

considered to hamper development in various sectors. As described Chapter 4, the first priority on the road development is placed on rehabilitation of national and provincial roads, and Kabupaten roads due to recent downturn in the economy. But the national and provincial roads in the Study Area is well maintained compared with those in other regions. Since main industry in the Study Area is agricultural, it is recommend to improve and rehabilitate existing Kabupaten roads connecting national/provincial roads and irrigation scheme areas for their favourable operation and maintenance.

#### **6.4 Electric Power Supply**

Power plants in the Study Area are wholly of diesel power plants. At present, power systems are isolated from the Banjarmasin power system. Although a total installed capacity of existing power plants exceed power demand, early interconnection of the Study Area with the Banjarmasin power system is recommended to enable the stable and efficient power supply to the Study Area. Besides, extension of distribution line in the Study Area is keenly necessary, since a lot of households are registered as waiting consumers for electric power supply according to information obtained from the PLN Wilayah VI office.

The power demand in PLN Wilayah IV is forecasted to reach to 913 MW in 2018. PLN contemplates to develop many thermal power plants to meet power demand in power systems of PLN Wilayah VI. Hydropower projects incorporated into the development plan are Riam Kiwa (42 MW) and Kusan (30 MW) projects only. Since the hydropower plants can be flexibly operated to bear a peak load of the power system, it is recommended to promote the development of the hydropower schemes in the region. HIPPS identified a lot of hydropower projects in the Wilayah IV, among which 13 projects exist in the Study Area. In general, it takes rather long period to complete their construction after commencement of feasibility study. Therefore, the feasibility study should be commenced as early as possible regarding the promising hydropower projects.



## ***TABLES***



Table 2.1 Development Type of Mini-hydropower Scheme

No.	Scheme	Kabupaten	Catchment Area (km <sup>2</sup> )	Development Type
1	Tapin	Tapin	164	Type-1
2	Amandit	H.S.S.	335	Type-1
3	Angkinang	H.S.S.	50	Type-1
4	Haruyan	H.S.T.	70	Type-1
5	Pacur	H.S.T.	35	Type-1
6	Paki-1	H.S.T.	27	Type-1
7	Paki-2	H.S.T.	43	Type-1
8	Barabai	H.S.T.	77	Type-1
9	Batang Alai-1	H.S.T.	108	Type-2
10	Batang Alai-2	H.S.T.	162	Type-1
11	Pitap-1	H.S.U.	125	Type-2
12	Pitap-2	H.S.U.	133	Type-1
13	Pitap-3	H.S.U.	144	Type-1
14	Tabuan	H.S.U.	55	Type-1
15	Hulen	H.S.U.	59	Type-1
16	Halong	H.S.U.	105	Type-1
17	Galombang	H.S.U.	67	Type-1
18	Kinarum	Tabalong	51	Type-1
19	Siwak	Tabalong	37	Type-1
20	Uya	Tabalong	98	Type-1
21	Ayu	Tabalong	401	Type-1
22	Kumap	Tabalong	278	Type-1
23	Tabalong	Tabalong	671	Type-1
24	Kotam	Tabalong	40	Type-1

Remarks: H.S.S. ; Hulu Sungai Selatan.  
H.S.U. ; Hulu Sungai Utara.  
H.S.T. ; Hulu Sungai Tengah.

Note: Development type  
Type-1 ; Intake weir only  
Type-2 ; Intake weir with headrace structure

Table 2.2 Output of Mini-hydropower Scheme

No.	Scheme	Installed Capacity (kW)	Annual Energy Output (10 <sup>3</sup> kWh)	Capital Cost (10 <sup>3</sup> US\$)	Present Worth <sup>1/</sup>		B/C Ratio
					Benefit (B) (10 <sup>3</sup> US\$)	Cost (C) (10 <sup>3</sup> US\$)	
1	Tapin	163	1,290	2,320	649	2,647	0.25
2	Amardit	333	2,636	2,188	1,325	2,517	0.53
3	Angkinang	50	393	1,352	198	1,524	0.13
4	Haruyan	70	551	1,317	277	1,570	0.18
5	Pacur	39	289	1,623	154	1,836	0.08
6	Paki-1	30	223	1,730	119	1,932	0.06
7	Paki-2	47	355	2,085	190	2,328	0.08
8	Barabai	85	635	2,069	340	2,332	0.15
9	Batang Alai-1	954	7,127	5,458	3,812	6,554	0.58
10	Batang Alai-2	179	1,336	2,787	715	3,171	0.23
11	Pitap-1	1,028	7,465	3,870	4,109	4,759	0.86
12	Pitap-2	153	1,112	3,256	612	3,694	0.17
13	Pitap-3	166	1,204	4,065	663	4,565	0.15
14	Tabuan	63	460	4,043	253	4,527	0.06
15	Hulen	68	493	4,189	272	4,711	0.06
16	Halong	121	878	5,380	483	6,019	0.08
17	Galombang	77	560	2,371	308	2,667	0.12
18	Kinarum	59	426	2,025	235	2,283	0.10
19	Siwak	43	309	1,729	170	1,931	0.09
20	Uya	113	819	1,532	451	1,740	0.26
21	Ayu	462	3,353	2,404	1,846	2,794	0.66
22	Kumap	320	2,324	4,510	1,280	5,118	0.25
23	Tabalong	773	12,248	6,307	3,088	7,211	0.43
24	Kotam	46	334	2,946	184	3,303	0.06

Note: <sup>1/</sup> Estimated at a discount rate of 12%.

Table 2.3 Cost Formulate Applied

Item	Cost Formula	Parameter
1. Access road	$CR = 110,000 \times RL$	CR : Cost of access road (US\$) RL : Length of access road (km)
2. Diversion weir Non-gated weir	$CDD = (7.5 \times VED + 80 \times VCD + 550 \times RSD + 3,750 \times WGD) \times 1.56$ $VED = 0.285 \times (HDD + WDD)$ $VCD = 1.15 \times HDI^2 \times WDD$ $RSD = 0.01 \times VCD$ $WGD = 0.2 \times WDD$	CDD : Cost of weir (US\$) VED : Excavation volume (m <sup>3</sup> ) VCD : Concrete volume (m <sup>3</sup> ) RSD : Reinforcement bar (ton) WGD : Weight of sand-flush gate (ton) HDD : Height of weir (m) WDD : Crest length (m)
3. Intake facility (Non-pressure type)	$CIN = 150 \times 10^3 \times (D \times Q_p/2)^{0.51}$	CIN : Cost of non-pressure type intake, incl. sandtrap basin (US\$) D : Tunnel diameter (m) Q <sub>p</sub> : Rated power discharge (m <sup>3</sup> /s)
4. Headrace tunnel	$CHT = 355 \times DIA^1.50 \times LHT \times N$	CHT : Cost of headrace tunnel, incl. excavation, support and lining
5. Penstock		
5-1 Civil work (Open-Air type)	$CPS_2 = (7.5 \times VEA + 90 \times VCA) \times 1.25$ $VEA = 10.5 \times DIAP^{1.85} \times LPT \times N$ $VCA = 3.4 \times DIAP^{1.16} \times LPT \times N$	CPS <sub>2</sub> : Civil work cost of open-air penstock (US\$) VEA : Excavation volume (m <sup>3</sup> ) VCA : Concrete volume (m <sup>3</sup> )
5-2 Steel liner	$CSL = UCL \times WF$ $WF = 0.148 \times DIAP^2 \times L_1 \times N$	CSL : Cost of steel liners including accessories (US\$) WF : Total weight of steel liners for portion UCS : Unit price per ton - \$4,000/ton where the shell of min. wall thickness is used (ton)
6. Powerhouse		DIAP : Diameter (m) (DIAP < 1.6 m)
6-1 Powerhouse building	$CHP_1 = 1.95 \times 10^3 \times (P/HEF^{1/2})^{0.71}$	CHP <sub>1</sub> : Cost of powerhouse building (super-structures (US\$)) P : Installed power capacity (kW) HEF : Effective head (m)
6-2 Substructures	$CHP_2 = 0.5 \times 10^3 \times (Q_p \times HEF^{2/3} \times N^{1/2})^{0.85}$	CHP <sub>2</sub> : Cost of substructures incl. Equip. foundation (US\$) N : Number of units (No.)
7. Power Equip. cost	$CPE = 5.9 \times 10^3 \times (P/HEF^{1/2})^{0.90}$	CPE : Cost of power equipment, incl. switchyard equipment (US\$) P : Installed power capacity (kW) HEF : Effective head (m)
8. Transmission Line	$CTL = 16,000 \times TL$	CTL : Cost for transmission line (km) TL : Length of transmission line (km)

Table 3.1 Standard of Water Quality for Drinking Water in Indonesia

No.	Chemical Symbols	Unit	Standard	
			Minimum	Maximum
1	pH	-	6.5	9.2
2	Ca	mg/lit.	-	200
3	Mg	"	-	150
4	Fe	"	-	1.0
5	Mn	"	-	0.5
6	Cu	"	-	1.5
7	Zn	"	-	15
8	Cl	"	-	600
9	SO <sub>4</sub>	"	-	400
10	H <sub>2</sub> S	"	-	0.0
11	F	"	1.0	2.0
12	NH <sub>4</sub>	"	-	0.0
13	NO <sub>3</sub>	"	-	20.0
14	NO <sub>4</sub>	"	-	0.0
15	As	"	-	0.002
16	Pb	"	-	0.05
17	Se	"	-	0.01
18	Cr	"	-	0.05
19	CN	"	-	0.05
20	Cd	"	-	0.01
21	Hg	"	-	0.001

Source: Laboratory of Department of Health in Banjarmasin



Table 3.2 Piped Water Supply Facility in the Study Area

Kabupaten	No.	Kecamatan or Capital Town of Kabupaten	Rated Supply Capacity (lit/sec)
Tapin	1	Tapin Selatan	2.5 ***
	2	Binuang	5.0 *
	3	Rantau	20.0 *
H.S.S.	4	Padang Batung	2.5 *
	5	Angkinang	5.0 *
	6	Kandangan	20.0 **
	7	Daha Selatan	10.0 *
	8	Daha Utara	2.5 *
H.S.T.	9	Bt. Alai Selatan	2.5 *
	10	Haruyan	2.5 *
	11	Batu Benawa	2.5 *
	12	Pandawan	2.5 *
	13	Barabai	20.0 *
	14	Batang Alai Selatan	2.5 **
H.S.U.	15	Batang Alai Utara	2.5 **
	16	Danau Panggang (Alabio)	2.5 **
	17	Sungai Pandan	5.0 *
	18	Batu Mandi	2.5 ***
	19	Awayan	2.5 **
	20	Paringin	2.5 *
Tabalong	21	Amuntai	45.0 *
	22	Kelua	2.5 *
	23	Tanjung	10.0 *
	Total		175.0

Remarks: \* ; Existing  
 \*\* ; Under construction  
 \*\*\* ; Planned

Source; PPSAB office in Banjarmasin

Table 3.3 Population Projection by Kecamatan in the Study Area, 1985 - 2018

(Unit: 1,000)

Kabupaten/ Kecamatan	1985 b/	1990 c/	1995 c/	1998 c/	2000 c/	2008 a/	2018 a/
1. Tapin							
Binaung	25.50	28.94	32.65	34.81	36.33	43.11	53.38
Bakaranga	7.97	9.05	10.21	10.89	11.36	13.48	16.69
Piani	3.94	4.47	5.05	5.38	5.61	6.66	8.25
Tapin Tenga	15.28	17.35	19.57	20.87	21.78	25.84	31.99
Tapin Selatan	17.88	20.30	22.90	24.42	25.49	30.24	37.44
Tapin Utara	15.65	17.77	20.04	21.37	22.30	26.46	32.77
Candi Laras Selatan	9.85	11.18	12.62	13.45	14.04	16.66	20.63
Candi Laras Utara	11.38	12.92	14.57	15.54	16.22	19.24	23.83
Bungur	6.91	7.85	8.85	9.44	9.85	11.69	14.47
Lokpa Ikat	6.04	6.86	7.74	8.25	8.61	10.21	12.65
Sub-total	120.41	136.69	154.20	164.41	171.59	203.59	252.09
2. H.S.S.							
Kandangan	39.04	39.89	40.39	40.45	40.49	40.65	40.85
Angk Inang	15.46	15.79	15.99	16.02	16.03	16.10	16.18
Telaga Langsat	8.36	8.54	8.65	8.66	8.67	8.71	8.75
Simpur	13.27	13.56	13.73	13.75	13.76	13.82	13.89
Kalumpang	7.05	7.21	7.30	7.31	7.31	7.34	7.38
Daha Selatan	34.80	35.56	36.00	36.06	36.09	36.24	36.42
Daha Utara	26.15	26.72	27.05	27.09	27.12	27.23	27.36
Padang Batung	15.63	15.97	16.17	16.20	16.21	16.28	16.36
Loksado	6.55	6.69	6.78	6.79	6.79	6.82	6.85
Sungai Raya	16.35	16.71	16.92	16.94	16.96	17.03	17.11
Sub-total	182.67	186.63	188.97	189.26	189.45	190.21	191.16
3 H.S.T.							
Barabai	37.21	38.42	39.35	39.62	39.81	40.54	41.49
Pandawan	25.41	26.23	26.87	27.05	27.18	27.68	28.32
Batu Benawa	26.15	26.99	27.65	27.84	27.97	28.49	29.15
Haruyan	18.11	18.70	19.15	19.29	19.37	19.73	20.19
Batang Alai Utara	23.95	24.73	25.33	25.50	25.62	26.10	26.70
Batang Alai Selatan	26.38	27.24	27.90	28.09	28.22	28.75	29.41
Labuan Amas Selatan	23.27	24.03	24.61	24.78	24.89	25.36	25.94
Labuan Amas Utara	24.86	25.67	26.29	26.47	26.59	27.09	27.72
Sub-total	205.35	212.01	217.15	218.65	219.65	223.73	228.93
4. H.S.U.							
Amuntai Tengah	45.90	47.41	48.63	48.99	49.24	50.23	51.50
Amuntai Selatan	17.96	18.55	19.03	19.17	19.27	19.66	20.15
Amuntai Utara	30.04	31.03	31.83	32.06	32.23	32.88	33.71
Sungai Pandan	36.00	37.19	38.15	38.44	38.63	39.41	40.40
Danau Panggang	18.80	19.42	19.92	20.07	20.17	20.58	21.10
Babirik	16.40	16.94	17.38	17.51	17.60	17.95	18.04
Lampihong	12.76	13.18	13.52	13.62	13.69	13.97	14.32
Paringin	18.92	19.54	20.04	20.19	20.30	20.70	21.23
Batu Mandi	12.31	12.71	13.04	13.14	13.21	13.47	13.81
Awayan	15.25	15.75	16.16	16.28	16.36	16.69	17.11
Juai	11.17	11.54	11.84	11.93	11.99	12.23	12.54
Halong	11.59	11.97	12.28	12.37	12.43	12.68	13.00
Sub-total	247.10	255.23	261.81	263.77	265.09	270.44	277.28
5. Tabalong							
Tanta	11.72	12.12	12.45	12.56	12.63	12.92	13.30
Haruai	16.39	16.94	17.40	17.55	17.65	18.06	18.59
Muara Uya	12.83	13.27	13.62	13.74	13.82	14.14	14.56
Banua Lawas	14.64	15.13	15.54	15.68	15.77	16.14	16.61
Kelua	15.60	16.13	16.56	16.70	16.80	17.19	17.70
Tanjung	21.39	22.11	22.71	22.90	23.04	23.58	24.27
Murung Pudak	28.36	18.98	19.49	19.66	19.77	20.24	20.83
Jaro	8.06	8.34	8.56	8.64	8.69	8.89	9.15
Upau	4.76	4.92	5.06	5.10	5.13	5.25	5.40
Harus	5.38	5.57	5.71	5.76	5.80	5.93	6.11
Pugaan	5.58	5.77	5.92	5.97	6.01	6.15	6.33
Sub-total	134.71	139.28	143.01	144.26	145.10	148.50	152.86
Study Area	890.23	929.84	965.14	980.35	990.89	1,036.46	1,102.32

Note: a/ ; The same growth rates from 1995 to 2000 projected by c/ are applied.

Source: b/ ; Statistical Yearbook of South Kalimantan 1986, Statistics Office, South Kalimantan

c/ ; Population and Labor Force Projection 1980-2000, Statistics Office, South Kalimantan

Table 4.1 Existing National and Provincial Road in South Kalimantan

Route No.	Section	Status	Distance (km)
001	Banjarmasin - Liang Anggang	N	13.5
002	Liang Anggang - Martapura	N	20
003	Martapura - Rantau	N	73
004	Rantau - Kandangan	N	22
005	Kandangan - Pantai Hambawang	N	20
006	Pantai Hambawang - Amuntai	N	34
007	Amuntai - Kelua	N	22
008	Kelua - Tanjung	N	21
009	Tanjung - Muara Uya	N	50
010	Banjarmasin - Martapura lama	P	30
011	Liang Anggang - Bati bati	P	13.5
012	Banjarbaru - Bati bati	P	21
013	Bati bati - Pleihari	P	32
014	Pleihari - Takisong	P	22
015	Pleihari - Kintap	P	79
016	Rantau - Margasari	P	30
017	Kandangan - Balimau	P	18
018	Kandangan - Padang Batung	P	7
019	Kandangan - Negara	P	28
020	Pantai Hambawang - Barabai	N	10
021	Barabai - Pagat	P	7
022	Barabai - Kapar Kinas	P	5
023	Kapar Kias - Mantimin	P	17
024	Kapar Kias - birayang	P	5
025	Amuntai - Lampihong	P	18
026	Lampihong - Mantimin	P	11.5
027	Lampihong - Paringin	P	12
028	Mantimin - Paringin	P	12
029	Kelua - Pasar panas	N	12.5
030	Paringin - Halong	P	33
031	Dahai - Paringin	P	10
032	Tanjung - Daha	P	14
033	Dahai - Mabu'un	P	14
034	Tanjung-Mabun-Batu babi	P	71
035	Sebamban - Pagatan	P	35.5
036	Pagatan - Batulicin	P	22.5
037	Kotabaru - Sebelimbingan	P	16.2
038	Kotabaru - Berangas	P	24.2
039	Kintap - Sebamban	P	67
040	Banjarbaru - Aranio	P	28
041	Anjir - Serapat	P	14
042	Banjarmasin - Marabahan	P	42
043	Batulicin - Sungai Kupang	P	42
044	Sungai Kupang - Kerang	P	137
Total			1,236.4

Remarks: N; National road  
P; Provincial road

Table 5.1 Existing Power Plant in the Study Area (Cabang Barabai of PLN Wilayah VI)

No.	Kabupaten	Location	Type	Installed Capacity (MW)	Effective Output (MW)	Operation Year	
1.	Tapin	Rantau	PLTD	336	269	1997	
		Rantau	PLTD	300	245	1982	
		Rantau	PLTD	300	245	1982	
		Rantau	PLTD	500	450	1985	
		Binuang	PLTD	108	85	1982	
		Binuang	PLTD	112	85	1983	
		Binuang	PLTD	100	85	1982	
		Binuang	PLTD	260	220	1985	
		Binuang	PLTD	260	220	1985	
			(Subtotal-1)		(2,276)	(1,904)	
2.	H.S.S.	Kandangan	PLTD	336	300	1977	
		Kandangan	PLTD	336	300	1977	
		Kandangan	PLTD	600	550	1982	
		Kandangan	PLTD	600	550	1982	
		Kandangan	PLTD	1,267	1,000	1984	
		Kandangan	PLTD	1,267	1,000	1984	
			(Subtotal-2)		(4,406)	(3,700)	
3.	H.S.T.	Barabai	PLTD	336	270	1977	
		Barabai	PLTD	336	270	1977	
		Barabai	PLTD	220	180	1981	
		Barabai	PLTD	850	750	1982	
			(Subtotal-3)		(1,742)	(1,470)	
4.	H.S.U.	Paringin	PLTD	108	80	1982	
		Paringin	PLTD	260	220	1985	
		Amuntai	PLTD	336	290	1977	
		Amuntai	PLTD	336	290	1977	
		Amuntai	PLTD	220	180	1981	
		Amuntai	PLTD	220	180	1981	
		Amuntai	PLTD	850	800	1982	
		Amuntai	PLTD	220	180	1980	
		Amuntai	PLTD	1,267	1,000	1984	
		Amuntai	PLTD	1,267	1,000	1984	
			(Subtotal-4)		(5,084)	(4,220)	
		5.	Tabalong	Haruai	PLTD	100	90
Haruai				100	100	1988	
Tanjung				220	180	1988	
Tanjung				336	270	1977	
Tanjung				300	270	1982	
Tanjung				300	270	1982	
Kelua				220	190	1983	
Kelua				100	100	1988	
	(Subtotal-5)				(1,670)	(1,470)	
Total				1,5224	12,794		

Remark : PLTD; Diesel power plant

Source : PLN Wilayah VI

Table 5.2 Existing Power Plant in PLN Wilayah VI by Plant Type as of 1987/88

(Unit: MW)

Plant Type/l	Subregion of PLN Wilayah VI					Total
	Banjar-masin	Barabai	Palangka Raya	Balik-papan	Sama-rinda	
PLTD	33.4	15.1	23.9	68.9	41.2	182.5
PLTA	30.0	0	0	0	0	30.0
PLTG	21.0	0	0	0	0	21.0
Total	84.4	15.2	23.9	125.6	20.8	233.6

Remarks : PLTD ; Diesel  
 PLTA ; Hydro  
 PLTG ; Gas turbine

Source : Wilayah VI of PLN

Table 5.3 Energy Production, Peak Load, Sale and Loss in PLN Wilayah VI in 1987/88

	Subregion of PLN Wilayah VI					Total
	Banjar-masin	Barabai	Palangka Raya	Balik-papan	Sama-rinda	
Energy Production (GWh)	190.9	25.9	38.4	125.6	96.2	477.0
Energy Sale (GWh)	156.8	22.1	34.3	107.5	82.7	403.4
Energy loss (%)	17.8	14.6	10.6	14.4	14.1	15.4
Peak load (MW)	46.6	8.7	9.9	24.1	20.8	110.1

Source : Wilayah VI of PLN

Table 5.4 Hydropower Project Identified in the Negara Sub-basin through HPFS

No.	Project ID. No.	Project Name	Catchment area (km <sup>2</sup> )	Installed capacity (MW)	Annual energy output (GWh)		
					Firm	Secondary	Total
1	3-27-4	Tabalong 1	313	8.7	38.1	3.5	41.6
2	3-27-5	Tabalong 2	569	8.3	36.6	20.2	56.8
3	3-27-6	Ayu - 1	482	9	39.5	3.8	43.3
4	3-27-7	Ayu - 2	368	4.7	20.8	2.8	23.6
5	3-27-8	Uwil	136	1.7	7.3	1	8.3
6	3-27-9	Halang 1	43	0.2	1.1	2.3	3.4
7	3-27-10	Halang 2	130	1.6	7.1	1.3	8.4
8	3-27-11	Pitap 1	134	4.9	21.4	2.4	23.8
9	3-27-12	Pitap 2	269	4	17.5	1.9	19.4
10	3-27-13	Batang Alai	321	4.1	17.8	1.7	19.5
11	3-27-14	Amandit 1	286	4.4	19.4	3.4	22.8
				(2.5)	(11.1)	(1)	(22.1)
12	3-27-15	Tapin	141	3.7	16.3	1.5	17.8
13	3-27-16	Amandit 2	342	6.7	29.4	2.6	32

Note: The values in parentheses show those for the Amandit Project optimized in the 21 Pre-F/S Project.

