

Table 2.8 Percentage of Gainful Workers 15 Years Old and Over in Region II-B to Those in the Philippines

Industry Group	Percentage (%)		
	1970	1975	1980
Total	5.0	4.5	4.5
Agriculture, Fishery, & Forestry	7.3	6.4	6.4
- Agriculture	7.7	6.9	6.9
- Fishery	1.2	1.2	1.0
- Forestry	6.7	6.0	11.6
- Others	7.2	8.5	14.3
Industry	2.1	2.0	1.9
- Mining & Quarrying	0.6	2.0	1.5
- Manufacturing	2.1	2.0	1.6
- Construction	2.4	2.3	2.5
- Electricity, Gas & Water	1.6	1.1	2.3
Services	2.6	2.5	2.7
- Transportation	2.4	2.4	2.5
- Commerce	2.3	2.2	2.1
- Service	2.7	2.7	3.1
Industry not Adequately Described	2.4	3.5	4.5

Source : EC-333 to EC-357

Table 2.9 Gross Domestic Product at Current Prices

Year	Gross Domestic Product			Gross Regional Domestic Product (Region II)			Percentage Share of Region II to the National Total (%)	Difference Between The Two Per Capita Values (£)	Ratio of Two Per Capita Values (%)	
	GDP		GDP Per Capita	GDP		GDP Per Capita				
	Amount (£10 ⁶)	Growth Rate (%)		Amount (£10 ⁶)	Growth Rate (%)					
1972	56,075	-	1,440	1,805	-	1,007	-	3.22	433	69.9
1973	71,786	28.0	1,794	2,408	33.4	1,308	29.9	3.35	486	72.9
1974	99,638	38.8	2,423	3,144	30.6	1,863	42.4	3.16	560	76.9
1975	114,603	15.0	2,712	3,028	-3.7	1,559	-16.3	2.64	1,153	57.5
1976	133,928	16.0	3,085	3,832	26.6	1,920	23.2	2.86	1,165	62.2
1977	155,631	16.2	3,491	4,297	12.1	2,095	9.1	2.76	1,296	60.0
1978	178,603	14.8	3,900	5,105	18.8	2,421	15.6	2.86	1,479	62.1
1979	220,477	23.4	4,687	6,510	27.5	2,913	20.3	2.95	1,774	62.2
1980	266,008	20.5	5,505	7,685	18.1	3,443	18.2	2.89	2,062	62.5
1981	305,274	14.8	6,165	8,800	14.5	3,858	12.1	2.88	2,307	62.6
1982	340,357	11.5	6,702	9,533	8.3	4,058	5.2	2.80	2,644	60.5
1983	380,821	11.9	7,312	10,790	13.2	4,505	11.0	2.83	2,807	61.6
1984	548,471	44.0	10,280	14,504	34.4	5,898	30.9	2.64	4,382	57.4

Source: EC-303

Table 2.10 Gross Domestic Product at 1972 Constant Prices

Year	Gross Domestic Product			Gross Regional Domestic Product (Region II)			Percentage Share of Region II to the National Total (%)	Difference Between The Two Per Capita Values (£)	Ratio of Two Per Capita Values (%)
	GDP			GRDP					
	Amount (£10s)	Growth Rate (%)	GRDP Per Capita	Amount (£10s)	Growth Rate (%)	GRDP Per Capita			
1972	56,075	-	1,450	1,805	-	1,007	3.22	443	69.4
1973	60,931	8.7	1,531	2,062	14.2	1,120	3.38	411	73.2
1974	64,135	5.3	1,564	1,999	-3.1	1,057	3.12	507	67.6
1975	68,361	6.6	1,622	1,788	-10.6	921	2.62	701	56.8
1976	72,962	6.7	1,703	2,060	15.2	1,032	2.82	671	60.6
1977	77,990	6.9	1,760	2,185	6.0	1,065	2.80	695	60.5
1978	82,797	6.2	1,808	2,332	6.7	1,106	2.82	702	61.2
1979	88,346	6.7	1,840	2,589	11.0	1,195	2.93	675	63.9
1980	92,706	4.9	1,917	2,615	1.0	1,174	2.82	743	61.2
1981	96,207	3.8	1,942	2,697	3.3	1,181	2.80	761	60.8
1982	99,097	3.0	1,950	2,640	-2.1	1,128	2.66	822	57.8
1983	100,068	1.1	1,921	2,585	-2.1	1,078	2.58	843	56.1
1984	95,555	-4.7	1,791	2,360	-8.7	960	2.47	831	53.6

Source: EC-303

Table 2.11 Gross Domestic Product by Industrial Origin in the Philippines at 1972 Constant Prices

Industrial Group	Gross Domestic Product (in 10 ⁶ pesos)					Annual Growth Rate (%)				
	1980	1981	1982	1983	1984	'80-'81	'81-'82	'82-'83	'83-'84	'80-'84
Total	92,706	96,207	99,097	100,088	95,555	3.78	3.00	0.98	-4.51	0.76
Agriculture, Fishery and Forestry	23,732	24,608	25,378	24,845	25,045	3.69	3.13	-2.10	0.80	1.35
- Agriculture	14,996	15,418	15,915	15,079	15,594	2.81	3.22	-5.25	3.42	0.98
• Paddy	4,169	4,307	4,544	3,953	4,172	3.31	4.20	-13.10	6.97	0.02
• Corn	1,447	1,494	1,544	1,403	1,469	3.25	1.81	-9.73	6.99	0.38
• Coconut	1,313	1,396	1,430	1,298	952	6.32	-6.52	-7.36	-21.26	-7.72
• Sugar cane	1,322	1,337	1,402	1,256	1,319	1.13	15.48	-27.40	17.66	-0.06
• Banana	2,402	2,356	2,358	2,393	2,550	-1.91	0.08	1.48	6.56	1.51
• Others	4,343	4,528	4,637	4,776	5,132	4.26	4.09	5.22	3.49	4.26
- Livestock	1,841	1,925	2,017	2,170	2,161	4.56	4.83	7.58	-0.46	4.09
- Poultry	1,633	1,958	2,192	2,481	2,587	19.90	12.00	13.18	4.23	12.19
- Fishery	3,876	4,132	4,314	4,417	4,032	6.60	4.40	2.39	-8.72	0.99
- Forestry	1,386	1,175	940	698	671	-15.22	-16.34	-16.68	-18.07	-16.59
Industry	33,471	34,963	35,812	35,955	32,159	4.46	2.43	0.40	-10.56	-0.99
- Mining and Quarrying	2,236	2,175	2,016	1,966	1,775	-2.73	-7.31	-2.48	-9.72	-5.61
- Manufacturing	23,175	23,959	24,535	25,108	23,318	8.04	2.40	2.34	-7.13	0.15
- Construction	7,139	7,830	8,177	7,689	5,866	9.68	4.43	-5.97	-23.71	-4.79
- Electric, Gas & Water	921	999	1,084	1,192	1,219	8.47	8.51	9.96	2.27	7.26
Services	35,503	36,636	37,907	39,268	38,351	3.19	3.47	3.59	-2.34	1.95
- Transportation	4,827	5,040	5,165	5,266	5,029	4.41	2.48	1.96	-4.50	1.03
- Commerce	19,345	19,695	20,355	21,656	21,455	1.81	3.35	6.39	-0.09	2.62
- Service	11,331	11,901	12,387	12,346	11,867	5.03	4.08	-0.33	-3.88	1.16

Source : EC-303

Table 2.12 Gross Regional Domestic Product by Industrial Origin in Region II at 1972 Constant Prices

Industrial Group	Gross Regional Domestic Product (in 10 ⁶ pesos)					Annual Growth Rate (%)				
	1980	1981	1982	1983	1984	'80-'81	'81-'82	'82-'83	'83-'84	'80-'84
Total	2,615	2,697	2,640	2,586	2,360	2.94	-2.11	-2.05	-8.74	-2.58
Agriculture, Fishery and Forestry	1,160	1,180	1,116	1,173	1,172	1.72	-5.42	5.11	-0.09	9.26
- Agriculture	781	812	716	697	747	3.97	3.97	-11.82	1.75	-1.11
. Paddy	438	451	431	441	448	2.97	-4.43	2.32	1.59	0.57
. Corn	99	109	123	99	130	8.08	12.84	-19.51	31.31	7.05
. Coconut	8	9	11	6	5	12.50	22.22	-45.45	-16.67	-11.09
. Sugar cane	0	0	0	0	0	0	0	0	0	0
. Banana	48	47	28	31	34	-2.08	-40.43	10.71	9.68	-8.26
. Others	189	196	123	120	129	3.70	-37.24	-2.44	7.50	-9.11
- Livestock	60	69	90	98	102	15.00	30.43	8.89	4.08	14.19
- Poultry	70	85	109	124	129	21.43	28.24	13.76	4.03	16.51
- Fishery	16	17	17	18	16	6.25	0	5.88	-11.11	0
- Forestry	233	197	184	237	178	-15.45	-6.80	28.80	-24.89	-6.51
Industry	672	709	718	570	348	5.51	1.27	-20.61	-38.95	-15.17
- Mining and Quarrying	7	29	31	12	48	314.29	6.90	-61.29	300.00	61.82
- Manufacturing	112	114	117	120	111	1.79	2.63	2.56	-7.50	-0.22
- Construction	543	555	557	423	173	2.21	0.36	-24.06	-59.10	-24.87
- Electric, Gas & Water	10	12	13	14	16	20.00	8.33	7.69	14.29	12.47
Services	788	808	806	842	840	2.54	-0.25	4.47	-0.24	1.61
- Transportation	43	45	46	46	45	4.65	2.22	0	-2.17	1.14
- Commerce	462	468	474	507	510	1.30	1.28	6.96	0.59	2.50
- Service	283	296	286	289	286	4.59	-3.38	1.05	-1.04	0.26

Sources: EC-319 and EC-359

Table 2.13 Gross Domestic Product by Expenditures Shares at 1972 Constant Prices

Type of Expenditure	1980		1981		1982		1983		1984		Average Annual Growth Rate '80-'84 (%)
	Amount (£10 ⁶)	Percentage Share (%)	Amount (£10 ⁶)	Percentage Share (%)	Amount (£10 ⁶)	Percentage Share (%)	Amount (£10 ⁶)	Percentage Share (%)	Amount (£10 ⁶)	Percentage Share (%)	
1. Personal Consumption Expenditure	59,270	63.91	61,617	64.05	63,535	64.11	64,472	65.39	66,033	69.14	2.76
2. General Government Consumption Expenditure	8,266	8.92	8,598	8.94	9,145	9.23	9,084	9.07	7,991	8.37	-0.84
3. Gross Domestic Capital Formation	26,609	28.72	27,220	28.29	26,418	26.66	25,250	25.22	15,851	16.60	-12.15
A. Fixed Capital Formation	22,737	85.45	23,542	86.49	23,838	90.23	23,186	91.83	16,541	104.35	-7.65
1) Construction	11,123	48.92	12,045	51.16	12,672	53.16	12,013	51.81	9,446	57.11	-4.00
a. Government	4,860	43.69	5,243	43.53	5,510	43.48	4,327	36.02	2,985	31.60	-11.47
b. Private	6,263	56.31	6,802	56.47	7,162	56.52	7,686	63.98	6,461	68.40	0.78
2) Durable Equipment	11,614	51.08	11,497	48.84	11,166	46.84	11,173	48.19	7,095	42.89	-11.59
B. Increase in Stocks	3,872	14.55	3,678	13.51	2,580	9.77	2,064	8.17	(690)	(4.35)	-
4. Exports of Goods and Non-factor Services	18,148	19.59	17,947	18.65	17,486	17.65	17,779	17.76	20,841	21.82	3.52
5. Less Imports of Goods and Non-factor Services	(19,450)	(20.99)	(18,854)	(19.60)	(19,510)	(19.69)	(19,114)	(19.09)	(18,540)	(19.41)	-
6. Statistical Discrepancy	(137)	(0.15)	(321)	(0.33)	2,023	2.04	2,587	1.65	3,379	3.48	-
Total	92,706	100.0	96,207	100.0	99,097	100.0	100,068	100.0	95,555	100.0	0.74

Source : EC-303

Table 2.14 Value Added Coefficient Induced by Construction Investment in the Philippines

No.	Sector	Inverse Coefficient	Value Added Coefficient	Value Added Inducement Coefficient
01	Crops, Livestock and Poultry	0.025186	0.825875	0.020801
02	Fishery	0.001015	0.868135	0.000881
03	Forestry and Logging	0.025133	0.785312	0.019737
04	Mining and Quarrying	0.079910	0.675340	0.053966
05	Food Manufactures	0.017856	0.254297	0.004541
06	Other Manufactures	0.540392	0.371091	0.200535
07	Construction	1.008290	0.578291	0.583085
08	Electricity, Gas and Water	0.007885	0.600480	0.004735
09	Transportation, Communication and Storage	0.051056	0.821206	0.041928
10	Trade	0.054885	0.817860	0.044888
11	Banking, Insurance and Real Estate	0.013877	0.817860	0.011349
12	Other Services	0.035156	0.731229	0.025707
Total		1.860641	-	1.012153

Source : EC-301

Table 2.15 Labor Productivity at 1972 Constant Prices

(Unit: ₱/Worker)

Year	Philippines	Region II	% Share of Region II to Philippine Value
1980	5,531	3,005	54.3
1981	5,487	2,999	54.7
1982	5,653	3,017	53.4
1983	5,126	2,434	47.5
1984	4,884	2,348	40.1

Note: Labor productivity is total output per unit of labor input.

Source: EC-359

Table 2.16 Average Family Income and Expenditure

(Unit: Pesos)

Year	Philippines		Region II		Difference		Ratio (%)
	Income	Expenditure	Income	Expenditure	Income	Expenditure	
	Surplus (Deficit)		Surplus (Deficit)		Income Expenditure		Income Expenditure
1961	1,804	1,793	11	-81	562	470	68.8 73.8
1965	2,541	2,877	-336	-413	908	831	64.3 71.1
1971	3,736	4,479	-743	-788	437	392	88.3 91.2
1975	6,698	6,742	-44	284	663	991	90.1 85.3
1985	30,748	26,714	4,034	4,332	3,826	4,124	87.6 84.6

Source: EC-302 & EC-388

Table 2.17 Average Family Expenditures by Expenditure Group : 1975

Expenditure Group	Philippines		Region II		Difference	Percentage Share of Region II to Philippines
	Amount (P)	Percentage Distribution (%)	Amount (P)	Percentage Distribution (%)		
Total	6,742	100.0	5,751	100.0	991	85.3
- Food, Beverage & Tobacco	3,620	53.7	3,267	56.8	353	90.2
- Housing	661	9.8	518	9.0	143	78.4
- Fuel, Light & Water	317	4.7	247	4.3	70	77.9
- Household Furnish & Equipment	148	2.2	138	2.4	10	93.2
- Household Operation	148	2.2	127	2.2	21	85.8
- Clothing & Other Wear	533	7.9	529	9.2	4	99.2
- Personal Care	128	1.9	103	1.8	25	80.5
- Medical Care	121	1.8	109	1.9	12	90.1
- Transportation & Communication	263	3.9	178	3.1	85	67.7
- Recreation	115	1.7	63	1.1	52	54.8
- Education	256	3.8	173	3.0	83	67.6
- Gifts & Contributions	27	0.4	17	0.3	10	63.0
- Taxes Paid	94	1.4	17	0.3	77	18.1
- Special Occasions	135	2.0	132	2.3	3	97.8
- Personal Effects	61	0.9	46	0.8	15	75.4
- Miscellaneous Goods & Services	101	1.5	81	1.4	20	80.2

Source: EC303

Table 2.18 Price Index : 1972-1985

(1972 Price=100)

Year	Consumer Price		Construction Cost	
	Philippines	Region II	Philippines	Region II
1972	100.0	100.0	100.0	100.0
1973	116.5	114.6	118.2	-
1974	156.3	153.8	189.3	-
1975	166.9	165.9	190.4	-
1976	182.3	180.1	205.5	-
1977	200.4	194.9	221.3	-
1978	215.0	207.4	241.3	241.3
1979	250.5	239.5	289.1	289.2
1980	294.7	285.4	335.9	335.9
1981	331.1	326.9	381.8	381.8
1982	372.4	356.1	410.5	410.3
1983	391.7	376.4	451.5	451.5
1984	615.8	588.0	673.6	678.0
1985	759.9	-	798.3	-
1986/1	770.7	-	-	-

Note : /1 Mean average between January and June

Sources : EC-303, EC-319 and EC-388

Table 2.19 Foreign Exchange Central Rate

(Unit : ₱/US\$1.00)

Year	Central Rate	Year / Month	Central Rate
1972	6.67	1985/1	18.72
1973	4.74	January	19.12
1974	6.78	February	18.71
1975	7.24	March	18.66
1976	7.44	April	18.65
1977	7.40	May	18.64
1978	7.37	June	18.63
1979	7.38	July	18.65
1980	7.51	August	18.69
1981	7.90	September	18.69
1982	8.54	October	18.73
1983	11.11		
1984	16.70		

Note : /1 Mean average between January and October

Source : Central Bank of the Philippines

Table 2.20 Infrastructure Actual Disbursement by Sector

(Unit : 10⁶ Pesos)

Sector	1980		1981		1982		1983		1984	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
1. Transportation	2,232	19.0	2,978	22.0	4,385	27.6	2,967	18.3	3,186	22.0
2. Communication	11	0.1	26	0.2	105	0.7	144	0.9	29	0.2
3. Water Resources	2,514	21.4	3,141	23.2	3,577	22.6	2,528	15.6	2,680	18.5
1) Irrigation/NLA	1,541	13.1	1,737	12.8	1,806	11.4	1,254	7.7	1,162	8.0
2) Irrigation/FSDC	50	0.4	108	0.8	112	0.7	50	0.3	19	0.1
3) Water Supply/MWSS	289	2.5	672	5.0	902	5.7	847	5.2	1,076	7.4
4) Water Supply/LWUA	157	1.3	225	1.7	194	1.2	129	0.8	121	0.8
5) Water Supply/MPWH	56	0.5	79	0.6	133	0.8	107	0.7	171	1.8
6) Flood Control/MPWH	421	3.6	320	2.4	430	2.7	141	0.9	131	0.9
4. Power & Electrification	6,332	53.8	6,842	50.1	7,207	45.4	9,931	61.3	8,106	55.8
1) Power Development	5,679	48.3	5,970	44.0	6,470	40.8	9,174	56.6	7,668	52.8
/NAPOCOR										
2) Rural Electrification	653	5.5	872	6.4	737	4.6	757	4.7	438	3.0
/NEA										
5. Social Infrastructure	475	4.0	450	3.3	533	3.4	499	3.1	355	2.4
6. Miscellaneous Project	204	1.7	122	0.9	55	0.3	122	0.8	160	1.1
Total	11,768	100.0	13,559	100.0	15,862	100.0	16,191	100.0	14,516	100.0

Sources : EC-311 to EC-315

Table 2.21 Standard Conversion Factor (SCF)

(Unit: 10⁶ Pesos)

Item	1980	1981	1982	1983
Value of imports (C.I.F.) (M)	42,867	44,749	42,417	55,307
Value of exports (F.O.B.) (X)	62,280	66,608	70,106	87,677
Value of trade (M+X)	105,147	111,357	112,523	142,984
Average import-tariff	11,027	10,866	11,613	12,108
Average export duty	473	254	300	263
SCF ¹	0.909	0.913	0.909	0.923
- Four year average of SCF				0.914
- <u>SCF</u> (allowing for non-tariff restriction)				<u>0.820</u>

Note : ¹ $SCF = (M + X) / [M(1 + t_m) + X(1 - t_x)]$

where t_m : the average tax rate on imports

t_x : the average tax rate on exports

Sources : EC-305 to EC-309, EC-348 and EC-388

Reference : UN Paper "Philippines; Social, Cost-Benefit Analysis
Estimates of Shadow Prices and Country Parameters"

