Unit: 000₱ -

1. Field to Drying Yard
   - Financial 6,857 - 1,591 = 5,266 (5,266,000₱/37,278 ton = 141.26 ₱/ton)
   - Economic 2,860 - 963 = 1,897 (1,897,000₱/37,278 ton = 50.89 ₱/ton)
2. Drying Yard to Existing Main Road
   - Financial 6,311 - 1,488 = 4,823 (4,823,000₱/23,683 ton = 203.65 ₱/ton)
   - Economic 2,642 - 895 = 1,747 (1,747,000₱/23,683 ton = 73.77 ₱/ton)

Total
- Financial 10,089
- Economic 3,644

Source: *1 .... Based on the municipal level data of 1980 Agricultural Census (NCSO, NEDA)

Note : *2 .... Estimated *3 .... Estimated by using the 1:20,000 map of sample area *4 .... (6) = (2)/(3) x (4)/(5)
*5 .... (7) = (6)/5.0 hr [5.0 hr = Working capacity per day]
*6 .... Wage rate - Financial ... human = 36.0 ₱/day, buffalo = 73.0 ₱/day
- Economic .... human = 14.8 ₱/day, buffalo = 60.0 ₱/day

Table 6-2-17 Farm Road Benefit Stream

Year	Percent Trend of Paddy Production With Project (%)	1. Field to Drying Yard			2. Drying Yard to Existing Main Road			Total Benefit (000₱)	
		Transportation Volume (ton)	Benefit (000₱)		Transportation Volume (ton)	Benefit (000₱)			
			Finan.	Econo.		Finan.	Econo.	Finan.	Econo.
~1988	-	-	-	-	-	-	-	-	-
1989	14.59	5,439	768	277	3,455	703	255	1,471	532
1990	24.09	8,980	1,269	457	5,705	1,162	421	2,431	878
1991	27.42	10,222	1,444	520	6,494	1,323	479	2,767	999
1992	63.15	23,541	3,325	1,198	14,956	3,046	1,103	6,371	2,301
1993	86.61	32,286	4,561	1,643	20,512	4,177	1,513	8,738	3,156
1994	94.71	35,306	4,987	1,797	22,430	4,568	1,655	9,555	3,452
1995	97.98	36,525	5,160	1,859	23,205	4,726	1,712	9,886	3,571
1996	99.60	37,129	5,245	1,889	23,588	4,804	1,740	10,049	3,629
1997~	100.00	37,278	5,266	1,897	23,683	4,823	1,747	10,089	3,644

2.2. Benefit of Hydropower Plant

Table 6-2-18 Benefit of Hydropower Plant

Items	Dam Site Power Station	Canal Route Power Station	Total
1. Power Scale (MWh'/year)	3,225	4,112	7,337
2. Value of Power (000₱)			
- Financial *1	5,160	6,579	11,739
- Economic *2	4,138	5,276	9,414

Note: *1 ... ₱1.60kWh of ILECO II is applied to benefit estimation as the cheapest alternative plan.

*2 ... 0.802 of conversion factor for electricity, gas & water is used to convert economic value.

2.3 Benefit of Sara Waterworks

Table 6-2-19 Benefit of Sara Waterworks

Year	Benefitted Households		Total Cost (000₱)*				Benefit (000₱)	
			Without P.		With P.			
	Without P.	With P.	Finan.	Econo.	Finan.	Econo.	Finan.	Econo.
∿1991	940	940	102	79	102	79	-	-
1992∿	940	3,384	102	79	365	284	263	205

Note: * .... Economic value of "Willingness to pay for domestic water supply" is considered 7 Pesos per family per month based on the average income and tariff of existing waterworks.

(Base of calculation)

- Financial value of willingness to pay = 9 ₱/family/month
- Conversion factor of electricity, gas and water = 0.802

Table 6-3-1 Separation of Project Cost for Cost Allocation

(Unit: 000₱)

Items	Project Cost				Specific Costs			
	Direct Cost	Administration & Engineering	Contingency	Total	Agriculture	Hidro-Power	Sara Water Works	Joint Costs
A. Financial								
1. Dam	337,416	38,467	56,382	432,265	-	-	-	432,265
2. Hydropower Station	42,147	4,805	7,043	53,995	-	53,995	-	-
3. Sara Waterworks	1,188	135	198	1,521	-	-	1,521	-
4. Irrigation	131,275	14,954	21,934	168,163	168,163	-	-	-
5. Roads	24,772	2,824	4,139	31,735	31,735	-	-	-
6. Integrated Community Center	3,511	400	587	4,498	4,498	-	-	-
7. Dry Yard	5,046	575	843	6,464	6,464	-	-	-
8. Land Acquisition	7,500	855	1,253	9,608	9,608	-	-	-
9. Facilities for O & M	17,290	1,985	2,893	22,168	22,168	-	-	-
10. Facilities for Agri-Extension	460	-	69	529	529	-	-	-
Total	570,605	65,000	95,341	730,946	243,165	53,995	1,521	432,265
B. Economic								
1. Dam	275,640	33,183	45,946	354,769	-	-	-	354,769
2. Hydropower Station	39,470	4,752	6,579	50,801	-	50,801	-	-
3. Sara Waterworks	1,092	131	182	1,405	-	-	1,405	-
4. Irrigation	101,419	12,209	16,905	130,533	130,533	-	-	-
5. Roads	18,137	2,184	3,023	23,344	23,344	-	-	-
6. Integrated Community Center	2,418	291	403	3,112	3,112	-	-	-
7. Dry Yard	3,660	440	610	4,710	4,710	-	-	-
8. Land Acquisition	-	733	1,000	1,733	1,733	-	-	-
9. Facilities for O & M	15,208	1,832	2,535	19,575	19,575	-	-	-
10. Facilities for Agri-Extension	460	-	78	538	538	-	-	-
Total	457,504	55,755	77,261	590,520	183,545	50,801	1,405	354,769

TABLE 6-3-2 **ALLOCATION OF PROJECT COST**

(Unit: 000₱)

Items	Financial				Economic			
	Agriculture	Hidro-Power	Sara Water Works	Total	Agriculture	Hidro-power	Sara Water-works	Total
A. Alternate Costs	675,430 *1	108,764 *2	5,952 *3	616,444	538,314	74,443 *4	4,862 *4	616,444
B. Benefits *5	659,077	106,054	2,376		731,275	71,647	1,560	804,482
C. Benefit limited by alternate cost (lesser of A or B)	659,077	106,054	2,376	767,410	538,314	71,647	1,560	611,521
D. Specific Costs	243,165	53,995	1,521	298,681	183,545	50,801	1,405	235,751
E. Remaining Benefit(C - D)	415,912	52,059	855	468,826	354,769	20,846	155	375,770
F. Percent of Remaining Benefit	88.71%	11.11%	0.18%	100%	94.41%	5.55%	0.04%	100%
G. Allocated Joint Costs	383,462	48,025	778	432,265	334,947	19,690	142	354,769
H. Total Allocated Cost (D + G)	626,627	102,020	2,299	730,946	518,482	70,491	1,547	590,520

Note: *1 .... Cost of agriculture only

*2 .... Present worth value of diesel power plant cost

Base of calculation
1. Diesel power plant
2. Annual cost of power = 12.033 million pesos (1.64 ₱/kWh x 7,337 kWh/year)
3. Discount Rate = 7 percent

*3 .... Financial cost of small dam in the Asue River Basin

Base of calculation

1. Dam Cost	- Foreign currency	3.366 million pesos
	- Local currency	1.496
	Total	5.952

*4 .... 0.802 of conversion factor for electricity is applied to convert economic value.

*5 .... Present worth value of benefit; 7 and 8 percent of interest rate are applied to calculate the present worth value of financial and economic benefit, respectively.

TABLE 6-3-3 **STREAM OF ALLOCATION PROJECT FINANCIAL COST**

(Unit: 000$)

Items	Total	1986	1987	1988	1989	1990	1991	1992
I. Allocation of Joint Costs by Year								
1. Direct Cost of Dam Construction								
- Total	337,416	-	30,775	47,523	17,051	106,676	135,391	-
- Agriculture	299,322	-	27,301	42,158	15,126	94,632	120,105	-
- Hydropower	37,487	-	3,419	5,280	1,894	11,851	15,043	-
- Sara Waterworks	607	-	55	85	31	193	243	-
2. Administration & Engineering								
- Total	38,467	14,612	4,267	3,918	3,918	3,918	3,918	3,916
- Agriculture	34,124	12,962	3,785	3,476	3,476	3,476	3,476	3,473
- Hydropower	4,274	1,623	474	435	435	435	435	437
- Sara Waterworks	69	27	8	7	7	7	7	6
3. Contingency								
- Total	56,382	2,217	5,133	7,135	5,470	14,538	18,932	2,957
- Agriculture	50,016	1,967	4,553	6,329	4,852	12,897	16,795	2,623
- Hydropower	6,264	246	570	793	608	1,616	2,103	328
- Sara Waterworks	102	4	10	13	10	25	34	6
4. Total								
- Total	432,265	16,829	40,175	58,576	26,439	125,132	158,241	6,873
- Agriculture	383,462	14,929	35,639	51,963	23,454	111,005	140,376	6,096
- Hydropower	48,025	1,869	4,463	6,508	2,937	15,902	17,581	765
- Sara waterworks	778	31	73	105	48	225	284	12
II. Cost Allocation by Sector								
A. Agriculture								
a. Joint Costs	383,462	14,929	35,639	51,963	23,454	111,005	140,376	6,096
b. Specific Costs								
- Direct Cost	189,854	-	18,460	26,453	38,388	51,478	27,862	27,215
- Administration & Engineering	21,593	8,204	3,010	2,052	1,972	1,980	2,095	2,280
- Contingency	31,718	1,319	3,734	4,027	2,938	7,606	10,964	1,130
Total	626,627	24,452	60,843	84,495	66,752	172,069	181,297	36,719
B. Hydropower								
a. Joint Costs	48,025	1,869	4,463	6,508	2,937	15,902	17,581	765
b. Specific Costs								
- Direct Cost	42,147	-	-	-	-	-	42,147	-
- Administration & Engineering	4,805	2,001	510	459	459	459	459	458
- Contingency	7,043	320	631	899	682	1,758	2,397	356
Total	102,020	4,190	5,604	7,866	4,078	16,119	62,584	1,579
C. Sara Waterworks								
a. Joint Costs	778	31	73	105	48	225	284	12
b. Specific Costs								
- Direct Cost	1,188	-	-	-	-	-	1,188	-
- Administration & Engineering	135	57	13	12	12	12	12	17
- Contingency	198	9	17	24	20	49	67	12
Total	2,299	97	103	141	80	286	1,551	41
TOTAL FINANCIAL COST	730,946	28,739	66,550	92,502	70,910	188,474	245,432	38,339

