

*The Feasibility Study of the Flood Control Project for
the Lower Cagayan River in the Republic of the Philippines
Final Report
Main Report*

Tables

Table 2.6.1 Ongoing Flood Control Projects in Region 2 Office (for the year 2000)

Serial No	Project Name	Location	Implementing Agency (District Office)	Kind of Works	Budget Allocation (Pesos1,000)	Scheduled Date of Completion
1	Minanga river control project	Gonzaga	Cagayan 1st	Concrete revetment	500	Oct.
2	Protection works along Cagayan valley road	Alcala	Cagayan 1st	Drainage canal	75	Jul.
3	Protection works along Cagayan valley road	Aparri	Cagayan 1st	Drainage canal	75	Jul.
4	Protection works along Gattaran-Bolos road	Baggao	Cagayan 1st	Slope protection	75	Jul.
5	Protection works along Dugo-San Vicente road	Buguey	Cagayan 1st	Slope protection	75	Jul.
6	Protection works along Cagayan valley road	Camalaniugan	Cagayan 1st	Drainage canal	75	Jul.
7	Protection works along Gattaran-Bolos road	Gattaran	Cagayan 1st	Slope protection	75	Jul.
8	Protection works along Cagayan valley road	Lal-Lo	Cagayan 1st	Drainage canal	75	Jul.
9	Protection works along Dugo-San Vicente road	Sta. Ana	Cagayan 1st	Slope protection	75	Jul.
10	Protection works along Dugo-San Vicente road	Sta. Tresita	Cagayan 1st	Slope protection	75	Jul.
11	Protection works along Dugo-San Vicente road	Gonzaga	Cagayan 1st	Slope protection	75	Jul.
12	Cagayan river control project	Alcala	Cagayan 1st	Concrete revetment	350	Aug.
13	Cagayan river control project	Aparri	Cagayan 1st	Concrete revetment	350	Aug.
14	Cagayan river control project	Camalaniugan	Cagayan 1st	Concrete revetment	350	Aug.
15	Cagayan river control project	Gattaran	Cagayan 1st	Concrete revetment	350	Aug.
16	Cagayan river control project	Lal-Lo	Cagayan 1st	Concrete revetment	350	Aug.
17	Lucha river control project	Abulug	Cagayan 2nd	Concrete revetment	1,580	Jun.
18	Zimundangan river control project	Lasam	Cagayan 2nd	Concrete revetment	690	May
19	Claveria river control project	Claveria	Cagayan 2nd	Gabion spur dike	570	May
20	Pamplona river control project	Pamplona	Cagayan 2nd	Dike	500	May
21	Malag river control project	Rizal	Cagayan 2nd	Dike	460	May
22	Cagayan river control project	Tuguegarao	Cagayan 3rd	Spur dike	1,250	Dec.
23	Cagayan river control project	Tuguegarao	Cagayan 3rd	Spur dike	1,250	Dec.
24	San Ignacio river bank protection project	Ilagan	Isabela 1st	Concrete revetment	1,000	Mar.
25	Cagayan river control project	Cabagan	Isabela 1st	Concrete revetment	2,000	Apr.
26	Aurora flood control project	Aurora	Isabela 2nd	Bank protection	1,500	Jun.
27	Siffu river control project	Roxas	Isabela 2nd	Concrete revetment	1,500	Jun.
28	Cagayan river control project	Angadanan	Isabela 3rd	Gabion bank protection	1,000	Jun.
29	Cagayan river control project	Cauayan	Isabela 3rd	Gabion bank protection	1,430	Jun.
30	Cagayan river control project	Reina Mercedes	Isabela 3rd	Concrete revetment	1,400	Jun.
31	Magat river control project	San Mateo	Isabela 3rd	Gabion spur dike	820	May
32	Magat river control project	Luna	Isabela 3rd	Gabion spur dike	650	Apr.
33	Guecab river control project	Echague	Isabela 4th	Gabion	1,510	May
34	Jones drainage system project	Jones	Isabela 4th	Drainage canal	480	Apr.
35	Dammang river control project	Echague	Isabela 4th	Gabion	1,510	May
36	Magat river control project	Bayombong	Nueva Viscaya	Dike and revetment	259	May
37	Magat river control project	Bayombong	Nueva Viscaya	Dike and revetment	225	May
38	Magat river control project	Bayombong	Nueva Viscaya	Dike and revetment	225	May
39	Magat river control project	Solano	Nueva Viscaya	Dike and revetment	225	May
40	Magat river control project	Solano	Nueva Viscaya	Dike and revetment	225	May
41	Magat river control project	Solano	Nueva Viscaya	Dike and revetment	187	May
42	Magat river control project	Bagabag	Nueva Viscaya	Dike and revetment	187	May
43	Magat river control project	Bambang	Nueva Viscaya	Dike and revetment	187	Apr.
44	Magat river control project	Bambang	Nueva Viscaya	Dike and revetment	187	Apr.
45	Magat river control project	Bambang	Nueva Viscaya	Dike and revetment	187	Apr.
46	Sta. Cruz river control project	Bambang	Nueva Viscaya	Dike and revetment	187	Mar.
47	Protection of La Union- Quirino road	Kayapa	Nueva Viscaya	Dike and revetment	345	Mar.
48	Sta. Fe river control project	Sta. Fe	Nueva Viscaya	Dike and revetment	187	Apr.
49	Sta. Fe river control project	Aritao	Nueva Viscaya	Dike and revetment	187	Mar.
50	Ponggo flood control project	Nagtirupan	Quirino	Gabion type bank protection	665	Jun.
51	Poblacion Norte flood control project	Maddela	Quirino	Gabion type bank protection	620	May
52	Diduyon flood control project	Maddela	Quirino	Gabion type bank protection	573	Apr.
53	Construction of protection along Cordon-Aurora road	Cabarroguis	Quirino	Canal lining and bank protection	467	Apr.
54	Abbag flood control project	Maddela	Quirino	Gabion type bank protection	467	Apr.
55	Dumadate flood control project	Quirino	Quirino	Gabion type bank protection	267	Mar.
56	Bank protection along Cordon-Maddela road	Aglipay	Quirino	Bank protection	267	Mar.
57	Lined canal and bank protection along Cordon- Aurora road	Aglipay	Quirino	Lined canal and bank protection	207	Apr.
58	Anak flood control project	Nagtirupan	Quirino	Gabion type bank protection	467	Apr.
59	Mahatao interior flood control project	Mahatao	Batanes	Gravity retaining wall	1,080	Jul.
60	Gaot flood control project	Ibayat	Batanes	Gravity retaining wall	580	Jul.
61	Charatayan-Panda flood control project	Basco	Batanes	Gravity retaining wall	340	Jul.

Total : 61 projects Allocated budget : 33,100,000 Pesos

Source: DPWH CY 2000 Infrastructure Program Region II, Feb. 2000

Table 2.6.2 Proposed Flood Control Projects in Region 2 Office (for the year 2001)

Serial No.	Project Name	Location	Implementing Agency (District Office)	Kind of Works	Budget Allocation (Pesos 1,000)
1	Cagayan river flood control project	Alcala	Cagayan 1st	Concrete revetment	1,000
2	Cagayan river flood control project	Apari	Cagayan 1st	Concrete revetment	1,000
3	Cagayan river flood control project	Gattaran	Cagayan 1st	Concrete revetment	1,000
4	Cagayan river flood control project	Lallo	Cagayan 1st	Concrete revetment	1,000
5	Protection works along JGCCSMBPR	Baggao	Cagayan 1st	Slope protection for erosion	440
6	Protection works along DSVR	Buguey	Cagayan 1st	Slope protection for erosion	440
7	Protection works along JGCCSMBPR	Gattaran	Cagayan 1st	Slope protection for erosion	1,000
8	Protection works along DSVR	Gonzaga	Cagayan 1st	Slope protection for erosion	440
9	Protection works along DSVR	Sta. Ana	Cagayan 1st	Slope protection for erosion	440
10	Protection works along DSVR	Sta. Teresita	Cagayan 1st	Slope protection for erosion	440
11	Minanga river control project	Gonzaga	Cagayan 1st	Revetment	1,800
12	Matalag river control project	Rizal	Cagayan 2nd	Revetment	1,500
13	Zinundungan river control project	Lasam	Cagayan 2nd	Revetment	3,000
14	Pamplona river control project	Pamplona	Cagayan 2nd	Dike	1,000
15	Lubcan river control project	Lubcan	Cagayan 2nd	Revetment	2,000
16	Claveria river control project	Claveria	Cagayan 2nd	Revetment	2,000
17	Claveria drainage system along road	Claveria	Cagayan 2nd	Lined canal	1,500
18	Nannarian flood control project	Penablanca	Cagayan 3rd	Gabion spurdike	3,700
19	Camasi flood control project	Penablanca	Cagayan 3rd	lined canal	700
20	Various flood control projects		Cagayan 3rd		2,600
21	Angasinan river control project	Ilagan	Isabela 1st	Spurdike	2,500
22	Baculud river control project	Ilagan	Isabela 1st	Concrete revetment	2,000
23	Various flood control projects		Isabela 1st		6,500
24	Siffu river control project	Roxas,Sitio	Isabela 2nd	Gabion spurdike	3,000
25	siffu river control project	Roxas,Ana	Isabela 2nd	SSP revetment	3,000
26	Aurora flood control project	Aurora	Isabela 2nd	Gabion bank protection	3,000
27	Siffu river control project	Burgos	Isabela 2nd	Gabion bank protection	3,000
28	Cagayan river control project	Angadanan	Isabela 3rd	Concrete revetment	2,000
29	Cagayan river control project	Cauayan	Isabela 3rd	Concrete revetment	3,950
30	Cagayan river control project	Reina Mercedes	Isabela 3rd	Concrete revetment	2,670
31	Magat river control project	San Mateo	Isabela 3rd	Gabion spudike	2,730
32	Magat river control project	Luna	Isabela 3rd	Gabion spudike	650
33	Jones town proper drainage system	Jones	Isabela 4th	Lined canal	1,700
34	Protection works along National road	Magsaysay	Isabela 4th	Lined canal	3,000
35	San Agustin town drainage system	San Agustin	Isabela 4th	Lined canal	1,300
36	Sta. Fe river control project	Bambang	Nueva Viscaya	Gabion revetment/dike	1,000
37	Magat river control project	Bayombong	Nueva Viscaya	Gabion revetment/dike	500
38	Magat river control project	Magsaysay	Nueva Viscaya	Gabion revetment/dike	500
39	Various flood control projects		Nueva Viscaya		3,000
40	Ponggo flood control project	Nagtipuanan	Quirino	Gabion bank protection	2,000
41	Poblacion Norte flood control project	Maddela	Quirino	Gabion bank protection	2,500
42	Diduyon flood control project	Maddela	Quirino	Gabion bank protection	2,000
43	Abbag flood control project	Maddela	Quirino	Gabion bank protection	2,500
44	Anak flood control project	Nagtipunan	Quirino	Gabion bank protection	1,000
45	Lusod flood control project	Maddela	Quirino	Gabion bank protection	1,500
46	Dumatat flood control project	Cabaroguis	Quirino	Gabion bank protection	500
47	Charatayan Panda Padangan FCP	Basco	Batanes	Retaining wall	4,500
48	Mahatao flood control project	Mahatao	Batanes	Retaining wall	2,000
49	Ivana flood control project	Ivana	Batanes	Retaining wall	2,000

Total Budget : 49 projects Budget to be allocated : 93,500,000 Pesos

Source : DPWH YEAR 2001 Infrastructure Program Region II, 20 July 2000

Table 2.6.3 Ongoing and Proposed Flood Control Projects by LGUs

Ongoing Projects by Cagayan Province (million Pesos)			
Project	Location	Works	Budget
River control	Centro, Abulug	Riverbank protection	0.50
Anti-erosion and river control	Tuguegarao river	Riverbank protection	0.76
Total			1.26

Proposed Projects by Nueva Viscaya Province (million Pesos)			
Project	Location	Works	Budget
Bagumbayan flood control	Dupax del Sur	Bank protection	-
Road protection	Solano	Slope protection	-
Construction of earth dike	Bayombong	Earth dike	-
Road protection	Bambang	Slope protection	-
Road protection	Solano	Slope protection	-
Road protection	Kayapa	Slope protection	-
Road protection	Solano	Slope protection	-
Road protection	Solano	Slope protection	-
Road protection	Sta.Fe	Slope protection	-
Road protection	Dupax del Sur	Slope protection	-
Total			-

Proposed Projects by Tuguegarao City (million Pesos)			
Project	Location	Works	Budget
River control (Phase VIII)	Centro	Riverbank protection	1.25
Cagayan River control	Caggay	Riverbank protection	1.25
River control (Phase IV)	Centro	Riverbank protection	3.00
Cagayan River control	Cataggaman	Riverbank protection	3.50
Total			9.00

Ongoing Projects by Ilagan City (million Pesos)			
Project	Location	Works	Budget
Ilagan dredging works	Cagayan river	Canalization	0.20

Proposed Projects by Ilagan City (million Pesos)			
Project	Location	Works	Budget
Flood control	Camunaran section	Riverbank protection	10.00
Flood control	Baculod	Riverbank protection	10.00
Flood control	Alinguigan 2nd	Riverbank protection	10.00
Flood control	Mulalum	Riverbank protection	10.00
Flood control	Aggasian	Riverbank protection	10.00
Flood control	Fugu	Riverbank protection	10.00
Flood control	Cab 17-21	Riverbank protection	10.00
Flood control	Cab 9-11	Riverbank protection	10.00
Flood control	Cab 7	Riverbank protection	10.00
Flood control	Cab 4	Riverbank protection	10.00
Flood control	?	Riverbank protection	10.00
Total			110.00

Note; All proposed projects above are not authorized yet and still in waiting approval.

Table 2.8.1 Status of Irrigation Development by Region

Region	Potential irrigable area (ha)	Irrigation development as of December 1999		Remaining area to be irrigated (ha)
		Area (ha)	Rate (%)	
CAR	99,650	72,754	73	26,896
1	277,180	173,395	63	103,785
2	472,640	196,899	42	275,741
3	482,230	251,193	52	231,037
4	263,590	128,055	49	135,535
5	239,660	116,288	49	123,372
6	197,250	75,141	38	122,109
7	50,740	26,168	52	24,572
8	84,380	46,485	55	37,895
9	76,500	35,136	46	41,364
10	108,140	39,408	36	68,732
11	249,990	82,972	33	167,018
12	205,789	54,841	27	150,948
ARMM	156,300	14,124	9	142,176
CARAGA	162,300	37,509	23	124,791
Total	3,126,339	1,350,368	43	1,775,971

Source: NIA Corporate Planning Office

Table 2.8.2 Indicative Ten-Year Irrigation Development Program by NIA

Year	Whole country				Region 2			CAR				
	Potential irrigable area (ha)	Irrigation developed area		Remaining area to be developed (ha)	Potential irrigable area (ha)	Irrigation developed area		Remaining area to be developed (ha)	Potential irrigable area (ha)	Irrigation developed area		Remaining area to be developed (ha)
		(ha)	(%)			(ha)	(%)			(ha)	(%)	
1999	3,126,340	1,350,368	43.2	1,775,972	472,640	196,899	41.7	275,741	99,650	72,754	73.0	26,896
2000	3,126,340	1,375,800	44.0	1,750,540	472,640	199,250	42.2	273,390	99,650	72,990	73.2	26,660
2001	3,126,340	1,445,960	46.3	1,680,380	472,640	215,080	45.5	257,560	99,650	73,620	73.9	26,030
2002	3,126,340	1,507,400	48.2	1,618,940	472,640	219,020	46.3	253,620	99,650	73,880	74.1	25,770
2003	3,126,340	1,584,250	50.7	1,542,090	472,640	224,840	47.6	247,800	99,650	75,800	76.1	23,850
2004	3,126,340	1,669,810	53.4	1,456,530	472,640	228,950	48.4	243,690	99,650	76,060	76.3	23,590
2005	3,126,340	1,753,940	56.1	1,372,400	472,640	231,230	48.9	241,410	99,650	79,380	79.7	20,270
2006	3,126,340	1,814,820	58.0	1,311,520	472,640	233,430	49.4	239,210	99,650	79,500	79.8	20,150
2007	3,126,340	1,850,000	59.2	1,276,340	472,640	234,660	49.6	237,980	99,650	79,530	79.8	20,120
2008	3,126,340	1,883,540	60.2	1,242,800	472,640	238,030	50.4	234,610	99,650	79,560	79.8	20,090
2009	3,126,340	1,918,220	61.4	1,208,120	472,640	241,020	51.0	231,620	99,650	79,560	79.8	20,090
Increase* (1999-2009)	-	567,852	18.2	-	-	44,121	9.3	-	-	6,806	6.8	-
Av. Increase* per year	-	56,785	1.8	-	-	4,412	0.9	-	-	681	0.7	-

Source: NIA, CO, with addition (*)

Table 2.9.1 Existing Flood Control Structures in Cagayan River Basin

District Office	Earth Dike		Spur Dike		Revetment		Main Drainage Canal		Lateral Drainage Canal		Estero	
	Sites	Length (km)	Sites	Length (km)	Sites	Length (km)	Sites	Length (km)	Sites	Length (km)	Sites	Length (km)
Cagayan I	-	-	2	0.284	19	2.804	-	-	-	-	10	11.000
Cagayan II	-	-	1	0.164	5	0.633	-	-	-	-	5	5.500
Cagayan III	-	-	11	2.146	5	1.205	-	-	1	1.690	5	6.100
Isabela I	3	0.125	5	0.452	26	5.444	7	3.145	12	3.372	10	11.360
Isabela II	-	-	7	0.453	4	0.815	21	3.860	-	-	6	2.210
Isabela III	-	-	1	0.012	8	0.799	-	-	1	4.988	4	4.600
Isabela IV	-	-	1	0.250	6	0.825	-	-	3	5.670	4	4.100
Nueva Vizcaya	-	-	44	2.308	38	10.425	1	6.000	-	-	12	13.850
Quirino	1	0.600	11	0.494	11	1.698	-	-	-	-	5	5.850
Total	4	0.725	83	6.563	122	24.648	29	13.005	17	15.720	61	64.570