Table 2.22 Agricultural Land Utilization and Production in Region II

Crops	1982				1983					
	Planted Area		Production		Planted Area		Production			
	(km ²)	(%)	(10 ³ t)	(%)	(t/ha)	(km ²)	(%)	(10 ³ t)	(%)	(t/ha)
Food Crops	7,263	95.1	1,282	93.0	1.8	7,624	95.8	1,358	95.2	1.8
Paddy (rough)	3,609	47.1	838	60.8	2.3	3,894	49.0	932	65.4	2.4
Corn (Shelled)	2,975	38.9	252	18.3	0.9	3,108	39.1	257	18.0	0.8
Fruits & Nuts	120	1.6	69	5.0	5.8	120	1.5	61	4.3	5.1
Root Crops	118	1.5	58	4.2	4.9	115	1.4	55	3.4	4.8
Vegetables	21	0.3	13	0.9	6.2	21	0.3	13	0.9	6.2
Peanut	283	3.7	23	1.7	0.8	239	3.0	14	1.0	0.6
Others	137	1.8	28	2.0	2.0	127	1.6	25	1.8	2.0
Commercial Crops	376	4.9	96	7.0	2.6	331	4.2	69	4.8	2.1
Coconuts	69	0.9	31	2.2	4.6	67	0.8	18	1.3	2.7
Sugar cane (raw)	105	1.4	49	3.6	4.7	105	1.3	41	2.9	3.9
Tobacco	175	2.3	13	0.9	0.7	151	1.8	9	0.6	0.6
Others	29	0.4	3	0.2	1.0	8	0.1	-	-	-
Total	7,640	100.0	1,378	100.0	1.8	7,995	100.0	1,426	100.0	1.8

Sources : EC-303 and EC-359

Table 2.23 Production and Sufficiency of Food Commodities, Livestock, Poultry and Fish : 1982

Commodity	Philippines				Region II			Percentage Share of Net Supply (%)	
	Net Supply (10 ³ t)	Require-ment (10 ³ t)	Difference (10 ³ t)	Suffi-ciency (%)	Net Supply (10 ³ t)	Require-ment (10 ³ t)	Difference (10 ³ t)		
Food Commodities									
Grains	7,597.71	7,340.99	256.72	103.5	631.31	303.64	327.67	207.9	8.3
Fruits & Vegetables	6,466.04	3,690.48	2,775.56	175.2	117.74	268.25	-150.51	43.9	1.8
Root crops & Tubers	2,799.31	871.55	1,929.76	321.2	61.94	63.10	-1.16	98.2	2.2
Dried Beans & Nuts	578.76	304.36	274.40	190.2	21.09	14.67	-6.42	143.8	3.6
Sugar	1,577.19	423.06	1,154.13	372.8	24.97	20.26	4.71	123.2	1.6
Livestock, Poultry and Fish									
Beef/Carabeef	136.93	67.16	69.77	203.9	10.79	10.31	0.40	103.9	7.5
Pork	612.47	409.07	203.40	149.7	20.85	23.52	-2.67	88.7	3.4
Poultry	292.06	230.28	61.78	126.8	6.44	12.41	-5.97	51.9	2.2
Eggs	424.31	175.26	249.05	242.1	2.58	11.06	-8.48	23.3	0.6
Fish	2,621.96	1,832.61	789.35	143.1	20.05	84.99	-64.94	23.6	0.8
Milk & Milk products	11.45	924.88	-913.43	1.2	-	-	-	-	-

Sources : EC-326 and EC-358

Table 2.24 Timberland Area and Selected Major-Minor Forestry Production : 1977 and 1981

Item	Unit	1977				1981	
		Philippines	Region II	% Share	Philippines	Region II	% Share
Timberland Area	ha	8,571,688	1,226,805	14.3	8,792,290	1,478,800	16.8
Major Product							
Log	m ³	7,873,490	903,619	11.5	5,399,523	1,100,535	20.3
Lumber	m ³	1,567,410	375,541	24.0	1,218,906	369,702	30.3
Plywood	m ³	489,326	12,058	2.5	457,037	49,737	10.8
Veneer	m ³	496,432	20,948	4.2	552,771	51,859	9.3
Minor Product							
Bamboo and Baho	10 ³ pieces	787	22	2.7	885	7	0.8
Nipa Shingle	10 ³ pieces	736	235	31.9	2,987	245	8.2

Sources : EC-301 and EC-359

Table 2.25 Management Performance of Manufacturing Establishments in Region II : 1980

Type of Manufacturing	Number of Establish- ment (Nos.)	Employ- ment (Nos.)	Fixed Assets as of 1st Jan.	Receipts	Costs		Compen- sation	Census Value Added
					Total	Materials & Supplies		
1. Total (Unit : 10 ³ Pesos)								
• Food Manufacturing	2,434	7,379	596,156	182,959	129,201	12,176	22,746	137,020
• Manufacture of Wearing Apparel except Footwear	1,071	4,601	14,066	33,577	7,881	3,608	9,445	17,468
• Manufacture of Wood and Cork Products except Furniture	186	8,425	170,599	372,303	293,468	215,334	62,868	124,638
• Manufacture and Repair of Furniture and Fixtures except Metal	260	1,017	8,508	8,364	5,135	4,468	1,986	6,851
• Manufacture of Pottery, China and Earthen Ware	170	643	393	1,797	758	570	311	2,380
• Manufacture of Fabricated Metal Products except Machines and Equipment and Furniture and Fixture Primary of Metal	263	1,475	6,862	23,946	14,809	6,421	3,268	10,240
• Others	200	1,439	31,815	66,595	49,495	30,034	10,418	27,534
Total	4,584	24,979	828,399	689,451	500,747	372,611	111,042	326,130
2. Average (Unit : Pesos)								
• Food Manufacturing		3.0	244,929	75,168	53,082	46,087	9,345	56,294
• Manufacture of Wearing Apparel except Footwear		4.3	13,133	31,351	7,359	3,369	8,819	16,309
• Manufacture of Wood and Cork Products except Furniture		45.3	917,199	2,001,629	1,577,785	1,157,710	338,000	670,097
• Manufacture and Repair of Furniture and Fixtures except Metal		3.9	32,723	32,169	19,750	17,185	7,638	26,350
• Manufacture of Pottery, China and Earthen Ware		3.8	2,312	10,571	4,459	3,353	1,829	14,000
• Manufacture of Fabricated Metal Products except Machines and Equipment and Furniture and Fixture Primary of Metal		5.6	26,091	91,049	56,308	24,414	12,426	38,935
• Others		7.2	159,075	332,975	247,475	150,170	52,090	137,670
Total		5.4	180,715	150,404	109,238	81,285	24,224	71,145

Source : NEDA, Region II

Table 2.26 Management Performance of Wholesale and Retail Trade
Establishments in Region II : 1981

Item	Wholesale	Retail	Total
Number of Establishments	550	13,427	13,978
Total Employment	2,138	27,236	29,374
Number of Paid Employees	872	5,559	6,431
Total (10 ³ Pesos)			
Capital Expenditures during the Year	13	1,621	1,634
Revenue	105,334	585,054	690,388
Costs	84,132	450,232	534,364
Compensation	5,708	26,394	32,102
Value of Inventories			
- As of January 1	26,240	142,924	169,164
- As of December 31	22,869	151,888	174,757
- Average	24,555	147,406	171,961
Average (Pesos)			
Capital Expenditures during the Year	24	120	116
Revenue	191,516	43,573	49,391
Costs	152,967	33,532	38,229
Compensation	10,378	1,966	2,297
Value of Inventories			
- As of January 1	47,709	10,645	12,102
- As of December 31	41,580	11,312	12,502
- Average	44,645	10,978	12,302

Sources : NEDA, Region II

Table 2.27 Existing Roads and Road Density : 1984

(Unit : km)

Item	Philippines	Region II-B	% Share
National	25,116	2,208	8.8
- Concrete	5,729	500	8.7
- Asphalt	5,316	103	1.9
- Gravel	13,420	1,535	11.4
- Earth	651	70	10.8
Provincial	28,826	1,943	6.7
- Concrete	723	8	1.1
- Asphalt	2,450	158	6.4
- Gravel	20,103	1,429	7.1
- Earth	5,550	348	6.3
Municipal	12,432	1,092	8.8
- Concrete	1,640	6	0.4
- Asphalt	1,570	56	3.6
- Gravel	6,000	805	13.4
- Earth	3,221	225	7.0
Barangay	86,868	6,918	8.0
- Gravel	86,868	6,918	8.0
Total	157,139	12,161	7.7
Land Area (km ²)	300,000	36,194	12.1
Road Density (km/km ²)	0.524	0.336	64.1

Source : EC-114

Table 2.28 Number of Registered Motor Vehicles and Ratio to Population : 1984

	Philippines		Region II-B		
	Number	Percentage Distribution	Number	Percentage Distribution	Percentage to the Philippines
Car	360,539	30.9	2,663	9.6	0.7
Utility Vehicle (Jeepney)	416,721	35.8	9,172	33.0	2.2
Buses	15,279	1.3	309	1.1	2.0
Trucks	102,254	8.8	3,286	11.8	3.2
Trailers	17,431	1.5	540	1.9	3.1
Motorcycle / Tricycle	253,333	21.7	11,861	42.6	4.7
Total	1,165,557	100.0	27,831	100.0	2.4
Population (10 ³)	52,055	-	2,438	-	4.7
Ratio per 10 ³ Population	23.1	-	11.4	-	-

Sources : EC-325 and EC-359

Table 2.29 Number of Ports : 1984

Port System	Philippines	Region II-B	
		Number	% Share
I. National Port	302	3	1.0
- Base Port	38	2	5.3
- Sub-port/National Port	14	1	7.1
- Other Port/Municipal Port	250	-	-
II. Private Port	240	4	1.7
Total	542	7	1.3

Sources : EC-327 and EC-358

Table 2.30 Cargo Flow Movement by Port : 1984

(Unit : 10³t)

Item	Philippines (in 1983)	Total	Region II-B				
			National Port			Regional Port	
			Aparri	Irene	Claveria	Maconacon	Others
Domestic Trade	9,018	220.8	93.4	62.9	20.3	25.5	18.7
- Inward	5,468	63.9	59.4	0.0	1.9	2.6	18.7
- Outward	3,550	156.8	34.0	62.9	18.4	22.9	0.0
Foreign Trade	8,324	116.2	40.3	17.8	19.4	38.7	-
- Import	6,501	1.2	0.0	0.0	0.5	0.7	-
- Exprot	1,823	115.0	40.3	17.8	18.9	38.1	-
Total	17,341	337.0	133.7	80.7	39.7	64.2	18.7

Sources : EC-102 and EC-301

Table 2.31 Domestic Aircraft Movement and Passenger Traffic by Airport : 1983

Airport	Aircraft Operations	Passenger Traffic (Persons)			Remarks
		Total	Arrival	Departure	
Philippines	238,775	6,285,422	3,131,820	3,153,602	
Region II-B					
Aparri, Cagayan	214	315	169	146	Feeder
Bagabag, N-Vizcaya	1,417	2,507	1,191	1,316	Secondary
Cauayan, Isabela	856	4,939	2,381	2,558	Secondary
Palanan, Isabela	484	1,712	803	909	Feeder
Tuguegarao, Cagayan	2,556	31,580	16,293	15,287	Trunkline
Total	5,527	41,053	20,837	20,216	
Percentage Share (%)	2.3	0.7	0.7	0.6	

Sources : EC-302 and EC-358

Table 2.32 Status of Irrigation Program by Province : 1984

Province	Potential Irrigable Area		Service Area		Ratio of Service Area to Irri.Area
	Area (ha)	Percentage (%)	Area (ha)	Percentage (%)	
Philippines ^{/1}	3,126,319	-	1,385,940	-	44.3
Region II-B	539,710	100.0	225,499	100.0	41.8
Cagayan	174,923	32.4	39,761	17.6	22.7
Ifugao	25,370	4.7	8,009	3.6	31.6
Isabela	196,570	36.4	131,462	58.3	66.9
Kalinga-Apayao	37,216	6.9	15,715	7.0	42.3
Nueva-Vizcaya	63,990	11.9	26,261	11.6	41.0
Quirino	41,641	7.7	4,291	1.9	10.3

Note : /1 Data in 1983

Sources : EC-327 and EC-358

Table 2.33 Number of Existing Waterworks and Households Served in Region II (including Mt. Province) : 1985

Item	MPWH	LWUA	RWDC	BWP	Total
Number of Waterworks					
Level I	1,599	-	1,820	0	3,419
Level II	75	-	7	0	82
Level III	24	5	0	4	33
Total	1,688	5	1,827	4	3,534
Number of Households Served					
Level I	178,506	-	51,712	0	230,218
Level II	5,518	-	758	0	6,276
Level III	15,710	5,510	0	15,976	37,196
Total	199,734	5,510	52,470	15,976	273,690
Number of Households in Region II (including Mt. Province)					463,283
Coverage by Waterworks					59.1%

Sources : EC-118 to EC-120

Table 2.34 Number of Connctions and Water Consumption Served by Tuguegarao Water District : 1985

Item	January	February	March	April	May	June	July	August	September	Total	Average
Number of Connctions											
- Residential	589	591	601	585	611	696	861	934	1,007	6,475	719
- Commercial	377	374	374	360	377	376	389	405	417	3,449	383
- Industrial	2	2	2	2	2	3	4	4	4	25	3
- Municipal	8	8	8	7	7	7	7	6	7	65	7
- Total	976	975	985	954	997	1,082	1,261	1,349	1,435	10,014	1,113
Consumption (m³/month)											
- Residential	9,616	9,867	8,627	7,794	9,676	15,586	16,536	21,185	22,206	121,093	13,455
- Commercial	8,768	8,723	7,680	6,672	7,195	10,365	10,273	12,301	13,836	85,813	9,535
- Industrial	23	108	95	103	96	204	261	337	305	1,532	170
- Municipal	89	100	150	115	229	631	568	560	731	3,173	353
- Total	18,496	18,798	16,552	14,884	17,196	26,786	27,638	34,383	37,078	211,611	23,513
Consumption per Consumer Unit (l/day/unit)											
- Residential	526	597	463	444	511	746	620	732	735	5,374	597
- Commercial	750	833	662	618	616	919	852	980	1,106	7,336	815
- Industrial	370	1,929	1,532	1,717	1,548	2,267	2,104	2,718	2,542	16,727	1,859
- Municipal	559	446	403	548	1,055	3,005	2,617	3,010	3,481	14,924	1,658

Source : EC-103

Table 2.35 Number of Dwelling Units by Year Built and by Structure in Region II-B

Year Built	Housing Structure				Total	Percentage Distribution (%)
	I	II	III	IV		
1976 - 1980	4,056	14,322	29,361	109,662	157,410	39.2
1971 - 1975	3,271	14,859	23,640	56,577	98,327	24.5
1961 - 1970	2,348	15,848	25,447	36,349	80,706	20.0
1951 - 1960	867	8,019	17,665	15,936	42,487	10.6
1942 - 1950	180	2,583	6,756	5,473	14,992	3.7
1941 & Earlier	50	2,291	2,844	2,858	8,043	2.0
Total	10,772	57,922	105,713	227,192	401,599	100.0
Percentage Distribution (%)	2.7	14.4	26.3	56.6	100.0	-

Note : Structure type I : Reinforced concrete
 II : Semi-concrete
 III : Strong material
 IV : Light material

Sources : EC-349 and EC-354

Table 2.36 Registered Market Value of Residential and Non-Residential Building

Classification				Sample		Result	
Province	Municipality	Barangay	Building Type	Total Number	Effective Number	Average	Deviation
1. Cagayan	Tuguegarao	Poblacion	Residential I II III IV	228 340 238 256 430	224 335 236 253 430	64,597 20,293 9,120 3,902 73,132	54,018 6,504 6,669 2,100 168,542
2. Cagayan	Solana	Cattaran	Residential III	19 58	17 51	33,648 2,522	18,652 1,954
3. Cagayan	Tuguegarao	Capatan	Residential I II III IV	26 37 54 8	26 37 54 8	15,948 8,155 3,393 18,512	5,120 1,571 1,742 13,862
4. Isabela	Ilagan	Calamagui	Residential II III IV	62 15 12 30	62 15 12 30	8,012 4,158 2,333 27,829	16,209 7,093 2,710 34,794
5. Isabela	Naguilian	Quirino	Residential III IV	32 33 4	32 33 4	2,260 1,801 17,362	2,360 657 17,767
6. Isabela	Gamu	Buenavista	Residential IV Non Residential	12 5	12 4	952 3,507	543 3,573
7. Isabela	Ilagan	Guinaton	Residential II III IV	28 77 18 28	28 71 18 28	8,891 2,075 1,038 70,474	12,327 2,871 2,907 166,203
8. Kalinga-Apayao	Tabuk	Laya West	Residential I II III IV	1 1 7	1 1 6	26,410 4,700 3,215	- - 2,235
9. Kalinga-Apayao	Pirukpak	Camalog	Residential II III	34 48	31 48	9,537 4,035	11,498 7,410
10. Nueva-Vizcaya	Bambang	San Leonardo	Residential III IV	41 9	7 9	1,704 1,865	1,276 1,263
Total			Residential I II III IV	228 510 547 401 1,686	224 489 498 397 1,608	64,598 18,698 6,175 3,333 17,322	54,018 10,824 6,315 2,130 31,934
			Total / Average Non Residential	505	504	68,427	161,428

Note : Structure type I : Reinforced concrete; II : Semi-concrete; III : Strong material; IV : Light material

Table 2.37 Present Land Use in the Basin

(Unit : Km²)

Province	Built-up Area	Agricultural Area	Grassland	Forest Land	Wetland	Bareland	Total
Cagayan	15	1,534	1,461	1,050	7	184	4,251
Ifugao	0	162	1,563	793	0	0	2,518
Isabela	24	2,331	2,857	2,933	0	92	8,237
Kalinga-Apayao	4	217	1,584	1,818	0	52	3,675
Nueva-Vizcaya	6	269	1,298	1,689	0	39	3,301
Quirino	0	70	1,048	1,939	0	0	3,057
Mt. Province	0	45	891	908	0	0	1,844
Aurora	0	0	0	398	0	0	398
Total	49	4,628	10,702	11,528	7	367	27,281
Percentage Distribution (%)	0.2	17.0	39.2	42.3	0.0	1.3	100.0

Table 2.38 Present Land Use in Region II-B

(Unit : Km²)

Province	Built-up Area	Agricultural Area	Grassland	Forest Land	Wetland	Bareland	Total
Cagayan	15	2,088	2,704	3,214	786	196	9,003
Ifugao	0	162	1,563	793	0	0	2,518
Isabela	23	2,385	2,913	5,251	0	92	10,664
Kalinga-Apayao	4	275	2,413	4,278	0	78	7,408
Nueva-Vizcaya	6	275	1,552	2,032	0	39	3,904
Quirino	0	70	1,048	1,939	0	0	3,057
Total	48	5,255	12,192	17,506	786	405	36,193
Percentage Distribution (%)	0.1	14.5	33.7	48.4	2.2	1.1	100.0

Table 3.1 Potential of Water Resources (Natural Run-Off)

No.	Water Resources Region	Annual Flow Available (MCM) in Indicated Percent of Time					
		50%		75%		90%	
		MCM	(%)	MCM	(%)	MCM	(%)
I	Ilocos	27,000	5.6	17,100	5.2	12,100	4.7
II	Cagayan Valley	65,500	13.7	51,400	15.7	39,300	15.3
III	Central Luzon	32,500	6.8	21,100	6.5	14,900	5.8
IV	Southern Tagalog	91,500	19.1	56,000	17.1	39,900	15.5
V	Bicol	29,100	6.1	18,000	5.5	14,700	5.7
VI	Western Visayas	17,000	3.5	12,000	3.7	11,600	4.5
VII	Central Visayas	16,600	3.5	11,200	3.4	8,700	3.4
VIII	Eastern Visayas	59,000	12.3	38,300	11.7	33,900	13.2
IX	Southwestern Mindanao	27,000	5.6	20,200	6.2	17,100	6.7
X	Northern Mindanao	37,900	7.9	28,400	8.7	24,000	9.3
XI	Southeastern Mindanao	39,000	8.1	25,300	7.7	18,700	7.3
XII	Southern Mindanao	37,200	7.8	28,300	8.6	22,000	8.6
Total		479,300	100.0	327,300	100.0	256,900	100.0

Source : EC-330

Table 3.2 Land Capability by Region : 1984

No.	Region/ ¹	Total Area		Class A,B,C/ ²		Class D/ ²		Sub-total (A to D)		Other Class	
		(km ²)	(%)	(km ²)	(%)	(km ²)	(%)	(km ²)	(%)	(km ²)	(%)
I	Ilocos	21,568	7.2	3,560	6.2	424	1.6	3,984	4.8	17,584	8.1
II	Cagayan Valley	36,403	12.1	4,780	8.3	4,387	17.1	9,167	11.0	27,235	12.6
III	Central Luzon	18,231	6.1	8,829	11.9	512	2.0	7,341	8.8	10,890	5.0
IV	Southern Tagalog	47,560	15.9	11,186	19.5	3,861	15.1	15,047	18.1	32,513	15.0
V	Bicol	17,632	5.9	2,186	3.8	1,741	6.8	3,927	4.7	13,706	6.3
VI	Western Visayas	20,223	6.7	3,881	6.8	725	2.8	4,606	5.6	15,617	7.2
VII	Central Visayas	14,951	5.0	2,386	4.2	61	0.2	2,447	3.0	12,504	5.8
VIII	Eastern Visayas	21,432	7.1	8,533	14.9	1,768	6.9	10,301	12.4	11,131	5.1
IX	Southwestern Mindanao	18,685	6.2	2,260	3.9	4,157	16.2	6,417	7.7	12,268	5.7
X	Northern Mindanao	28,328	9.4	3,300	5.8	4,149	16.2	7,449	9.0	20,879	9.6
XI	Southeastern Mindanao	31,693	10.6	4,898	8.5	1,869	7.3	6,767	8.2	24,926	11.5
XII	Southern Mindanao	23,293	7.8	3,558	6.2	1,989	7.8	5,547	6.7	17,746	8.2
Total		300,000	100.0	57,357	100.0	25,643	100.0	83,000	100.0	217,000	100.0

Note : /¹ National Capital Region (NCR) is included in Regions III and IV. The scale of the map (1:1.6M) which served as a basis for the table did not allow separation of NCR.