TABLE 6-3-4 **STREAM OF ALLOCATED PROJECT ECONOMIC COST**

(Unit: 000$)

Items	Total	1986	1987	1988	1989	1990	1991	1992
I. Allocation of Joint Costs by Year								
1. Direct Cost of Dam Construction								
- Total	275,640	-	25,810	40,883	14,932	84,198	109,817	-
- Agriculture	260,231	-	24,367	38,598	14,097	79,491	103,678	-
- Hydropower	15,298	-	1,432	2,269	829	4,673	6,095	-
- Sara Waterworks	111	-	11	16	6	34	44	-
2. Administration & Engineering								
- Total	33,183	13,820	3,520	3,169	3,169	3,169	3,169	3,167
- Agriculture	31,328	13,047	3,323	2,992	2,992	2,992	2,992	2,990
- Hydropower	1,842	767	195	176	176	176	176	176
- Sara Waterworks	13	6	2	1	1	1	1	1
3. Contingency								
- Total	45,946	2,087	4,116	5,864	4,449	11,470	15,635	2,325
- Agriculture	43,378	1,970	3,886	5,536	4,200	10,829	14,761	2,196
- Hydropower	2,550	116	228	325	247	637	868	129
- Sara Waterworks	18	1	2	3	2	4	6	0
4. Total								
- Total	354,769	15,907	33,446	49,916	22,550	98,837	128,621	5,492
- Agriculture	334,937	15,017	31,576	47,126	21,289	93,312	121,431	5,186
- Hydropower	19,690	883	1,855	2,770	1,252	5,486	7,139	305
- Sara Waterworks	142	7	15	20	9	39	51	1
II. Cost Allocation by Sector								
A. Agriculture								
a. Joint Costs	334,937	15,017	31,576	47,126	21,289	93,312	121,431	5,186
b. Specific Costs								
- Direct Cost	141,302	-	10,456	19,788	29,877	39,892	20,415	20,874
- Administration & Engineering	17,689	7,367	1,877	1,689	1,689	1,689	1,689	1,689
- Contingency	24,554	1,115	2,200	3,134	2,378	6,130	8,356	1,241
Total	518,482	23,499	46,109	71,737	55,233	141,023	151,891	28,990
B. Hydropower								
a. Joint Costs	19,690	883	1,855	2,770	1,252	5,486	7,139	305
b. Specific Costs								
- Direct Cost	39,470	-	-	-	-	-	39,470	-
- Administration & Engineering	4,752	1,979	504	454	454	454	454	453
- Contingency	6,579	299	589	840	637	1,642	2,239	333
Total	70,491	3,161	2,948	4,064	2,343	7,582	49,302	1,091
C. Sara Waterworks								
a. Joint Costs	142	7	15	20	9	39	51	1
b. Specific Costs								
- Direct Cost	1,092	-	-	-	-	-	1,092	-
- Administration & Engineering	131	55	13	12	12	12	12	15
- Contingency	182	8	16	22	18	45	62	11
Total	1,547	70	44	54	39	96	1,217	27
TOTAL ECONOMIC COST	590,520	26,730	49,101	75,855	57,615	148,701	202,410	30,108

3.2 Project Benefits

Table 6-3-5 Project Benefits

(Unit: 000P)

Year	Agriculture				Power Plant	Sara Water works	Total
	Crops	ICC	Farm Road	Sub-total			
A. Financial							
~1988	-	-	-	-	-	-	-
1989	5,715	108	1,471	7,294	-	-	8,689
1990	10,435	152	2,431	13,018	-	-	16,685
1991	12,375	152	2,767	15,294	-	-	20,345
1992	34,065	405	6,371	40,841	11,739	263	52,843
1993	47,405	540	8,738	56,683	11,739	263	68,685
1994	53,999	540	9,555	64,094	11,739	263	76,096
1995	56,384	540	9,886	66,810	11,739	263	78,812
1996	57,366	540	10,049	67,955	11,739	263	79,957
1997~	64,663 (74.1)	540 (0.6)	10,089 (11.6)	75,292 (86.3)	11,739 (13.4)	263 (0.3)	87,294 (100%)
B. Economic							
~1985	-	-	-	-	-	-	-
1986	-20	-	-	-20	-	-	-20
1987	-20	-	-	-20	-	-	-20
1988	-20	-	-	-20	-	-	-20
1989	8,073	84	532	8,689	-	-	8,689
1990	15,689	118	878	16,685	-	-	16,685
1991	19,228	118	999	20,345	-	-	20,345
1992	46,700	315	2,301	49,316	9,414	205	58,935
1993	66,326	420	3,156	69,902	9,414	205	79,521
1994	77,325	420	3,452	81,197	9,414	205	90,816
1995	81,336	420	3,571	85,327	9,414	205	94,946
1996	82,990	420	3,629	87,039	9,414	205	96,658
1997~	82,998 (85.9)	420 (0.4)	3,644 (3.8)	87,062 (90.1)	9,414 (9.7)	205 (0.2)	96,681 (100%)

3.3 Financial and Economic Indicator of the Project

3.3.1 Financial Analysis

1. Agriculture

a) Farm Budget

TABLE 6-3-6 **FARM BUDGET**

Items	1.5ha Farm W.O.P.	1.5ha Farm W.P.	2.4ha Farm (Average Size) W.O.P.	2.4ha Farm (Average Size) W.P.	3.5ha Farm W.O.P.	3.5ha Farm W.P.
(Farm Land, unit: ha)						
(1) Operated Area - Paddy Field	--- 1.5 ---		--- 2.4 ---		--- 3.5 ---	
(2) Planted Area of Paddy						
a. 1st Crop, Irrigated, DS 1/	0.42	0.90	0.67	1.44	0.98	2
b. - do - TR 2/	0.03	0.60	0.05	0.96	0.07	1
c. 1st Crop, Rainfed, DS	1.00	-	1.59	-	2.31	-
d. - do - TR	0.08	-	0.12	-	0.18	-
e. 2nd & 3rd Crop, Irrigated, DS	0.34	0.97	0.54	1.55	0.80	2
f. - do - TR	0.02	0.65	0.04	1.03	0.06	1
g. 2nd Crop, Rainfed, DS	0.51	-	0.82	-	1.20	-
h. - do - TR	0.04	-	0.06	-	0.09	-
Sub-total	2.44	3.12	3.89	4.95	5.69	1
(3) Gross Production Value of Paddy	15,100	41,700	24,074	66,553	35,210	97
(4) Production Cost	11,943	27,222	19,042	43,451	27,854	63
(5) Net Production Value of Paddy	3,157	14,478	5,032	23,102	7,356	33
(6) Net Production Value of Livestock 3/	541	541	541	541	541	
(7) Total of Agricultual Income	3,698	15,019	5,573	23,643	7,897	54
(8) Non-farm Income 3/	4,981	4,981	4,981	4,981	4,981	4
(9) Total of Farm Income	8,679	20,000	10,554	28,624	12,878	59
(10) Household Expenditure						
- Food expenditure for own farm 4/	2,960	3,100	2,960	3,100	2,960	3
- Other expenditure	5,100	15,640	6,810	23,720	8,930	33
- Sub-total	8,060	18,740	9,770 3/	26,820	11,890	36
(11) Disposable Income	619	1,260	784	1,804	988	2

Note: 1/ ..... Direct Seeding
2/ ..... Transplant
3/ ..... Based on Farm Survey
4/ ..... Base of calculation is as follows:
- Annual consumption of paddy per capita = 186kg
- Family size = 6 persons
- Paddy price Without Project = 2.65₱/kg
- Paddy price With Project = 2.78₱/kg