Source : Inventory Survey by DPWH, Region II Office

Table 2.9.2 Principal Features of Magat Dam and Major Intake Weirs

Magat Dam	
Location	Oscariz, Ramon, Isabela
Completion date	October-82
Purpose	Irrigation and hydroelectric generation
Dam	
Type	: Zoned earth rock fill
Direct height	: 114 m
Crest length	: 4,160 m
Crest elevation	: 200 EL m
Spillway	
Width (m)	: 164 m
Radial gates	: 7 sets
Orifice gates	: 2 sets
Discharge capacity	: 30,600 cu.m/s
Reservoir	
Full supply level (FSL)	: 193.0 EL m
Maximum flood level (MFL)	: 197.6 EL m
Storage capacity at FSL	: 1.08 billion cu.m
Storage capacity at MFL	: 1.26 billion cu.m
Power house	
Installed capacity	: 360 MW
Additional capacity	: 180 MW
Total	: 540 MW
Irrigation service	
Service area	: 95,000 ha
Maris Diversion Weir (Maris Dam)	
Location	Oscariz, Ramon, Isabela
Completion date	August-82
Purpose	Irrigation
Weir	
Type	: Ogee type concrete weir
Direct height	: 10.5 m
Crest length	: 102.00 m
Crest elevation	: EL m
Scouring sluice	
Sluice gate	: 2 sets
Stoplog gate	: 16 sets
Sluiceway	
North gate	: 2 sets
South gate	: 2 sets
Service area	: 88,400 ha
Chico Diversion Weir	
Location	Bo. Ngipen, Tabuk
Completion date	December-83
Purpose	Irrigation
Weir	
Type	: Ogee type concrete weir
Direct height	: 3.65- 7.1 m
Crest length	: 759 m
Crest elevation	: 204.50 EL m
Probable afflux elevation	: 207.55 EL m
Scouring sluice	
Sluice gate	: 2 sets
Sluiceway	
Left sluiceway	: 4 bays with 2 steel gate(2.5 × 3.8m)
Right sluiceway	: 1 bay with 2 steel gate(2.06 × 1.32m)
Siphon	
Length	: 733 m
Diameter of conduit	: 3-3.8 m
Service area	: 17,600 ha
Source : NIA, Region II Office	

Table 2.9.3 Principal Features of Irrigation Pump Stations along Cagayan River

Item	Name of Station				
	Magapit	Amulung		Iguig	Solana
Location	Magapit	Baculud		Minanga	Solana
Completion date	May-85	Jun-82		Sep-83	Dec-80
Service Area (ha)	11,457	(H):1,371	(L): 801	776	2,780
Water Requirement (cu.m/s)	21.081	(H):2.523	(L): 1.474	1.427	5.33
Water Level (EL,m)					
HWL	11.00	20.00		20.00	48.45
MWL (Wet season)	1.24	6.30		8.02	36.10
MWL (Dry season)	0.46	4.52		7.08	34.60
LWL	0.00	1.40		4.00	34.10
Pump Plant					
Type		Vertical mixed flow pump with volute casing			
Numbers	4	(H): 3	(L): 1	3	4
Diameter of Suction Pipe (mm)	1,800	(H): 700	(L): 800	600	700
Diameter of Discharge Pipe (mm)	1,500	(H): 600	(L): 800	500	700
Suction Pipe Level (EL,m)	0.70[0.70]	(H): 5.21[-2.37]	(L): 5.21[-2.37]	7.46[-0.12]	31.30[2.67]
Discharge Pipe Level (EL,m)	14.00[14.00]	(H): 23.00[15.42]	(L): 17.00[9.42]	19.50[-11.92]	52.15[23.95]
Actual Head (m)	13.30	(H): 17.79	(L): 11.79	12.04	16.80
Total Head (m)	14.60			13.70	18.50
Pump Capacity (cu.m/min/unit)	340	(H): 70.5	(L): 80.0	37.6	60

Note: 1. At Solana station, three pump plants will be added soon.

2. [] indicates assumed elevation in terms of mean sea level

Source: NIA Region II Office

Table 2.9.4 Principal Features of Major Bridges

River	Name of Bridge	Bridge Type	Completion Year	No. of Span	Total Length (m)	Width (m)	Remarks
Cagayan	Magapit	Suspension	1980	1	376.00	7.32	
		RC-I beam		1			
	Truss	2					
	RCDG	2					
	Buntun	Truss	1968	8	1,098.00	7.32	
	Comp.I-beam	5					
Gamu	Truss	1964	3	442.00	6.75		
Comp.I-beam	8						
Naguilian	Truss	2000	8	687.80	7.32		
Comp.I-beam	5						
Dalibubon	Continuous box	-	30	210.00	5.60	ongoing	
Jones	PC	1982	22	154.00	3.34		
Chico	Itawes	PC	-	29	283.00	4.00	ongoing
	Tuao	PC	1984	6	42.00	4.00	
	Calanan	Truss	-	5	-	-	
	Pinukupuk	Truss	-	-	-	-	
Dummon	Dummon	Truss	1945	1	89.14	6.10	
RCDG	2						
Pared	Pared	I-beam	1946	2	226.32	7.32	
DCRG	8						
Tuguegarao	Pinacanauan	RCDG	1992	8	303.84	6.70	
Pinacanauan	San Pablo	RCDG	1998	7	279.15	7.32	
Tumauni	Arcon	Truss	1946	3	121.14	6.20	
	Minanga	RCDG	1973	11	339.90	7.32	
Siffu	Siffu	RCDG	1971	20	300.00	6.75	
Mallig	Mallig	RCDG	1974	14	210.00	6.75	
Ilagan	Mallam	PCDG	1996	10	487.84	9.52	
Magat	Magat	Truss	1978	-	274.00	12.00	
	San Lorenzo	PSDG	1996	-	483.90	7.32	
	Batu	PSDG	-	-	345.63	7.32	
Abian	Abian	Comp.I-beam	-	7	108.22	6.75	
Sta.Fe	Cupas	Truss	-	6	279.00	-	
	Indiana	PSCG	-	-	98.40	6.70	
	Sta.Fe	RCDG	-	1	24.30	6.70	
Ganano	Ganano	Truss	1975	3	73.20	7.32	
	Ipil	Truss	1975	3	73.20	7.32	
	Buluarte	-	-	-	-	-	
Diaddi	Calao 1	Truss	1975	1	130.00	7.32	
	Calao 2	RCDG	-	-	-	-	

Source: DPWH Region II office

Table 3.1.1 Assumed Cost Disbursement

(Unit: Mill. Pesos)

Item	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total		
I. MULTIPURPOSE PROJECT																						
1. Mallig Project				44.87	281.51	748.07	905.79	1,016.20	718.82												3,715.26	
2. Siffu Project				31.72	158.58	264.31	338.31	264.31													1,057.23	
3. Matuno Project						152.16	507.20	937.26	1,348.04	1,568.00	1,342.41										5,855.07	
4. Alimit Project											61.10	305.57	509.28	651.87	509.28						2,037.10	
																				Sub-Total	12,664.66	
II. FLOOD CONTROL PROJECT																						
1. Tuguegarao Dike				27.60	131.70	131.70	131.70	131.70														554.40
2. Magapit (Naasiping Left, NLL)					49.00	232.30	232.30	232.30	232.30													978.20
3. Bank Protection		53.30	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90	53.90		969.60
4. Cabagan Dike										15.50	72.80	72.80	72.80	72.80								306.70
5. Magapit (Nassiping Right, NLR)										147.70	312.10	312.10	312.10	312.10	312.10	312.10	312.10	312.10	312.10	312.10		2,956.60
																				Sub-Total	5,765.50	
III. IRRIGATION PROJECT																						
1. Pinacanauan RIS			1.85	21.16																		23.01
2. Dabubu RIP			5.54	46.81	46.72																	99.07
3. Lulutan IP											7.80	88.29	87.85									183.94
4. Solana IS											2.92	35.10	35.10									73.12
5. Gappal IP											19.79	88.08	259.24	238.96								606.07
6. Ilagan IP													7.00	79.75	79.39							166.14
7. Tuguegarao IP													4.15	47.64	47.46							99.25
8. Alcala Amulung West IP														13.59	128.62	166.15	125.41					433.77
9. Bagao IS														21.23	85.97	182.51	161.27					450.98
10. Dummon RIS															20.75	84.38	182.50	161.75				449.38
11. Tumauni IS																	20.74	178.93	178.73			378.40
12. Zinundungan IEP																17.57	73.19	172.55	154.75			418.06
13. Magat O & M Improvement		157.75	352.95	234.71	183.46	131.13																1,060.00
																				Sub-Total	4,441.19	
IV. HYDROPOWER																						
1. Ibulao									16.53	82.65	137.75	176.32	137.75									551.00
2. Tanudan												19.38	96.90	161.50	206.72	161.50						646.00
3. Diduyon															1,069.78	1,337.22	2,674.44	2,674.44	1,158.92			8,914.80
																				Sub-Total	10,111.80	
Total	0.00	211.05	414.24	460.77	904.87	1,713.57	2,169.20	2,635.67	2,369.59	1,867.75	2,010.57	1,151.54	1,576.07	1,653.34	2,513.97	2,315.33	3,603.55	3,553.67	1,858.40			32,983.15
V. PROJECT COST BY SECTOR																						0.00
1. Flood Control	0.00	53.30	53.90	90.62	291.87	552.21	612.35	618.26	383.32	217.10	468.15	585.53	683.36	751.82	610.56	366.00	366.00	366.00	366.00	366.00		7,436.35
2. Irrigation	0.00	157.75	360.34	369.43	559.38	948.74	1,031.64	1,188.56	1,065.94	540.95	477.20	251.98	460.85	484.13	412.86	404.61	489.67	441.94	289.61			9,935.58
3. Hydropower	0.00	0.00	0.00	10.72	53.62	212.62	525.21	828.85	920.33	1,109.70	1,065.22	314.03	431.86	417.39	1,490.55	1,544.72	2,747.88	2,745.73	1,202.79			15,621.22

Table 4.3.1 Incremental Capital Output Ratio of Nation and Region 2: 1993-1998

Item	1993	1994	1995	1996	1997	1998	Average* ²
Philippines							
1. Capital Formation	164,125	176,388	184,667	206,854	230,662	204,279	192,539
2. Incremental Output	15,215	32,212	35,856	46,897	43,739	-4,785	34,784
3. ICOR	10.79	5.48	5.15	4.41	5.27	-42.69	5.54
4. Average of ICOR							5.5
Region 2							
1. Capital Formation	2,593	5,880	5,131	6,265	6,276	6,136	5,229
2. Incremental Output	460	969	714	570	1,738	-1,073	890
3. ICOR	5.64	6.07	7.19	10.99	3.61	-5.72	5.88
4. Average of ICOR							5.9

Source: 1999 Philippine Statistical Year book, NSCB

Gross Regional Domestic Expenditure 1996-1998, July 2000, NSCB

Note: *1 ICOR stands for Incremental Capital Output Ratio.

*2 An average of ICOR was estimated excluding 1998 values because the national economy suffered from the Asian crisis seriously.

Remark

In order to accelerate economic growth, the regional government has to increase production factors such as capital and labor, to increase productivity or to improve technology level. Since the labor force is in excess in developing countries, the government has to increase capital stock through investment on condition that the investment efficiency is constant. An economic growth is calculated as follows.

$$G(Y) = \frac{1}{ICOR} \times \frac{I}{Y}$$

Where, $G(Y)$: Economic Growth ($\Delta Y/Y$)

$ICOR$: Incremental capital-output ratio ($\Delta K/\Delta Y = I/\Delta Y$)

I : Investment ($=\Delta K$)

ΔY : Increment of GRDP

Y : GRDP

Thus, an increase of investment makes an economic growth in the region, since the ICOR is considered as constant during a certain period for the industrial structure keeps the same conditions. Incidentally, the smaller is the ICOR, the higher is the economic efficiency of investment, as shown in the formula above. On basis of the GRDE records as shown in the table above, the ICORs of Region 2 and the country were 5.9 and 5.5 respectively.

Table 4.3.2 GRDP Projection at 1998 Constant Prices: 1998-2020

Item	Actual	Estimate	Projection			Growth Rate (%)	
	1998	2004	2005	2010	2020	2005	2010
	*1	*2				- 2010	- 2020
GRDP Under Medium Growth Scenario (Billion Pesos)							
1. Philippines	2,667.1	3,613.0	3,800.7	4,896.3	8,125.9	5.2	5.2
2. NCR	925.4	1,268.1	1,336.6	1,738.6	2,941.8	5.4	5.4
3. CAR	59.7	92.8	99.9	144.6	302.6	7.7	7.7
4. Region 2 *3	54.5	77.5	83.1	100.6	143.0	3.9	3.6
5. Other Regions	1,627.5	2,174.6	2,281.1	2,912.5	4,738.5	5.0	5.0
6. Philippines without NCR	1,741.7	2,344.8	2,464.1	3,157.7	5,184.1	5.1	5.1
7. Region 2							
1) Low Scenario*3	54.5	77.5	83.1	100.6	143.0	3.9	3.6
2) High Scenario*4	54.5	77.5	83.1	126.6	268.3	8.8	7.8
GRDP per Capita (1000 Pesos)							
1. Philippines	36.5	43.8	45.1	53.3	77.0	3.4	3.7
2. NCR	92.5	114.2	118.4	144.6	225.9	4.1	4.6
3. CAR	44.6	61.0	64.3	85.0	154.5	5.7	6.2
4. Region 2	20.2	25.6	26.9	30.1	38.2	2.3	2.4
5. Other Regions	27.6	32.5	33.4	38.9	54.6	3.1	3.4
6. Philippines without NCR	29.6	32.8	33.8	39.6	56.1	3.2	3.5
7. Region 2							
1) Low Scenario	20.2	25.6	26.9	30.1	38.2	2.3	2.4
2) High Scenario	20.2	25.6	26.9	37.9	71.7	7.1	6.6
Expected Capital Investment and GRDP in Region 2 (Billion Pesos)							
1. Low Scenario							
	ICOR = 5.9		5.9	5.9	5.9		
a. Incremental GDP (Billion Pesos)		5.2	5.6	2.6	5.5		
b. Required Basic Capital Formation		30.7	33.2	15.2	32.4		
2. Special Projects for Region 2		8.8	15.5	20.0	33.3		
AFMA*5		0.5	0.6	0.7	1.2		
CEZA*5		1.2	1.3	1.6	2.7		
W/R Projects in M/P*6		-	1.3	1.6	2.7		
Ripple & Private Capital Formation		7.0	12.4	16.0	26.6		
Total Capital Formation		39.5	48.8	35.2	65.7		
	ICOR= 5.9		5.9	5.8	5.5		
Incremental GRDP		6.7	8.3	6.1	11.9		
GRDP		79.0	85.7	119.1	211.5	6.8	5.9
GRDP per Capita (1000 Pesos)		26.1	27.8	35.7	56.1	5.1	4.6
Reference							
Philippines (Billion Pesos)	ICOR = 5.5		5.5	5.5	5.5		
a. Incremental GDP	-	216.8	187.7	241.9	401.4		
b. Required Capital Formation		1,192.5	1,032.6	1,330.2	2,207.6		

Note: *1 Actual values at current prices

*2 Estimates in Medium-Term Development Plan 1999-2004

*3 Estimates based on the past trend by NEDA Regional Office 2

*4 Estimates by NEDA Regional Office 2. They include AFMA, CEZA and other economic development programs in addition to the ordinal investment programs.

*5 The capital investment of special projects are assumed by means of trend projection. (Unit: Bil. Pesos)

Projects	Initial Investment **1		Growth Rate **2	Total Investment **3	Expected Total Investment**4
	2000	2001			
AFMA	0.447	0.492	5.2%	16.3	28.6
CEZA	0.108	1.063	5.2%	36.0	61.0

**1 AFMA's investment 447 million pesos for Region 2 in 2000 was already appropriated by the central government.

The investment of CEZA in 2000 was appropriated around 108.38 million pesos. In the following year, it was assumed to increase to 1.06 billion pesos, which is a minimum investment to attain the target public investment of 60 billion pesos by 2020. The total investment of CEZA is estimated at around 120 billion pesos including private investment.

**2 The growth rates are assumed to be the same as the national economic growth rate, although they were expected as 10% by NEDA Regional Office 2 in the high scenario.

**3 The total investment of the respective projects by the target year 2020.

**4 The accumulated amount by 2020

*6 The minimum investment to attain the regional economic target of 56,100 pesos per capita in 2020. The total investment was estimated at around 30 billion pesos by 2020, accounting for 1/3 of the total amount, 90.6 billion pesos in the M/P.

*7 ICOR was assumed to be improved to the national level due to improvement of regional economic environment.

