

3.2.2 Gilirang intake weir

The weir consists of various components such as an intake weir, intake, bridge, diversion channel, closure embankment, etc. The weir will be constructed by means of diversion channel. The time required for construction of the intake will be 36 months from the start of the preparatory works.

The construction of the weir will be carried out in the excavated site on the diversion channel in the dry condition. Since the weir consisting of mainly concrete will be constructed by machine, the time required for completing the weir will be 25 months. The construction of weir will be started on the beginning of September 1998 and completed by the end of September 2000.

After completing the intake weir, the excavation of diversion channel will be started and completed by the end of February 2001. Earthfilling of the closure embankment will be carried out by use of excavated material from the diversion channel, so that the embankment will be conducted in parallel with the construction of the diversion channel. Since these works involve a large volume of earthworks, the machinery works will mainly be employed.

3.2.3 Paselloreng dam

Time required for completing the dam will be about 43 month from the start of the preparatory works consisting a coffer dam and pressure diversion tunnel will be started on the beginning of September 1998 and completed by the end of July 1999. Following to the completion of the diversion works, the main dam construction will be started on the August 1999, and it will be completed by the end of December 2001. Diversion tunnel excavation will be executed by blasting and picking, and excavated muck is hauled to stock pile by dump truck. concrete lining will be done by using steel form.

Excavation of dam foundation will be mainly made by heavy duty equipment such as bulldozer, ripper-dozer and back-hoe shovel. Rock excavation will be executed by blasting.

After excavation of the dam core trench, curtain-grouting will be executed by the combination of boring machines and grouting pump.

Embankment materials to be transported from the proposed areas will be spread by bulldozer at the specified thickness and compacting runs.

These specifications will be as follows:

Zone	Thickness of Spreading (m)	Compaction (runs)	Compaction machine
Impervious zone	0.2	6	Tamping roller
Filter & Drain	0.3	3	Vibration roller
Pervious zone	0.5	4	Vibration roller
Rock zone	1.0	0	Bulldozer

The concrete work of the spillway will be executed in parallel with the embankment work of the main dam, starting on the January 2000 and completing by the end of July 2001. The construction of intake and installation of gates will be executed in 6 months completing by the end of November 2001.

After completion of all facilities concerning to the dam construction, plug works in the diversion tunnel will be executed.

3.2.4 Irrigation System, Drainage System and Construction Roads

The construction of main irrigation canal including main inspection road will be carried out for 22 months from December 1998 through September 2000. In parallel with construction of the main irrigation canal, the secondary irrigation canals will be constructed in 17 months, starting from July 2002. The construction of the irrigation canal will be executed from the upper reaches to the lower reaches. In the rainy season, the earthworks will be suspended and a main effort will be paid to the construction of related structures. The excavated materials from the canals will be used for embankment of canals and inspection roads.

The construction road for access of constructing the Project facilities will be started on October 1998, parallel with the main canal construction. The inspection roads will also be use of access during the construction. The lack of embankment material of canals and inspection roads will be obtained from excavation in drainage canals. The major drainage canals will be executed for the period from January 2000 to the end of March 2001.

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

3.2.5 Tertiary Development

The detailed design of the tertiary development will be started from April 1998 based on the areal photo maps field survey. The construction will be executed in stage wise. The construction will be started on February 2000 from the upper part of the Project area, and be completed by the end of November 2001.

4. COST ESTIMATE

4.1 Basic Assumptions

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

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

$$\text{US\$1.0} = \text{Rp.2,160} = \text{¥97.27}$$

- 2) The construction works would be executed on the contract basis. The construction machinery and equipment required for the construction works would be provided by the contractors themselves. Therefore depreciation cost of the machinery and equipment is considered in the estimate of the construction cost, instead of the procurement cost of machinery and equipment.
- 3) The construction unit price comprises foreign currency and local currency portions. The foreign currency portion and the local currency portion basically include the following cost ;
 - a) Local currency portion
 - Local labour cost
 - Cost of local material
 - Inland transportation cost
 - Contractor's general expenses
 - b) Foreign currency portion
 - Foreign labour cost

- Cost of imported material and foreign portion of local material
 - Contractor's general expenses
- 4) The construction unit prices are estimated on the basis of the current price in South Sulawesi and of the data obtained from the on-going and completed irrigation projects around the Project area. The labour cost, material cost and equipment cost of those unit prices are adjusted it to the price of August 1994 by the statistic data. Labour cost, material cost, equipment cost and construction unit price are shown in Tables A.7.1 to A.7.4
 - 6) The physical contingency related to the construction quantities is set at 10% of the direct cost in view of the preliminary nature of the estimate. The price contingency of 2.5% per annum for the foreign currency portion and 6% for the local currency portion is included in the estimate.
 - 7) The associated costs to be financed by the Government, such as the cost for strengthening the extension services, facilities of the water users' association, and improvement of the social infrastructures are not included in the estimate.

4.2 Preparatory Works

The preparatory works include the construction, operation and maintenance of the following major items :

- Temporary access
- Office, workshops, staff quarters and labour camps
- Water supply system and drainage and sewerage systems
- Electricity supply system
- Telephone system
- Contractor's laboratory
- First-aid facilities

The preparatory works are estimated at 5.0% of the total direct construction cost.

4.3 O&M Facility and Equipment

The O&M equipment and facility is listed in accordance with necessity for the operation and maintenance work during and after implementation of the Project. The equipment and vehicles are estimated on the C.I.F. cost. The Procurement cost of O&M equipment is shown in Table A.7.5

4.4 Land Acquisition and Compensation

The land acquisition cost required for the construction of project facilities is estimated based on the present land use, grade of house and kind of tree. The unit cost is referred to the data obtained from Bupati Office. The Estimated land acquisition and compensation cost is shown in Table A.7.6.

4.5 Administration

The administration cost are estimated at 2.5% of the total direct construction cost including preparatory works to cover the cost of supervision and management of the project. The

construction cost of the field office staff quarters for the government staff and consultants is also included in the expenses.

4.6 Engineering Services

The engineering service cost to be required for the project implementation is estimated on man-month basis. The engineering services cost is shown in Table A.7.7.

4.7 Estimate of Construction Cost

The construction cost comprises direct construction cost, preparatory works, O&M facility and equipment, land acquisition and compensation, administration, engineering services, physical contingency and price contingency. The total construction costs of the project are estimated at Rp. 160,687 million equivalent, comprising Rp. 61,066 million of local currency and Rp. 99,621 million equivalent of foreign currency. The summary of total construction cost and breakdown of direct construction cost are as shown in Table A.7.8 and Table A.7.9 through Table A.7.11.

4.8 Annual Disbursement Schedule

The annual disbursement schedule is worked out based on the construction time schedule as shown in Table A.7.12. The summary is as shown below :

Year	Unit : Rp. Million		
	Foreign Currency	Local Currency	Total
1996	4,368	1,384	5,752
1997	5,894	1,956	7,850
1998	11,185	6,674	17,859
1999	23,842	13,163	37,005
2000	30,589	23,815	54,404
2001	23,747	14,071	37,818
Total	99,625	61,063	160,688

4.9 Annual Operation and Maintenance Costs

Annual operation and maintenance costs at the full development stage is estimated at Rp.804 x 10⁶, comprising the costs for; 1) salaries and wages, 2) running cost 3) maintenance cost of the project facilities. These costs are shown in Table A.7.13

4.10 Replacement Cost

Some of the Project facilities, especially equipment and mechanical works have some shorter useful life than the civil works, and require replacement at a certain time within the Project useful life. The replacement costs and the useful life of those facilities are listed in Table A.7.14.

5. SEPARATE COSTS OF GRAVITY AND PUMP IRRIGATION SYSTEMS

5.1 Introduction

On the basis of the request made by the Steering Committee on the Draft Final Report, the above estimated construction cost is divided into two, i.e. the construction cost required for the gravity irrigation system and that for the pump irrigation system.

5.2 Conditions and Assumptions for Estimate

The conditions and assumptions taken in the estimate of separate costs of gravity and pump irrigation systems are as follows:

5.2.1 Implementation schedule

Period of the implementation schedule is assumed to be the same with that programmed in the original schedule as illustrated in Figure A.7.1. Within this period of six years, both the gravity and pump irrigation systems would be completed giving a priority to the gravity irrigation system.

5.2.2 Cost items to be required for gravity irrigation system

Since the Paselloreng reservoir is of water source both for the gravity and pump irrigation systems, it is assumed that the costs for the most project works would be needed for the development of gravity irrigation system. These project works would include weir, dam, main system, secondary system, drainage system and farm road network. These are all required for the development of gravity irrigation system, although smaller-scale of these facilities (particularly for dam, weir, main system and secondary system) would be sufficient for the gravity system, if no pump irrigation system development would be carried out. However, cost allocation of these costs for the gravity and pump irrigation system is not carried out in this cost estimate, because the pump irrigation system would be constructed within six years and the original scale of these structure both for gravity and pump irrigation systems would be required soon within this period. In addition, all the costs for the O&M facilities & equipment and land acquisition & compensation are also assumed to be required only for the development of gravity system.

5.2.3 Cost items to be required for pump irrigation system

The estimated cost for pumping facilities in Chapter 4 above is required all for the development of pump irrigation system.

5.2.4 Cost items to be separated

The costs to be separated are those for the preparatory works, tertiary system, administration and engineering services. Physical contingency and price contingency are also separated based on the same assumptions taken in the original cost estimate.

Among these cost items, the separate costs of engineering services for gravity and pump irrigation systems are estimated based on the following man-month allocation:

		Gravity System	Pump System	Total
Detailed design stage				
- Foreign	(M/M)	106	6	112
- Local	(M/M)	241	20	261
Construction stage				
- Foreign	(M/M)	162	0	162
- Local	(M/M)	351	27	378
Total				
- Foreign	(M/M)	268	6	274
- Local	(M/M)	592	47	639

The separate costs are thus estimated as follows:

	Gravity System	Pump System	Total
Detailed design stage (Rp.Million)	9,419	576	9,995
Construction stage (Rp.Million)	15,630	164	15,794
Total (Rp.Million)	25,049	740	25,788

Note: Figures are rounded.

5.3 Separate Costs of Gravity and Pump Irrigation Systems

Based on the above conditions and assumptions, separate costs of gravity and pump irrigation systems including price contingency are estimated as given in Table A. 7.15, and summarized as follows:

- Costs of gravity irrigation system	:	Rp. 157,871 million
- Costs of pump irrigation system	:	Rp. 2,830 million
Total	:	Rp. 160,702 million

Note: Figures are rounded.

Table A.7.1 List of Labour Cost

Unit : Rp.				
Item	Unit	F.C.	L.C.	Total
Foreman	m•day	0	9,508	9,508
Skilled Labour	m•day	0	7,924	7,924
Semi-Skilled Labour	m•day	0	6,656	6,656
Common Labour	m•day	0	3,486	3,486
Operator	m•day	0	9,508	9,508
Ass. Operator	m•day	0	7,924	7,924
Driver	m•day	0	7,924	7,924
Mechanic A	m•day	0	9,508	9,508
Mechanic B	m•day	0	6,656	6,656
Steel Worker A	m•day	0	7,924	7,924
Steel Worker B	m•day	0	6,656	6,656
Electrician A	m•day	0	7,924	7,924
Electrician B	m•day	0	6,656	6,656
Carpenter A	m•day	0	7,924	7,924
Carpenter B	m•day	0	6,656	6,656
Mason A	m•day	0	7,924	7,924
Mason B	m•day	0	6,656	6,656
Plumber A	m•day	0	7,924	7,924
Plumber B	m•day	0	6,656	6,656
Painter A	m•day	0	7,924	7,924
Painter B	m•day	0	6,656	6,656
Concrete Worker A	m•day	0	7,924	7,924
Concrete Worker B	m•day	0	6,656	6,656
Welder	m•day	0	7,924	7,924
Rigger	m•day	0	7,924	7,924
Driller	m•day	0	7,924	7,924
Blaster	m•day	0	7,924	7,924
Foreman Foreign	m•day	403,423	73,953	477,376

Table A.7.2 List of Material Cost (1/2)

					Unit : Rp.
Item	Unit	F.C.	L.C.	Total	
Portland Cement	ton	59,983	140,000	199,983	
Water Reducing Agents	kg	1,642	2,475	4,117	
Fine Aggregate for Concrete	m ³	19,526	2,171	21,697	
Coarse Aggregate for Concrete	m ³	14,839	5,775	20,614	
Masonry Stone	m ³	16,373	8,060	24,433	
Reinforcement Bar (Round)	ton	380,959	889,333	1,270,292	
Reinforcement Bar (Deformed)	ton	417,074	973,667	1,390,741	
Structural Steel	ton	525,485	1,226,667	1,752,152	
Steel Bridge Girder	ton	1,642,097	1,642,857	3,284,954	
Steel Pipe, 48ka/m	m	63,612	7,071	70,683	
Steel Pipe, dia 250mm	m	149,904	104,146	254,050	
L-Shaped Steel, L-60x60x5	m	2,074	4,830	6,904	
L-Shaped Steel, L-40x40x3	m	713	1,648	2,361	
Iron Wire	kg	1,166	2,172	3,338	
Steel Wire	m	346	526	872	
Barbed Wire 250kg/Glg	Glg	14,947	27,764	42,711	
Wire Fabric, o4cm	m ²	1,490	2,776	4,266	
Nail	kg	1,037	1,958	2,995	
Checkered Plate	ton	671,976	448,193	1,120,169	
Wooden Class II, Plank	m ³	82,469	330,018	412,487	
Wooden Class II, Square	m ³	82,469	330,018	412,487	
Wooden Class II, Log	m ³	82,469	330,018	412,487	
Wooden Class III, Plank	m ³	54,259	217,117	271,376	
Wooden Class III, Square	m ³	54,259	217,117	271,376	
Wooden Class III, Log	m ³	54,259	217,117	271,376	
Plywood, Waterproof 900x1800x12mm	m ³	732,434	732,770	1,465,204	
Plywood, Waterproof 900x1800x9mm	m ³	689,018	689,347	1,378,365	
Wooden Pile, dia 200mm L=6m	no.	10,238	40,992	51,230	
Concrete Pipe dia 1200mm	m	262,116	11,236	273,352	
Concrete Pipe dia 1000mm	m	176,062	75,492	251,554	
Concrete Pipe dia 800mm	m	114,458	49,079	163,537	
Concrete Pipe dia 700mm	m	93,658	40,156	133,814	
Concrete Pipe dia 600mm	m	77,155	33,089	110,244	
Concrete Pipe dia 500mm	m	59,011	25,305	84,316	
Concrete Pipe dia 400mm	m	40,802	17,489	58,291	
Concrete Pipe dia 300mm	m	22,939	9,738	32,677	
Adhesive Agent	kg	25,445	10,910	36,355	
Light Oil	lit	238	152	390	
Gasoline	lit	410	280	690	
Kerosine	lit	173	112	285	
Heavy Oil	lit	216	144	360	

Table A.7.2 List of Material Cost (2/2)

Unit : Rp.

Item	Unit	F.C.	L.C.	Total
Heavy Oil	lit	216	144	360
Straight Asphalt	kg	432	284	716
Asphalt Emulsion	lit	518	342	860
Steel Fixed Shoe	pc	210,190	52,571	262,761
Steel Movable Shoe	pc	227,707	56,952	284,659
Steel Expansion Joint	pc	180,079	77,214	257,293
High-tensile Strength Bolt	pc	842	210	1,052
Angle Steel, 65x65	kg	1,080	272	1,352
Road Metal	m3	11,815	1,314	13,129
Welding Electrode	kg	842	361	1,203
Form Oil	lit	108	72	180
Joint Filler, t=20mm	m2	32,724	3,637	36,361
Dynamite	kg	5,702	2,443	8,145
ANFO Power	kg	907	391	1,298
Detonator, L=1.8m	pc	1,296	326	1,622
Cross Bit, 22x50mm	pc	201,442	0	201,442
Rod, 32mm, L=3.0m	pc	492,912	0	492,912
Sleeve, 32mm	pc	171,439	0	171,439
Shank, 32mm	pc	257,170	0	257,170
Paint	lit	2,268	977	3,245
PPF Sheet	m2	3,002	0	3,002
Gauge Plate	m	131,998	56,602	188,600
Valve, 300mm	no.	2,544,847	134,003	2,678,850

Table A.7.3 List of Equipment Cost (1/2)

					Unit : Rp.
Item	Unit	F.C.	L.C.	Total	
Bulldozer 21t	hr	68,969	17,247	86,216	
Bulldozer w/Ripper	hr	72,576	18,146	90,722	
Bulldozer 15t	hr	42,703	10,673	53,376	
Bulldozer 11t	hr	26,568	6,640	33,208	
Bulldozer 8t	hr	23,069	5,764	28,833	
Backhoe 0.6m3	hr	41,018	10,257	51,275	
Backhoe 0.4m3	hr	27,648	6,925	34,573	
Backhoe 0.2m3	hr	17,302	4,318	21,620	
Crawler Shovel 2.0m3	hr	52,553	13,149	65,702	
Crawler Shovel 1.2m3	hr	23,846	5,961	29,807	
Dump Truck 11ton	hr	30,866	4,844	35,710	
Dump Truck 8ton	hr	21,838	3,419	25,257	
Dump Truck 4ton	hr	10,627	1,666	12,293	
Cargo Truck 6ton	hr	12,463	1,951	14,414	
Truck Crane 30ton	hr	94,327	16,656	110,983	
Truck Crane 20ton	hr	87,977	15,539	103,516	
Truck Crane 4.9ton	hr	25,942	4,581	30,523	
Truck Mixer 3.2m3	hr	17,496	2,850	20,346	
Truck Mixer 1.6m3	hr	13,997	2,279	16,276	
Motor Grader 3.1m	hr	32,400	5,282	37,682	
Vibrating Tamping Roller 15ton	hr	123,746	23,581	147,327	
Vibrating Roller 15ton	hr	123,682	23,559	147,241	
Vibrating Roller 3ton	hr	18,209	3,463	21,672	
Vibrating Roller 0.2ton	hr	4,946	811	5,757	
Vibrating Compactor 90kg	hr	518	110	628	
Tire Roller 10ton	hr	23,458	4,471	27,929	
Macadam Roller	hr	25,488	4,866	30,354	
Engine Sprayer	hr	475	65	540	
Asphalt Kettle	hr	540	88	628	
Diesel Pile Driver 3.5ton	hr	236,239	38,484	274,723	
Vibratory Pile Driver	hr	222,674	36,270	258,944	
Diesel Generator 200KVA	hr	13,932	2,082	16,014	
Diesel Generator 150KVA	hr	13,586	2,038	15,624	
Diesel Generator 75KVA	hr	7,906	1,184	9,090	
Diesel Generator 10KVA	hr	2,268	351	2,619	
Concrete Pump Car 30m3/hr	hr	36,763	6,487	43,250	
Concrete Bucket 1.5m3	hr	5,681	767	6,448	
Vibrator 60mm	hr	907	132	1,039	
Vibrator 45mm	hr	648	88	736	
Vibrator 38mm	day	17,129	2,345	19,474	

Table A.7.3 List of Equipment Cost (2/2)

Unit : Rp.