TABLE 6-3-7 FINANCIAL PROJECT COST AND BENEFITS - AGRICULTURE -

(UNIT : MILLION PESOS)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						6 %		8 %		10 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1986	24.452	0.0	24.452	0.0	-24.452	24.452	0.0	24.452	0.0	24.452	0.0
2 1987	60.843	0.0	60.843	0.0	-60.843	54.150	0.0	52.163	0.0	50.284	0.0
3 1988	84.495	-0.744	83.751	0.0	-83.751	70.319	0.0	66.484	0.0	62.923	0.0
4 1989	66.752	-0.541	66.211	7.294	-58.917	52.445	5.778	48.667	5.361	45.223	4.982
5 1990	172.069	-0.541	171.528	13.018	-158.510	128.176	9.728	116.739	8.860	106.506	8.083
6 1991	181.297	0.862	182.159	15.294	-166.865	128.416	10.782	114.791	9.638	102.825	8.633
7 1992	36.719	1.366	38.085	40.841	2.756	25.329	27.162	22.222	23.830	19.544	20.958
8 1993	0.0	1.366	1.366	56.683	55.317	0.857	35.564	0.738	30.624	0.637	26.443
9 1994	0.0	1.366	1.366	64.094	62.728	0.809	37.937	0.683	32.063	0.579	27.182
10 1995	0.0	1.366	1.366	66.810	65.444	0.763	37.307	0.633	30.946	0.527	25.758
11 1996	0.0	1.366	1.366	67.955	66.589	0.720	35.798	0.586	29.145	0.479	23.818
12 1997	0.0	7.381	7.381	75.292	67.911	3.668	37.418	2.931	29.900	2.352	23.991
13 1998	0.0	1.366	1.366	75.292	73.926	0.640	35.300	0.502	27.685	0.396	21.810
14 1999	0.0	1.366	1.366	75.292	73.926	0.604	33.302	0.465	25.634	0.360	19.827
15 2000	0.0	1.366	1.366	75.292	73.926	0.570	31.417	0.431	23.735	0.327	18.025
16 2001	0.0	1.366	1.366	75.292	73.926	0.538	29.639	0.399	21.977	0.297	16.386
17 2002	0.0	1.366	1.366	75.292	73.926	0.507	27.961	0.369	20.349	0.270	14.896
18 2003	0.0	1.366	1.366	75.292	73.926	0.479	26.379	0.342	18.842	0.246	13.542
19 2004	0.0	1.366	1.366	75.292	73.926	0.451	24.885	0.317	17.446	0.223	12.311
20 2005	0.0	1.366	1.366	75.292	73.926	0.426	23.477	0.293	16.154	0.203	11.192
21 2006	0.0	1.366	1.366	75.292	73.926	0.402	22.148	0.271	14.957	0.185	10.174
22 2007	0.0	7.381	7.381	75.292	67.911	2.048	20.894	1.358	13.849	0.907	9.249
23 2008	0.0	1.366	1.366	75.292	73.926	0.358	19.712	0.233	12.824	0.153	8.409
24 2009	0.0	1.366	1.366	75.292	73.926	0.337	18.596	0.215	11.874	0.139	7.644
25 2010	0.0	1.366	1.366	75.292	73.926	0.318	17.543	0.199	10.994	0.126	6.949
26 2011	0.0	1.366	1.366	75.292	73.926	0.300	16.550	0.185	10.180	0.115	6.318
27 2012	0.0	1.366	1.366	75.292	73.926	0.283	15.614	0.171	9.426	0.104	5.743
28 2013	0.0	1.366	1.366	75.292	73.926	0.267	14.730	0.158	8.728	0.095	5.221
29 2014	0.0	1.366	1.366	75.292	73.926	0.252	13.896	0.147	8.081	0.086	4.746
30 2015	0.0	1.366	1.366	75.292	73.926	0.238	13.109	0.136	7.482	0.078	4.315
31 2016	0.0	24.201	24.201	75.292	51.091	3.975	12.367	2.227	6.928	1.261	3.923
32 2017	0.0	7.381	7.381	75.292	67.911	1.144	11.667	0.629	6.415	0.350	3.566
33 2018	0.0	1.366	1.366	75.292	73.926	0.200	11.007	0.108	5.940	0.059	3.242
34 2019	0.0	1.366	1.366	75.292	73.926	0.188	10.384	0.100	5.500	0.053	2.947
35 2020	0.0	1.366	1.366	75.292	73.926	0.178	9.796	0.092	5.092	0.049	2.679
36 2021	0.0	1.366	1.366	75.292	73.926	0.168	9.242	0.086	4.715	0.044	2.436
37 2022	0.0	1.366	1.366	75.292	73.926	0.158	8.719	0.079	4.366	0.040	2.214
38 2023	0.0	1.366	1.366	75.292	73.926	0.149	8.225	0.073	4.043	0.037	2.013
39 2024	0.0	1.366	1.366	75.292	73.926	0.141	7.760	0.068	3.743	0.033	1.830
40 2025	0.0	1.366	1.366	75.292	73.926	0.133	7.320	0.063	3.466	0.030	1.664
41 2026	0.0	1.366	1.366	75.292	73.926	0.125	6.906	0.058	3.209	0.027	1.512
42 2027	0.0	7.381	7.381	75.292	67.911	0.639	6.515	0.291	2.971	0.135	1.375
43 2028	0.0	1.366	1.366	75.292	73.926	0.112	6.146	0.050	2.751	0.023	1.250
44 2029	0.0	1.366	1.366	75.292	73.926	0.105	5.798	0.046	2.548	0.021	1.136
45 2030	0.0	1.366	1.366	75.292	73.926	0.099	5.470	0.043	2.359	0.019	1.033
46 2031	0.0	1.366	1.366	75.292	73.926	0.094	5.161	0.040	2.184	0.017	0.939
47 2032	0.0	1.366	1.366	75.292	73.926	0.088	4.868	0.037	2.022	0.015	0.854
48 2033	0.0	1.366	1.366	75.292	73.926	0.083	4.593	0.034	1.872	0.014	0.776
49 2034	0.0	1.366	1.366	75.292	73.926	0.079	4.333	0.031	1.734	0.013	0.706
50 2035	0.0	1.366	1.366	75.292	73.926	0.074	4.088	0.029	1.605	0.012	0.641
TOTAL	626.627	106.035	732.662	3268.377	2535.715	507.055	792.992	461.465	554.049	422.890	403.343

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.56 (6%), 1.20 (8%), 0.95 (10%)

INTERNAL RATE OF RETURN (IRR) = 9.6 %

b) Total Costs and Benefits

TABLE 6-3-8 FINANCIAL PROJECT COST AND BENEFITS - Hydropower -

(UNIT : MILLION PESOS)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE 6 %		8 %		10 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1986	4.190	0.0	4.190	0.0	-4.190	4.190	0.0	4.190	0.0	4.190	0.0
2 1987	5.604	0.0	5.604	0.0	-5.604	4.988	0.0	4.805	0.0	4.631	0.0
3 1988	7.866	0.0	7.866	0.0	-7.866	6.604	0.0	6.244	0.0	5.910	0.0
4 1989	4.078	0.0	4.078	0.0	-4.078	3.230	0.0	2.997	0.0	2.785	0.0
5 1990	16.119	0.0	16.119	0.0	-16.119	12.045	0.0	10.970	0.0	10.009	0.0
6 1991	62.584	0.0	62.584	0.0	-62.584	44.119	0.0	39.439	0.0	35.327	0.0
7 1992	1.579	0.0	1.579	11.739	10.160	1.050	7.807	0.921	6.850	0.810	6.024
8 1993	0.0	0.0	0.0	11.739	11.739	0.0	7.365	0.0	6.342	0.0	5.476
9 1994	0.0	0.0	0.0	11.739	11.739	0.0	6.948	0.0	5.872	0.0	4.979
10 1995	0.0	0.0	0.0	11.739	11.739	0.0	6.555	0.0	5.437	0.0	4.526
11 1996	0.0	0.0	0.0	11.739	11.739	0.0	6.184	0.0	5.035	0.0	4.114
12 1997	0.0	0.0	0.0	11.739	11.739	0.0	5.834	0.0	4.662	0.0	3.740
13 1998	0.0	0.0	0.0	11.739	11.739	0.0	5.504	0.0	4.316	0.0	3.400
14 1999	0.0	0.0	0.0	11.739	11.739	0.0	5.192	0.0	3.997	0.0	3.091
15 2000	0.0	0.0	0.0	11.739	11.739	0.0	4.898	0.0	3.701	0.0	2.810
16 2001	0.0	0.0	0.0	11.739	11.739	0.0	4.621	0.0	3.427	0.0	2.555
17 2002	0.0	0.0	0.0	11.739	11.739	0.0	4.360	0.0	3.173	0.0	2.323
18 2003	0.0	0.0	0.0	11.739	11.739	0.0	4.113	0.0	2.938	0.0	2.111
19 2004	0.0	0.0	0.0	11.739	11.739	0.0	3.880	0.0	2.720	0.0	1.919
20 2005	0.0	0.0	0.0	11.739	11.739	0.0	3.660	0.0	2.519	0.0	1.745
21 2006	0.0	0.0	0.0	11.739	11.739	0.0	3.453	0.0	2.332	0.0	1.586
22 2007	0.0	0.0	0.0	11.739	11.739	0.0	3.258	0.0	2.159	0.0	1.442
23 2008	0.0	0.0	0.0	11.739	11.739	0.0	3.073	0.0	1.999	0.0	1.311
24 2009	0.0	0.0	0.0	11.739	11.739	0.0	2.899	0.0	1.851	0.0	1.192
25 2010	0.0	0.0	0.0	11.739	11.739	0.0	2.735	0.0	1.714	0.0	1.083
26 2011	0.0	0.0	0.0	11.739	11.739	0.0	2.580	0.0	1.587	0.0	0.985
27 2012	0.0	0.0	0.0	11.739	11.739	0.0	2.434	0.0	1.470	0.0	0.895
28 2013	0.0	0.0	0.0	11.739	11.739	0.0	2.297	0.0	1.361	0.0	0.814
29 2014	0.0	0.0	0.0	11.739	11.739	0.0	2.167	0.0	1.260	0.0	0.740
30 2015	0.0	0.0	0.0	11.739	11.739	0.0	2.044	0.0	1.167	0.0	0.673
31 2016	0.0	26.292	26.292	11.739	-14.553	4.319	1.928	2.419	1.080	1.370	0.612
32 2017	0.0	0.0	0.0	11.739	11.739	0.0	1.819	0.0	1.000	0.0	0.556
33 2018	0.0	0.0	0.0	11.739	11.739	0.0	1.716	0.0	0.926	0.0	0.505
34 2019	0.0	0.0	0.0	11.739	11.739	0.0	1.619	0.0	0.857	0.0	0.460
35 2020	0.0	0.0	0.0	11.739	11.739	0.0	1.527	0.0	0.794	0.0	0.418
36 2021	0.0	0.0	0.0	11.739	11.739	0.0	1.441	0.0	0.735	0.0	0.380
37 2022	0.0	0.0	0.0	11.739	11.739	0.0	1.359	0.0	0.681	0.0	0.345
38 2023	0.0	0.0	0.0	11.739	11.739	0.0	1.282	0.0	0.630	0.0	0.314
39 2024	0.0	0.0	0.0	11.739	11.739	0.0	1.210	0.0	0.584	0.0	0.285
40 2025	0.0	0.0	0.0	11.739	11.739	0.0	1.141	0.0	0.540	0.0	0.259
41 2026	0.0	0.0	0.0	11.739	11.739	0.0	1.077	0.0	0.500	0.0	0.236
42 2027	0.0	0.0	0.0	11.739	11.739	0.0	1.016	0.0	0.463	0.0	0.214
43 2028	0.0	0.0	0.0	11.739	11.739	0.0	0.958	0.0	0.429	0.0	0.195
44 2029	0.0	0.0	0.0	11.739	11.739	0.0	0.904	0.0	0.397	0.0	0.177
45 2030	0.0	0.0	0.0	11.739	11.739	0.0	0.853	0.0	0.368	0.0	0.161
46 2031	0.0	0.0	0.0	11.739	11.739	0.0	0.805	0.0	0.341	0.0	0.146
47 2032	0.0	0.0	0.0	11.739	11.739	0.0	0.759	0.0	0.315	0.0	0.133
48 2033	0.0	0.0	0.0	11.739	11.739	0.0	0.716	0.0	0.292	0.0	0.121
49 2034	0.0	0.0	0.0	11.739	11.739	0.0	0.676	0.0	0.270	0.0	0.110
50 2035	0.0	0.0	0.0	11.739	11.739	0.0	0.637	0.0	0.250	0.0	0.100
TOTAL	102.020	26.292	128.312	516.516	388.204	80.546	127.306	71.986	89.342	65.033	65.265