Table 5.2.1 Summary of Meteorological Record (1/2)

Rainfall (mm)

Station	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Amount
Aparri	1951-85	134.4	75.2	45.4	35.3	99.4	175.2	183.5	226.5	286.8	345.2	397.6	210.8	2,215.3
APC, Iguig	1981-99	27.6	16.1	18.7	42.5	153.0	161.0	225.2	267.1	232.5	346.8	180.0	133.1	1,803.6
Lal-lo	1972-84	125.0	56.1	29.5	55.5	162.3	145.9	171.2	275.0	197.7	310.3	349.1	197.2	2,074.8
Bitag Grande	1975-80	85.5	21.0	28.9	27.4	212.6	118.3	313.0	199.9	548.7	214.2	286.3	141.2	2,197.0
Tuao	1956-85	29.4	24.3	31.2	63.3	171.0	195.4	214.8	232.2	175.1	246.7	230.8	96.9	1,711.1
Tuguegarao	1949-85	18.7	14.5	30.2	49.1	113.1	155.2	195.5	234.5	202.2	248.5	276.4	94.7	1,632.6
Pinukpuk	1970-81	83.7	26.0	58.4	75.8	203.8	233.6	263.2	322.3	212.7	365.5	364.2	189.2	2,398.4
Naneng	1956-85	38.3	28.1	51.4	72.9	208.0	271.8	285.4	337.8	288.7	298.2	299.2	94.9	2,274.7
Guilguila	1963-80	122.7	56.1	61.7	77.0	215.4	321.8	329.1	284.7	312.9	318.5	375.9	237.2	2,713.0
Lubuagan	1969-78	62.6	32.8	65.2	51.2	147.7	224.6	213.1	236.5	210.8	237.2	275.0	155.4	1,912.1
Basao	1963-75	95.6	27.2	70.6	114.8	288.8	422.0	382.0	341.4	314.9	312.6	439.8	271.5	3,081.2
Ilagan	1965-84	59.1	20.9	32.3	62.6	155.4	172.8	144.7	186.0	172.2	291.1	315.9	191.1	1,804.1
Banga-an	1963-78	27.2	7.6	22.0	78.8	218.7	274.8	302.4	375.6	274.5	148.8	115.3	26.4	1,872.1
Bontoc	1963-85	17.9	11.9	46.6	127.6	263.8	294.5	390.5	267.9	302.8	204.8	152.5	54.4	2,135.2
Barlig	1963-85	134.4	41.0	92.9	95.2	309.7	402.6	394.7	411.6	372.1	407.8	499.5	326.3	3,487.8
Bauko	1963-80	6.5	7.5	43.8	169.1	284.5	304.8	371.0	421.4	313.4	188.7	67.9	54.4	2,233.0
Mt. Polis	1963-80	160.4	134.0	110.1	157.7	337.3	457.1	516.8	553.5	453.0	378.1	370.9	246.6	3,875.5
Mt. Data	1950-78	27.2	25.0	74.6	187.9	357.0	413.5	619.4	563.3	465.2	296.3	220.4	78.2	3,328.0
Lagawe	1968-82	176.0	88.5	65.2	190.1	171.3	265.0	362.0	319.9	341.4	331.6	394.3	146.3	2,851.6
Nayon	1968-80	63.4	25.5	69.9	89.5	217.2	200.4	207.8	243.6	220.4	240.2	185.7	99.3	1,862.9
Echague	1976-85	17.5	9.1	18.2	91.7	114.5	97.1	148.8	259.9	189.6	272.8	128.0	142.3	1,489.5
Diadi	1968-71	54.2	16.3	49.9	54.4	173.0	239.2	275.8	192.4	211.4	399.6	280.0	153.3	2,099.5
Barat	1968-80	23.8	10.1	35.8	90.0	226.7	224.8	271.4	323.1	302.7	337.8	156.4	104.9	2,107.5
Consuelo	1956-85	33.5	18.0	44.0	70.9	221.5	252.6	380.4	331.0	325.5	263.9	211.8	60.5	2,213.6
Gabong	1972-52	38.6	13.0	25.5	33.4	128.5	179.9	251.5	216.7	229.0	230.0	284.9	90.3	1,721.3
Dakgan	1972-82	18.4	11.3	29.8	23.1	134.5	158.8	234.2	176.5	216.5	273.1	274.6	68.9	1,619.7
Casiguran	1961-84	234.2	113.8	176.5	136.3	242.3	229.4	284.7	251.9	592.5	421.7	628.8	402.9	3,715.0
Wacal	1980-85	36.8	19.6	112.2	160.7	174.1	107.5	255.5	201.4	183.2	259.9	141.4	50.4	1,702.7
Banti	1980-85	33.7	12.4	17.9	71.4	102.7	86.6	133.0	169.9	224.6	177.9	78.9	34.7	1,143.7
Dippadiw	1980-83	185.8	19.7	53.2	27.2	190.1	59.7	245.8	239.2	181.1	249.7	458.1	299.5	2,209.1
San Francisco	1975-80	122.8	138.2	47.0	41.8	146.3	82.3	143.1	143.4	153.9	328.3	209.8	171.7	1,728.6
NIA Cabarroguis	1982-85	54.2	7.7	52.0	95.5	170.3	185.8	96.0	187.8	124.2	159.2	121.0	117.5	1,371.2
Hapid	1976-85	15.4	21.7	42.8	115.2	222.5	167.9	209.4	173.7	241.4	213.4	109.4	29.9	1,562.7
Baretbet	1977-85	21.1	12.5	58.9	128.1	262.7	184.7	231.4	194.9	254.4	250.8	125.1	49.4	1,774.0
Baligatan	1976-85	29.4	10.7	37.6	98.7	206.8	177.0	234.2	213.1	231.0	202.9	160.2	50.9	1,652.5
Poblacion Lagawe	1976-85	44.9	37.5	62.7	117.9	240.1	183.3	284.8	267.4	230.1	250.7	136.3	64.3	1,920.0
Sto. Domingo	1976-85	28.6	14.6	29.7	115.3	113.9	161.7	193.5	157.3	232.7	245.3	116.3	44.8	1,453.7
Kasibu	1978-85	52.5	44.4	86.0	189.8	260.1	221.3	223.1	234.9	259.6	555.6	398.4	132.1	2,657.8
Kamamasi	1978-85	183.1	55.5	111.5	158.7	279.0	187.7	325.4	216.4	401.2	521.3	505.7	306.7	3,252.2
Alayan	1978-85	112.1	42.4	60.1	191.4	229.6	170.4	253.8	200.3	375.2	535.9	475.1	268.3	2,914.6
Packet	1979-84	45.4	30.5	75.2	126.2	261.3	171.9	259.5	187.3	335.8	231.5	277.7	201.8	2,204.1

Mean air temperature (°C)

Station	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Aparri	1951-85	23.1	23.8	25.3	27.1	28.3	28.5	28.3	27.9	27.6	26.8	25.4	23.8	26.3
Tuguegarao	1951-83	23.1	24.1	26.1	28.2	29.0	28.6	28.0	27.7	27.3	26.3	24.8	23.5	26.4
Echague	1981-84	21.5	22.7	24.5	26.1	26.9	27.6	26.8	26.6	26.3	25.3	24.2	22.2	25.1

Mean maximum air temperature (°C)

Station	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Echague	1980-97	27.1	29.4	32.3	34.5	34.9	34.4	33.2	33.3	32.2	31.5	29.5	27.2	31.6
APC, Iguig	1981-99	28.1	29.8	32.9	35.3	36.5	35.7	34.5	33.9	33.2	31.2	29.6	27.6	32.4
Aparri	1951-85	26.3	27.6	29.6	31.6	33.3	33.5	32.9	32.4	31.6	30.2	28.3	26.8	30.3
Tuguegarao	1951-83	29.2	31.2	33.8	35.9	36.8	35.7	34.9	34.2	33.6	32.2	30.1	28.8	33.0
Malasin	1976-80	27.2	27.4	30.2	32.8	32.9	31.9	31.5	31.3	30.9	29.0	27.0	26.0	29.8
San Isidro	1976-80	27.3	28.2	30.6	33.1	33.0	31.9	31.7	31.6	31.3	29.2	27.3	26.2	30.1
Lagawe	1981-84	29.1	29.0	28.9	28.8	29.7	30.2	29.7	29.9	29.7	29.7	29.6	28.4	29.4
Hapid	1981-84	23.7	24.6	25.7	27.3	28.5	28.2	27.7	26.8	28.2	26.7	25.5	23.0	26.3
Baretbet	1981-84	26.1	28.2	31.2	31.0	30.1	29.9	29.1	28.8	29.8	28.4	27.8	25.9	28.9
Consuelo	1981-84	25.5	28.7	30.3	30.9	31.7	31.1	29.2	27.6	28.6	27.4	27.1	24.8	28.6
Sto Domingo	1981-84	27.7	29.1	28.9	31.0	32.2	32.7	31.9	30.1	30.0	29.4	30.1	27.2	30.0

Table 5.2.1 Summary of Meteorological Record (2/2)

Mean minimum air temperature (°C)

Station	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Echague	1980-97	19.8	20.1	20.6	22.7	23.7	24.0	23.6	23.7	23.4	22.9	22.0	19.0	22.1
APC, Iguig	1981-99	20.0	20.2	21.3	23.0	24.1	24.5	24.0	24.2	23.8	23.1	22.2	20.4	22.6
Aparri	1961-99	20.4	20.6	22.0	23.5	24.4	24.8	24.7	24.5	24.2	23.7	22.8	21.2	23.1
Tuguegarao	1951-83	19.3	19.4	20.9	22.6	23.7	23.8	23.6	23.6	23.3	22.5	21.6	20.3	22.1
Malasin	1976-80	21.8	21.9	23.6	24.6	24.8	25.3	25.1	25.3	25.4	24.7	23.2	22.3	24.0
San Isidro	1976-80	21.3	21.1	23.0	24.9	25.4	25.7	25.6	25.5	24.6	24.1	22.8	21.6	23.8
Lagawe	1981-84	20.5	19.0	22.0	21.7	21.2	22.1	20.6	21.8	21.5	21.8	22.0	21.1	21.3
Hapid	1981-84	21.2	20.5	21.1	22.7	23.3	24.1	23.8	23.2	23.0	23.4	22.0	20.5	22.4
Baretbet	1981-84	21.7	23.1	23.3	24.3	24.5	24.4	24.2	24.8	25.0	24.0	23.8	22.5	23.8
Consuelo	1981-84	20.4	21.5	23.7	24.2	25.4	25.2	24.0	23.4	23.6	22.9	22.0	21.1	23.1
Sto Domingo	1981-84	19.6	20.1	19.5	20.2	22.2	22.0	21.2	20.4	20.1	18.7	19.1	18.9	20.2

Relative humidity (%)

Station	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
APC, Iguig	1983-97	89	88	82	79	78	82	84	85	86	88	89	90	85
Aparri	1951-85	85	83	82	81	80	80	81	83	84	84	86	87	83
Tuguegarao	1949-99	80	76	73	69	69	72	74	76	77	79	82	82	76
Echague	1981-84	88	86	81	79	83	84	84	87	86	85	90	92	85
Malasin	1976-80	85	81	78	70	72	80	81	80	85	83	88	86	81
San Isidro	1976-80	86	82	78	74	73	80	82	81	83	86	90	88	82

Daily evaporation, A-pan (mm)

Station	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
APC, Iguig	1980-99	2.8	4.1	5.8	6.6	6.5	6.0	5.1	4.7	4.3	3.5	2.7	2.3	4.5
Tuguegarao	1974-91	2.6	3.9	5.0	5.8	5.7	5.1	4.8	4.0	3.4	3.2	2.6	2.1	4.0
Alimano reservoir	1957-67	4.9	5.5	6.6	7.8	7.5	6.4	6.0	5.5	5.8	5.3	4.5	4.4	5.9
Talictic (Baligatan)	1957-84	3.7	4.6	6.0	7.3	7.1	6.1	5.6	5.1	5.1	4.6	3.7	3.3	5.2
Bontoc	1969-74	3.9	4.4	4.2	4.3	3.0	3.5	2.5	3.1	3.6	3.2	2.9	3.0	3.5
Echague	1977-97	2.6	3.2	5.0	5.3	5.3	4.8	4.8	4.1	3.9	3.4	2.5	2.3	3.9
Lagawe	1980-82	3.9	3.7	4.3	5.4	5.7	4.8	4.9	5.7	4.9	6.4	5.5	3.9	4.9
Consuelo	1980-84	3.5	4.6	5.2	6.0	6.1	5.4	5.1	3.7	4.7	3.3	3.3	3.1	4.5
Sto Domingo	1979-84	4.3	5.3	6.3	7.3	6.3	6.4	5.8	5.6	6.0	5.3	4.7	4.7	5.7
Baretbet	1980-84	3.4	3.3	5.7	6.2	6.2	5.8	5.6	5.3	5.0	4.3	3.6	3.2	4.8
Wacal	1980-84	3.0	4.2	5.2	5.6	5.8	6.6	5.7	5.4	4.8	4.7	3.5	3.0	4.8
Malasin	1976-80	3.5	4.4	6.2	8.3	7.5	6.2	6.0	5.5	4.3	3.8	3.1	2.6	5.1
San Isidro	1976-80	3.5	4.4	5.8	7.3	7.1	6.4	6.1	5.4	4.9	3.8	3.1	2.6	5.0

Wind speed (km/hr)

Station	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Aparri	1951-85	12.0	10.0	10.0	10.0	8.0	8.0	9.0	8.0	8.0	11.0	14.0	12.0	10.0
APC, Iguig	1983-96	8.0	8.0	8.8	8.1	8.0	7.6	7.7	5.9	6.2	7.6	7.8	7.7	7.6
Tuguegarao	1958-99	5.4	5.0	5.7	6.4	5.7	5.8	5.5	4.5	4.5	5.9	5.4	5.6	5.5

Daily sunshine duration (hr)

Station	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Tuguegarao	1978-99	4.3	5.9	7.1	7.8	7.4	7.3	6.6	5.7	5.6	4.8	3.8	3.1	5.8
Echague	1981-97	3.3	5.0	6.2	6.9	7.0	6.5	6.0	5.2	5.1	4.2	3.4	2.5	5.1

Mean Monthly Atmospheric Pressure (hpa)

Station	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Tuguegarao	1984-99	1,008	1,001	1,004	1,002	1,002	1,000	1,004	1,001	1,007	1,000	1,001	1,008	1,003
APC, Iguig	1984-99	1,017	1,018	1,017	1,013	1,011	1,009	1,009	1,008	1,009	1,012	1,014	1,017	1,013

Table 5.2.2 Storm Records in the Cagayan River Basin

Tropical Cyclone/Monsoon Rain			Flood Hydrograph		Hourly Rainfall	Remarks
Code	Name	Period	Availability	Peak (m ³ /s)	Availability	
(1) Magat damsite (C.A. = 4,143 km²)						
T6718	Welming	Nov. 1 - 5 '67	x	8,281	x	
T6811	Nitang	Sep. 24 - 29 '68	x	1,790	x	
T6905	Elang	Jul. 24 - 27 '69	x	1,242	x	
T7013	Pitang	Sep. 8 - 12 '70	x	9,540	x	
T7311	Narsing	Oct. 12 - 16 '73	x	6,128	x	
T7416	Tering	Oct. 14 - 17 '74	x	5,658	x	
T7604	Didang	May 15 - 26 '76	x	4,900	x	
T7717	Uding	Nov. 10 - 17 '77	x	1,449	o	
T7810	MIDING	Aug. 23 - 26 '78	o	3,060	o	
T7818	WELING	Sep. 26 - 30 '78	o	3,100	o	
T7822	Kading	Oct. 25 - 27 '78	o	7,906	o	
TS7922	Krising	Dec. 21 - 24 '79	o	2,537	x	
T8011	Nitang	Jul. 18 - 22 '80	x	3,101	o	
T8012	Osang	Jul. 22 - 27 '80	o	1,650	x	
TS8019	Yoning	Oct. 28 - 30 '80	x	3,297	o	
T8020	Aring	Nov. 1 - 7 '80	o	7,637	o	
TS8105	Elang	Jul. 3 - 5 '81	o	3,996	o	
T8120	Anding	Nov. 21 - 27 '81	o	5,440	o	
TS8410	Maring	Aug. 28 - Sept. 5 '84	o	2,140	o	
TD8415	Seniang	Oct. 28 - Nov. 3 '84	o	4,440	o	
TS8510	Miling	Sept. 2 - 11 '85	o	3,192	o	
T8516	Tasing	Oct. 18 - 26 '85	o	6,300	o	
	Reming	29-Oct-84	x	4,259	x	
	Saling	19-Oct-85	x	7,634	x	
	Ruping	20-Oct-86	x	1,706	x	
	Weling	11-Nov-86	x	2,154	x	
	Toyang	21-Oct-88	x	5,293	x	
	Yoning	8-Nov-88	x	2,678	x	
	Tasing	19-Oct-89	x	8,671	x	
	Pasing	16-Oct-90	x	2,349	x	
	Maring	21-Sep-92	o	2,444	o	
	Kadiang	5-Oct-93	o	8,527	o	
	Husing	2-Nov-93	o	7,079	o	
	Monang	7-Dec-93	x	784	o	
	Oneng	16-Dec-93	x	1,326	o	
	Mameng	1-Oct-95	o	5,713	o	
	Neneng	Oct 8-12, '95	x	2,567	o	
	Rosing	Nov. 3-8, '95	o	5,918	o	
	Monsoon	Dec. 24-28, 1995	o	3,442	o	
	Ulpiang	14-Nov-96	x	1,005	x	
	Iliang	15-Oct-98	o	2,797	o	
	Loleng	24-Oct-98	o	6,976	o	
	Norming	12-Dec-98	x	843	o	
(2) Matuno damiste (C.A. = 550 km²)						
T8011	Nitang	Jul. 18 - 22 '80	o	852	o	2 hrs. rainfall
(3) Palattao G/S (C.A. = 6,626 km²)						
		Nov. 22 - 23 '61	o	5,978	x	
		Nov. 6 - 7 '62	o	4,786	x	
		Jun. 27 - 28 '63	o	3,290	x	
(4) Cabulay G/S (C.A. = 196 km²)						
		Sept. 18 - 19 '65	o	105	x	
(5) Ibulao G/S (C.A. = 606 km²)						
		Sept. 23 - '71	o	445	x	
(6) Gabong G/S (C.A. = 586 km²)						
		Jul. 19 - 25 '80	o	441	x	

Table 5.3.1 Probable Rainfall in the Base Point Basin

Unit: mm

	Basin	1/2*	1/5	1/10	1/25	1/50	1/100	1/200	1/1000	1/10000
1 - Day Rainfall	Casecnan	133	209	277	360	440	520	600	820	1,200
	Cagayan No. 2	122	200	270	360	420	505	590	800	1,100
	Cagayan No. 1	116	184	247	330	400	470	550	780	1,080
	Diduyon	127	201	268	360	430	520	700	850	1,300
	Addalam (A)	102	156	201	271	333	405	488	733	1,261
	Matuno No. 1	117	152	174	202	222	242	261	307	373
	Alimit No. 1 (A)	100	141	168	203	230	257	284	349	450
	Magat	89	119	139	158	164	200	218	261	324
	Ilagan No. 1	132	186	223	273	312	352	394	498	669
	Disabungan	141	206	254	319	371	426	484	633	887
	Siffu No. 1 (A)	81	123	153	194	226	259	293	379	519
	Mallig No. 2	90	141	180	234	277	324	375	507	741
	Chico No. 2	131	190	237	303	359	421	489	677	1,036
	Chico No. 4	110	160	195	240	275	311	348	439	581
	Pinukupuk	104	155	191	238	275	312	351	448	603
4 - Day Rainfall	Base Point No. 1	157	205	236	274	302	329			
	Base Point No. 2	158	212	246	289	321	352			
	Base Point No. 3	164	221	258	304	338	372			
	Base Point No. 4	169	233	277	333	376	420			
	Base Point No. 5	178	250	303	373	430	489			
	Base Point No. 6	173	231	269	317	352	386			
	Base Point No. 7	167	223	260	305	338	371			
	Base Point No. 8	188	255	298	354	395	436			
	Base Point No. 9	162	221	261	311	349	388			