Source: Hydro Power Potentials Study (HPFS)

Table 5.5 Power and Energy Demand Forecast for PLN Wilayah VI

PLN Wilayah VI (Cabang)	1984/85		1988/89		1993/94		1998/99		2003/04		2006/07	
	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW
Barabai	13.5	4.1	28.1	7.9	51.4	13.1	77.6	18.1	103.3	22.2	117.9	24.2
Banjarmasin	131.9	32.7	216.4	50.1	333.2	71.1	463.8	91.8	602.8	118.0	689.5	134.9
Pl. Karaya	23.4	5.9	58.1	13.7	123.3	26.7	213.1	42.7	321.4	62.9	393.0	76.9
Balikpapan	100.1	20.0	190.0	37.2	346.6	67.8	559.1	109.4	826.0	161.6	1,011.4	197.9
Samarinda	72.9	17.3	135.6	30.1	239.4	49.2	376.7	73.7	546.2	106.9	662.9	129.7
Total	341.9	80.1	628.3	138.9	1,094.0	227.9	1,690.3	335.8	2,399.8	471.6	2,874.7	563.7

Source : Final Report for Pre-Feasibility Study, 21 Hydro Electric Power Development Projects, Volume II Package II

Table 5.6 Planned Power Plants in PLN Wilayah VI

No.	Location	Plant Type	Installed Capacity (MW)	Planned Operation Year
1	Trisakti	PLTD	2 x 6	1988/89
2		PLTD	2 x 12	1989/90
3		PLTD	2 x 12	1990/91
4	Riam Kiwa	PLTA	2 x 21	1992/93
5	Kusan	PLTA	1 x 30	1999/00
6	Barabai	PLTD	2 x 2.5	1988/89
7	Tanjung	PLTD	1 x 1.0	1989/90
8	Samarinda	PLTD	2 x 5	1988/89
9		PLTD	2 x 5	1987/88
10		PLTD	1 x 6	1988/89
11		PLTD	2 x 8	1989/90
12		PLTD	2 x 12.5	1990/91
13	Sanga-Sanga	PLTD	2 x 0.25	1988/89
14	Samurinda	PLTU	1 x 50	1993/94
15		PLTU	1 x 50	1994/95
16	B. Papan	PLTD	4 x 6.00	1987/88
17	B. Papan	PLTD	2 x 6.00	1988/89
18	B. Papan	PLTD	2 x 8.00	1990/91
19	K. Kapuas	PLTD	3 x 2.50	1989/90
20	P. Pisau	PLTD	1 x 0.50	1989/90
21		PLTD	1 x 0.50	1991/92
22	Pangkalan Bun	PLTD	3 x 1.20	1988/89
23	Palangka raya	PLTD	2 x 2.5	1992/93
24	Kota Baru	PLTD	2 x 1.20	1988/89
25		PLTD	1 x 1.20	1990/91
26	Tarakan	PLTD	2 x 2.50	1989/90
27	Tarakan	PLTD	2 x 2.50	1990/91
28	Sampit	PLTD	2 x 1.28	1988/89
29	Sampit	PLTD	1 x 2.5	1987/88
30		PLTD	1 x 2.5	1989/90
31		PLTD	2 x 2.5	1990/91
32	Bontang	PLTD	5 x 0.22	1987/88
33		PLTD	4 x 2.50	1989/90
34		PLTD	2 x 5.00	1990/91
35	Marabahan	PLTD	1 x 0.50	1988/89
36		PLTD	1 x 0.50	1992/93
37	Pagatan	PLTD	1 x 0.50	1989/90
38		PLTD	1 x 1.00	1990/91
39		PLTD	1 x 1.00	1991/92
40	T. Selor	PLTD	1 x 0.50	1992/93
41		PLTD	1 x 0.50	1993/94
42	T. Grogot	PLTD	2 x 0.25	1993/94
43	Nunukan	PLTD	1 x 0.50	1989/90
44		PLTD	1 x 0.50	1990/91
45		PLTD	1 x 0.50	1992/93
46	T. Redep	PLTD	1 x 0.50	1989/90
47		PLTD	2 x 1.00	1991/92
48	Kuaro	PLTD	2 x 0.25	1989/90
49		PLTD	1 x 0.25	1991/92
50	M. Muntai	PLTD	1 x 0.25	1989/90
51		PLTD	1 x 0.25	1990/91
52	Melak	PLTD	1 x 0.25	1989/90
53		PLTD	1 x 0.25	1990/91
54	T. Iayang	PLTD	2 x 0.25	1990/91
55		PLTD	1 x 0.50	1993/94
56	Buntok	PLTD	1 x 0.50	1990/91
57		PLTD	1 x 0.50	1992/93
58	M. Teweh	PLTD	2 x 0.50	1990/91
59		PLTD	1 x 0.50	1993/94
60	P. Cahu	PLTD	2 x 0.25	1990/91
61		PLTD	1 x 0.25	1992/93
62	Kuala Pem	PLTD	1 x 0.25	1990/91
63	Buang	PLTD	1 x 0.50	1992/93
64	Kt. Bangun	PLTD	1 x 0.25	1989/90
65	Longkali	PLTD	1 x 0.25	1989/90
66		PLTD	1 x 0.25	1991/92
67	Samuda	PLTD	1 x 0.50	1989/90
68		PLTD	1 x 0.50	1991/92
69	Baras (Melak)	PLFM	1 x 0.100	1990/91
70	Mawurung	PLFM	1 x 0.250	1990/91

Remarks ; PLTD : Diesel  
 PLFM : Minihydro  
 Source ; PLN Wilayah IV



## ***FIGURES***



List of Mini-hydropower Potential Sites

No.	Project Name
1	Tapin
2	Amandit
3	Angkinang
4	Haruyan
5	Pacur
6	Paki - 1
7	Paki - 2
8	Baraboi
9	Batang Alai - 1
10	Batang Alai - 2
11	Pitap - 1
12	Pitap - 2
13	Pitap - 3
14	Tabuan
15	Hulon
16	Halong
17	Galombang
18	Kinarum
19	Siwak
20	Uya
21	Ayu
22	Kurnap
23	Tabalong
24	Kotam

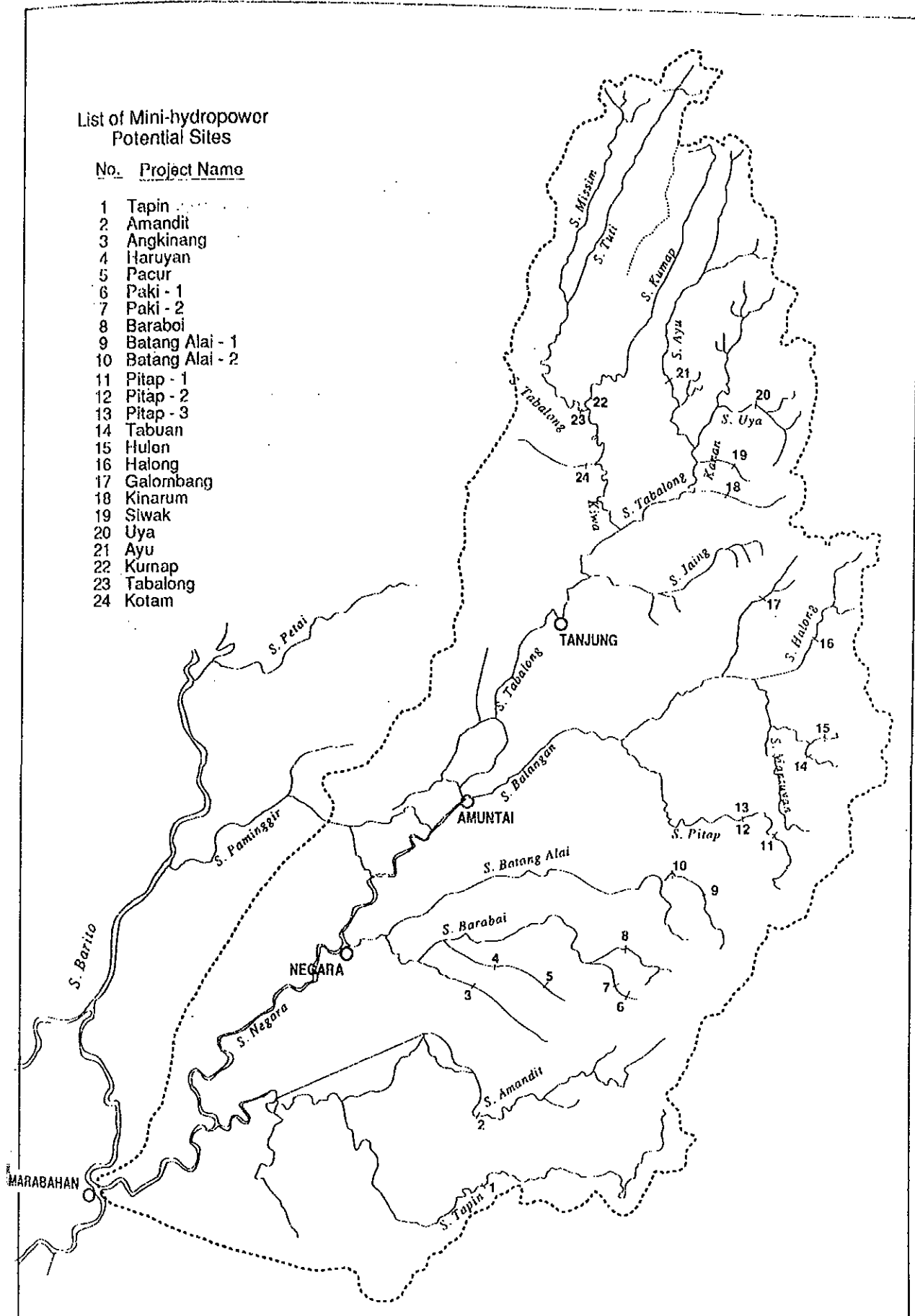
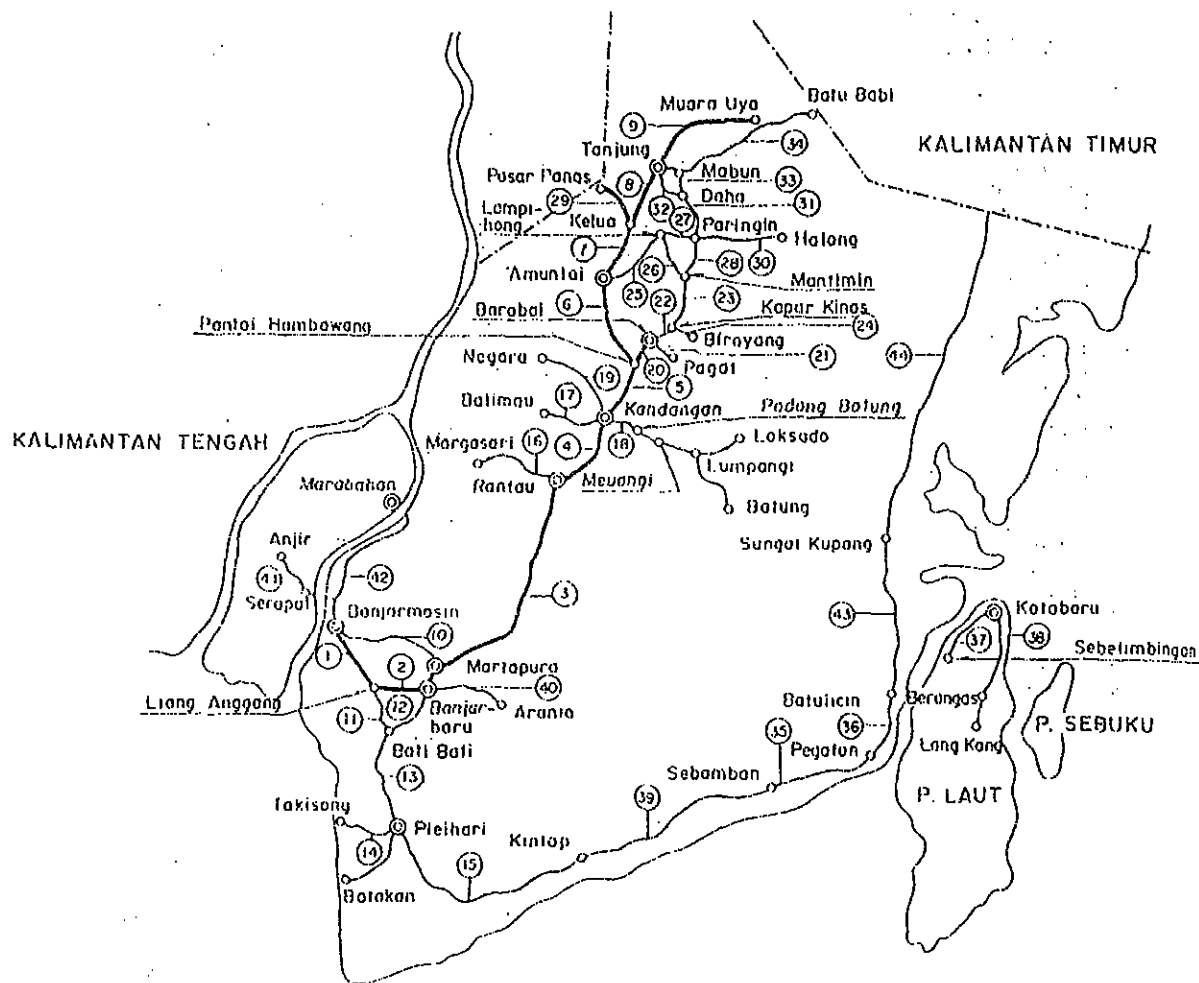


Figure 2.1 Location of Mini-hydropower Potential Sites

REPUBLIC OF INDONESIA  
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**LEGEND**






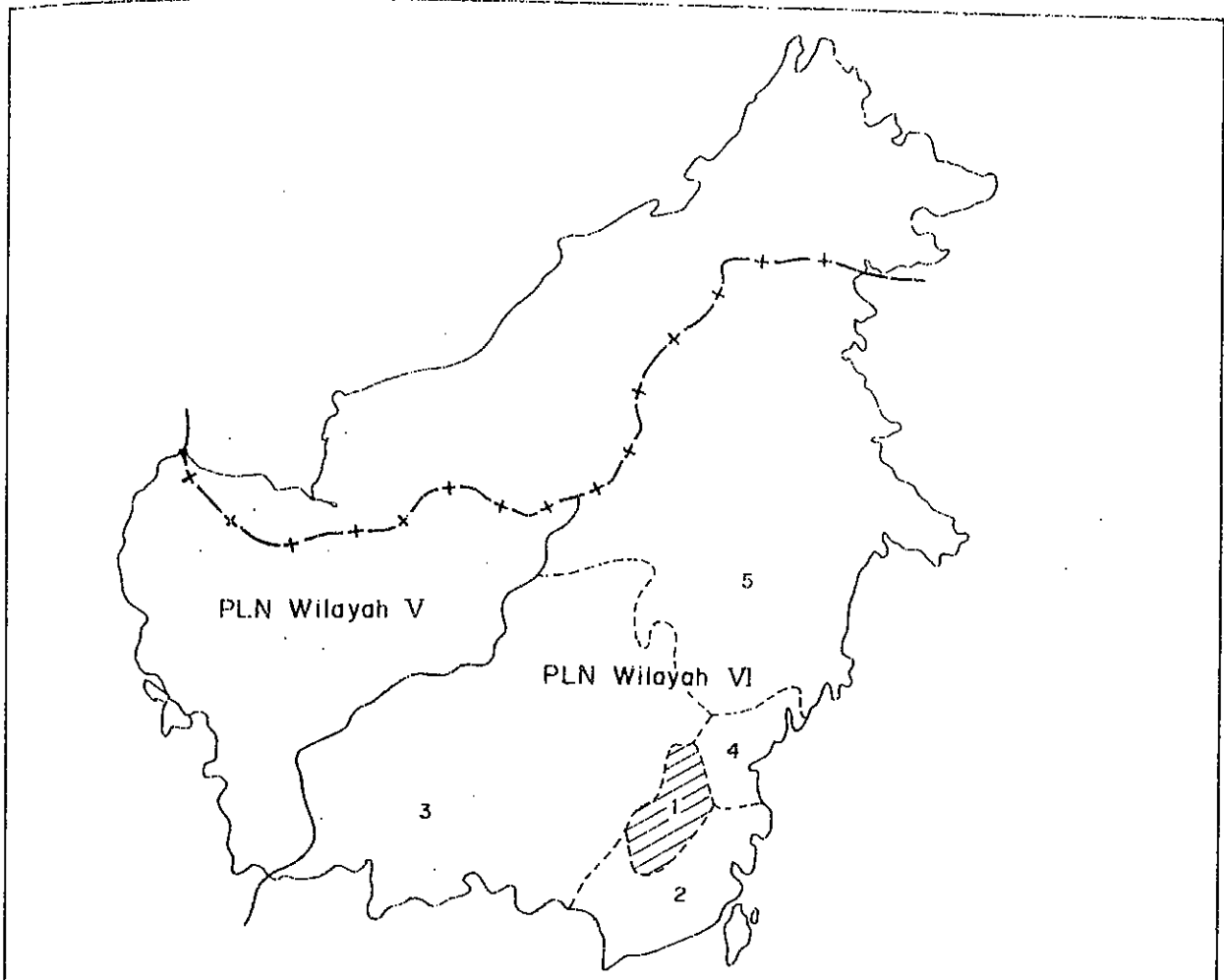
-  Road Section No.
-  National road
-  Provincial road
-  Capital town of Kabupaten
-  Town

Figure 4.1 Route of Existing Provincial Road

REPUBLIC OF INDONESIA  
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT  
 NEGARA RIVER BASIN OVERALL  
 IRRIGATION DEVELOPMENT PLAN STUDY  
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**LEGEND**

- +— National boundary
- Boundary of PLN Wilayah (Region) VI and V
- - - Boundary of Cabang in PLN Wilayah VI

List of Cabang in PLN Wilayah VI

- 1 CABANG BARABAI (the Study Area)
- 2 CABANG BANJARMASIN
- 3 CABANG PALANGKARAYA
- 4 CABANG BALIKPAPAN
- 5 CABANG SAMARINDA


Figure 5.1 Jurisdiction of PLN Wilayah VI in Kalimantan

List of Hydropower Project

No. Project Name

- 1 Tablong-1
- 2 Tablong-2
- 3 Ayu-1
- 4 Ayu-2
- 5 Uwi
- 6 Halong-1
- 7 Halong-2
- 8 Pitap-1
- 9 Pitap-2
- 10 Batang Alai
- 11 Amandit-1
- 12 Tapin
- 13 Amandit-2

LEGEND

 Proposed Damsite

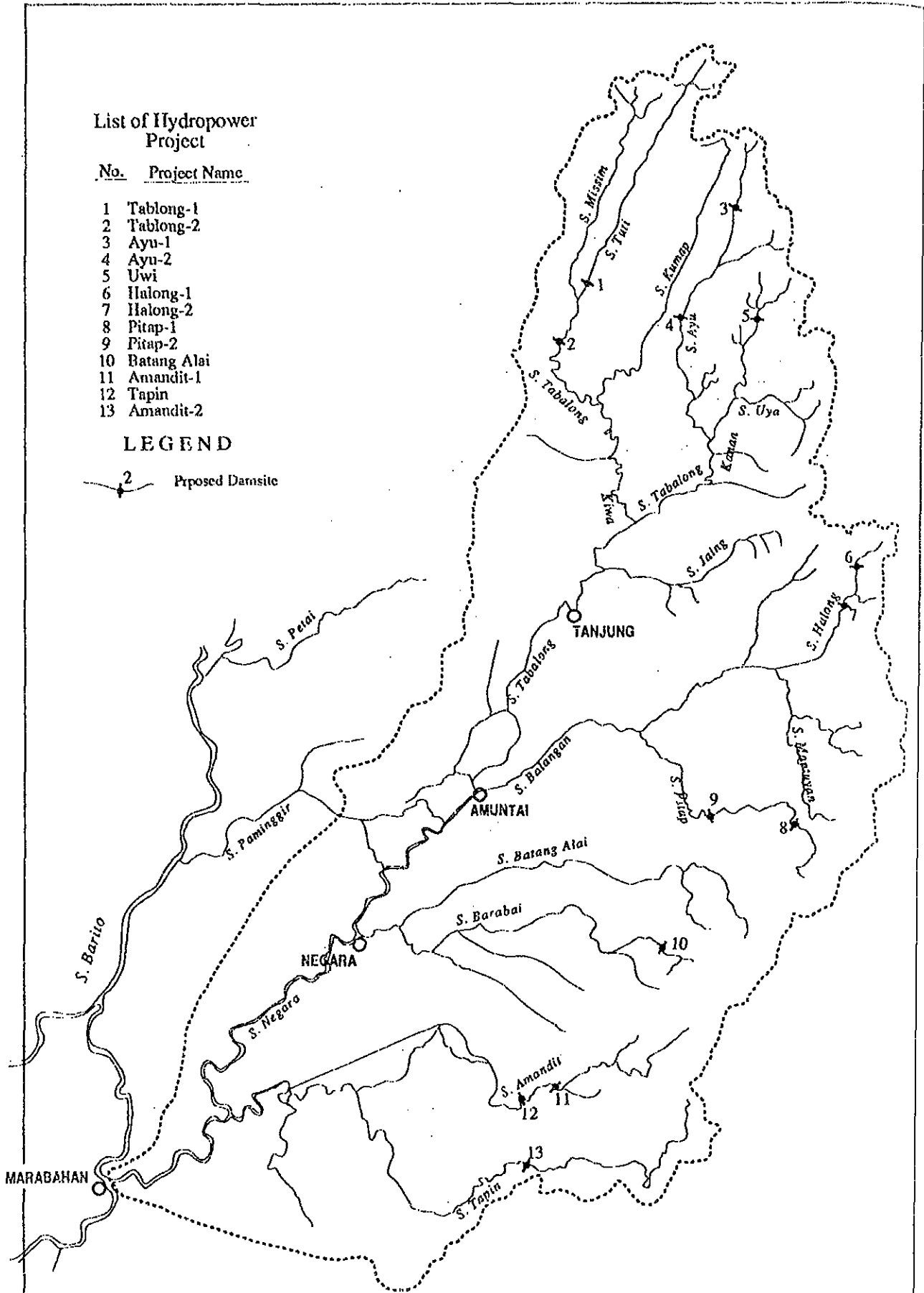


Figure 5.2 Location of Hydropower Project Sites Identified in the Study Area Through IPPS

REPUBLIC OF INDONESIA  
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 NEGERA RIVER BASIN OVERALL  
 IRRIGATION DEVELOPMENT PLAN STUDY  
 JAPAN INTERNATIONAL COOPERATION AGENCY

## ***BIBLIOGRAPHY***





Number in Order	Title	Year Issued	Author/ Organization Issued
H - 01	Fishery Statistics of Indonesia	1985	Directorate Jenderal Perikanan Departemen Pertanian, Jakarta
H - 02	Laporan Tahunan Statistik Perikanan	1976/86	Dinas Perikanan, Propinsi Dati I, Kalimantan Selatan Banjarbaru
H - 03	Special Report No. 3 Tidal Swamp Land Development Project, Nation wide Inventory, Tidal Lands	1983	Republic of Indonesia Directorate General of Water Resources Development
H - 04	Investigations into the Fishery of the Middle Mahakam Area	1986	Technical Cooperation for Area Development, Kutai District, East Kalimantan
H - 05	Final Report on the Activities of the Sub project Agriculture Development For the period : April'82 - April'86	1986	Technical Cooperation for Area Development, Kutai District, East Kalimantan
H - 06	Final Report on Project Activities, Agriculture in the Middle Mahakam Area, No. 1, 87	1987	Technical Cooperation for Area Development, Kutai District, East Kalimantan
H - 07	Jurnal Penelitian & Pengembangan Pertanian, Volume IV, Nomor 1 (Kendala - Kendala dalam Distribusi dan Pemasaran Ikan Asin)	1985	Badan Penelitian dan Pengembangan Pertanian Departemen Pertanian
H - 08	Informasi Lingkungan Sumur Eksplorasi Minyak Bankan dan Samuda	1986	Pusat Penelitian Universitas Lambung Mangkurat
H - 09	Propinsi Daerah Tingkat I Kalimantan - Selatan, Program Pengembangan Wilayah II Laporan Survey dan Pengembangan Ikan Gabus	1983	Pusat Penelitian Universitas Lambung Mangkurat
H - 10	Propinsi Daerah Tingkat I Kalimantan - Selatan, Program Pengembangan Wilayah II Laporan Survey dan Pengembangan Ikan Gabus	1983	Pusat Penelitian Universitas Lambung Mangkurat



***ANNEX I***  
***INLAND FISHERY***



## ANNEX I INLAND FISHERY

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## **1. INTRODUCTION**

The objectives of the Study are to identify fisheries development potentials and to propose a suitable development plan of the Study Area. Most statistical data are collected from Dinas Fishery South Kalimantan.