/² Land suitable for crop cultivation with varying for soil conservation.

Source : EC-327

Table 3.3 Population and Gross Regional Domestic Product by Region

No.	Region	Population in 1980		Density (Person/km ²)	GRDP/1 in 1983		GRDP/1/Capita in 1983	
		(Person)	(%)		(10 ⁶ Pesos)	(%)	(Pesos)	Ratio to the Country
NCR	National Central Region	5,970,310	12.4	9,548.4	32,383	32.3	4,986	2.59
I	Ilocos	3,542,760	7.3	164.3	3,789	3.9	1,025	0.53
II	Cagayan Valley	2,227,287	4.6	61.2	2,586	2.6	1,147	0.60
III	Central Luzon	4,826,669	10.0	4.7	8,734	8.7	1,743	0.90
IV	Southern Tagalog	6,154,755	12.7	1.2	13,877	13.9	2,049	1.06
V	Bicol	3,489,368	7.2	197.9	3,089	3.1	912	0.47
VI	Western Visayas	4,537,778	9.4	224.4	8,290	8.3	1,691	0.88
VII	Central Visayas	3,796,049	7.9	253.9	7,100	7.1	1,797	0.93
VIII	Eastern Visayas	2,805,089	5.8	130.9	2,329	2.3	800	0.42
IX	Southwestern Mindanao	2,546,820	5.3	136.3	3,324	3.3	1,225	0.64
X	Northern Mindanao	2,773,021	5.7	97.9	4,495	4.5	1,461	0.76
XI	Southeastern Mindanao	3,368,256	7.0	106.3	6,566	6.6	1,733	0.90
XII	Southern Mindanao	2,278,371	4.7	97.8	3,556	3.5	1,185	0.61
	Total	48,316,503	100.0	160.3	100,118	100.0	1,927	1.00

Note : /1 At 1972 constant prices

Sources : EC-303 and EC-348

Table 3.4 Population Projection by Municipality in the Basin

Municipality	Projected		Population		Density	
Province					(P./km ²)	
Region	1985	1990	1995	2000	2005	2005
Alcala	26,979	29,499	31,997	34,371	36,513	195
Allacapan	10,760	12,967	15,395	17,974	20,603	164
Amulung	32,546	36,133	39,746	43,244	46,472	192
Aparri	21,454	23,399	25,402	27,392	29,287	291
Baggao	29,678	32,808	36,002	39,143	42,100	82
Camalanyugan	13,888	15,295	16,723	18,117	19,419	325
Enrile	26,330	29,372	32,453	35,452	38,237	207
Gattaran	25,589	27,624	29,643	31,564	33,298	74
Iguigu	17,617	19,535	21,465	23,331	25,050	232
Lallo	6,645	7,490	8,379	9,283	10,167	80
Lasam	20,511	22,855	25,244	27,590	29,792	183
Penablanca	17,788	20,296	22,894	25,487	27,963	38
Piat	16,194	18,479	20,847	23,210	25,467	182
Rizal	12,571	13,712	14,840	15,908	16,868	136
Santo Nino	18,474	20,466	22,485	24,452	26,283	62
Solana	52,948	60,249	67,794	75,301	82,449	411
Tuao	41,321	46,651	52,115	57,506	62,591	290
Tuguegarao	82,271	91,337	100,472	109,314	117,474	811
Cagayan	473,565	528,167	583,896	638,639	690,034	162
Banaue	25,665	28,673	31,789	34,850	37,674	115
Hungduan	10,789	11,792	12,813	13,791	14,662	56
Kiangnan	19,418	21,517	23,674	25,776	27,691	62
Lagawe	16,627	18,303	20,017	21,673	23,168	54
Lamut	12,414	13,937	15,522	17,088	18,542	177
Mayoyao	25,324	26,734	28,134	29,413	30,459	56
Partia	12,661	14,479	16,400	18,335	20,174	49
Ifugao	122,898	135,435	148,349	160,926	172,370	68
Alicia	44,549	53,317	62,851	72,699	82,291	534
Angadanan	31,381	35,168	39,023	42,714	45,997	225
Aurora	23,378	26,577	29,883	33,105	36,039	751
Benito Solive	19,223	21,853	24,571	27,221	29,634	178
Burgos	17,414	19,798	22,260	24,660	26,846	465
Cabagan	32,315	35,777	39,258	42,536	45,385	105
Cabatuan	24,091	26,848	29,638	32,290	34,625	481
Cauayan	73,635	85,936	98,979	112,090	124,475	327
Cordon	24,869	29,051	33,489	37,955	42,178	293
Dinapigui	351	337	325	313	300	1
Divilican	1,070	1,216	1,367	1,514	1,649	17
Echague	44,985	48,525	51,988	55,114	57,660	85
Gamu	19,845	22,968	26,251	29,521	32,575	252
Ilagan	60,442	68,242	76,511	84,856	92,819	109
Jones	30,495	32,082	33,592	34,874	35,802	101
Luna	11,210	12,745	14,330	15,875	17,282	378
Maconacon	3,745	6,203	9,868	15,018	21,804	335

(To be continued)

(Continuation)

Municipality	Projected		Population		Density	
Province					(P./km ²)	
Region	1985	1990	1995	2000	2005	2005
Magsaysay	20,304	22,993	25,761	28,445	30,875	163
Mallig	19,797	22,541	25,380	28,153	30,684	230
Naguilian	21,882	23,615	25,313	26,846	28,097	313
Palanan	1,303	1,481	1,665	1,845	2,008	24
Quezon	11,314	12,881	14,502	16,086	17,531	92
Quirino	16,533	18,796	21,133	23,412	25,488	202
Ramon	36,862	43,452	50,510	57,682	64,544	861
Reina Mercedes	16,396	18,478	20,610	22,665	24,511	692
Roxas	38,014	43,216	48,591	53,831	58,603	317
San Augustin	17,003	19,212	21,479	23,672	25,650	92
San Guillermo	8,035	9,135	10,271	11,379	12,387	74
San Isidro	13,217	14,980	16,796	18,560	20,159	280
San Manuel	21,400	25,124	29,097	33,116	36,941	484
San Mariano	27,751	32,211	37,005	41,915	46,674	47
San Meteo	47,325	53,787	60,461	66,965	72,886	727
San Pablo	8,617	9,541	10,470	11,345	12,106	34
Santa Maria	15,607	17,743	19,950	22,101	24,060	172
Santiago	79,977	90,497	101,314	111,799	121,276	475
Santo Tomas	17,208	18,474	19,705	20,807	21,689	357
Tunauini	36,774	41,807	47,006	52,075	56,691	121
Isabela	938,317	1,066,608	1,201,204	1,335,054	1,460,221	177
Balbaran	9,985	10,790	11,578	12,304	12,907	25
Conner	11,768	13,564	15,442	17,320	19,078	39
Flora	1,129	1,449	1,822	2,238	2,676	118
Kabugao	472	512	545	568	576	14
Lubuagan	9,481	10,424	11,363	12,251	13,020	40
Pasil	7,861	8,890	9,946	10,979	11,921	63
Pinukpuk	19,434	21,542	23,659	25,682	27,464	38
Rizal	12,490	13,317	14,113	14,830	15,400	87
Tabuk	49,418	56,411	63,650	70,817	77,437	121
Tanudan	6,844	7,350	7,841	8,289	8,655	25
Tinglayan	12,774	13,833	14,870	15,829	16,632	88
Kalinga-Apayao	141,657	158,083	174,830	191,107	205,767	56
Ambagio	4,965	6,260	7,724	9,306	10,943	59
Aritao	25,165	28,426	31,704	34,831	37,678	142
Bagabag	22,900	24,912	26,839	28,570	30,037	163
Bambang	29,991	33,902	37,835	41,592	45,015	130
Bayombong	36,855	41,824	46,844	51,663	56,081	412
Diadi	11,151	14,142	17,546	21,246	25,096	138
Dupax d. Norte	19,148	21,630	24,124	26,503	28,669	83
Dupax del Sur	10,575	11,945	13,323	14,637	15,833	44
Kasib	19,670	25,177	31,501	38,440	45,726	143
Kayapa	12,726	13,526	14,265	14,892	15,383	55
Quezon	12,753	16,368	20,530	25,109	29,926	170
Santa Fe	4,462	5,189	5,979	6,809	7,666	48
Solano	41,472	46,320	51,125	55,636	59,669	427
Villaverde	11,967	13,306	14,626	15,858	16,950	208
Alf. Castaneda	1,216	1,373	1,531	1,682	1,820	13
Nueva-Vizcaya	265,016	304,301	345,496	386,775	426,492	129

(To be continued)

(Continuation)

Municipality	Projected		Population		Density	
Province					(P./km ²)	
Region	1985	1990	1995	2000	2005	2005
Aglipay	14,509	16,805	19,232	21,706	24,008	148
Cabarroguis	23,063	29,758	37,613	46,482	55,994	215
Diffun	27,543	32,324	37,443	42,729	47,893	150
Maddela	27,938	32,444	37,219	42,099	46,810	21
Saguday	7,286	7,877	8,462	9,015	9,497	171
Quirino	100,339	119,208	139,969	162,031	184,202	60
Barlig	5,339	5,418	5,462	5,466	5,434	64
Bauko	18,076	19,418	20,625	21,648	22,470	147
Bontoc	18,014	18,869	19,581	20,121	20,488	52
Natonin	7,721	8,087	8,392	8,624	8,781	18
Paraceles	11,766	14,000	16,336	18,683	20,960	47
Sabangan	8,636	9,046	9,388	9,647	9,823	77
Sadanga	7,194	7,718	8,189	8,586	8,994	107
Sagada	9,618	9,744	9,807	9,800	9,730	161
Mt. Province	86,364	92,300	97,780	102,575	106,590	58
Casigran	2,454	2,883	3,355	3,842	4,298	32
Dilasag	2,166	2,526	2,915	3,307	3,664	23
Danalongan	811	925	1,040	1,144	1,224	39
Dipaculao	2,284	2,773	3,328	3,924	4,377	58
Aurora	7,714	9,107	10,637	12,217	13,563	34
Basin Total	2,135,869	2,413,208	2,702,161	2,989,325	3,259,238	119
Region II-B	2,508,020	2,830,655	3,166,803	3,500,310	3,632,435	100
Region II	2,520,974	2,844,695	3,182,116	3,517,966	3,834,664	105
Philippines	54,668,332	61,480,180	68,424,077	75,223,853	81,590,921	272

Source : EC-326

Table 3.5 Population Projection by Urban/Rural and by Province
in the Basin

Province	Urban/Rural	1985	1990	1995	2000	2005
Cagayan	Total	473,565	528,167	583,896	638,639	690,034
	Urban	91,835	110,497	132,114	156,357	182,479
	Rural	381,730	417,670	451,782	482,282	507,555
Ifugao	Total	122,898	135,435	148,349	160,926	172,370
	Urban	12,323	15,108	18,453	22,324	26,607
	Rural	110,575	120,327	129,896	138,602	145,263
Isabela	Total	938,317	1,066,608	1,201,204	1,335,054	1,460,221
	Urban	188,795	243,055	310,001	389,357	479,033
	Rural	749,522	823,553	891,203	945,697	981,188
Kalinga- Apayao	Total	141,657	158,083	174,830	191,107	205,767
	Urban	23,320	31,682	42,554	56,196	72,474
	Rural	118,337	126,401	132,276	134,911	133,293
Nueva- Vizcaya	Total	265,016	304,301	345,496	386,775	426,492
	Urban	60,320	79,860	104,229	133,399	166,809
	Rural	204,690	224,347	241,077	253,087	259,295
Quirino	Total	100,339	119,208	139,969	162,031	184,202
	Urban	21,652	28,845	37,964	49,140	62,184
	Rural	78,687	90,363	102,005	112,891	122,018
Mountain Province	Total	86,364	92,300	97,780	102,575	106,590
	Urban	4,563	5,382	6,311	7,339	8,444
	Rural	81,801	86,918	91,469	95,236	98,146
Aurora	Total	7,714	9,107	10,637	12,217	13,563
	Urban	0	0	0	0	0
	Rural	7,714	9,107	10,637	12,217	13,563
Basin	Total	2,135,869	2,413,208	2,702,161	2,989,325	3,259,238
	Urban	402,808	514,429	651,626	814,112	998,030
	Rural	1,733,061	1,898,779	2,050,535	2,175,213	2,261,208

Source : EC-326

Table 3.6 Gross Regional Domestic Product : 1987-1992

(Unit : 10⁶ Pesos at 1972 Prices)

Region	1987	1992	Average Annual Growth Rates 1987/1992
Philippines	96,935	135,331	6.9
NCR	28,208	37,607	5.8
I	4,265	6,099	7.4
II	2,714	3,916	7.7
III	8,530	12,152	7.3
IV	13,862	19,662	7.2
V	3,296	4,753	7.4
VI	7,755	10,923	7.0
VII	6,785	9,452	6.9
VIII	2,423	3,511	7.7
IX	3,490	5,024	7.4
X	4,944	7,109	7.6
XI	6,689	9,452	7.3
XII	3,974	5,671	7.3

Source : NEDA Regional Office
Philippine Development Plan, 1987-1992

Table 3.7 Long-Term GDP Projection

Sector	1985	1990	1995	2000	2005
Gross Domestic Product (10 ⁹ Pesos at 1972 Prices)					
GDP	90.5	118.9	154.3	189.3	229.0
- Agriculture	26.2	34.5	44.8	55.5	66.2
- Industry	29.0	38.0	49.2	59.1	74.9
- Services	35.3	46.4	60.3	74.7	87.9
Percentage Distribution (%)					
GDP	100.0	100.0	100.0	100.0	100.0
- Agriculture	29.0	29.0	29.0	29.3	28.9
- Industry	32.0	32.0	31.9	31.2	32.7
- Services	39.0	39.0	39.1	39.5	38.4
Average Annual Growth Rate (%)					
	1985/1990	1990/1995	1995/2000	2000/2005	1985/2005
GDP	5.61	5.35	4.17	3.88	4.75
- Agriculture	5.66	5.36	4.38	3.59	4.74
- Industry	5.55	5.30	3.73	4.85	4.86
- Services	5.62	5.38	4.38	3.31	4.67

Table 3.8 Long-Term Projection of GRDP in Region II

Sector	1985	1990	1995	2000	2005
Gross Regional Domestic Product (10 ⁶ Pesos at 1972 Prices)					
GDP	2,324	3,370	4,972	6,732	8,490
- Agriculture	1,213	1,496	1,948	2,297	2,587
- Industry	295	480	801	1,685	2,727
- Services	816	1,393	2,223	2,750	3,176
Percentage Distribution (%)					
GDP	100.0	100.0	100.0	100.0	100.0
- Agriculture	52.2	44.4	39.2	34.1	30.5
- Industry	12.7	14.2	16.1	25.0	32.1
- Services	35.1	41.4	44.7	40.8	37.4
Average Annual Growth Rate (%)					
	1985/1990	1990/1995	1995/2000	2000/2005	1985/2005
GDP	7.72	8.09	6.25	4.75	6.69
- Agriculture	4.28	5.42	3.35	2.41	3.86
- Industry	10.23	10.78	16.04	10.11	11.76
- Services	11.30	9.78	4.35	2.92	7.03

Table 3.9 Long-Term Projection of GRDP in the Basin

Sector	1985	1990	1995	2000	2005
Gross Regional Domestic Product (10 ⁶ Pesos at 1972 Prices)					
GDP	1,825	2,689	4,014	5,536	7,080
- Agriculture	862	1,062	1,383	1,631	1,837
- Industry	272	444	743	1,568	2,544
- Services	691	1,183	1,888	2,337	2,699
Percentage Distribution (%)					
GDP	100.0	100.0	100.0	100.0	100.0
- Agriculture	47.2	39.5	34.5	29.5	25.9
- Industry	14.9	16.5	18.5	28.3	35.9
- Services	37.9	44.0	47.0	42.2	38.1
Average Annual Growth Rate (%)					
	1985/1990	1990/1995	1995/2000	2000/2005	1985/2005
GDP	8.06	8.35	6.64	5.04	7.01
- Agriculture	4.28	5.42	3.35	2.41	3.85
- Industry	10.31	10.86	16.10	10.16	11.83
- Services	11.33	9.81	4.36	2.93	7.05

Table 3.10 Projection of Domestic Capital Stock in the Basin

(Unit : 10⁶ Pesos at 1985 Prices)

Item	1985	1990	1995	2000	2005
GRDP at 1972 Prices	1,825	2,689	4,014	5,536	7,080
GRDP at 1985 Prices	13,870	20,436	30,506	42,074	53,808
Regional Income(at factor cost)	10,672	16,555	24,719	34,032	43,450
Capital Consumption Allowance ¹	1,950	2,043	3,042	4,255	5,515
Indirect Tax - Subsidy ²	1,248	1,839	2,746	3,787	4,843
Domestic Capital Stock (at the beginning of a term)	15,367	24,511	36,505	51,059	66,182
Gross Domestic Capital Formation	3,657	4,019	6,088	7,648	8,853
Net Domestic Capital Formation ³	1,707	1,976	3,045	3,393	3,338
Domestic Capital Stock (at the end of a term)	17,075	26,487	39,550	54,451	69,520

Notes : /1 Average period of depreciation is assumed to be 12 years.

/2 Amount is assumed to account for 9% of GRDP.

/3 Both capital coefficient and marginal capital coefficient are assumed to be 1.6.