Note: *1: Probability

Table 5.5.1 Projected Source Water Requirement by Municipality (2/2)

Province	Municipality	2000		2005		2010		2015		2020	
		water req't (m ³ /day)	population (capita)	water req't (m ³ /day)	population (capita)	water req't (m ³ /day)	population (capita)	water req't (m ³ /day)	population (capita)	water req't (m ³ /day)	population (capita)
Isabela	Magsaysay	1,935	24,471	2,405	26,953	2,817	29,169	3,666	30,966	4,712	32,421
Isabela	Santo Tomas	2,020	22,539	2,611	24,825	3,246	26,866	4,783	28,521	6,837	29,861
Isabela	Tumauini	4,180	51,106	5,220	56,290	6,170	60,917	8,214	64,671	10,744	67,709
Block 13	Total	8,135	98,115	10,236	108,069	12,233	116,951	16,663	124,158	22,292	129,990
Isabela	Cabagan	3,058	39,329	3,801	43,318	4,455	46,879	5,790	49,768	7,468	52,105
Isabela	Maconacon	202	3,057	241	3,367	263	3,644	282	3,868	300	4,050
Isabela	San Pablo	857	12,984	1,022	14,301	1,119	15,476	1,200	16,430	1,275	17,202
Isabela	Santa Maria	1,439	21,835	1,720	24,050	1,881	26,027	2,017	27,631	2,144	28,929
Block 14	Total	5,557	77,205	6,783	85,037	7,719	92,026	9,290	97,697	11,187	102,286
K. Apayao	Lubuagan	1,567	10,994	2,210	12,022	3,087	12,929	5,570	13,654	9,070	14,238
K. Apayao	Pasil	654	9,925	776	10,853	843	11,672	900	12,327	953	12,854
K. Apayao	Rizal	892	13,522	1,057	14,787	1,150	15,902	1,226	16,794	1,298	17,513
K. Apayao	Tabuk	9,927	70,546	13,653	77,143	18,531	82,960	32,195	87,614	50,716	91,364
K. Apayao	Tanudan	822	12,489	975	13,657	1,063	14,687	1,133	15,511	1,199	16,175
K. Apayao	Tinglayan	996	15,097	1,180	16,509	1,283	17,754	1,369	18,750	1,450	19,553
Block 15	Total	14,859	132,574	19,850	144,971	25,957	155,903	42,392	164,650	64,686	171,696
K. Apayao	Balbaran	860	13,043	1,019	14,263	1,109	15,339	1,182	16,199	1,253	16,893
K. Apayao	Conner	1,086	15,011	1,265	16,453	1,349	17,696	1,418	18,660	1,478	19,414
K. Apayao	Flora	41	632	50	693	54	745	57	786	61	818
K. Apayao	Kabugao	39	601	48	659	52	708	54	747	58	777
K. Apayao	Pinukupuk	1,688	25,613	2,002	28,008	2,177	30,120	2,323	31,809	2,459	33,171
Block 16	Total	3,714	54,900	4,383	60,075	4,741	64,609	5,034	68,202	5,308	71,072
Cagayan	Tuguegarao	17,569	117,656	22,749	127,378	28,971	136,414	46,632	144,284	67,915	150,773
Block 17	Total	17,569	117,656	22,749	127,378	28,971	136,414	46,632	144,284	67,915	150,773
Cagayan	Amulung	3,135	41,396	3,769	44,817	4,262	47,996	5,202	50,765	6,285	53,049
Cagayan	Enrile	4,202	31,517	5,380	34,121	6,743	36,542	10,538	38,650	15,078	40,388
Cagayan	Iguig	1,971	20,948	2,442	22,679	2,905	24,288	4,050	25,689	5,410	26,845
Cagayan	Peñablanca	1,558	23,621	1,828	25,573	1,979	27,387	2,114	28,967	2,243	30,270
Cagayan	Solana	5,326	66,186	6,428	71,654	7,335	76,738	9,236	81,165	11,392	84,815
Block 18	Total	16,193	183,668	19,847	198,845	23,225	212,951	31,140	225,237	40,408	235,367
Cagayan	Piat	1,892	19,163	2,333	20,746	2,767	22,218	3,859	23,500	5,121	24,557
Cagayan	Rizal	1,005	15,246	1,179	16,506	1,278	17,677	1,365	18,697	1,449	19,538
Cagayan	Santo Niño	1,967	18,697	2,470	20,241	3,002	21,677	4,385	22,928	6,036	23,959
Cagayan	Tuao	4,124	54,054	4,949	58,521	5,586	62,672	6,807	66,288	8,189	69,269
Block 19	Total	8,989	107,160	10,931	116,014	12,633	124,244	16,416	131,412	20,795	137,323
Cagayan	Alcala	3,416	35,135	4,273	38,038	5,152	40,737	7,370	43,087	10,053	45,025
Cagayan	Allcapan	1,275	12,927	1,542	13,995	1,786	14,988	2,395	15,853	3,052	16,566
Cagayan	Aparri	3,439	31,695	4,364	34,313	5,370	36,748	8,009	38,868	11,181	40,616
Cagayan	Baggao	4,156	41,177	5,198	44,579	6,276	47,742	9,027	50,496	12,298	52,767
Cagayan	Camalaniugan	2,258	18,241	2,891	19,748	3,616	21,149	5,592	22,369	7,969	23,375
Cagayan	Gattaran	2,883	32,793	3,570	35,502	4,230	38,021	5,795	40,215	7,692	42,023
Cagayan	Lal-lo	1,033	9,539	1,292	10,327	1,562	11,060	2,266	11,698	3,085	12,224
Cagayan	Lasam	2,680	26,613	3,343	28,812	4,019	30,856	5,746	32,636	7,789	34,104
Block 20	Total	21,140	208,119	26,473	225,315	32,011	241,300	46,200	255,220	63,120	266,700
GRAND TOTAL	(m³/day)	282,540	2,844,176	363,039	3,125,557	449,500	3,383,886	684,985	3,603,526	978,651	3,787,934

Table 5.5.3 5-year Probable Annual Water Deficit at Balance Points

Unit: Million m³/Year

(President Condition)					
Balance Point	2000 Demand	2005 Demand	2010 Demand	2015 Demand	2020 Demand
1	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	-1.79	-5.85	-8.77
7	0.00	0.00	0.00	0.00	0.00
8	-1.43	-6.51	-6.51	-6.51	-6.51
9	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00
11	-4.80	-4.80	-4.87	-4.95	-112.99
12	-0.29	-0.29	-0.34	-0.40	-0.48
13	-85.27	-85.27	-89.95	-91.83	-93.37
14	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00
21	-0.04	-0.04	-0.07	-0.10	-0.14
22	-0.38	-0.38	-0.38	-0.40	-0.42
23	-6.52	-61.30	-61.44	-61.58	-61.75
24	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00
29	-68.96	-68.96	-68.96	-68.96	-68.96
30	-162.10	-162.10	-162.10	-162.10	-162.10
31	-18.45	-18.45	-18.45	-18.45	-18.45
32	-15.18	-16.56	-20.61	-22.43	-24.75
33	-4.15	-4.15	-4.15	-4.15	-13.36
34	0.00	-1.45	-1.45	-1.45	-1.45
35	0.00	0.00	0.00	0.00	0.00
36	0.00	0.00	0.00	0.00	0.00
37	0.00	0.00	0.00	0.00	0.00
38	0.00	0.00	0.00	0.00	0.00
39	0.00	0.00	0.00	0.00	0.00
40	-3.38	-11.24	-11.24	-11.24	-11.24
41	0.00	0.00	0.00	0.00	0.00
42	-9.90	-9.90	-9.90	-9.90	-31.54
43	0.00	0.00	0.00	0.00	0.00
44	-24.93	-24.00	-24.00	-24.00	-24.00
45	-7.27	-7.27	-7.27	-7.27	-11.85
46	-20.32	-20.32	-20.32	-20.32	-32.98
47	0.00	0.00	0.00	0.00	0.00
48	0.00	0.00	0.00	0.00	0.00
Total	-433.37	-502.99	-513.80	-521.89	-685.09

Table 6.1.1 Principal Features of Siffu No.1 Dam

Purpose	Flood Control, Hydropower and Supplemental Water Supply of Magat Dam	
Catchment area (km ²)	656	
River name	Siffu	
<u>Reservoir</u>		
Flood water level (EL .m)		115.5
Surcharge water level (EL .m)		113.0
High water level (EL .m)		106.0
Low water level (EL .m)		97.0
Gross storage(10 ⁶ m ³)		314
Storage for water utility (10 ⁶ m ³)		93
Storage for flood control (10 ⁶ m ³)		115
Reservoir area at SWL (km ²)		19.0
<u>Dam</u>		
Type		Earthfill
Crest elevation (EL .m)		118
Crest length (m)		240
Crest width (m)		12
Height (m)		58
Upstream slope		1:3.9
Downstream slope		1:2.7
Embankment volume (m ³)		1,659,500
<u>Spillway</u>		
Type	Gated open chuteway	
Design flood (m ³ /s)		3,000
Gate width (m)		9.4
Gate height (m)		11.7
Gate units (nos)		3
Crest elevation (EL .m)		101.3
Crest width (m)		28.2
Energy dissipator	Stilling basin	
<u>Diversion</u>		
Type		Tunnel
Design flood (m ³ /s)		1,300
Tunnel diameter (m)		5.6
Tunnel length (m)		500
Number of tunnel (lanes)		2
<u>Waterway</u>		
Maximum discharge (m ³ /s)		19.9
Intake sill elevation (EL .m)		93.5
Length of Waterway (m)		350
<u>Power and Energy</u>		
Maximum plant discharge (m ³ /s)		19.9
Maximum gross head (m)		40.0
Rated head (m)		32.0
Installed capacity (kW)		5,400
Annual energy (GWh)		41.1

Table 6.1.2 Principal Features of Mallig No.2 Dam

Purpose	Irrigation and Flood control	
Catchment area	362 km ² at damsite and 1,951 km ² at Chico river intake w	
River name	Mallig	
<u>Reservoir</u>		
	Flood water level (EL .m)	185.5
	Surcharge water level (EL .m)	183
	High water level (EL .m)	180
	Low water level (EL .m)	160
	Gross storage(10 ⁹ m ³)	1037
	Storage for water utility (10 ⁹ m ³)	545
	Storage for flood control (10 ⁹ m ³)	112
	Reservoir area at SWL (km ²)	41
<u>Dam</u>		
	Type	Rockfill
	Crest elevation (EL .m)	188
	Crest length (m)	300
	Crest width (m)	12
	Height (m)	84
	Upstream slope	1:2.9
	Downstream slope	1:2.0
	Embankment volume (m ³)	2,365,000
<u>Spillway</u>		
	Type	Gated open chuteway
	Design flood (m ³ /s)	1,680
	Gate width (m)	7.2
	Gate height (m)	9
	Gate units (nos)	3
	Crest elevation (EL .m)	174
	Crest width (m)	21.6
	Energy dissipator	Stilling basin
<u>Diversion</u>		
	Type	Tunnel
	Design flood (m ³ /s)	800
	Tunnel diameter (m)	4.4
	Tunnel length (m)	650
	Number of tunnel (lanes)	2
<u>Waterway</u>		
	Maximum discharge (m ³ /s)	61
	Intake sill elevation (EL .m)	150
	Length of Waterway (m)	270
<u>Transbasin basin (from Chico river to Mallig No.2 Dam)</u>		
	Type	Open channel and tunnel
	Design discharge (m ³ /s)	30
	Tunnel diameter (m)	4.0
	Tunnel length (m)	4,000
	Channel length (m)	1,600

Table 6.1.3 Principal Features of Matuno No.1 Dam

Purpose Flood Control, Hydropower and Supplemental water Supply of Magat Dam

Catchment area (km ²)	550
River name	Matuno
<u>Reservoir</u>	
Flood water level (EL .m)	524.7
High water level (EL .m)	520.0
Low water level (EL .m)	480.0
Gross storage(10 ⁹ m ³)	137
Effective Storage (10 ⁹ m ³)	97
Reservoir area at HWL (km ²)	3.5
<u>Dam</u>	
Type	Rockfill with a center core zone
Crest length (m)	580
Crest width (m)	14
Height (m)	147
Upstream slope	1:3.3
Downstream slope	1:2.1
Embankment volume (m ³)	10,000,000
<u>Spillway</u>	
Type	Gated and open chute spillway
Design flood (m ³ /s)	10,300
Gate width (m)	12
Gate height (m)	16
Gate units (nos)	4
Crest elevation (EL .m)	504
Crest width (m)	57
Overflow crest length (m)	48
Chuteway length (m)	225
Chuteway width	57
Energy dissipator	Stilling basin
<u>Irrigation</u>	
Water requirement (m ³ /s)	21.4
Service area (ha)	13,680
<u>Power and Energy</u>	
Maximum plant discharge (m ³ /s)	112.2
Firm plant discharge (m ³ /s)	37.4
Installed capacity (kW)	180,000
Annual energy (GWh)	356
Total (GWh)	528

Table 6.1.4 Principal Features of Alimit No.1 Dam

Purpose Compensation for Flood Control by Magat Dam, Hydropower and Supplemental Water Supply of Magat Dam

Catchment area (km ²)	559
River name	Alimit
<u>Reservoir</u>	
Flood water level (EL .m)	279
High water level (EL .m)	271
Low water level (EL .m)	246
Gross storage(10 ⁹ m ³)	254
Storage for water utility (10 ⁹ m ³)	156
Reservoir area at SWL (km ²)	8.4
<u>Dam</u>	
Type	Concrete gravity
Crest elevation (EL .m)	281
Crest length (m)	430
Crest width (m)	8
Height (m)	89
Upstream slope	1:0.1
Downstream slope	1:0.8
Embankment volume (m ³)	647,000
<u>Spillway</u>	
Type	Non-gated open chuteway
Design flood (m ³ /s)	2,000
Crest elevation (EL .m)	271
Crest width (m)	44
Energy dissipator	Stilling basin
<u>Diversion</u>	
Type	Tunnel
Design flood (m ³ /s)	450
Tunnel diameter (m)	5.4
Tunnel length (m)	630
Number of tunnel (lanes)	1
<u>Waterway</u>	
Maximum discharge (m ³ /s)	26.0
Intake sill elevation (EL .m)	240
Length of Waterway (m)	130
<u>Power and Energy</u>	
Maximum plant discharge (m ³ /s)	26.0
Maximum gross head (m)	75.0
Rated head (m)	56.3
Installed capacity (kW)	12,200
Annual energy (GWh)	80.6

Table 8.2.1 Proposed Reforestation Area

No.	Forest Compartment	Catchment Area (Forest Register) (km ²)*1	Adjusted Catchment Area (km ²)*2	Forest Area (Forest Register) (km ²)*1	Adjusted Forest Area (km ²)*2	Land Area over 18% in slope		Forest Area in Land over 18% in slope			Area of Reforestation after 1993 (km ²)	Agricultural Land over 18% in Slope	Proposed Reforestation Area (km ²)
						(%)	(km ²), X	(%)	(km ²), Y	Y/X			
1	0401	764.57	752	406.53	400	35	263	32	241	91%		19	4
2	0402	535.87	527	299.61	295	30	158	23	121	77%			37
3	0403	865.58	851	576.23	567	64	545	48	408	75%		41	95
4	0404	168.01	165	158.06	155	93	154	93	154	100%			0
5	0405	1,013.79	997	782.82	770	85	847	75	748	88%			100
6	0406	1,021.34	1,004	216.49	213	26	261	5	50	19%		2	209
7	0407	469.17	461	98.42	97	32	148	1	5	3%		5	138
8	0408	717.12	705	117.23	115	10	71	3	21	30%			49
9	0409	1,044.18	1,027	194.06	191	23	236	2	21	9%		6	210
10	0410	534.75	526	200.35	197	35	184	6	32	17%		4	148
11	0411	559.37	550	157.07	154	0	0	0	0	-			0
12	0412	519.94	511	139.21	137	0	0	0	0	-			0
13	0413	649.12	638	451.80	444	30	191	26	166	87%			26
14	0501	898.80	884	444.28	437	57	504	31	274	54%		27	203
15	0502	933.12	917	895.87	881	96	881	93	853	97%			28
16	0503	517.87	509	234.77	231	53	270	32	163	60%		27	80
17	0504	589.70	580	549.56	540	95	551	91	528	96%			23
18	0505	583.60	574	431.34	424	70	402	57	327	81%			75
19	0506	377.92	372	347.39	342	100	372	91	338	91%			33
20	0507	687.14	676	530.59	522	90	608	75	507	83%		2	99
21	0508	374.52	368	358.70	353	97	357	96	353	99%			4
22	0509	457.46	450	377.12	371	90	405	77	346	86%		5	53
23	0510	385.47	379	235.96	232	91	345	61	231	67%			114
24	0601	425.63	418	86.47	85	1	4	0	0	0%			4
25	0602	979.37	963	492.19	484	26	250	17	164	65%		51	36
26	0603	1,512.91	1,487	610.03	600	67	997	29	431	43%	13	23	529
27	0604	462.42	455	124.44	122	59	268	17	77	29%			191
28	0605	545.98	537	376.38	370	92	494	65	349	71%	7		138
29	0606	507.43	499	462.23	454	88	439	86	429	98%			10
30	0607	914.26	899	702.38	691	94	845	76	683	81%		15	147
31	0608	871.26	857	585.26	575	78	668	53	454	68%		7	207
32	0701	3,304.32	3,249	2,640.27	2,596	77	2,501	73	2,371	95%		112	18
33	0801	332.65	327	330.28	325	99	324	99	324	100%			0
34	0802	2,349.66	2,310	2,210.83	2,174	88	2,033	82	1,894	93%	8	1	130
35	0901	874.63	860	809.24	796	85	731	79	679	93%			52
	Total	27,748.93	27,281	17,633.46	17,336		17,304		13,742		28	347	3,188

Notes: *1; Forest Register prepared in 1995 by JAFTA, DENR, NAMRIA, and RSRDAD.