## **2. SITUATION OF FISHERY PRODUCTION**

### **2.1 Kalimantan Island**

Kalimantan Island has a lot of rich inland fishing grounds comprising broad swamp areas and many river courses. Kalimantan has been the dominant freshwater fish producer of the country, contributing about 50% of national inland open water fishery production as shown in Table 2.1. The inland open water fishery annually produced about 140,000 to 145,000 tons between 1984 and 1986. The fishery production from marine water were about 190,000 tons annually, however, it is relatively low in comparison to the marine fish landings of other bigger islands like Sumatra, Java and Sulawesi where marine fishery is carried out on large scale. The aquaculture production from brackish water and freshwater is presently very low. It was only 2,077 tons in 1986 sharing about 0.6% of the national aquaculture production.

Among four provinces in Kalimantan, the West and East Kalimantan Provinces land much fish from marine fishery, while in the South and Central Provinces the landings from inland open water fishery are predominant as shown in Table 2.1. Brackish water culture is mainly confined to East Kalimantan and to lesser extent in South Kalimantan. Freshwater culture using fish ponds and cages is mainly found in South, East and West Kalimantan. The fish production from paddy field is negligible in all the Provinces in Kalimantan.

### **2.2 South Kalimantan Province and the Study Area**

The fishery production by Kabupaten in South Kalimantan for 1986 is shown in Tables 2.2 and 2.3. The total fishery production of the Province was 107,748 tons of which 45,036 tons or 41.7% was come from by marine fishery and 62,072 tons or 57.5% from inland open open fishery. The aquaculture production accounted for as low as 0.6% in quantity and 2.5% in value to the total fishery production of the Province

Among 10 Kabupatens in the Province, the fishery productions of Kabupatens Kotabaru and Hulu Sungai Utara are particularly high. Kotabaru is a center of marine fishery unloading 26,832 tons and Hulu Sungai Utara is a center of inland open water fishery unloading 20,661 tons, respectively, in 1986. Kotabaru is also known as relatively high brackishwater aquaculture activity in the Province, however, the production is only 448 tons. Freshwater culture is mainly carried out in Kabupatens in the Study Area, although productions are not conspicuous.

A schematic production structure of Indonesia, Kalimantan Island, South Kalimantan and the Study Area is shown in Figure 2.1. It can be easily recognized that the inland open

water fishery production in the Study Area is noteworthy occupying about 7% of the country while aquaculture production is negligible in its share to the country.

### **3. PRESENT FISHERY ACTIVITY**

#### **3.1 Inland Open Water Fishery**

##### **3.1.1 General production structure**

The inland open water fishery is commonly carried out at every river and swamp areas by local fishermen for either daily income earning or self sustenance. Generally using a small canoe of about 5 m in length and 0.6 m in width and several units of small fishing gears such as gill nets, fish traps and hook & line, a fisherman captures small and medium size fishes such as Gouramies, Anabas and Snake Heads. Daily catch varies up to 20 kg which are sold to fish dealers at certain collection places. They transport the fishes to local fish markets or directly to the central market in Banjarmasin. Reflecting the typical ecosystem of floodplain areas where fishes grow up during the wet season and gather in small water body in the dry season, large quantities of fish are caught during the dry season from July to September.

The total fish catch has been fluctuating slightly from about 35,000 to 41,000 tons with an average production of 38,303 tons during the period from 1984 to 1986 as shown in Table 3.1.

The per household production of inland open water fishery is estimated to be 1.86 ton/year or Rp 2.5 million a year in the Study Area in 1986 as shown in Table 3.2. This per household income is rather high in comparison to that of the other Kabupatens in the Province.

##### **3.1.2 Fishing grounds**

The Study Area is topographically divided into three regions, i.e. mountainous/hilly areas, alluvial plains and swamp areas. Based on the review of statistical data and field investigation, the fishing grounds of the Study Area are classified preliminarily into the following seven groups, locations of which are shown in Figure 3.1.

- |               |   |   |
|---------------|---|---|
| Tabalong      | : | riverine fishing ground along the Tabalong river, the uppermost reaches of the Negara river and its tributaries |
| Upper Negara  | : | riverine/swamp fishing ground along the upper reaches of the Negara river and its tributaries                   |
| Middle Negara | : | riverine/swamp fishing ground along the middle reaches of the Negara river and its tributaries                  |
| Lower Negara  | : | riverine/swamp fishing ground along the lower reaches of the Negara river                                       |

- Danau Panggang : riverine and lake fishing ground formulated in the west of the Alabio polder. This fishing ground comprises five lakes: Bitin (major), Maningti, Datu, Panggasam, and Panggan which are all independent water bodies in the dry season and appear as one large water body in the wet season when they get inundated
- Danau Bankau : swamp and lake fishing ground at and around the Bankau lake lying between Kabupatens Hulu sungai Tengah and Hulu sungai Selatan. This fishing ground includes Sungaibuluh which is known as an important fish landing site in the vicinity
- Muning Swamp : riverine/swamp fishing ground formulated along the Muning river in Kabupaten Tapin

The statistical fishery data provided for Kabupatens by two categories, i.e. riverine fishery and swamp fishery, are consolidated for those fishing grounds as shown in Table 3.3. The fishery productions by fishing ground are calculated as shown in Table 3.4.

Significant quantity of fish catch of the Study Area is brought from the Danau Panggang fishing ground with a share of 46.7%. The Danau Bankau and Middle Negara fishing grounds are also important producing 23.4% and 12.9% of fish, respectively, in the Study Area.

### 3.1.3 Species composition

Species composition of inland open water fishery are shown in Table 3.5 and summarized below by species group. Names of fish species commonly caught in South Kalimantan are listed in Table 3.6.

Species Group	Average Production (ton)	Composition (%)
1. Fishes	37,532	98.0
- Carps	3,766	9.8
- Catfishes	4,024	10.5
- Snake heads	6,335	16.5
- Anabas	5,474	14.3
- Gouramies	16,832	43.9
- Others	1,101	2.9
2. Shrimps	499	1.3
3. Snails	272	0.7
Total	38,303	100.0

It can be stressed that large quantity of fish production in the Study Area is sustained by swamp-dwelling species such as Gouramies, Anabas, Snake Heads and Catfishes. The species compositions of each fishing ground are similar and the dominant species being Gouramies as shown in Table 3.7. In particular the production ratio of Gouramies reaches about 60% in the Middle Negara and Danau Bankau fishing grounds. The production ratio of freshwater shrimps is high in the Lower Negara and Muning Swamp fishing grounds, although ample quantity of shrimp has been fished in the Danau Panggang fishing ground.

#### 3.1.4 Fishing gear

Traditional small scale fishing gears are popularly used in the Study Area. There are set gill net (Tetap), portable lift net (Anco), scoop net (Serok), long line (Rawai), hand and line (Pancing), portable net (Bubu) and cast net (Rengge). Guiding barrier (Seco), which is a kind of set net requiring a large open water area, is operated only in the Danau Panggang fishing ground. Number of fishing gear units is shown in Table 3.8. Considering the number of fishermen's household as given in Table 3.2, a household may possess two or three units of fishing gear.

#### 3.1.5 Fisheries resources condition

Applying the fishery statistical data for a number of fishing gear unit as shown in Table 3.8 and fishery production by fishing gear unit as presented in Table 3.9, the recent relationship between them for two major fishing gear units, gill net and portable net, was analyzed as indicated in Figure 3.2. Although it may be difficult to arrive at some absolute figures at present, such tendency can be recognized that the fish catch increases when large number of fishing gear units are applied. In the following the year, however, decreases to some extent.

Interviews conducted to local fishermen indicated that the fish sizes, particularly the carnivorous Snake Head, have been gradually getting smaller and also the catch per unit effort has been recognized to be decreasing.

Therefore the fishery resources in the Study Area are seemed to be exploited well near to the carrying capacity of the fishing grounds.

### 3.2 Aquaculture

Freshwater aquaculture has been developing gradually in recent years, however, its production is still very low comparing with inland open water fishery production. In 1986 aquaculture production reached 91 tons which corresponds to only 0.2% of total fishery production in the Study Area.

The fish species that are cultured at present are mainly common carp (Ikan mas), Cyprinus carpio and to some extent Ikan nila, Tilapia nilotica and several local barbs such as Puntius nilotica, P. javanicus and so on.

Recent aquaculture production is shown in Table 3.10 by Kabupaten and its characteristics of activity are described below.

### **3.2.1 Fish pond culture (Kolam)**

Small scale fish ponds mainly under 0.1 ha have been developed in hilly areas especially in Kabupaten Tabalong by reforming the paddy fields. Pond owners are usually agriculture farmers and they operate ponds in an extensive manner feeding supplementary with trashed food like rice and rice bran. These attempts are primitive or on side-job scale, and hence systematic production in a commercial base has not been carried out.

Fish fry are produced in their home yard ponds or purchased from hatcheries of Kabupaten Fishery Offices at a price of about Rp.10/fry. Total pond areas in the Study Area are 350 ha with the average productivity of 0.2 ton/ha/year in 1986 as shown in Table 3.11.

### **3.2.2 Fish cage culture (Karamba)**

Traditional cage culture using "karamba" that is a rectangular floating cage made of bamboo or wood with size about two by three m and one m in depth is practiced in open water areas; Danau Panggang and Danau Bankau and in rivers that have continuous current. The karamba is operated mainly for temporary stocking and short-term grow-out of the native carp and barb species. It contributes to supplemental income earning for fishermen and farmers.

### **3.2.3 Paddy field culture (Sawa)**

Paddy field culture has just been started in Kabupaten Tapin since 1986 and 0.6 ton of carp was produced in 1986.

## **3.3 Fish Marketing and Processing**

### **3.3.1 Fish marketing and Processing**

In the Study Area, 26.4% of the inland open water fishery catch of 39,553 tons in 1986 were preserved as shown in Table 3.12, and the rest 73.6% were marketed fresh. Fresh fishes are mostly marketed for local fish markets within the Study Area and the central fish market in Banjarmasin. Snake Heads and Anabas are often marketed alive using wooden containers with water. Since no ice is used for transporting to and handling in fish markets, the freshness of fishes are sometimes not kept well.

A considerable quantity of dried fish is produced popularly by fishermen families in every fishing ground. Spotted Gouramy of a size of 5 to 7 cm comprises the dominant item in the dried fish production. Production of dried fish in the Study Area is shown in Table 3.13. It was 7,715 tons in 1986 corresponding to 16.4% of the countries total dried fish production of 43,808 tons. These dried fishes are marketed not only for South Kalimantan but also for Jakarta, Surabaya and other areas in the country through wholesalers in Banjarmasin. In

South Kalimantan nearly 50% of dried fish products or 5,513 tons (Table 3.14) are transported to outside the Province. Dried Snake Head is the most preferred product and some are exported to Hongkong though the export quantity is not known statistically.

The Study Area has few export fishery commodities besides the aforementioned dried Snake Heads and Giant Freshwater Shrimp. Giant Freshwater Shrimp is sold to shrimp packers in Banjarmasin and exported to Europe, USA and Japan.

At present the Negara river serves as one of the major fish transportation routes from the inland fishing grounds to Banjarmasin.

### **3.3.2 Price of fish**

The average producer's prices of fish from inland open water fishery are shown in Table 3.15. The freshwater fish price in the Study Area has been rather expensive at 1,316 Rp/kg in 1986 in comparison to that of the Province and the country. This may be due to the food preference of people living inland who generally prefer freshwater fishes to marine fishes and lacking of price competition with marine fishes. Retail prices of freshwater fishes in the fish markets of Banjarmasin on August 1988 were Rp.1,500 to 2,000 Rp./kg for smaller size fishes such as Marble Gouramy, Spotted Gouramy and Anabas and Rp.2,000 to 2,500/kg for larger size fishes such as Snakeheads and Catfishes. The price of freshwater shrimp is the highest among freshwater species, though it is cheaper than the marine shrimp as shown in Table 3.16.

### **3.3.3 Per capita fish consumption**

The local fish consumption volume of South Kalimantan is estimated to be 76,410 tons in 1986 as shown in Figure 3.3. and the per capita fish consumption is calculated to be 32.4 kg. This is about 2.5 times the average per capita fish consumption of 13 kg in the country and 1.8 times the national targeted per capita consumption of 18 kg.

Since statistical data on the volume of fish marketed from the Study Area to Banjarmasin and other areas within the Province are not available, the per capita fish consumption in the Study Area was preliminarily estimated with the assumption that 20% of freshwater fishes caught in the Study Area are consumed in Banjarmasin. Therefore, the per capita fish consumption in the Study Area is estimated to be 31.2 kg in 1986 as shown in Figure 3.4.

## **3.4 Fisheries Extension Service**

### **3.4.1 Extension activity of fisheries offices**

The fisheries extension services in the South Kalimantan Province are carried out by the related fisheries offices through the extension facilities as shown in Table 3.17.

In the Study Area there is a fish landing site for supporting inland open water fishery at Danau Panggang, where some Kabupaten fisheries staff are monitoring its activities.

However, the activities and services are seemed to be inadequate because the wooden facilities have superannuated.

As for inland aquaculture development, there are four fry production centers (BBIs) operated in the hilly area, the locations of which are shown in Fig. 3.5. These centers provide carp and tilapia fry for small scale fish farmers. BBI Binuang operated by Dinas Fishery produced about 309,000 fry in 1987, however, in general the fry production of BBIs is still insufficient as shown in Table 3.18.

### **3.4.2 Extension activity of BAPPEDA**

BAPPEDA South Kalimantan provides extension service following the Rural Development Programme (PPW) as shown in Table 3.19. Budget provided in the Study Area was Rp.65 million amounting to 81% of the total budget allocated to the Province in 1986/87. Total number of annual beneficiaries in the Study Area may reach some 300 households though the definite number is unknown. This programme is mainly focused on the development of small scale aquaculture including provisions of necessary fund for items as traditional cage (Karamba), fish pond, fish fry and harvesting gears.

## **4. EXAMINATION OF DEVELOPMENT POTENTIAL**

### **4.1 Inland Open Water Fishery Production**

Since price of fish is relatively high compared to agricultural crops, many fishermen as well as farmers participate in open water fishery for earning cash income and acquiring adequate animal protein. The fishery resources in the Study Area have been well exploited mainly due to high intensity of their fishing efforts, although their individual fishery activities are small.

According to Repelita V, the target production of this sector in the Study Area is set to be 44,712 tons in 1993 as shown in Table 4.1. Although an average annual growth rate during the planned period is only 1.8% as shown in Table 4.2, the target production seems to be rather over the carrying capacity of the fishing ground because the target production nearly corresponds to the highest production of 44,568 tons recorded in 1982.

Taking into account the examinations, the inland open water fishery production potential at a level of maximum sustenance yield (MSY) is evaluated under such condition that no measurement for natural resources management has been performed. The historical trend of production is used as input data to estimate MSY for each fishing ground. The evaluation results of inland open water fishery production potential are illustrated in Figure 4.1 and summarized as follows:

Fishing Ground	Present Production (ton)	Production Potential (ton)
Tabalong	913	1,000
Upper Negara	2,575	2,800
Middle Negara	4,935	5,000
Lower Negara	1,423	1,400
Danau Panggang	17,885	20,000
Danau Bankau	8,969	9,000
Muning Swamp	1,603	1,600
Total	38,303	40,800

Although the absolute production should not exceed the MSY level in case of the traditional fishery approach, the production will be able to be improved quantitatively and qualitatively by means of artificial propagation. With respect to the potential sites to introduce artificial propagation measures, the Danau Panggang and Danau Bankau fishing grounds can be firstly considered because the broad open water areas of these fishing grounds are suitable for promotion of the progressive fish production system.

#### 4.2 Aquaculture Development Potential

Besides these situations of the inland open water fisheries, aquaculture has not been well progressed in the Study Area. The reasons are mainly due to the present adequate fish production by capture fishery, and the insufficient technical and financial support. The aquaculture development potentials are examined hereinafter.

##### (1) Pond culture

The fish production from small scale fish pond provides agriculture farmers with additional incomes. However, since the design capacity of present irrigation canals is not enough for supplying water to large scale ponds and the land is spatially restricted, it is difficult to expect high production potential.

On the contrary, few fish ponds are developed in the swamp areas at present. The main reason is attributed to the difficulty of water management under low cost and low technology measures. For the proper operation of fish ponds, pond water should be drained and pond bottom should be dried completely at least for a month every year in order to rehabilitate bottom condition and eliminate harmful organisms before stocking of fry. A certain amount of daily water change is also required for the increase of production. These swamp areas, however, will have a significant potential for large scale pond development when the embankment type pond with pumping facility is considered. Although this progressive culture system requires high operation and maintenance cost, some financial and economic benefits can be expected if high valued shrimp is cultured as an export item.



The potential sites for the shrimp ponds are identified among the riverine areas extending over levees consisting of riverine sediments indicated Sites A to D in Figure 4.2.

At present the swamp area inside the Alabio polder can not be utilized for paddy cultivation because of the difficulty of the drainage control in the wet season. However, from an aquaculture point of view, this area seems to have a high potential for the embankment type pond development. Hence this area is also identified as potential sites for pond culture. Its location is indicated as Site E in Figure.4.2. These potential sites are evaluated considering several criteria such as overlapping with existing and/or planned drainage schemes of DPUP, accessibility, present infrastructure conditions and distance between the hatchery to be constructed and Banjarmasin. The results of evaluation are summarized as below.

	Overlap with DPUP's Drainage Schemes	Accessi- bility	Present Infra- structure	Distance to Hatchery or Banjarmasin	Priority Order
Site A	G*	G	B	G	2
Site B	B	G	M	G	3
Site C	G	B	B	G	4
Site D	B	B	B	G	5
Site E	G	G	M	M	1

- Remarks: 1) G; good or no problem  
M; moderate  
B; bad or serious problem  
2) Since seawater is required for the initial rearing of shrimp larvae for about 20 days, the hatchery site is usually near the sea.  
3) \*; Minor area is overlapped with the existing DPUP's drainage scheme site but it seems not to cause serious problems.

As a result, the above Site E seems to be most appropriate for the earlier implementation of new aquaculture scheme. The Site A shall be developed when the infrastructure conditions especially electric supply are improved in the future.

## (2) Cage culture

The industrial development potential of traditional cage culture is apparently low in river tributaries of the hilly area, although introduction of the traditional cage has significant means for the initial stage of rural development in remote areas.

On the contrary it seems to have some potentials for development of cage culture in open water areas like Danau Panggang and Danau Bankau, especially when modern cages made of nylon net cloth with wooden or iron frames are used. The target species will be Tilapia and common carp as well as native species.

### (3) Paddy field culture

The fish production in paddy fields has just been started in Kabupaten Tapin. For the development of paddy field culture, the following conditions should be generally secured in paddy field:

- 1) Continuous impoundment of water to a depth of over 15 cm for a period of over three months
- 2) Sufficient dike height and proper sluice to keep fish in captivity
- 3) Suitable secondary or tertiary canals to provide refuge for fish and to harvest easily

Since the paddy fields in the swamp areas cannot satisfy the above conditions except for those inside the Alabio polder, the potential areas should be considered among the irrigated paddy fields in the alluvial plains.

### (4) Potential aquaculture production

The potential production of aquaculture varies depending much on the culture methods that are usually classified as extensive, semi-intensive and intensive methods. For the Study Area, the intensive method in which fishes are reared in high density with regular feeding is not recommendable at the primary stage of development. The productivity for potential areas identified above is considered based on extensive or semi-intensive culture method. The potential production of aquaculture is summarized in Table 2.5.

## 5. INLAND FISHERY DEVELOPMENT PLAN

### 5.1 Basic Principle

The basic principles for the inland fishery development in the Study Area are identified integrating all the above examinations as follows.