Item	Unit	F.C.	L.C.	Total
Water Tanker 8ton	hr	12,204	1,994	14,198
Water Sprinkler 8kl	hr	21,233	3,463	24,696
Bar Bender 22mm	hr	994	44	1,038
Welder	hr	864	132	996
Crawler Drill 7m3/min	hr	16,006	2,608	18,614
Jack Hammer 3m3/min	day	11,210	1,666	12,876
Pick Hammer 1.7m3/min	day	5,616	833	6,449
Air Compressor 16m3/min	hr	12,722	1,906	14,628
Air Compressor 10m3/min	hr	11,686	1,753	13,439
Belt Feeder 600mm	hr	10,152	1,512	11,664
Vibration Screen 1.2x2.4m	hr	8,316	1,249	9,565
Vibration Screen 0.9x1.8m	hr	7,970	1,184	9,154
Classifier	hr	11,016	1,643	12,659
Belt Conveyor 750mmx30m	hr	31,622	4,734	36,356
Belt Conveyor 600mmx30m	hr	26,849	4,010	30,859
Batching Plant 1m3x1no.	hr	170,554	32,501	203,055
Cement Silo 20ton	hr	17,604	3,353	20,957
Portable Mixer 0.2m3	day	44,820	6,707	51,527
Submergible Pump 150mm 11KW	hr	1,123	175	1,298
Submergible Pump 150mm 5.5KW	hr	1,123	175	1,298
Submergible Pump 50mm 2.2KW	hr	324	44	368
Boring Machine 5.5KW	day	59,400	8,832	68,232
Boring Pump 3.7KW	day	2,592	395	2,987
Grout Pump 7.5KW	day	48,708	7,276	55,984
Grout Mixer 5.5KW	day	21,125	3,156	24,281
Grout Injection & Pressure Gauge	day	169,236	25,291	194,527
Wheel Loader 2.2m3	hr	89,791	22,464	112,255
Tunnel Rock Loading Shovel with Belt Conveyor	hr	127,526	6,707	134,233
Battery Locomotive 6ton	hr	69,898	3,682	73,580
Trolley Car 3m3	day	39,593	2,082	41,675
Battery Charge Stabilizer 19KVA	day	4,579	504	5,083
Leg Hammer 40kg	hr	25,574	4,165	29,739
Fan 55m3/min	hr	2,830	460	3,290
Concrete Placer 3.0m3	hr	67,111	3,529	70,640
Electrode Dryer 100kg	hr	756	110	866

Table A.7.4 List of Construction Unit Prices (1/3)

Unit : Rp.				
Work Item	Unit	F.C.	L.C.	Total
1 Dam & Weir				
1.1 Earth Works				
Clearing & Grubbing	m2	443	181	624
Stripping of Top Soil	m3	3,918	1,284	5,202
Excavation, Sand Silt	m3	3,918	1,263	5,181
Excavation, Weathered rock	m3	6,361	2,010	8,371
Excavation, Massive and soft rocks, weathered rock zone	m3	11,592	3,278	14,870
Excavation, Massive and soft rocks, fresh rock zone	m3	15,688	4,438	20,126
Backfill, Large area	m3	4,618	1,520	6,138
Embankment, Impervious zone	m3	8,172	2,396	10,568
Embankment, Semi-pervious zone	m3	5,857	1,675	7,532
Embankment, Refilling	m3	4,455	1,423	5,878
Embankment Common, L=25m	m3	1,834	755	2,589
Embankment Common, L=1000m	m3	4,434	1,524	5,958
Filter	m3	25,213	6,602	31,815
Sod Facing	m2	64	973	1,037
Sand & Gravel Filter for Under Drain	m3	105,636	17,868	123,504
Sand & Gravel Bedding	m3	28,119	7,498	35,617
Backfill, Small area	m3	5,873	2,348	8,221
Toe Rock Zone	m3	6,365	1,900	8,265
1.2 Concrete Works				
Concrete 225kg/cm2	m3	88,891	73,510	162,401
Concrete 175kg/cm2	m3	89,172	68,811	157,983
Concrete 100kg/cm2	m3	86,779	52,902	139,681
Concrete for Lining	m3	81,084	120,569	201,653
Form for Concrete, Surface	m2	994	7,902	8,896
Form for Concrete, Back face	m2	1,242	8,564	9,806
Reinforcement Bar Cut and Installation	ton	503,391	1,119,211	1,622,602
1.2 Tunnel Works (*)				
Tunnel Excavation	m3	58,504	17,129	75,633
Wooden Sheet Pile	m3	767,454	1,713,893	2,481,347
Form for Tunnel Concrete	m2	10,390	19,550	29,940
Plug Concrete	m3	109,044	74,255	183,299
Cooling Concrete (Plug Works)	Ls	809,638	524,285	1,333,923
1.3 Grout Works				
Drilling Grout Hole	m	83,487	7,969	91,456
Drilling Inclined Grout Hole	m	83,562	7,940	91,502

Table A.7.4 List of Construction Unit Prices (2/3)

Unit : Rp.

Work Item	Unit	F.C.	L.C.	Total
Drilling Vertical Test Hole	m	96,578	10,115	106,693
Drilling Inclined Test Hole	m	113,221	11,440	124,661
Drilling Holes in Tunnel	m	108,874	10,158	119,032
Drilling Test Holes in Tunnel	m	122,685	14,032	136,717
Grouting Cement Paste	ton	208,307	206,292	414,599
Steel Sheet Pile	ton	1,577,710	177,251	1,754,961
1.4 Pavement Works				
Road Metaling	m3	28,069	4,515	32,584
Asphalt Pavement	m2	3,952	2,603	6,555
1.5 Stone Works				
Gabion Mattress H=0.5m B=2.0m L=4.0m	pc	128,047	97,014	225,061
Riprap	m3	22,585	12,496	35,081
Sand Foundation	m3	26,244	4,996	31,240
Stone Masonry	m3	46,390	50,724	97,114
2 Irrigation & Drainage				
2.1 Earth Works				
Clearing & Grubbing	m2	252	112	364
Stripping of Top Soil	m2	197	96	293
Excavation, Common	m3	3,538	1,154	4,692
Excavation, Weathered Rock	m3	6,477	2,039	8,516
Backfilling	m3	2,063	1,370	3,433
Embankment Common, L=25m	m3	1,834	755	2,589
Embankment Common, L=1000m	m3	4,434	1,524	5,958
Sod Facing	m2	64	973	1,037
2.2 Concrete Works (*)				
Concrete 225kg/cm2	m3	59,008	72,219	131,227
Concrete 175kg/cm2	m3	55,944	66,792	122,736
Concrete 100kg/cm2	m3	35,211	47,267	82,478
Form for Concrete	m2	1,317	8,931	10,248
Reinforcement Bar Cut and Installation	ton	503,391	1,119,211	1,622,602
Concrete Pipe dia.1500mm	m	312,066	18,289	330,355
Concrete Pipe dia.1000mm	m	212,117	91,503	303,620
Concrete Pipe dia.800mm	m	140,145	60,436	200,581
Concrete Pipe dia.700mm	m	115,724	49,837	165,561
Concrete Pipe dia.600mm	m	96,166	41,446	137,612
Concrete Pipe dia.500mm	m	74,769	32,245	107,014
Concrete Pipe dia.400mm	m	32,768	14,050	46,818

Table A.7.4 List of Construction Unit Prices (3/3)

Unit : Rp.				
Work Item	Unit	F.C.	L.C.	Total
2.3 Steel Works				
Sluice Gate	no	4,344,106	10,140,987	14,485,093
Crump-De Gruyter Gate	no	1,615,205	3,770,620	5,385,825
2.4 Pavement Works				
Road Metaling	m3	28,069	4,515	32,584
Asphalt Pavement	m2	3,952	2,603	6,555
Stone Masonry	m3	46,390	50,724	97,114
2.5 Stone Works				
Gabion Mattress H=0.5m B=2.0m L=4.0m	pc	128,047	97,014	225,061
Riprap	m3	22,585	12,496	35,081
Stone Masonry	m3	46,390	50,724	97,114

(*): Due mainly to differences in concrete curing and placing between dam & weir and irrigation & drainage, different unit prices are applied to the respective concrete works.

Table A.7.5 Procurement Cost of O & M Equipment

Unit : 1,000Rp.

Equipment	Unit Price	No.	Amount
1 Vehicle and Equipment			
1.1 Motor Grader, 3.1m	213,410	1	213,410
1.2 Wheel Loader, 2.2m ³	187,550	1	187,550
1.3 Tamper, 80kg	6,470	3	19,410
1.4 Soil Compactor, 90kg	4,310	3	12,930
1.5 Portable Concrete Mixer, 0.2m ³	8,620	1	8,620
1.6 Diesel Engine Pump, 5HP	8,620	1	8,620
1.7 Generator, 5KVA	8,620	1	8,620
1.8 Dump Truck, 2ton	56,050	1	56,050
1.9 Cargo Truck, w/Crane, 2ton	103,470	1	103,470
1.10 Truck, 1ton Pick-up Type	23,710	3	71,130
1.11 Jeep, Four Wheel Drive	38,800	3	116,400
1.12 Motor Cycle	4,310	5	21,550
1.13 Spareparts (20% of the above)	133,650	L.S.	133,650
Sub-Total			961,410
2 Wireless Communication Equipment			
2.1 Wireless Radio Set	17,250	5	86,250
2.2 Transceiver, Handy Type	2,160	5	10,800
Sub-Total			97,050
Total			1,058,460

Table A.7.6 Cost of Land Acquisition and Compensation

Unit : 1,000Rp.

Item	Unit	Q'ty	Cost of	
			Land Acquisition	Compensation
1 Dam				
1.1 Public Facilities				
Village Office				
Land	m2	1,000	-	2,000
Building	m2	140	-	42,000
Village Office				
Land	m2	2,000	-	4,000
Barracks	m2	400	-	10,000
Elementary School				
Land	ha	2	-	40,000
Buildings	m2	1,200	-	480,000
Furniture	Ls.	1	-	120,000
Junior High School				
Land	ha	2	-	40,000
Buildings	m2	1,000	-	400,000
Furniture	Ls.	1	-	300,000
Houses for School Principal				
Land	m2	3,000	-	6,000
Buildings	m2	600	-	180,000
Mosque				
Land	m2	6,000	-	12,000
Buildings	m2	500	-	250,000
Health Facilities				
Land	m2	2,000	-	4,000
Buildings	m2	200	-	60,000
Furniture	Ls.	1	-	40,000
Water Supply System	Ls.	1	-	300,000
Micro Hydro Electric	Ls.	1	-	250,000
Farmer Meeting Facilities	m2	150	-	6,000
Cemetery	m2	5,000	-	10,000
1.2 Residential Land	m2	300,000	90,000	-
1.3 House	no.	220	165,000	-
1.3 Paddy Field	m2	2,400,000	360,000	-
1.4 Tree	no.	52,000	-	234,000
Sub-Total 1			615,000	2,790,000
2 Weir				
2.1 Paddy Field	m2	30,000	4,500	-
2.2 Tree	no.	1,500	-	5,400
Sub-Total 2			4,500	5,400
3 Irrigation & Drainage System				
3.1 Main Canal				
Paddy field	m2	1,179,533	176,930	-
3.2 Secondary Canal				
Paddy field	m2	510,287	76,543	-
3.3 Tertiary Canal (*)				
Paddy field	m2	0	0	-
3.4 Drainage Canal				
Paddy field	m2	165,135	24,770	-
3.5 Farm Road				
Paddy field	m2	275,000	41,250	-
Sub-Total 3			319,493	0
Grand Total			938,993	2,795,400

(*): In general, tertiary development is carried out by farmers themselves, and the Indonesian government is not necessary to pay land acquisition cost for tertiary canal.

Table A.7.7 Cost of Engineering Services

Unit : 1,000Rp.

Item	Unit	Q'ty	Amount			
			F.C.	L.C	Total	
1 Detailed Design Stage						
Remuneration	Foreign	M/M	112.0	5,490,820	0	5,490,820
	Local	M/M	261.0	1,172,460	0	1,172,460
Direct Cost, Equipment Cost, Additional Survey & Investigation (50% above)		Ls.	1.0	3,331,640	0	3,331,640
Sub-Total				9,994,920	0	9,994,920
2 Construction Stage						
Remuneration	Foreign	M/M	162.0	7,942,080	0	7,942,080
	Local	M/M	378.0	1,698,040	0	1,698,040
Direct Cost & Equipment Cost (35% above)		Ls.	1.0	3,374,040	2,779,330	6,153,370
Sub-Total				13,014,160	2,779,330	15,793,490
Grand Total				23,009,080	2,779,330	25,788,410

Table A.7.8 Summary of Construction Cost

Unit : Rp. Million			
Item	F.C.	L.C	Total
1 Preparatory Works (5% of 2)	2,583	1,548	4,131
2 Civil Works			
2.1 Weir	4,252	4,732	8,984
2.2 Dam	25,423	10,478	35,901
2.3 Main System	15,588	7,441	23,029
2.4 Secondary System	3,919	2,612	6,531
2.5 Tertiary System	-	4,453	4,453
2.6 Drainage System	1,389	584	1,973
2.7 Farm Road Network	1,018	476	1,494
2.8 Pumping Facilities	70	164	234
Sub-Total 2	51,659	30,940	82,599
3 O & M Facilities and Equipment	741	317	1,058
4 Land Acquisition and Compensation	-	3,734	3,734
5 Administration (2.5% of 1&2)	1,354	810	2,164
6 Engineering Services	23,009	2,779	25,788
7 Physical Contingency (10% of 1,2,3,4,5 & 6)	7,935	4,013	11,948
Total	87,280	44,141	131,421
8 Price Contingency	12,345	16,922	29,267
Grand Total	99,625	61,063	160,688

Table A.7.9 Breakdown of Direct Construction Cost, Weir (1/2)

Unit : 1,000Rp

Item	Unit	Q'ty	F.C.(Rp.)	L.C.(Rp.)	Total (Rp.)
1 Temporary Work	Ls.	1	0	214,908	214,908
2 Intake Weir					
Excavation, Sand & Silt	m3	28,200	110,419	35,617	146,036
Excavation, Weathered rock	m3	10,613	67,476	21,332	88,809
Excavation, Massive&soft rocks, w/r	m3	7,311	84,707	23,965	108,672
Excavation, Massive&soft rocks, f/r	m3	404	6,334	1,793	8,127
Backfill, Large area	m3	19,740	91,106	30,005	121,110
Concrete 175kg/cm2	m3	17,064	1,520,850	1,174,191	2,695,041
Concrete 100kg/cm2	m3	642	55,682	33,963	89,645
Reinforcement Bar	ton	712	358,423	797,304	1,155,726
Form	m2	31,870	39,562	272,935	312,497
Gabion Mattress	pcs.	570	72,949	55,298	128,247
Road Metaring	m3	50	1,401	226	1,627
Sub-Total 2			2,408,909	2,446,628	4,855,537
3 Diversion Channel					
Excavation, Sand & Silt	m3	194,768	762,631	245,992	1,008,623
Backfill	m3	20,400	94,152	31,008	125,160
Sub-Total 3			856,783	277,000	1,133,783
4 Closure Embankment					
Stripping	m3	10,800	42,286	13,867	56,154
Excavation, Sand & Silt	m3	1,480	5,794	1,869	7,664
Excavation, Weathered rock	m3	840	5,339	1,688	7,027
Embankment, Common	m3	49,976	221,460	76,163	297,623
Embankment, Impervious material	m3	24,144	197,200	57,849	255,049
Embankment, Semi-pervious material	m3	1,344	7,867	2,251	10,118
Embankment, Pervious material	m3	1,008	6,412	1,915	8,327
Grouting Cement Paste	ton	150	31,228	30,944	62,172
Sub-Total 4			517,588	186,547	704,135
5 Bridge					
Concrete 200kg/cm2	m3	243	21,589	17,863	39,452
Reinforcement Bar	ton	29	14,670	32,636	47,306
Form	m2	437	542	3,746	4,288
Sub-Total 5			36,801	54,245	91,046
6 Hydromechanical Works					
Under Scoring Sluice Gate B3.0xH2.5m	no.	2	50,376	151,200	201,576
Under Scoring Sluice Gate B2.0xH2.5m	no.	2	33,584	100,800	134,384
Upper Scoring Sluice Gate B3.0xH3.0m	no.	2	67,703	174,182	241,886
Upper Scoring Sluice Gate B2.0xH3.0m	no.	2	45,134	116,122	161,256
Intake Gate B 1.8 x H 1.9m	no.	2	27,565	70,917	98,482
Intake Gate B 2.7 x H 2.3m	no.	2	50,052	128,771	178,823
Intake Trash Racks	set	5	0	181,055	181,055
Intake Stoplog	lot	1	0	101,684	101,684
Potable Engine Driving Units	set	2	107,280	3,196	110,476

Table A.7.9 Breakdown of Direct Construction Cost, Weir (2/2)

Unit : 1,000Rp

Item	Unit	Q'ty	F.C.(Rp.)	L.C.(Rp.)	Total (Rp.)
Electrical Equipment and Accessories	set	2	0	444,236	444,236
Maintenance Tool	lot	1	0	11,996	11,996
Sub-Total 6			381,694	1,484,159	1,865,852
7 Electrical Supply System					
Cable Line and Accessories	km	0.5	0	8,500	8,500
Installation of Guardhouse	Ls.	1	0	6,800	6,800
Sub-Total 7			0	15,300	15,300
8 Miscellaneous Works	Ls.	1	50,421	53,383	103,804
Grand Total			4,252,196	4,732,170	8,984,366

Table A.7.10 Breakdown of Direct Construction Cost, Dam (1/3)

Unit : 1,000Rp

Item	Unit	Q'ty	F.C.(Rp.)	L.C.(Rp.)	Total (Rp.)
1 Temporary Works	Ls.	1	329,879	138,432	468,312
2 Main Dam					
2.1 Earth Work					
Excavation, Sand & Silt	m3	125,000	489,653	157,843	647,496
Excavation, Wethered rock	m3	33,000	209,900	66,317	276,217
Excavation, Soft rocks, fresh rock zone	m3	8,000	125,493	35,497	160,990
Embankment, Impervious material	m3	89,000	727,233	213,201	940,434
Embankment, Semi-pervious material	m3	258,000	1,510,869	432,064	1,942,932
Filter	m3	24,000	605,046	158,416	763,463
Sub-Total 2.1			3,668,194	1,063,338	4,731,532
2.2 Foundation Treatment					
Drilling Grout Hole	m	15,000	1,252,192	119,511	1,371,703
Drilling Inclined Grout Hole	m	300	25,064	2,382	27,446
Drilling Vertical Test Hole	m	500	48,284	5,056	53,341
Drilling Inclined Test Hole	m	900	101,889	10,294	112,183
Grouting Cement Paste	ton	900	187,458	185,626	373,083
Sub-Total 2.2			1,614,887	322,869	1,937,755
Sub-Total 2			5,283,080	1,386,207	6,669,287
3 Saddle Dam					
3.1 Earth Work					
Excavation, Sand & Silt	m3	27,000	105,763	34,094	139,857
Embankment, Impervious material	m3	37,000	302,333	88,634	390,967
Sub-Total 3.1			408,096	122,728	530,825
3.2 Foundation Treatment					
Drilling Grout Hole	m	10,000	834,795	79,674	914,469
Drilling Inclined Grout Hole	m	200	16,710	1,588	18,298
Drilling Vertical Test Hole	m	300	28,969	3,034	32,003
Grouting Cement Paste	ton	600	124,973	123,750	248,723
Sub-Total 3.2			1,005,447	208,046	1,213,493
Sub-Total 3			1,413,544	330,775	1,744,318
4 Spillway					
Excavation, Sand & Silt	m3	94,000	368,218	118,698	486,916
Excavation, Soft rocks, wethered rock	m3	102,000	1,182,303	334,289	1,516,592
Excavation, Soft rocks, fresh rock zone	m3	34,000	533,345	150,862	684,207
Concrete 175kg/cm2	m3	29,400	2,621,405	2,022,639	4,644,044
Concrete 100kg/cm2	m3	6,984	606,007	369,394	975,401
Reinforcement Bar	ton	1,764	887,898	1,973,893	2,861,791
Form	m2	16,170	20,080	138,452	158,532
Sub-Total 4			6,219,256	5,108,227	11,327,484

Table A.7.10 Breakdown of Direct Construction Cost, Dam (2/3)

Unit : 1,000Rp

Item	Unit	Q'ty	F.C.(Rp.)	L.C.(Rp.)	Total (Rp.)
5 Diversion Tunnel					
5.1 Tunnel Works					
Excavation, Sand & Silt	m3	33,000	129,268	41,671	170,939
Excavation, Soft rocks, wethered rock	m3	57,000	660,698	186,809	847,507
Tunnel Excavation	m3	28,500	1,667,204	488,079	2,155,282
Concrete for Lining	m3	8,700	705,367	1,048,741	1,754,107
Form for Tunnel Concete	m2	6,597	68,533	128,946	197,478
Sub-Total 5.1			3,231,069	1,894,244	5,125,314
5.2 Grouting Works					
Drilling Holes in Tunnel	m	6,000	653,182	60,936	714,118
Drilling Test Holes in Tunnel	m	920	112,858	12,907	125,765
Grouting Cement Paste	ton	100	20,827	20,625	41,452
Sub-Total 5.2			786,867	94,468	881,335
5.3 Plug Works					
Plug Concrete	m3	1,600	174,454	118,784	293,238
Drilling Holes in Tunnel	m	4,200	457,225	42,655	499,880
Grouting Cement Paste	ton	100	20,827	20,625	41,452
Cooling Concrete	Ls.	1	808	524	1,332
Sub-Total 5.3			653,314	182,588	835,902
Sub-Total 5			4,671,250	2,171,300	6,842,551
6 Intake Structure					
6.1 Earth & Concrete Works					
Embankment, Common	m3	30,000	132,996	45,711	178,707
Concrete 175kg/cm2	m3	8,500	757,889	584,777	1,342,665
Concrete 100kg/cm2	m3	600	52,062	31,735	83,797
Reinforcement Bar	ton	66	33,220	73,853	107,073
Form	m2	9,888	12,278	84,664	96,942
Sub-Total 6.1			988,445	820,739	1,809,185
6.2 Hydromechanical Works					
Intake Trash Racks	Lot	1	232,416	91,670	324,086
Intake Gate	Lot	1	180,252	23,062	203,314
Regulating Facilities	Lot	1	4,730,400	144,430	4,874,830
Potable Engine Driving Units	Lot	1	89,208	0	89,208
Electrical Equipment and Accessories	Lot	1	414,504	76,665	491,169
Maintenance Tool	Lot	1	31,752	0	31,752
Sub-Total 6.2			5,678,532	335,827	6,014,359
Sub-Total 6			6,666,977	1,156,566	7,823,544

Table A.7.10 Breakdown of Direct Construction Cost, Dam (3/3)

Unit : 1,000Rp

Item	Unit	Q'ty	F.C.(Rp.)	L.C.(Rp.)	Total (Rp.)
7 Electrical Supply System					
Cable Line and Accessories	km	1	0	16,997	16,997
Installation of Guardhouse	Ls.	1	0	6,800	6,800
Sub-Total 6			0	23,797	23,797
8 Miscellaneous Works	Ls.	1	839,252	162,861	1,002,113
Grand Total			25,423,239	10,478,166	35,901,405

Table A.7.11 Breakdown of Direct Construction Cost, Irrigation & Drainage (1/3)

Unit : 1,000Rp.