Table 3.11 Projected Family Income at 1985 Prices

Year	Population	GDP (10 ⁶ Pesos)	GDP (Pesos)	Family Income in the Country
1985	54,668,332	610.3	11,163	30,748
1990	61,480,180	901.8	13,041	35,768
1995	68,424,077	1,040.5	15,206	41,708
2000	75,223,853	1,276.5	16,969	46,543
2005	81,590,091	1,544.2	18,926	51,911

Notes : 1. An implicit price index number is 674.32 in 1985.

2. Family income is estimated by the following formula on the assumption that it follows the GDP per capita :

$$Y = 2.743X - 3.277$$

where X : GDP per capita

Y : Family income

Table 3.12 Criteria for Water Demand Projection

Item	1985	1990	1995	2000	2005
<u>Unit Consumption</u>					
Domestic Water (l/capita/day)					
Level I	30	30	30	30	30
Level II	60	60	60	60	60
Level III	100	105	110	115	120
Trade Establishment (m ³ /establishment/day)	1.0	1.25	1.5	1.75	2.0
Other Facility					
School (m ³ /unit/day)	1.0	1.25	1.5	1.75	2.0
Hospital (m ³ /unit/day)	3.0	3.25	3.5	3.75	4.0
Others (Office etc.) (m ³ /unit/day)	2.0	2.25	2.5	2.75	3.0
Construction (m ³ /day/GVA(₱10 ⁶ at 1972 prices))	31	31	31	31	31
Other Industries (m ³ /day/GVA(₱10 ⁶ at 1972 prices))	763	743	723	703	684
<u>Service Factor for Domestic Demand (%)</u>					
Rural : Level I	44	47	50	53	50
Level II	16	28	30	32	35
Level III	40	25	20	15	15
Urban : Level I	50	25	0	0	0
Level II	25	25	25	0	0
Level III	25	50	75	100	100
<u>Existing Waterworks</u>					
Capacity (10 ³ m ³ /day)	52.4	58.1/1	-	-	-
Loss Rate (%)	35	32.5	30	27.5	25

Note : /1 Existing capacity plus expansion plan
Sources: EC-376 and EC-379 to EC-387

Table 3.13 Projected Water Demand by Municipality

Municipality	Water Demand (m ³ /day)				
Province	1985	1990	1995	2000	2005
Alcala	1,706	2,236	2,832	4,263	6,114
Allacapan	690	964	1,284	1,969	2,847
Amulung	1,603	2,050	2,470	3,213	4,129
Aparri	1,514	2,008	2,598	4,093	6,046
Baggao	1,948	2,581	3,312	5,074	7,358
Camalanyugan	1,118	1,511	2,001	3,284	4,965
Enrile	2,283	3,125	4,191	7,009	10,705
Gattaran	1,463	1,874	2,308	3,298	4,571
Iguigu	1,078	1,419	1,797	2,667	3,786
Lallo	468	632	828	1,304	1,924
Lasam	1,343	1,789	2,301	3,522	5,103
Penablanca	763	979	1,158	1,349	1,554
Piat	1,040	1,402	1,817	2,764	3,983
Rizal	539	661	751	842	938
Santo Nino	1,264	1,685	2,179	3,391	4,966
Solana	2,771	3,647	4,535	6,213	8,305
Tuao	2,050	2,662	3,251	4,282	5,549
Tuguegarao	7,989	11,006	14,933	25,618	39,683
Cagayan	31,632	42,232	54,545	84,155	122,525
Banaue	1,510	2,001	2,550	3,784	5,405
Hungduan	463	569	648	730	815
Kiangnan	1,020	1,320	1,628	2,250	3,051
Lagawe	1,221	1,649	2,181	3,551	5,392
Lamut	825	1,114	1,459	2,291	3,398
Mayoyao	1,207	1,472	1,702	2,131	2,672
Potia	543	698	830	971	1,121
Ifugao	6,790	8,823	10,997	15,707	21,854
Alicia	3,270	4,724	6,606	11,169	17,475
Angadanan	1,953	2,657	3,504	5,531	8,319
Aurora	1,464	2,019	2,675	4,238	6,384
Benito Solive	1,397	1,961	2,687	4,526	7,084
Burgos	747	955	1,126	1,305	1,492
Cabagan	1,634	2,118	2,611	3,588	4,878
Cabatuan	1,248	1,635	2,041	2,866	3,964
Cauayan	5,451	7,776	10,788	18,284	28,685
Cordon	1,191	1,598	2,008	2,679	3,525
Dinapigui	15	16	16	17	17
Divilican	46	59	69	80	92
Echague	2,848	3,795	4,946	7,866	11,927
Gamu	1,551	2,216	3,093	5,333	8,455
Ilagan	4,530	6,360	8,755	14,928	23,552
Jones	1,868	2,434	3,111	4,863	7,306
Luna	803	1,125	1,537	2,575	4,019
Maconacon	161	299	499	795	1,212

(To be Continued)

(Continuation)

Municipality	Water		Demand		(m ³ /day)
Province	1985	1990	1995	2000	2005
Magsaysay	1,044	1,384	1,741	2,442	3,365
Mallig	1,686	2,412	3,393	5,997	9,649
Naguilian	1,960	2,757	3,857	6,925	11,261
Palanan	56	71	84	98	112
Quezon	1,061	1,533	2,185	3,953	6,440
Quirino	709	907	1,069	1,239	1,417
Ramon	2,307	3,246	4,387	6,967	10,485
Reina Mercede	1,408	2,007	2,819	4,995	8,051
Roxas	3,385	4,863	6,882	12,301	19,915
San Augustin	925	1,237	1,580	2,307	3,284
San Guillermo	721	1,036	1,467	2,627	4,257
San Isidro	567	722	850	983	1,121
San Manuel	1,916	2,793	3,989	7,130	11,529
San Mariano	2,187	3,133	4,386	7,590	12,060
San Meteo	3,224	4,486	6,070	9,980	15,393
San Pablo	370	460	530	601	673
Santa Maria	669	856	1,009	1,170	1,337
Santiago	6,188	8,732	12,077	20,771	32,917
Santo Tomas	1,003	1,311	1,666	2,530	3,724
Tunauini	1,956	2,616	3,332	4,796	6,746
Isabela	63,518	88,306	119,444	196,047	302,122
Balbaran	428	520	586	651	718
Conner	505	654	781	917	1,061
Flora	48	70	92	118	149
Kabugao	20	25	28	30	32
Lubuagan	879	1,293	1,899	3,624	6,220
Pasil	337	429	503	581	663
Pinukpuk	833	1,039	1,197	1,360	1,527
Rizal	536	642	714	785	856
Tabuk	4,522	6,736	9,950	18,869	32,236
Tanudan	293	354	397	439	481
Tinglayan	548	667	752	838	925
Kalinga-Apayao	8,950	12,429	16,899	28,212	44,866
Ambagio	213	302	391	493	608
Aritao	1,680	2,350	3,198	5,315	8,354
Bagabag	1,782	2,503	3,478	6,130	9,996
Bambang	2,656	3,866	5,549	10,115	16,773
Bayombong	4,115	6,144	9,091	17,369	28,984
Diadi	675	1,003	1,411	2,263	3,449
Dupax del Norte	1,206	1,671	2,242	3,628	5,606
Dupax del Sur	453	576	674	775	880
Kasib	843	1,214	1,594	2,035	2,542
Kayapa	546	652	722	788	855
Quezon	547	789	1,039	1,329	1,664
Santa Fe	384	564	813	1,473	2,432
Solano	3,137	4,446	6,189	10,788	17,461
Villaverde	513	642	740	839	942
Alfonso Castaneda	52	66	77	89	101
Nueva-Vizcaya	18,803	26,788	37,207	63,429	100,648

(To be Continued)

(Continuation)

Municipality	Water		Demand		(m ³ /day)
Province	1985	1990	1995	2000	2005
Aglipay	742	1,006	1,294	1,857	2,651
Cabarroguis	1,688	2,581	3,785	6,606	10,822
Diffun	2,053	2,988	4,242	7,432	12,277
Maddela	1,712	2,406	3,265	5,272	8,263
Saguday	778	1,142	1,680	3,234	4,908
Quirino	6,973	10,124	14,267	24,400	38,921
Barlig	229	261	276	289	302
Bauko	775	937	1,043	1,146	1,249
Bontoc	1,335	1,726	2,185	3,428	5,034
Natonin	331	390	425	457	488
Paraceles	505	675	826	989	1,165
Sabangan	370	436	475	511	546
Sadanga	308	372	414	455	495
Sagada	412	470	496	519	541
Mountain Province	4,266	5,268	6,141	7,793	9,820
Casigran	105	139	170	203	239
Dilasag	93	122	147	175	204
Danalongan	35	45	53	61	68
Dipaculao	98	134	168	208	243
Aurora	331	439	538	647	754
Total	141,261	194,410	260,038	420,390	641,511
Total (t/sec)	1.63	2.25	3.01	4.87	7.42

Table 3.14 Projected Water Demand by Sector

Sector	Water		Demand		(m ³ /day)
	1985	1990	1995	2000	2005
Domestic	82,465	111,495	143,504	179,761	211,343
Service & Public	17,258	23,722	31,307	39,872	49,182
Industrial	41,538	59,193	85,227	200,757	380,986
Total	141,261	194,410	260,038	420,390	641,511

Table 3.15 Projected Source Water Requirement by Municipality

Province	Municipality	Water Requirement (m ³ /day)				
		1985	1990	1995	2000	2005
Quirino	Aglipay	1,141	1,491	1,849	2,561	3,535
Quirino	Cabarroguis	2,598	3,824	5,407	9,111	14,429
Quirino	Diffun	3,159	4,427	6,060	10,251	16,370
Quirino	Maddela	2,633	3,565	4,665	7,272	11,017
Quirino	Saguday	1,196	1,692	2,400	4,461	6,544
Aurora	Casigran	162	206	242	281	319
Aurora	Dilasag	143	180	211	241	272
Aurora	Danalongan	54	66	75	84	91
Aurora	Dipaculao	151	198	240	287	324
Block 1	Total	11,236	15,650	21,150	34,548	52,901
N.Vizcaya	Ambagio	328	447	558	680	811
N.Vizcaya	Aritao	2,585	3,481	4,569	7,331	11,139
N.Vizcaya	Dupax del Norte	1,856	2,475	3,203	5,004	7,475
N.Vizcaya	Dupax del Sur	698	854	963	1,069	1,174
N.Vizcaya	Kayapa	840	966	1,031	1,087	1,140
N.Vizcaya	Santa Fe	591	835	1,162	2,031	3,242
N.Vizcaya	Alfonso Castaneda	80	98	111	123	135
Block 2	Total	6,977	9,157	11,596	17,324	25,116
N.Vizcaya	Bagabag	2,741	3,709	4,969	8,455	13,328
N.Vizcaya	Bambang	4,087	5,728	7,927	13,952	22,364
N.Vizcaya	Bayombong	6,330	9,102	12,988	23,957	38,646
N.Vizcaya	Diadi	1,039	1,486	2,015	3,122	4,598
N.Vizcaya	Kasib	1,298	1,799	2,276	2,807	3,389
N.Vizcaya	Quezon	841	1,170	1,484	1,833	2,218
N.Vizcaya	Solano	4,826	6,586	8,841	14,881	23,281
N.Vizcaya	Villaverde	789	951	1,057	1,158	1,256
Block 3	Total	21,951	30,530	41,557	70,164	109,081
Isabela	Echague	4,381	5,623	7,066	10,850	15,903
Isabela	Jones	2,873	3,606	4,445	6,707	9,742
Isabela	San Augustin	1,423	1,832	2,257	3,183	4,378
Isabela	San Isidro	872	1,070	1,214	1,355	1,494
Block 4	Total	9,550	12,132	14,981	22,095	31,517
Isabela	Cordon	1,832	2,368	2,868	3,695	4,700
Isabela	Ramon	3,550	4,809	6,267	9,610	13,980
Isabela	Santiago	9,519	12,936	17,253	28,649	43,889
Block 5	Total	14,901	20,113	26,387	41,954	62,569
Isabela	Alicia	5,030	6,998	9,436	15,405	23,301
Isabela	Angadanan	3,004	3,937	5,006	7,629	11,092
Isabela	San Guillermo	1,109	1,535	2,096	3,624	5,676
Block 6	Total	9,143	12,470	16,539	26,658	40,069
Isabela	Benito Solive	2,150	2,905	3,838	6,243	9,446
Isabela	Dinapigui	23	24	23	23	22
Isabela	Divilican	71	87	99	111	122
Isabela	Ilagan	6,969	9,422	12,507	20,591	31,403
Isabela	Palanan	86	106	120	135	149
Isabela	San Mariano	3,365	4,641	6,265	10,469	16,080
Block 7	Total	12,664	17,185	22,853	37,570	57,222

(To be Continued)

(Continuation)

Province	Municipality	Water Requirement (m ³ /day)				
		1985	1990	1995	2000	2005
Isabela	Cauayan	8,386	11,520	15,411	25,220	38,247
Isabela	Naguilian	3,016	4,085	5,509	9,552	15,015
Isabela	Reina Mercedes	2,166	2,974	4,027	6,890	10,735
Block 8	Total	13,568	18,578	24,947	41,661	63,997
Isabela	Aurora	2,252	2,982	3,821	5,846	8,512
Isabela	Burgos	1,149	1,415	1,609	1,801	1,990
Isabela	Cabatuan	1,920	2,422	2,915	3,954	5,285
Isabela	Luna	1,235	1,667	2,196	3,552	5,358
Isabela	San Manuel	2,948	4,137	5,698	9,834	15,372
Isabela	San Mateo	4,961	6,646	8,672	13,766	20,524
Block 9	Total	14,465	19,269	24,911	38,751	57,041
Ifugao	Banaue	2,324	2,964	3,643	5,219	7,206
Ifugao	Hungduan	712	843	926	1,007	1,087
Ifugao	Kiangnan	1,569	1,956	2,325	3,103	4,068
Ifugao	Lagawe	1,879	2,443	3,115	4,898	7,189
Ifugao	Lamut	1,270	1,651	2,084	3,160	4,530
Ifugao	Mayoyao	1,857	2,181	2,431	2,939	3,563
Ifugao	Potia	835	1,035	1,185	1,339	1,495
Block 10	Total	10,445	13,072	15,711	21,665	29,139
Mt. Prov.	Barlig	352	387	395	399	403
Mt. Prov.	Bauko	1,192	1,387	1,490	1,581	1,665
Mt. Prov.	Bontoc	2,054	2,558	3,122	4,729	6,712
Mt. Prov.	Natonin	509	578	606	630	651
Mt. Prov.	Paraceles	776	1,000	1,181	1,364	1,554
Mt. Prov.	Sabangan	570	646	678	704	728
Mt. Prov.	Sadanga	475	551	592	627	660
Mt. Prov.	Sagada	634	696	709	716	721
Block 11	Total	6,563	7,804	8,773	10,749	13,093
Isabela	Gamu	2,386	3,283	4,418	7,356	11,274
Isabela	Hallig	2,594	3,574	4,848	8,272	12,865
Isabela	Quezon	1,632	2,271	3,122	5,452	8,587
Isabela	Quirino	1,091	1,343	1,527	1,709	1,889
Isabela	Roxas	5,208	7,205	9,831	16,967	26,553
Block 12	Total	12,911	17,676	23,746	39,757	61,168
Isabela	Magsaysay	1,607	2,050	2,487	3,368	4,487
Isabela	Santo Tomas	1,543	1,942	2,379	3,490	4,965
Isabela	Tunauini	3,009	3,876	4,761	6,616	8,995
Block 13	Total	6,159	7,868	9,627	13,474	18,447
Isabela	Cabagan	2,514	3,139	3,730	4,949	6,504
Isabela	Maconacon	247	443	713	1,097	1,616
Isabela	San Pablo	568	682	757	828	897
Isabela	Santa Maria	1,030	1,268	1,442	1,614	1,783
Block 14	Total	4,359	5,531	6,642	8,488	10,801
K. Apayao	Lubuagan	1,353	1,915	2,713	4,998	8,293
K. Apayao	Pasil	519	635	719	802	884
K. Apayao	Rizal	824	952	1,020	1,083	1,141
K. Apayao	Tabuk	6,957	9,979	14,215	26,026	42,982
K. Apayao	Tanudan	451	525	567	605	642
K. Apayao	Tinglayan	843	988	1,075	1,156	1,233
Block 15	Total	10,947	14,994	20,308	34,669	55,174

(To be Continued)

(Continuation)

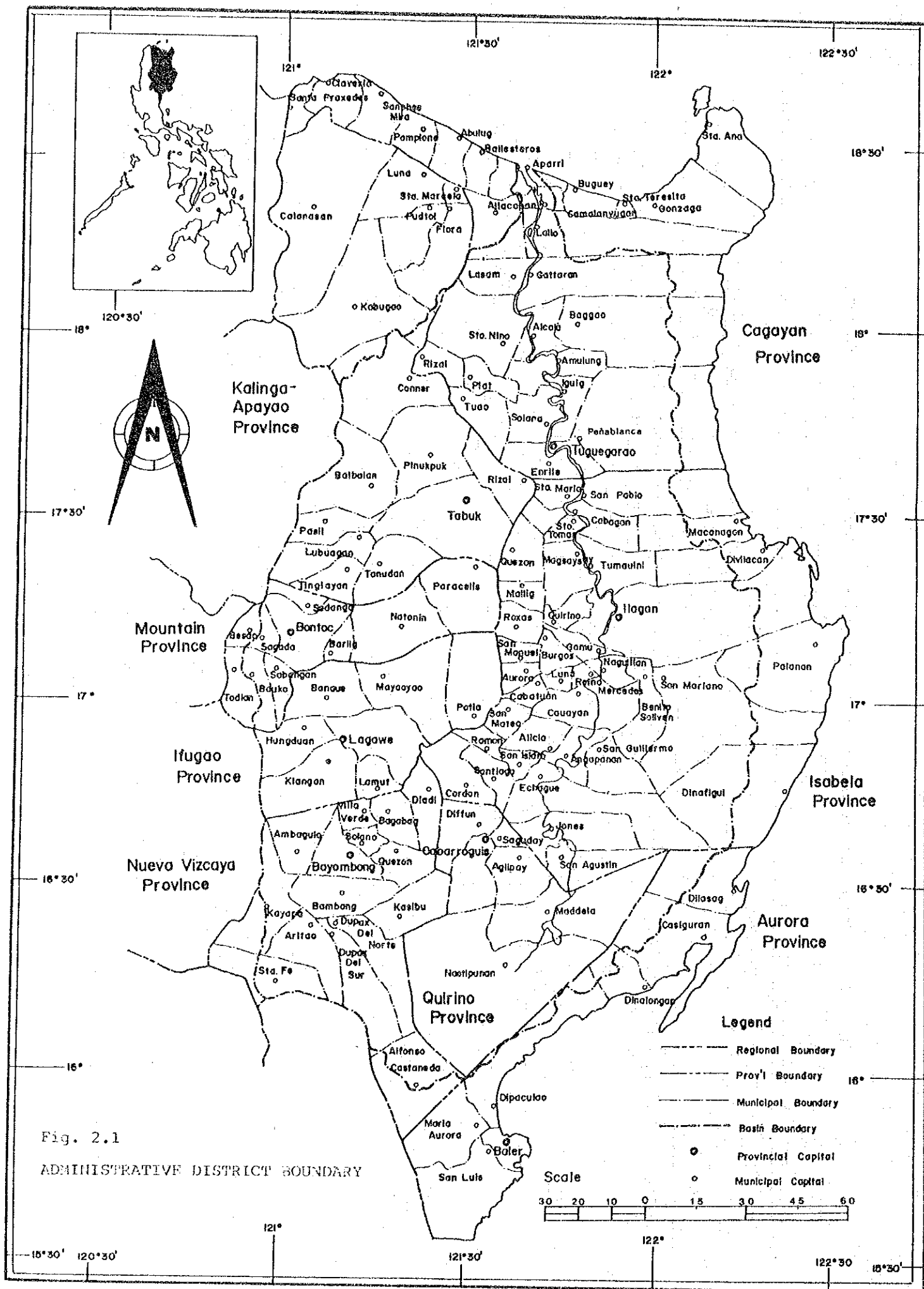
Province	Municipality	Water Requirement (m ³ /day)				
		1985	1990	1995	2000	2005
K. Apayao	Balbaran	659	771	837	898	957
K. Apayao	Conner	776	969	1,116	1,265	1,414
K. Apayao	Flora	74	104	132	163	198
K. Apayao	Kabugao	31	37	39	41	43
K. Apayao	Pinukpuk	1,282	1,539	1,710	1,875	2,036
Block 16	Total	2,823	3,420	3,833	4,243	4,647
Cagayan	Tuguegarao	12,290	16,306	21,333	35,336	52,911
Block 17	Total	12,290	16,306	21,333	35,336	52,911
Cagayan	Amulung	2,467	3,037	3,528	4,432	5,505
Cagayan	Enrile	3,513	4,629	5,987	9,667	14,273
Cagayan	Iguigu	1,658	2,102	2,567	3,679	5,048
Cagayan	Penablanca	1,173	1,450	1,654	1,861	2,073
Cagayan	Solana	4,263	5,403	6,479	8,569	11,073
Block 18	Total	13,075	16,622	20,216	28,208	37,972
Cagayan	Piat	1,600	2,078	2,596	3,812	5,310
Cagayan	Rizal	829	980	1,072	1,162	1,250
Cagayan	Santo Nino	1,944	2,496	3,113	4,677	6,621
Cagayan	Tuao	3,154	3,944	4,644	5,906	7,398
Block 19	Total	7,528	9,497	11,426	15,557	20,580
Cagayan	Alcala	2,625	3,313	4,046	5,879	8,152
Cagayan	Allacapan	1,062	1,428	1,835	2,716	3,796
Cagayan	Aparri	2,330	2,975	3,711	5,645	8,061
Cagayan	Baggao	2,997	3,824	4,732	6,998	9,811
Cagayan	Camalanyugan	1,721	2,239	2,858	4,529	6,621
Cagayan	Gattaran	2,251	2,776	3,297	4,549	6,095
Cagayan	Lallo	720	936	1,182	1,799	2,565
Cagayan	Lasam	2,067	2,650	3,287	4,858	6,804
Block 20	Total	15,772	20,142	24,947	36,974	51,904
GRAND	TOTAL (m ³ /day)	217,325	288,015	371,484	579,848	855,349
GRAND	TOTAL (t/sec)	2.52	3.33	4.30	6.71	9.90