- (1) To maintain present fishery resources by means of preservation of natural environment

Fisheries resources in the Study Area depend on the changes in water depth and area during the periodical fluctuations between the dry and wet seasons. Most of the fish spawn at the beginning of wet season and the larvae/fry grow feeding on the planktonic organisms in the floodplain waters. In order to maintain the reproduction cycle of fishes, it is necessary to preserve the natural environment in the fishing grounds as well as in the permanently water-logged swamp areas. The paddy fields developed in the swamp areas may cause some hazardous effect on fishes, although the quantitative impact evaluation is difficult at this stage. Basic field data on the fishery activity and environment should be collected prior to the implementation of any large agriculture development plan in the swamp areas.

- (2) To modernize fishery activity from an economic view point

The Study Area is now one of the most important inland fishing ground in the country, with the per capita consumption of about 31 kg which is very high compared to that of the national target of 18 kg. In the inland open water fishery sector, fishery resources management and monitoring will have to be implemented continuously to produce stable fishery production as well as more importantly to upgrade quality of fishery products and to propagate quality fishes.

- (3) To increase aquaculture production

The freshwater aquaculture has been promoted in the hilly area and its production is increasing gradually through the extension activity of Dinas Fishery and BAPPEDA. However in the swamp areas, there are few aquaculture activities particularly in cage culture on small scale for temporary rearing of fish, though there seems to have potential for freshwater shrimp.

The aquaculture development shall be encouraged for the following areas that have different background and natural environment:

- 1) Hilly area; The present aquaculture extension activity shall be strengthened and continuously implemented.
- 2) Swamp area; New aquaculture development scheme shall be promoted and targeted for freshwater shrimp which has high commercial value and demand in export market.

- (4) To strengthen supporting services to fishermen and fish farmers

For the efficient implementation of fishery development, necessary supporting facilities shall be established, following education and extension services for fishermen and fish farmers. These services and Dinas fishery staff's capability have to be strengthened.

## **5.2 Proposed Development Strategy**

### **5.2.1 Promotion of inland open water fishery**

The proposed overall open water fishery development programmes are explained below:

- (1) Education and organization of fishermen

It is indispensable to educate fishermen including farmers and part-time fishermen for the efficient utilization of limited inland fishery resources. Education and extension of the fishermen require continuous efforts of Dinas Fishery of South Kalimantan.

Formulation of systematic extension programmes for the extension officers under the instruction of local and/or overseas experts are required. The training and extension measures shall include:

- 1) Feature of fishery resources and proper utilization; Migration routes of main fish species, spawning ground, spawning season, age of maturation, etc. and examination of the suitable location of fishing grounds, formulation of the regulation on fishing gear and fishing season.
- 2) Activities of fishermen's cooperatives in other areas; Exchange of information and views on the activity of progressive fishermen's cooperatives in similar fishery communities in Kalimantan Island or in the country. The activities of fishermen's cooperative such as buying and selling in cooperative manner, provision of fishermen loan and implementation of special fishery promotion projects on their own.
- 3) Fishing rights and necessity of fishermen organization; Examination on the formation of fishing rights and suitable fishermen's organization for the local community to achieve stable and planned fish production

(2) Improvement of fishing gear and fishing method

When the fishermen are well organized, improvement of fishing boats and gear shall be considered for the full-time fishermen initially. However, when fishing effort is conducted above the potential production level, the fisheries resources may decline or be damaged. Hence suitable number and size of fishing gear shall be examined previously. Large scale fishing boat and fishing gear seem to be not recommendable.

(3) Production of quality class fishes through the propagation measures

Fish species that have high commercial value at present are Snake Head and freshwater shrimp. Based on the interview survey, production of these species (per fishing trip production) has been decreasing and sizes are becoming smaller. Since the ecology of these species are almost clarified, propagation measures be considered such as culture based fishery through the stocking programme of fry, construction of spawning grounds and establishment of prohibited fishing area (sanctuary).

New fish species that can be introduced in the Study Area such as Indian major carps which promise higher growth and reach bigger sizes shall be examined for thoroughly.

(4) Establishment of open water fishery supporting facilities

There are few loading facilities except for Danau Panggang fish landing site which is already dilapidated. Considering the present ample fish catch, suitable fishery centers are proposed to be established in the major fishing communities. The facilities to be included in a center

are fish landing site, unloading facilities, primary auction hall, ice processing plant, fuel supply facility, work shop, ware house and relevant equipment.

(5) Quality improvement and to make specialized product

The dried fish produced in the Study Area using mainly Gouramy and Snake Head is the only fishery products marketed to outside Kalimantan, and it should be promoted as speciality of the Study Area. Besides the dry fish production, new fishery products, for example frozen fish, fish cake and pet food shall be also introduced after considering both technical and economic feasibility.

Establishment of a dry fish processing and marketing center is therefore proposed in the Study Area in order to accelerate these activities

Basic research on the fishery processing shall be promoted with assistance of Research Center in Jakarta.

### **5.2.2 Regional development strategy by fishing ground**

Specific regional development strategies are explained by the fishing ground as follows.

(1) Tabalong fishing ground

The Tabalong fishing ground is located in the upper most reaches of Negara river and the best fish catch was around 1000 tons which is the lowest among the seven fishing grounds. In this fishing ground, fishing on small scale shall be continuously promoted and targeted for marketing to Tanjung and neighboring consumption areas. This fishing ground does not seem to be suitable for location of a fishery center.

(2) Upper Negara fishing ground

The situation is the same as the above Tabalong fishing ground. The development potential of this fishing ground is limited. Small scale fishery shall be promoted for local consumption.

In this fishing ground, Kabupaten Fishery Office at Amuntai is carrying out monitoring of fishing activities mainly for the Danau Panggang fishing ground. These activities shall be strengthened and it is recommendable to support fishery services including the Tabalong and Upper Negara fishing grounds.

(3) Middle Negara fishing ground

Most of the fishermen are based in villages in the vicinity of Negara. Small size Gouramy, mainly used for fried fish materials, comprises about 60% of fish catch in this fishing ground. Presently most fishes are marketed directly to Banjarmasin by boat or to Kandagan and Banjarmasin by road. Since Negara now serves as a center of inland navigation,

significant amount of fishes caught in the Danau Panggang and the Dariau Bankau fishing grounds are marketed through Negara.

Taking into account the above condition, this area shall be developed as a center of fish processing and marketing rather than as fish production center. The development strategies are to promote fish processing industry as specialized product the area using small size fishes caught in this fishing ground and also fishes collected from two major fishing grounds, Danau Panggang and Danau Bankau.

As for location of a fish processing and marketing center, Kandangan is more appropriate rather than Negara because Kandangan has more advantages in traffic condition and land space availability.

(4) Lower Negara fishing ground

Fish production is relatively low, but the capture ratio of freshwater shrimp is high. Continuous monitoring on shrimp fishery and propagation measures shall be therefore indispensable. Since this area has considerable potential for shrimp culture, fishermen and farmers shall be informed of aquaculture procedures and will be gradually encouraged to take up pond culture operation.

(5) Danau Panggang fishing ground

This is one of the most important fishing ground in the country. Since fish marketing facilities and road infrastructure are not well developed, most fishes caught are transported by boat taking the Barito river in the north or Negara river in the south. Presently there is fishing landing site, however, its wooden facilities are already dilapidated and not provided with necessary working equipment. As a center of fishery production, supporting facilities shall be established at Danau Panggang.

The center shall also serve as training and extension center for fishermen. Following measures are of importance especially in this fishing ground.

- 1) Maintenance of stable productivity of fishing grounds through preservation of natural environment in the permanently waterlogged swamp area and promotion of culture base fishery.
- 2) Formulation of suitable fishing rights and progressive fishermen's organization.
- 3) Increase of per household fish production through the improvement of fishing gear and fishing methods.
- 4) When there are surplus fishermen/fishing households, they will be encouraged to take up aquaculture which has a significant development potential through promotion of the above second and third programs.

(6) Danau Bankau fishing ground .

This fishing ground is identified as a secondary fishery production center next to the Danau Panggang fishing ground. Since fish unloading and marketing places are dispersed for example from the north up to Amuntai, west in Negara and Banjarmasin, east to Barabai, south from Kandangan to Banjarmasin, it is recommendable to facilitate fisheries supporting centers in several strategic places. Considering the present conditions and distribution of fishermen's villages, Sungaibuluh and Danau Bankau are seemed to be suitable sites for the centers .

The development measures are same as described in the Danau Panggang fishing ground.

(7) Munning Swamp fishing ground

Most fishing activities are conducted in irrigation canal of the swamp area. The capture ratio of freshwater shrimp is high like the Lower Negara fishing ground.

Small scale fishery is promoted under monitoring and propagation of shrimp resources. The fishermen and farmers shall be gradually encouraged to move into aquaculture as mentioned for the Lower Negara fishing ground

### 5.2.3 Promotion of traditional small-scale aquaculture in hilly area

The present aquaculture extension programmes shall be implemented continuously in fish fry production and distribution by Dinas Fishery, and provision of small scale facilities and equipment under the Regional Development Programme by BAPPEDA. Problems and issues for the development are as follows.

- 1) Fry production conducted by Dinas Fishery is very important as the input supply for fish pond. Since the fry produced is not enough quantitatively, however, it is necessary to enlarge capacity of hatchery facilities and to upgrade the technical level of the staff.
- 2) Target aquaculture species are mainly carp and Tilapia. These species are suitable for aquaculture because they are omnivorous in feeding habits and can be cultured easily without any expertise techniques as long as extensive method is applied. In future various new aquacultural species with high commercial value shall be examined following the fish farmer's technical development. Culturable species that can be considered are freshwater shrimp, Snake Heads, Sleeper Gobby and freshwater turtle (terrapiin).
- 3) In the fish pond operated in the existing irrigation scheme areas, there is a problem of water shortage in the paddy field located down stream of fish pond. It is necessary to examine and calculate the demand of water to fish pond at the stage of planning and appropriate plan for utilization of limited water shall be considered with the coordination of DPUP.

- 4) Most of existing fish ponds are low in productivity. One of the reasons for the low productivity of existing fish ponds might be inadequate pond structure having shallow depth, rough bottom and narrow dike with small sluice gates. The engineering support shall then be required for the formulation of standard design criteria of fish ponds and structures to suit the local conditions.
- 5) The development of traditional cage culture in the hilly area seems to have minor potential as an industry, however, continuous assistance shall be made available to provide farmers with stable protein source as well as additional cash income.
- 6) Paddy field culture shall not be recommended in the planned irrigated paddy fields because paddy will be cultivated under intensive method.

#### **5.2.4 Proposed aquaculture development in swamp area**

##### **(1) Shrimp culture development**

According to the socio-economic needs in South Kalimantan, the promotion of valuable crop production especially export-oriented crop production is given high priority. As for aquaculture development, the Giant Freshwater Shrimp culture will be the one among the various alternative culture potentials discussed earlier.

When considerable quantity of shrimp is produced in the Study Area, the inducement of supporting facilities such as ice plant and cold storage will be possible. The better impacts on the fishery sector and rural economy can be expected.

For the development of shrimp culture the following technical problems and issues should be overcome.

##### Production of shrimp fry

According to the shrimp farmers at Tabunganan where the only one shrimp aquaculture site in South Kalimantan is located at the west side of lower reaches of the Barito river, shrimp fry can be easily collected by scoop net in the Barito river and its tributaries. However, it is expected that the amount of natural fry will decline when intensive fry collection is carried out to meet the demand of large scale shrimp farms if operated.

It will be therefore required to produce shrimp fry artificially and distribute for aquaculture ponds. In addition when stable large-scale fry production system is realized, the restocking of fry to the natural nursery ground will also be considered.

The activity of fry production and basic research shall be strengthened by referring to the result of experimental fry production that has been done in the Lambung Mangkurat University in Banjarbaru, and keeping close communication with advanced research organizations like the Research Institute for Freshwater Fisheries in Bogor.



The location of a shrimp hatchery is ordinarily considered in areas close to the sea because seawater is necessary for the larval rearing of Giant Freshwater Shrimp. Since the required amount of seawater is not much, however, it is possible to establish the hatchery even in the Study Area under the condition that the seawater is transported to the hatchery periodically. As a priority site for shrimp hatchery inside the Study Area, the vicinity of BBI Binuang shall be recommendable because of its fair accessibility to the sea and Banjarmasin and the availability of technical support from BBI Binuang.

#### Training and extension of aquaculture techniques

For the fish culture the extension services are carried out by the training staff of Dinas Fishery of South Kalimantan and branch offices in Kabupatens through the workshop and discussion with fishermen. These activities should be strengthened and systemized by means of upgrading technical knowledge of the training staff. In order to master the shrimp culture technique and pond design, the technical transfer through experts or training in countries advanced in shrimp culture will be considered. For the extension services to the local farmers, the practical training and instruction will be indispensable.

#### Pilot operation

The pilot scale operation has to be carried out to clarify the technical problems on the productivity such as stocking density, survival rate, feeding intensity and water quality and to minimize the risk for large scale development. It is ideal to grasp the productivities for several different sites and culture methods such as in the experimental ponds in the Alabio polder and potential swamp area, or the existing ponds.

#### (2) Cage Culture in Open Waters

The open water area in the Danau Panggang and Danau Bankau fishing grounds has significant potential for the development of cage culture using net cage facilities. The net cage culture shall increase the rearing density to about 150 kg/m<sup>2</sup>, that is comparatively higher than in the fish ponds. The criteria for the establishment of net cage facilities are:

- 1) water depth of more than 2 m having good water current
- 2) less air and wind actions
- 3) less damage to the net by floating materials such as weeds, tree trunks, etc.

Among the above open water areas, Bitin lake in the Danau Panggang fishing ground seemed to be suitable for cage culture though in the selection of sites, floating materials, lake bottom and fluctuations of water level between the dry and wet seasons should be considered. Investigations must be carried out to identify suitable cage structure design based on such conditions as water level fluctuation, location, stocking density and seasonal variation.

### 5.3 Identification of Priority Scheme

Location of the major proposed scheme areas and the supporting facilities described in the previous section is shown in Figure 3.1 and summarized by Kabupaten as shown below.

	Tabalong	H.S.U.	H.S.T.	H.S.S.	Tapin
<u>Proposed scheme</u>					
Open water fishery promotion		o	o	o	
Development of fish processing industry				o	
Shrimp culture development		o			o
Net cage culture development		o			
<u>Supporting facilities</u>					
Fishery resources monitoring center		o			
Open water fishery supporting facility		o	o	o	
Fish processing and distribution center				o	
Shrimp fry production center					o

Although all of the above schemes should be implemented, it is recommended that aquaculture related schemes namely shrimp culture scheme should be given high priority because of its production increase potential and anticipated contribution to export enhancement.

### 5.4 Preliminary Feasibility Examination of Shrimp Culture

#### 5.4.1 Demand for freshwater shrimp culture

Giant Freshwater Shrimp is cultured on small scale in Tabungānen, Kabupaten Barito Kuala of South Kalimantan by immigrants. Cultured shrimps have high demand and are sold to a shrimp processor and trading company in Banjarmasin. Presently there are three shrimp packers in Banjarmasin. According to interview, more or less 60 tons of the freshwater shrimp are exported monthly to Hong Kong, Europe, USA and Japan. Since their most serious problem is shortage and fluctuation of natural shrimp catch, it is definite they will buy cultured shrimp when stable aquaculture production system is established. The local demand for this shrimp is also very high in South Kalimantan.

#### 5.4.2 Financial viability

Financial viability is examined preliminarily for the following three cases considering the analysis of development potential as described in Section 4.2.

- Case 1 : Inside the Alabio Polder for short term development
- Case 2 : Inside the Alabio Polder for middle and long term development
- Case 3 : In the vicinity of Margasari for long term development

The results are shown below. The target productivities of shrimp are 0.4, 1.2 and 2.4 ton/ha/year for Cases 1, 2 and 3, respectively. The expected profits for the one ha model representing each development area are approximately Rp.1.8, 3.8 and 3.0 million/ha for Cases 1, 2 and 3, respectively.



## ***TABLES***



Table 2.1 Fishery Production in Indonesia (1984-86)

Region/Province	Year	Total		Marine Fishery		Inland Open Water Fishery		Aquaculture					
		(ton)	(%)	(ton)	(%)	(ton)	(%)	Sub-total		Brackish Water Pond (ton)	Fresh Water Pond (ton)	Cage (ton)	Paddy Field (ton)
								(ton)	(%)				
Indonesia Total	1984	2,260,989	100.0	1,712,804	100.0	269,321	100.0	278,863	100.0	142,404	76,528	1,051	58,880
	1985	2,395,562	100.0	1,821,725	100.0	269,266	100.0	304,571	100.0	156,367	84,240	746	63,218
	1986	2,529,899	100.0	1,922,781	100.0	273,012	100.0	334,106	100.0	170,310	88,743	557	74,496
Kalimantan	1984	307,335	13.6	165,870	9.7	139,962	52.0	1,502	0.5	676	375	451	0
	1985	319,762	13.3	177,409	9.7	140,771	52.3	1,582	0.5	1,034	427	121	0
	1986	337,269	13.3	190,202	9.9	144,990	53.1	2,077	0.6	1,460	588	28	1
South Kalimantan	1984	91,295	4.0	38,586	2.3	52,545	19.5	163	0.1	82	73	8	0
	1985	97,134	4.1	43,792	2.4	53,153	19.7	189	0.1	93	80	16	0
	1986	103,205	4.1	44,587	2.3	58,063	21.3	555	0.2	448	87	19	1
Central Kalimantan	1984	74,033	3.3	31,296	1.8	42,737	15.9	0	0.0	0	0	0	0
	1985	75,364	3.1	32,089	1.8	43,275	16.1	0	0.0	0	0	0	0
	1986	75,324	3.0	35,395	1.8	39,929	14.6	0	0.0	0	0	0	0
East Kalimantan	1984	67,748	3.0	43,153	2.5	23,533	8.7	1,062	0.4	594	25	443	0
	1985	70,648	2.9	45,387	2.5	24,163	9.0	1,098	0.4	941	52	105	0
	1986	76,704	3.0	47,670	2.5	27,963	10.2	1,071	0.3	1,012	50	9	0
West Kali.	1984	74,259	3.3	52,835	3.1	21,147	7.9	277	0.1	0	277	0	0
	1985	76,616	3.2	56,141	3.1	20,180	7.5	295	0.1	0	295	0	0
	1986	82,036	3.2	62,550	3.3	19,035	7.0	451	0.1	0	451	0	0
Sumatra	1984	619,961	27.4	516,591	30.2	69,320	25.7	34,050	12.2	14,824	11,396	65	7,765
	1985	651,576	27.2	537,832	29.5	69,172	25.7	44,572	14.6	22,171	14,295	50	8,056
	1986	691,671	27.3	580,681	30.2	70,860	26.0	40,130	12.0	20,796	14,109	61	5,164
Java	1984	651,852	28.8	435,963	25.5	22,004	8.2	193,885	69.5	84,418	60,996	520	47,951
	1985	686,423	28.7	456,526	25.1	23,010	8.5	206,887	67.9	89,146	64,992	568	52,181
	1986	726,000	28.7	464,541	24.2	23,114	8.5	238,345	71.3	103,042	69,515	465	65,323
Iali Nusa Tenggara-Timor	1984	139,481	6.2	133,058	7.8	2,249	0.8	4,174	1.5	2,405	797	0	972
	1985	171,194	7.1	164,378	9.0	1,978	0.7	4,838	1.6	3,060	868	0	910
	1986	178,721	7.1	172,220	9.0	1,623	0.6	4,878	1.5	2,749	912	0	1,217
Sulawesi	1984	409,143	18.1	334,044	19.5	30,075	11.2	45,024	16.1	40,078	2,739	15	2,192
	1985	426,297	17.8	349,002	19.2	30,922	11.5	46,373	15.2	40,946	3,349	7	2,071
	1986	443,824	17.5	364,884	19.0	30,546	11.2	48,394	14.5	42,260	3,340	3	2,791
Maluku-Irian Jaya	1984	133,217	5.9	127,278	7.4	5,711	2.1	228	0.1	3	225	0	0
	1985	140,310	5.9	136,578	7.5	3,413	1.3	319	0.1	10	309	0	0
	1986	152,414	6.0	150,253	7.8	1,879	0.7	282	0.1	3	279	0	0

Source: Fisheries Statistics of Indonesia, Directorate General Fisheries, Department of Agriculture, Jakarta

Table 2.2 Fishery Production Volume in South Kalimantan and the Study Area in 1986

Kabupaten	Total		Marine Fishery		Inland Open Water Fishery		(Unit: ton)			
							Aquaculture			
							Brackish-water Culture		Fresh-water Culture	
(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)			
Tapin	3,202	3.0	0	0.0	3,189	5.1	0	0.0	13	11.5
H.S.S.	7,404	6.9	0	0.0	7,389	11.9	0	0.0	17	14.6
H.S.T.	7,286	6.8	0	0.0	7,272	11.7	0	0.0	14	12.0
H.S.U.	20,678	19.2	0	0.0	20,661	33.3	0	0.0	17	14.5
Tabalong	1,072	1.0	0	0.0	1,043	1.7	0	0.0	29	25.0
Study Area total	39,642	36.8	0	0.0	39,554	63.7	0	0.0	90	77.6
Tanah Laut	11,820	11.0	8,700	19.3	3,047	4.9	67	12.8	6	5.2
Kota Baru	32,112	29.8	26,832	59.6	4,829	7.8	448	85.3	3	2.6
Banjar	9,280	8.6	3,591	8.0	5,670	9.1	10	1.9	9	7.7
Barito Kuala	13,531	12.6	5,308	11.8	8,222	13.2	0	0.0	1	0.9
Banjarmasin	1,362	1.3	605	1.3	750	1.2	0	0.0	7	6.0
Area	68,105	63.2	45,036	100.0	22,518	36.3	525	100.0	26	22.4
South Kalimantan (% of sub sector)	107,747 (100.0)	100.0	45,036 (41.7)	100.0	62,072 (57.5)	100.0	525 (0.5)	100.0	116 (0.1)	100.0

Source: Report of Fisheries Statistics, Dinas Fisheries of South Kalimantan

Table 2.3 Fishery Production Value in South Kalimantan and the Study Area in 1986

Kabupaten	Total		Marine Fishery		Inland Open Water Fishery		(Unit: Rp.million)			
							Aquaculture			
							Brackish-water Culture		Freshwater Culture	
(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)			
Tapin	11,958	11.5	0	0.0	11,903	17.9	0	0.0	55	19.6
H.S.S.	14,260	13.7	0	0.0	14,234	21.3	0	0.0	26	9.2
H.S.T.	6,209	6.0	0	0.0	6,165	9.2	0	0.0	44	15.4
H.S.U.	19,202	18.5	0	0.0	19,177	28.8	0	0.0	25	8.7
Tabalong	673	0.6	0	0.0	582	0.9	0	0.0	92	32.3
Study Area total	52,302	50.4	0	0.0	52,061	78.1	0	0.0	241	85.2
Tanah Laut	5,789	5.6	3,498	10.2	1,852	2.8	424	17.7	16	5.6
Kota Baru	29,683	28.6	25,131	73.2	2,587	3.9	1,959	81.8	6	2.2
Banjar	6,911	6.7	1,901	5.5	4,990	7.5	11	0.5	8	2.9
Barito Kuala	8,052	7.8	3,470	10.1	4,581	6.9	0	0.0	1	0.4
Banjarmasin	975	0.9	355	1.0	609	0.9	0	0.0	11	3.7
Other Area total	51,410	49.6	34,354	100.0	14,618	21.9	2,394	100.0	42	14.8
South Kalimantan (% of sub sector)	103,712 (100.0)	100.0	34,354 (33.1)	100.0	66,679 (64.3)	100.0	2,394 (2.3)	100.0	283 (0.3)	100.0

Source: Report of Fisheries Statistics, Dinas Fisheries of South Kalimantan.