*2; Adjustment factor of 0.983 (=27,281/27,749) is introduced in the adjustment.

Table 9.1.1 Present Land Use to Proposed Land Use Plan in 2020 by SAFDZ Zoning

SAFDZ No.	SAFDZ No.	1	2	3	8	x	9	10	11	Total
	Proposed : 2020	Crop	Livestock	Fishery	Remaining NPAAAD	Grasses /Shrubs	Agro-Forestry	Watershed /Forestry	Built-up areas	
1	Crop fields	608,021	7,827	0	-	0	14,474	11,023	35,094	676,439
2	Livestock areas	11,901	51,909	0	-	0	2,065	0	37,583	103,458
3	Fishery areas	94	6	11,803	-	0	0	0	0	11,903
8	Remaining NPAAAD	-	-	-	-	-	-	-	-	0
x	Grasses/Shrubs	28,547	92,582	0	-	172,446	42,117	317,305	92,648	745,645
9	Fruit trees, etc. incl. Agro-Forestry	27,872	257	0	-	0	8,938	34	3,758	40,859
10	Forest	4	139	1,628	-	0	37,506	1,058,402	30	1,097,709
11	Built-up areas	0	0	0	-	0	0	0	52,087	52,087
Total		676,439	152,720	13,431	0	172,446	105,100	1,386,764	221,200	2,728,100

Note: SAFDZ No. 4 to 7, being combination of crop, livestock and fishery, are involved to No.1 or 2, because of their small areas.

Source : Present Land Use/SAFDZ; "SAFDZ data, R-2 and CAR", 1999, BSWM, R-2 & CAR

Proposed Land Use in 2020; prepared by the JICA Study Team

Table 9.2.1 Paddy and Corn Production Plan

	Present (1)	Proposed (2020) (2)	Increase rate (2)/(1)
Paddy			
Physical area (1,000 ha)			
gross	473	528	1.12
net	331	396	1.20
irrigated	218	269	1.23
rainfed	113	127	1.12
Cropping Intensity (%)			
irrigated	170	220	1.29
rainfed	110	130	1.18
Harvested area (1,000 ha)			
irrigated	371	592	1.60
rainfed	124	165	1.33
Total	495	757	1.53
Yield (t/ha)			
irrigated	3.5	4.75	1.36
rainfed	1.8	2.2	1.22
Production (1,000 t)			
irrigated	1,297	2,811	2.17
rainfed	224	363	1.62
Total	1,521	3,174	2.09
Corn			
Cropping Intensity (%)			
gross	137	114	0.83
net	123	103	0.83
Cropping Intensity (%)	195	220	1.13
Harvested area (1,000 ha)	240	226	0.94
Yeild (t/ha)	2.1	3.75	1.79
Production (1,000 t)	505	846	1.68
Beans			
Cropping Intensity (%)			
gross	67	35	0.52
net	60	32	0.52
paddy field		60	
Cropping Intensity (%)	195	200	1.03
Harvested area (1,000 ha)	118	123	1.05
Yeild (t/ha)	1.0	1.5	1.50
Production (1,000 t)	118	185	1.57

Source: Present = Estimate based on data from BAS, 2000

Proposed = by the Study Team

Table 9.3.1 Projected Paddy Production and Rice Supply for the whole country (The Philippines)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Yield (t/ha)																					
Irrigated	3.94	3.98	4.02	4.06	4.10	4.14	4.18	4.22	4.26	4.30	4.34	4.36	4.38	4.40	4.42	4.44	4.46	4.48	4.50	4.52	4.54
Rainfed	2.73	2.74	2.75	2.77	2.78	2.79	2.80	2.81	2.83	2.84	2.85	2.86	2.86	2.87	2.87	2.88	2.89	2.89	2.90	2.91	2.91
	3.33	3.38	3.42	3.46	3.50	3.55	3.59	3.64	3.68	3.73	3.78	3.81	3.84	3.87	3.90	3.93	3.96	3.99	4.02	4.05	4.08
Annual Rice Area																					
new area generation (ha)	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000	31,000
NIS	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
CIS	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Priv.																					
physical irrigated area (1,000 ha)	1,381	1,412	1,443	1,474	1,505	1,536	1,567	1,598	1,629	1,660	1,691	1,722	1,753	1,784	1,815	1,846	1,877	1,908	1,939	1,970	2,001
NIS	701	721	741	761	781	801	821	841	861	881	901	921	941	961	981	1,001	1,021	1,041	1,061	1,081	1,101
CIS	506	517	528	539	550	561	572	583	594	605	616	627	638	649	660	671	682	693	704	715	726
Priv.	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174
irrigated cropping intensity																					
NIS	1.39	1.41	1.43	1.45	1.48	1.50	1.52	1.54	1.57	1.59	1.61	1.63	1.65	1.66	1.68	1.70	1.71	1.73	1.75	1.76	1.78
CIS	1.18	1.20	1.22	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.37	1.38	1.40	1.41	1.43	1.44	1.45	1.47	1.48	1.50	1.51
Priv.	1.18	1.20	1.22	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.37	1.38	1.40	1.41	1.43	1.44	1.45	1.47	1.48	1.50	1.51
harvested area (1,000 ha)	1,777	1,845	1,915	1,986	2,059	2,134	2,210	2,289	2,369	2,451	2,535	2,608	2,683	2,758	2,835	2,913	2,993	3,073	3,155	3,239	3,323
NIS	974	1,017	1,061	1,106	1,152	1,199	1,248	1,297	1,348	1,400	1,453	1,501	1,548	1,597	1,647	1,697	1,748	1,800	1,853	1,907	1,962
CIS	597	619	642	665	689	713	738	764	790	816	844	867	891	916	941	966	991	1,017	1,044	1,071	1,098
Priv.	205	208	212	215	218	221	225	228	231	235	238	241	243	246	248	250	253	255	258	261	263
Annual harvested area (1,000 ha)																					
Irrigated	1,777	1,845	1,915	1,986	2,059	2,134	2,210	2,289	2,369	2,451	2,535	2,608	2,683	2,758	2,835	2,913	2,993	3,073	3,155	3,239	3,323
Rainfed	1,787	1,762	1,737	1,713	1,688	1,663	1,638	1,613	1,589	1,564	1,539	1,514	1,489	1,465	1,440	1,415	1,390	1,365	1,341	1,316	1,291
Total	3,564	3,607	3,652	3,698	3,747	3,797	3,849	3,902	3,958	4,015	4,074	4,123	4,172	4,223	4,275	4,328	4,383	4,439	4,496	4,554	4,614
Paddy Production (1,000 t)																					
Irrigated	7,001	7,342	7,696	8,063	8,442	8,834	9,239	9,659	10,092	10,540	11,003	11,373	11,751	12,137	12,532	12,935	13,347	13,769	14,199	14,639	15,088
Rainfed	4,879	4,831	4,784	4,736	4,687	4,638	4,589	4,539	4,488	4,437	4,386	4,324	4,263	4,201	4,138	4,076	4,013	3,950	3,886	3,823	3,759
Total	11,879	12,174	12,480	12,799	13,129	13,472	13,828	14,198	14,580	14,977	15,389	15,697	16,013	16,338	16,670	17,011	17,360	17,719	18,086	18,462	18,847
Seeds, feeds, wasted (9.5 %) (1,000 t)	1,129	1,157	1,186	1,216	1,247	1,280	1,314	1,349	1,385	1,423	1,462	1,491	1,521	1,552	1,584	1,616	1,649	1,683	1,718	1,754	1,790
Paddy for Consumption (1,000 t)	10,751	11,017	11,295	11,583	11,882	12,192	12,515	12,849	13,195	13,555	13,927	14,206	14,492	14,786	15,086	15,395	15,711	16,035	16,367	16,708	17,056
Miling Recovery Rate	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66
Rice for Consumption (1,000 t)	7,095	7,271	7,455	7,645	7,842	8,047	8,260	8,480	8,709	8,946	9,192	9,376	9,565	9,758	9,957	10,161	10,369	10,583	10,803	11,027	11,257
Demand																					
Population (Million)	76.320	77.898	79.476	81.054	82.637	84.215	85.769	87.312	88.841	90.355	91.851	93.328	94.783	96.216	97.625	99.008	100.366	101.697	102.997	104.267	105.503
Per Capita Demand (kg)	101.6	102.0	102.4	102.8	103.2	103.6	104.1	104.5	104.9	105.3	105.7	106.2	106.6	107.0	107.4	107.9	108.3	108.7	109.2	109.6	110.0
Total Demand (1,000 t)	7,754	7,946	8,139	8,334	8,531	8,729	8,925	9,122	9,319	9,516	9,712	9,908	10,102	10,296	10,489	10,680	10,870	11,058	11,244	11,428	11,610
Surplus(+)/Deficit(-) (1,000 t)	(659)	(675)	(685)	(690)	(689)	(682)	(666)	(642)	(610)	(570)	(520)	(532)	(538)	(538)	(532)	(519)	(500)	(475)	(442)	(401)	(353)
Surplus(+)/Deficit(-) percentage	-8.5%	-8.5%	-8.4%	-8.3%	-8.1%	-7.8%	-7.5%	-7.0%	-6.5%	-6.0%	-5.4%	-5.4%	-5.3%	-5.2%	-5.1%	-4.9%	-4.6%	-4.3%	-3.9%	-3.5%	-3.0%

Reference: "Corporate Plan, 1993-2002", Jun. 1993, NIA, p.62 Table 6.2
 "The Study on Strengthening og NIA's Management System, Draft Final Report, August 2001", JICA

Table 9.3.2 List of Candidate Scheme for Proposed Irrigation Development in Long Term Plan

Candidate Scheme for Long Term Plan	*1	Location Province Municipality	Irrigation Area			FC=Flood Control					
			Total (ha)	New/ extension (ha)	Rehabili/ improve't (ha)	Financial					
						Cost (mil.P)	Benefit (mil.P/yr)	Benefit (mil.P/yr)			
I. Affected by Flood (Need Flood Control)											
1. Alcala Amulung West Irrigation Project	AAWPIP	Cagayan Alcala, Amulung	7,700	7,700		1,527	-	556			
Stage I			(4,000)			980	219	-			
2. Solana Pump Irrigation System-Reh. & Ext. Project	SPIS-REP (*)	Cagayan Solana	7,880	5,100	2,780	1,071	-	475			
Stage I			(3,000)			504	288	-			
3. Mamil Pump Irrigation Project	MPIP	Cagayan Enrile	563	563		115	18	36			
4. Santa Isabel Pump Irrigation Project	SIPIP	Isabela Gamu	1,000	1,000		206	34	61			
5. Damao Pump Irrigation Project	DPIP	Isabela Gamu	1,000	1,000		209	32	64			
6. Lapogan Pump Irrigation Project	LPIP	Isabela Tumauni	400	400		93	13	26			
7. Lulutan Pump Irrigation Project	LAPIP	Isabela Gamu	3,800	3,800		782	140	231			
8. Gamu Pump Irrigation Project	GPIP	Isabela Gamu	400	400		80	12	24			
9. Enrile Pump Irrigation Project	EPPI	Cagayan Enrile	3,100	3,100		588	168	241			
10. Zinundungan Irrigation Extension Project	ZIEP (*)	Cagayan Lasam	3,495	2,045	1,450	920	179	224			
11. Lallo West Pump Irrigation Project	LWPIP	Cagayan Lallo	900	900		196	48	60			
12. Nassiping Pump Irrigation Project	NPIP	Cagayan Gattaran	765	765		149	46	55			
Rehabilitation of CIADP (Magapit & Iguig-Alcala-Amulung PISs)											
13. Magapit Pump Irrigation System	MPIS *	Cagayan Lallo	10,914		10,914						
14. Iguig-Alcala-Amulung Pump Irrigation System	IAAPIS *	Cagayan Iguig, Amulung	2,306		2,306						
15. Dummun River Irrigation System	DRIS *	Cagayan Gattaran	1,802		1,802	1,015	80	101			
16. Pinacanan River Irrigation System	PRIS *	Cagayan Penablanca	880		880	91	45	56			
17. San Pablo-Cabagan Irrigation System	SPCIS *	Isabela San Pablo	1,273		1,273	108	52	65			
18. Santa Maria Communal Pump Irrigation System	SMPIS *	Isabela Sta. Maria	690		690	58	28	35			
19. Delfin Albano Pump Irrigation Project	DAPIP	Isabela Delfine Albano	2,445	2,445		502	145	181			
20. Tumauni Multipurpose (Reservoir) Project	TRP (*)	Isabela Tumauni	6,600	2,985	3,615	2,349	524	654			
21. Upper Chico River Irrigation System	UCRIS *	Kal./Isa. Tabuk/Quezon	17,551		17,551	1,326	646	807			
22. Mallig River Irrigation System	MRIS *	Isabela Mallig, Quezon	2,427		2,427	166	100	127			
23. Nueva Vizcaya Bagabag Irrigation System	NVBIS *	N. Viz. Bagabag	2,160		2,160	125	81	105			
24. Ilagan Pump Irrigation Project	IPIP	Isabela Ilagan	5,000	5,000		1,184	276	292			
25. Napacu Pump Irrigation Project	NAPIP	Isabela Reina Mercedes	1,000	1,000		216	47	59			
26. Tagaran Pump Irrigation Project	TPIP	Isabela Cauayan	500	500		106	25	28			
27. Reina Mercedes Pump Irrigation Project	RMPIP	Isabela Reina Mercedes	900	900		195	42	52			
28. Sto. Nino Pump Irrigation Project	SNPIP	Cagayan Sto Nino	1,200	1,200		240	65	69			
Total			88,651	40,803	47,848	14,293	3,567	5,008			
II. No Need of Flood Control											
1. Upper Ilagan Western Brgy. Pump Irrigation Project	UIWBPIP	Isabela Ilagan	3,000	3,000		648	162	-			
2. San Agustin Pump Irrigation Project	SAPIP	Isabela San Agustin	22,700	22,700		5,376	1,271	-			
3. Dibuluan River Irrigation Project	DRIP	Isabela San Agustin	3,000	3,000		738	221	-			
4. Dabubu Irrigation Project	DIP	Isabela San Agustin	1,000	1,000		312	75	-			
5. Rizal Irrigation Project	RIP	Kalinga Rizal	1,500	1,500		465	116	-			
6. Baggao Irrigation System	BIS *	Cagayan Baggao	2,067		2,067	1,306	65	-			
7. Lower Chico River Irrigation System	LCRIS *	Cagayan Tuao	1,856		1,856	134	71	-			
8. Bantug Pump Irrigation System	BPIS *	Isabela Angadanan	150		150	13	6	-			
9. San Mariano Pump Irrigation Project	SMPPIP	Isabela San Mariano	400	400		88	26	-			
10. East Tabacal Pump Irrigation Project	ETPIP	Isabela Cauayan	1,800	1,800		407	101	-			
11. Debibi Groundwater IP	DGIP	Quirino Cabarruguis	4,000	4,000		640	159	-			
12. Villaverde IP	VIP	N.Viz. Villaverde	3,000	3,000		451	112	-			
Total			44,473	40,400	4,073	10,578	2,385	-			
New / Extension Project (including combined one)			28 schemes			81,203	81,203	20,529	4,779	3,712	
Rehabilitation / Improvement Project			12 schemes			51,921		51,921	4,341	1,173	1,296
GRAND TOTAL			40 schemes			133,124	81,203	51,921	24,870	5,952	5,008

Note:

- *1: Blank = New / Extension Project
- * = Rehabilitation / Improvement Project
- (*) = Combination of New/Ext. and Reh./Imp.
- *2: On-going projects are not presented.