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.58 (6%), 1.24 (8%), 1.00 (10%) ,
INTERNAL RATE OF RETURN (IRR) = 10.0 %

TABLE 6-3-9 FINANCIAL PROJECT COST AND BENEFITS - Sara Waterworks -

(UNIT : MILLION PESOS)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						6 %		8 %		10 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1986	0.097	0.0	0.097	0.0	-0.097	0.097	0.0	0.097	0.0	0.097	0.0
2 1987	0.103	0.0	0.103	0.0	-0.103	0.092	0.0	0.088	0.0	0.085	0.0
3 1988	0.141	0.0	0.141	0.0	-0.141	0.118	0.0	0.112	0.0	0.106	0.0
4 1989	0.080	0.0	0.080	0.0	-0.080	0.063	0.0	0.059	0.0	0.055	0.0
5 1990	0.286	0.0	0.286	0.0	-0.286	0.214	0.0	0.195	0.0	0.178	0.0
6 1991	1.551	0.0	1.551	0.0	-1.551	1.093	0.0	0.977	0.0	0.876	0.0
7 1992	0.041	0.0	0.041	0.263	0.222	0.027	0.175	0.024	0.153	0.021	0.135
8 1993	0.0	0.0	0.0	0.263	0.263	0.0	0.165	0.0	0.142	0.0	0.123
9 1994	0.0	0.0	0.0	0.263	0.263	0.0	0.156	0.0	0.132	0.0	0.112
10 1995	0.0	0.0	0.0	0.263	0.263	0.0	0.147	0.0	0.122	0.0	0.101
11 1996	0.0	0.0	0.0	0.263	0.263	0.0	0.139	0.0	0.113	0.0	0.092
12 1997	0.0	0.0	0.0	0.263	0.263	0.0	0.131	0.0	0.104	0.0	0.084
13 1998	0.0	0.0	0.0	0.263	0.263	0.0	0.123	0.0	0.097	0.0	0.076
14 1999	0.0	0.0	0.0	0.263	0.263	0.0	0.116	0.0	0.090	0.0	0.069
15 2000	0.0	0.0	0.0	0.263	0.263	0.0	0.110	0.0	0.083	0.0	0.063
16 2001	0.0	0.0	0.0	0.263	0.263	0.0	0.104	0.0	0.077	0.0	0.057
17 2002	0.0	0.0	0.0	0.263	0.263	0.0	0.098	0.0	0.071	0.0	0.052
18 2003	0.0	0.0	0.0	0.263	0.263	0.0	0.092	0.0	0.066	0.0	0.047
19 2004	0.0	0.0	0.0	0.263	0.263	0.0	0.087	0.0	0.061	0.0	0.043
20 2005	0.0	0.0	0.0	0.263	0.263	0.0	0.082	0.0	0.056	0.0	0.039
21 2006	0.0	0.0	0.0	0.263	0.263	0.0	0.077	0.0	0.052	0.0	0.036
22 2007	0.0	0.0	0.0	0.263	0.263	0.0	0.073	0.0	0.048	0.0	0.032
23 2008	0.0	0.0	0.0	0.263	0.263	0.0	0.069	0.0	0.045	0.0	0.029
24 2009	0.0	0.0	0.0	0.263	0.263	0.0	0.065	0.0	0.041	0.0	0.027
25 2010	0.0	0.0	0.0	0.263	0.263	0.0	0.061	0.0	0.038	0.0	0.024
26 2011	0.0	0.0	0.0	0.263	0.263	0.0	0.058	0.0	0.036	0.0	0.022
27 2012	0.0	0.0	0.0	0.263	0.263	0.0	0.055	0.0	0.033	0.0	0.020
28 2013	0.0	0.0	0.0	0.263	0.263	0.0	0.051	0.0	0.030	0.0	0.018
29 2014	0.0	0.0	0.0	0.263	0.263	0.0	0.049	0.0	0.028	0.0	0.017
30 2015	0.0	0.0	0.0	0.263	0.263	0.0	0.046	0.0	0.026	0.0	0.015
31 2016	0.0	0.0	0.0	0.263	0.263	0.0	0.043	0.0	0.024	0.0	0.014
32 2017	0.0	0.0	0.0	0.263	0.263	0.0	0.041	0.0	0.022	0.0	0.012
33 2018	0.0	0.0	0.0	0.263	0.263	0.0	0.038	0.0	0.021	0.0	0.011
34 2019	0.0	0.0	0.0	0.263	0.263	0.0	0.036	0.0	0.019	0.0	0.010
35 2020	0.0	0.0	0.0	0.263	0.263	0.0	0.034	0.0	0.018	0.0	0.009
36 2021	0.0	0.0	0.0	0.263	0.263	0.0	0.032	0.0	0.016	0.0	0.009
37 2022	0.0	0.0	0.0	0.263	0.263	0.0	0.030	0.0	0.015	0.0	0.008
38 2023	0.0	0.0	0.0	0.263	0.263	0.0	0.029	0.0	0.014	0.0	0.007
39 2024	0.0	0.0	0.0	0.263	0.263	0.0	0.027	0.0	0.013	0.0	0.006
40 2025	0.0	0.0	0.0	0.263	0.263	0.0	0.026	0.0	0.012	0.0	0.006
41 2026	0.0	0.0	0.0	0.263	0.263	0.0	0.024	0.0	0.011	0.0	0.005
42 2027	0.0	0.0	0.0	0.263	0.263	0.0	0.023	0.0	0.010	0.0	0.005
43 2028	0.0	0.0	0.0	0.263	0.263	0.0	0.021	0.0	0.010	0.0	0.004
44 2029	0.0	0.0	0.0	0.263	0.263	0.0	0.020	0.0	0.009	0.0	0.004
45 2030	0.0	0.0	0.0	0.263	0.263	0.0	0.019	0.0	0.008	0.0	0.004
46 2031	0.0	0.0	0.0	0.263	0.263	0.0	0.018	0.0	0.008	0.0	0.003
47 2032	0.0	0.0	0.0	0.263	0.263	0.0	0.017	0.0	0.007	0.0	0.003
48 2033	0.0	0.0	0.0	0.263	0.263	0.0	0.016	0.0	0.007	0.0	0.003
49 2034	0.0	0.0	0.0	0.263	0.263	0.0	0.015	0.0	0.006	0.0	0.002
50 2035	0.0	0.0	0.0	0.263	0.263	0.0	0.014	0.0	0.006	0.0	0.002
TOTAL	2.299	0.0	2.299	11.572	9.273	1.705	2.852	1.552	2.002	1.417	1.462

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.67 (6%), 1.29 (8%), 1.03 (10%)