Remarks: The annual variations of fishery production value are very high for several Kabupatens probably due to the miscalculatio of fishermen. For example, the inland open water fishery production in Kabupaten Tapin was Rp.3,292 million in 1985 or less than one third comparing with that of 1986 as shown above although the production values were almost the same in these years as 3,061 tons in 1985 and 3,189 tons in 1986.



Table 3.1 Inland Open Water Fishery Production in the Study Area by Kabupaten (1980-1987)

Area	1980	1981	1982	1983	1984
Tapin	2,287	2,623	2,759	2,437	2,828
H.S.S.	5,196	4,829	7,553	6,797	7,147
H.S.T.	8,812	8,356	9,616	5,119	6,075
H.S.U.	18,442	26,556	23,709	24,309	20,420
Tabalong	699	957	931	863	823
Total	35,436	43,321	44,567	39,525	37,293
Other Kabupatens	15,685	15,408	15,332	14,679	15,059
South Kalimantan	51,121	58,729	59,899	54,204	52,352

Area	1985	1986	1987	Average 1984-86
Tapin	3,061	3,189	3,483	3,026
H.S.S.	7,219	7,389	8,496	7,251
H.S.T.	6,611	7,272	7,286	6,653
H.S.U.	20,299	20,661	20,723	20,460
Tabalong	875	1,043	1,045	914
Total	38,064	39,553	41,033	38,303
Other Kabupatens	14,195	22,354	21,209	17,203
South Kalimantan	52,259	61,907	62,242	55,506

Source: Report of Fisheries Statistics, Dinas Fisheries of South Kalimantan

Table 3.2 Estimated per Fishery Household Production of Inland Open Water Fishery by Kabupaten in 1986

Kabupaten	Estimated Number of Fishery Household	Per Fishery Household Production		
		(%)	Volume (ton/yr)	Value ('000 RP/yr)
Tapin	2,900	8.7	1.10	4,104
H.S.S.	5,624	16.8	1.31	2,531
H.S.T.	2,211	6.6	3.29	2,788
H.S.U.	9,919	29.6	2.08	1,933
Tabalong	607	1.8	1.72	958
Study Area total	21,261	63.5	1.86	2,449
Tanah Laut	1,269	3.8	2.40	1,459
Kota Baru	910	2.7	5.31	2,842
Banjar	5,207	15.5	1.09	958
Barito Kuala	4,378	13.1	1.88	1,046
Banjarmasin	468	1.4	1.60	1,301
Other Area total	12,232	36.5	1.84	1,195
South Kalimantan	33,493	100.0	1.85	1,991

Remarks: 1) Number of inland open water fishery households (NFH) in 1986 is set estimated preliminary based on the following formula.

$$\text{NFH (1986)} = \text{Census (1983)} \times \text{FS (1986)/FS (1983)}$$

where;

NFH (1986): Estimated NFH in 1986 by Kabupaten

Census (1983): NFH by Kabupaten in Indonesia, 1983

FS (1983): NFH of the South Kalimantan Province shown in the Fishery Statistics of South Kalimantan, 1983

FS (1986): - do -, 1986

2) According to the reason indicated in Table 2.3, the per household production value in Kabupaten Tapin seems to be irregular one. The per household production values for the Study Area total as about Rp.2,450 million is likely to represent approximate average figure based on the interview survey of fishermen.

Table 3.3 Kabupaten's Inland Open Water Fishery Production for Each Fishing Ground

(Unit: %)

Fishing Ground	Tabalong		H.S.U.		H.S.T.	
	River	Swamp	River	Swamp	River	Swamp
Tabalong	100	N.A.	-	-	-	-
Upper Negara	-	-	50	-	-	-
Middle Negara	-	-	-	-	-	-
Lower Negara	-	-	-	-	-	-
Danau Panggang	-	-	50	100	N.A.	-
Danau Bankau	-	-	-	-	-	100
Muning Swamp	-	-	-	-	-	-

Fishing Ground	H.S.S.		Tapin	
	River	Swamp	River	Swamp
Tabalong	-	-	-	-
Upper Negara	-	-	-	-
Middle Negara	100	-	-	-
Lower Negara	-	-	100	-
Danau Panggang	-	-	-	-
Danau Bankau	-	100	-	-
Muning Swamp	-	-	-	100

Remarks: Diving ratio of 50% : 50% for the river fishery of Kabupaten Hulu Sungai Utara between the Upper Negara and Danau Panggang grounds is used preliminary based on the fishery production by Kecamatan and field survey.

Table 3.4 Inland Open Water Fishery Production by Fishing Ground (1980-1986)

Fishing Ground								(Unit: ton)		
	Annual Production							Average	Ave. Annual Growth	
	1980	1981	1982	1983	1984	1985	1986	in 1984-86 (%)	Rate in 1980-86 (%)	
1) Tabalong	699	957	931	863	823	874	1,043	913	(2.4)	14.3
2) Upper Negara	2,684	3,471	2,809	2,598	2,185	2,362	3,178	2,575	(6.7)	5.8
3) Middle Negara	4,216	3,783	6,057	5,410	5,172	4,807	4,827	4,935	(12.9)	4.6
4) Lower Negara	1,273	1,399	1,502	1,386	1,368	1,337	1,564	1,423	(3.7)	7.1
5) Danau Panggang	15,758	23,085	20,900	21,711	18,236	17,936	17,483	17,885	(46.7)	3.5
6) Danau Bankau	9,791	9,402	11,112	6,506	8,051	9,022	9,833	8,969	(23.4)	0.1
7) Muning Swamp	1,015	1,224	1,258	1,051	1,460	1,724	1,625	1,603	(4.2)	17.0
Total	35,435	43,321	44,568	39,525	37,294	38,063	39,553	38,303	(100.0)	3.7

Table 3.5 Inland Open Water Fishery Production in the Study Area by Species (1980-1986)

	1980	1981	1982	1983	1984	1985	1986	Average 1984-	Unit: ton (%)
Total	35,436	43,322	44,569	39,525	37,294	38,064	39,552	38,303	100
Fishes Total	34,037	41,296	43,090	38,840	36,430	37,233	38,933	37,532	98
Hoven's carp	145	420	327	165	205	167	113	162	0
Asian barb	95	413	1,870	2,640	840	2,074	2,424	1,780	5
Jawa barb	0	0	0	0	0	0	0	0	0
Catfish	66	85	41	70	182	149	114	148	0
Glass catfish	702	1,003	939	849	1,025	1,165	1,226	1,139	3
Snake head	5,338	6,777	4,683	5,894	5,058	4,655	4,760	4,824	13
Indonesian snake head	1,907	2,629	2,288	2,024	1,778	1,685	1,069	1,511	4
Snakeskin gourami	6,467	7,414	10,623	7,150	6,802	6,204	5,915	6,307	16
Kissing gourami	3,051	3,389	5,260	3,076	2,888	3,363	3,186	3,145	8
Sleeper goby	18	18	26	8	70	176	0	82	0
Kife fish	171	280	210	167	100	231	237	189	0
Other Fishes	16,077	18,869	16,823	16,796	17,483	17,363	19,889	18,245	48
(Spotted gourami)	(6,431)	(7,547)	(6,729)	(6,718)	(6,993)	(6,945)	(7,956)	(7,298)	(19)
(Anabas)	(4,823)	(5,661)	(5,047)	(5,039)	(5,245)	(5,209)	(5,967)	(5,474)	(14)
(Catfishes)	(2,412)	(2,830)	(2,523)	(2,519)	(2,622)	(2,604)	(2,983)	(2,737)	(7)
(Barbs)	(1,608)	(1,887)	(1,682)	(1,680)	(1,748)	(1,736)	(1,989)	(1,825)	(5)
(Other fishes)	(804)	(943)	(841)	(840)	(874)	(868)	(994)	(912)	(2)
Shrimps Total	855	1,580	1,261	531	449	451	596	499	1
Giant FW shrimp	244	358	448	164	84	142	230	152	0
Other shrimps	611	1,222	813	367	366	309	366	347	1
Snails Total	269	439	218	154	414	379	23	272	1
Turtles Total	0	3	0	0	0	0	0	0	0
Frogs Total	276	4	0	0	0	0	0	0	0

Remarks: The species composition of other fishes are estimated at the ratios of Spotted gourami, 40%

Anabas, 30% ; Catfishes, 15% ; Barbs, 10% ; Other fishes, 5% based on the information from Dinas fishery.

Source: Report of Fisheries Statistics, Dinas Fisheries of South Kalimantan Province

Table 3.6 List of Fishery Species Commonly Caught in South Kalimantan

Classification/English Name	Scientific Name	Indonesian Name
<b>Fishes</b>		
<b>Cypriniforms</b>		
Hoven's carp	<i>Leptobarbus hoeveni</i>	Jelewat
Asian barb	<i>Puntius</i> spp.	Lampan
Jawa barb	<i>P. javanicus</i>	Tawes
Nilem carp	<i>Osteochilus hasselti</i>	Nilem (Puyau)
<b>Siluriforms</b>		
Catfish	<i>Pangasius</i> spp.	Jambal, Patin
Glass catfish	<i>Macronis</i> spp. <i>Cyptopterus</i> spp.	Baung (Panting), Lais
<b>Perciforms</b>		
Snake head	<i>Ophiocephalus</i> spp.	Gabus (Haruan)
Indonesian snake head	<i>O. micropeltus</i>	Toman
Anabas	<i>Anabas testudeni</i>	Pepuyu (Betok)
Spotted gourami	<i>Tricogaster trichopterus</i>	Sepat rawa
Snakeskin gourami	<i>Tricogaster pectoralis</i>	Sepat siam
Kissing gourami	<i>Helostoma temmincki</i>	Tambakan (Biawan)
Sleeper gobby	<i>Oxcelotris marmoratus</i>	Betulu
<b>Ostecoglossiforms</b>		
Kife fish	<i>Notopterus</i> spp.	Belida (Pipih)
<b>Shrimps</b>		
Giant freshwater shrimp	<i>Macrobrachium rosenbergi</i>	Udang galah
Freshwater shrimp	<i>Paraemon</i> spp.	Udang tawar
Snails	<i>Pila</i> spp.	Siput
Turtles	<i>Tryanix</i> spp.	Kura-kura
Frogs	<i>Rana</i> spp.	Kodok

Table 3.7 Species Composition by Fishing Ground

	Tabalong		Upper Negara		Middle Negara		Lower Negara	
	(ton)	(%)	(ton)	(%)	(ton)	(%)	(ton)	(%)
1. Fishes	906	99.1	2,536	98.5	4,927	99.8	1,372	96.5
Carp	50	5.5	460	17.9	260	5.3	123	8.6
Catfishes	167	18.3	305	11.8	415	8.4	227	16.0
Snake heads	215	23.5	416	16.1	576	11.7	204	14.4
Anabas	151	16.6	396	15.4	585	11.9	233	16.4
Gouramies	297	32.5	874	33.9	2,994	60.7	546	38.4
Other fishes	25	2.8	86	3.3	98	2.0	39	2.7
2. Shrimps	8	0.9	27	1.0	8	0.2	51	3.5
3. Snails	0	0.0	12	0.5	0	0.0	0	0.0
Total	913	100.0	2,575	100.0	4,935	100.0	1,423	100.0

	Danau Panggang		Danau Bankau		Muning Swamp		Total	
	(ton)	(%)	(ton)	(%)	(ton)	(%)	(ton)	(%)
1. Fishes	17,324	96.9	8,940	99.7	1,526	95.2	37,532	98.0
Carp	2,318	13.0	394	4.4	161	10.1	3,766	9.8
Catfishes	1,995	11.2	675	7.5	241	15.0	4,024	10.5
Snake heads	3,295	18.4	1,325	14.8	304	18.9	6,334	16.5
Anabas	2,744	15.3	1,142	12.7	222	13.8	5,474	14.3
Gouramies	6,346	35.5	5,214	58.1	562	35.0	16,832	43.9
Other fishes	626	3.5	190	2.1	37	2.3	1,101	2.9
2. Shrimps	301	1.7	29	0.3	77	4.8	499	1.3
3. Snails	260	1.5	0	0.0	0	0.0	272	0.7
Total	17,885	100.0	8,969	100.0	1,603	100.0	38,303	100.0

Remarks: Average of 3 years in 1983-1986

Table 3.8 Number of Fishing Gear Unit in the Study Ara (1980-1986)

	1980	1981	1982	1983	1984	1985	1986	Average in 1980-86 (Unit)	(%)
Total	39,769	34,536	67,145	51,107	51,129	55,214	46,966	49,409	100.0
Gill net									
Draft gill net	0	150	0	0	0	0	0	21	0.0
Set gill net	5,867	5,862	10,238	10,202	10,141	11,218	8,166	8,813	17.8
Lift net									
Portable lift net	9,597	3,649	5,666	5,284	5,387	5,684	5,340	5,801	11.7
Scoop net	2,635	1,482	1,383	2,288	2,485	2,713	3,106	2,299	4.7
Hook and line									
Long line	3,440	5,371	8,294	3,699	2,240	1,614	1,013	3,667	7.4
Hand and line	0	0	18,061	6,805	5,640	6,916	5,658	6,154	12.5
Trap									
Guiding barrier	1,769	2,264	1,573	1,522	1,112	865	736	1,406	2.8
Stow net	0	0	0	0	0	0	0	0	0.0
Portable net	6,327	7,433	12,077	11,120	10,653	12,771	8,961	9,906	20.0
Others	10,134	8,325	9,853	10,187	13,471	13,433	13,986	11,341	23.0

Remarks: There is a mistake in the statistical data on the numbers of hand and line unit during 1980-82.

Table 3.9 Inland Open Water Fishery Production in the Study Area by Fishing Gear (1980-1986)

	1980	1981	1982	1983	1984	1985	1986	Unit: ton Average in 1984-86
Total	35,436	43,321	44,568	39,525	37,293	38,064	39,553	38,303
Gill net								
Draft gill net	0	0	0	0	0	0	0	0
Set gill net	5,379	5,056	10,513	5,656	4,853	6,592	7,472	6,306
Lift net								
Portable lift	2,917	2,886	3,053	1,434	2,328	2,366	3,963	2,886
Scoop net	1,590	1,019	616	843	1,265	1,238	1,617	1,374
Hook and line								
Long line	2,745	2,931	2,936	5,811	3,907	3,241	2,699	3,282
Hand and line	3,867	5,945	3,372	3,982	5,353	4,542	5,097	4,997
Trap								
Guiding barrier	3,661	3,526	3,214	3,469	2,873	3,433	4,147	3,484
Stow net	0	0	0	0	0	0	0	0
Portable net	3,571	6,109	7,732	4,641	5,358	6,633	7,145	6,379
Others	11,708	15,850	13,132	13,689	11,356	10,019	7,413	9,596



Table 3.10 Freshwater Aquaculture Production in the Study Area by Kabupaten (1984-1986)

Kabupaten	Year	Freshwater Pond	Cage	Paddy Field	Total
Tapin	1984	6.7	-	-	6.7
	1985	3.0	-	-	3.0
	1986	11.8	1.0	0.7	13.5
H.S.S.	1984	3.7	1.5	-	5.2
	1985	6.7	4.8	-	11.5
	1986	11.8	5.2	-	17.0
H.S.T.	1984	1.4	1.5	-	2.9
	1985	4.9	1.5	-	6.4
	1986	14.5	-	-	14.5
H.S.U.	1984	1.6	5.7	-	7.3
	1985	4.6	6.8	-	11.4
	1986	5.9	10.9	-	16.8
Tabalong	1984	44.9	-	-	44.9
	1985	50.7	-	-	50.7
	1986	29.2	-	-	29.2
Total	1984	58.3	8.7	-	67.0
	1985	69.9	13.1	-	83.0
	1986	73.2	17.1	0.7	91.0

Source: Report of Fisheries Statistics, Dinas Fisheries of South Kalimantan

Table 3.11 Outline of Freshwater Pond Culture in the Study Area in 1986

Kabupaten	Fish Pond Area (ha)	Production (ton)					Productivity (ton/ha/yr)
		Total	Common Carp	Jawa Barb	Tilapia Mossambica	Tilapia Nilotica	
Tapin	56.2	11.8	7.6	-	1.3	0.8	0.21
H.S.S.	33.0	11.8	0.1	-	2.9	8.8	0.36
H.S.T.	43.1	14.5	7.1	1.0	6.4	-	0.34
H.S.U.	14.2	5.9	1.7	-	1.7	2.4	0.42
Tabalong	202.0	29.2	18.9	4.5	4.3	1.5	0.14
Total (%)	348.5	73.2 (100.0)	35.4 (48.4)	5.5 (7.5)	16.6 (22.7)	13.5 (18.4)	0.21

Source: Report of Fisheries Statistics, Dinas Fisheries of South Kalimantan

Table 3.12 Disposition of Inland Open Water Fishery Production in the Study Area by Kabupaten (1984-1986)

Kabupaten	Year	Marketing Volume		Percentage of Preserved Fish to Total Marketing Volume (%)
		Fresh Condition (ton)	Preserved Condition (ton)	
Tapin	1984	1,745	1,083	38.3
	1985	1,757	1,304	42.6
	1986	1,953	1,235	38.7
U.S.S.	1984	4,183	2,964	41.5
	1985	4,114	3,104	43.0
	1986	5,033	2,355	31.9
U.S.T.	1984	5,475	601	9.9
	1985	5,522	1,089	16.5
	1986	6,212	1,060	14.6
U.S.U.	1984	9,302	11,018	54.2
	1985	16,926	3,373	16.6
	1986	15,110	5,551	26.9
Tabalong	1984	603	220	26.7
	1985	675	199	22.8
	1986	801	242	23.2
Study Area Total	1984	21,307	15,886	42.7
	1985	28,994	9,070	23.8
	1986	29,110	10,443	26.4
Other Kabupatens	1984	9,659	5,500	36.3
	1985	8,746	5,449	38.4
	1986	11,500	10,854	48.6
South Kalimantan	1984	30,966	21,386	40.9
	1985	37,740	14,519	27.8
	1986	40,710	21,362	34.4

Source: Report of Fisheries Statistics, Dinas Fisheries of South Kalimantan Province

Table 3.13 Production of Dry Fish in the Study Area by Kabupaten

Kabupaten	1984	1985	1986
Tapin	650	725	794
U.S.S.	2,181	1,862	1,352
U.S.T.	360	795	634
U.S.U.	3,936	2,390	4,282
Tabalong	130	114	113
Total	7,256	5,887	7,175
Other Kabupatens	3,410	3,376	4,690
South Kalimantan	10,667	9,263	11,865

Source: Report of Fisheries Statistics, Dinas Fisheries of South Kalimantan Province

Table 3.14 Domestic Trade and Export of Fishery Products from South Kalimantan in 1986

Products	Volume of Products (tons)	Converted Volume to fresh condition (tons)
<b>Domestic Trade</b>		
Dried/salted Marine Fish	8,269	18,458
Dried/salted Freshwater Fish	5,513	9,933
Fresh Shrimp	457	457
Froglegs	20	20
Total	14,259	28,868
<b>Export</b>		
Fozen Shrimp (Marine and Freshwater)	1,387	2,312
Other Frozen Products	236	393
Total	1,623	2,705

Remarks: Applied conversion ratios from product volume to fresh fish volume are 44.8% for dried/salted marine fish, 55.5% for dried/salted freshwater fishes and 60% for frozen products based on the analysis of fishery statistics.

Source: Annual Report, 1986, Dinas Fisheries of South Kalimantan province

Table 3.15 Average Producers' Prices of Inland Open Water Fishery

	1984			1985			1986		
	ton	Rp.million	Rp./kg	ton	Rp./million	Rp./kg	ton	Rp.million	Rp./kg
Indonesia	269,321	203,353	755	269,266	217,867	809	273,012	256,207	938
Kalimantan	139,962	106,001	757	140,771	118,185	840	144,990	140,964	973
South Kalimantan	52,545	41,749	795	53,153	50,219	944	58,063	62,547	1,077
Study Area	37,294	35,658	956	38,064	38,478	1,011	39,554	52,061	1,316

Table 3.16 Shrimp Purchase Price of Export Companies in Banjarmasin in August 1988

	Size Category for Trade (No. of headless shrimp/lb)	Shrimp Size with Head	Price (Rp.)
Giant FW Shrimp	16 under	70 g <	9,000-9,500
	16/30	25-70 g	7,000-6,500
	30 over	< 25 g	2,500-3,000
Giant Tiger Shrimp	20 under	40 g <	31,000
	21/30	25-40 g	19,000
	31/40	20-25 g	13,000
	41/50	15-20 g	9,000
	51/60 over	< 15 g	< 7,000

Table 3.17 Fisheries Extension Facilities in South Kalimantan

	Location	Office in Charge of Operation
<b>BBI (Fry Production Centre)</b>		
1) BBI Mandiangan	Banjar	Provincial Fishery Office
2) BBI Pañan Jarak	Banjar	Provincial Fishery Office
3) BBI Binuang	Tapin	Provincial Fishery Office
4) Masinpan	H.S.S.	Kabupaten Fishery Office
5) BBI Manggunan	H.S.T.	Kabupaten Fishery Office
6) BBI Jaro	Tabalong	Kabupaten Fishery Office
<b>Fish Landing Site</b>		
1) Banjarmasin Fishery Harbour	Banjarmasin	Directorate General Fishery Office, Jakarta
2) Danau Panggang Fish landing site	H.S.U.	Kabupaten Fishery Office
<b>PPI (Fish Landing Station)</b>		
1) PPI Jorong	Tanah Laut	Kabupaten Fishery Office
2) PPI Muara Kintab	Tanah Laut	Kabupaten Fishery Office
3) PPI Kotabaru	Kotabaru	Kabupaten Fishery Office
4) PPI Pagatan	Kotabaru	Kabupaten Fishery Office
<b>TPI (Fish Auction Station)</b>		
1) TPI Banjar Raya	Banjarmasin	Directorate General Fishery Office, Jakarta
<b>UPPI (Capture Fishery Promotion Office)</b>		
1) UPPI Kotabaru	Kotabaru	Provincial Fishery Office
<b>UPMHP (Fish Quality Control Office)</b>		
1) UPMHP Banjarmasin	Banjarmasin	Provincial Fishery Office

Table 3.18 Fry Production by the Hatcheries of Kabupaten Fishery Office (BBD) in 1984-1987

Kabupaten	Name of Hatchery	Unit: '000 fry			
		1984	1985	1986	1987
Tapin	Binuang	33.8	138.4	153.2	309.2
U.S.S.	Masinpan	N.A.	N.A.	N.A.	N.A.
U.S.T.	Mangunang	10.4	65.5	43.0	-
U.S.U.		-	-	-	-
Tabalong	Jaro	19.4	26.7	10.2	-
Total		63.6	230.6	206.4	309.2

Source: Dinas Fishery Office

Table 3.19 Budget and Beneficiaries for the Rural Development Programme (PPW), Phase II on the Fisheries Sector

Kabupaten	Budgets (Rp.)				Beneficiaries (No. of Households)			
	1984/85	1985/86	1986/87	1987/88	1984/85	1985/86	1986/87	1987/88
Tapin	3,700	429	12,000	N.A.	N.A.	N.A.	N.A.	44
U.S.S.	11,255	9,288	15,000	5,397	N.A.	N.A.	N.A.	41
U.S.T.	10,000	16,474	18,000	17,452	14	52	41	N.A.
U.S.U.	12,500	14,320	20,000	7,835	30	90	110	150
Tabalong	-	-	-	-	-	-	-	-
Total	37,455	40,511	65,000	N.A.	N.A.	N.A.	N.A.	N.A.
South Kalimantan	40,455	57,181	80,000	N.A.	N.A.	N.A.	N.A.	N.A.