Table 9.3.3 List of Candidate Scheme for Proposed Irrigation Development in Long Term Plan and Reviewed Master Plan

FC=Flood Control

Candidate Scheme for Long Term Plan	*1	Location Province Municipality		EIRR (%)				Candidate for Reviewed M/P ref. to Subsec.10.8.3 (3)			EIRR (%) Without FC (3)	(3) < 15 %	Pipeline project in CO and matuted project in R-2	New/ext. project EIRR >=16.5%: O <16.5%: X	Reh/imp project EIRR >=25%: O <25%: X	Reviewed Master Plan	Reviewed M/P	
				Without FC (1)	Additional to FC (2)	Both (1) and (2) < 15 %	Long Term Plan	(Package 1- irrigation component)		Without FC in Rev.MP							New fund	NIA regular fund
				IL	IS	IL	IS											
I. Affected by Flood (Need Flood Control)																		
1. Alcala Amulung West Irrigation Project	AAWPIP	Cagayan	Alcala, Amulung	15.5*2	22.8		O	O	-			O	---	---	O	O	-	
2. Solana Pump Irrigation System-Reh. & Ext. Project	SPIS-REP (*)	Cagayan	Solana	26.7*2	25.0		O	O	-				---	---	O	O	-	
3. Mamil Pump Irrigation Project	MPIP	Cagayan	Enrile	11.1	19.9		O	-	O	y	11.1	X			-	-	-	
4. Santa Isabel Pump Irrigation Project	SIPIP	Isabela	Gamu	11.7	18.1		O	-	O	y	11.7	X			-	-	-	
5. Damao Pump Irrigation Project	DPIP	Isabela	Gamu	10.6	19.2		O	-	-	y	10.6	X			-	-	-	
6. Lapogan Pump Irrigation Project	LPIP	Isabela	Tumauni	9.6	19.0		O	-	-	y	9.6	X			-	-	-	
7. Lulutan Pump Irrigation Project	LAPIP	Isabela	Gamu	12.3	18.1		O	-	-	y	12.3	X			-	-	-	
8. Gamu Pump Irrigation Project	GPIP	Isabela	Gamu	10.9	18.5		O	-	-	y	10.9	X			-	-	-	
9. Enrile Pump Irrigation Project	EPIP	Cagayan	Enrile	17.8	23.1		O	O	-				---	---	O	O	-	
10. Zinundungan Irrigation Extension Project	ZIEP (*)	Cagayan	Lasam	16.3	18.8		O	-	O				---	---	O	O	-	
11. Lallo West Pump Irrigation Project	LWPIP	Cagayan	Lallo	16.5	19.5		O	-	O				---	---	O	O	-	
12. Nassiping Pump Irrigation Project	NPIP	Cagayan	Gattaran	18.5	21.8		O	-	O				---	---	O	O	-	
Rehabilitation of CIADP (Magapit & Iguig-Alcala-Amulung PISs)				26.7	31.0								O	---	---	O	O	-
13. Magapit Pump Irrigation System	MPIS *	Cagayan	Lallo				O	-	O									
14. Iguig-Alcala-Amulung Pump Irrigation System	IAAPIS *	Cagayan	Iguig, Amulung				O	O	-									
15. Dummun River Irrigation System	DRIS *	Cagayan	Gattaran	8.6	10.3	X	-								-	-	-	
16. Pinacunan River Irrigation System	PRIS *	Cagayan	Penablanca	28.2	31.9		O	-	O	y	28.2				O	O	-	
17. San Pablo-Cabagan Irrigation System	SPCIS *	Isabela	San Pablo	23.1	27.0		O	-	O	y	23.1				O	O	-	
18. Santa Maria Communal Pump Irrigation System	SMPIS *	Isabela	Sta. Maria	23.1	27.3		O	-	O	y	23.1				O	-	O	
19. Delfin Albano Pump Irrigation Project	DAPIP	Isabela	Delfine Albano	18.5	21.8		O	-	O	y	18.5		O	---	---	O	O	-
20. Tumauni Multipurpose (Reservoir) Project	TRP (*)	Isabela	Tumauni	17.8	20.4		O	-	O	y	17.8		O	---	---	O	O	-
21. Upper Chico River Irrigation System	UCRIS *	Kal./Isa.	Tabuk/Quezon	27.8	31.4		O	-	-	y	27.8				O	-	-	
22. Mallig River Irrigation System	MRIS *	Isabela	Mallig, Quezon	31.5	35.5		O	-	-	y	31.5				O	O	-	
23. Nueva Vizcaya Bagabag Irrigation System	NVBIS *	N. Viz.	Bagabag	33.0	37.1		O	-	-	y	33.0				O	O	-	
24. Ilagan Pump Irrigation Project	IPIP	Isabela	Ilagan	16.5	17.2		O	-	-	y	16.5			O	-	O	-	
25. Napaccu Pump Irrigation Project	NAPIP	Isabela	Reina Mercedes	15.2	18.2		O	-	-	y	15.2			X	-	-	-	
26. Tagaran Pump Irrigation Project	TPIP	Isabela	Cauayan	15.2	17.7		O	-	-	y	15.2			X	-	-	-	
27. Reina Mercedes Pump Irrigation Project	RMPIP	Isabela	Reina Mercedes	15.0	17.5		O	-	-	y	15.0			X	-	-	-	
28. Sto. Nino Pump Irrigation Project	SNPIP	Cagayan	Sto Nino	16.8	17.6		O	-	-	y	16.8			O	-	O	-	
Total							27	4	11						16	14	2	
II. No Need of Flood Control																		
1. Upper Ilagan Western Brgy. Pump Irrigation Project	UIWBPIP	Isabela	Ilagan	16.8	-		O	-	-	-	16.8			O	-	-	O	
2. San Agustin Pump Irrigation Project	SAPIP	Isabela	San Agustin	16.1	-		O	-	-	-	16.1			X	-	-	-	
3. Dibuluan River Irrigation Project	DRIP	Isabela	San Agustin	19.8	-		O	-	-	-	18.4		O	---	---	O	-	
4. Dabubu Irrigation Project	DIP	Isabela	San Agustin	18.6	-		O	-	-	-	18.6			O	-	O	-	
5. Rizal Irrigation Project	RIP	Kalinga	Rizal	19.1	-		O	-	-	-	16.6		O	---	---	O	-	
6. Baggao Irrigation System	BIS *	Cagayan	Baggao	7.0	-	X	-								-	-	-	
7. Lower Chico River Irrigation System	LCRIS *	Cagayan	Tuao	29.0	-		O	-	-	-	29.0				O	-	O	
8. Bantug Pump Irrigation System	BPIS *	Isabela	Angadanan	22.8	-		O	-	-	-	22.8				X	-	-	
9. San Mariano Pump Irrigation Project	SMPIP	Isabela	San Mariano	17.8	-		O	-	-	-	17.8		O	---	---	O	-	
10. East Tabacal Pump Irrigation Project	ETPIP	Isabela	Cauayan	16.1	-		O	-	-	-	16.1			X	-	-	-	
11. Debibi Groundwater IP	DGIP	Quirino	Cabarruguis	17.0	-		O	-	-	-	16.1		O	---	---	O	-	
12. Villaverde IP	VIP	N.Viz.	Villaverde	17.0	-		O	-	-	-	16.1		O	---	---	O	-	
Total							11	0	0						8	1	7	
GRAND TOTAL	40 schemes						38	4	11						24	15	9	

Note:

- *1: Blank = New / Extension Project
- * = Rehabilitation / Improvement Project
- (*) = Combination of New/Ext. and Reh./Imp.
- ** : On-going projects are not presented.

- *2: Stage 1
- ***: O = selected
- X = postponed
- y, Y = yes

Table 10.4.1 Comparison of Long Term Plans in 1987 Master Plan and Reviewed Master Plan

Long Term Plan in 1987 Master Plan	Long Term Plan in Reviewed Master Plan
Study Area: Whole Cagayan River Basin Design Flood: 25 Years Probable Flood	Study Area: Whole Cagayan River Basin Design Flood: 25 Years Probable Flood
(A) Multipurpose Dam Projects	
1) Siffu No.1 Dam Project	1) Siffu No.1 Dam Project
2) Mallig No.2 Dam Project	2) Mallig No.2 Dam Project
3) Matuno No.1 Dam Project	3) Matuno No.1 Dam Project
4) Alimit No.1 Dam Project	4) Alimit No.1 Dam Project
5) Magat Dam	5) Magat Dam
(B) Flood Control Schemes	
<i>Structural Measures</i>	
1) Dike embankment including revetment and sluice along the main Cagayan River and major tributaries - in the main Cagayan River - in major tributaries including Siffu, Ilagan and Magat River	1) Dike embankment including revetment, sluice and riverbank tree zone along the main Cagayan River and major tributaries - in the main Cagayan River - in major tributaries including Siffu, Ilagan and Magat River
2) Narrow excavation at Nassiping	<i>Not adopted</i>
3) Cut-off channel works - in the main Cagayan River at Gabut and San Isidro - in Magat, Siffu and Mallig Rivers	2) Cut-off channel works - in the main Cagayan River at Gabut, San Isidro and Tuguegarao - in Magat, Siffu and Mallig Rivers
4) Bank protection (75 sites)	3) Bank protection (73 sites)
5) Flood control dams (Single purpose) - Cagayan No.1 dam - Ilagan No.1 dam	4) Flood control dams (Single purpose) - Cagayan No.1 dam - Ilagan No.1 dam
<i>Non-structural Measures</i>	
	1) Evacuation system (FFWS, Evacuation center)
	2) Resettlement
<i>Supporting Measures</i>	
	1) Strengthening of institution and organization
(C) Watershed Management Schemes	
	1) Reforestation plan (Reforestation area 3,188 km ²)
	2) Sabo works plan (26 Sabo dams)
(D) Agricultural Development Schemes	
<i>Structural Measures</i>	
1) New irrigation/ extension schemes (9 schemes, total 65,330 ha) including Chico Mallig and Matuno (multipurpose project)	1) New irrigation/ extension schemes (28 schemes, total 81,203 ha)
2) Irrigation rehabilitation/ improvement schemes (5 schemes, total 12,212 ha)	2) Irrigation rehabilitation/ improvement schemes (10 schemes, total 48,052 ha)
3) Diversified crop land (170,000 ha)	3) Diversified crop land (148,400 ha)
4) Permanent crop land (200,000 ha)	4) Permanent crop land (277,600 ha)
5) Pasture land (300,000 ha)	5) Pasture land (153,300 ha)
6) Fresh water fisheries	6) Fresh water fisheries
7) Magat O&M improvement	7) Magat O&M improvement
<i>Supporting Measures</i>	
	1) Continuation and enhancement of on-going agriculture support services
	2) Strengthening of support system for irrigation system through establishment of rural development center
	3) Enhancement of marketing and transportation system
	4) Establishment of upland development experimental center
(E) Hydropower Development Schemes	
1) Ibulao scheme (Run-of-river type)	1) Ibulao scheme (Run-of-river type)
2) Tanudan scheme (Run-of-river type)	2) Tanudan scheme (Run-of-river type)
3) Diduyon scheme with Diduyon dam	3) Diduyon scheme with Diduyon dam

Table 10.6.1 Proposed Land Use Plan

(Unit: 1,000 ha)

Land Use	Present	Proposed (2020)	Increase/decrease (-)	Remarks
Agricultural area				in gross
Rice field	472.5	528.0	55.5	
Corn field	137.3	113.8	-23.5	
Other diversified cropland	66.6	34.6	-32.0	
Sub-total	676.4	676.4	0.0	
Grassland				
Pasture	103.5	152.7	49.2	
Wild grass	471.4	108.4	-363.0	
Shrub	274.2	63.6	-210.6	
Sub-total	849.1	324.7	-524.4	
Agro-Forest	40.9	105.1	64.2	
Forest	1,097.5	1,386.8	289.3	
Others				Kaingin
Slash and Burn Cultivation	0.2	0.0	-0.2	
Fishpond (controlled)	11.9	13.9	2.0	
Built-up areas	52.1	221.2	169.1	
Sub-total	64.2	235.1	170.9	
Total	2,728.1	2,728.1	-0.0	

Table 10.6.2 Present Land Use and Example of Agricultural Development Plan

	Alluvial Plain				Undulated/hilly area	Mountanous area village, etc. mostly river side	Remarks
	lower	middle	higher				
			non-irrigated	irrigated			
Vegetation/ agricultural land use	corn- corn	corn- tabaco peanut veget.	paddy- fallow upl.crp	paddy- paddy	brush grass pasture sugarcane	upl.crp. forest vegetable brush fruits grass paddy* ¹	*1: terrace type field
Flood hazard	inundation					soil erosion	*2: river cross-section changed from deep narrow one to shallow wide one (APC)
related problem	several times/year period: 2-7 days once/several years / depth: 2-5 m in 1973	siltation* ²			slope slide	
Land use plan	with flood control* ³				improved pasture low	by spray/drip irrigation	*3: inundation less than 3-day = not so serious (DA-02, APC) *4: Alcala-Amulung West PIP *5: IAAPIS, SPIS
example	by irrigation/extension		by rehabilitation /improvement			vegetable/fruits	
agr-intensity	paddy-paddy, paddy-paddy-veg. corn- water melon/vegetable		paddy-paddy-bean/vegetables paddy-paddy-corn			very high	
	middle	high	*4 high	*5 high			
irrigation water source	river	river	river (larger scale) reservoir groundwater (small scale)		stream/pond groudwater	stream spring	
intake	pump up from the Cagayan River lower reach					natural	
distribution	weir from tributary gravity				gravity/pump	gravity/pump	

Table 10.6.3 Comparison of Irrigation NIS/NIP in 1987 Master Plan and in 1999

(Unit: ha)

NIS and Proposed NIP in 1987 MP and NIS/NIP by NIA in 1999	1987 Master Plan					Status in 1999							Difference in NIS area = (6) - (1)	Remarks
	Service area			Proposed project		Existing service area		On-going project			Programmed project			
	Existing NIS (1)	On-going NIS (2)	Existing other sys. (3)	New develop't (4)	Rehabilitation (5)	NIS (6)	converted to CIS (7)	Rehabilitation (8)	Extension (new) (9)	Restored (10)	listed NIP (11)	Rehabilitation (12)		
Existing NIS Service Area and Its Change	131,480					139,893							8,413	(1)+(2)= 150,797 (6)-(1)-(2)= -10,904
1. Existing System (partly with Rehbili./Exten.)	(131,480)				(12,212)									
Dummon River Irrigation System DRIS	2,070				2,070	1,802		317						-268
Zinundungan River Irrigation System ZRIS	1,760					2,045		977						285
Baggao Irrigation System BIS	1,812				1,812	2,067			62	453				255
Solana-Tuguegarao Irrigation System	3,143				3,143	2,777		500						-366
Pinacanauan River Irrigation System PRIS	1,200				1,200	880		305						-320
Tumauni Irrigation System TIS	3,987				3,987	3,615		1,130		91	6,600			-372
Chico River Irrigation System CRIP	20,108					1,856 9,842 7,709								-701
Magat River Integrated Irrigation System MRIIS	97,400					88,370								-9,030
2. On-going Project at the time of 1987MP		(19,317)												
San Pablo-Cabagan Irrigation Project SPCIS		2,890				1,273		386	35	370				1,273
Mallig River Irrigation Project MRIS		2,427				2,427		1,650						2,427
Cagayan Integrated Agricultural Development Project CIADP		14,000				2,306 10,914		1,870		670 290				13,220
3. Proposed New Project 1987MP			(11,540)	(53,790)										
Zinundungan Irrigation Extension Project				150	1,600									partly implemented or not?
Alcala-Amulung West Irrigation Project					6,750						2,500			AAWPIP, FS
Chico Mallig Irrigation Project				2,100	29,100									FS of Rizal IP conducted in Kalinga
Tuguegarao Irrigation Project					1,400			202						TPIS
Lulutan Irrigation Project					2,950						4,000			SIPIP: Sta.Isabela PIP
Ilagan Irrigation Project				60	3,140						1,000			LPIP:
Gappal Irrigation Project					4,400			400			400			GCIP(S), mostly shifted to SAPIP
Matuno River Irrigation Project				9,230	3,450			650 323			12,600			2,010
Dabubu River IrrigationProject					1,000						1,000			Nueva Vizcaya Bagabag Irr,Sys.? DIP: Dabubu IP
4. Newly Proposed Project (after 1987 MP) in 1999														
Addalam River Irrigation Project ARIP											5,830			incl.hilly grassland, EL<100m
Dibuluan River Irrigation Project DRIP											3,000			incl.hilly grassland, EL<200m
Santa Isabel Pump Irrigation Project SIPIP											4,000			
San Agustin Pump Irrigation Project SAPIP											22,700			group of river bank lowland
Rizal Irrigation Project RIP											1,500			
Delfine Albano Pump Irrigation Project DAPIP											2,445			part of Mallig Multipurpose Pjt
Upper Ilagan Western Brgy. Pump Irr. Pjt UIWBPIP											3,000			detached from MRIIS
Dammao Pump Irrigation Project DPIP											1,000			detached from MRIIS

Source: (1) - (6): "Final Report for The Master Plan Study on The Cagayan River Basin Water Resources Development", Aug.1987,JICA
(7) - (12); Tables prepared by NIA, R-02

Table 10.6.4 Candidate and Selected Scheme for Proposed Irrigation Development in Reviewed Master Plan