Item	Unit	Q'ty	F.C.(Rp.)	L.C.(Rp.)	Total (Rp.)
1 Main System					
1.1 Main Canal					
Stripping	m2	1,179,533	232,829	113,204	346,033
Excavation, Sand & Silt	m3	2,004,399	7,090,975	2,312,451	9,403,426
Excavation, Weathered rock	m3	501,100	3,244,961	1,021,466	4,266,427
Embankment, Common	m3	433,601	1,922,099	661	1,922,760
Backfill	m3	41,806	86,230	57,259	143,489
Sod Facing	m2	325,100	20,920	316,237	337,157
Concrete 175kg/cm2	m3	3,630	203,043	242,390	445,433
Concrete 100kg/cm2	m3	312	10,984	14,743	25,727
Reinforcement Bar	ton	218	109,619	243,698	353,317
Form	m2	5,418	7,131	48,375	55,506
Gravel Pavement	m3	21,287	597,408	96,085	693,493
Sub-Total 1.1			13,526,199	4,466,569	17,992,768
1.2 Related Structure					
Excavation, Sand & Silt	m3	44,521	157,500	51,363	208,863
Embankment	m3	4,087	18,115	6,227	24,342
Backfill	m3	27,139	55,978	37,170	93,148
Concrete 200kg/cm2	m3	405	23,864	29,205	53,069
Concrete 175kg/cm2	m3	7,826	437,727	522,549	960,276
Concrete 100kg/cm2	m3	1,490	52,440	70,390	122,830
Reinforcement Bar	ton	432	217,856	484,319	702,175
Form	m2	15,234	20,050	136,013	156,063
Concrete Pipe D=1500	m	228	71,139	4,169	75,308
Concrete Pipe D=1000	m	426	90,346	38,969	129,315
Stone Masonry	m3	9,462	438,880	479,834	918,714
Sluice Gate	no.	85	369,186	861,751	1,230,937
Crump-De Gruyter Gate	no.	67	108,200	252,564	360,764
Sub-Total 1.2			2,061,281	2,974,525	5,035,806
Sub-Total 1			15,587,480	7,441,093	23,028,573
2 Secondary System					
2.1 Secondary Canal					
Stripping	m2	510,287	100,710	48,969	149,679
Excavation, Sand & Silt	m3	40,336	142,674	46,530	189,204
Excavation, Weathered rock	m3	10,084	65,289	20,553	85,842
Embankment, Common	m3	170,154	311,932	128,417	440,349
Sod Facing	m2	68,589	4,411	66,712	71,123
Gravel Pavement	m3	22,335	626,722	100,805	727,527
Sub-Total 2.1			1,251,738	411,986	1,663,724
2.2 Related Structure					
Excavation, Sand & Silt	m3	455,300	1,610,462	525,216	2,135,678
Embankment	m3	3,172	5,815	2,394	8,209
Backfill	m3	95,887	197,751	131,315	329,066
Concrete 200kg/cm2	m3	75	4,394	5,378	9,772
Concrete 175kg/cm2	m3	1,191	66,608	79,521	146,129

Table A.7.11 Breakdown of Direct Construction Cost, Irrigation & Drainage (2/3)

Unit : 1,000Rp.

Item	Unit	Qty	F.C.(Rp.)	L.C.(Rp.)	Total (Rp.)
Concrete 100kg/cm2	m3	196	6,884	9,241	16,125
Reinforcement Bar	ton	69	34,808	77,387	112,195
Form	m2	2,814	3,703	25,124	28,827
Concrete Pipe D=1000	m	385	81,637	35,216	116,853
Stone Masonry	m3	3,833	177,747	194,345	372,092
Sluice Gate	no.	58	251,876	587,953	839,829
Crump-De Gruyter Gate	no.	52	225,820	527,131	752,951
Sub-Total 2.2			2,667,505	2,200,222	4,867,727
Sub-Total 2			3,919,243	2,612,208	6,531,451
3 Tertiary System	ha	7,000	0	4,453,242	4,453,242
4 Drainage System					
4.1 Drainage Canal					
Stripping	m2	360,372	71,113	34,544	105,657
Excavation, Sand & Silt	m3	275,155	973,128	317,053	1,290,181
Embankment	m3	80,781	148,071	60,899	208,970
Sub-Total 4.1			1,192,312	412,495	1,604,807
4.2 Related Structure					
Concrete 175kg/cm2	m3	222	12,412	14,806	27,218
Reinforcement Bar	ton	9	4,527	10,058	14,585
Form	m2	817	1,073	7,286	8,359
Stone Masonry	m3	259	12,008	13,118	25,126
Gabion	pc.	1,304	166,895	126,316	293,211
Sub-Total 4.2			196,915	171,584	368,499
Sub-Total 4			1,389,227	584,080	1,973,307
5 Farm Road Network					
5.1 Earth Works					
Stripping	m2	275,000	54,254	26,358	80,612
Excavation, Sand & Silt	m3	34,375	121,543	39,606	161,149
Embankment	m3	103,125	188,983	77,734	266,717
Sod Facing	m2	44,000	2,830	42,744	45,574
Gravel Pavement	m3	16,500	462,819	74,379	537,198
Sub-Total 5.1			830,429	260,820	1,091,249
5.2 Related Structure					
Excavation, Sand & Silt	m3	5,297	18,725	6,102	24,827
Backfill	m3	4,791	9,875	6,552	16,427
Concrete 175kg/cm2	m3	1,840	102,850	122,684	225,534
Concrete 100kg/cm2	m3	90	3,173	4,256	7,429
Reinforcement Bar	ton	35	17,430	38,719	56,149
Form	m2	2,640	3,473	23,540	27,013
Concrete Pipe D=600	m	330	31,713	13,655	45,368

Table A.7.11 Breakdown of Direct Construction Cost, Irrigation & Drainage (3/3)

Unit : 1,000Rp.

	Item	Unit	Q'ty	F.C.(Rp.)	L.C.(Rp.)	Total (Rp.)
	Sub-Total 5.2			187,239	215,510	402,749
	Sub-Total 5			1,017,668	476,330	1,493,998
6	Pumping Facilities					
	Pump 10HP	no.	6	3,112	7,350	10,462
	Pump 18HP	no.	22	23,051	54,439	77,490
	Pump 27HP	no.	13	31,789	75,075	106,864
	Accessories	Ls.	1	11,590	27,373	38,963
	Sub-Total 6			69,543	164,237	233,779
	Grand Total			21,983,161	15,731,189	37,714,350

Table A.7.12 Annual Disbursement Schedule

Unit: Rp. Million

Item	Total		1996		1997		1998		1999		2000		2001	
	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.	F.C.	L.C.
1 Preparatory Works	2,583	1,548	-	-	-	-	2,583	1,548	-	-	-	-	-	-
2 Civil Works														
2.1 Weir	4,252	4,732	-	-	-	-	390	613	1,171	1,190	1,836	1,216	855	1,713
2.2 Dam	25,423	10,478	-	-	-	-	2,095	936	4,380	1,730	6,949	3,980	11,999	3,832
2.3 Main System	15,588	7,441	-	-	-	-	623	297	8,574	4,093	6,391	3,051	-	-
2.4 Secondary System	3,919	2,612	-	-	-	-	-	-	705	470	2,783	1,855	431	287
2.5 Tertiary System	-	4,453	-	-	-	-	-	-	-	-	-	3,162	-	1,291
2.6 Drainage System	1,389	584	-	-	-	-	-	-	-	-	986	415	403	169
2.7 Farm Road Network	1,018	476	-	-	-	-	-	-	-	-	723	338	295	138
2.8 Pumping Facilities	70	164	-	-	-	-	-	-	-	-	35	82	35	82
Sub-Total 2	51,659	30,940	-	-	-	-	3,108	1,846	14,830	7,483	19,703	14,099	14,018	7,512
3 O & M Facilities and Equipment	741	317	-	-	-	-	519	222	222	95	-	-	-	-
4 Land Acquisition and Compensation	-	3,734	-	1,120	-	1,494	-	747	-	373	-	-	-	-
5 Administration	1,354	810	-	-	-	-	142	84	370	187	492	352	350	187
6 Engineering Services	23,009	2,779	3,798	-	4,997	-	2,891	361	3,774	806	3,774	806	3,774	806
7 Physical Contingency	7,935	4,013	380	112	500	149	924	481	1,920	894	2,397	1,526	1,814	851
Total	87,280	44,141	4,178	1,232	5,497	1,643	10,167	5,289	21,116	9,838	26,366	16,783	19,956	9,356
8 Price Contingency	12,345	16,922	190	152	397	313	1,018	1,385	2,726	3,325	4,223	7,032	3,791	4,715
Grand Total	99,625	61,063	4,368	1,384	5,894	1,956	11,185	6,674	23,842	13,163	30,589	23,815	23,747	14,071

Table A.7.13 Annual Operation & Maintenance Cost

Unit : 1,000Rp.

Item	Unit	Q'ty	Unit Price	Total
Administration Cost				220,500
1 Salaries and Wages				177,600
Chief	m/m	12	1,200	14,400
Ass. Engineer	m/m	120	800	96,000
Ass. Officer	m/m	84	800	67,200
2 Running Cost				42,900
Ranting Dinas	month	12	715	8,580
Sub Ranting	month	48	715	34,320
Direct Operation & Maintenance Cost				583,493
1 Salaries and Wages				81,600
Gate Operator	m/m	72	400	28,800
Labour, Security	m/m	264	200	52,800
2 Running Cost				5,664
2.1 Equipment				163
Light Oil	lit.	360	0.39	140
Gasoline	lit.	33	0.69	23
2.2 Electric Charge of Dam & Weir Operation	month	12	458	5,501
3 Maintenance Cost				496,229
3.1 Inspection Road				216,790
Main Canal	m3	4,800	32.60	156,480
Secondary Canal	m3	1,850	32.60	60,310
3.2 Canal	m2	358,900	0.37	133,224
3.3 Structures (0.5% of Direct Cost)				146,215
Dam	Ls.	1	90,895	90,895
Weir	Ls.	1	18,204	18,204
Related Structure of Canal	Ls.	1	37,116	37,116
Grand Total				803,993

Table A.7.14 Replacement Cost

Unit : 1,000Rp.

	Useful Yr.	Unit	Q'ty	Total
1 O & M Equipment				1,060,560
1.1 Vehicle and Equipment	10	Ls.	1	963,360
1.2 Wireless Communication Equipment	10	Ls.	1	97,200
2 Project Facilities				2,041,825
2.1 Weir				2,041,825
Gate, Trush Racks, Stoplog	25	Ls.	1	1,487,058
Electrical Equipment and Accessories, etc.	10	Ls.	1	554,767
2.2 Dam				5,982,607
Gate, Trush Racks	25	Ls.	1	5,402,230
Electrical Equipment and Accessories, etc.	10	Ls.	1	580,377
2.3 Irrigation Canal				3,420,065
Sluice Gate	25	no.	143	2,071,367
Crump-De Gruyter Gate	25	no.	119	1,114,074
Pumping Facilities	15	no.	41	234,624
Grand Total				12,505,057

Table A.7.15 Separate Costs of Gravity and Pump Irrigation Systems

Unit: Rp. Million

Item	Gravity Irrigation System			Pump Irrigation System			Total		
	F.C.	L.C	Total	F.C.	L.C	Total	F.C.	L.C	Total
1 Preparatory Works	2,579	1,503	4,083	4	44	47	2,583	1,548	4,131
2 Civil Works									
2.1 Weir	4,252	4,732	8,984	0	0	0	4,252	4,732	8,984
2.2 Dam	25,423	10,478	35,901	0	0	0	25,423	10,478	35,901
2.3 Main System	15,588	7,441	23,029	0	0	0	15,588	7,441	23,029
2.4 Secondary System	3,919	2,612	6,531	0	0	0	3,919	2,612	6,531
2.5 Tertiary System	0	3,741	3,741	0	712	712	0	4,453	4,453
2.6 Drainage System	1,389	584	1,973	0	0	0	1,389	584	1,973
2.7 Farm Road Network	1,018	476	1,494	0	0	0	1,018	476	1,494
2.8 Pumping Facilities	0	0	0	70	164	234	70	164	234
Sub-Total 2	51,589	30,064	81,653	70	876	946	51,659	30,940	82,599
3 O & M Facilities and Equipment	741	317	1,058	0	0	0	741	317	1,058
4 Land Acquisition and Compensation	0	3,734	3,734	0	0	0	0	3,734	3,734
5 Administration	1,352	787	2,139	2	23	25	1,354	810	2,164
6 Engineering Services	22,269	2,779	25,048	740	0	740	23,009	2,779	25,788
7 Physical Contingency	7,853	3,919	11,772	82	94	176	7,935	4,013	11,948
Total	86,384	43,103	129,487	897	1,037	1,934	87,281	44,141	131,422
8 Price Contingency	11,965	16,419	28,384	393	503	896	12,358	16,922	29,280
Grand Total	98,348	59,523	157,871	1,290	1,540	2,830	99,639	61,063	160,702