Remarks: The Kecamatan where these programmes were carried out are as follows.

Tapin ; Tapin Selatan, Tapin Utara, Tapin Tengah  
 U.S.S. ; Padang Batung, Telaga Langsung, Sungai Raya, Angkinang  
 U.S.T. ; Haruyan, Batu Benawa, Batang Alai Selatan, Labuan Amas Selatan  
 U.S.U.; Sungai Pandan, Batu Mandi, Amuntai Selatan, Lampihong

Source: PPW Project Evaluation, Second Phase, 1988, Bappeda of South Kalimantan

Table 4.1 Target Fishery Production of the Study Area and South Kalimantan in 1993

Kabupaten	Total		Marine Fishery		Inland Open Water Fishery		Aquaculture			
							Brackish-water Culture		Freshwater Culture	
	(ton)	(%)	(ton)	(%)	(ton)	(%)	(ton)	(%)	(ton)	(%)
Tapin	3,822	2.6	0	0.0	3,800	5.6	0	0.0	22	8.0
H.S.S.	9,254	6.3	0	0.0	9,227	13.6	0	0.0	27	9.9
H.S.T.	7,966	5.4	0	0.0	7,938	11.7	0	0.0	28	10.5
H.S.U.	22,608	15.4	0	0.0	22,594	33.3	0	0.0	14	5.0
Tabalong	1,277	0.9	0	0.0	1,153	1.7	0	0.0	124	45.8
Study Area total	44,927	30.5	0	0.0	44,712	65.9	0	0.0	215	79.1
Tanah Laut	20,019	13.6	16,552	21.2	3,189	4.7	262	25.8	16	6.0
Kota Baru	48,960	33.3	44,660	57.2	3,596	5.3	700	69.0	4	1.5
Banjar	12,587	8.6	5,934	7.6	6,578	9.7	53	5.2	22	8.0
Barito Kuala	18,804	12.8	9,838	12.6	8,959	13.2	0	0.0	7	2.5
Banjarmasin	1,915	1.3	1,093	1.4	814	1.2	0	0.0	8	3.0
Other Area total	102,285	69.5	78,077	100.0	23,136	34.1	1,015	100.0	57	20.9
South Kalimantan (% of sub sector)	147,212 (100.0)	100.0	78,077 (41.7)	100.0	67,848 (57.5)	100.0	1,015 (0.5)	100.0	271 (0.1)	100.0

Source: Repelita V, BAPPEDA



Table 4.2 Expected Average Annual Growth Rate for  
1986-1993 by Kabupaten by Fishery Sub Sector

Unit: %

Kabupaten	Total	Marine Fishery	Inland Open Water Fishery	Aquaculture	
				Brackish- water Culture	Fresh- water Culture
Tapin	2.6	-	2.5	-	7.1
H.S.S.	3.2	-	3.2	-	6.8
H.S.T.	1.3	-	1.3	-	10.6
H.S.U.	1.3	-	1.3	-	3.1
Tabalong	2.5	-	1.4	-	23.1
Study Area total	1.8	-	1.8	-	13.2
Tanah Laut	7.8	9.6	0.7	21.5	15.2
Kota Baru	6.1	7.5	4.1	6.6	4.2
Banjar	4.4	7.4	2.1	26.9	13.3
Barito Kuala	4.8	9.2	1.2	-	31.5
Banjarmasin	5.0	8.8	1.2	-	2.1
Other Area total	5.9	8.2	0.4	9.9	11.8
South Kalimantan (% of sub sector)	4.5	8.2	1.3	9.9	12.9

Table 4.3 Development Potential of Aquaculture

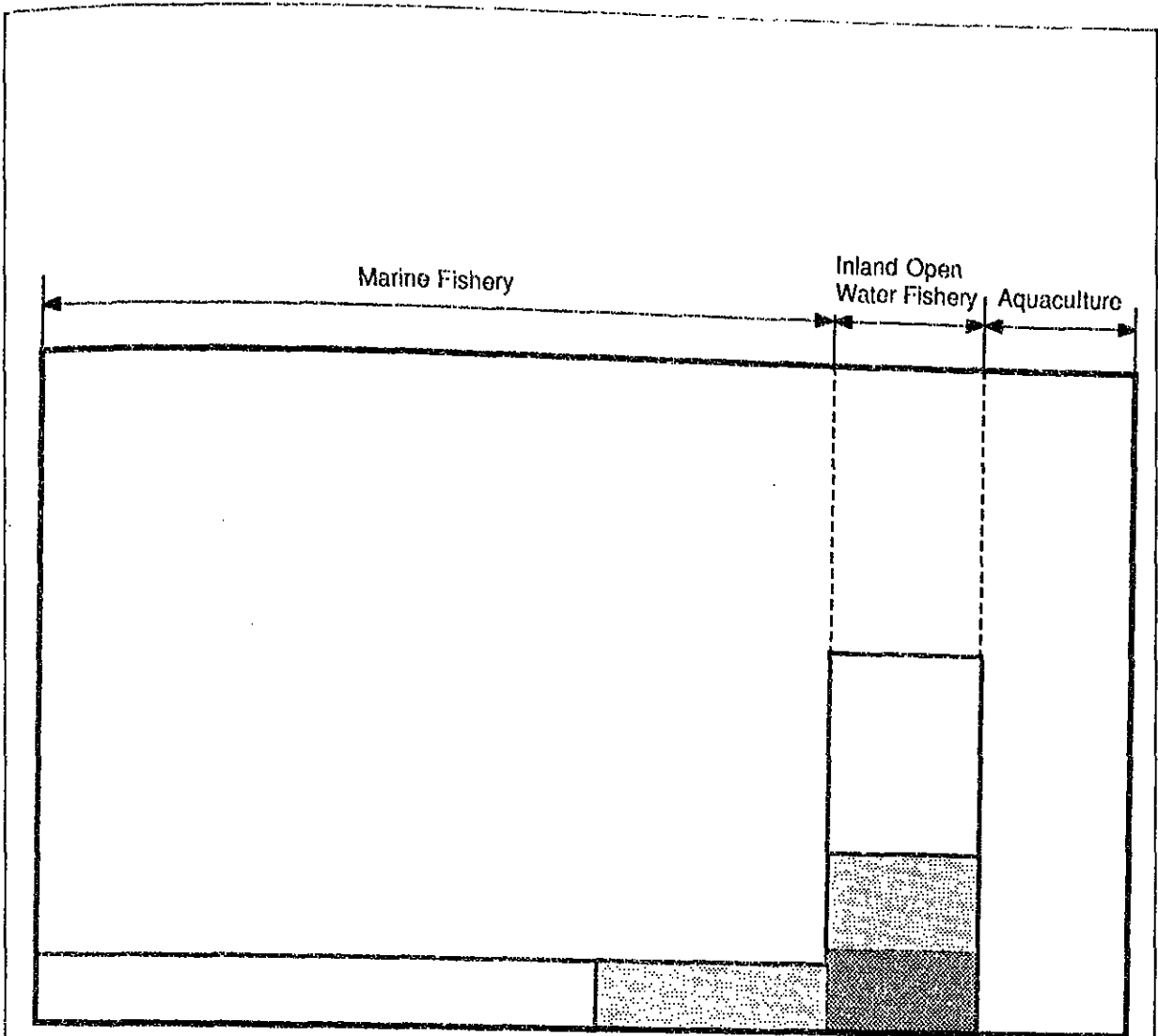
	Extent of Potential Area (ha)	Potential Aquaculture Area (ha)	Target Species	Productivity (ton/ha/year)	Annual Production Potential (tons)	Remarks
<u>Potential without New Programme</u>						
1) Pond culture	-	433	Common carp, Tilapia	0.4	173	Mainly in hilly area
2) Cage culture	-	0.9	Native carp/barb species	43	40	Traditional cages
3) Paddy field culture	-	N.A.	Common carp	N.A.	2	
Sub total					215	
<u>Potential with New Programme</u>						
1) Pond culture						
a. Alabio polder (Site B)	1,450	1,000	Shrimp	0.75 (0.5-3.0)	750	Semi-intensive method
b. Margasari (Site A)	3,500	2,000	Shrimp	0.50 (0.2-2.0)	1,000	Extensive-semi intensive method
2) Cage culture						
a. Danau Panggang	500-1,000	1	Common carp, Tilapia	100	100	Nylon net cage
3) Paddy field culture						
a. Single crop paddy field in hilly area	8,121	6,500	Common carp, Native carp/barb species	0.09	585	
b. Double crop paddy field in hilly area	37,920		Shrimp			
c. Paddy field in Alabio polder	4,500	3,000	Shrimp	0.05	150	Small size shrimp
Sub total					2,585	
Total					2,800	

Remarks: 1) The target production of Replita V, 215 tons for the year 1993 are applied for potential production without new programme. The breakdown by aquaculture category is conducted by applying the production ratio in 1986 as 80.5% for pond culture, 18.8% for cage culture and 0.7% for paddy field culture. The development areas are estimated based on the productivity in 1986.

2) For the paddy field culture, the longer the impoundment period, the better for fish production. According to the cropping pattern this period will be 3 to 4 months, that is the minimum duration for fish culture. Therefore the aquaculture development areas are considered in conservatively as 80% of single crop paddy field area.

## ***FIGURES***





- Remarks :
- Indonesia
  - Kalimantan Island
  - South Kalimantan
  - Study Area

Figure 2.1 Schematic Fishery Production Structure of Kalimantan Island, South Kalimantan and the Study Area in the Country for 1986

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 NEGARA RIVER BASIN OVERALL  
 IRRIGATION DEVELOPMENT PLAN STUDY  
 JAPAN INTERNATIONAL COOPERATION AGENCY

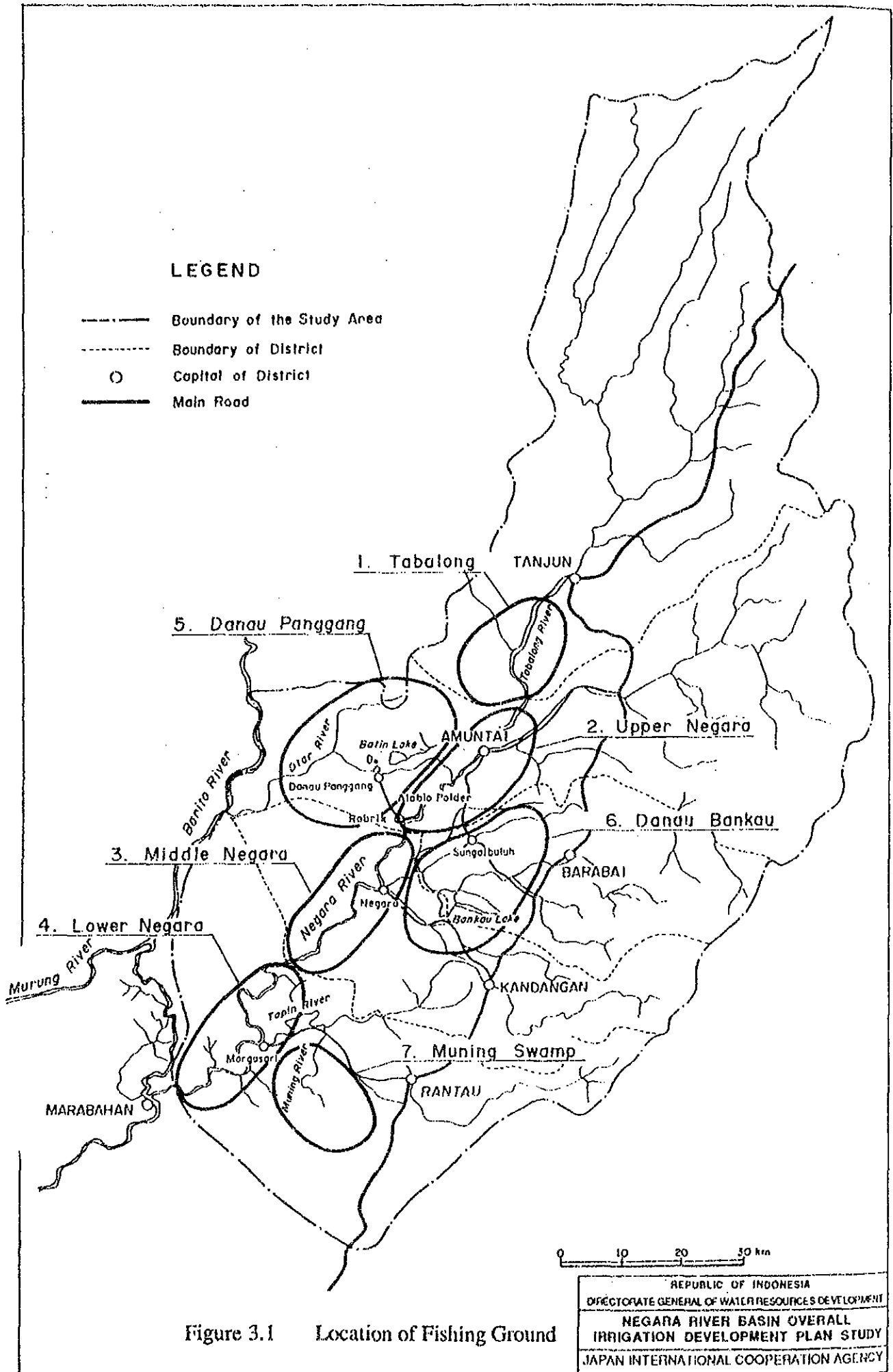


Figure 3.1 Location of Fishing Ground

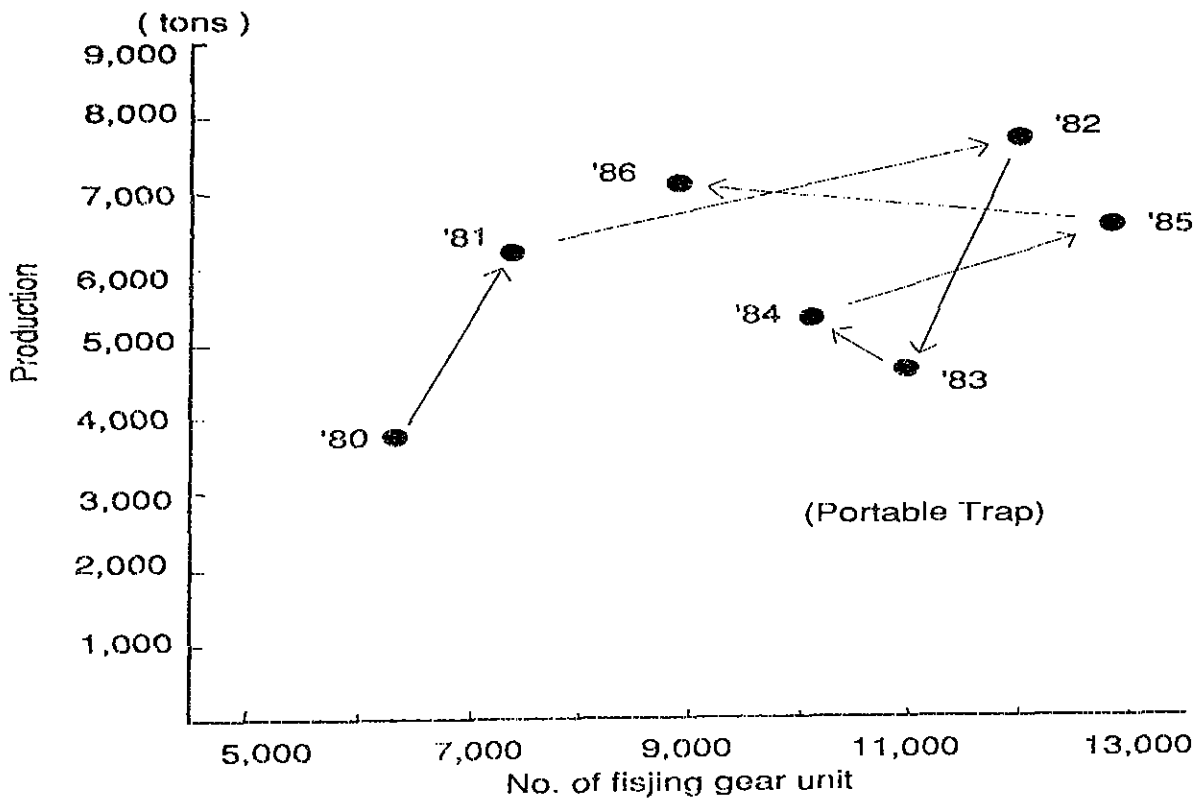
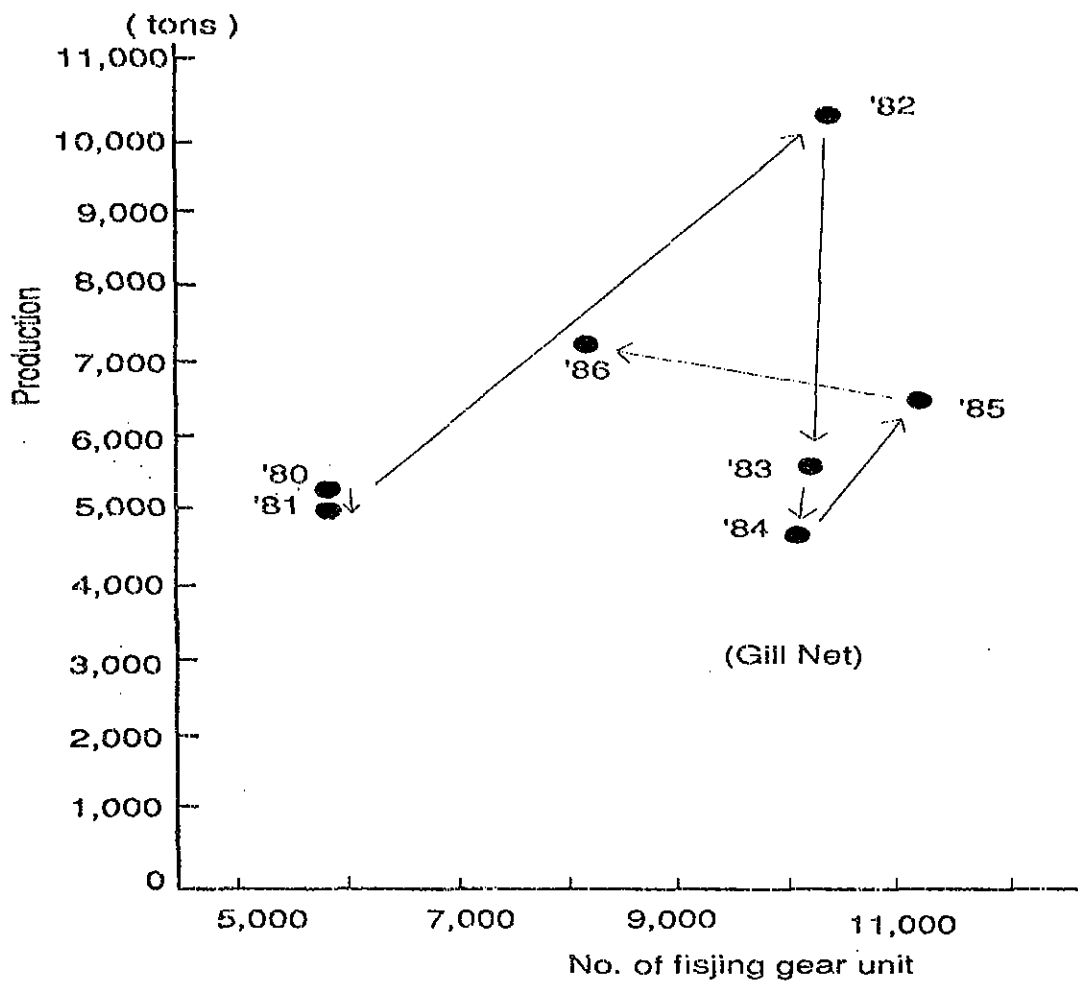


Figure 3.2 Relationship between Number of Fishing Gear Unit and Fish Production for Major Fishing Gear