Table 3.16 Projected Source Water Requirement by Sector

Sector	Water Requirement (m ³ /day)				
	1985	1990	1995	2000	2005
Domestic	126,869	165,178	205,006	247,946	281,791
Service & Public	26,551	35,144	44,725	54,996	65,577
Industrial	63,905	87,693	121,753	276,906	507,981
Total	217,325	288,015	371,484	579,848	855,349

Table 3.17 Projected Investment for New Water-Related Infrastructure Projects

Year	Irrigation		Water Supply			Flood Control	NAPOOR	Total
	NIA	FSDC	MWSS	LMUA	MPWH			
Actual Data (Percentage Distribution to National Disbursement of Total Infrastructure Investment)								
1980	13.1	0.4	2.5	1.3	0.5	3.6	12.6	34.0
1981	12.8	0.8	5.0	1.7	0.6	2.4	11.4	34.7
1982	11.4	0.7	5.7	1.2	0.8	2.7	10.6	33.1
1983	7.7	0.3	5.2	0.8	0.7	0.9	14.7	30.3
1984	8.0	0.1	7.4	0.8	1.8	0.9	13.7	32.7
Average	10.6	0.5	5.2	1.2	0.9	2.1	12.6	33.0
Projection (10 ⁶ Pesos in 1984 Constant Prices)								
1985	2,291	108	1,124	259	195	454	2,724	7,155
1990	3,011	142	1,477	341	256	596	3,579	9,401
1995	3,908	184	1,917	442	332	774	4,645	12,203
2000	4,794	226	2,352	543	407	950	5,699	14,971
2005	5,800	274	2,845	657	492	1,149	6,894	18,111
Average	3,961	187	1,943	448	336	785	4,708	12,368
Projected Annual Amount for Region II (10 ⁶ Pesos in 1984 Constant Prices)								
Case 1 : 4.7% Share	186	9	-	21	16	37	221	490
Case 2 : 7.5% Share	297	14	-	34	25	59	353	782
Case 3 : 10% Share	396	19	-	45	34	78	471	1,043



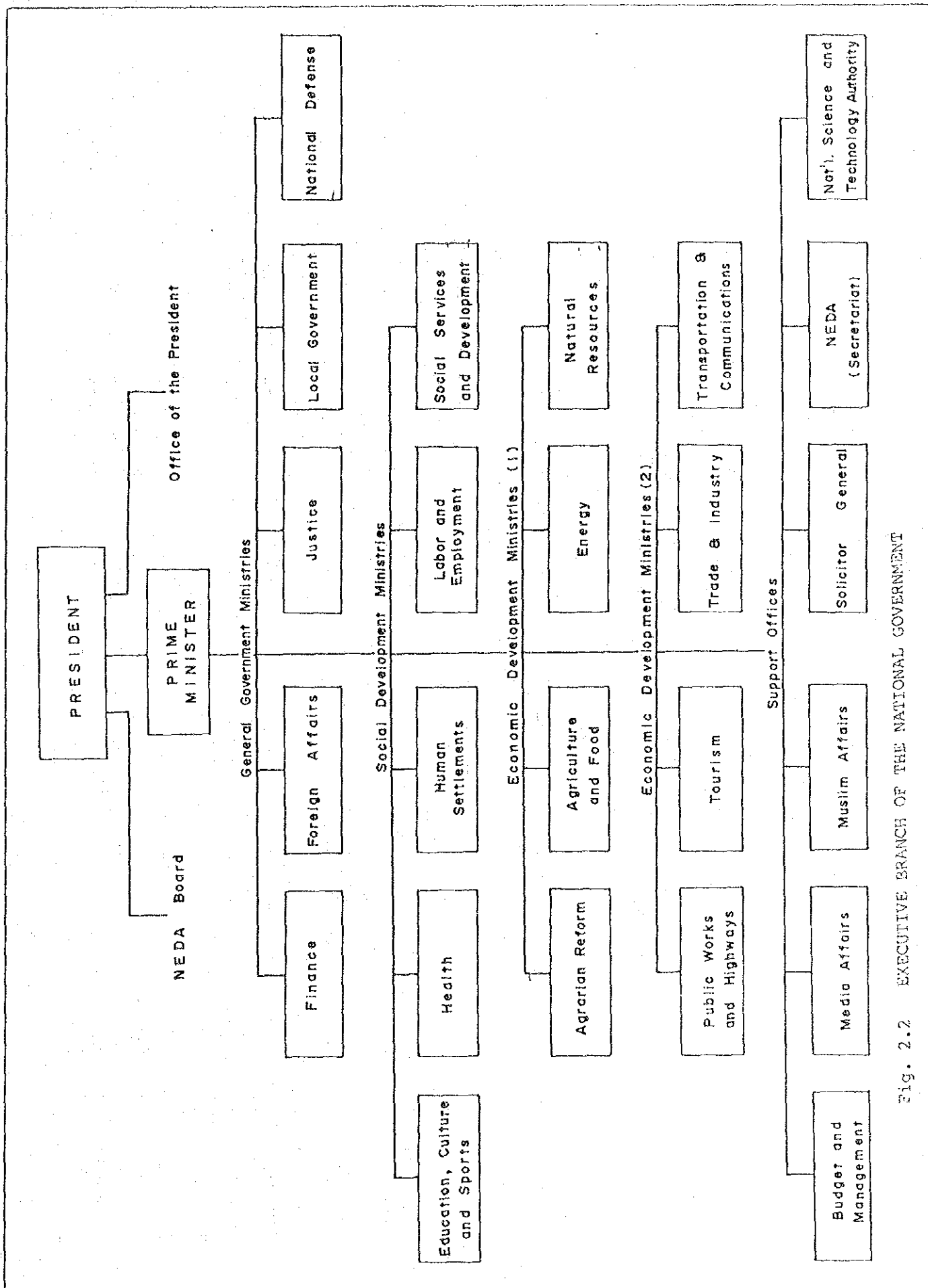


Fig. 2.2 EXECUTIVE BRANCH OF THE NATIONAL GOVERNMENT

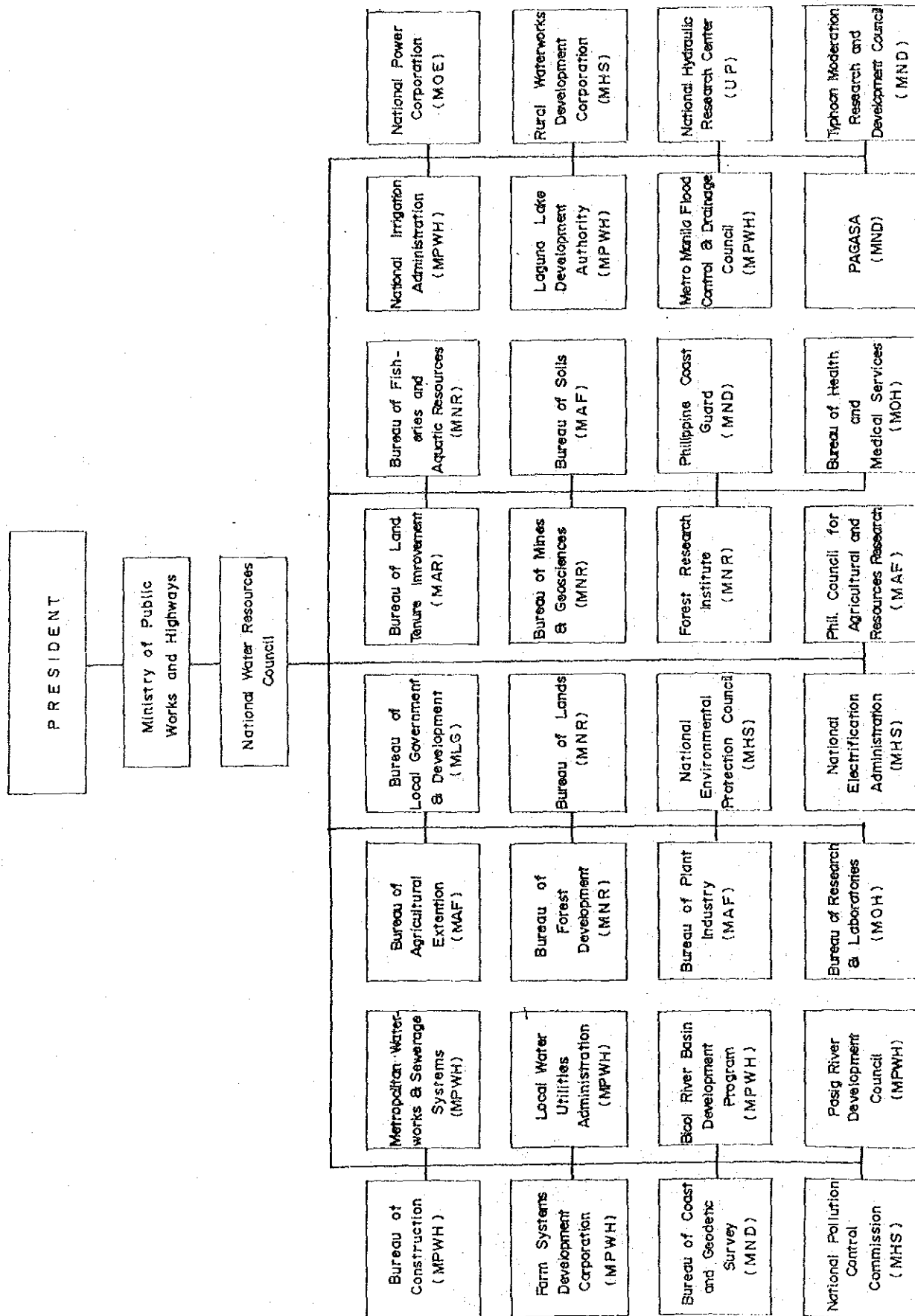


Fig.2.3 WATER RESOURCES COORDINATION CHART

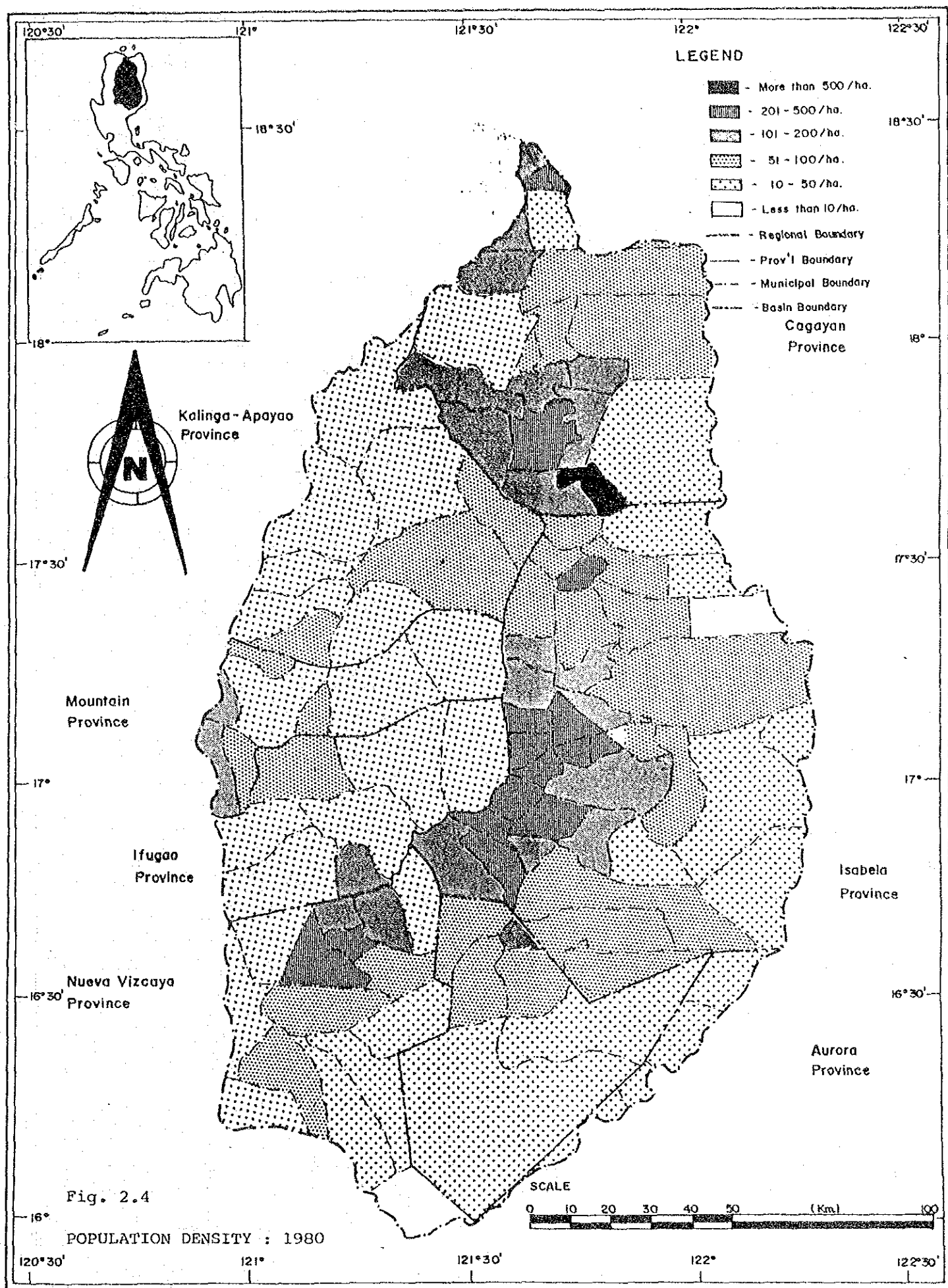
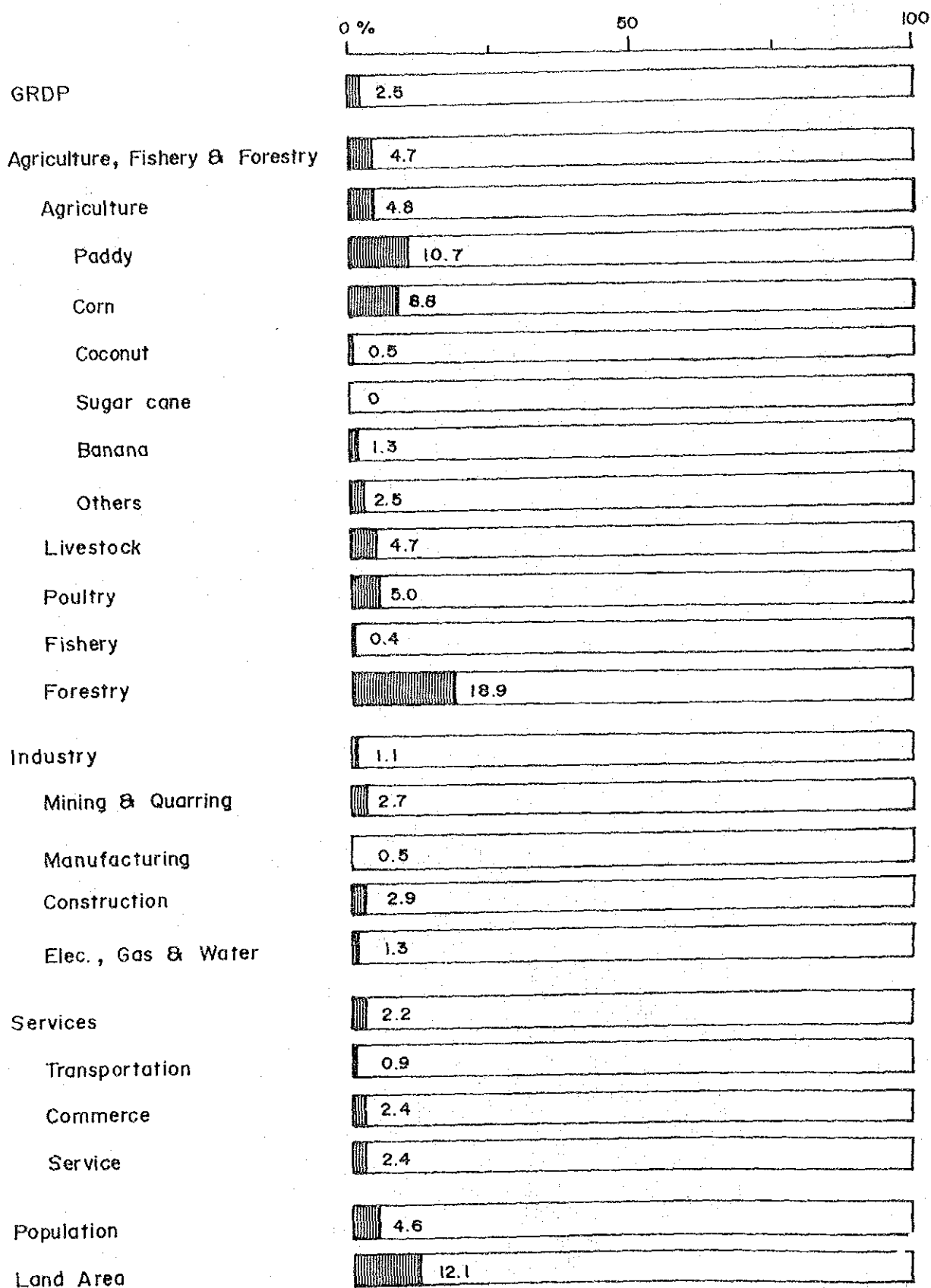