INTERNAL RATE OF RETURN (IRR) = 10.3 %

TABLE 6-3-10 FINANCIAL PROJECT COST AND BENEFITS - OVERALL -

(UNIT : MILLION PESOS)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						6 %		8 %		10 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1986	28.739	0.0	28.739	0.0	-28.739	28.739	0.0	28.739	0.0	28.739	0.0
2 1987	66.550	0.0	66.550	0.0	-66.550	59.229	0.0	57.056	0.0	55.000	0.0
3 1988	92.502	-0.744	91.758	0.0	-91.758	77.042	0.0	72.841	0.0	68.939	0.0
4 1989	70.910	-0.541	70.369	7.294	-63.075	55.739	5.778	51.723	5.361	48.063	4.982
5 1990	188.474	-0.541	187.933	13.018	-174.915	140.435	9.728	127.904	8.860	116.692	8.083
6 1991	245.432	0.862	246.294	15.294	-231.000	173.628	10.782	155.207	9.638	139.027	8.633
7 1992	38.339	1.366	39.705	52.843	13.138	26.406	35.144	23.168	30.833	20.375	27.117
8 1993	0.0	1.366	1.366	68.685	67.319	0.857	43.094	0.738	37.109	0.637	32.042
9 1994	0.0	1.366	1.366	76.096	74.730	0.809	45.041	0.683	38.067	0.579	32.272
10 1995	0.0	1.366	1.366	78.812	77.446	0.763	44.009	0.633	36.505	0.527	30.386
11 1996	0.0	1.366	1.366	79.957	78.591	0.720	42.121	0.586	34.292	0.479	28.025
12 1997	0.0	7.381	7.381	87.294	79.913	3.668	43.383	2.931	34.666	2.352	27.815
13 1998	0.0	1.366	1.366	87.294	85.928	0.640	40.927	0.502	32.098	0.396	25.286
14 1999	0.0	1.366	1.366	87.294	85.928	0.604	38.611	0.465	29.720	0.360	22.988
15 2000	0.0	1.366	1.366	87.294	85.928	0.570	36.425	0.431	27.519	0.327	20.898
16 2001	0.0	1.366	1.366	87.294	85.928	0.538	34.363	0.399	25.481	0.297	18.998
17 2002	0.0	1.366	1.366	87.294	85.928	0.507	32.418	0.369	23.593	0.270	17.271
18 2003	0.0	1.366	1.366	87.294	85.928	0.479	30.583	0.342	21.845	0.246	15.701
19 2004	0.0	1.366	1.366	87.294	85.928	0.451	28.852	0.317	20.227	0.223	14.274
20 2005	0.0	1.366	1.366	87.294	85.928	0.426	27.219	0.293	18.729	0.203	12.976
21 2006	0.0	1.366	1.366	87.294	85.928	0.402	25.679	0.271	17.342	0.185	11.796
22 2007	0.0	7.381	7.381	87.294	79.913	2.048	24.225	1.358	16.057	0.907	10.724
23 2008	0.0	1.366	1.366	87.294	85.928	0.358	22.854	0.233	14.868	0.153	9.749
24 2009	0.0	1.366	1.366	87.294	85.928	0.337	21.560	0.215	13.766	0.139	8.863
25 2010	0.0	1.366	1.366	87.294	85.928	0.318	20.340	0.199	12.747	0.126	8.057
26 2011	0.0	1.366	1.366	87.294	85.928	0.300	19.189	0.185	11.802	0.115	7.325
27 2012	0.0	1.366	1.366	87.294	85.928	0.283	18.102	0.171	10.928	0.104	6.659
28 2013	0.0	1.366	1.366	87.294	85.928	0.267	17.078	0.158	10.119	0.095	6.053
29 2014	0.0	1.366	1.366	87.294	85.928	0.252	16.111	0.147	9.369	0.086	5.503
30 2015	0.0	1.366	1.366	87.294	85.928	0.238	15.199	0.136	8.675	0.078	5.003
31 2016	0.0	50.493	50.493	87.294	36.801	8.294	14.339	4.646	8.033	2.631	4.548
32 2017	0.0	7.381	7.381	87.294	79.913	1.144	13.527	0.629	7.438	0.350	4.135
33 2018	0.0	1.366	1.366	87.294	85.928	0.200	12.762	0.108	6.887	0.059	3.759
34 2019	0.0	1.366	1.366	87.294	85.928	0.188	12.039	0.100	6.377	0.053	3.417
35 2020	0.0	1.366	1.366	87.294	85.928	0.178	11.358	0.092	5.904	0.049	3.106
36 2021	0.0	1.366	1.366	87.294	85.928	0.168	10.715	0.086	5.467	0.044	2.824
37 2022	0.0	1.366	1.366	87.294	85.928	0.158	10.108	0.079	5.062	0.040	2.567
38 2023	0.0	1.366	1.366	87.294	85.928	0.149	9.536	0.073	4.687	0.037	2.334
39 2024	0.0	1.366	1.366	87.294	85.928	0.141	8.996	0.068	4.340	0.033	2.122
40 2025	0.0	1.366	1.366	87.294	85.928	0.133	8.487	0.063	4.018	0.030	1.929
41 2026	0.0	1.366	1.366	87.294	85.928	0.125	8.007	0.058	3.721	0.027	1.753
42 2027	0.0	7.381	7.381	87.294	79.913	0.639	7.554	0.291	3.445	0.135	1.594
43 2028	0.0	1.366	1.366	87.294	85.928	0.112	7.126	0.050	3.190	0.023	1.449
44 2029	0.0	1.366	1.366	87.294	85.928	0.105	6.723	0.046	2.954	0.021	1.317
45 2030	0.0	1.366	1.366	87.294	85.928	0.099	6.342	0.043	2.735	0.019	1.198
46 2031	0.0	1.366	1.366	87.294	85.928	0.094	5.983	0.040	2.532	0.017	1.089
47 2032	0.0	1.366	1.366	87.294	85.928	0.088	5.645	0.037	2.345	0.015	0.990
48 2033	0.0	1.366	1.366	87.294	85.928	0.083	5.325	0.034	2.171	0.014	0.900
49 2034	0.0	1.366	1.366	87.294	85.928	0.079	5.024	0.031	2.010	0.013	0.818
50 2035	0.0	1.366	1.366	87.294	85.928	0.074	4.739	0.029	1.861	0.012	0.744
TOTAL	730.946	132.327	863.273	3796.465	2933.192	589.305	923.151	535.003	645.393	489.339	470.070

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.57 (6%), 1.21 (8%), 0.96 (10%)
INTERNAL RATE OF RETURN (IRR) = 9.7 %

TABLE 6-3-11 ECONOMIC PROJECT COST AND BENEFITS - AGRICULTURE -

(UNIT : MILLION PESOS)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						10 %		12 %		14 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1986	23.499	0.0	23.499	-0.020	-23.519	23.499	-0.020	23.499	-0.020	23.499	-0.020
2 1987	46.109	0.0	46.109	-0.020	-46.129	38.107	-0.017	36.758	-0.016	35.479	-0.015
3 1988	71.737	-0.703	71.034	-0.020	-71.054	53.369	-0.015	50.561	-0.014	47.946	-0.013
4 1989	55.233	-0.533	54.700	8.689	-46.011	37.361	5.935	34.763	5.522	32.387	5.145
5 1990	141.023	-0.533	140.490	16.685	-123.805	87.234	10.360	79.718	9.468	72.966	8.666
6 1991	151.891	0.638	152.529	20.345	-132.184	86.099	11.484	77.276	10.307	69.491	9.269
7 1992	28.990	1.055	30.045	49.316	19.271	15.418	25.307	13.591	22.308	12.007	19.709
8 1993	0.0	1.055	1.055	69.902	68.847	0.492	32.610	0.426	28.232	0.370	24.505
9 1994	0.0	1.055	1.055	81.197	80.142	0.447	34.436	0.380	29.281	0.324	24.969
10 1995	0.0	1.055	1.055	85.327	84.272	0.407	32.898	0.340	27.473	0.285	23.017
11 1996	0.0	1.055	1.055	87.039	85.984	0.370	30.507	0.303	25.022	0.250	20.595
12 1997	0.0	7.070	7.070	87.062	79.992	2.253	27.741	1.815	22.347	1.467	18.071
13 1998	0.0	1.055	1.055	87.062	86.007	0.306	25.219	0.242	19.952	0.192	15.852
14 1999	0.0	1.055	1.055	87.062	86.007	0.278	22.926	0.216	17.815	0.168	13.905
15 2000	0.0	1.055	1.055	87.062	86.007	0.253	20.842	0.193	15.906	0.148	12.197
16 2001	0.0	1.055	1.055	87.062	86.007	0.230	18.947	0.172	14.202	0.130	10.699
17 2002	0.0	1.055	1.055	87.062	86.007	0.209	17.225	0.154	12.680	0.114	9.385
18 2003	0.0	1.055	1.055	87.062	86.007	0.190	15.659	0.137	11.322	0.100	8.233
19 2004	0.0	1.055	1.055	87.062	86.007	0.173	14.236	0.122	10.109	0.088	7.222
20 2005	0.0	1.055	1.055	87.062	86.007	0.157	12.941	0.109	9.026	0.077	6.335
21 2006	0.0	1.055	1.055	87.062	86.007	0.143	11.765	0.098	8.058	0.067	5.557
22 2007	0.0	7.070	7.070	87.062	79.992	0.869	10.695	0.584	7.195	0.396	4.875
23 2008	0.0	1.055	1.055	87.062	86.007	0.118	9.723	0.078	6.424	0.052	4.276
24 2009	0.0	1.055	1.055	87.062	86.007	0.107	8.839	0.070	5.736	0.045	3.751
25 2010	0.0	1.055	1.055	87.062	86.007	0.097	8.036	0.062	5.121	0.040	3.290
26 2011	0.0	1.055	1.055	87.062	86.007	0.089	7.305	0.055	4.573	0.035	2.886
27 2012	0.0	1.055	1.055	87.062	86.007	0.080	6.641	0.049	4.083	0.031	2.532
28 2013	0.0	1.055	1.055	87.062	86.007	0.073	6.037	0.044	3.645	0.027	2.221
29 2014	0.0	1.055	1.055	87.062	86.007	0.067	5.488	0.039	3.255	0.024	1.948
30 2015	0.0	1.055	1.055	87.062	86.007	0.060	4.990	0.035	2.906	0.021	1.709
31 2016	0.0	23.793	23.793	87.062	63.269	1.240	4.536	0.709	2.595	0.410	1.499
32 2017	0.0	7.070	7.070	87.062	79.992	0.335	4.124	0.188	2.317	0.107	1.315
33 2018	0.0	1.055	1.055	87.062	86.007	0.045	3.749	0.025	2.068	0.014	1.153
34 2019	0.0	1.055	1.055	87.062	86.007	0.041	3.408	0.022	1.847	0.012	1.012
35 2020	0.0	1.055	1.055	87.062	86.007	0.038	3.098	0.020	1.649	0.011	0.888
36 2021	0.0	1.055	1.055	87.062	86.007	0.034	2.816	0.018	1.472	0.009	0.779
37 2022	0.0	1.055	1.055	87.062	86.007	0.031	2.560	0.016	1.315	0.008	0.683
38 2023	0.0	1.055	1.055	87.062	86.007	0.028	2.328	0.014	1.174	0.007	0.599
39 2024	0.0	1.055	1.055	87.062	86.007	0.026	2.116	0.013	1.048	0.006	0.525
40 2025	0.0	1.055	1.055	87.062	86.007	0.023	1.924	0.011	0.936	0.006	0.461
41 2026	0.0	1.055	1.055	87.062	86.007	0.021	1.749	0.010	0.835	0.005	0.404
42 2027	0.0	7.070	7.070	87.062	79.992	0.129	1.590	0.061	0.746	0.029	0.355
43 2028	0.0	1.055	1.055	87.062	86.007	0.018	1.445	0.008	0.666	0.004	0.311
44 2029	0.0	1.055	1.055	87.062	86.007	0.016	1.314	0.007	0.595	0.003	0.273
45 2030	0.0	1.055	1.055	87.062	86.007	0.014	1.194	0.006	0.531	0.003	0.239
46 2031	0.0	1.055	1.055	87.062	86.007	0.013	1.086	0.006	0.474	0.003	0.210
47 2032	0.0	1.055	1.055	87.062	86.007	0.012	0.987	0.005	0.423	0.002	0.184
48 2033	0.0	1.055	1.055	87.062	86.007	0.011	0.897	0.005	0.378	0.002	0.162
49 2034	0.0	1.055	1.055	87.062	86.007	0.010	0.816	0.004	0.337	0.002	0.142
50 2035	0.0	1.055	1.055	87.062	86.007	0.009	0.742	0.004	0.301	0.002	0.124
TOTAL	518.482	92.087	610.569	3813.858	3203.289	350.645	481.221	323.042	363.623	298.868	282.085