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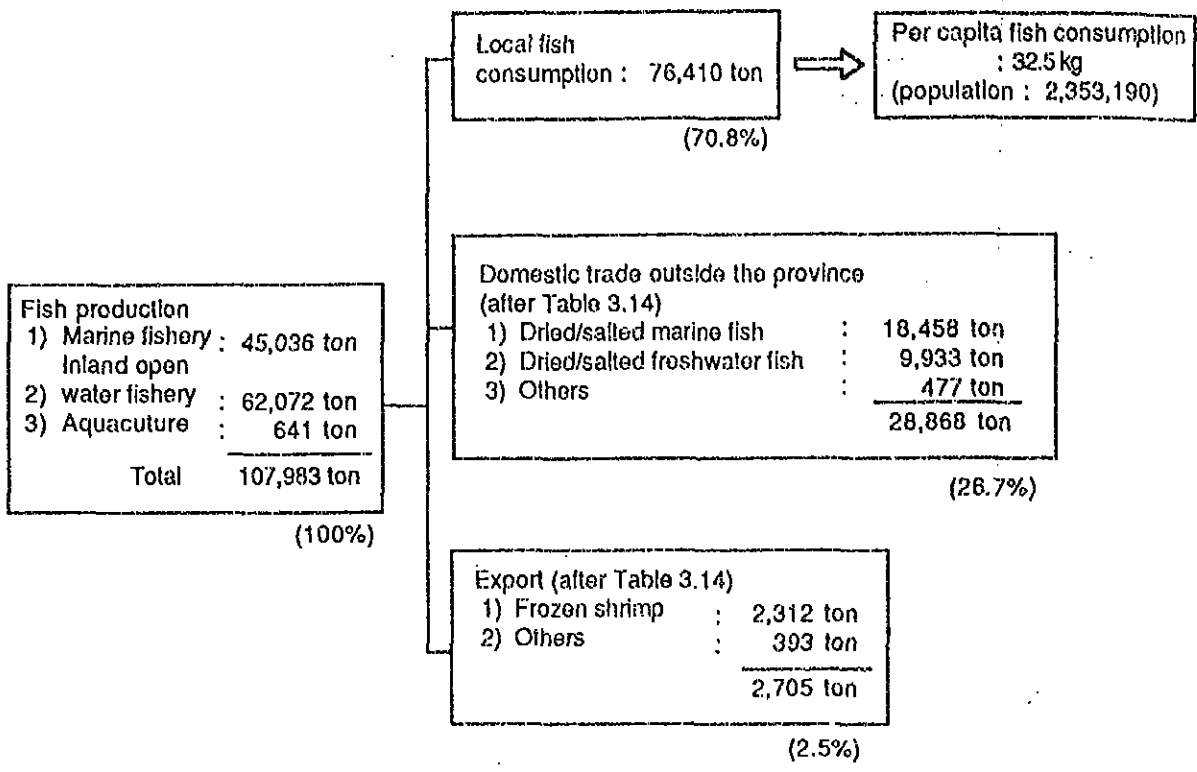
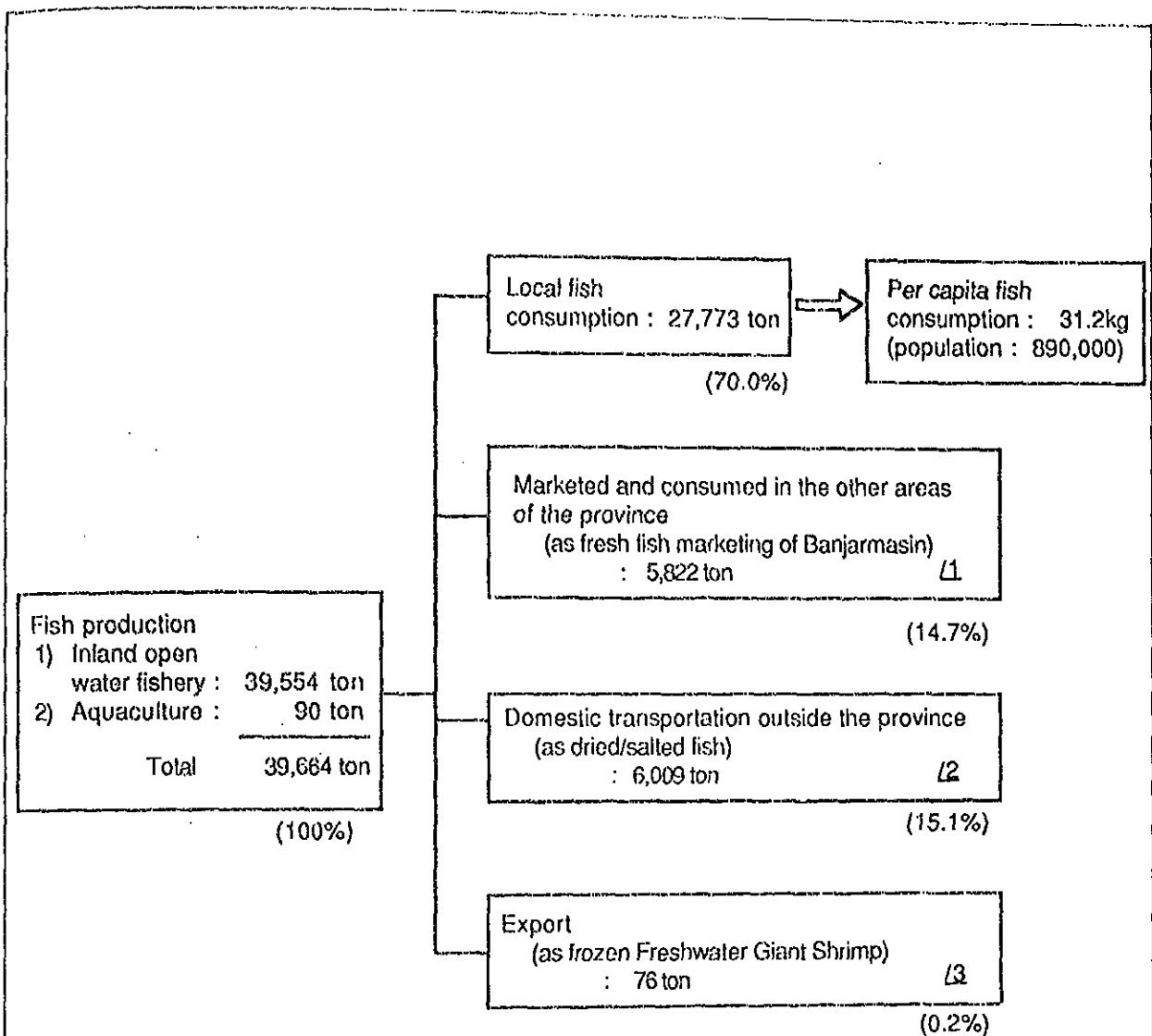


Figure 3.3 Estimated Fish Marketing Structure and Per Capita Fish Consumption of the South Kalimantan Province in 1986

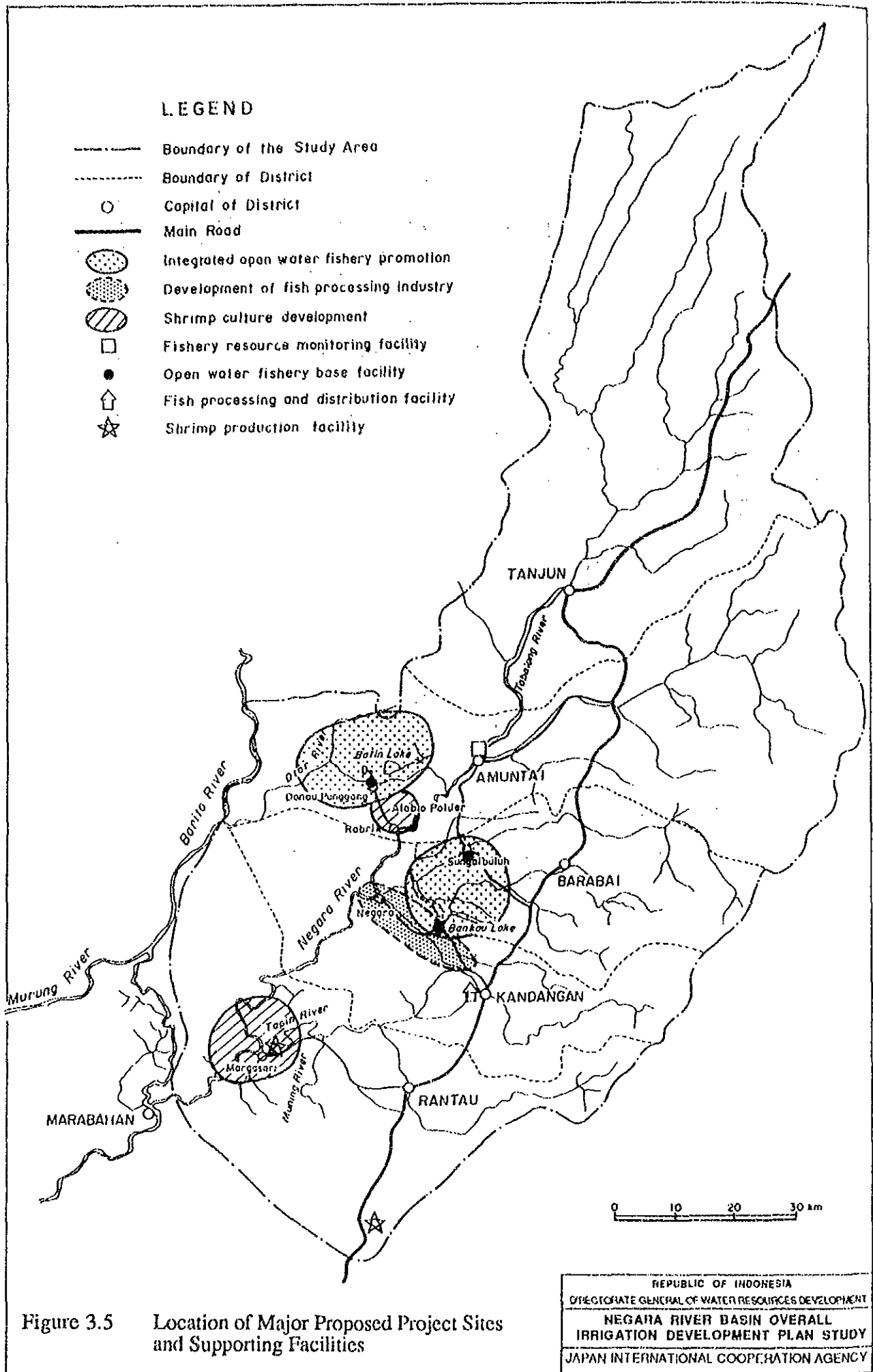
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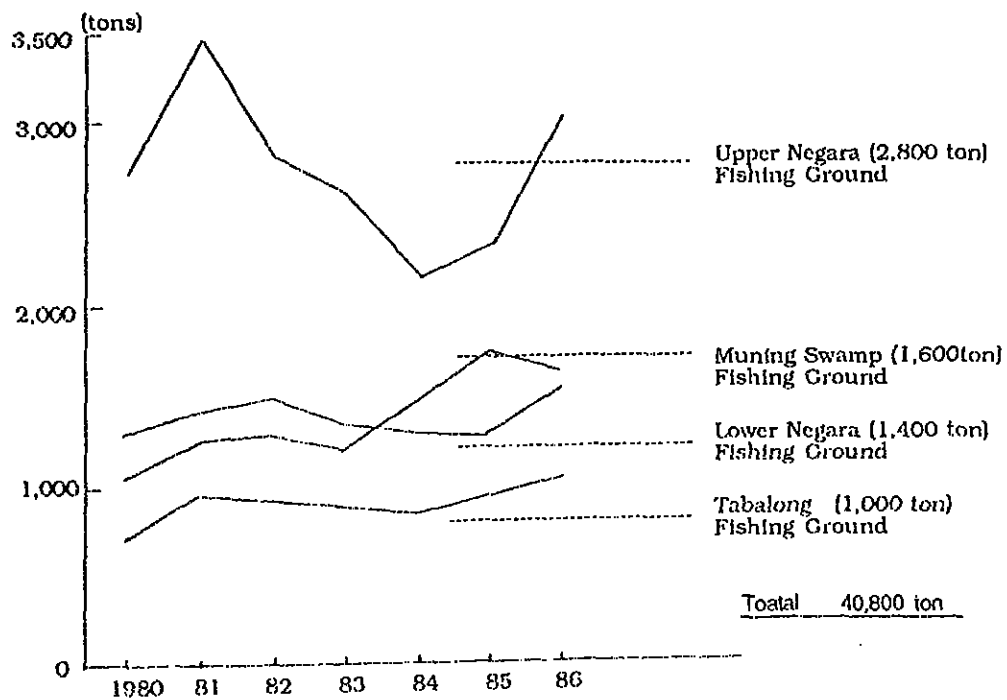
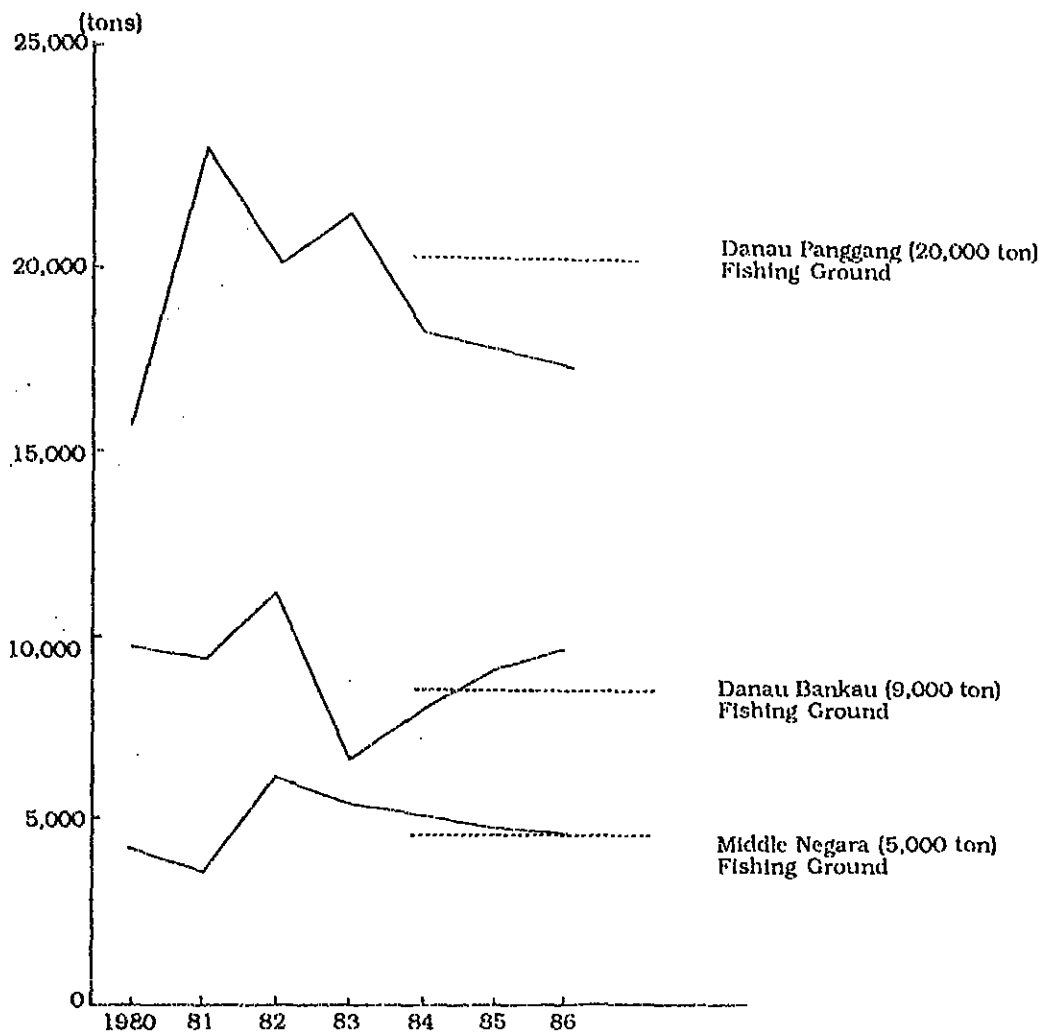




- Remarks:
- ⊃1 Applied 20% of fresh fish marketing volume in the Study Area (refer to Table 3.12)
  - ⊃2 Applied 60.5% of domestic trade volume of dried/salted fish from the province (refer to Table 3.13 and 3.14)
  - ⊃3 Applied 50% of fresh giant shrimp production (refer to Table 3.5)

Figure 3.4 Estimated Fish Marketing Structure and Per Capita Fish Consumption of the Study Area in 1986





Toatal 40,800 ton

Figure 4.1 Judgement of Inland Open Water Fishery Production Potential by Fishing Ground

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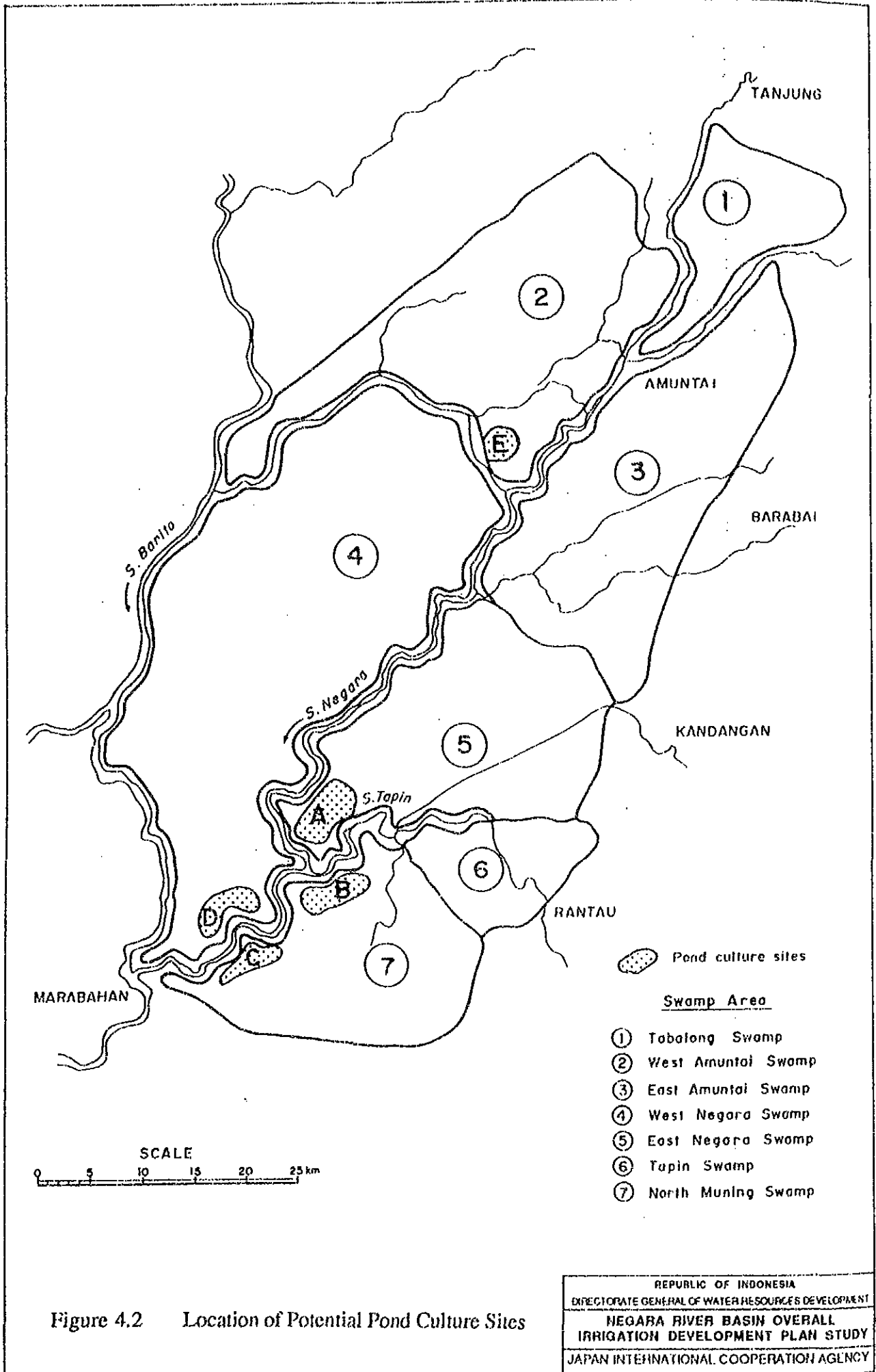


Figure 4.2 Location of Potential Pond Culture Sites

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## ***BIBLIOGRAPHY***



Number in Order	Title	Year Issued	Author/ Organization Issued
I - 01	Existing Power Plants in Wilayah VI of PLN	1988	Wilayah VI of PLN
I - 02	Planned Power Plants in Wilayah VI of PLN	1988	Wilayah VI of PLN
I - 03	Power Demand Forecast by Wilayah VI of PLN	-	Wilayah VI of PLN
I - 04	Existing and Planned Power Transmission Lines in Wilayah VI of PLN and PLN	1988	Wilayah VI of PLN Pusat
I - 05	Recorded Peak Load and Energy Production, Sale and Loss in Wilayah VI of PLN	-	Wilayah VI of PLN
I - 06	Feasibility Report on the Riam Kiwa Hydroelectric Development Project, Main Report	1982	JICA
I - 07	Final Report for Pre-feasibility Study on 21 Hydro Electric Power Development Projects, Volume II, Package-II	1987	Nippon Koei Co.,Ltd.
I - 08	Gambar Jaringan Pipa S/D. 1986/1987 (Layout Plan of Water Supply System in the South Kalimantan Province)	1987	PPSAB Kal.Sel
I - 09	Hasil Penyusunan Laporan Keuangan, Badan Pengelola Air Minum, Kabupaten Daerah Tingkat II, Hulu Sungai Utara (Report on Planning of Water Supply System in Kabupaten Hulu Sungai Utara)	1986	GT. Mahfudz
I - 10	Hasil Penyusunan Laporan Keuangan, Badan Pengelola Air Minum, Kabupaten Daerah Tingkat II, Tabalong (Report on Planning of Water Supply System in Kabupaten Tabalong)	1987	GT. Mahfudz
I - 11	Hasil Penyusunan Laporan Keuangan, Badan Pengelola Air Minum, Kabupaten Daerah Tingkat II, Hulu Sungai Selatan (Report on Planning of Water Supply System in Kabupaten Hulu Sungai Selatan)	1986	GT. Mahfudz
I - 12	Hasil Penyusunan Laporan Keuangan, Badan Pengelola Air Minum, Kabupaten Daerah Tingkat II, Tapin (Report on Planning of Water Supply System in Kabupaten Tapin)	1987	GT. Mahfudz

Number in Order	Title	Year Issued	Author/ Organization Issued
I - 13	Hasil Penyusunan Laporan Keuangan, Badan Pengelola Air Minum, Kabupaten Daerah Tingkat II, Hulu Sungai Tengah (Report on Planning of Water Supply System in Kabupaten Hulu Sungai Tengah)	1987	Swadesi Konsultan
I - 14	Results of Laboratory test for water quality analysis for domestic water	1985/87	Laboratory of Dept. of Health
I - 15	Penyediaan Air Bersih untuk Pedesaan, Buku 1 (View of simple water supply systems)	-	Department of Health
I - 16	List of existing simple water supply systems	-	Department of Health
I - 17	Water Supply Records in a Capital Town of Each Kabupaten	-	PPSAB Kal.Sel
I - 18	Detailed Design, Distribution System for Tambarangan, Kalimantan Selatan, the Water Supply Program for 100 Ibu Kota Kecamatan in Indonesia	1988	Cipta Karya
I - 19	Installation cost of piped water supply systems in Kabupaten Hulu Sungai Selatan and Hulu Sungai Tengah	-	PPSAB H.S.S and H.S.T
I - 20	Water Tariff Table	-	PPSAB Tapin
I - 21	Inventarisasi Jembatan, Propinsi Kalimantan Selatan (List of Existing Bridges in the South Kalimantan Province)	1988	Proyek Penggantian Jembatan Propinsi Kalimantan Selatan
I - 22	Second Highway Betterment Project, Bridge Replacement Programme, Phase IV, Volume IV : Drawing, Package No : 21	1987	Bina Marga
I - 23	Second Highway Betterment Project, Bridge Replacement Programme, Phase IV, Volume IV : Drawing, Package No : 22	1987	Bina Marga
I - 24	Daftar Harga Satuan, Bahan Bangunan Dan Upah Kerja Di Kalimantan Selatan (Basic Price of Construction Materials in the South Kalimantan Province)	1988	Cipta Karya
I - 25	Standard Specification for Geometric Design of Rural Highways	1970	Bina Marga



Number in Order	Title	Year Issued	Author/ Organization Issued
I - 26	The Feasibility Study of the Local Road Development in the Republic of Indonesia, Kabupaten Report 21, Kabupaten Tapin	1986	JICA
I - 27	The Feasibility Study of the Local Road Development in the Republic of Indonesia, Kabupaten Report 22, Kabupaten Hulu Sungai Selatan	1986	JICA
I - 28	The Feasibility Study of the Local Road Development in the Republic of Indonesia, Kabupaten Report 23, Kabupaten Hulu Sungai Tengah	1986	JICA
I - 29	The Feasibility Study of the Local Road Development in the Republic of Indonesia, Kabupaten Report 24, Kabupaten Hulu Sungai Utara	1986	JICA
I - 30	The Feasibility Study of the Local Road Development in the Republic of Indonesia, Kabupaten Report 25, Kabupaten Tabalong	1986	JICA



***ANNEX J***  
***PROJECT EVALUATION***



## ANNEX J PROJECT EVALUATION

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The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This not only helps in tracking expenses but also ensures compliance with tax regulations.