Fig. 2.5

PERCENT SHARE OF GRDP TO GDP : 1984



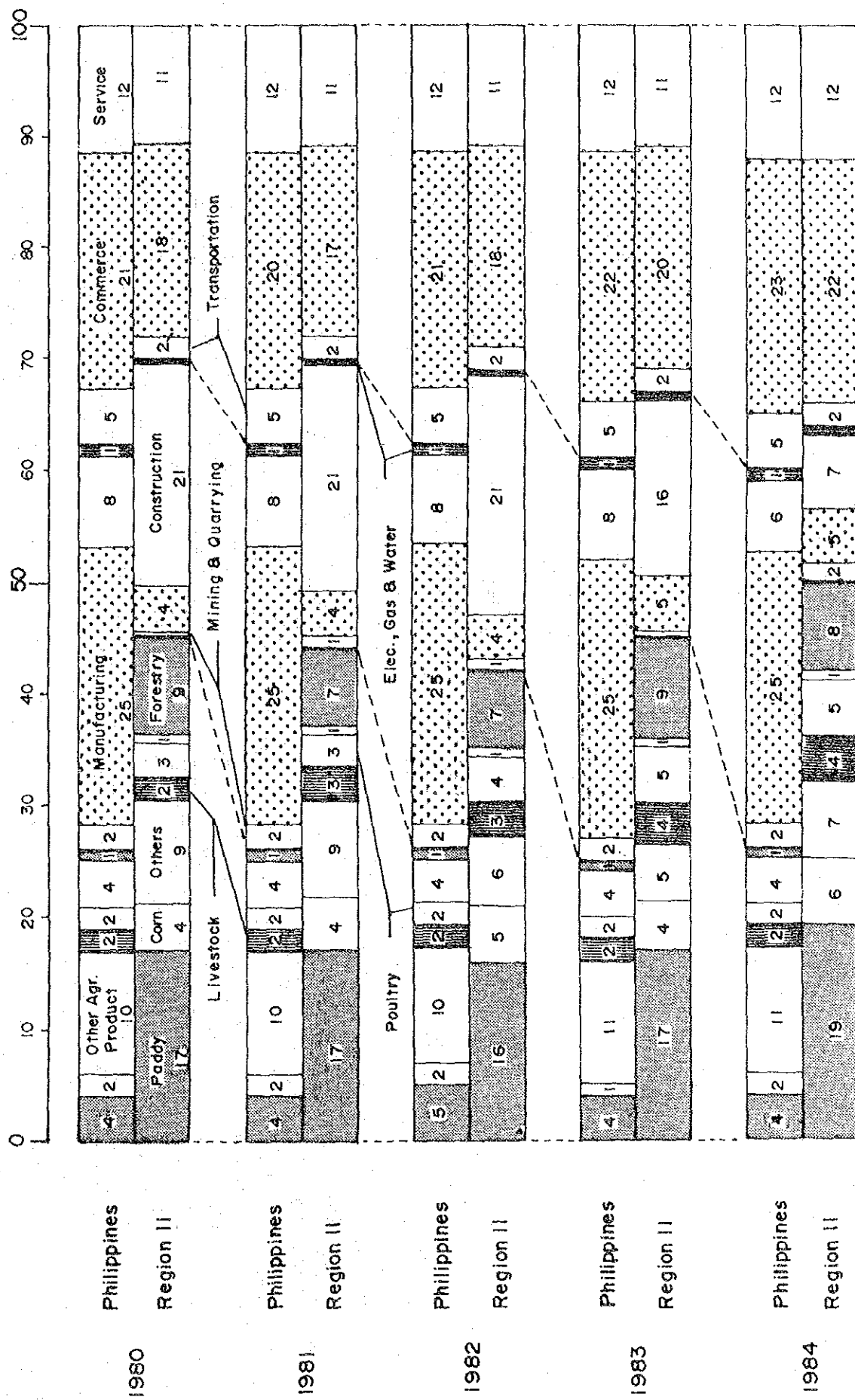


Fig. 2.6 PERCENT DISTRIBUTION OF GDP AND GRDP : 1980 TO 1984

Water Rates of Tuguegarao Water District Effective Since June 1, 1985

Connection Pipe Size : 1/2"

Type of Connection	Minimum Charge	Commodity Charge (₱/m ³)			
		11 - 20	21 - 30	31 - 40	41 - 50
Residential / Municipal / Government	₱ 37.50	1.90	2.30	2.75	3.25
Mixed Account	₱ 56.25	2.85	3.45	4.15	4.90
Commercial (A)	₱ 75.00	3.80	4.60	5.50	6.50
Commercial (D)	₱ 97.50	4.35	5.25	6.10	9.90
Fish Section					
Industrial	₱112.50	5.70	6.90	8.25	9.75

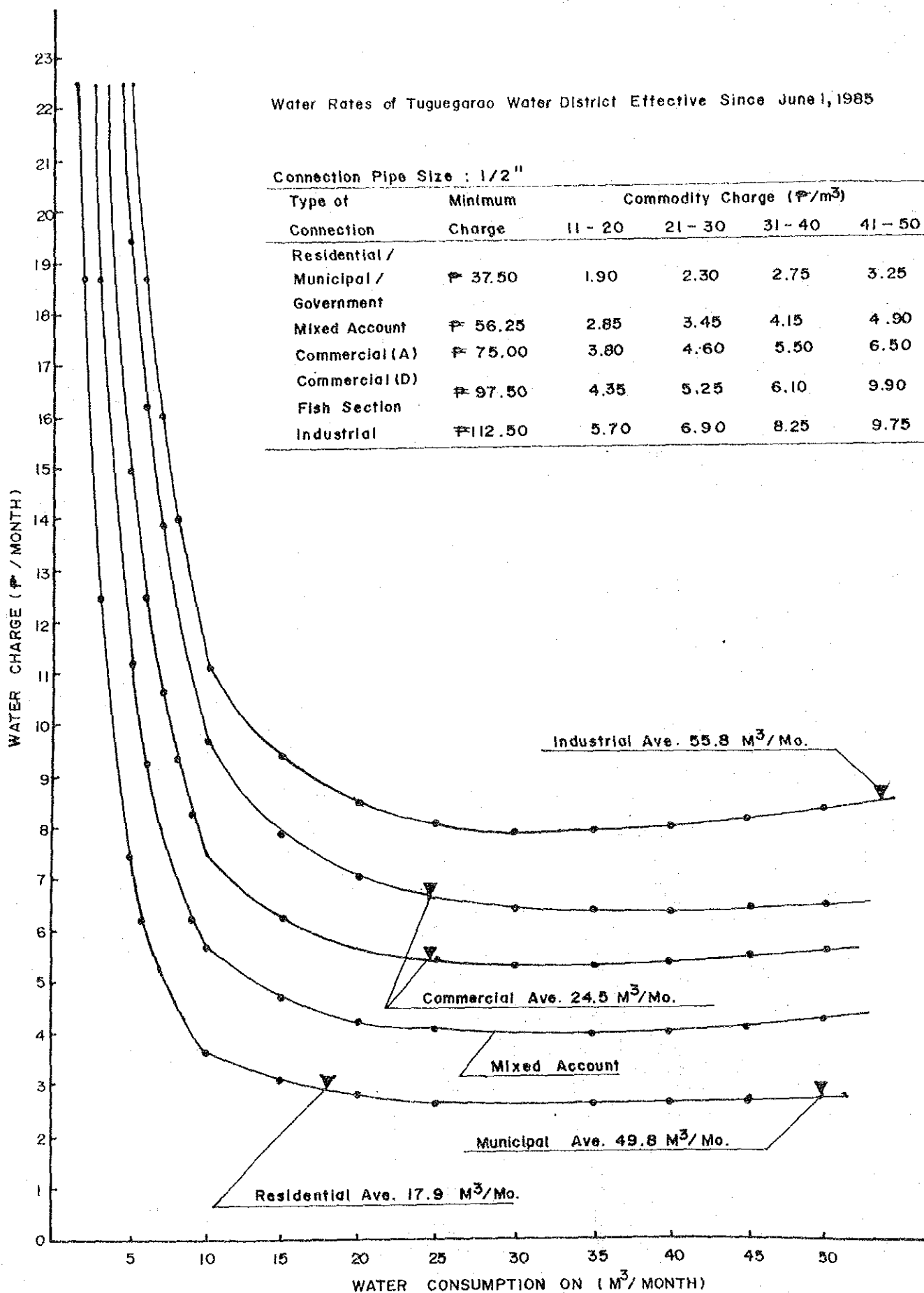
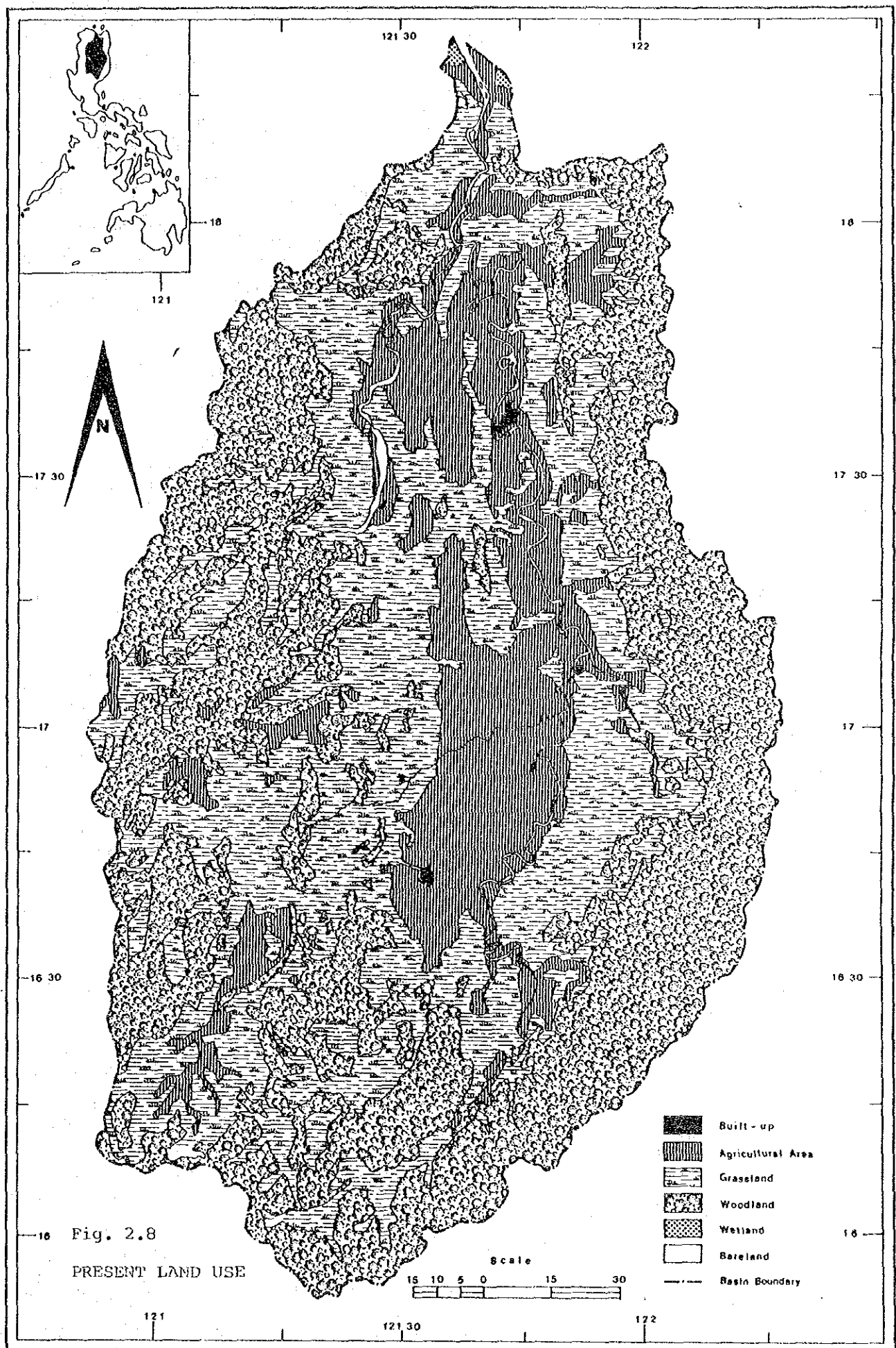
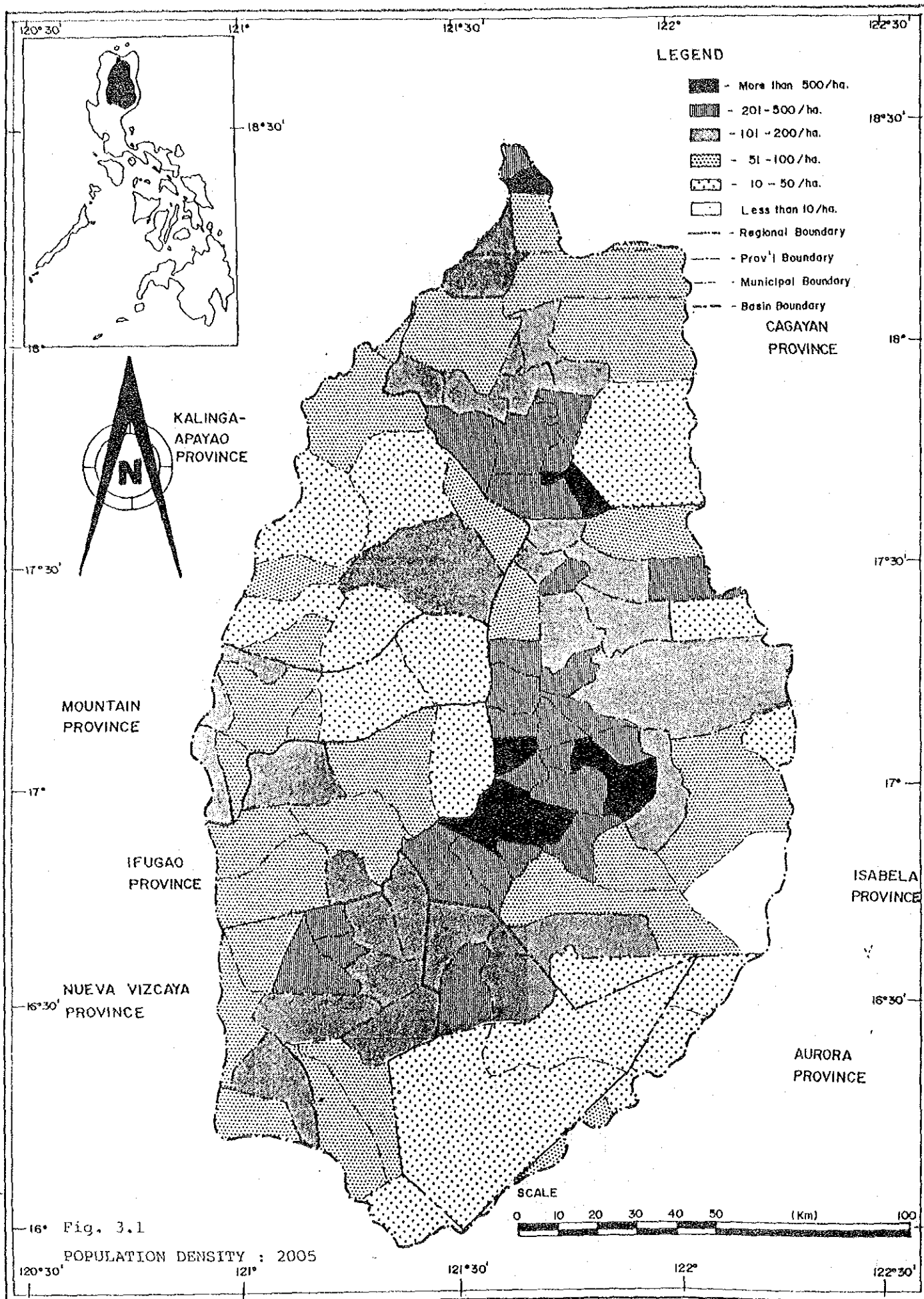