Figure A.7.1 Implementation Schedule

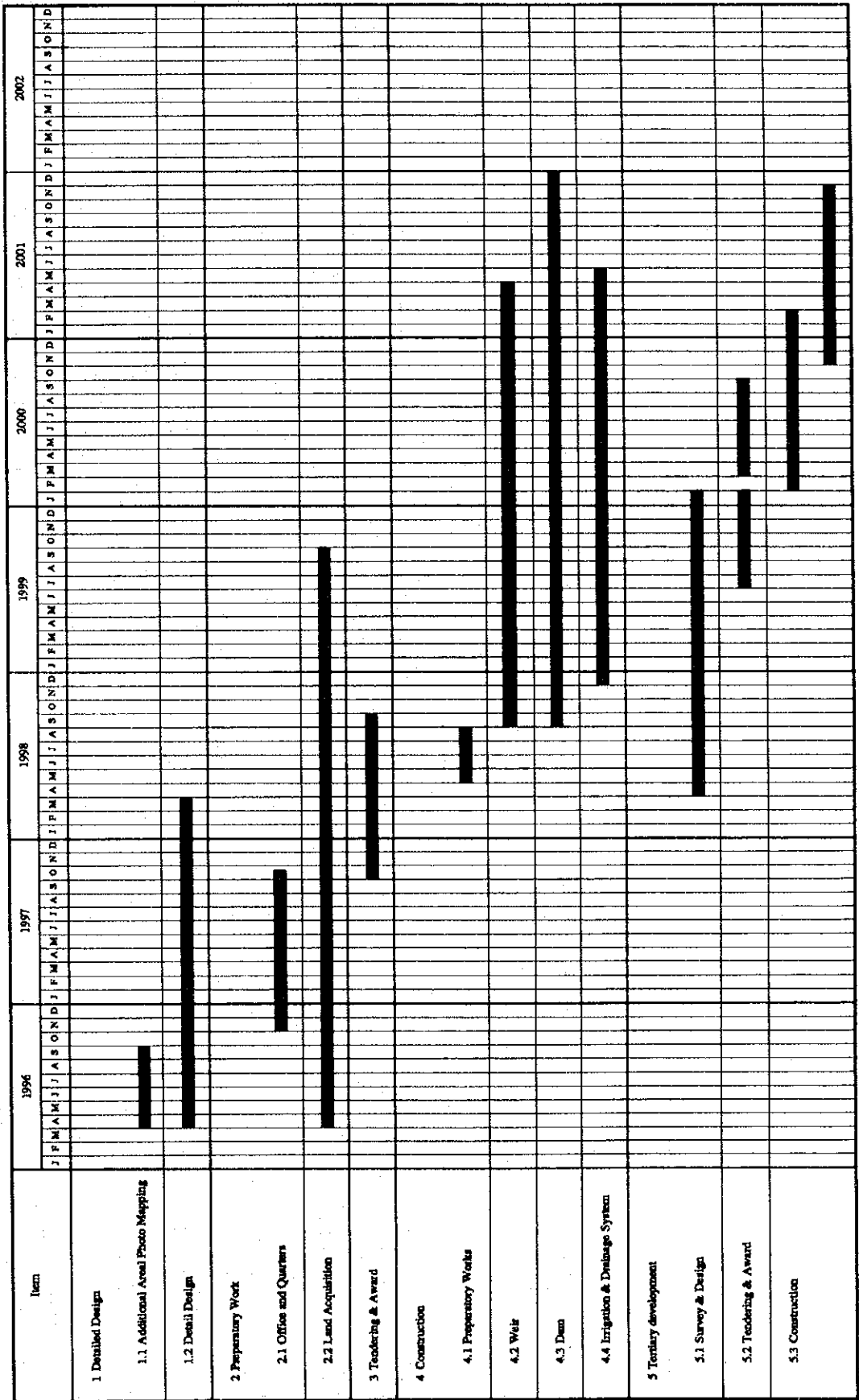
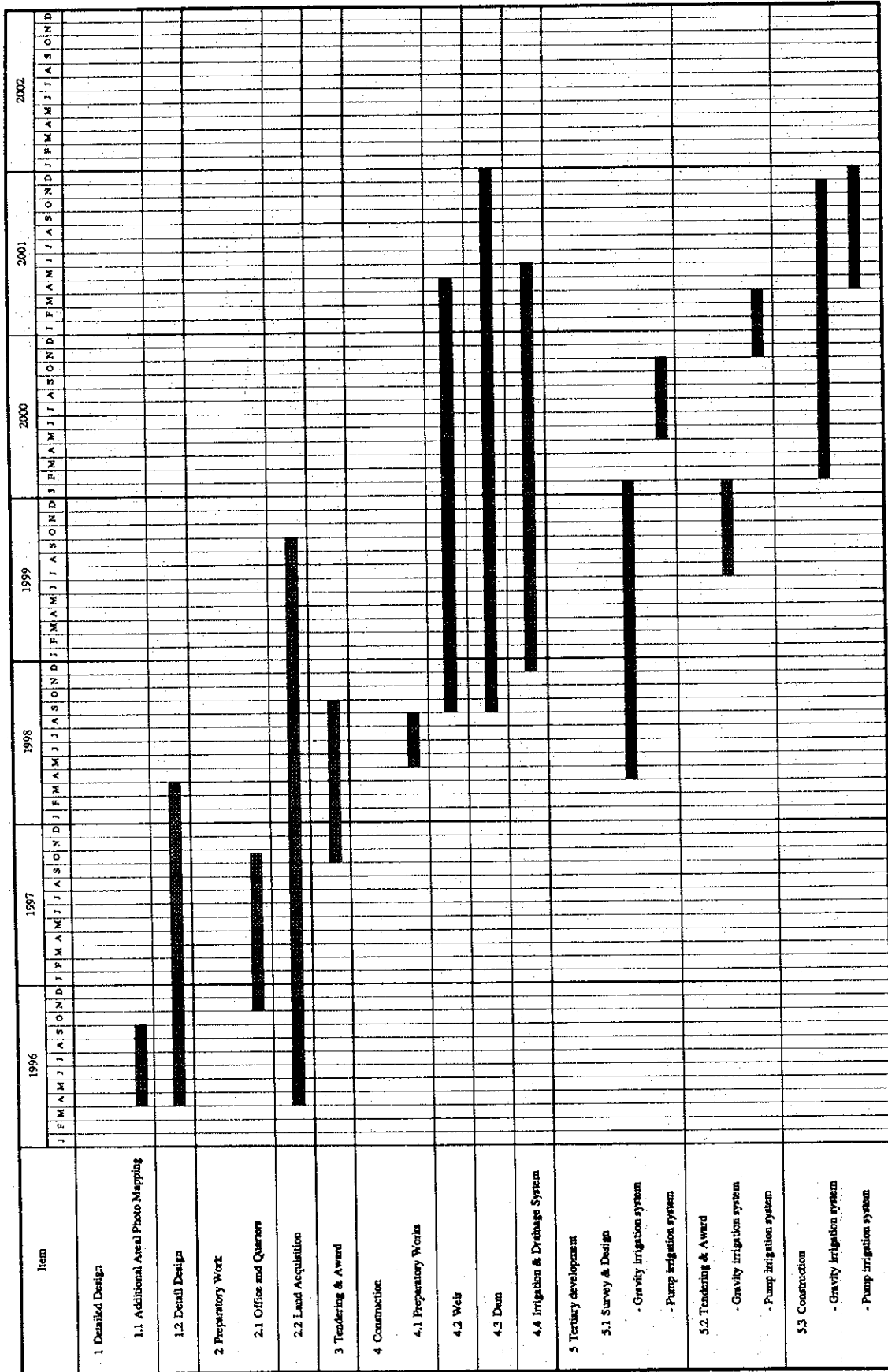
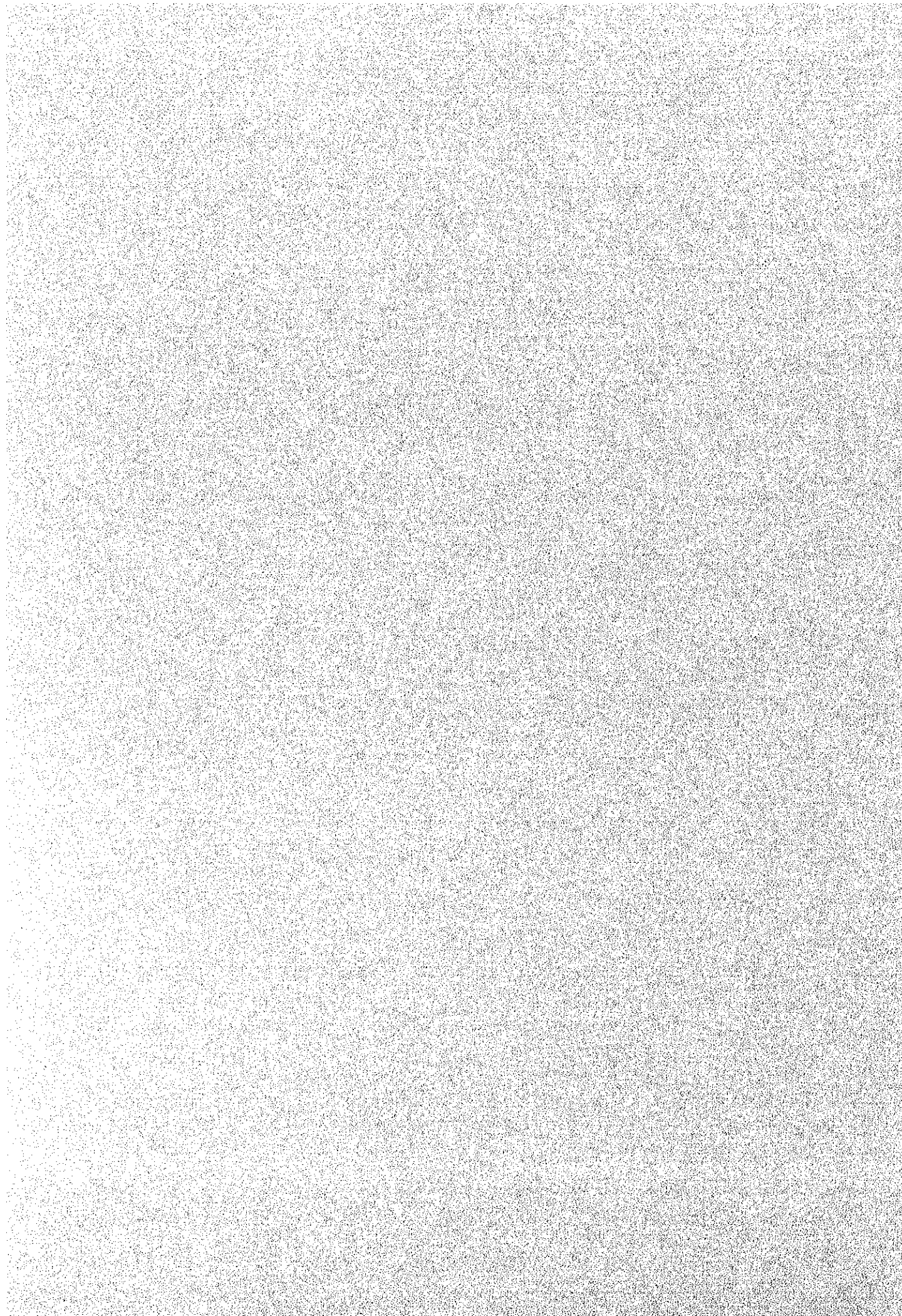


Figure A.7.2 Implementation Schedule
 (Separate Tertiary Development Schedule for Gravity and Pump Irrigation Systems)



ANNEX 8
ORGANIZATION AND MANAGEMENT



ANNEX 8 ORGANIZATION AND MANAGEMENT

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ANNEX 8 ORGANIZATION AND MANAGEMENT

1. ORGANIZATION FOR PROJECT EXECUTION

The Directorate General of Water Resources Development (hereinafter referred to as DGWRD), the Ministry of Public Works, the Government of the Republic of Indonesia would be the executing agency for implementation of the Gilirang Irrigation Project. DGWRD would coordinate all activities of the relevant Government agencies and regional administrative organizations in connection with the project implementation.

The Directorate of East Region Implementation (DERI) under the said DGWRD would have direct responsibility for the project implementation including both the engineering and the construction works. DERI comprises five (5) Sub Directorates by each region, the Project would belong under the Sub Directorate of Regional-II Implementation, South Sulawesi. The South Sulawesi Provincial Public Works for Water Resources (Dinas PU Pengairan Sulawesi Selatan) would coordinate the construction of the Project at the provincial level on behalf of the Ministry of Public Works.

The Construction Office of the Gilirang Irrigation Project (the Gilirang Project Office) is established newly in or near the project site. Sengkang which is capital of Kabupaten Wajo is ideal as the place of office, from the stand point of easy access to the project site and a good communication with the provincial and district governments concerned. At present, there is an existing construction office of DERI at Sengkang. It is the Bila Irrigation Project Office which is now managing three (3) on-going irrigation projects located in and around Wajo; i.e., Bila, Langkeme and Luwu Projects. The former two will be terminated within several years, and the latter will be continued further. So far there is no plan on the use of these facilities and staff after the completion of the above two projects, but it may be possible to use them for the Gilirang Project. It is proposed that the Gilirang Project Office belongs to the Bila Irrigation Project Office.

The organizational structure is proposed as presented in Figure A.8.1, referring the Bila Irrigation Project Office. The main tasks of the Gilirang Project Office would be as listed below.

- 1) Financial arrangements needed for the engineering and construction works of the Project.
- 2) Design and construction supervision of all the implementation works.
- 3) Coordination between the Government authorities concerned with implementation of the Project; i.e., Provincial and District (Kabupaten) Government Offices, Provincial Development Planning Agency (BAPPEDA), National Land Board (BPN), Agricultural Service Office, etc.
- 4) Personnel arrangements for staff to be required during the detailed design and construction stage.
- 5) Preparation of O&M manual.
- 6) Supporting services to the establishment of water user's association (P3A) by Dinas PU Pengairan and introduction of irrigation service fees by BAMUS.
- 7) Supporting services to the resettlement of peoples in the reservoir area.

The proposed Project Office has almost same organizational structure with that of the existing on-going projects. Namely, the Gilirang Project Office comprises following six (6) sections and two (2) Sub Project Manager's Offices; i.e., sections of i) Accounting, ii) Planning and Design, iii) Implementation, iv) Operation and Maintenance, v) Finance and vi) General Affairs, and Sub Project Manager's Offices of i) Dam and ii) Irrigation. A project manager would be responsible for the above tasks and manage all field and office works of the Project, assisted by these sections and Sub Project Managers. Necessary staff will be despatched from DERI and the Dinas PU Pengairan, Ujung Pandang.

2. OPERATION AND MAINTENANCE OF THE PROJECT

2.1. Water Management System for Irrigation in South Sulawesi Province

2.1.1 General

The South Sulawesi Province is marked as one of the advanced irrigation areas in Indonesia, and has a long and plentiful experiences of the water management for irrigation. Figure A.8.2 shows an overall structure of water management system in South Sulawesi Province. The management system comprises three (3) major components, i.e., irrigation committee, BAMUS (Badang Musyawarah), and "Manre Sipulung." All of governmental offices and associations related to the irrigation water are incorporated into these three institutions without an exception. The former two are official institutions and the latter is unofficial and traditional meeting.

The irrigation committee makes to plan cropping and irrigation schedules with coordination between the offices and associations concerned for them. BAMUS is a government agency for collecting irrigation services fees (IPAIR) needed to repair and maintain those facilities. "Manre Sipulung" has almost same function with the irrigation committee, but this traditional meeting has a strong power to decide water management matters over the irrigation committee.

The O&M of the Gilirang Irrigation Project which is carried out by the Dinas PU Pengairan (Provincial Public Work), South Sulawesi is also incorporated completely and automatically in this system. The water management system and its relation with the Project is outlined hereinafter.

2.1.2 Water Management System

(1) Irrigation Committee

The irrigation committee has been established in each administrative level; i.e., Province, Kabupaten and Kecamatan. Those administrative chiefs are appointed as chairmen of the committees of each level, as shown in Figure A.8.3. The committee comprises basically the following members which are governmental agencies; PEMDA (Administrative Office of Kabupaten), Dinas PU Pengairan, Agricultural Service Office (DIPERTA), Rural Development Office (BANGDES), National Land Board (BPN), and Police Office. These membership differ between the committees more or less, and depend on the water user's sectors. For instance, the committee in Kabupaten Wajo includes the fishery office.

The committee decides the cropping and irrigation schedules in each season and coordinate between the offices related to the irrigation water. In addition, the committee has played an important role to make maximum utilization of limited water resources for irrigation with its effective use. The tasks of the committee are summarized as below, and the details are shown in Table A.8.1.

- 1) To coordinate the water user's to make maximum utilization of irrigation water resources,
- 2) To make cropping and irrigation schedules,
- 3) To make schedule on maintenance of irrigation facilities at non-irrigating period,
- 4) To prepare flood control plan,
- 5) To decide the cropping area in each Desa/Kecamatan according to the available water to be estimated,
- 6) To motivate the public participation to protect the irrigation facilities from natural damage,
- 7) To clear and/or decide regally the boundary of irrigated lands,
- 8) To settle land tenure problems between the water users,
- 9) To protect the irrigated lands from the change of land use,
- 10) To investigate illegal water use by the farmers or other people and to give guidance to them,

- 11) To give guidance to the farmers or people who damage irrigation facilities, and
- 12) To prepare the schedule of water distribution and maintenance of facilities with water requirement in each season.

The irrigation committee has maintained and controlled strictly the irrigation facilities and land use of irrigated area where were constructed under the public budget. The farmers can't change their irrigated lands for any other purposes such as land for buildings and industry without permission of the BPN, even though it is own land.

(2) BAMUS

BAMUS is established in each Kabupaten level, and the duties are to formulate IPAIR implementation policy including fee regulation and collect IPAIR. Although, the extension of IPAIR has been implemented by an organization nation-wide in its scope as shown in Figure A.8.4, but its actual activity is entrusted to BAMUS. In Kabupaten Wajo, it is not yet established because of no IPAIR. The organizational structure of BAMUS in Kabupaten Sidrap is presented in Figure A.8.5. BAMUS consists of two (2) components; Board and working group for implementation of IPAIR. Board has a chairman (Bupati), three (3) vice chairmen, a secretary (Dinas PU Pengairan) and seven (7) members who come from the heads of governmental offices concerned. One should be a chairman of Gabungan P3A (P3A Group) for every Kecamatan.

The working group is organized by each administrative level; Kabupaten, Kecamatan and Desa, and has a function of executive agency to extent IPAIR. An IPAIR Permanent Secretariat is organized in each Kabupaten under the Board of IPAIR. Kecamatan level form a team called TIMLAK (IPAIR Executive Team) led by head of Kecamatan assisted by secretary of Kecamatan. Each Desa has a Team of IPAIR Implementation and Extension headed by Kepala Desa.

(3) Provincial Public Works for Water Resources

All of the operation and maintenance works of the irrigation systems are implemented by the Provincial Public Works for Water Resources (Dinas PU Pengairan) which belongs under the Provincial Government. The organization structure of the Dinas PU Pengairan in South Sulawesi Province consists of the following four (4) offices; i.e., i) Head Office at Ujung Pandang, ii) Cabang, iii) Ranting, and iv) Sub Ranting Offices. The detailed organizational structure of the former two offices as of November 1994 are presented in Figures. A.8.6 and A.8.7.

The Head Office has one Administrative Affairs and five (5) Departments (Sub Dinas); Planing, and Programming, Irrigation, River and Swamps, Operation and Maintenance, and Logistic and Equipment Departments. Under the Head Office, there are 14 Cabang Offices which cover all of the irrigation systems in the Province and have a direct responsibility of those O&M. The O&M of the Gilirang Irrigation Project will also be handed over to this Dinas PU Pengairan and its O&M is implemented by the Soppeng-Wajo Cabang Office located in Watang Soppeng, Kabupaten Soppeng.

(4) Manre Sipulung

In parallel with the activities of the irrigation committee, "Manre Sipulung" is functioning at present. This is a session of the community top figures and the governments, but not government's organization. Manre Sipulung is held in each season and decide the type of paddy to be planted, planting and harvesting seasons, etc. This meeting also decide the irrigation schedule and coordinate the offices concerned for irrigation water, as well as the irrigation committee. In addition, this traditional session coordinate the water use between the industrial sectors like that agriculture and fish culture. The head is Bupati and its power is

limited within the Kabupaten area, but almost all government offices, cooperatives and other any institutions related to the irrigation and agriculture have followed the matters decided by Manre Sipulung. The neighbouring Kabupatens have also such traditional committees, and are functioning effectively.

The cropping and irrigation schedule of the Gilirang irrigation system will be prepared by the Dinas PU Pengairan, and the Irrigation Committee makes those final decisions, but actual decisions are made by the Manre Sipulung.

2.1.3 Government Policy for On-Farm Water Management

The policy of Indonesian Government on operation and management of irrigation system is meant to arouse sense of belonging and responsibility to the farmers who are the members of association to keep and control irrigation system that is developed with the government order No. 23, 1982 about irrigation.

Based on this policy, it has been formed a farmer participation system in a form of groups called "Perkumpulan Petani Pemakai Air" (Water Users Association) or P3A. This association is formed for every tertiary block that has a very important function and role to have decision for operation and maintenance in tertiary level. In addition, O&M of farm road in tertiary level has been built in the P3A's functions to make it easy to carry farmers' productions for their places or mill and shed.

2.1.4 Irrigation Service Fees

(1) General

Several recent Government Degrees have altered these conditions such that Government policy is now to collect irrigation service fees and recover all O&M costs in main and secondary systems from the fees. In South Province, the provincial government and Dinas PU Pengairan have promoted powerfully to introduce irrigation services fees since 1987.

There are three kinds of irrigation service fees, i) IPEP (Iuran Pembiayaan Eksploitasi dan Peneliharaan¹), ii) IPAIR (Iuran Pelayanan Irigasi) and iii) Membership Fee of P3A. In 1987, IPEP was decided equally for all irrigation area without any classification. IPEP is a fixed rate amounting Rp.5,000/ha per every planting season or Rp.10,000/year, and collectors come from the PU Pengairan (State Irrigation). The implementation of IPEP however did not run well and also was not effective. In the same time the Government had needed a high finance for maintenance of irrigation system. In South Sulawesi Province, the Irrigation Service Fee Project appeared only in 4 districts pilot projects including Kabupaten Sidrap.

In 1989, the Government changed its irrigation service fee from IPEP to IPAIR. This new service fee is flexible rate which is calculated by each Kabupaten and irrigation system. The Government's basic concept for IPAIR is that irrigation service fee should be estimated according to the quality of services with necessity of repairing and maintenance budget by each system. The amount of IPAIR is calculated basically by the following formula.

$$\text{IPAIR} = (\text{Total Maintenance Cost} + \text{Collecting Cost of IPAIR}) / \text{Total Irrigation Area}$$

In the case of Kabupaten Sidrap, it is Rp.34,000/ha/year or Rp.19,000/ha for the dry season

¹ A water user's contribution to the cost of operation and maintenance of the irrigation system.

and Rp.15,000/ha for the wet season².

IPEP and IPAIR are used for repairing and maintenance especially for main and secondary canals. As for the maintenance cost of facilities in the tertiary block, it is covered by the membership fees of P3A. P3A is established in each tertiary block, and collects membership fees from the members. Of its total amount, 40% is paid to the staff of P3A, and remaining 60% is invested to the maintenance of irrigation facilities. As of November 1994, the membership fee of a P3A in Kabupaten Sidrap is Rp.3,000/ha/season.

(2) Collecting Procedure

The collection of IPAIR is implemented generally on March-April and August-September, and it is collected directly from the beneficiaries, through a collector of P3A. Overall collecting procedure is presented in Figure A.8.9.

IPAIR is collected by a collector. The chairman of P3A who has been elected automatically become a collector to arrange administration and fee collection from the members of P3A. In addition, a chairman of the Gabungan P3A coordinate fee collection between P3As. Collected fees is paid to the office of BRI (Bank Rakyat Indonesia) or Indonesian People Bank at the Village Unit within 7 days. If the farmers pay full amount and on time, 5% of amount is reimbursed to him as incentive called "Bonus." On the contrary, as a punishment, the farmers are fined 1.5% per month, who are not able to pay on time.

Gabungan P3A chairman and collector who have deposited all the fees in the Bank also receive 10% of total fees (9% for collector and 1% for the chairman of Gabungan P3A). Once in a week BRI Unit Desa deposits its amount to BRI Cabang Office (every Saturday) and transferred to BPD (Local Development Bank) which is a handling agency for tax, Reeves and other official revenue. Then BPD keep all IPAIR, and it becomes the local government cash. BAMUS is responsible for management and operation of IPAIR. If some repairing of irrigation facilities is requested from O&M office, a BAMUS meeting is held to assess its necessity and released its fund to the repairing works.