In the second section, the author outlines the process of reconciling bank statements with the company's ledger. It is noted that discrepancies often arise due to timing differences or errors in data entry. Regular reconciliation is crucial to identify and correct these issues promptly.

The third part of the document focuses on budgeting and financial forecasting. It suggests that a well-defined budget can help in controlling costs and identifying areas for potential savings. Additionally, forecasting future financial performance can aid in strategic decision-making.

Finally, the document concludes with a reminder to stay updated on the latest financial trends and regulations. Continuous learning and adaptation are key to maintaining a healthy and profitable financial state.



## 1. INTRODUCTION

This sectoral study report presents the results of economic comparison among the candidate schemes. For the comparison, economic internal rate of return (EIRR), present value of costs (C) and benefits (B), B/C, B-C and (B-C)/ha are calculated for each candidate schemes in order to know its development priority. In the first step of the comparison, screening of schemes is made by the calculated B/C. In the second step, ranking of schemes is carried out by the calculated EIRR and (B-C)/ha.

This report also presents the investment plan formulated for the prior schemes based on the given ranking and the investment scale which is projected in Chapter 4 in Annex A.

In addition, the effect to be accrued from the proposed schemes is also assessed in this report.

## 2. ESTIMATE OF ECONOMIC COST AND BENEFIT

### 2.1 Estimate of Economic Cost

The financial costs of the construction works are estimated in Annex F, G, and H, and are summarized as shown in Tables 2.1, 2.2, 2.3 and 2.4 for the respective irrigation, Drainage, polder and fishery projects. In the estimate of the economic costs, all the financial costs, except for those to be required for land acquisition and the development until the stage of without project condition are taken as forming an economic base cost to which the standard conversion factor (SCF) is applied. The SCF used in the present study is 0.8. By applying the SCF to the said base cost, the economic construction cost is estimated as also shown in Tables from 2.1 to 2.4.

The annual O&M costs in terms of financial prices are estimated at Rp. 30,000/ha for the irrigation project, Rp. 20,000/ha for the drainage and polder projects, Rp. 104,400/ha for the short-term development of fishery project in Alabio, Rp. 176,300/ha for the medium-term development of fishery project in Alabio and Rp. 1,814,500 /ha for the fishery project in Margasari. By applying the SCF of 0.8 to these financial O&M costs, the economic O&M costs are estimated to be as follows:

Irrigation project	:	Rp.	24,000/ha
Drainage and polder projects	:	Rp.	16,000/ha
Fishery Project			
- Short-term development in Alabio	:	Rp.	83,520/ha
- Medium-term development in Alabio	:	Rp.	141,040/ha
- Long-term development in Margasari	:	Rp.	1,451,600/ha

The replacement cost is not taken into account in the present study except for the fishery scheme in Margasari which would have water intake pumps with a financial cost of Rp.

6,000 million for the total area of 2,000 ha. The economic cost of the said intake pumps is estimated to be Rp. 4,800 million by applying SCF of 0.8. This cost is assumed to be required once in each five years during the project life.

## **2.2 Estimate of Economic Benefit**

### **2.2.1 Pricing assumption**

All economic and financial prices of agricultural inputs and outputs in terms of 1988 constant prices are estimated as shown in Tables 2.5 and 2.6.

The economic prices of traded commodities are estimated, based on the recent IBRD projections (Revision of Commodity Price Forecasts and Quarterly Review of Commodity Markets, September 1988), while those not traded internationally are estimated to be the same as the financial prices. These prices are used in the economic comparison of the candidate schemes. In the estimate, the exchange rate between US dollar and Indonesian Rupiah is taken as US\$ 1.0 = Rp. 1,730 based on prevailing market rates at the end of 1988.

Financial prices in 1988 values are estimated based on the prevailing local market prices in the Study Area for the farm budget analyses.

### **2.2.2 Estimate of economic benefit**

The economic benefits from all the schemes would primarily be derived from the increased crop production (or shrimps production) that would be possible once the proposed irrigation and drainage works are completed. These benefits are estimated as the difference between the values of annual net crop production under future with and without project conditions. The net production value is defined as the difference between the gross production value and the crop production cost.

In the estimate, crop budgets are calculated from the crop yields, farm input levels and economic prices. Then, the gross income, production cost and net production return are estimated on a per hectare basis for paddy and palawija (mungbeans as a representative) as well as shrimps to be included in the future with and without project situations. These crop budgets are tabulated as shown in Table 2.7 for the without project situation and Table 2.8 for the with project situation.

The annual net production values under future without and with project conditions are, then, calculated for the 104 candidate schemes including 45 irrigation, 45 drainage, 11 polder and three fishery schemes as shown in Tables from 2.9 to 2.12.

The benefit is estimated as the difference between the annual net production value under without project condition and that under with project condition as also shown in Tables from 2.9 to 2.12.

### 3. ECONOMIC COMPARISON

#### 3.1 Economic Evaluation of Candidate Schemes

Based on the economic costs and benefits estimated in the previous chapter, economic evaluation is made for all the candidate schemes in order to make economic comparison among these schemes. In the evaluation, present value of costs (C) and benefits (B) at discount rate of 10% and economic internal rate of return (EIRR) are calculated, and using the said present values, B/C, B-C and (B-C)/ha are also calculated for each candidate scheme.

For these calculation, the cash flows are prepared based on the following assumptions aiming at the equal comparison among the 104 candidate schemes.

- 1) The project life of irrigation, drainage and polder schemes would be 30 years, and that for fishery schemes would be 15 years.
- 2) The construction works would start in the first year and complete in the third year, and the one third of the works would be completed in each year.
- 3) The benefits would be derived from the fourth year. The build-up period would be taken for four years. The benefits during build-up would increase linearly; 60% of the full benefits in the fourth year, 70% in the fifth year, 80% in the sixth year and 90% in the seventh year.
- 4) The O&M cost would be required from the fourth year for all the area of each candidate scheme.

These assumptions for the preparation of cash flows for irrigation, drainage and polder scheme can be summarized as follows:

Year	Construction Cost	O&M Cost	Benefit
1	33%	-	-
2	33%	-	-
3	33%	-	-
4	-	100%	60%
5	-	100%	70%
6	-	100%	80%
7	-	100%	90%
8	-	100%	100%
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
30	-	100%	100%

The calculated figures on present value of costs and benefits, EIRR, B/C, B-C and (B-C)/ha for each candidate scheme are as shown in Tables 3.1, 3.2 and 3.3.

### 3.2 Selection of Prior Schemes

Using the calculated B/C as an index, the screening of scheme is made. In this screening, the candidate schemes which have B/C more than 1.0 are assumed to be the prior schemes. The result is as shown in Tables 3.1, 3.2 and 3.3. Through the screening, 76 prior schemes are selected as shown below:

Sub-project	Candidate Sub-project	Prior Sub-project	Balance *
a. Irrigation	45	30	15
b. Drainage	45	38	7
c. Polder	11	5	6
d. Fishery	3	3	0
Total	104	76	28

\*: Schemes with lower economic viability

### 3.3 Ranking of Prior Schemes

In order to know the development priority of each scheme, ranking of the above selected prior scheme is carried out. In the first step of ranking, Rank from A to E is given to each scheme according to characteristics of the calculated EIRR and (B-C)/ha as shown below:

Rank	EIRR (%)	(B-C)/ha (Rp. million)
A:	More than 20.1	More than 2.51
B:	18.1 - 20.0	2.01 - 2.50
C:	14.1 - 18.0	1.01 - 2.00
D:	12.1 - 14.0	0.51 - 1.00
E:	Less than 12.0	Less than 0.50

In the second step, the ranking of the schemes from Rank 1 to Rank 5 is made according to the combination of the above evaluated ranks of EIRR and (B-C)/ha as shown below:

Rank	Combination
1:	AA
2:	AB, AC, BB
3:	AD, BC, BD, CC, AE
4:	BE, CD, CE, DD
5:	DE, EE

The result of the ranking is as shown in Tables form 3.4 to 3.7, and the number of prior schemes by ranking can be summarized as follows:

Rank	Prior Schemes in Number				Total
	Irrigation	Drainage	Polder	Fishery	
1:	8	27	1	3	39
2:	11	6	0	0	17
3:	4	3	2	0	9
4:	4	1	1	0	6
5:	3	1	1	0	5
Total	30	38	5	3	76

### 3.4 Alternative Study

Among 104 schemes, some alternative development plans can be formulated from the technical viewpoints. These alternative plans in irrigation schemes are composed of the following cases:

- Case 1 : New scheme
- Case 2 : Irrigation water supply from new scheme to the existing drainage scheme
- Case 3 : Supplemental water supply from new scheme to the existing scheme
- Case 4 : Water source conversion of the existing schemes to be located within the command area of new scheme to newly developed water source for new scheme
- Case 5 : In addition to Case 4, water source conversion of the existing scheme located around the command area of new scheme
- Case 6 : Combination of Case 1, Case 2 and Case 4
- Case 7 : Development of water source regulated by dam for Case 4

New scheme with alternative development plans are Pitap, Batang Alai, Barabai, Amandit and Tapin. The list of alternative development plans for each scheme is as shown in Table 3.8 and summarized below:

Irrigation Scheme	Alternative Development Case						
	1	2	3	4	5	6	7
Pitap	0	0	0	-	-	0	-
Batang Alai	0	0	0	0	-	0	-
Balabai	0	0	-	-	-	-	-
Amandit	0	-	0	0	0	-	0
Tapin	0	0	0	0	0	0	0

For the Case 2, required cost for supplying irrigation water is estimated. Accordingly, overall estimate of cost and benefit is made for the following four combination development plans:

New Irrigation Scheme	Existing Drainage Scheme
Pitap	Batu Mandi
Batang Alai	Tg. Semanggi Kambat
Barabai	Tg. Jaranih
Tapin	Pintu Air

The ranking is made for the respective alternative development cases in due consideration of characteristics of the calculated EIRR and (B-C)/ha as described in Section 3.3. As clearly shown in Tables 3.9 and 3.10, all of alternative development plans indicate lower values of EIRR and (B-C)/ha compared with Case 1 for each new scheme with only one exception which is a combination development plan of Barabai irrigation scheme and Tg. Jaranih drainage scheme.

An alternative plan in drainage schemes is of step-wise development for six new/planned schemes. The economic comparison is made for package and step-wise development plans as follows:

Drainage Scheme	Target Level of Drainage Facilities	
	Package	Step-wise
R. Pinang Kara	Type D	W/O - Type A - Type D
S. Hadangan	Type D	W/O - Type A - Type D
S. Batang Alai	Type D	W/O - Type A - Type D
Tinjau Langit	Type D	W/O - Type A - Type D
R. Muning Extension	Type E	W/O - Type D - Type E
R. Muning 2nd Extension	Type E	W/O - Type D - Type E

W/O = Without project condition

The results of economic comparison reveal that no merit can be expected in promoting step-wise development of the respective new/planned drainage schemes as shown in Table 3.11.

#### 4. DEVELOPMENT PRIORITY AND INVESTMENT PLAN

##### 4.1 Development Priority

According to the above ranking and the recent Government policy to give first priority to the existing projects, 76 schemes are classified into the following seven development priority groups.

Priority	Rank	Development Stage
1:	1	Existing schemes
2:	2	Existing schemes
3:	1	Planned and new schemes
4:	2	Planned and new schemes
5:	3	Existing schemes
6:	3	Planned and new schemes
7:	4 & 5	Existing, planned and new schemes

As a result, the schemes by the development priority group is as shown in Table 4.1 for the irrigation, Table 4.2 for drainage, Table 4.3 for polder and Table 4.4 for all the schemes.

##### 4.2 Investment Plan

###### 4.2.1 Investment to be available

The public investment to be available for the next 30 years in the water resources development in the Study Area is projected in Chapter 4, Annex A. The projection is made for the four cases on the basis of the four different growth rates of public investment, i.e. 10% (Case 1), 7% (Case 2), 5% (Case 3) and 2.5% (Case 4), and the estimated public investment assigned to the Sub-Dinas WRD in water resources development in the Study Area in 1987/88 at 1988 constant prices (Rp. 2,194.5 million).

The projected total investment for the next 30 years presented in Chapter 4, Annex A is summarized as follows:

Case 1:	Rp. 397.0 billion
Case 2:	Rp. 221.8 billion
Case 3:	Rp. 153.0 billion
Case 4:	Rp. 98.7 billion

For the investment planning, these amounts are assumed to be the limits of the investment in the respective cases.

#### 4.2.2 Investment plan

The highest priority is given to the proposed five pilot schemes, i.e. Jaro Bawa irrigation scheme in Kabupaten Tabalong, Alabio polder scheme in Hulu Sungai Utara, Rawa Taras Drainage scheme in Hulu Sungai Tengah, Rawa Negara drainage scheme in Hulu Sungai Selatan, and S. Tapin Gadung Drainage scheme in Tapin. The investment for these schemes with the total construction cost of Rp. 17,639 million is assumed to be done during the period of Repelita V in all the four cases.

In addition to the investment in the pilot schemes, the estimated investment of Rp. 2,194.5 million in the base year of 1987/88 is assumed to be available in every year during the period of Repelita V in all the four cases. Accordingly, the total investment would be Rp. 28,612 million during the Repelita V for all the cases.

The investment to be available for the remaining 25 years from Repelita VI to Repelita X is, then, calculated based on the assumption that the investment would increase in an arithmetic progression to the extent of the above mentioned limits in the four cases.

As a result, the public investment to be available in the water resources development in the Study Area for the respective Repelita periods would be as follows:

(Unit: Rp. million)

	Repelita V	Repelita VI	Repelita VII+VIII	Repelita IX+X	Total
Case 1	28,612	15,940	81,778	270,750	397,080
Case 2	28,612	14,190	54,203	124,800	221,805
Case 3	28,612	13,049	40,330	71,099	153,090
Case 4	28,612	11,593	26,612	31,936	98,753

The investment to be available in each Kabupaten is estimated based on the ratio of the total construction cost of prior schemes in each Kabupaten to that in the Study Area. Such ratio is estimated as follows:

	Tabalong	H.S.U	H.S.T	H.S.S	Tapin	Total
Construction Cost (Rp.10 <sup>6</sup> )	15,496	73,609	72,798	87,443	108,283	357,629
Ratio of investment (total=100)	4.3	20.6	20.4	24.4	30.3	100.0



By applying the above estimated ratio to the total investment to be available in each Repelita period, the investment for each Kabupaten is estimated for all the four cases as shown in Table 4.5. Based on this, the investment plans for Case 1, Case 2, Case 3 and Case 4 are prepared as shown in Tables from 4.6 to 4.9.

## 5. EFFECT ACCRUED FROM THE PROPOSED SCHEMES

### 5.1 Incremental Paddy Production

The implementation of project would provide a basis on increasing unit yield and expansion of farm land with improved facilities through the proposed irrigation and drainage works. As a result, crop production would increase in proportion to the implementation.

The table below shows the incremental and total paddy production at the end of Repelita X (2018) and increase rate during the period from 1985 to 2018 to be expected in each case of investment plan.

	Base Year Produc.1985 (tons)	Incremental Produc.2018 (tons)	Total Produc.2018 (tons)	G. Rate 1985-2018 (% p.a.)
Case 1	417,500	462,560	880,060	2.29
Case 2	417,500	221,530	639,030	1.30
Case 3	417,500	196,480	613,980	1.18
Case 4	417,500	124,950	542,450	0.80

According to the food balance projection presented in Chapter 4, Annex A, the paddy production in the Study Area would increase with the growth rate of 2.05% p.a. during the period from 1985 to 2018 and attained 815,600 tons (554,600 tons of rice) in 2018, while the paddy demand in the Study Area would be 261,900 tons (178,100 tons of rice) in 2018, and the surplus in that year would be 553,700 tons (376,500 tons of rice). The result of food balance projection also presents that such paddy surplus in the Study Area would cover the local demands in the neighbor provinces of South Kalimantan, i.e. East and Central Kalimantan.

Accordingly, the paddy production in Case 1 would exceed the demand in Kalimantan as a whole and the excess of 64,470 tons (43,840 tons of rice) would flow out to the other paddy deficit regions in Indonesia, e.g. Jakarta. (According to the food balance projection, Indonesia would have paddy deficit of about 3,654,000 tons in 2018).

The incremental paddy production in Case 2, Case 3 and Case 4 would not be able to cover the demand in Kalimantan in 2018. Such shortage in Kalimantan would be 176,570 tons

(120,080 tons of rice) in Case 2, 201,620 tons (137,100 tons) in Case 3 and 273,150 tons (185,740 tons) in Case 4.

## **5.2 Incremental Employment Opportunity**

The implementation of schemes would create an additional demand for farm labor requirement to be accrued from increased farming activities due to intensive use of the land and its high productivity.

The incremental farm labor requirement in 2018 is estimated at 24.0 million man-days in Case 1, 15.1 million man-days in Case 2, 13.3 million man-days in Case 3 and 8.3 million man-days in Case 4 as shown in Table 5.1.

On the assumption that one labor would work 290 man-days per annum, the said incremental farm labour requirement would provide incremental employment opportunity for about 82,800 persons in Case 1, 52,200 persons in Case 2, 45,700 persons in Case 3 and 28,500 persons in Case 4 in 2018. By applying the ratio (0.4) of working population to total population in the Study Area projected for 2018 directly to the said number of population, the population which contains such incremental employment is calculated to be 207,000 in Case 1, 130,500 in Case 2, 114,250 in Case 3 and 71,300 in Case 4 in 2018. By adding this population to the projected population of about 1,102,000 in 2018 under without project condition, the population in 2018 in the respective cases are to be 1,309,000 in Case 1, 1,232,500 in Case 2, 1,216,300 in Case 3 and 1,173,300 in Case 4. Accordingly, the population increase rate during the period from 1985 to 2018 in each case is calculated to be 1.18% p.a. in Case 1, 0.99% p.a. in Case 2, 0.95% in Case 3 and 0.84% in Case 4, while that under without project condition is projected to be 0.65% p.a. (from 890,000 in 1985 to 1,102,000 in 2018 as presented in Chapter 4, Annex A).

As a result, it can be said that the implementation of the proposed project would prevent the population outflow from the Study Area.

## **5.3 Improvement of Farmers' Economy**

The farmers' income would be expected to improve considerably as a direct result of the increase of crop production under with project condition. In order to assess the degree of such improvement, the farm budget analysis is made for the typical farmers both under the future with and without project conditions. The analysis is made for two typical farmers; a farmer in the Rawa Negara Drainage scheme with 1.0 ha of farm land and a farmer in the Jaro Bawa Irrigation scheme with 0.5 ha of farm land as shown in Table 5.2.

As seen in the table, the farm income of typical farmer under with project condition would increase 4.5 times of that under without project condition in the Rawa Negara Drainage scheme and 4.4 times in the Jaro Bawa Irrigation scheme. The net income of typical farmer under with project condition would also increase about 1.4 times of that under without project condition in both in the schemes. As a result, the net reserve of typical farmers

would be expected to be improved from subsistence level under without project condition to Rp. 560,000 in the Rawa Negara Drainage scheme and Rp. 457,000 in the Jaro Bawa Irrigation scheme.

#### 5.4 Foreign Exchange Savings

As already mentioned in Section 5.2, the incremental paddy production in 2018 would be 462,560 tons per annum in the Case 1 development, 221,530 tons in Case 2, 196,480 tons in Case 3 and 124,950 tons in Case 4. By applying the estimated CIF price of rice (US\$ 243/ton) at 1988 constant prices to the said increment in each case, the foreign exchange savings in 2018 would be US\$ 76.4 million in Case 1, US\$ 36.6 million in Case 2, US\$32.5 million in Case 3 and US\$ 20.6 million in Case 4 as shown below:

	Incremental		CIF Price (US\$/ton)	Foreign Exchange Savings (US\$ MN)
	Paddy (1000 tons)	Rice * (1000 tons)		
Case 1	462.6	314.5	243	76.4
Case 2	221.5	150.6	243	36.6
Case 3	196.5	133.6	243	32.5
Case 4	125.0	85.0	243	20.6

\*: Milling rate of 0.68 is applied.

In addition, shrimps to be produced in the proposed fishery project would bring about US\$39.0 million of export earnings in Case 1, US\$7.8 million in Case 2 and Case 3 and US\$0.3 million in Case 4.