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.37 (10%), 1.13 (12%), 0.94 (14%)
INTERNAL RATE OF RETURN (IRR) = 13.3 %

TABLE 6-3-12 ECONOMIC PROJECT COST AND BENEFITS - Hydropower -

(UNIT : MILLION PESOS)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						10 %		12 %		14 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1986	3.161	0.0	3.161	0.0	-3.161	3.161	0.0	3.161	0.0	3.161	0.0
2 1987	2.948	0.0	2.948	0.0	-2.948	2.436	0.0	2.350	0.0	2.268	0.0
3 1988	4.064	0.0	4.064	0.0	-4.064	3.053	0.0	2.893	0.0	2.743	0.0
4 1989	2.343	0.0	2.343	0.0	-2.343	1.600	0.0	1.489	0.0	1.387	0.0
5 1990	7.582	0.0	7.582	0.0	-7.582	4.708	0.0	4.302	0.0	3.938	0.0
6 1991	49.302	0.0	49.302	0.0	-49.302	27.830	0.0	24.978	0.0	22.461	0.0
7 1992	1.091	0.0	1.091	9.414	8.323	0.560	4.831	0.494	4.258	0.436	3.762
8 1993	0.0	0.0	0.0	9.414	9.414	0.0	4.392	0.0	3.802	0.0	3.300
9 1994	0.0	0.0	0.0	9.414	9.414	0.0	3.992	0.0	3.395	0.0	2.895
10 1995	0.0	0.0	0.0	9.414	9.414	0.0	3.630	0.0	3.031	0.0	2.539
11 1996	0.0	0.0	0.0	9.414	9.414	0.0	3.300	0.0	2.706	0.0	2.228
12 1997	0.0	0.0	0.0	9.414	9.414	0.0	3.000	0.0	2.416	0.0	1.954
13 1998	0.0	0.0	0.0	9.414	9.414	0.0	2.727	0.0	2.157	0.0	1.714
14 1999	0.0	0.0	0.0	9.414	9.414	0.0	2.479	0.0	1.926	0.0	1.504
15 2000	0.0	0.0	0.0	9.414	9.414	0.0	2.254	0.0	1.720	0.0	1.319
16 2001	0.0	0.0	0.0	9.414	9.414	0.0	2.049	0.0	1.536	0.0	1.157
17 2002	0.0	0.0	0.0	9.414	9.414	0.0	1.863	0.0	1.371	0.0	1.015
18 2003	0.0	0.0	0.0	9.414	9.414	0.0	1.693	0.0	1.224	0.0	0.890
19 2004	0.0	0.0	0.0	9.414	9.414	0.0	1.539	0.0	1.093	0.0	0.781
20 2005	0.0	0.0	0.0	9.414	9.414	0.0	1.399	0.0	0.976	0.0	0.685
21 2006	0.0	0.0	0.0	9.414	9.414	0.0	1.272	0.0	0.871	0.0	0.601
22 2007	0.0	0.0	0.0	9.414	9.414	0.0	1.156	0.0	0.778	0.0	0.527
23 2008	0.0	0.0	0.0	9.414	9.414	0.0	1.051	0.0	0.695	0.0	0.462
24 2009	0.0	0.0	0.0	9.414	9.414	0.0	0.956	0.0	0.620	0.0	0.406
25 2010	0.0	0.0	0.0	9.414	9.414	0.0	0.869	0.0	0.554	0.0	0.356
26 2011	0.0	0.0	0.0	9.414	9.414	0.0	0.790	0.0	0.494	0.0	0.312
27 2012	0.0	0.0	0.0	9.414	9.414	0.0	0.718	0.0	0.441	0.0	0.274
28 2013	0.0	0.0	0.0	9.414	9.414	0.0	0.653	0.0	0.394	0.0	0.240
29 2014	0.0	0.0	0.0	9.414	9.414	0.0	0.593	0.0	0.352	0.0	0.211
30 2015	0.0	0.0	0.0	9.414	9.414	0.0	0.540	0.0	0.314	0.0	0.185
31 2016	0.0	26.292	26.292	9.414	-16.878	1.370	0.490	0.784	0.281	0.453	0.162
32 2017	0.0	0.0	0.0	9.414	9.414	0.0	0.446	0.0	0.250	0.0	0.142
33 2018	0.0	0.0	0.0	9.414	9.414	0.0	0.405	0.0	0.224	0.0	0.125
34 2019	0.0	0.0	0.0	9.414	9.414	0.0	0.368	0.0	0.200	0.0	0.109
35 2020	0.0	0.0	0.0	9.414	9.414	0.0	0.335	0.0	0.178	0.0	0.096
36 2021	0.0	0.0	0.0	9.414	9.414	0.0	0.305	0.0	0.159	0.0	0.084
37 2022	0.0	0.0	0.0	9.414	9.414	0.0	0.277	0.0	0.142	0.0	0.074
38 2023	0.0	0.0	0.0	9.414	9.414	0.0	0.252	0.0	0.127	0.0	0.065
39 2024	0.0	0.0	0.0	9.414	9.414	0.0	0.229	0.0	0.113	0.0	0.057
40 2025	0.0	0.0	0.0	9.414	9.414	0.0	0.208	0.0	0.101	0.0	0.050
41 2026	0.0	0.0	0.0	9.414	9.414	0.0	0.189	0.0	0.090	0.0	0.044
42 2027	0.0	0.0	0.0	9.414	9.414	0.0	0.172	0.0	0.081	0.0	0.038
43 2028	0.0	0.0	0.0	9.414	9.414	0.0	0.156	0.0	0.072	0.0	0.034
44 2029	0.0	0.0	0.0	9.414	9.414	0.0	0.142	0.0	0.064	0.0	0.030
45 2030	0.0	0.0	0.0	9.414	9.414	0.0	0.129	0.0	0.057	0.0	0.026
46 2031	0.0	0.0	0.0	9.414	9.414	0.0	0.117	0.0	0.051	0.0	0.023
47 2032	0.0	0.0	0.0	9.414	9.414	0.0	0.107	0.0	0.046	0.0	0.020
48 2033	0.0	0.0	0.0	9.414	9.414	0.0	0.097	0.0	0.041	0.0	0.017
49 2034	0.0	0.0	0.0	9.414	9.414	0.0	0.088	0.0	0.036	0.0	0.015
50 2035	0.0	0.0	0.0	9.414	9.414	0.0	0.080	0.0	0.033	0.0	0.013
TOTAL	70.491	26.292	96.783	414.216	317.433	44.718	52.338	40.450	39.474	36.848	30.539

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.17 (10%), 0.98 (12%), 0.83 (14%)
INTERNAL RATE OF RETURN (IRR) = 11.7 %