(3) Extension Progress of Irrigation Service Fees

IPAIR is now spreading gradually in the advanced irrigation area in the whole country, but IPEP still exist in a part of irrigation systems. In Kabupaten Wajo, IPAIR is not introduced yet, because of a small irrigation area. The area adopted IPAIR in the whole country and the collecting progress of IPAIR in South Sulawesi Province are summarized as follows.

Province	Area (ha)
South Sulawesi	114,500
West Sumatra	10,100
Lampung	81,000
West Java	269,500
Central Java	130,800
Yogyakarta	17,200
East Java	126,700
Total	749,800

Source: Procedure of IPAIR Collection, PU Pengairan, South Sulawesi, 1993.

² Kab. Sidrap introduced at first IPEP (Rp.5,000/ha/crop) into the Sadan Irrigation Project, and is now changing it to IPAIR. The Cabang Office in Sidrap said that actual O&M cost is estimated to be Rp.60,000/ha at present, and present IPAIR of Rp.34,000/ha/year will be increased to the amount of actual O&M cost with some collecting fees in the future.

Progress of IPAIR Collection in South Sulawesi Province

Kabupaten	Area (ha)	Target Amount (Rp. Million)					Collected Amount (Rp. Million)					Progress (%)
		92/93	1993	93/94	94	Total	92/93	1993	93/94	94	Total	
						(1)					(2)	(2)/(1)
Pinrang	37,703	290.9	250.9	295.6	-	837.4	36.4	55.5	38.0	-	129.9	15.5
Sidrap	18,209	-	131.7	193.0	-	324.7	-	131.5	126.5	-	258.0	79.5
Bone	7,563	-	-	40.8	40.7	81.5	-	-	32.9	-	32.9	40.4
Soppeng	6,778	-	-	26.4	-	26.4	-	-	18.4	-	18.4	69.7
Maros	5,717	-	-	29.5	23.6	53.1	-	-	18.6	2.5	21.1	39.7
Pangkep	6,871	-	-	35.0	7.9	42.9	-	-	20.4	-	20.4	47.6
Total	82,841	290.9	382.6	620.3	72.2	1,366.0	36.4	187.0	254.8	2.5	480.7	35.2

Source: Progress Report for IPAIR, BAPPEDA-South Sulawesi Province, December 1994.

The collecting ratio to a target in South Sulawesi averages 35%. Kabupaten Sidrap shows a good progress which is estimated to be 80%, while Kabupaten Pinrang is only 15%. To these systems, the Government introduced at first IPEP amounting Rp.10,000/ha/year in 1987, and changed its fees from IPEP to IPAIR amounting Rp.34,000/ha/season in 1989, as mentioned in preceding section. It seems that many farmers have hesitated to pay the fees, because of drastic change in its amount. The farmers in Kabupaten Sidrap know well the worth of irrigation water, because they know fear of drought. In the case of the Gilirang project, it may be estimated that the collecting progress shows a good result over that of Kabupaten Sidrap, for the reasons that IPAIR will be introduced from the first stage and all farmers are well aware of its fear as well as the farmers of Sidrap.

2.1.5 Training of Water Management

The Water Management Project Office (Proyekt Tataguna Air, PTGA) is responsible for the implementation of water management training. There are two training centers in Kabupaten Sidrap and Pinrang under PTGA. The training capacity is each 40 persons. The training program is divided into 3 courses depending on training contents and trainee's educational background, Course-A, -B, and -C. The training content itself is almost same between the three courses, but training method differ by each course. The Course-A is for senior officials of the Dinas PU Pengairan and senior staff from other agencies involved in O&M at Kabupaten level, 'B' is for officials involved in irrigation management at Kecamatan and Desa levels, and 'C' is for farmer's level including leaders of water user's association, "Mandor Wae" (water master), key farmers and informal rural leaders. In the case of 'C', the lecture is made visually by the use of overhead projector, TV, etc. The training has been implemented periodically. The recent training schedule is as follows.

Training Course	Period of Course (day)	Persons/Course (Person)	Times/Year (Time)
Course-A	2	4 - 5	1
Course-B	6	20	2
Course-C	12	20 - 30	3

Source: PTGA, Ujung Pandang

PTGA said that the biggest problem on training program is for budget and it is difficult to implement more intensive training over the above schedule.

2.2 Organization and Maintenance of the Gilirang Irrigation Project

2.2.1 Organization and Staffing

After completion of the project works, all project facilities constructed by the Project Office will be handed over to the Operation and Maintenance (O&M) Office which is responsible for the

operation and maintenance of all facilities, except for tertiary block. The operation and maintenance of the tertiary blocks down to terminal facilities is entrusted to the water user's association (P3A) and farmers themselves.

The Office of Dinas PU Pengairan (Provincial Public Works of Water Resources) which belongs under the Provincial Government is responsible for O&M of all irrigation systems in the Province. The operation and maintenance offices of the Dinas PU Pengairan are classified into three ranks, Cabang, Ranting and Sub Ranting Offices. For the establishment of these offices, PU has the following regulation.

**Regulation for Covering Area and
Office Staff Number of PU-O&M Office**

	Cabang Dinas PU	Ranting Dinas PU	Sub Ranting Dinas PU
Irrigation to be covered (ha)	25,000	5,000	1,000
Total office staff (persons)	56	6	8
Educational background of office staff to be employed			
- Engineer	1	-	-
- Bachelor	4	1	-
- High School	43	5	1
- Middle School	3	-	7
- Primary School	5	-	-

Note: Field staff such as gate keeper and foremen are excluded from the above office staff.

Source: Dinas PU Pengairan, Ujung Pandang.

As seen in the above table, the O&M Offices are classified into three ranks according to the size of irrigation area to be covered by those offices. Then the number of office staff also be defined with their educational background. The field staff are excluded from the above regulation, and in general, it has been estimated on the basis of the actual number of advanced irrigation area located in the west or east Java. The O&M Office of the Gilirang project having about 7,000 ha will be ranked as one of Ranting Office, and will have several Sub Ranting Offices.

The organizational structure of the O&M Office was planned as shown in Figure A.8.7, referring a regulation of PU and the existing O&M Offices (Awo, Soppeng Utra, Soppeng Selatan and Wajo). The proposed O&M Office will have one Security Section and four affairs; Operation, Repair and Maintenance, Tertiary and Administrative Affairs. The main tasks of these affairs are summarized as below.

- 1) Operation Affair
 - Planing of irrigation schedule
 - Water distribution
 - Control of water delivery
 - Hydrological measurement
 - Data collection and data processing
- 2) Maintenance Affair
 - Repair and maintenance of facilities and equipment
 - Inspection of facilities and equipment
- 3) Tertiary Affair
 - Guidance and training to tertiary block development by P3A
 - Guidance and training to on-farm water management by P3A
 - Supporting to IPAIR collection by BAMUS
 - Supporting to monitoring and evaluation activities of Provincial and Cabang offices
- 4) Administration Affair
 - Personnel services

- Accounting and cashiering
 - General affair services
- 5) Security
- Security service for O&M office

The O&M Office will be set up at the Project site or Sengkang. Taking into consideration the need for smooth and effective water supply, it is proposed that the service area for water management be divided into four areas (4 Sub Ranting Offices); one in upstream area including dam and intake weir, one in the left bank area, and two in the right bank area. Outline and covering area of these Sub Ranting Office are presented in Figure A.8.8. It is not proposed that any other branch offices be established in these areas without the above Sub Ranting Offices, because water management should be carried out through a short channel. In short, irrigation scheduling and water delivery will be made separately within these areas, but the planning and water control must be done by one office (Ranting Office).

The staff necessary for the operation and maintenance of the Project were estimated to be eight (8) persons for Ranting Office (including two securities) and thirty eight (38) persons for four (4) Sub Ranting Offices. The staff of the Sub Ranting Offices include Mantri Pengairan (Irrigation Overseer), Labour Supervisors and Gate Keepers (PPA). The details are presented in Table A.8.2. The number of field staff were estimated on the basis of those typical density in the irrigation area of West Java and South Sulawesi Provinces.

The O&M of irrigation system in Kabupaten Wajo is covered by the Soppeng-Wajo Cabang Office which is located in Watang Soppeng, Kabupaten Soppeng, and covers two Kabupatens (Soppeng and Wajo). The O&M office of the Gilirang Project will belongs under this Cabang Office so far. The Dinas PU Pengairan has however a plan for the establishment of a new Cabang Office in Kabupaten Wajo. At present, there are two (2) on-going irrigation projects in the territory of the Soppeng-Wajo Cabang Office; the Langkeme and the Bila Irrigation Projects. Total irrigation area of both projects is estimated to be 16,800 ha. These will be terminated within several years. After the completion of the Gilirang Irrigation Project, the irrigation area will reach over 23,800 ha. In accordance with the PU regulation, a new Cabang Office will be established to manage these three (3) projects with several existing small scale systems.

On the other hand, these days the central Government has set up several new policies for water management system in the whole country. These are to integrated and comprehensive water resources management by each basin and localization of O&M by the Government. For the former, the Government is now establishing "Water Resources Development Committee" by each basin or province. This Committee will coordinate the water resources development activities of all sectors including irrigation, industry, potable water, hydropower, and so on. The latter is that the Dinas PU Pengairan turn over all Cabang Offices to the local Government (Kabupaten) and will establish newly a liaison office (executive office) in each Kabupaten level. It means that O&M of the Gilirang irrigation system is implemented by a new Cabang Office under Kabupaten Wajo.

In either case, it would be estimated that the organizational structure of the Cabang Office itself has no drastic change with its functions, and the O&M of irrigation system would be continued without problems, because the Dinas PU Pengairan of South Sulawesi Province has a lot of experience during the long period. This office has stated that the Dinas PU Pengairan makes full support to the Cabang Offices in any other cases.

2.2.2 Operation and Maintenance Plan

The O&M of the Gilirang irrigation system is carried out by the Cabang, Ranting and several Sub Ranting Offices. Major management works of these O&M offices will consist of planning of the irrigation schedule, control of irrigation water delivery, and maintenance and repair of facilities. Those detailed operation and maintenance manual will be prepared by the O&M expert at the construction stage with those training to the O&M staff. In this report, the

following matters are recommended to O&M of the Gilirang Irrigation Project, and a completed and detailed plan is left to the next stage.

1) Planning of Irrigation Schedule

Planning of the irrigation schedule is made in three stages; long-term plan, yearly plan and seasonal plan.

Long Term Plan This plan is prepared once every 3 to 4 years. The plan define the targets such as total irrigation area, irrigation efficiency, operation cost and other specific targets for operation and maintenance.

Yearly Plan Before the start of the wet season, the yearly plan is prepared for the coming wet and dry seasons in accordance with the long-term plan. It is proposed that several alternatives are studied in this planning procedure by means of simulation studies made, for instance, for combinations of irrigated crop area and irrigation schedules against a drought year, a normal year and a rainy year of appropriate probability.

Seasonal Plan The seasonal plan is prepared for every crop season in line with the yearly and long term plans, but some adjustment will be made, depending on the actual hydrological conditions.

The Operation Section in the Cabang Office is responsible for these plans. A hydrologist should be assigned in this section, and statistical analyses for previous seasons is included in the evaluation report which is issued yearly.

2) Control of Irrigation Water Delivery

The Operation Affair in the Ranting Office is responsible for the control of irrigation water delivery, and it will be realized by the following work flow:

a) Data Collection and Processing

The data required for operation are farming activities and hydrological data such as hourly rainfall, river water level, reservoir water level, canal water level, and gate opening records. As for the collection of data on farming activities, the field investigation is done by field personnel. Major survey items consist of i) kind of crops, ii) crop varieties, iii) planting area, iv) harvesting area, and v) start and end of transplanting. These data are compiled by each month.

The data processing is composed of three main items; i) water balance simulation to be required for operation planning, ii) hydrological data processing, and iii) processing of dimensions such as cropping area and canal discharge necessary for the operation. These are basic information for the preparation of water management and the operation plan mentioned below. If a micro computer is available, this processing can be done easily and accurately.

b) Water Management and Operation Plan

The water management and operation plan will be prepared for each irrigation block in accordance with the seasonal plan. The plan consists of the following three items; i) seasonal management plan, ii) monthly

management plan, and iii) weekly management plan. The seasonal management plan clarify the proposed irrigation area, irrigation schedule, cropping calendar, and so on. After irrigation starts, the seasonal management plan should always be checked and corrected by the daily water balance study. The monthly management plan indicate the water distribution, and is prepared for the next month. The weekly operation plan is made for the operation of the following week from the result of water balance study for the previous week based on the operation monitoring records. This plan indicate the volume of irrigation water delivery required at each point of the field.

c) Operation and Monitoring

According to the weekly operation plan, the field personnel under the Sub Ranting Offices set the irrigation facilities to control the water delivery. It should be noted that the minimum operation term is not a day but week, so that the control facilities be set at the beginning of the week, and will not be changed except in the case of an order from the Operation Affair of the Ranting Office.

The irrigation water distribution and hydrological features are monitored through the field personnel, and reported immediately to the Operation Affair through the wireless radio system.

3) Operation Rule

The establishment of the operation rule aims at achieving the highest irrigation efficiency, equitable distribution of irrigation water, and equality of control between irrigation blocks. The following several operation rules are proposed to the operation manual to be prepared at the next stage.

- a) Unit operation period is one week. The control structures in a system should be set according to the weekly operation plan on the first day of the week (unit operation period), and there must be no change of control within the week unless daily rainfall exceeds the effective rainfall. If rainfall over the effective rainfall is monitored, the irrigation water supply should be stopped in the appropriate irrigation block from the next day until the end of the week (unit operation period).
- b) At the beginning of weekly operation, the daily water balance for the previous week should be reviewed on the basis of the data on farming activities (cropping area), daily rainfall and the volume of water supplied. At this time, some modifications will be made to the original weekly operation plan, if necessary. After review, the control order should be transmitted from the Operation Affair in the Ranting Office to the field personnel through the wireless radio system.
- c) For the collection of data on farming activities, the field investigation is carried out by the field personnel. Major survey items were mentioned in 2) - a)).
- d) The condition of flow and water distribution must be monitored by the patrol of field personnel. If the distribution is found to be skewed from the schedule, the field personnel must report immediately to the Operation Affair in the Ranting Office. Then necessary readjustment should be ordered from this Affair to the field personnel.

In addition to the above operation rules, it would be necessary to establish operation

rules in the case of emergency which will be considered for mismatching between the farming stage and operation period, troubles at major control points, flood, and so on. In the case of large scale irrigation system, its mismatching will often occur, especially at the transplanting stage when much paddling water is required. Owing mainly to reasons of the farmers side, transplanting will be delayed beyond the scheduled staggering period. Under the emergency operation rule, the reasons for problems should be cleared through the field investigation, and in parallel with this, prompt readjustment of water schedule is made by the Operation Affair. Then, the proper time for transplanting under reschedule is propagate to the water user's associations (P3A).

As for the troubles at major control points, detailed operation rules or an instruction manual for countermeasure must be prepared, assuming possible troubles which will occur at each major control points. Moreover, materials and spare parts necessary for repairing should be stocked by the Sub Ranting Offices.

4) Repair and Maintenance

Irrigation maintenance is needed to guarantee irrigation operation and still can be used efficiently in a long time and the age irrigation can be prolonged. This maintenance covers with irrigation improvement that has been developed. Both the Rehabilitation and Maintenance Section in the Cabang Office and the Maintenance Affair in the Ranting Office are responsible for repair and maintenance of the facilities. It is proposed that the daily maintenance activities should be intensified with cooperation between the Maintenance Affair and the Operation Affair in the Ranting Office. Namely, the field personnel under the Operation Affair are given responsibility for daily maintenance works which would always be required as soon as possible. The works of the Repair and Maintenance Section in the Cabang Office is concentrated on major irrigation and drainage facilities including dam

The maintenance works can be divided principally into two parts, which are implemented by the Ranting Office.

- a) Routine Maintenance which covers drainage, bank, delivery and take out mud. The cost of this activities is relatively light (not so expensive) and it can be done continuously the whole year.
- b) Periodic Maintenance ; It covers the activities in medium scale and even larger, as building improvement, changing of water gates, clearing the grass and trees at the farm road (canal road), etc.

Considering about development and rehabilitation of irrigation is larger, so the involvement of farmers are very needed indeed in the form of the awareness of paying IPAIR, in order the function of irrigation can be utilize permanently and irrigation service can reliable for farmers.

5) Farmer's Assistance and Administrative Work

Many P3A will be set up in the irrigation service area. For active and effective management, these associations will require powerful assistance of the O&M Office. The Tertiary Scheme Section of the Cabang Office and the Tertiary Affair in the Ranting Office are responsible for this assistance. These section and affair carry out assistance works such as training in water control on field and guidance in repair and maintenance of irrigation facilities.

Monitoring and evaluation of the effects of irrigation services will be conducted by the Office of Dinas PU Pengairan, Ujung Pandang through the Project Benefit Monitoring and Evaluation Survey (PBME), and the result of evaluation will be fed

back to the management of the O&M Office. The Tertiary Affair would assist this survey.

The Administrative Affair in the Ranting Office is responsible for the administrative works in cooperation with the Cabang Office. Administrative works consist of personnel services, accounting, cashiering, book keeping and other general affair's services. Of these, the book keeping is a prerequisite work. Through the operation and management activities of the O&M Office, many data and documents such as rainfall record, monthly and yearly reports for O&M, budgetary reports and texts for guidance and training will be collected and issued by all staff. These data and documents are very important sources for the improvement and up-grading of the operation and management, and in general, each staff has kept them. However, these document have often lost with replacement of staff. Therefore, it is proposed that all these document should be kept at one place by the Administration Affair.

2.2.3 O&M Equipment

The O&M equipment that will be required during the O&M stage are bulldozers, motor graders, vehicles, measuring instrument, and so on. The field offices such as meteorological measuring station and O&M stations at dam and intake site are newly constructed in the project area. These are listed in the following table. The Ranting Office of the Gilirang Irrigation Project will have these O&M equipment. If a new Cabang Office will be established at Sengkang where is located near the Project site, these equipment will be managed by this Office.

O&M Equipment	
Equipment	No.
1. Vehicle and Equipment	
1) Motor Grader, 3.1m	1
2) Wheel Loader, 2.2m ³	1
3) Tamper, 80kg	3
4) Soil Compactor, 90kg	3
5) Portable Concrete Mixer, 0.2m ³	1
6) Diesel Engine Pump, 5HP	1
7) Generator, 5KVA	1
8) Dump Truck, 2 tons	1
9) Cargo Truck, w/Crane, 2 tons	1
10) Truck, 1 ton Pick-up Type	3
11) Jeep, Four Wheel Drive	3
12) Motor Cycle	5
13) Spare Parts (20% of the above)	L.S.
2. Wireless Communication Equipment	
1) Wireless Radio Set	5
2) Transceiver, Handy Type	5

In order to maintain a good liaison between the Ranting and the Sub Ranting Offices, the wireless radio system will be introduces as communication network. The proposed system will be the VHF simplex wireless radio network. The data and information collected by the field staff will be reported immediately through this wireless radio network.

2.3. Water User's Association

2.3.1 Water User's Association in the Project Area

The O&M of irrigation and drainage facilities in the tertiary block is carried out by the water user's associations (P3A). In the Project area, there is no existing P3A because of no irrigation facilities. Although there are several private irrigation systems by pump, these systems have no association. It is therefore necessary to establish newly P3As to be covered all irrigation area, without exception. The number of P3A to be established in the Project area is estimated as follows.

Number and Size of P3A to be Established in the Project Area

		Left Bank*2	Right Bank			Total
			I	II	III*2	
Gravity Irrigation						
- Irrigable Area	(ha)	2,030	1,299	1,301	1,250	5,880
- No. of P3A	(No.)	28	32	26	15	101
- Average Size of P3A	(ha)	73	41	50	83	58
- Household/P3A*1	(No.)	31	18	21	35	25
Pump Irrigation						
- Irrigable Area	(ha)	75	859	186	-	1,120
- No. of P3A	(No.)	5	24	9	-	38
- Average Size of P3A	(ha)	15	36	21	-	29
- Household/P3A*1	(No.)	6	15	9	-	12
Total						
- Irrigable Area	(ha)	2,105	2,158	1,487	1,250	7,000
- No. of P3A	(No.)	33	56	35	15	139
- Average Size of P3A	(ha)	64	39	42	83	50
- Household/P3A*1	(No.)	27	17	18	35	21

*1 Estimated on the basis of an average holding size per household (2.34ha) in the whole project area.