Fig. 2.7 AVERAGE WATER CONSUMPTION AND WATER RATE IN TUGUEGARAO





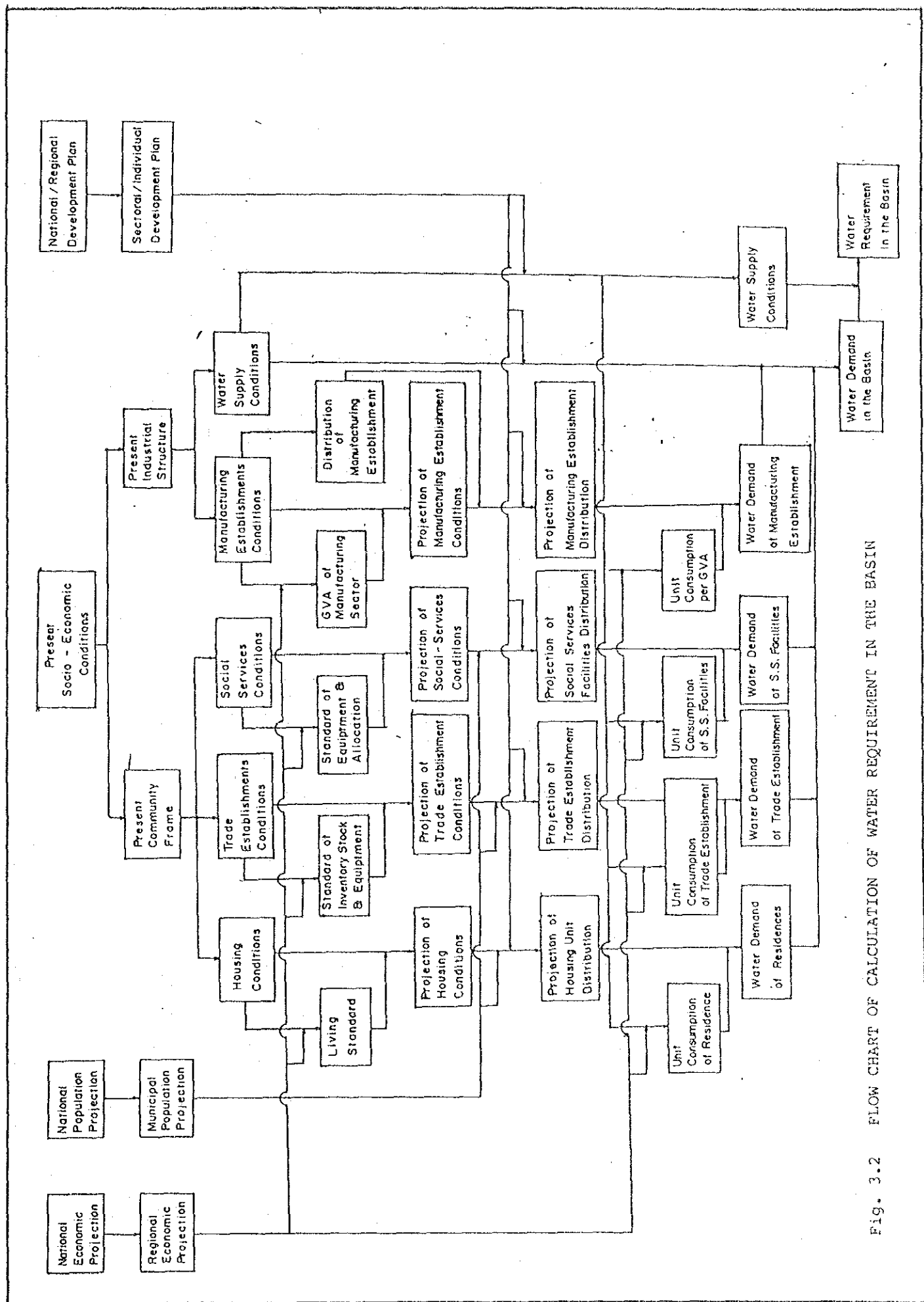


Fig. 3.2 FLOW CHART OF CALCULATION OF WATER REQUIREMENT IN THE BASIN

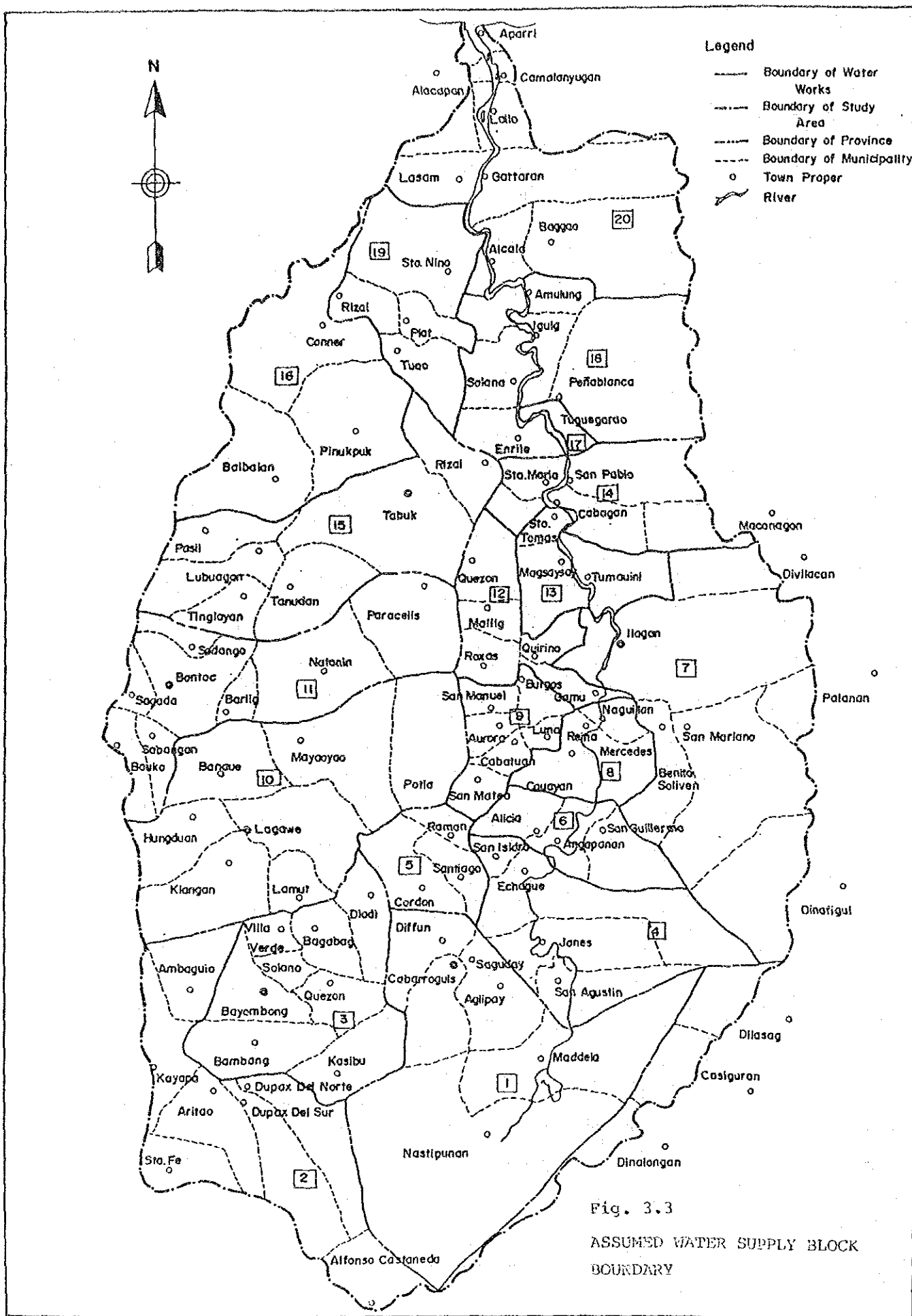


Fig. 3.3

ASSUMED WATER SUPPLY BLOCK
BOUNDARY

Fig. 3.4 FLOW CHART FOR INVESTMENT PROJECTION

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graph TD
    GDP_Actual["GDP Data Actual & Projected by NEDA"] --> Expenditures["Expenditures on GDP"]
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    GDP_Actual --> GDP_Projected["GDP Projected up to 2005"]
    Expenditures --> FCF["Disbursement of Fixed Capital Formation (FCF)"]
    FCF --> Rate_FCF_GDP["Rate of FCF / GDP"]
    Rate_FCF_GDP --> GDP_Projected
    Rate_FCF_GDP --> Rate_GVA_Investment["Rate of GVA to Investment {0.5}"]
    Rate_GVA_Investment --> Actual_Infra_Investment["Actual Data of Infrastructure Investment"]
    Actual_Infra_Investment --> GVA_Infra_Investment["GVA of Infrastructure Investment"]
    GVA_Infra_Investment --> Share_Water_Related_Investment["Share of Water-related Investment to Total Infrastructure Investment"]
    Share_Water_Related_Investment --> Projected_Infra_Investment["Projected Disbursement of Infra-Investment"]
    Projected_Infra_Investment --> Projected_Water_Related_Investment["Projected Investment for Water-related Projects"]
    Distribution_Region_II["Distribution for Region II"] --> Projected_Water_Related_Investment
    Projected_Water_Related_Investment --> Total_Investment["Total Amount of Investment for the PROJECT"]
```

The flowchart illustrates the process of investment projection. It begins with 'GDP Data Actual & Projected by NEDA' and a 'Scenario' input, leading to 'GDP Projected up to 2005'. 'Expenditures on GDP' lead to 'Disbursement of Fixed Capital Formation (FCF)', which then leads to 'Rate of FCF / GDP'. This rate is used to project 'Projected Disbursement in FCF'. The 'Rate of FCF / GDP' also leads to 'Rate of GVA to Investment {0.5}', which is used to calculate 'GVA of Infrastructure Investment' from 'Actual Data of Infrastructure Investment'. This GVA is then used to determine the 'Share of Water-related Investment to Total Infrastructure Investment', which is added to the 'Projected Disbursement in FCF' to get the 'Projected Disbursement of Infra-Investment'. This is then used to calculate the 'Projected Investment for Water-related Projects', which is further adjusted by the 'Distribution for Region II' to arrive at the 'Total Amount of Investment for the PROJECT'.

Attachment A. List of Collected Data

No	Title	Collected on	Collected in
<u>Economic Data</u>			
EC-101	Statistics for All Manufacturing and Establishments in Region II	Nov.1985	NEDA, Region II
EC-102	Cargo Flow Movement by Port	Oct.1985	PPA, Region II
EC-103	Sales Records of Tuguegarao Water District	Nov.1985	Tuguegarao-WD
EC-104	Depreciation Table in Cagayan, Isabela and Nueva-Vizcaya	Dec.1985	Provincial Assessor's Office
EC-105	Guidelines for the Resettlement Program of MRMP	Nov.1985	MRMP
EC-106	MRMP Resettlement	Nov.1985	MRMP
EC-107	Magat Resettlement Program (Brochure)	Nov.1985	MRMP
EC-108	Resettlement Program (Brochure)	Nov.1985	MRMP
EC-109	Cagayan Valley Electrification Project	Nov.1985	MRMP
EC-110	Final Report on Typhoon Damage of Tropical Storm "Reming"	Dec.1985	Regional Disaster Coordination Committee
EC-111	List of Ranchers in Region II	Jan.1986	MAF, Region II
EC-112	List of Pasture Land in Region II	Jan.1986	BFD, Region II
EC-113	GDP Projection	Feb.1986	NEDA
<u>Management and Inventory Record</u>			
EC-114	Inventory of Roads in Region II	Dec.1985	MPWH
EC-115	Inventory of All Establishments in Region II	Dec.1985	NCSO
EC-116	Inventory of School Building in Region II	Jan.1986	MECS
EC-117	Inventory of Hospitals and Clinics	Jan.1986	MOH

(To be continued)

(Continuation)

No	Title	Collected on	Collected in
EC-118	Plans and inventory of Waterworks in Region II	Dec.1985	MPWH, Region II
EC-119	Inventory of Waterworks by MPWH in Region II	Dec.1985	MPWH
EC-120	Inventory of Waterworks by RWDC in Region II	Jan.1985	RWDC
<u>Assets Holdings</u>			
EC-121	Registered Market Value of Buildings and Their Sites in Sample Areas of Cagayan	Dec.1985	Provincial Assessor's Office Cagayan
EC-122	Registered Market Value of Buildings and Their Sites in Sample Areas of Isabela Province	Dec.1985	Provincial Assessor's Office, Isabela
EC-123	Registered Market Value of Buildings and Their Sites in sample Area of Kalinga-Apayao Province	Dec.1985	Provincial Assessor's Office, Kalinga-Apayao
EC-124	Registered Market Value of Buildings and Their Sites in Sample Areas of nueva-Vizcaya Province	Dec.1985	Provincial Assessor's Office, Vizcaya
EC-125	Sample Survey of Assets Holdings in Tuguegarao	Dec.1985	---
EC-126	Sample Survey of Equipment and Inventory Stock in Tuguegarao	Dec.1985	---
<u>Land Use Map</u>			
EC-127	Land Use Map (Region II & I: 1/250000)	Nov.1985	BOS
EC-128	Agricultural Land Use Map (Region II: 1/500000)	Jan.1986	NEDA
EC-129	Land Use Plan (Region II: 1/2500000) in 1983-2000)	Nov.1985	MHS
EC-130	Land Classification Map (Region I, II & IV 1/500000) in 1980	Nov.1985	BOL
EC-131	Municipality Boundary Map (1/250000)	Nov.1985	BOL
EC-132	Aerophotographs (1/60000) in 1981)	Nov.1985	BOL

Attachment B. List of Collected Publications and Reference Books

No	Title	Collected on	Collected in
<u>Socio-Economic Data</u>			
EC-301	Philippine Yearbook 1983	Dec.1982	NEDA, NCSO
EC-302	Philippine Yearbook 1985	Aug.1985	NEDA, NCSO
EC-303	Philippine Statistical Yearbook 1984	Aug.1984	NEDA
EC-304	The BCS Survey of Households Bulletin Series Nos. 38-47; 1973-1976	Mar.1974	NCSO
EC-305	Integrated survey of Households Bulletin Series No. 50-B	Feb.1985	NCSO
EC-306	Foreign Trade Statistics of the Philippines 1980	1980	NCSO
EC-307	Foreign Trade Statistics of the Philippines 1981	1981	NCSO
EC-308	1982 Foreign Trade Statistics of the Philippines	1982	NCSO
EC-309	1983 Foreign Trade Statistics of the Philippines	1983	NCSO
EC-310	1984 Foreign Trade Statistics of the Philippines	1984	NCSO
EC-311	Philippines 1980; Population Land Area; and Density: 1970, 1975 and 1980	1980	NEDA, NCSO
EC-312	1980 NEDA Year-End Report to the President on the Implementation of National Development Programs	Mar.1981	NEDA
EC-313	1981 NEDA Year-End Report to the President the Implementation of National Development Programs	1982	NEDA
EC-314	NEDA Quarterly Report to the President on the Implementation of National Development Programs as of 31 December 1982	1983	NEDA
EC-315	1983 NEDA Year-End Report to the President on the Implementation of National Development Programs	Apr.1984	NEDA
EC-316	1984 NEDA Year-End Report to the President on the Implementation of National Development Programs	May 1985	NEDA
EC-317	Study of Infrastructure Investment and Maintenance in the Republic of Philippines	Dec.1984	Development and Tech- nology Con- sultants, Inc.
EC-318	Cagayan Valley (Region II), Physical Resource	--	NEDA, Region

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(Continuation)

No.	Title	Issued on	Issued by
EC-319	Estimating the Shadow Exchange Rate, the Shadow Wage Rate and the Social Rate of Discount for the Philippines	--	NEDA
EC-320	Regional Development Information, Cagayan Valley (Region II)	--	NEDA
EC-321	Rural Bliss 1, Guidelines for Physical Development	Nov.1980	MHS
EC-322	CB Review	July 1985	The Central Bank of the Philippines
EC-323	Economic and Financial Developments First Quarter 1985	July 1985	The Central Bank of the Philippines
EC-324	National Physical Framework Plan 1986-2000	1985	National Land Use Committee, NEDA
EC-325	Probing Our Futures: The Philippines 2000 A.D.	July 1980	PREFP
EC-326	Philippine Population Projection 1980-2030	1984	NEDA
EC-327	Population Food Requirements: 1984-2020	1985	NEDA
EC-328	Handbook of Land and other Physical Resources	1984	National Land Use Committee, NEDA
EC-329	Rural Water Supply Design Manual (Vol. I)	Mar.1980	NWRC
EC-330	Presidential Inter-Agency Committee for the re-study of the Marikina River Project: Manila Water Supply III Project. Appendix D-Water Demand Projections	Dec.1979	MWSS
EC-331	Philippines Water Resources	Dec.1976	NWRC
<u>Census</u>			
EC-332	Philippines-1970 Census of Population and Housing	Apr.1974	NCSO
EC-333	Cagayan-1970 Census of Population and Housing	Apr.1974	NCSO

(To be continued)

(Continuation)

No.	Title	Issued on	Issued by
EC-334	Ifugao-1970 Census of Population and Housing	Apr. 1974	NCSO
EC-335	Isabela-1970 Census of Population and Housing	Apr. 1974	NCSO
EC-336	Kalinga-Apayao-1970 Census of Population and Housing	Apr. 1974	NCSO
EC-337	Nueva-Vizcaya-1970 Census of Population and Housing	Apr. 1974	NCSO
EC-338	Mountain Province-1970 Census of Population and Housing	Apr. 1974	NCSO
EC-339	Quezon-1970 Census of Population and Housing	Apr. 1974	NCSO
EC-340	1975 Integrated Census of the Population and its Economic Activities-Population-Philippines	Nov. 1975	NCSO
EC-341	1975 Integrated Census of the Population and its Economic Activities-Population-Cagayan	Nov. 1975	NCSO
EC-342	1975 Integrated Census of the Population and its Economic Activities-Population-Ifugao	Nov. 1975	NCSO
EC-343	1975 Integrated Census of the Population and its Economic Activities-Population-Isabela	Nov. 1975	NCSO
EC-344	1975 Integrated Census of the Population and its Economic Activities-Population-Kalinga-Apayao	Nov. 1975	NCSO
EC-345	1975 Integrated Census of the Population and its Economic Activities-Population-Nueva-Vizcaya	Nov. 1975	NCSO
EC-346	1975 Integrated Census of the Population and its Economic Activities-Population-Quirino	Nov. 1975	NCSO
EC-347	1975 Integrated Census of the Population and its Economic Activities-Population-Mountain Province	Nov. 1975	NCSO

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No.	Title	Issued on	Issued by
EC-348	1975 Integrated Census of the Population and its Economic Activities-Population-Quezon	Nov.1975	NCSO
EC-349	1980-Census of Population and Housing-Philippines	May 1983	NCSO
EC-350	1980-Census of Population and Housing-Cagayan	May 1983	NCSO
EC-351	1980 Census of Population and Housing-Ifugao	May 1983	NCSO
EC-352	1980 Census of Population and Housing-Isabela	May 1983	NCSO
EC-353	1980 Census of Population and Housing-Kalinga-Apayao	May 1983	NCSO
EC-354	1980 Census of Population and Housing-Nueva-Vizcaya	May 1983	NCSO
EC-355	1980 Census of Population and Housing-Quirino	May 1983	NCSO
EC-356	1980 Census of Population and Housing-Mountain Province	May 1983	NCSO
EC-357	1980 Census of Population and Housing-Aurora	May 1983	NCSO
EC-358	1980 Census of Population and Housing-Quezon	May 1983	NCSO

Economic Profile

EC-359	Socio-Economic Profile of Cagayan Vally Region II	1984	NACIAD, CIADP
EC-360	1984 Regional Socio-Economic Profile	--	Regional Development Council II, NEDA, Region II
EC-361	Socio-Economic Profile, Cagayan Province	--	CIADP
EC-362	Physico-Socioeconomic Profile, Ifugao Province	--	PDS, Ifugao
EC-363	Socio-Economic Profile, Province of Isabela	--	PDS, Isabela

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(Continuation)

No.	Title	Issued on	Issued by
EC-364	Kalinga-Apayao, Socio-Economic Profile, 1982 Revised Edition	1982	PDS, Kalinga-Apayao
EC-365	Nueva-Vizcaya, Socio-Economic and Physical Profile, 1985	1985	PDS, Nueva-Vizcaya
EC-366	Socio-Economic Profile, Quirino, 1984	1984	PDS, Quirino
<u>Development Plan</u>			
EC-367	Updated Philippine Development Plan, 1984-1987	Sep.1984	NEDA
EC-368	Updated Cagayan Valley Region Development Plan, 1984-1987	July 1985	RDC, Cagayan Valley (Region II)
EC-369	Perspective Plan for the Cagayan Valley Region 1978-2000	Nov.1986	Regional Development Council II, NEDA, REGION II
EC-370	Cagayan Valley Integrated Area Development Plan	1984	NACIAD, CIADP
EC-371	Regional Multi-Year Human Settlements Plan 1983-1987 & 2000, a Physical Development Framework-Region II	Oct.1983	MHS
EC-372	Regional Multi-Year Human Settlements Plan 1983-1987 & 2000, a Physical Development Framework-Region I	Oct.1983	MHS
EC-373	Regional Multi-Year Human Settlement Plan 1978 to 2000, Realizing the Vision of a New Society	Oct.1978	MHS
EC-374	List of KKK Projects in Region II Funded under the Regular Lending Program	June 1985	MHS
EC-375	Chico River Irrigation Project, Agricultural Progress Report	Sep.1984	NIA
EC-376	Rural Water Supply and Sanitation Master Plan	Dec.1982	MOH, MHS, MPWH

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No.	Title	Issued on	Issued by
<u>Feasibility Study</u>			
EC-377	Port of Irene, Export Processing Zone Pre-feasibility Study	--	NACIAD
EC-378	Feasibility Study on Port Irene Development Plan	Mar.1982	JICA
EC-379	Roxas Water District-Pre Design Report	Feb.1984	LWUA
EC-380	Alicia Water District-Pre Design Report	Dec.1984	LWUA
EC-381	Tuguegarao Water District-Water Supply Feasibility Study	Aug.1982	LWUA
EC-382	Cauayan Water District-Water Supply Feasibility Study	Oct.1983	LWUA
EC-383	Cabagan Water District-Water Supply Feasibility Study	Dec.1983	LWUA
EC-384	Gonzaga Water District-Water Supply Feasibility Study	Mar.1984	LWUA
EC-385	Bambang Water District-Pre Design Report	Dec.1984	LWUA
EC-386	Project Report for the Interim Improvement of Aparri Water District	July 1980	LWUA
EC-387	Ilagan Water District-Water Supply Feasibility Study	Aug.1983	LWUA
<u>Additional Reference</u>			
EC-388	Philippine Statistical Yearbook 1986	Aug.1986	NEDA

ANNEX HY
METEO-HYDROLOGY

ANNEX HY

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I. DATA COLLECTION AND REVIEW

1.1 Data Collection

The meteo-hydrological data, which are recorded in the Cagayan river basin, are collected in order to examine the meteo-hydrological condition of the Basin for water resources development study. These data comprise climatological record including rainfall, runoff record, sediment record and water quality record.

Two synoptic stations in Aparri and Tuguegarao are in operation in the Cagayan basin to observe weather. Besides these stations, 13 meteorological stations' data are collected. These climatological stations and their data availability are shown in Fig. 1.1, and the location of the stations is given in Fig. 1.3.

The daily rainfall data are collected at 64 gauging stations. The hourly rainfall data are available for long period at Aparri and Tuguegarao. The data periods of hourly and daily rainfall are shown in Fig. 1.1 and 1.2, respectively. The location of the rainfall gauging stations is illustrated in Fig. 1.3.

The daily mean gauge height and river runoff data are collected at 78 gauging stations. The data period and the location are shown in Fig. 1.4 and 1.6, respectively. The discharge measurement records are also collected at 50 stations.

The flood hydrograph is observed at Magat damsite, Matuno damsite, Palattao, Cabulay, Ibulao and Gabong gauges. The hourly rainfall records are also available for some of the above flood hydrograph records at Magat and Matuno damsites. The above hydrograph and hourly rainfall records are listed in Table 4.1.

The sediment load observation record and water quality record are collected as shown in Fig. 1.5. The location of the observation is given

in Fig. 1.6.

1.2 Review of Climatological Data

Long period climatological records are available at Aparri and Tuguegarao synoptic stations. These stations observe rainfall, air temperature, relative humidity and wind for more than 25 years. At Tuguegarao station, sunshine duration and evaporation are also measured. The other 13 stations observe rainfall, air temperature, relative humidity, evaporation or sunshine duration. Almost all the stations are located in the lowland of the Basin except for Consuelo and Bontoc.

1.3 Review of Rainfall Data

The daily rainfall data are collected at 64 gauging stations in the Cagayan basin. Among these collected data, the fragmentary or very short period data at 22 gauging stations are decided not to be used, which are,

(5) Imurung, (6) Bauan, (9) Bagabba, (11) Salegseg, (12) Tomiangan, (15) Tumauini, (16) Cabagan, (24) Reina Mercedes, (27) Namulditan, (33) Bayombong, (35) Dupax, (36) Malico, (37) Imugan, (42) Taan, (43) Upper Casecnan, (44) Aurora, (45) Aritao, (46) Kayapa, (49) Conwap, (51) Tabayong, (52) Lias, and (62) Biyoy.

The reliability of remaining data at 42 stations is examined by the double mass curve method. Through this examination, the rainfall data at (3) Aggunetan and (32) Solano are revealed not to be reliable as shown in Fig. 1.7. Moreover, the data at (26) Mt. Data are very big value in July, 1963, then the rainfall data in July, 1963 are disregarded.

Finally, the daily rainfall data at 40 stations are concluded to be used for further study, which are marked as * in Fig. 1.2. Among these 40 stations, 8 stations at Aparri, Tuao, Tuguegarao, Naneng, Ilagan, Bontoc, Nayon and Consuelo cover the observation period of 22 years from 1963 to 1984 as shown in Table 3.2, though some missing data exist which are assumed from the adjacent records.

1.4 Review of Streamflow Data

The daily mean gauge height and/or runoff data are collected at 78 gauging stations. Among them, the runoff data at 40 stations are selected to examine the reliability, which are over 2 years period data. The reliability of the selected data is studied by the double mass curve method as shown in Fig. 1.8. Out of 40 stations, 2 stations at (24) Abbot and (57) Kamamasi, which have no adjacent and simultaneous data, are not checked by the double mass.