TABLE 6-3-13 ECONOMIC PROJECT COST AND BENEFITS - Sara Waterworks -

(UNIT : MILLION PESOS)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						10 %		12 %		14 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1986	0.070	0.0	0.070	0.0	-0.070	0.070	0.0	0.070	0.0	0.070	0.0
2 1987	0.044	0.0	0.044	0.0	-0.044	0.036	0.0	0.035	0.0	0.034	0.0
3 1988	0.054	0.0	0.054	0.0	-0.054	0.041	0.0	0.038	0.0	0.036	0.0
4 1989	0.039	0.0	0.039	0.0	-0.039	0.027	0.0	0.025	0.0	0.023	0.0
5 1990	0.096	0.0	0.096	0.0	-0.096	0.060	0.0	0.054	0.0	0.050	0.0
6 1991	1.217	0.0	1.217	0.0	-1.217	0.687	0.0	0.617	0.0	0.554	0.0
7 1992	0.027	0.0	0.027	0.205	0.178	0.014	0.105	0.012	0.093	0.011	0.082
8 1993	0.0	0.0	0.0	0.205	0.205	0.0	0.096	0.0	0.083	0.0	0.072
9 1994	0.0	0.0	0.0	0.205	0.205	0.0	0.087	0.0	0.074	0.0	0.063
10 1995	0.0	0.0	0.0	0.205	0.205	0.0	0.079	0.0	0.066	0.0	0.055
11 1996	0.0	0.0	0.0	0.205	0.205	0.0	0.072	0.0	0.059	0.0	0.049
12 1997	0.0	0.0	0.0	0.205	0.205	0.0	0.065	0.0	0.053	0.0	0.043
13 1998	0.0	0.0	0.0	0.205	0.205	0.0	0.059	0.0	0.047	0.0	0.037
14 1999	0.0	0.0	0.0	0.205	0.205	0.0	0.054	0.0	0.042	0.0	0.033
15 2000	0.0	0.0	0.0	0.205	0.205	0.0	0.049	0.0	0.037	0.0	0.029
16 2001	0.0	0.0	0.0	0.205	0.205	0.0	0.045	0.0	0.033	0.0	0.025
17 2002	0.0	0.0	0.0	0.205	0.205	0.0	0.041	0.0	0.030	0.0	0.022
18 2003	0.0	0.0	0.0	0.205	0.205	0.0	0.037	0.0	0.027	0.0	0.019
19 2004	0.0	0.0	0.0	0.205	0.205	0.0	0.034	0.0	0.024	0.0	0.017
20 2005	0.0	0.0	0.0	0.205	0.205	0.0	0.030	0.0	0.021	0.0	0.015
21 2006	0.0	0.0	0.0	0.205	0.205	0.0	0.028	0.0	0.019	0.0	0.013
22 2007	0.0	0.0	0.0	0.205	0.205	0.0	0.025	0.0	0.017	0.0	0.011
23 2008	0.0	0.0	0.0	0.205	0.205	0.0	0.023	0.0	0.015	0.0	0.010
24 2009	0.0	0.0	0.0	0.205	0.205	0.0	0.021	0.0	0.014	0.0	0.009
25 2010	0.0	0.0	0.0	0.205	0.205	0.0	0.019	0.0	0.012	0.0	0.008
26 2011	0.0	0.0	0.0	0.205	0.205	0.0	0.017	0.0	0.011	0.0	0.007
27 2012	0.0	0.0	0.0	0.205	0.205	0.0	0.016	0.0	0.010	0.0	0.006
28 2013	0.0	0.0	0.0	0.205	0.205	0.0	0.014	0.0	0.009	0.0	0.005
29 2014	0.0	0.0	0.0	0.205	0.205	0.0	0.013	0.0	0.008	0.0	0.005
30 2015	0.0	0.0	0.0	0.205	0.205	0.0	0.012	0.0	0.007	0.0	0.004
31 2016	0.0	0.0	0.0	0.205	0.205	0.0	0.011	0.0	0.006	0.0	0.004
32 2017	0.0	0.0	0.0	0.205	0.205	0.0	0.010	0.0	0.005	0.0	0.003
33 2018	0.0	0.0	0.0	0.205	0.205	0.0	0.009	0.0	0.005	0.0	0.003
34 2019	0.0	0.0	0.0	0.205	0.205	0.0	0.008	0.0	0.004	0.0	0.002
35 2020	0.0	0.0	0.0	0.205	0.205	0.0	0.007	0.0	0.004	0.0	0.002
36 2021	0.0	0.0	0.0	0.205	0.205	0.0	0.007	0.0	0.003	0.0	0.002
37 2022	0.0	0.0	0.0	0.205	0.205	0.0	0.006	0.0	0.003	0.0	0.002
38 2023	0.0	0.0	0.0	0.205	0.205	0.0	0.005	0.0	0.003	0.0	0.001
39 2024	0.0	0.0	0.0	0.205	0.205	0.0	0.005	0.0	0.002	0.0	0.001
40 2025	0.0	0.0	0.0	0.205	0.205	0.0	0.005	0.0	0.002	0.0	0.001
41 2026	0.0	0.0	0.0	0.205	0.205	0.0	0.004	0.0	0.002	0.0	0.001
42 2027	0.0	0.0	0.0	0.205	0.205	0.0	0.004	0.0	0.002	0.0	0.001
43 2028	0.0	0.0	0.0	0.205	0.205	0.0	0.003	0.0	0.002	0.0	0.001
44 2029	0.0	0.0	0.0	0.205	0.205	0.0	0.003	0.0	0.001	0.0	0.001
45 2030	0.0	0.0	0.0	0.205	0.205	0.0	0.003	0.0	0.001	0.0	0.001
46 2031	0.0	0.0	0.0	0.205	0.205	0.0	0.003	0.0	0.001	0.0	0.000
47 2032	0.0	0.0	0.0	0.205	0.205	0.0	0.002	0.0	0.001	0.0	0.000
48 2033	0.0	0.0	0.0	0.205	0.205	0.0	0.002	0.0	0.001	0.0	0.000
49 2034	0.0	0.0	0.0	0.205	0.205	0.0	0.002	0.0	0.001	0.0	0.000
50 2035	0.0	0.0	0.0	0.205	0.205	0.0	0.002	0.0	0.001	0.0	0.000
TOTAL	1.547	0.0	1.547	9.020	7.473	0.934	1.140	0.852	0.860	0.778	0.665

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.22 (10%), 1.01 (12%), 0.85 (14%)
INTERNAL RATE OF RETURN (IRR) = 12.1 %

TABLE 6-3-14 ECONOMIC PROJECT COST AND BENEFITS - OVERALL -

(UNIT : MILLION PESOS)

YEAR	PROJECT COST			BENEFITS	RETURN	PRESENT WORTH VALUE BY DISCOUNT RATE					
						10 %		12 %		14 %	
	CAPITAL	O & M	TOTAL			(COST)	(BENEFITS)	(COST)	(BENEFITS)	(COST)	(BENEFITS)
1 1986	26.730	0.0	26.730	-0.020	-26.750	26.730	-0.020	26.730	-0.020	26.730	-0.020
2 1987	49.101	0.0	49.101	-0.020	-49.121	40.579	-0.017	39.143	-0.016	37.782	-0.015
3 1988	75.855	-0.703	75.152	-0.020	-75.172	56.463	-0.015	53.492	-0.014	50.726	-0.013
4 1989	57.615	-0.533	57.082	8.689	-48.393	38.988	5.935	36.277	5.522	33.797	5.145
5 1990	148.701	-0.533	148.168	16.685	-131.483	92.001	10.360	84.075	9.468	76.954	8.666
6 1991	202.410	0.638	203.048	20.345	-182.703	114.616	11.484	102.871	10.307	92.506	9.269
7 1992	30.108	1.055	31.163	58.935	27.772	15.992	30.243	14.097	26.659	12.454	23.553
8 1993	0.0	1.055	1.055	79.521	78.466	0.492	37.097	0.426	32.117	0.370	27.877
9 1994	0.0	1.055	1.055	90.816	89.761	0.447	38.515	0.380	32.749	0.324	27.927
10 1995	0.0	1.055	1.055	94.946	93.891	0.407	36.606	0.340	30.570	0.285	25.611
11 1996	0.0	1.055	1.055	96.658	95.603	0.370	33.878	0.303	27.787	0.250	22.871
12 1997	0.0	7.070	7.070	96.681	89.611	2.253	30.806	1.815	24.816	1.467	20.067
13 1998	0.0	1.055	1.055	96.681	95.626	0.306	28.005	0.242	22.157	0.192	17.603
14 1999	0.0	1.055	1.055	96.681	95.626	0.278	25.459	0.216	19.783	0.168	15.441
15 2000	0.0	1.055	1.055	96.681	95.626	0.253	23.145	0.193	17.663	0.148	13.545
16 2001	0.0	1.055	1.055	96.681	95.626	0.230	21.041	0.172	15.771	0.130	11.881
17 2002	0.0	1.055	1.055	96.681	95.626	0.209	19.128	0.154	14.081	0.114	10.422
18 2003	0.0	1.055	1.055	96.681	95.626	0.190	17.389	0.137	12.572	0.100	9.142
19 2004	0.0	1.055	1.055	96.681	95.626	0.173	15.808	0.122	11.225	0.088	8.020
20 2005	0.0	1.055	1.055	96.681	95.626	0.157	14.371	0.109	10.023	0.077	7.035
21 2006	0.0	1.055	1.055	96.681	95.626	0.143	13.065	0.098	8.949	0.067	6.171
22 2007	0.0	7.070	7.070	96.681	89.611	0.869	11.877	0.584	7.990	0.396	5.413
23 2008	0.0	1.055	1.055	96.681	95.626	0.118	10.797	0.078	7.134	0.052	4.748
24 2009	0.0	1.055	1.055	96.681	95.626	0.107	9.816	0.070	6.370	0.045	4.165
25 2010	0.0	1.055	1.055	96.681	95.626	0.097	8.923	0.062	5.687	0.040	3.654
26 2011	0.0	1.055	1.055	96.681	95.626	0.089	8.112	0.055	5.078	0.035	3.205
27 2012	0.0	1.055	1.055	96.681	95.626	0.080	7.375	0.049	4.534	0.031	2.811
28 2013	0.0	1.055	1.055	96.681	95.626	0.073	6.704	0.044	4.048	0.027	2.466
29 2014	0.0	1.055	1.055	96.681	95.626	0.067	6.095	0.039	3.614	0.024	2.163
30 2015	0.0	1.055	1.055	96.681	95.626	0.060	5.541	0.035	3.227	0.021	1.898
31 2016	0.0	50.085	50.085	96.681	46.596	2.609	5.037	1.493	2.881	0.862	1.665
32 2017	0.0	7.070	7.070	96.681	89.611	0.335	4.579	0.188	2.573	0.107	1.460
33 2018	0.0	1.055	1.055	96.681	95.626	0.045	4.163	0.025	2.297	0.014	1.281
34 2019	0.0	1.055	1.055	96.681	95.626	0.041	3.784	0.022	2.051	0.012	1.124
35 2020	0.0	1.055	1.055	96.681	95.626	0.038	3.440	0.020	1.831	0.011	0.986
36 2021	0.0	1.055	1.055	96.681	95.626	0.034	3.128	0.018	1.635	0.009	0.865
37 2022	0.0	1.055	1.055	96.681	95.626	0.031	2.843	0.016	1.460	0.008	0.758
38 2023	0.0	1.055	1.055	96.681	95.626	0.028	2.585	0.014	1.303	0.007	0.665
39 2024	0.0	1.055	1.055	96.681	95.626	0.026	2.350	0.013	1.164	0.006	0.584
40 2025	0.0	1.055	1.055	96.681	95.626	0.023	2.136	0.011	1.039	0.006	0.512
41 2026	0.0	1.055	1.055	96.681	95.626	0.021	1.942	0.010	0.928	0.005	0.449
42 2027	0.0	7.070	7.070	96.681	89.611	0.129	1.765	0.061	0.828	0.029	0.394
43 2028	0.0	1.055	1.055	96.681	95.626	0.018	1.605	0.008	0.740	0.004	0.346
44 2029	0.0	1.055	1.055	96.681	95.626	0.016	1.459	0.007	0.660	0.003	0.303
45 2030	0.0	1.055	1.055	96.681	95.626	0.014	1.326	0.006	0.590	0.003	0.266
46 2031	0.0	1.055	1.055	96.681	95.626	0.013	1.206	0.006	0.526	0.003	0.233
47 2032	0.0	1.055	1.055	96.681	95.626	0.012	1.096	0.005	0.470	0.002	0.205
48 2033	0.0	1.055	1.055	96.681	95.626	0.011	0.997	0.005	0.420	0.002	0.179
49 2034	0.0	1.055	1.055	96.681	95.626	0.010	0.906	0.004	0.375	0.002	0.157
50 2035	0.0	1.055	1.055	96.681	95.626	0.009	0.824	0.004	0.335	0.002	0.138
TOTAL	590.520	118.379	708.899	4237.094	3528.195	396.297	534.699	364.344	403.956	336.495	313.289

BENEFIT COST RATIO BY DISCOUNT RATE (B/C) = 1.35 (10%), 1.11 (12%), 0.93 (14%)
INTERNAL RATE OF RETURN (IRR) = 13.2 %

APPENDIX XIII

STAGE DEVELOPMENT

APPENDIX XIII

STAGE DEVELOPMENT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX XIII

STAGE DEVELOPMENT

1. BASIC CONSIDERATIONS

The main component of the Project is irrigation development. Irrigation water sources in the basin include the Asue, Serruco and Gubaton rivers, as well as the tributaries of the same. The water resources from the Catipayan River basin, bordering the Project area in the northwest mountain region, will also be utilized under the development plan. Water resources in the Asue Basin will mainly be tapped by direct intake from the rivers while those of the Catipayan basin will be stored by the proposed Catipayan dam and will be used to supplement water shortage in the former.