*2 Irrigation block covered by the Sub Ranting Offices.

The organizational structure of P3A is presented in Fig A.8.9, referring the existing associations located in Kabupaten Sidrap and the guideline prepared by the Dinas PU Pengairan. The P3A would have a Board, and be staffed by a manager, treasurer, secretary and "Mandor Wae" (water master). One Mandor Wae would be appointed in each tertiary block in the water user's association to carry out water management including preparation of irrigation calendar, handling of canal structures, diverting of the scheduled amount of water to supply quaternary canals, and supervision of maintenance works. A farmers' leader will be selected in each quaternary block to assist the Mandor Wae.

In addition to the above P3A, the Gabungan P3A (P3A Group) will be formed in each Desa and Kecamatan, in order to coordinate IPAIR collection between P3As. The Ranting Office of PU Pengairan appoint a chairman of the Gabungan P3A.

Before completion of the construction of the project facilities, these P3A and Gabungan P3A should be established in all irrigation area. The Tertiary Scheme Section in the Cabang Office (see Figure A.8.7) is responsible for establishment of P3A in cooperation with the offices concerned (Agricultural Service Office, Administrative Offices of Kecamatan and Desa, BAMUS working team, etc.). In particular, the Tertiary Scheme Section will provide full technical guidance and advice for water management and maintenance of the irrigation facilities, because the farmers in the project area have no experience on on-farm water management. The activities of the Mandor Wae and farmers' leaders are important for proper water management both at on-farm level and at project level. In order to fulfil their missions, it is necessary that they have a through knowledge of water management in the Project as well as at on-farm level.

2.3.2 Irrigation Service Fee and Membership Fee

IPAIR will be introduced to the Gilirang irrigation area, which is calculated by the following formula. The amount of IPAIR to the farmers is estimated to be Rp.96,000/ha/year (prices in 1994).

$$\text{IPAIR} = (\text{Total Maintenance Cost} + \text{Collecting Cost of IPAIR}^3) / \text{Total Irrigation Area}$$

Irrigation Area: 7,000 ha	Total Cost (Rp. Million)	IPAIR per Ha (Rp./ha/year)
Direct Operation and Maintenance Cost	583.5	83,000
Collecting Fee (15%)	87.5	13,000
IPAIR in 1994 Prices	671.0	96,000

Maintenance of the tertiary block done 50m from tertiary gate is the farmers' responsibility especially P3A. They keep it mainly by working together with members of P3A (Gotong Royong system). In addition, necessary budget for repairing of facilities such as division boxes, ditches and farm roads is covered by the membership collected from the members. Of its total amount, 40% is paid to the staff of P3A including chairman, secretary, treasurer and Mandor Wae as their allowances, and remaining 60% is invested to the maintenance of facilities. The amount of membership fees is assumed at Rp.3,000/ha/season (current price in 1994), referring the fees of a P3A in Kabupaten Sidrap.

Thus total fees to be paid by a farmer in the Gilirang irrigation area amount to Rp.102,000/ha/year in total. IPAIR is sent to BAMUS for repairing of main facilities. Membership fees are kept by P3A and invested to the maintenance of facilities in the tertiary block as mentioned in preceding paragraph. A typical P3A has about 50 ha of paddy field, and total annual budget for maintenance is estimated to be Rp.180,000/year (50 ha x Rp.6,000/ha/year x 60%). It seems that this amount will enable P3A to maintain irrigation facilities completely, because funds necessary for repairing are only for division boxes, and other maintenance works are done mainly by the manpower under the Gotong Royong system within the members.

2.3.3 Articles and By-Laws of the Water User's Associations

A standard articles and by-laws of P3A has been prepared by the PU Pengairan under the decrees⁴. A farmers' group of tertiary block fulfil this document and submit to the Bupati Office with witnesses of Camat and Kepala Desa. The Bupati Office register its association according to the Minister's decree, thereby it is authorized regally as P3A. At same time, this P3A also is registered at the Government Offices concerned (Dinas PU Pengairan, BAMUS, Agricultural Service Office, etc.)

There are two specific items in this articles and by-laws. The one is for membership of tenant farmers, and the another one is for punishment role. The tenant farmers have a right to join P3A with the election for leaders (chairman, treasurer, etc.), and are in duty bound to pay the irrigation service and membership fees⁵, as well as owner farmers. In accordance with the articles and by-laws, P3A can inflict punishment on members who use irrigation water and facilities illegally and do not pay the fees.

³ Collecting cost of IPAIR is estimated to be 15% of total O&M cost.

⁴ 1) Instruksi Presiden R.I. No.2, 1994.

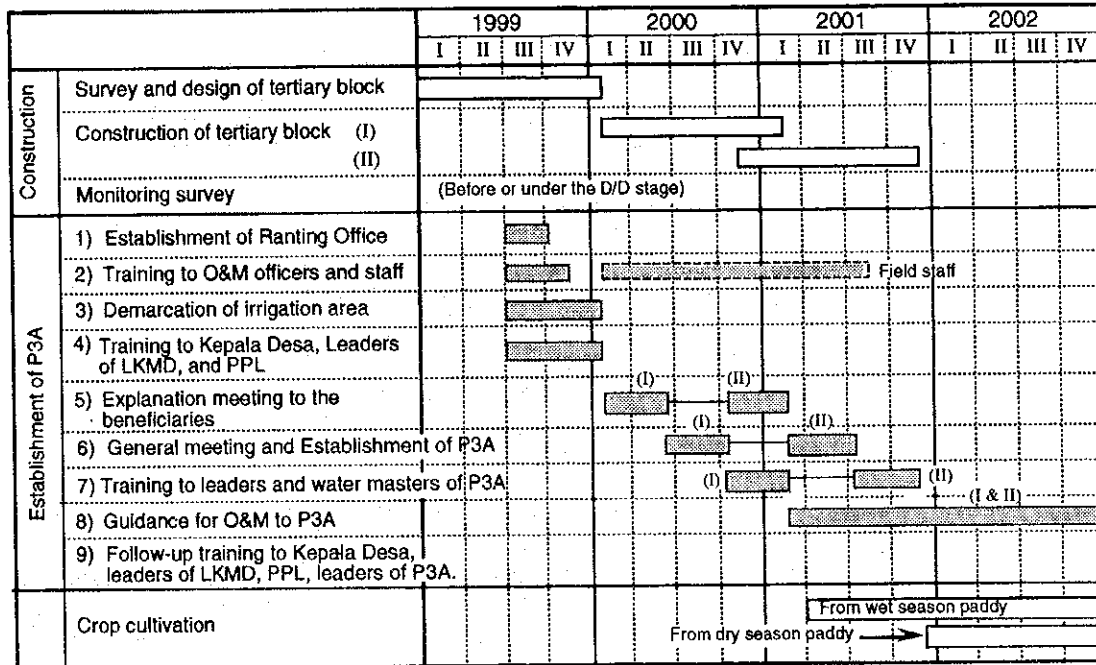
2) Peraturan Menteri Dalam Negri R.I. No.12, 1992

3) Keputusan Gubernur KDH. TK.I Sulawesi Selatan No.714/V/1988, 1988.

⁵ Land owner pays 50% of total amount and remaining 50% is by tenant farmer, but in most cases, a collector of P3A collects the fee from tenant farmer, because he always can't contact with land owener.

2.3.4 Implementation Plan for Establishment of P3A

The survey and design of tertiary block and its construction are implemented by the Gilirang Construction Office. The construction is divided into two stages, and those will be completed in the beginning and the end of 2001, respectively. In accordance with this construction schedule, the implementation for establishing P3A is planned as follows.



Main activities required for the establishment of P3A are as follows:

1) Monitoring Survey

Before or under the detailed design stage, the monitoring survey to the farmers in the project area is carried out by the Gilirang Construction Office and the Dinas PU Pengairan, in order to grasp the farmers' intention to establish O&M of tertiary block by P3A. The survey result is reflected in the establishment plan.

2) Establishment of Ranting Dinas and Training of O&M Staff

Before the commencement of construction of the tertiary block, the Ranting Office for O&M would be established by the Dinas PU Pengairan. For the arrangement of O&M officers excluding field staff such as foreman and gate keepers, it is proposed to make changes in officers from existing irrigation and construction offices to this new office. Namely, officers who are now engaging in the existing systems and have a lot of experience are despatched to this new O&M office. As for field staff, they will be newly employed or collected from the existing irrigation systems.

Training to O&M officers and field staff are carried out by PTGA of the Dinas PU Pengairan. The Dinas PU Pengairan would despatch them to exiting training centers (Kabupaten Pinrang and Sidrap). In addition, before the commencement of O&M, all O&M staff would study on the O&M manual which will be prepared by the Construction Office in cooperation with a Consultancy Team through the construction stage of irrigation facilities.

3) Demarcation of Irrigable Area and Training of Kepala Desa, Leaders of LKMD and PPL

In the survey and design of tertiary block, the irrigation area is confirmed finally by the Construction Office. Based on these data, the new Ranting Office would prepare a list of beneficiaries and Desas related to the irrigation, and train Kepala Desa, leaders of LKMD and PPL for P3A. Their powerful cooperation is required with their good understanding., for successful establishment of P3A. Their training is carried out also at the existing training centers of PTGA.

4) Explanation Meeting to Beneficiaries

Prior to establish P3A, explanation meeting to the beneficiaries is held by the Ranting Office in cooperation with Kepala Desa, leaders of LKMD and PPL.

- Outline of the Gilirang Irrigation Project
- Necessity and importance of O&M by the beneficiaries
- Purpose of P3A and details of activities to be required to P3A
- Government's guidance and supporting services to P3A
- Necessity of IPAIR and its collection system
- Articles and by-laws of P3A
- Schedule for establishment of P3A

5) General Meeting and Establishment of P3A

The general meeting for establishment of P3A is held by the beneficiaries in each tertiary block during the construction stage. The Ranting Office and Kepala Desa take initiative in establishing the general meeting in cooperation with leaders of LKMD and PPL. In this meeting following matters would be discussed and adopted by the beneficiaries; i.e., i) selection of leaders and water master, ii) discussion and adoption of articles and by-laws, and iii) amount of membership fees. Registration of P3A is also carried out by new leaders after general meeting.

6) Guidance to P3A and Training to Kepala Desa, Leaders of LKMD, PPL and Leaders of P3A

After establishment of P3A, the training and guidance is carried out by the Dinas PU Pengairan, Ranting Office and PTGA. In addition, follow-up training to Kepala Desa, leaders of LKMD, PPL and leaders of P3A is also carried out by these offices.

2.3.5 Recommendations for Establishment and Operation of P3A

The water user's association would be established in the all tertiary blocks under the guidance of Cabang Dinas PU Pengairan at Soppeng or a new Cabang Office which will be established in Kabupaten Wajo. The following points are recommended to ensure effective operation and management of P3A.

- 1) Establishment of P3A should be on a village basis as much as possible, and every farmer who is either a land proprietor or a share-cropper in the tertiary block must be a member.
- 2) If leaders of P3A can't transact accounting work fully, all P3A activities will stop or have a little progress, because all members have a suspicious look to them. It means that the facilities will deteriorate and crop yields will drop due to water problems. It is not to much to say that active organizations, which manage the facilities successfully, depends on the leaders' capability. It therefore requires the intensive training to them, especially for accounting. In addition, it is proposed to introduce an auditing system to their accounting. Several auditors are elected from the members, and they make auditing periodically. All auditing result is reported to

the members at the general meeting. The training program on accounting to them would also be required as well as the leaders.

- 3) A good cooperation of Kepala Desa is crucial factor for establishment of such village level associations and those successful operation. The Kepala Desa is elected by village people, and in general, he has a grate influence on leading people in village community. Even though the O&M office makes an intensive training and a lot of supporting service to P3A, no or little result is available for P3A's activities without cooperation of Kepala Desa. Although training to Kepala Desa is now implementing by PTGA, more intensive training is needed to obtain their powerful cooperation with good understanding on P3A's activities.
- 4) At present, LKMD is organized in each Desa which is responsible for village community development (see Sub section 3.10.7 and Figure A.6.7 in Annex 6). It is proposed that this LKMD keeps in contact with P3As established in the Desa and gives powerful support to them.

Table A.8.1 Tasks of Irrigation Committee in Kabupaten Wajo

POSITION	TASKS
<p>1) PEMDA Chairman Bupati</p> <p>Vice Chairman Chief of Economic Division, PEMDA</p>	<p>a) To coordinate the members of BAMUS and members' services to make maximum utilization of irrigation water resources, b) To have responsibility for installation, guidance and development of P3A, c) To make decision for cropping pattern according to the available water and policies to develop production and farmers' income, and d) To have responsibility for all of activities of irrigation committee.</p> <p>a) To manage irrigation committee, and b) To prepare economic data.</p>
<p>2) Secretary Cabang Dinas PU Pengairan</p>	<p>a) To prepare the data of water available for irrigation, b) To make cropping and irrigation schedules, c) To make schedule on maintenance of irrigation facilities at non-irrigating period, d) To prepare flood control plan, and e) To execute monitoring for irrigation and cropping (rotation of water supply, crop rotation, etc.)</p>
<p>3) Member Agricultural Service Office (DIPERTA)</p>	<p>a) To prepare the recommended cropping pattern with its water requirement, b) To prepare data on land classification, c) To make plan on the cropping pattern and crop management with its water requirement in each season, d) To prepare crop intensification program in irrigated paddy field, and e) To decide the cropping area in each Desa/Kecamatan according to the available water to be estimated.</p>
<p>4) Member Rural Development Office (BANGDES)</p>	<p>a) To promote the public participation into maintenance and security of irrigation facilities, b) To strengthen the public participation to irrigation development in tertiary block and rural area. c) To increase the public participation on financial investment to the irrigation development in rural area, and d) To motivate the public participation to protect the irrigation facilities from natural damage.</p>
<p>5) Member National Land Board (BPN)</p>	<p>a) To prepare the land use map in the areas covered by the irrigation facilities and necessary for the conservation of water resource, b) To prepare the land capability map in order to identify and confirm the capability of irrigation service. c) To clear and/or decide regally the boundary of irrigated lands, d) To settle land tenurial problems between the water users, and e) To protect the irrigated lands from the change of land use. *1</p>
<p>6) Member Police Office</p>	<p>a) To investigate illegal water use by the farmers or other people and to give guidance to them, b) To make security services for protection of irrigation facilities, c) To give guidance to the farmers or people who damage irrigation facilities, and d) To give guidance to the farmers or people who occupy illegally the irrigated land for other purposes.</p>
<p>7) Member Fishery Office</p>	<p>a) To make plan on the area and water requirement necessary for fish pond and water pool, and b) To prepare the schedule of water distribution and maintenance of facilities with water requirement in each season.</p>

*1 The farmers can't change their irrigated lands for any other purposes such as land for buildings and industry without permission of the BPN, even though it is own land.

Source: Data and information obtained from PU Dinas Pengairan, Ujung Pandang.

Table A.8.2 Number of Office and Field Staff for O&M

		Size of Facilities				Total
		Left Bank	Right Bank			
			I	II	III	
1. FACILITIES						
1) Dam	(Nos.)	-	1	-	-	1
2) Intake Weir	(Nos.)	-	1	-	-	1
3) Net Irrigation Area	(ha)	2,105	2,158	1,487	1,250	7,000
4) Main Canal						
- Length	(km)	21.0	19.3	7.2	0	47.5
- Structure	(Nos.)	21	36	14	0	71
5) Secondary Canal						
- Length	(km)	8.2	8.7	11.8	8.5	37.2
- Structure	(Nos.)	9	18	19	9	55
6) Drainage Canal	(km)	40.7	41.4	54.0	15.8	151.9
7) Tertiary Block						
- Gravity Irrigation	(Nos.)	28	32	26	15	101
- Pump Irrigation	(Nos.)	5	24	9	0	38
8) Inspection Road						
- Main Canal	(km)	21.0	19.3	7.2	-	47.5
- Secondary Canal	(km)	8.2	8.7	11.8	8.5	37.2
2. OFFICES TO BE ESTABLISHED						
- Ranting Dinas	(No.)	-	-	-	-	1
- Sub Ranting Dinas	(No.)	1	1	1	1	4
3. OFFICE AND FIELD STAFF						
1) Ranting Dinas		-	-	-	-	8
- Head	(Person)	-	-	-	-	1
- Operation Affairs	(Person)	-	-	-	-	2
- Maintenance Affairs	(Person)	-	-	-	-	1
- Tertiary Affairs	(Person)	-	-	-	-	1
- Administration Affairs	(Person)	-	-	-	-	1
- Security	(Person)	-	-	-	-	2
2) Sub Ranting Dinas		9	18	7	4	38
- Mantri (Juru) Pengairan	(Person)	2	2	1	1	6
- Labor Supervisor	(Person)	2	2	1	1	6
- Dam & Weir Operator	(Person)	-	6	-	-	6
- PPA	(Person)	5	8	5	2	20

Note: (1) O&M staff of Ranting Dinas is estimated on the basis of the regulation of Dinas PU Pengairan, South Sulawesi Province.

	Ranting	Sub Ranting
Irrigation to be covered (ha)	5,000	1,000
Total office staff (persons)	6	8
Educational background of office staff to be employed		
- Engineer	-	-
- Bachelor	1	-
- High School	5	1
- Middle School	-	7
- Primary School	-	-
Total	6	8

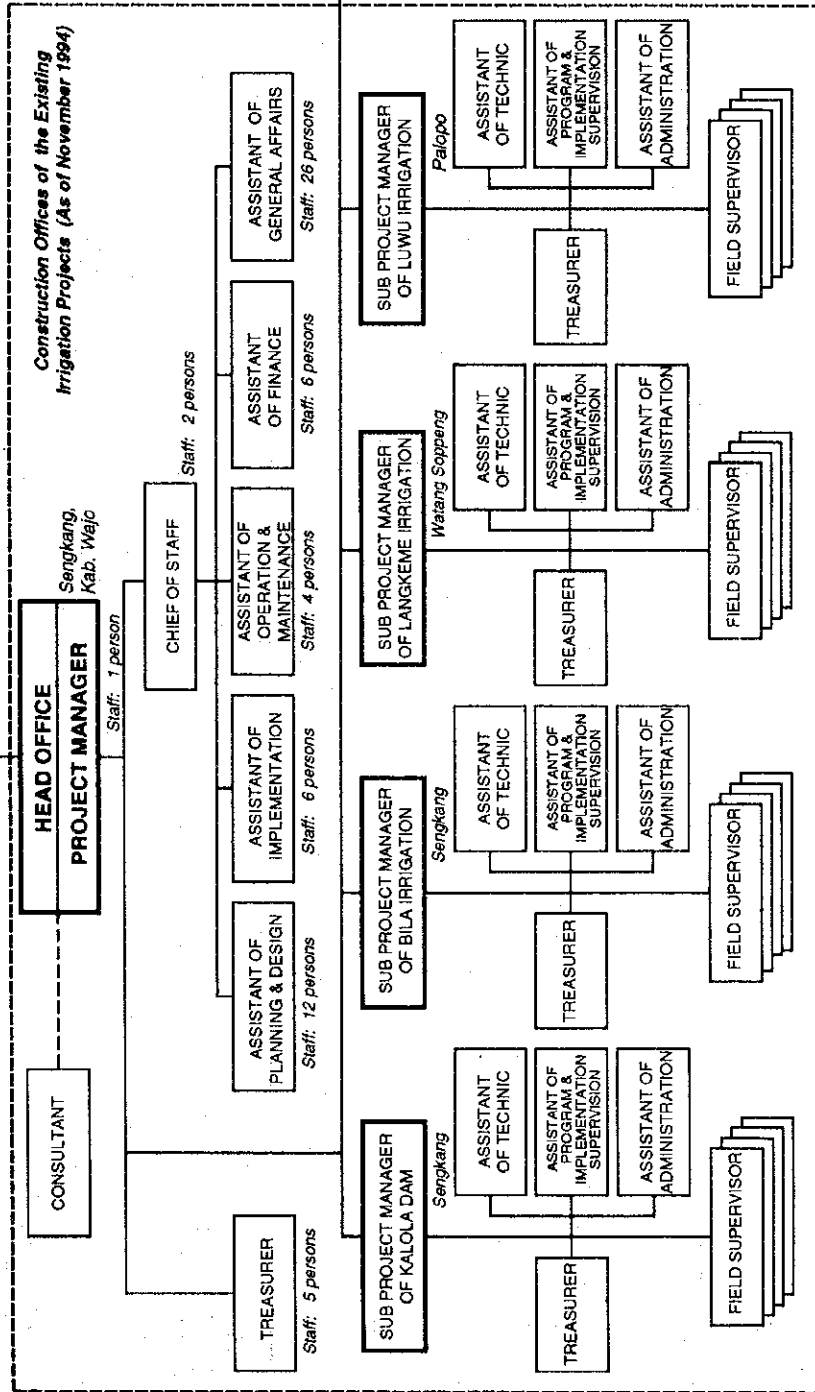
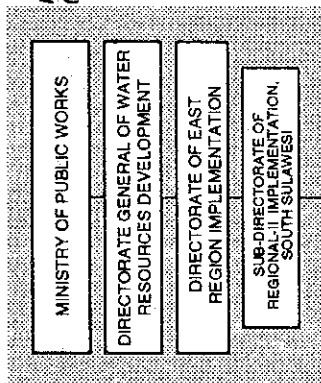
Remark: Security is excluded from the above regulation.
Source: Dinas PU Pengairan, South Sulawesi Province.