FC=Flood Control

Candidate Scheme for Long Term Plan	*1	Location Province Municipality		EIRR (%)		Candidate for Reviewed M/P ref. to Subsec.10.8.3 (3)			EIRR (%)		(3) < 15 %	Pipeline project in CO and mated project in R-2	New/ext. project EIRR >=16.5%: O <16.5%: X	Reh/imp project EIRR >=25%: O <25%: X	Reviewed Master Plan	Reviewed M/P		
				Without FC (1)	Additional to FC (2)	(Package 1- irrigation component)		Without FC (3)	New fund	NIA regular fund								
						IL	IS									in Rev.MP		
I. Affected by Flood (Need Flood Control)																		
1. Alcala Amulung West Irrigation Project	AAWPIP	Cagayan	Alcala, Amulung	15.5*2	22.8	O	-					O	---	---	O	O	-	
2. Solana Pump Irrigation System-Reh. & Ext. Project	SPIS-REP (*)	Cagayan	Solana	26.7*2	25.0	O	-						---	---	O	O	-	
3. Mamil Pump Irrigation Project	MPIP	Cagayan	Enrile	11.1	19.9	-	O	y	11.1	X					-	-	-	
4. Santa Isabel Pump Irrigation Project	SIPIP	Isabela	Gamu	11.7	18.1	-	O	y	11.7	X					-	-	-	
5. Damao Pump Irrigation Project	DPIP	Isabela	Gamu	10.6	19.2	-	-	y	10.6	X					-	-	-	
6. Lapogan Pump Irrigation Project	LPIP	Isabela	Tumauni	9.6	19.0	-	-	y	9.6	X					-	-	-	
7. Lulutan Pump Irrigation Project	LAPIP	Isabela	Gamu	12.3	18.1	-	-	y	12.3	X					-	-	-	
8. Gamu Pump Irrigation Project	GPIP	Isabela	Gamu	10.9	18.5	-	-	y	10.9	X					-	-	-	
9. Enrile Pump Irrigation Project	EPIP	Cagayan	Enrile	17.8	23.1	O	-						---	---	O	O	-	
10. Zinundungan Irrigation Extension Project	ZIEP (*)	Cagayan	Lasam	16.3	18.8	-	O						---	---	O	O	-	
11. Lallo West Pump Irrigation Project	LWPIP	Cagayan	Lallo	16.5	19.5	-	O						---	---	O	O	-	
12. Nassiping Pump Irrigation Project	NPIP	Cagayan	Gattaran	18.5	21.8	-	O					O	---	---	O	O	-	
Rehabilitation of CIADP (Magapit & Iguig-Alcala-Amulung PISs)				26.7	31.0							O	---	---	O	O	-	
13. Magapit Pump Irrigation System	MPIS	Cagayan	Lallo			-	O											
14. Iguig-Alcala-Amulung Pump Irrigation System	IAAPIS	Cagayan	Iguig, Amulung			O	-											
15. Pinacanan River Irrigation System	PRIS	Cagayan	Penablanca	28.2	31.9	-	O	y	28.2						O	O	-	
16. San Pablo-Cabagan Irrigation System	SPCIS	Isabela	San Pablo	23.1	27.0	-	O	y	23.1						O	O	-	
17. Santa Maria Communal Pump Irrigation System	SMPIS	Isabela	Sta. Maria	23.1	27.3	-	O	y	23.1						O	O	-	
18. Delfin Albano Pump Irrigation Project	DAPIP	Isabela	Delfine Albano	18.5	21.8	-	O	y	18.5			O	---	---	O	O	-	
19. Tumauni Multipurpose (Reservoir) Project	TRP (*)	Isabela	Tumauni	17.8	20.4	-	O	y	17.8			O	---	---	O	O	-	
20. Upper Chico River Irrigation System	UCRIS	Kal./Isa.	Tabuk/Quezon	27.8	31.4	-	-	y	27.8						O	-	-	
21. Mallig River Irrigation System	MRIS	Isabela	Mallig, Quezon	31.5	35.5	-	-	y	31.5						O	O	-	
22. Nueva Vizcaya Bagabag Irrigation System	NVBIS	N. Viz.	Bagabag	33.0	37.1	-	-	y	33.0						O	O	-	
23. Ilagan Pump Irrigation Project	IPIP	Isabela	Ilagan	16.5	17.2	-	-	y	16.5						O	-	O	
24. Napaccu Pump Irrigation Project	NAPIP	Isabela	Reina Mercedes	15.2	18.2	-	-	y	15.2					X	-	-	-	
25. Tagaran Pump Irrigation Project	TPIP	Isabela	Cauayan	15.2	17.7	-	-	y	15.2					X	-	-	-	
26. Reina Mercedes Pump Irrigation Project	RMPIP	Isabela	Reina Mercedes	15.0	17.5	-	-	y	15.0					X	-	-	-	
27. Sto. Nino Pump Irrigation Project	SNPIP	Cagayan	Sto Nino	16.8	17.6	-	-	y	16.8					O	-	O	-	
Total							4	11							16	14	2	
II. No Need of Flood Control																		
1. Upper Ilagan Western Brgy. Pump Irrigation Project	UIWBPIP	Isabela	Ilagan	16.8	-	-	-	-	16.8					O	-	O	-	
2. San Agustin Pump Irrigation Project	SAPIP	Isabela	San Agustin	16.1	-	-	-	-	16.1					X	-	-	-	
3. Dibuluan River Irrigation Project	DRIP	Isabela	San Agustin	18.4	-	-	-	-	19.8			O	---	---	O	-	O	
4. Dabubu Irrigation Project	DIP	Isabela	San Agustin	18.6	-	-	-	-	18.6					O	-	O	-	
5. Rizal Irrigation Project	RIP	Kalinga	Rizal	16.6	-	-	-	-	19.1			O	---	---	O	-	O	
6. Lower Chico River Irrigation System	LCRIS	Cagayan	Tuao	29.0	-	-	-	-	29.0					-	O	O	-	
7. Bantug Pump Irrigation System	BPIS	Isabela	Angadanan	22.8	-	-	-	-	22.8					-	X	-	-	
8. San Mariano Pump Irrigation Project	SMPIP	Isabela	San Mariano	17.8	-	-	-	-	17.8			O	---	---	O	-	O	
9. East Tabacal Pump Irrigation Project	ETPIP	Isabela	Cauayan	16.1	-	-	-	-	16.1					X	-	-	-	
10. Debibi Groundwater IP	DGIP	Quirino	Cabarruguis	16.1	-	-	-	-	17.0			O	---	---	O	-	O	
11. Villaverde IP	VIP	N.Viz.	Villaverde	16.1	-	-	-	-	17.0			O	---	---	O	-	O	
Total							0	0							8	1	7	
GRAND TOTAL		38 schemes					4	11							24	15	9	

Note:

- *1: Blank = New / Extension Project
- * = Rehabilitation / Improvement Project
- (*) = Combination of New/Ext. and Reh./Imp.
- ** : On-going projects are not presented.

- *2: Stage 1
- ***: O = selected
- X = postponed
- y, Y = yes

Table 10.6.5 List of Proposed Irrigation Development Scheme in Reviewed Master Plan and Selection of Pre-Feasibility Study Project

Proposed Scheme for Reviewed Master Plan	*1	Location		Irrigation Area (ha)	FC=Flood Control			Selection of Pre-FS Project (if yes, 1 point)						Pre-FS
		Province	Municipality		Financial			Related FC: proposed in Rev.MP	Preparedness		Equitable develop't		Total point	
					Cost (mil.P)	Benefit (mil.P/yr)	Benefit (mil.P/yr)		NIA 10-year program	FS DE	Except Isabela province:	without highway		
To be implemented by New Funding Source														
I. Affected by Flood (Need Flood Control)														
1. Alcala Amulung West Irrigation Project	AAWPIP	Cagayan	Alcala, Amulung	7,700	1,527	-	556	1	1	1	1	1	5	O
Stage I				(4,000)	980	219	-							
2. Solana Pump Irrigation System-Reh. & Ext. Project	SPIS-REP (*)	Cagayan	Solana	7,880	1,071	-	475	1	0	0	1	0	2	
Stage I				(3,000)	504	288	-							
3. Enrile Pump Irrigation Project	EPiP	Cagayan	Enrile	3,100	588	168	241	1	0	0	1	0	2	
4. Zinundungan Irrigation Extension Project	ZIEP (*)	Cagayan	Lasam	3,495	920	179	224	1	0	0	1	1	3	
5. Lallo West Pump Irrigation Project	LWPIP	Cagayan	Lallo	900	196	48	60	1	0	0	1	0	2	
6. Nassiping Pump Irrigation Project	NPIP	Cagayan	Gattaran	765	149	46	55	1	1	1	1	0	4	
7. Rehabilitation of CIADP (Magapit & Iguig-Alcala-Amulung PISs)	* = MPIS + IAAPIS				376	215	324	1	1	1	1	0	4	
Magapit Pump Irrigation System	MPIS	-	Cagayan	Lallo	10,914									
Iguig-Alcala-Amulung Pump Irrigation System	IAAPIS	-	Cagayan	Iguig, Amulung	2,306									
8. Pinacanan River Irrigation System	PRIS *	Cagayan	Penablanca	880	91	45	56	0	0	0	1	0	1	
9. San Pablo-Cabagan Irrigation System	SPCIS *	Isabela	San Pablo	1,273	108	52	65	0	0	0	0	0	0	
10. Delfin Albano Pump Irrigation Project	DAPIP	Isabela	Delfine Albano	2,445	502	145	181	0	0	1	0	1	2	
11. Tumauni Multipurpose (Reservoir) Project	TRP (*)	Isabela	Tumauni	6,600	2,349	524	654	0	1	1	0	0	2	
12. Mallig River Irrigation System	MRIS *	Isabela	Mallig, Quezon	2,427	166	100	127	0	0	0	0	0	0	
13. Nueva Vizcaya Bagabag Irrigation System	NVBIS *	N. Viz.	Bagabag	2,160	125	81	105	0	0	0	1	0	1	
14. Sto. Nino Pump Irrigation Project	SNPIP	Cagayan	Sto Nino	1,200	240	65	69	0	0	0	1	1	2	
Total				54,045	8,409	2,174	3,193							
II. No Need of Flood Control														
1. Dabubu Irrigation Project	DIP	Isabela	San Agustin	1,000	312	75	-	0	1	0	0	1	2	
Total				1,000	312	75	-							
New / Extension Project (including combined one)	10 schemes			30,768										
Rehabilitation / Improvement Project	5 schemes			24,277										
TOTAL	15 schemes			55,045										
To be implemented by NIA Regular Fund														
I. Affected by Flood (Need Flood Control)														
1. Ilagan Pump Irrigation Project	IPIP	Isabela	Ilagan	5,000	1,184	276	292	0	0	0	0	1	1	
2. Santa Maria Communal Pump Irrigation System	SMPIS *	Isabela	Sta. Maria	690	58	28	35	0	0	0	0	1	1	
Total				5,690	1,241	305	327							
II. No Need of Flood Control														
1. Dibuluan River Irrigation Project	DRIP	Isabela	San Agustin	3,000	738	221	-	0	1	0	0	1	2	
2. Rizal Irrigation Project	RIP	Kalinga	Rizal	1,500	465	116	-	0	1	1	1	1	4	
3. San Mariano Pump Irrigation Project	SMPiP	Isabela	San Mariano	400	88	26	-	0	0	1	0	1	2	
4. Lower Chico River Irrigation System	LCRIS *	Cagayan	Tuao	1,856	134	71	-	0	0	0	1	1	2	
5. Upper Ilagan Western Brgy. Pump Irrigation Project	UIWBPIP	Isabela	Ilagan	3,000	648	162	-	0	0	0	0	1	1	
6. Debibi Groundwater IP	DGIP	Quirino	Cabarruguis	4,000	640	159	0	0	1	0	1	1	3	
7. Villaverde IF	VIP	N.Viz.	Villaverde	3,000	451	112	-	0	1	0	1	1	3	
Total				16,756	3,164	867	0							
New / Extension Project (including combined one)	7 schemes			19,900										
Rehabilitation / Improvement Project	2 schemes			2,546										
TOTAL	9 schemes			22,446										
Grand Total														
New / Extension Project (including combined one)	17 schemes			50,668										
Rehabilitation / Improvement Project	7 schemes			26,823										
TOTAL	24 schemes			77,491										

Note:
 *1: Blank = New / Extension Project
 * = Rehabilitation / Improvement Project
 (*) = Combination of New/Ext. and Reh./Imp.

Table 10.7.1 Comparison between 1987 Master Plan and Reviewed Master Plan

1987 Master Plan	Reviewed Master Plan
Study Area: Whole Cagayan River Basin Design Flood: 25 Years Probable Flood	Study Area: Whole Cagayan River Basin Design Flood: 25 Years Probable Flood
(A) Multipurpose Dam Projects	
1) Siffu No.1 Dam Project	1) Siffu No.1 Dam Project ○
2) Mallig No.2 Dam Project	<i>Not adopted</i>
3) Matuno No.1 Dam Project	2) Matuno No.1 Dam Project
4) Alimit No.1 Dam Project	<i>Not adopted</i>
5) Magat Dam	(supplement of a part of deficit in Magat project by Siffu No.1 dam)
(B) Flood Control Schemes	
<i>Structural Measures</i>	
1) Dike embankment including revetment and sluice	1) Dike embankment including revetment, sluice and riverbank tree zone ○
- Tuguegarao dike	- in the main Cagayan River from river mouth to Tuguegarao
- Cabagan dike	- <i>Not adopted</i>
2) Narrow excavation at Nassiping	<i>Not adopted</i>
- Left side bank of lower portion, Nassiping (NLL)	<i>Not adopted</i>
- Right side bank of lower portion, Nassiping (NLR)	<i>Not adopted</i>
	2) Cut-off channel works ○
	- in the main Cagayan River at Gabut, San Isidro and Tuguegarao
3) Bank protection (75 sites)	3) Bank protection (73 sites) ○
	- 21 sites from river mouth to Cabagan in main Cagayan River ○
	- 52 sites upstream from Tumauini in main Cagayan, Siffu, Mallig, Ilagan, and Magat River ○
<i>Non-structural Measures</i>	
	1) Evacuation system (FFWS, Evacuation center) ○
	2) Resettlement ○
<i>Supporting Measures</i>	
	1) Strengthening of institution and organization ○
(C) Watershed Management Schemes	
	1) Reforestation plan (Reforestation area 3,188 km ²)
	2) Sabo works plan (26 Sabo dams)
(D) Agricultural Development Schemes	
<i>Structural Measures</i>	
1) New irrigation/ extension schemes (9 schemes, total 65,530 ha) including Chico Mallig and Matuno (multipurpose project)	1) New irrigation/ extension schemes (17 schemes, total 54,985 ha) ○
	- by new fund (10 schemes, total 35,085 ha)
	- by NIA regular fund (7 schemes, total 19,900 ha)
2) Irrigation rehabilitation/ improvement schemes (5 schemes, total 11,898 ha)	2) Irrigation rehabilitation/ improvement schemes (7 schemes, total 22,506 ha) ○
	- by new fund (5 schemes, total 19,960 ha)
	- by NIA regular fund (2 schemes, total 2,546 ha)
3) Diversified crops development (170,000 ha)	3) Diversified crops development (148,400 ha)
4) Permanent crops development (57,000 ha)	4) Permanent crops development (105,100 ha)
5) Pasture land development (210,000 ha)	5) Pasture land development (152,700 ha)
6) Magat O&M improvement	6) Magat O&M improvement
<i>Supporting Measures</i>	
	1) Continuation and enhancement of on-going agriculture support services ○
	2) Strengthening of support system for irrigation system through establishment of rural development center ○
	- for Alcala Amulung West PIP
	- for other irrigation systems
	3) Enhancement of marketing and transportation system
	4) Establishment of upland development experimental center
(E) Hydropower Development Schemes	
1) Ibulao scheme (Run-of-river type)	1) Ibulao scheme (Run-of-river type)
2) Tanudan scheme (Run-of-river type)	2) Tanudan scheme (Run-of-river type)
3) Diduyon scheme with Diduyon dam	3) Diduyon scheme with Diduyon dam

Note: ○ indicates projects to be implemented under the investment amount of Pesos 30 billion by the target year 2020.

Table 10.7.2 Features of Projects in Reviewed Master Plan

Name of Projects	Project Outlines	Project Cost (Million Pesos)	EIRR (%)	F/S
(A) Multipurpose Dam Projects				
1) Siffu No.1 Dam Project	Earthfill type dam, 58 m high, 1.7 million m ³ in embankment volume, 93 million m ³ in effective storage volume, 115 million m ³ in flood control space, installed capacity of 5.4 MW, output of 41.1 GWh,	3,172	28.3	
(B) Flood Control Schemes				
<i>Structural Measures</i>				
1) Dike embankment including revetment, sluice and riverbank tree zone in the main Cagayan River from river mouth to Tuguegarao				
- Dikes from river mouth to Nassiping with riverbank tree zone	Lower Reach Dike, Total dike length of 82.7 km, total embankment volume of 9.3 million m ³ ,	2,844	28.1	*
- Dikes from Alcala to Tuguegarao with riverbank tree zone	Dikes of Alcala-Buntun, Tuguegarao and Enrile, Total dike length of 57.5 km, total embankment volume of 8.5 million m ³ ,	2,891	27.0	*
2) Cut-off channel works in the main Cagayan River				
- Gabut cut-off channel	Length of 0.9 km, excavation volume of 4.0 million m ³ ,	1,008	16.6	*
- San Isidro cut-off channel	Length of 2.1 km, excavation volume of 7.4 million m ³ ,	1,722	18.8	*
- Tuguegarao cut-off channel	Length of 6.7 km, excavation volume of 17.5 million m ³ . Spoil bank plan	4,662	15.0	*
3) Bank protection (73 sites)				
- 21 sites from river mouth to Cabagan in main Cagayan River	Total length of 18.8 km, total bank protection area of 514,900 m ² ,	726	19.2	*
- 52 sites upstream from Tumauni in main Cagayan, Siffu, Mallig, Ilagan and Magat River	Total length of 51.9 km, total bank protection area of 931,000 m ² ,	3,657	15.1 for 73 sites	
<i>Non-structural Measures</i>				
1) Evacuation system				
- Flood forecasting and warning system (FFWS)	Improvement of facilities and strengthening of local disaster management capacity in Tuguegarao	242	18.0	*
- Evacuation center	Strengthening of center and DCC capability	152		*
2) Resettlement	2,776 households, land acquisition of 7,468 ha	1,185	-	*
<i>Supporting Measures</i>				
1) Strengthening of institution and organization	Funding, River administration, People's awareness	150	-	*
(C) Watershed Management Schemes				
1) Reforestation plan	Reforestation area of 3,188 km ²	5,000	16.3	
2) Sabo works plan	26 Sabo dams in Magat River basin	5,472	16.8	
(D) Agricultural Development Schemes				
<i>Structural Measures</i>				
1) New irrigation/ extension schemes (17 schemes, total 54,985 ha)				
- by new fund (10 schemes, total 35,085 ha)	- a scheme of Alcala Amulung West PIP	1,527	22.8	*
	- other 9 schemes of Enrile, Lallo West, Nassiping, Delfin Albano, Sto Nino, Dabubu, Solana, Zinundungan, and Tumauni	6,327	17.6 ~ 25.0	
- by NIA regular fund (7 schemes, total 19,900 ha)	7 schemes of Dibuluan, Rizal, San Mariano, Upper Ilagan Western Brgy., Ilagan, Debibi, and Villaverde,	4,214	16.1 ~ 18.4	
2) Irrigation rehabilitation/ improvement schemes (7 schemes, total 22,506 ha)				
- by new fund (5 schemes, total 19,960 ha)	5 schemes of Magapit & Iguig-Alcala-Amulung, Pinacanauan, San Pablo-Cabagan, Mallig, and Nueva Vizcaya Bagabag,	866	27.0 ~ 37.1	
- by NIA regular fund (2 schemes, total 2,546 ha)	2 schemes of Lower Chico, and Santa Maria Communal,	192	27.3 ~ 29.0	
3) Diversified crops development	Improvement in unit yield (148,400 ha)	-	-	
4) Permanent crops development	Promotion of agro-forestry (105,100 ha)	-	-	
5) Pasture land development	Reinforcement of agro-pastoral linkage (152,700 ha)	-	-	
6) Magat O&M improvement	Improvement of irrigation efficiency	-	-	
<i>Supporting Measures</i>				
1) Continuation and enhancement of on-going agriculture support services	Agrarian reform and agricultural modernization through CARP and AFMA	Included in Structural measures	-	*
2) Strengthening of support system for irrigation system through establishment of rural development center				
- for Alcala Amulung West PIP	Rice mills and multipurpose dry yards	367	-	*
- for other irrigation systems	Improvement of post harvest and marketing system including rice mill and corn mill at 4 centers	433	-	
3) Enhancement of marketing and transportation system	Study on alternative route to Metro Manila including that with tunnels and sea route via Irene port	150	-	
4) Establishment of upland development experimental center	Experimental/ pilot farm for fruit tree with drip and sprinkler irrigation system at 3 centers	360	-	
(E) Hydropower Development Schemes				
1) Ibulao scheme (Run-of-river type)	Installed capacity of 17 MW, output of 85 GWh,	1,653	26.6	
2) Tanudan scheme (Run-of-river type)	Installed capacity of 25 MW, output of 130 GWh,	1,938	31.5	
3) Diduyon scheme with Diduyon dam	Installed capacity of 352 MW, output of 957 GWh, Diduyon concrete gravity dam, 111 m high,	26,745	26.5	
4) Matuno No.1 Dam Project (multipurpose)	Rockfill type, 147 m high, 10 million m ³ in embankment volume, 97 million m ³ in effective storage, installed capacity of 180 MW, irrigation area of 12,860 ha	17,565	36.8	

Note: indicates projects to be implemented under the investment amount of Pesos 30 billion by the target year 2020.