Promotion of agricultural development, particularly of rice farming for increased productivity, and stabilization of rice yields is urgently required in view of physical, topographical, and socioeconomic constraints which prevent conversion from rice to cultivation of other crops and of the trend towards reduction in farm scale. Accordingly, the formulated overall development plan covering the entire feasible development area is recommended.

Water resources available for the Project in the Asue River basin however, are limited for full development of the potential area while repeated use of return flow is also restricted by topographical conditions as discussed in APPENDIX VI WATER RESOURCES DEVELOPMENT. Construction of a dam and trans-diversion canal in the Catipayan River basin is therefore necessary, although it requires a substantial construction cost. For this reason, comparative analysis of construction costs, development effectiveness and benefits as opposed to optimum development scale have been made for stage development.

In formulation of a staged development plan attention was paid to the conformity of each stage with the overall development plan and to the realization of immediate benefit with minimal initial investment. In addition, timely implementation of other components such as hydropower generation and the domestic water supply plan was optimized.

2. STAGE DEVELOPMENT APPROACH

2.1 Staging of the Project

Based on the considerations discussed above, staging of project implementation focused on effective stage development of irrigation water resources.

Water resources development of the proposed scheme (original plan) can be broadly divided into three categories i.e. Asue Basin development, trans-diversion from the Catipayan River and construction of the proposed Catipayan dam. Several alternatives are conceivable for staging of Project implementation and the Team studied the same in consideration of the above three categories.

As the proposed scheme show, through construction of the dam on the Catipayan River, a 6760ha area including the enriched benefit area, becomes irrigable mainly for 200% paddy cultivation. The Team examined irrigable area for 1st stage development for the two cases by the water resources of the Asue Basin (Case A) and of the Catipayan River natural flow in addition to the Asue Basin without the dam (Case B) as shown below.

IRRIGABLE AREA WITHOUT DAM

Unit: ha

Item		Case A	Case B
Water Source		Serruco, Gubaton, Asue rivers	Serruco, Gubaton, Asue rivers and Catipayan natural flow
Irrigable Area			
Serruco Area		360	360
Bakabak Area		1,000	1,000
Gubaton and	Ave.	840	2,030
Asue Area	1/10	360	910
Total	Ave.	2,200	3,390
	1/10	1,720	2,270

Note: Ave. are the average for a 20-year period, 1/10 refers to a 10-year return period

The results show that in Case A, only an average 840ha in the Gubaton/Asue area is irrigable and the scale of irrigable area is thus comparatively small. On the other hand in Case B, utilizing the Catipayan river flow, an average of 2,030ha is irrigable in the same area, and this value is almost equivalent to that of the command area of 2,250ha of the proposed Asue main canal.

Benefit cost ratio (B/C) and net present value (B-C) for the above two cases were also compared as shown below.

(1) Case B

As discussed in section 3, EVALUATION, benefit cost ratio and net present value were obtained as follows:

Discounted Cost : ₱113.66 million
Discounted Benefit : ₱178.85 million
B/C = 1.57
B-C = ₱65.19 million

(2) Case A

In the same manner benefit cost ratio and net present value were obtained as follows:

Discounted Cost : ₱80.8 million
Discounted Benefit : ₱135.5 million
B/C = 1.68
B-C = ₱54.70 million

As a result, Case A shows a slightly higher B/C ratio. In this study for the staging of implementation, Case B which proposes trans-diversion of irrigation water from the Catipayan River was selected as an appropriate plan considering the scale of irrigable area in Stage I. Consequently, staging of the Project was determined as follows:

Stage I: An irrigation area of 4,130ha will be developed including three diversion dams i.e. Asue, Bakabak and Gubaton, irrigation canals and on-farm development. The area of 4,130ha excludes the command area of the Eastern main canal and the area directly irrigated by the trans-diversion canal. This stage includes the

construction of a temporary trans-diversion canal and temporary diversion works on the Catipayan River. However, the trans-diversion tunnel will be constructed to the final dimensions since enlargement of the tunnel requires a large amount of additional cost. The road network and Integrated Community Center will also be included in this stage for the said area.

Stage II: Irrigation for the area under the proposed Eastern main canal (240ha) and the area directly under the trans-diversion canal (190ha) will be developed in this stage. The proposed Catipayan dam coupled with hydropower and domestic water supply works will also be implemented. The trans-diversion canal will be enlarged in the final plan.

The road network and Integrated Community Center will be implemented along with irrigation development in consideration of the advantageousness of simultaneous construction. On the other hand, the hydropower plant and domestic water supply will be constructed at the same time as the Catipayan dam.

2.2 Trans-diversion Planning

In the case of first stage development, required maximum diversion capacity to the Asue Basin was calculated at 1.5 m^3/sec from the water balance study. Required facilities for trans-diversion under Stage I are the intake at the Catipayan River, trans-diversion canal and tunnel. The physical planning of these facilities is discussed below.

A trans-diversion canal on the left bank of the Catipayan River will convey irrigation water to the Asue Basin. In Stage I, an open canal at the proposed Catipayan dam presents no constraints; however for dam construction Stage II, the open canal will hinder dam embankment. In consideration of dam construction, the following three methods were compared for diversion around the proposed dam.

(1) By-pass tunnel

In this case, a cofferdam and by-pass tunnel will be constructed in advance and diversion water will be conveyed through the latter. A temporary gate will be installed at the end of the by-pass tunnel to realize flow pressure in the same. In this case, cofferdam reservoir elevation must be kept above EL. 90m, and in case of flood, gate operation to release cofferdam reservoir water is required. Additional cost of the original plan is ₱6.40 million including the costs for tunnel lining and the end gate.

(2) Conduit plan

In this case, a concrete pipe conduit will be laid on the bedrock at the right bank of the Catipayan River. After completion of dam embankment, the conduit will be plugged. The required cost is ₱5.15 million, including construction of the conduit and plug. This plan, however, is undesirable as it involves embedding a structure in the fill dam.

(3) Tunnel plan

This plan proposes construction of a new tunnel at the proposed Catipayan dam for diversion during dam embankment. The minimum tunnel section will be determined according to construction conditions. Although this plan proposes an additional new tunnel, the additional cost required, ₱4.55 million is the least of the three alternatives.

Based on comparison of the additional cost required for Stage I and of other plan characteristics, the tunnel plan was determined to be the most technically and economically feasible plan.

2.3 Implementation and Disbursement Schedule

The implementation schedule for stage development includes one 5-year period for each stage, i.e. Stage I and II with a total period of 10 years as presented in FIG. XIII-1. Disbursement schedule is presented in TABLE XIII-1. According to the schedule, total financial cost including physical and price contingencies for each stage and overall case are as presented in the following table.

FINANCIAL COST

Unit: ₱ million

Item	Stage I	Stage II	Stage III
F.C.	173.281	560.189	733.469
L.C.	262.055	778.729	1,040.783
Total	435.336	1,338.917	1,774.253

3. EVALUATION

3.1 Economic Cost Stream

On the basis of the financial cost disbursement schedule, economic cost stream was obtained as shown in TABLE XIII-2. The economic cost stream of operation and maintenance is presented in TABLE XIII-3.

3.2 Benefit Analysis

Based on the implementation schedule and resulting irrigation area development schedule, crop benefit stream was prepared and is presented in TABLE XIII-4 for Stage I and TABLE XIII-5 for Stage II.

Water supply benefit stream for the Integrated Community Center and farm road benefit stream are presented in TABLE XIII-6 and XIII-7 respectively, and total project economic benefit stream is presented in TABLE XIII-8.

3.3 Evaluation

Evaluation was made on the basis of the economic internal rate of return (EIRR) and investment scale both for each stage and overall as presented in TABLE XIII-9, XIII-10, XIII-11 and summarized in the table below.

ECONOMIC INTERNAL RATE OF RETURN

	Stage I	Stage II	Overall
EIRR	15.5%	11.8%	13.1%

As shown in the above table, overall EIRR is 13.1% which is 0.1% smaller than that of the original plan; however, Stage I has a high EIRR of 15.5%.

Comparison of financial cost was also conducted as shown in the table below.

FINANCIAL COST COMPARISON

Unit: ₱ million

	Stage I	Stage II	Overall	Original Plan
Financial Cost	213.4	424.3	637.7	635.6
Physical Contingency	32.0	63.7	95.7	95.3
Price Contingency	190.0	850.9	1,040.9	652.5
Total Financial Cost	435.4	1,338.9	1,774.3	1,383.5

Although the total financial cost of the staged development plan is rather large compared to the original plan because of the high price contingency, the cost required for Stage I is ₱435 million. In view of the high Economic Internal Rate of Return for Stage I development, this approach seems advantageous in reducing initial investment.