(2) The standard for field staff including Juru, labor supervisor, dam and weir operator and PPA are based on the density of the O&M personnel in the irrigation system in West Java and South Sulawesi Provinces.

- Mantri (Juru) Pengairan 1,000 ha per 1 person
- Labor Supervisor 1,000 ha per 1 person
- Dam & Weir Operator 3 persons per weir or dam
- PPA 7 tertiaries per 1 person

Source: Guidelines on PROM, Provincial Irrigation and Agriculture Development Project, (PIADP). DGWRD, 1993.

PU Head Office, Jakarta
(As of November 1994)



CONSTRUCTION OFFICE
OF THE GILIRANG
IRRIGATION PROJECT

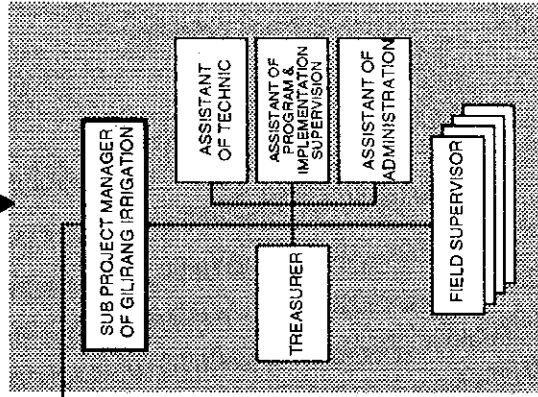


Figure A.8.1 Organizational Structure of Construction Office of the Gilirang Irrigation Project

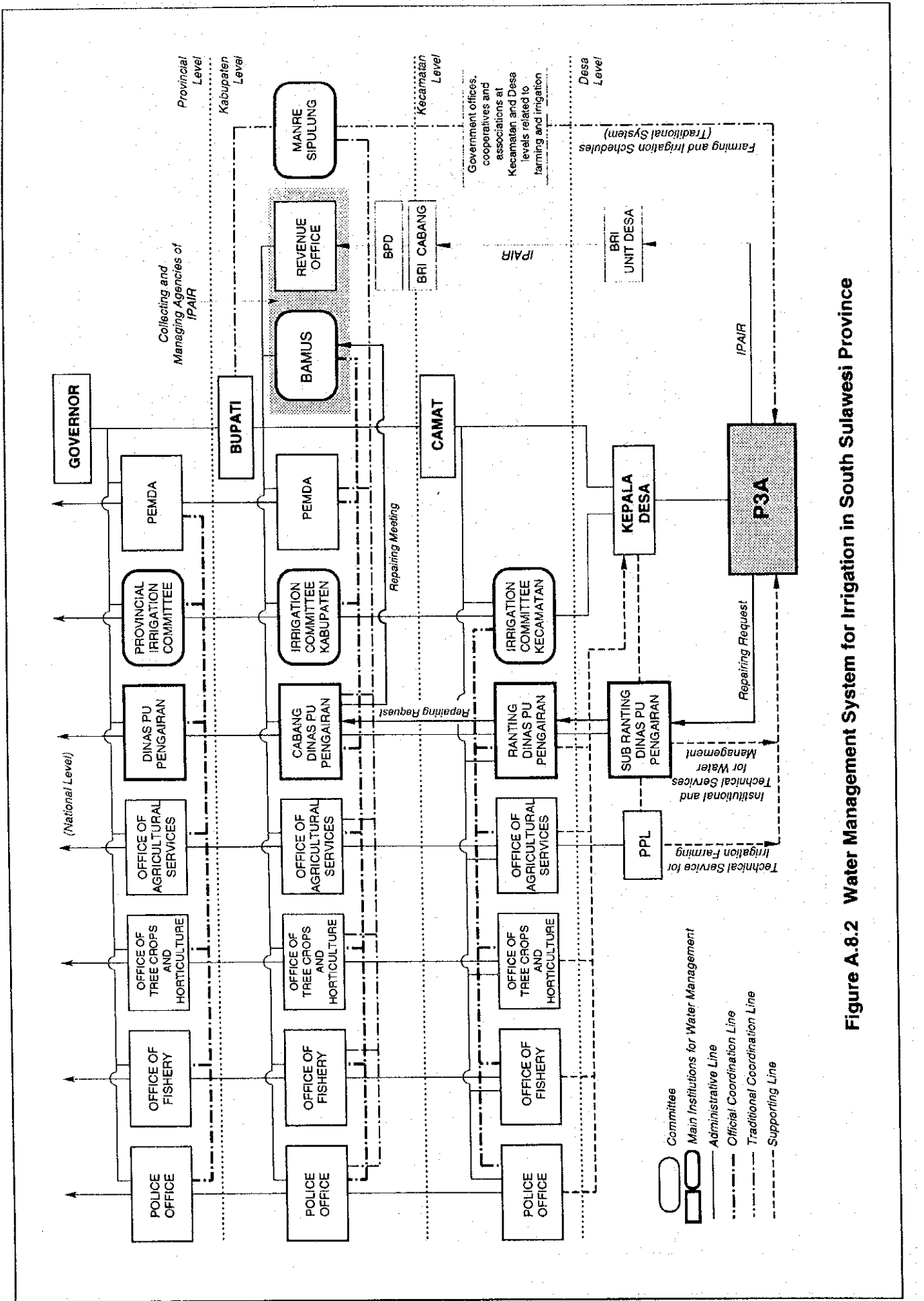


Figure A.8.2 Water Management System for Irrigation in South Sulawesi Province

Provincial Level

Kabupaten Level

Kecamatan Level

Desa Level

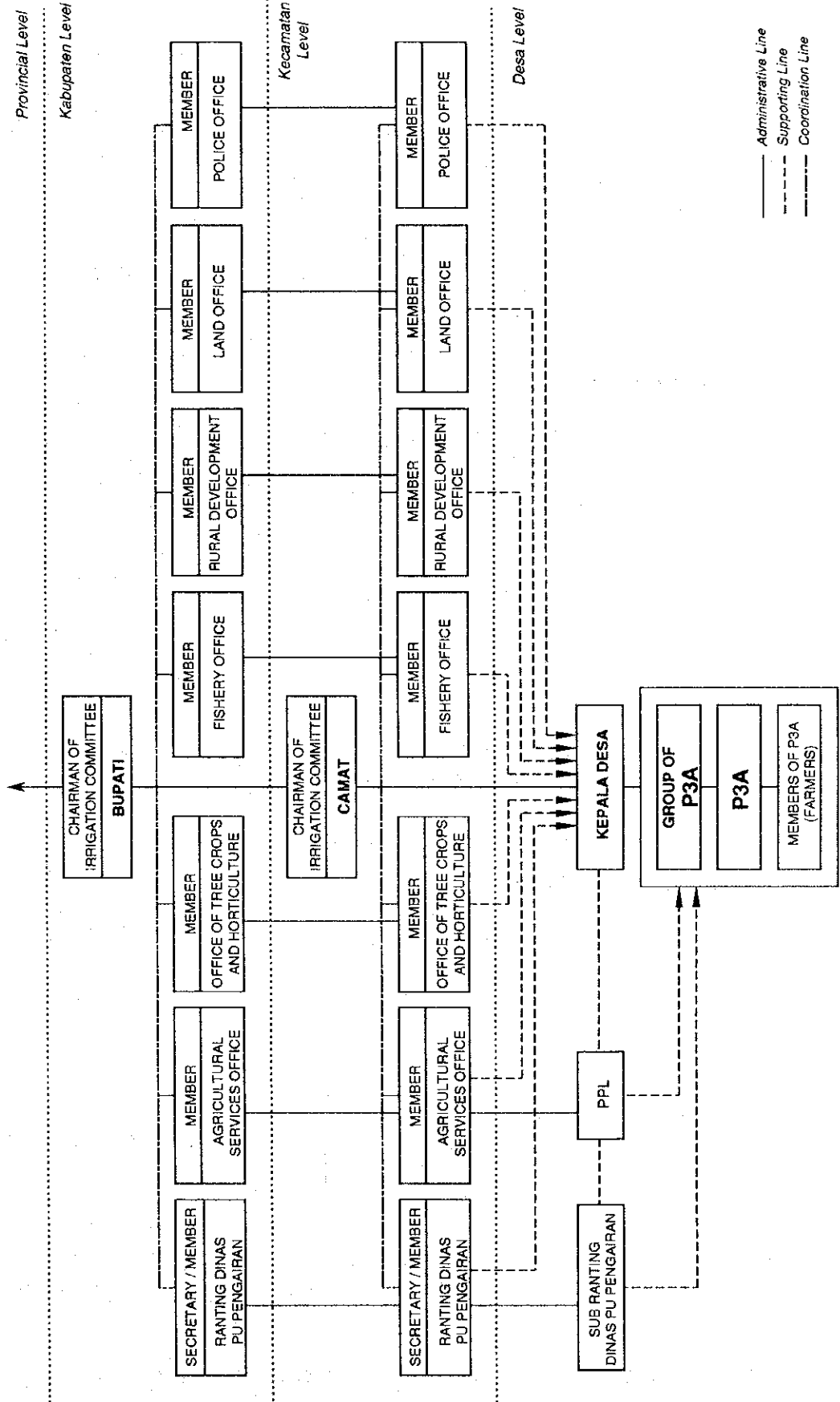


Figure A.8.3 Organizational Structure of Irrigation Committee in Kabupaten Wajo

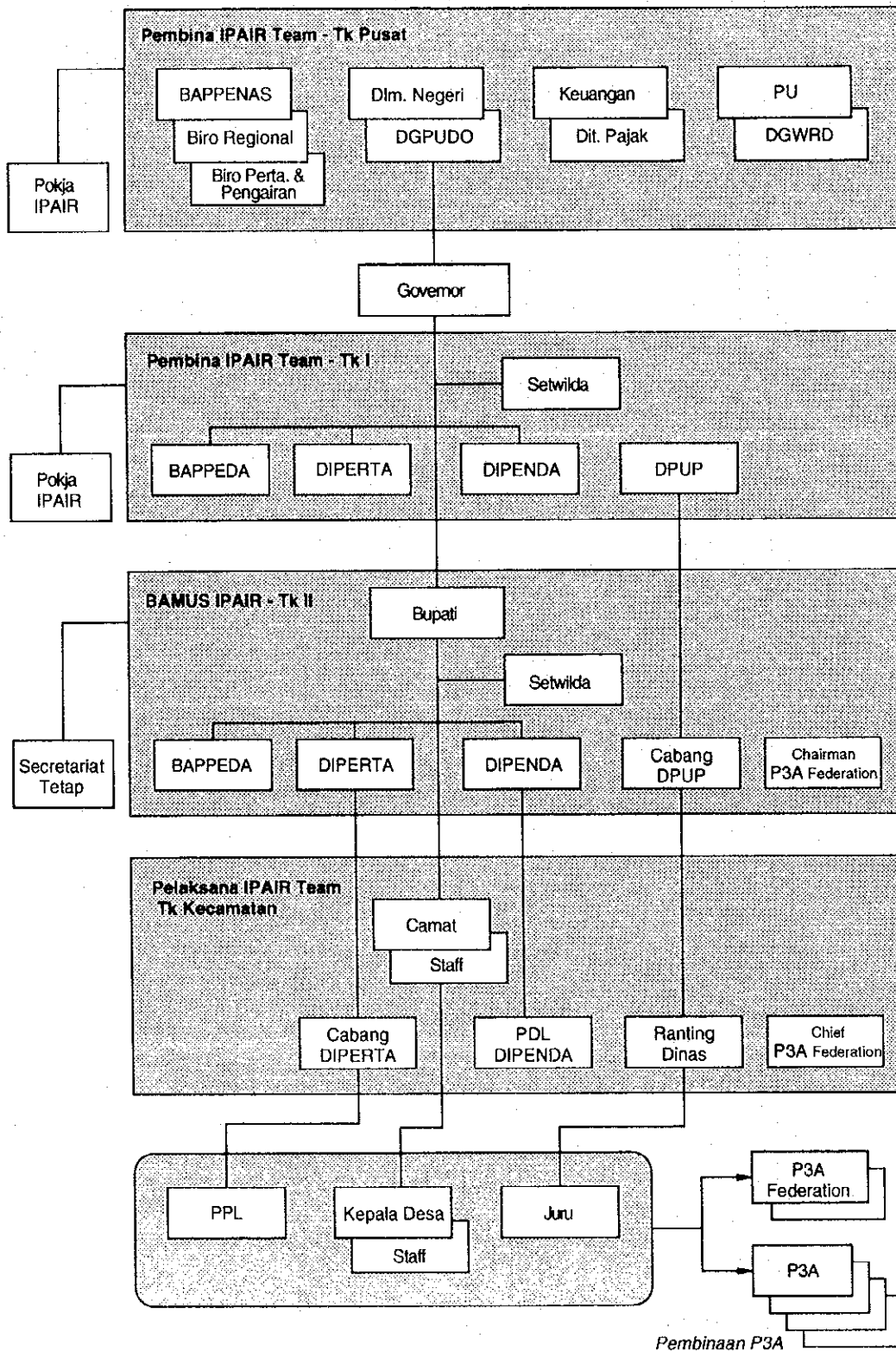


Figure A.8.4 Organizational Structure of BAMUS - IPAIR

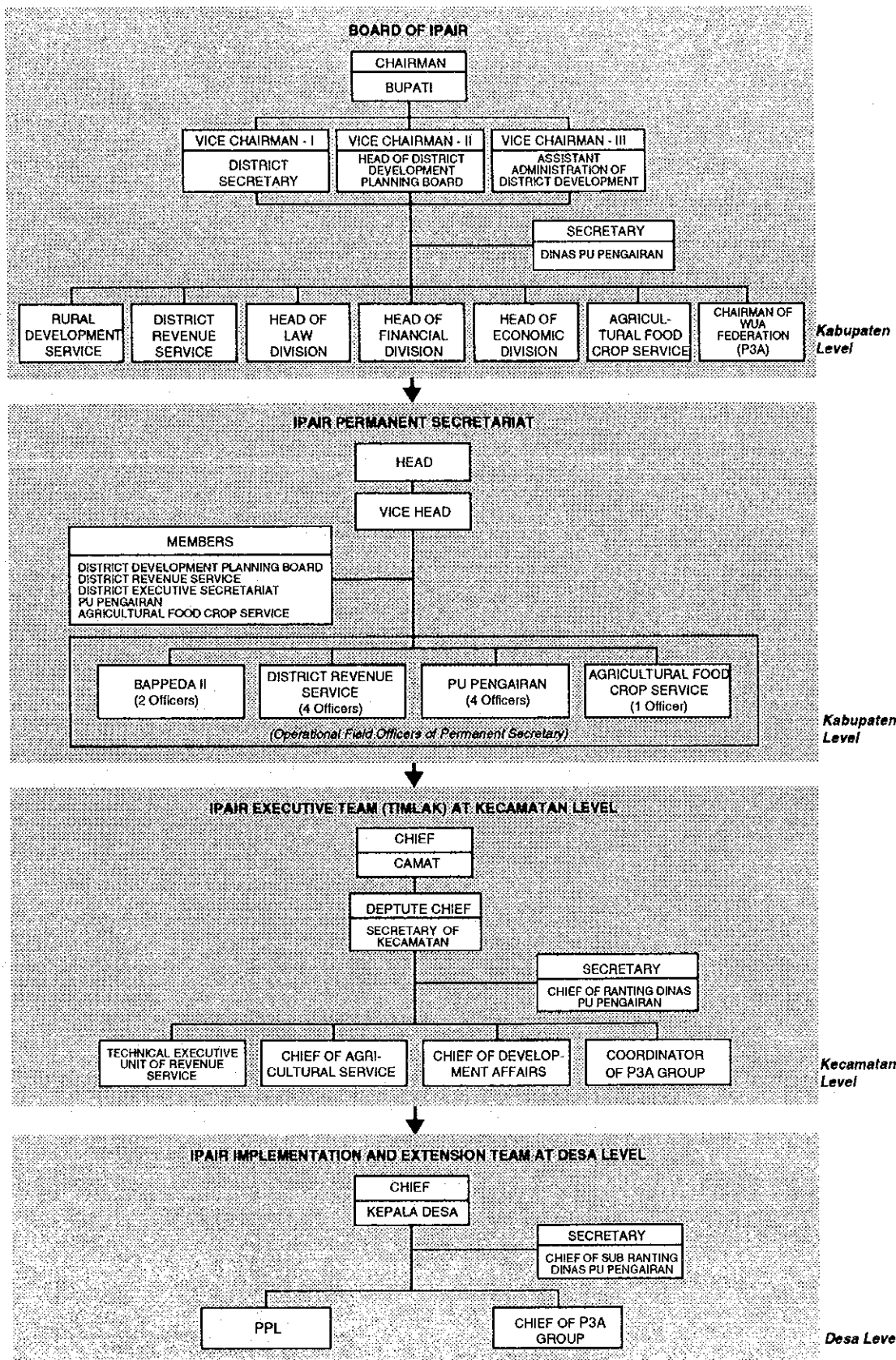


Figure A.8.5 Organizational Structure of BAMUS in Kabupaten Sidrap

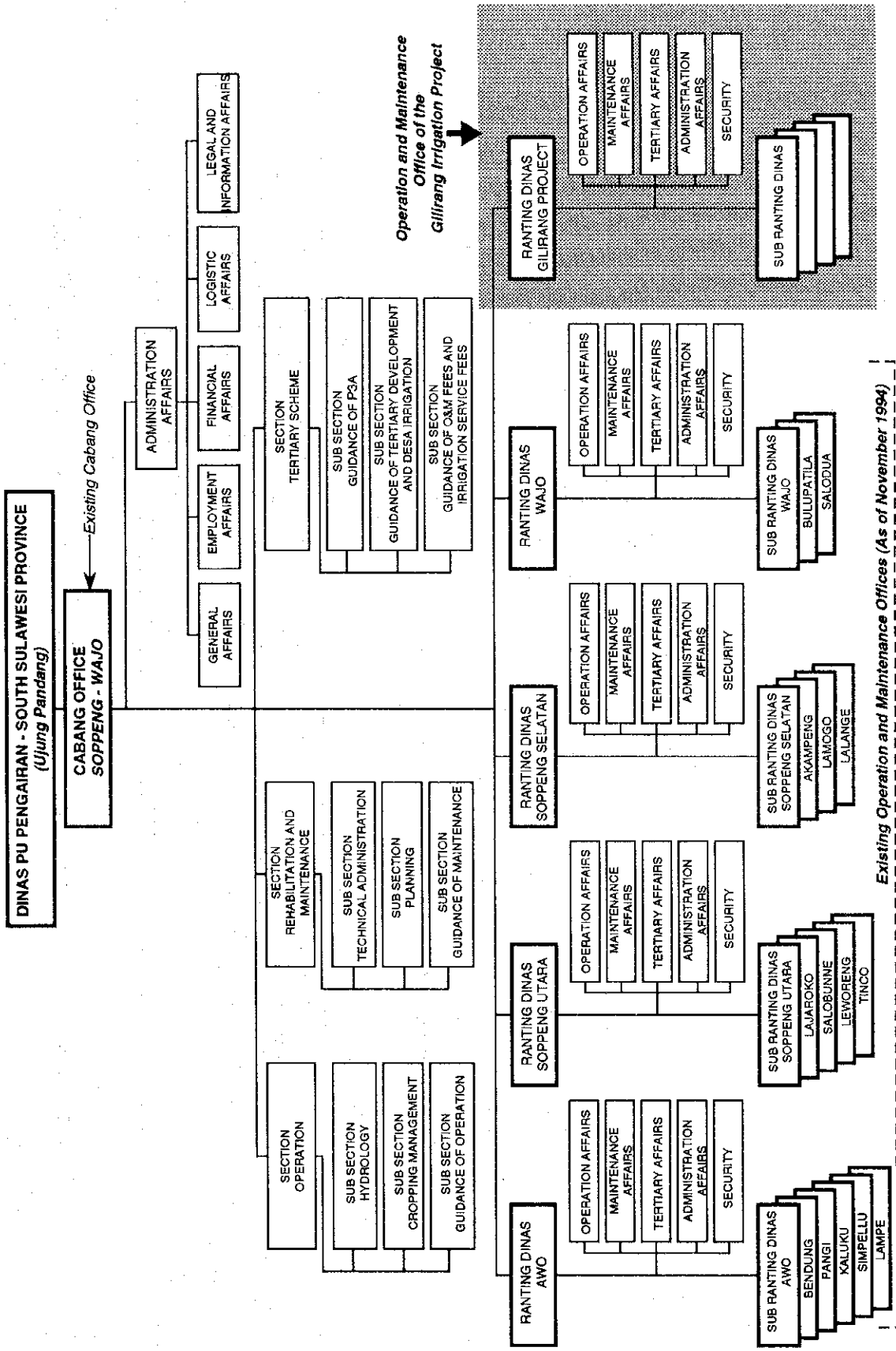


Figure A.8.7 Organizational Structure for Existing and Proposed Operation and Maintenance Offices