Through the above study, the runoff data at 31 stations are selected including 2 stations at Abbot and Kamamasi. Next, the data at 31 stations are compared with rainfall as shown in Table 1.1. Judging from the annual runoff coefficient estimated preliminarily in Table 1.1, the extremely big or small runoff data at the following 8 stations are disregarded:

(5) Simay, (24) Abbot, (25) Pasonglao, (37) Casile, (38) Maligaya, (39) Munoz, (45) Caipilan, (57) Kamamasi.

Finally, the daily runoff data at the following 23 stations are used for further studies:

(7) Calaoagan, (10) Calantac, (12) Escolta, (18) Larion Alto,
(19) Pinukpuk, (29) Antagan, (30) Ampawilen, (34) Taed,
(40) Malalam, (41) Palattao, (42) Supang, (43) Minanga,
(46) Dipalin, (47) Oscariz, (48) Dulao, (50) Hapid,
(51) Camandag, (52) Pangal, (53) Panang, (54) Guinalvin,
(55) Bante, (61) Bato, (62) Dippadiw

The tide level is observed at Aparri. The daily mean tide level at Aparri is shown in Fig. 1.9 and the mean monthly level is given in Table 1.2. The maximum tide level is observed to be 1.4 m above the mean sea level on July 17, 1964 and the minimum is 0.80 m below the mean sea level on September 18, 1959. The average tide level is 0.24 m above the mean sea level during 4 years from 1960 to 1963.

1.5 Review of Sediment and Water Quality Data

The suspended sediment load is observed at 25 stations in the Cagayan basin. Many times of observations are carried out at (6) Pasonglao, (13) Oscariz, (17) Lamut, (18) Hapid, (21) Bante, (25) Dippadiw, (41) Dakgan and (42) Bagabag. The riverbed material observation is also conducted in the main river and major tributaries such as Magat, Ilagan, Siffu-Mallig, Tuguegarao and Chico river.

The water sampling and the water quality analysis are done at 24 points in the Cagayan basin.

II. CLIMATE

2.1 General

The climate in the Cagayan river basin is of tropical monsoon with two wind systems, the Southwest Monsoon and the Northeast Monsoon. According to the climate classification by PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration), the climate in the Cagayan basin falls under Type III characterized by not very pronounced seasons with relatively dry from November to April and wet during the rest of the year as shown in Fig. 2.1.

The major storms that have occurred in the Cagayan basin result from typhoon and monsoon. In the Cagayan basin, the typhoon is centered to attack within a six-month period, July through December with about 8 times a year on an average.

A primal portion of annual rainfall is, however, ascribed to the southwest monsoon. This monsoon is caused by the thermal variations of the Asiatic mainland, and accompanies humid air mass to the Cagayan basin.

2.2 Meteorological Features

2.2.1 Rainfall

The average annual rainfall varies from under 2,000 mm in the plain of the basin to over 4,000 mm in the eastern mountainous parts. The heavier rainfall in the eastern and western mountainous parts is caused by the southwest monsoon with the humid air mass. The isohyetal map of the Cagayan basin is developed as shown in Fig. 2.2. This isohyetal map is based on both of rainfall and runoff data. From this map, the average annual basin rainfall is estimated to be 2,600 mm.

The monthly pattern of rainfall shows the rainy season from May to November as presented in Fig. 2.2. In this rainy season, the rainfall

depth reaches about 80% of the annual rainfall. The maximum monthly rainfall appears in July or August when the southwest monsoon is heaviest on the left bank of the Cagayan river and in November when the typhoon is the most frequent in a year on the right bank.

The maximum annual rainfall was observed to be 5,352 mm at Mt. Polis, Banaue in 1974. The maximum daily rainfall was recorded to be 732 mm at Consuelo on November 5, 1980. The maximum 1, 2 and 3-hour rainfall was observed to be 130 mm, 157.5 mm and 180.5 mm at Aparri on November 4, 1970.

2.2.2 Temperature

The air temperature in the Cagayan basin is relatively low in the country due to its location with high latitude. The hottest month is May or June, while the coldest month is January.

The monthly mean air temperature ranges from 23.1°C in January to 29.0°C in May, and the annual mean is 26.4°C at Tuguegarao as shown in Table 2.1.

2.2.3 Relative Humidity

The high relative humidity is observed in the basin ranging between 70% and 90%. At Tuguegarao, the monthly mean relative humidity varies from 68% in April to 83% in December and the annual mean is 76% as shown in Table 2.1.

2.2.4 Evaporation

The daily evaporation is measured by A-pan in the basin. The maximum evaporation is recorded in April and the minimum is in December. The annual mean daily value is between 3.5 mm at Bontoc (EL. 855 m) and 5.9 mm at Alimanao, Tuguegarao (EL. 30 m) as shown in Table 2.1.

2.2.5 Wind

The prevailing wind direction is south in May to September and north in October to April.

The wind speed is about 10 km/hour at Aparri and 5 km/hour at Tuguegarao throughout the year as shown in Table 2.1.

2.2.6 Sunshine Duration

The annual average daily sunshine duration is 5-6 hours in the basin. The longest duration is shown in April and the shortest in December.

The daily sunshine duration ranges from 2.7 hours in December to 8.0 hours in April at Tuguegarao as shown in Table 2.1.

2.2.7 Atmospheric Pressure

The monthly average atmospheric pressure is relatively high in the dry season and low in the rainy season. At Tuguegarao, the monthly average atmospheric pressure varies from 1,005.9 mb in July to 1,015.4 mb in January.

III. STREAMFLOW ANALYSIS

3.1 General

Streamflow analysis is made in order to grasp the hydrologic cycle in the Cagayan river basin and to estimate the available river runoff to formulate water resources development plan.

The Cagayan river basin, of which drainage area is 27,281 km², catches abundant rainfall of 2,600 mm as an annual average. The following sections present the detail of analysis of the naturalized streamflow in the Cagayan river basin.

3.2 Data Availability and Methodology

3.2.1 Available Data and Necessity of Generation

In the Cagayan river basin, 23 reliable runoff gauges exist or existed as shown in Table 3.1. However, records at these gauges are fragmentary and the observation period is more or less 10 years which is deemed to be insufficient to analyze available water for irrigation and domestic use.

On the other hand, some rainfall data are available for more than about 20 years at several gauges in the Cagayan river basin. These gauges are Aparri, Tuao, Tuguegarao, Naneng, Ilagan, Bontoc, Nayan and Consuelo. Long term streamflow is, therefore, generated by developing a runoff simulation model which converts rainfall into runoff.

3.2.2 Procedure of Generation

The following procedure is applied in order to generate long term naturalized runoff in the Cagayan river basin:

- a) Simulation of long term runoff at the selected runoff gauge by the runoff simulation model,

- b) Estimate of long term runoff in the subbasin by applying the catchment and rainfall ratio of the above gauge and the subbasin to the simulated runoff,
- c) Verification of the estimated long term runoff.

In the above item a), the Cagayan river basin is divided into several basins considering topography and climate. One runoff gauge is, then, selected for each divided basin. The runoff simulation model is developed at each selected gauge. Tank Model is applied as the runoff simulation model because of the simpleness of structure and calculation, and easy simulation of rainfall-runoff relation. The long term runoff is simulated at the selected gauges by the Tank Models applying long term rainfall data.

In the above item b), the Cagayan river basin is divided again into subbasins considering existing and screened damsites, and the confluences of the Cagayan river and tributary or those of tributaries. The long term runoff is estimated in each subbasin by multiplying the simulated runoff at the gauge by the drainage area and annual rainfall ratio of the runoff gauge and the subbasin.

In the above item c), finally, the estimated long term runoff in subbasins is verified by the recorded gauge height and discharge, and/or existing study results.

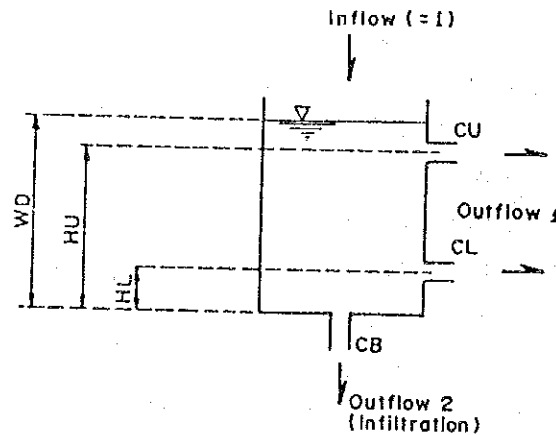
Ten-day mean runoff is generated following the above procedure, instead of daily runoff. The general work flow of streamflow analysis is given in Fig. 3.1.

3.2.3 Outline of Tank Model

The tank model is composed of several, usually four tanks set vertically in series. Each tank corresponds to each runoff mechanism of the basin. The top tank represents the ground surface and the outflow from the top tank gives the surface runoff. The second tank corresponds to the

upper ground layer and the discharge from the second tank shows the intermediate runoff. The third and fourth tanks are set as the lower ground layer and the discharge from these tanks is baseflow.

The calculation process of the inflow to and outflow from a tank is expressed below.



a) inflow (mm) : Inflow for the top tank is rainfall. Inflow for lower tanks is infiltration from the upper tank.

b) outflow 1 (mm): Outflow 1 is the river runoff which is computed as follows:

$$(CU) \times (WD + I - HU) + (CL) \times (WD + I - HL)$$

c) outflow 2 (mm): Outflow 2 is the infiltration into lower layer and computed as follows:

$$(CB) \times (WD + I)$$

After the above computation, the initial water depth, WD becomes to be

$$(WD) + (\text{inflow}) - (\text{outflow 1}) - (\text{outflow 2}) - ET$$

where, ET is the evapotranspiration of the basin.

The coefficients of a tank, CU, CL, CB, WD, HU and HL are determined by trial and error calculation.

The advantage and disadvantage of Tank Model are described below.

- a) The tank model expresses easily non-linear relation between rainfall and runoff.
- b) The time lag between rainfall and runoff is automatically included.
- c) Both of flood and low streamflow can be simulated.
- d) Calculation is simple.
- e) Determination of tank coefficient requires much trial calculation.

3.3 Simulation of Runoff at Gauge

3.3.1 Basin Division

The Cagayan river basin is divided into 6 basins taking account of the topography, river system and climate as shown in Fig. 3.2. The divided basins are Upper Cagayan, Magat, Ilagan, Lower Cagayan, Upper Chico, and Lower Chico basin.

3.3.2 Selection of Gauge

Six Tank Models are prepared for the divided 6 basins mentioned above. Then, each model represents the streamflow characteristics of the corresponding basin. In order to develop 6 Tank Models, runoff and rainfall gauges are selected for 6 basins.

Six runoff gauges are selected, which meet the following conditions:

- a) The record is reliable.
- b) The observation period is long with less missing.

- c) The intake discharge upstream the gauge is negligible to simulate naturalized flow.
- d) The drainage area of the gauge site is between 500 km² and 1,000 km².

The selected gauges are Guinalvin, Dulao, Minanga, Larion Alto, Ampawilen and Pinukpuk as shown in Table 3.1. The reliability of records at the selected runoff gauges is examined again by the daily hydrograph and the double mass, and records are confirmed to be reliable as shown in Fig. 3.3 and 3.4.

Not only runoff, also rainfall data are necessary for developing the Tank Model. The raingauge is selected considering the record period and its location where is near the runoff gauge. The selected raingauges are Ilagan, Nayon, Tuguegarao, Bontoc and Tuao. Almost all the selected gauges have the records for 22 years from 1963 to 1984. Therefore, the Tank Model simulation is carried out for the above 22 years. The missing data are assumed on the basis of data at the surrounding gauges. The 10 days rainfall at the selected raingauges is given in Table 3.2.

The selected runoff gauge and raingauge are summarized below.

<u>Basin No.</u>	<u>Basin Name</u>	<u>Runoff Gauge</u>	<u>Raingauge</u>
Basin 1	Upper Cagayan	Guinalvin	Ilagan
Basin 2	Magat	Dulao	Nayon
Basin 3	Ilagan	Minanga	Ilagan
Basin 4	Lower Cagayan	Larion Alto	Tuguegarao
Basin 5	Upper Chico	Ampawilen	Bontoc
Basin 6	Lower Chico	Pinukpuk	Tuao

3.3.3 Calibration of Tank Coefficient

The tank coefficient of the Tank Model is calibrated by using selected runoff and rainfall data.

In this calibration, a rainfall ratio and an evaporation ratio are applied. The rainfall ratio is the ratio of basin rainfall for the selected runoff gauge to point rainfall at the selected gauge. The basin rainfall for the selected runoff gauge is derived from the isohyetal map shown in Fig. 3.5. The rainfall ratio is summarized below and shown in Table 3.3.

<u>Basin</u>	<u>Upper Cagayan</u>	<u>Magat</u>	<u>Ilagan</u>	<u>Lower Cagayan</u>	<u>Upper Chico</u>	<u>Lower Chico</u>
Rainfall Ratio	1.35	1.60	1.20	2.20	1.40	1.70

The evaporation ratio is the ratio of basin evapotranspiration to the evaporation record by A-pan. The basin average evaporation record by A-pan is given below.

(Unit: mm/day)											
Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
3.6	4.4	5.5	6.5	6.2	5.7	5.3	4.9	4.8	4.3	3.7	3.2

The evaporation ratio is determined to be 0.7, though that in Basin 5 is 0.6 because of higher basin elevation.

After calibration, hydrographs and duration curves of the observed and simulated 10-day runoff are compared as shown in Fig. 3.6 and 3.7. In these figures, the simulated runoff shows good fits to records. Moreover, the simulated and observed annual runoff depths are nearly equal with the difference of less than 10% in Table 3.3. Then, the developed Tank Model is considered to be appropriate. The calibrated tank coefficient is summarized in Fig. 3.8.

3.3.4 Long Term Runoff at Gauge

The long term 10-day runoff is simulated at 6 selected runoff gauges for 22 years from 1963 to 1984 by applying the rainfall data in Table 3.2 to corresponding Tank Model. The simulation result is shown in Table 3.4.

3.4 Estimate of Runoff in Subbasin

3.4.1 Basin Division

The Cagayan river basin is divided into 53 subbasins as shown in Fig. 3.9. Each subbasin belongs to one of divided basins, Basin 1 - Basin 6. The long term runoff is estimated for each subbasin. Then, the above subbasin division is carried out taking the following sites into account:

- a) Magat damsite and screened 14 damsites - Casecnan, Cagayan No. 2, Cagayan No. 1, Diduyon, Addalam (A), Alimit No. 1 (A), Matuno No. 1, Ilagan No. 1, Disabungan, Siffu No. 1 (A), Mallig No. 2, Chico No. 2, Chico No. 4, and Pinukpuk damsite,
- b) confluences of the Cagayan river and tributaries,
- c) confluences of main tributaries and lesser tributaries.

The drainage area of each subbasin is tabulated in Table 3.5.

3.4.2 Long Term Runoff in Subbasin

The long term naturalized 10-day mean runoff for 22 years is estimated in each subbasin by multiplying the simulated runoff at the gauge by the drainage area and annual rainfall ratios of the runoff gauge and the subbasin, as expressed below.

$$Q_{\text{sub}} = Q_{\text{gauge}} \times \frac{C_{\text{sub}}}{C_{\text{gauge}}} \times \frac{R_{\text{sub}}}{R_{\text{gauge}}}$$

where, Q_{sub} : 10-day mean naturalized runoff in subbasin

Q_{gauge} : 10-day mean naturalized runoff at gauge

C_{sub} : Drainage area of subbasin

C_{gauge} : Drainage area of gauge basin

R_{sub} : Annual rainfall in subbasin

R_{gauge} : Annual rainfall in gauge basin

The annual rainfall for gauges and subbasins is derived from the isohyetal map for the period from 1963 to 1978 shown in Fig. 3.5.

The drainage area and the annual rainfall are summarized for the runoff gauge and the subbasin in Table 3.5. The calculation point is presented in Fig. 3.10. The result of the runoff estimation is given in Table 3.6 and 3.7.

3.5 Verification of Estimated Runoff

The naturalized 10-day mean runoff estimated in the preceding sections is verified by comparing with the observed runoff or existing study results.

The summary of comparison between estimated and observed/studied runoff is in Table 3.8. In this table, the estimated runoff is considered to be well simulated judging from the annual average or the dry season's runoff.

The estimated and observed/studied runoffs are compared by hydrographs and duration curves at Palattao in the Cagayan river, Magat damsite in the Magat river and Chico No. 4 damsite in the Chico river as shown in Fig. 3.11-3.14. From these figures, the estimated runoff is judged to be simulated well.

At Nassiping in the lowerreach of the Cagayan river, the estimated runoff is compared with the runoff converted from the observed gauge height as shown in Fig. 3.15. This conversion is based on a stage-discharge curve derived from the non-uniform flow calculation. In Fig. 3.15, the duration curves of the above estimated and converted runoff fit well. Consequently, the estimated 10-day mean runoff is appropriate.

The flow duration curves of estimated runoff are illustrated for tributaries in Fig. 3.16. The average of the estimated runoff is summarized below.

Tributary	Drainage Area (km ²)	Annual Average (m ³ /s)	Average Annual Minimum (m ³ /s)	Minimum 10-day (m ³ /s)
Upper Cagayan River	6,633	291.6	60.9	31.6
Magat River	5,113	262.6	53.7	38.2
Ilagan River	3,132	143.9	40.0	18.0
Siffu Mallig River	2,015	85.8	17.6	12.5
Chico River	4,551	251.4	38.9	28.3
Whole Basin	27,281	1,343.2	277.3	166.2