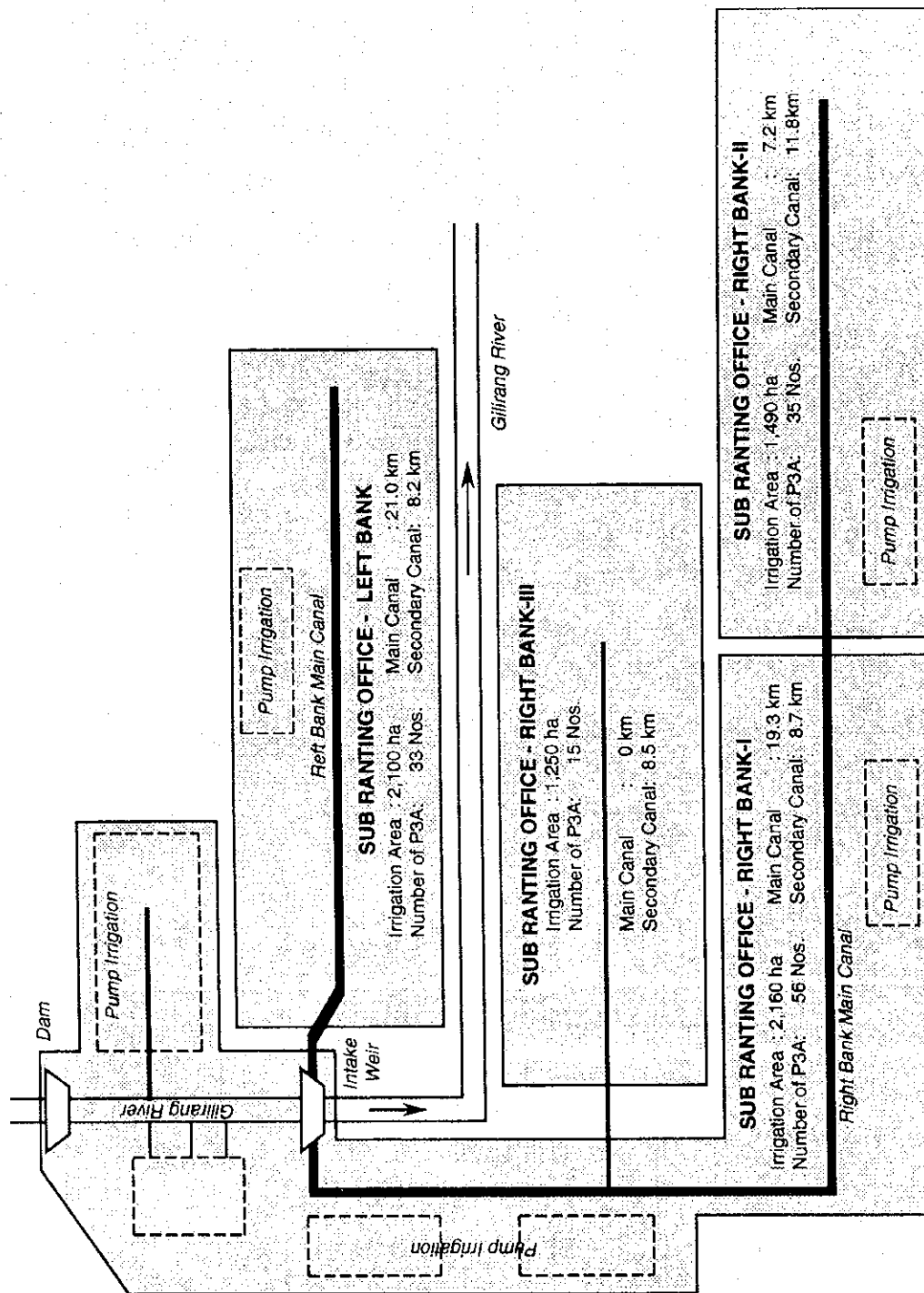


Figure A.8.8 Outline of Irrigation Block and Covering Area of Sub Ranting Offices

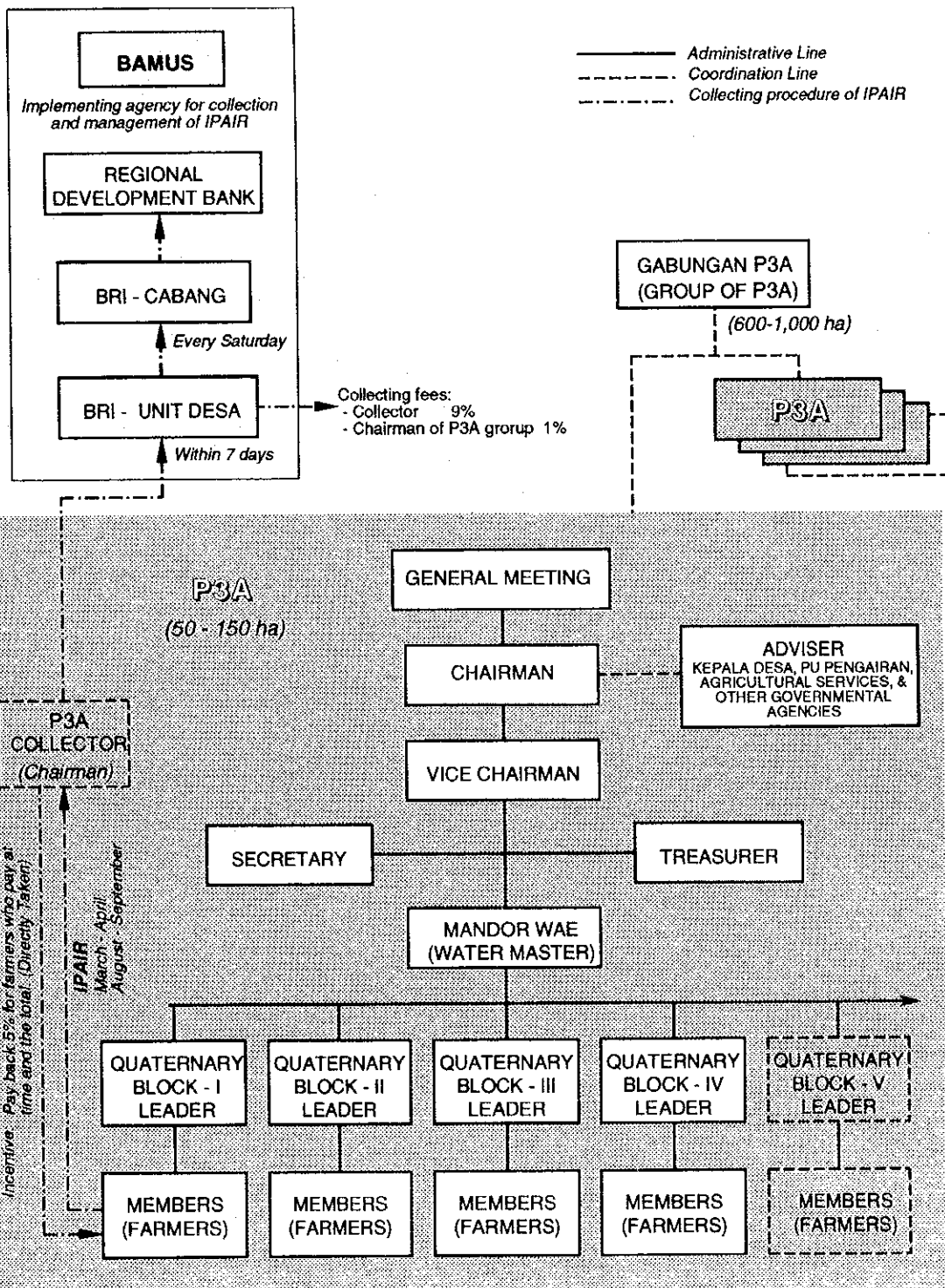


Figure A.8.9 Organizational Structure of Water User's Association (P3A) and Collecting Procedure of IPAIR

ANNEX 9
ENVIRONMENTAL STUDY

APPENDIX 9 ENVIRONMENTAL STUDY

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APPENDIX 9 ENVIRONMENTAL STUDY

1. FINDINGS RELATED TO ENVIRONMENT IMPACT ANALYSIS

1.1 Responsible Ministries and Agencies Related to Environmental Matters

Environmental conservation is currently world importance in earth level. Indonesia has long history of intensive concern to maintain balance and coordinate between development effort and environmental conservation. Sustainable development is one of the main basic principles of the country. Environmental administrative structure is remarkably advanced in Indonesia, comparing with other ASEAN countries. Ministry of Population and Environment (KLH) is responsible for planning, coordination and adjustment of the government on environmental affairs. Overall coordination of Environmental Impact Analysis (EIA) process was initially Ministry of Population and Environment. This responsibility was transferred to the new Environmental Impact Management Agency (BAPEDAL) in 1990. The Agency aims actual environmental administration under direct control of the President.

Authority for EIA process implementation currently lies at the central and provincial level of government:

- a) At the central level with 14 sectoral ministries and government institutions.
- b) At the regional level with 27 provincial government.

The central committee for EIA of various types of development projects have been established in the eight (8) Ministries:

Ministry	Project Type
1) Public Work	Public work sector project, ground water irrigation, surface water irrigation, swamp irrigation, road and bridge, solid water disposal site, waste water, urban drainage, clean water
2) Industry	
3) Transmigration	Transmigration sector
4) Mine and Energy	General mining oil and natural gas, electrical power
5) Agriculture	Food crop, animal husbandry, fishing trade, plantation trade
6) Forestry	Forest concessions, products of industrial forests
7) Home Affairs	Regional project
8) Tourism and Post Telecommunication	Starred hotel, non-starred hotel, camping field, recreation park, arenas/swimming pool, golf course, national bathing area, fantasy world, wild animal park and performance, water facility, tourism region

Aside from the above, Indonesian Forest Protection and Natural Conservation Agency (PHPA) and World Wide Foundation for Nature Conservation (WWF) are working for nature conservation in Indonesia. The Provincial Office of Ministry of Population and Environment is responsible to the regional environmental matters.

1.2 Environmental Laws, Government Regulations, Ministerial Decree, Guidelines, and Environmental Quality Standards

The Indonesian Constitution (1945) suggested already the importance of sustainable

development. It said that the nation's land, water and natural resources were to be managed by the government for the advancement of general welfare of the Indonesian people including future generation. However, it takes about 40 years for the government enacted the Law No.4/1982, regarding Basic Provision of the Living Environment Management. The Law again stated that environmental management is based on sustenance of balanced environment to support continuous development for the improvement of human welfare. Living environment here included physio-chemical, biological, socio-economical and socio-cultural environment.

Since then, there has been development to reinforce environmental laws, beginning with Government Regulation No.29/1986, regarding the Analysis of Environmental Impact. It set the foundation for the EIA methodologies and procedures. The subsequent series of Ministerial Decrees No.49-No.53/1987 from the Ministry of Population and Environment in form of guideline set out detailed process of EIA. Each sectorial Ministries have followed to set out the guidelines for various types of development projects within the Ministries. It is one of the prominent characters that these regulation approved the jointment of citizens to the regional commission for EIA in regions.

Forty one (41) Laws, Government Regulations, Ministerial Decrees, Guidelines and Environmental Quality Standards including newest ones were collected. Also, seven case study reports of Initial Environment Examination (IEE), Environmental Impact Assessment (EIA) and Resettlement, seven reference literatures were collected (see Table A.9.1).

1.3 Terms of Reference for Environmental Impact Assessment (EIA)

EIA was subletted to local consultant in the Second Study Stage. Terms of reference (TOR) for EIA was approved by the Central Committee, Ministry of Public Works. The contents of TOR was as follows.

1. Introduction
 - 1.1 Project Background
 - 1.2 EIA Laws, Regulations, Guidelines and Environmental Quality Standard Acts
 - 1.3 Objective of the Project
 - 1.4 Project Target
 - 1.5 Relation between Project Activities and Significant Impact
2. Objective of the Study
3. Scope of the Study
 - 3.1 Scope of the Study
 - 3.2 Project Component Activities Affect to the Environment
 - 3.3 Scope of Works for Environmental Impact Assessment
 - 3.3.1 Physio-chemical Environment
 - 3.3.2 Biological Environment
 - 3.3.3 Socio- economical and Socio-cultural Environment
 - 3.3.4 Infrastructure and Facilities of the Public Utility
 - 3.4 Relation to Other Sector Activity
4. Methodology of the Study
 - 4.1 Methodology of Data Collection
 - 4.2 Method of Sample Analysis, Data Analysis and Prediction
 - 4.3 Method of Impact Identification, Impact Prediction and Impact Evaluation
 - 4.4 Formation of Environmental Management Plan and Environment Monitoring Plan
5. Study Implementation
 - 5.1 EIA Team
 - 5.2 Study Schedule
 - 5.3 Report Schedule

1.4 Zoning of Ecological Boundary Area

Apart from the project boundary area, ecological boundary was set up covering the whole area of Gilirang catchment area. Major ecosystems included are upersteam primary forest, paddy field and mangrove. From ecological viewpoint, the ecological boundary area would be divided into three areas in order to evaluate positive and negative significant impact to living environment at each area.

- 1) Uperstream rolling area (upperstream area of Gilirang river from dam site) : Land is hilly and rolling, and covered by forest and grassland. There is submerged area of about 1,100 ha after creation of the reservoir.
- 2) Central plain area (middle stream area from dam site to pisculture zone) : Land is low and fairly flat, and has been mainly developed for rainfed paddy field at present.
- 3) Downstream coastal area (coastal area along Bone Bay) : Land is developed for pisculture and sea coast covered with mangrove forest.

1.5 National Parks, Wildlife Reserves and Marine Reserves in Sulawesi

In Indonesia, there are 13 national parks, 60 wildlife reserves and 5 marine reserves. There are 3 national parks, 15 wildlife reserves and 2 marine reserves in Sulawesi. Total number of national parks and reserves of Sulawesi follows the number of Java. It is because that Sulawesi is very special area in biographically where the endemic animal species is very rich as shown by Walles Line in west and Weber Line in the east of Sulawesi.

Region	National Park	Wildlife Reserve	Marine Reserve
1) Java and surrounding island	5	20	-
2) Sumatra and surrounding island	4	13	-
3) Kalimantan and surrounding island	-	1	-
4) Sulawesi and surrounding islands	3	15	2
5) Irian Jaya and surrounding islands	-	10	2
6) Maluku islands	1	1	1
Total	13	60	5

Four (4) wildlife reserves are located in South Sulawesi. That is Lampuka Mampie Reserve and Latimojong Mts. Reserve in the central, and Bantimurung Reserve and Mt. Lampobatang Reserve in the south of South Sulawesi. Although Latimojong Mts. Reserve is located in north-east direction of the project area, the project area and surrounding is not included in the Reserve.

1.6 Forest Use Zoning in Sulawesi

In Indonesia, forest is zoned as protected forest (21% of total forest in Indonesia), conservation forest (13%), limited production forest (21%), regular production forest (23%), and conversion forest (22%).

Protection forest	:	Forest assigned to protecting important water resources and soil erosion. Logging is prohibited.
Conservation forest	:	Forest assigned to conservation of natural inhabitation of important flora and fauna. Logging and hunting is prohibited.
Limited production forest	:	Forest assigned to produce timber. Selective cutting is permitted for protection of erosion.
Regular production forest	:	Forest assigned to produce timber. Clear cutting is permitted.
Conversion forest	:	Forest land assigned to convert to agricultural farming.

Assignment of conservation forest is decided by consideration of biological and cultural characteristics of forest land. Likewise, assignment of the categories of forest is decided by indexes of land slope, erosion dangerousness, and rain intensity of particular forest land. Special consideration is given to the forest land of steep slope (more than 45 degrees), and the forest within a 200 km radius from a spring.

Forest occupies 57% of total land in Sulawesi. It is consisted 32% of protection forest, 3% of conservation forest, 11% of limited production forest, 3% of regular production forest, and 4% of conversation forest. In the upper stream area of Gilirang river, there are production forests according to the map of forest classification provided by BAPPEDA Kab. Wajo. Detailed study will be needed on this point.

(Unit: 1.000 ha)

Province	Protect forest	Conserv. forest	Limited product forest	Regular product forest	Convers. forest area	Total forest area	Total land
North Sulawesi	285	327	741	231	699	2,283	2,751
Central Sulawesi	1,157	617	1,364	1,028	335	4,501	6,803
SE Sulawesi	421	273	827	669	699	2,889	3,814
South Sulawesi	2,004	190	993	165	259	3,611	6,292
Total	3,867	1,407	3,925	2,093	1,992	13,284	19,660

1.7 Natural Vegetation Types in Sulawesi

Natural vegetation are dependent on various factors such as climate, altitude, soil water, soil type and distance from sea. Sixteen (16) types of natural vegetation were reported in Sulawesi. The forest of upper stream area of Gilirang river is Lowland Monsoon Forest (Uperstream rolling area). Mangrove Forest is developing on the coastal zone of Bone Bay (Downstream coastal area).

Vegetation Type	Climate	Soil Water	Location	Soil Type	Altitude
1) Lowland Forest	Ever-wet	Dry land	Inland	Zonal >1000m	Lowland
2) Lowland Montane Forest					Montane 1000-2100m
3) Upper Montane Forest					Montane 2100-3250m
4) Sub-alpine Forest					Montane 3250-3450m
5) Forest on Ultra basic		Dry land	Inland	Ultra basic	Mainly lowland
6) Forest on Limestone		Inland	Limestone		Mainly lowland