* indicates projects selected to conduct feasibility study.
EIRRs were estimated under future condition.

Table 10.8.1 Benefits of Flood Control Project

Category of Damageable Assets and Activities				Damages Mitigated by FC Project		
Benefits of Flood Mitigation	Direct Damages	Effects of Mitigating Damages to General Assets	Damages to General Assets	Building Unit	Damage to residential and business's buildings due to inundation	
				Household Effects	Furniture and movables such as automobile, electric appliances	
				Depreciable Assets of Business Establishments	Damage to depreciable assets of business establishments except their sites and buildings	
				Inventory Stocks of Business Establishments	Damage to inventory stocks of business establishments due to inundation	
				Depreciable Assets for Farming and Fishery	Damage to depreciable assets of farming or fishery in farmers or business establishments except their sites and buildings	
				Inventory Stocks for Farming and Fishery	Damage to inventory stocks of farming or fishery in farmers or business establishments except their sites and buildings	
			Damages to Agricultural Production		Damage to crop production due to inundation	
			Damages to Infrastructures	Road, Bridge, Railway, River Facility, Sewerage, Water Supply, Electric Power, Gas, Telephone, Park, Irrigation, etc.	Damage to infrastructures supporting livelihood, business activities and farming production	
			Effects of Mitigating Damage to Human Lives			Damage to living space, causing casualties
			Indirect Damages	Effects of Mitigating Damages to Daily Activities	Damage to Daily Maintenance and Business Activities	Household Economy
	Industrial Production	Stoppage or decrease of business and production activities due to inundation				
	Public Services	Stoppage or decrease of public services				
	Effects of Mitigating Damages after Flood	Expenses for State of Emergency		Household Economy	After inundation, cleaning and repairing houses damaged by flood, and extra expenses for state of emergency	
				Industrial Production	After inundation, cleaning and repairing buildings damaged by flood, and extra expenses for state of emergency	
				Government's Activities	Expenses for emergency activities to casualties in addition to the works above	
		Damage due to Traffic Disruption		Road, Railway, Port, Airport, etc.	Disruption of traffic systems such as road network, railway, etc., spreading to surrounding areas	
		Damage due to Disruption of Lifeline Services		Water Supply, Electric Power, Gas, Telephone, etc.	Disruption of public utility services such as water supply, electricity, gas, etc., spreading to surrounding areas	
	Damage due to Stoppage and Decrease of Daily Activities			Decrease of production due to lack of raw and semi finished materials, Stoppage of public services such as medical and utilities, spreading to surrounding areas		
	Effects of Mitigating Mental Influence	Influence due to Damages Above		Mental influence due to damages to general assets, business losses, casualties, aftereffects, and influence over surrounding areas		
	Benefit from Sophisticated Environment				Land appreciation owing to improvement of flood control	

Table 10.8.2 Review of Projects Proposed in 1987 Master Plan at 2000 Prices

Flood Control Schemes

Project Name	Cost *1		Benefit Under Present Condition			
	Initial Investment (Mil. Pesos)	O/M per Year	Benefit (Million Pesos per Year)	EIRR (%)	B/C*3	NPV*3 (Million Pesos)
1. Tuguegarao Dike	1,501	6	216	16.8	1.12	89
2. Narrow Improvement (Site: NLL)	2,700	10	294	12.5	0.84	-217
3. Siffu No.1 Dam	1,469	5	110	6.9	0.48	-455
4. Bank Protection Work	3,502	13	264	6.9	0.49	-1,076
5. Cabagan Dike	761	3	62	7.6	0.53	-217
6. Narrow Improvement (Site: NLR)	8,152	31	573	6.4	0.45	-2,669
7. Magat/Alimit Dam	5,559	20	416	6.9	0.48	-1,720
8. Cagayan No.1 Dam	4,461	15	273	5.2	0.39	-1,631
9. Mallig No.2 Dam	1,207	4	57	3.7	0.30	-504
10. Ilagan No.1 Dam	5,894	21	133	-	0.15	-3,020
11. Narrow Improvement (Site: NUP)	9,218	35	17	-	0.01	-5,470

Project Name	Benefit Counting on Future Economic Growth					Priority Order Based on Economic Efficiency
	Benefit		EIRR (%)	B/C*3	NPV*3 (Million Pesos)	
	in 2010 (Million Pesos per Year)	in 2020 (Million Pesos per Year)				
1. Tuguegarao Dike	216	703	28.5	2.23	922	1
2. Narrow Improvement (Site: NLL)	294	955	22.6	1.67	915	2
3. Siffu No.1 Dam	110	357	14.6	0.96	-32	6
4. Bank Protection Work	510	905	15.1	1.01	20	4
5. Cabagan Dike	62	200	15.5	1.05	21	3
6. Narrow Improvement (Site: NLR)	573	1,862	13.9	0.91	-462	6
7. Magat/Alimit Dam	416	1,352	13.2	0.86	-539	5
8. Cagayan No.1 Dam	273	888	11.3	0.70	-889	8
9. Mallig No.2 Dam	57	184	9.0	0.88	-115	9
10. Ilagan No.1 Dam	133	433	4.1	0.26	-2,949	10
11. Narrow Improvement (Site: NUP)	17	57	-	0.02	-5,401	11

Multipurpose Schemes

Project Name	Cost *1		Benefit Under Present Condition			
	Initial Investment (Mil. Pesos)	O/M per Year	Benefit (Million Pesos per Year)	EIRR (%)	B/C*3	NPV*3 (Million Pesos)
1. Multipurpose Siffu No.1 Dam	2,696	52.1	942.3	21.4	1.56	974
2. Multipurpose Magat/Alimit Dam	4,989	68.7	810.9	11.7	0.75	-790
3. Multipurpose Mallig No.2 Dam	9,474	71.9	1,897.7	14.4	0.95	-308
4. Multipurpose Matuno Dam	14,794	19.2	4,428.1	19.9	1.46	4,022

Project Name	Benefit Counting on Future Economic Growth					Priority Order Based on Economic Efficiency
	Benefit		EIRR (%)	B/C*3	NPV*3 (Million Pesos)	
	in 2000 (Million Pesos per Year)	in 2020 (Million Pesos per Year)				
1. Multipurpose Siffu No.1 Dam	1,388	1,999	28.5	2.55	2,696	2
2. Multipurpose Magat/Alimit Dam	1,359	2,188	19.3	1.44	1,384	3
3. Multipurpose Mallig No.2 Dam	2,512	3,219	18.5	1.34	1,962	4
4. Multipurpose Matuno Dam	7,818	13,084	29.7	3.01	17,569	1

Note: *1 Costs at 2000 constant prices was estimated from the M/P estimates applying a price deflator of 3.0, derived from CPI and WPI.

*2 Benefit at 2000 constant prices was estimated from the M/P estimates applying a price deflator of 3.4, derived from CPI, and growth of population and GRDP per capita.

*3 Discounted at 15%.

Table 10.8.3 Result of Economic Evaluation for Urgent Bank Protection Works

Location No.	Location	Financial Cost (Million Pesos)	Economic Cost		Economic Benefit after Completion (Mil. Pesos/Yr)	EIRR (%)		Priority Order on Economic Efficiency
			Initial Investment (Million Pesos)	O/M (Mil. Pesos/Yr)		Under Present Conditions	Under Future Conditions	
1	Agusi	47.1	40.0	0.15	3.89	9.2	17.8	10
2	Camalaniugan	30.3	25.7	0.10	4.70	17.8	29.4	1
3	Tucalana	61.7	52.4	0.20	5.08	12.3	22.2	4
4	Sta. Maria	45.1	38.3	0.14	3.51	8.6	17.0	17
5	Magapit	31.8	27.0	0.10	1.15	3.1	9.2	20
6	Gattaran	30.2	25.6	0.10	2.93	8.7	17.1	12
7	Tupang	10.8	9.2	0.03	0.90	9.6	18.1	9
8	Dugayong	9.5	8.0	0.03	0.74	8.7	17.1	13
9	Babayuan	6.7	5.7	0.02	0.77	13.2	23.2	3
10	San Vicente	75.9	62.4	0.23	8.88	13.8	24.0	2
11	Nattapian	32.3	27.4	0.10	3.18	11.1	20.5	5
12	Cataggaman	102.2	83.5	0.30	9.33	10.7	19.9	7
13	Jct. Enrile	13.5	11.4	0.04	1.05	8.7	17.1	15
14	Alibago	10.9	9.2	0.03	0.85	8.7	17.1	14
15	Namabbalan	64.6	54.8	0.21	5.90	10.3	19.3	8
16	Sta. Maria	47.6	40.3	0.15	3.70	8.7	17.0	16
17	Cabagan	80.8	68.3	0.26	6.19	8.5	16.9	19
18	Bagumbayan	10.2	8.7	0.03	1.01	11.1	20.4	6
19	Larion	0.8	0.7	0.00	0.02	2.3	7.8	21
20	Caggay	11.0	9.3	0.04	0.86	8.8	17.2	11
21	Tanza	2.8	2.4	0.01	0.22	8.6	17.0	18
	Whole Works	725.9	607.0	2.29	64.87	10.2	19.2	-

Table 10.8.4 Summary of Economic Evaluation of Alternative Irrigation Projects

Project	Initial Investment Cost (Mil.Pesos/Yr)	Without Flood Control			Combined to Flood Control		
		Annual Benefit	EIRR under Present Condition (%)	EIRR under Future Condition (%)	Annual Benefit (Mil.Pesos/Yr)	EIRR under Present Condition (%)	EIRR under Future Condition (%)
I. Affected by Flood (Need Flood Control)							
1. Alcala Amulung West Irrigation Project	1,298	-	-	-	473	18.1	22.8
2. Solana Pump Irrigation System Rehabilitation & Extension Project	910	-	-	-	404	20.1	25.0
3. Enrile Pump Irrigation Project	500	143	13.0	17.8	205	18.2	23.1
4. Zinundungan Irrigation Extension Project	782	152	12.7	16.3	190	15.0	18.8
5. Lal-lo West Pump Irrigation Project	167	41	12.0	16.5	51	14.9	19.5
6. Nassiping Pump Irrigation Project	127	38	13.9	18.5	47	17.0	21.8
7. Rehabilitation of CIADP (Magapit & Iguig-Alcala-Amulung PISs)	320	148	15.7	21.8	213	22.7	28.7
8. Pinacanan River Irrigation System	77	38	23.7	28.2	48	27.1	31.9
9. San Pablo-Cabagan Irrigation System	92	44	16.9	22.8	55	21.1	27.0
10. Santa Maria Communal Pump Irrigation System*	49	24	17.1	23.1	30	21.4	27.3
11. Delfin Albano Pump Irrigation Project	427	123	13.9	18.5	154	17.0	21.8
12. Tumauni Reservoir Project	1,997	445	14.0	17.8	556	16.4	20.4
13. Mallig River Irrigation System	141	87	26.7	31.5	108	30.5	35.5
14. Nueva Vizcaya Bagabag Irrigation System	106	71	28.1	33.0	89	32.0	37.1
15. Ilagan Pump Irrigation Project*	1,006	235	11.5	15.9	258	12.6	17.2
16. Sto. Nino Pump Irrigation Project	204	55	12.2	16.8	59	12.8	17.6
II. No Need of Flood Control							
1. Upper Ilagan Western Barangay. Pump Irrigation Project	551	138	12.3	16.8	-	-	-
2. Dabubu Irrigation Project	265	64	14.8	18.6	-	-	-
3. Lower Chico River Irrigation System	114	60	24.3	29.0	-	-	-
4. San Mariano Pump Irrigation Project	75	21	13.1	17.8	-	-	-
5. Dibuluan River Irrigation Project	627	188	15.9	19.8	-	-	-
6. Rizal Irrigation Project	395	99	15.3	19.1	-	-	-
7. Debibi Groundwater Irrigation Project	544	135	15.1	17.0	-	-	-
8. Villaverde Irrigation Project	383	95	15.1	17.0	-	-	-

Note: * To be implemented by NIA Regular Fund

Table 10.9.1 Assumed Cost Disbursement for Reviewed Master Plan

(Unit : Million Pesos)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
1. Multipurpose Dam Project																				
(1) Siftu No.1 Dam Project									317.2	713.7	713.7	713.7	713.7							3,172.0
Subtotal (1.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	317.2	713.7	713.7	713.7	713.7	0.0	0.0	0.0	0.0	0.0	0.0	3,172.0
2. Flood Control Project																				
(1) Lower Reach Dike		284.4	426.6	426.6	426.6	426.6	426.6	426.6												2,844.0
(2) Alcala Buntun Dike						208.3	234.3	234.3	234.3	234.3	234.3	234.3	234.3	234.6						2,083.0
(3) Gabut Cut-off Channel						100.8	226.8	226.8												1,008.0
(4) San Isidro Cut-off Channel									172.2	310.0	310.0	310.0	310.0	309.8						1,722.0
(5) Tuguegarao and Enrile Dike													80.8	121.2	121.2	121.2	121.2	121.2		808.0
(6) Tuguegarao Cut-off Channel													466.2	699.3	699.3	699.3	699.3	699.3		4,662.0
(7) Bank Protection		640.0	640.0	640.0	164.2	164.2	164.2	164.2	164.2	164.2	164.2	164.2	164.2	164.2	164.2	164.2	164.2	164.2		4,383.0
(8) FFWS/Evacuation Center		78.8	78.8	78.8	78.8	78.8	78.8	78.8												394.0
(9) Resettlement		65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	65.9	64.7	1,185.0
(10) Supporting Measures		8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.9	150.0
Subtotal (2.)	0.0	1,077.4	1,219.6	1,219.6	743.8	1,052.9	1,126.1	1,126.1	871.7	1,009.5	782.7	782.7	1,329.7	1,603.3	1,058.9	1,058.9	1,058.9	1,058.9	1,058.3	19,239.0
3. Irrigation Project																				
3.1 Irrigation Project to be Implemented by New Funding Sources																				
NIP/NIS																				
(1) Reh. of CIADP (Iguig-Alcala-Amulung PIS & Magapit PIS)	N	P	*																	376.0
(2) Tumauni Multipurpose P				50.0	375.0	500.0	600.0	450.0	374.0											2,349.0
(3) Alcala Amulung West PIF	N	P		152.7	229.0	229.0	229.1						114.6	229.0	229.0	114.6				1,527.0
(4) Nueva Vizcaya Bagabag IS	N	G	*					12.5	37.4	37.4	37.4									124.7
(5) Mallig RIS	N	G	*					16.6	49.8	49.8	49.7									165.9
(6) Solana PIS-REP	N	P							107.1	160.6	160.7	160.7	160.6	160.7	160.6	160.7				1,071.0
(7) Dabubu IP	N	G							31.2	93.6	93.6	93.6								312.0
(8) Delfin Albano PIF	N	P							50.2	150.6	150.6	150.6								502.0
(9) Enrile PIP	N	P													58.8	176.4	176.4	176.4		588.0
(10) Sto. Nino PIP	N	P										24.0	55.2	72.0	72.0					223.2
(11) Pinacanauan RIS	N	G	*											9.1	27.1	27.2	27.2	27.2		90.6
(12) San Pablo-Cabagan IS	N	G	*											10.8	32.5	32.5	32.4			108.2
(13) Zinundungan Irr. Ext. P	N	G													92.0	276.0	276.0	276.0	276.0	920.0
CIP/CIS																				
(14) Nassingip PIP	C	P		14.9	44.7	44.7	44.7													149.0
(15) Lallo West PIP								19.6	58.8	58.8	58.8	58.8								196.0
(16) Supporting Measures				20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.2	367.0
Subtotal (3.1)	0.0	75.3	417.8	855.1	794.1	849.5	519.1	540.4	354.9	571.1	425.3	403.2	465.2	540.9	563.9	509.1	532.5	356.0	296.2	9,069.6
Total (1.-3.1)	0.0	1,152.7	1,637.4	2,074.7	1,537.9	1,902.4	1,645.2	1,983.7	1,940.3	2,294.3	1,921.7	1,899.6	1,794.9	2,144.2	1,622.8	1,568.0	1,591.4	1,414.9	1,354.5	31,480.6
3.2 Irrigation Project to be Implemented by NIA and Other Agencies' Regular Fund																				
(1) San Mariano PIP			8.8	26.4	26.4															88.0
(2) Rizal IP				50.0	100.0	191.0	125.0													466.0
(3) Debibi Groundwater IP						100.0	150.0	200.0	190.0											640.0
(4) Dibuluan IP								91.0	100.0	200.0	200.0	147.0								738.0
(5) Villa verde IP											70.0	80.0	100.0	100.0	100.0					450.0
(6) Lower Chico RIS											13.4	40.2	40.2	40.3						134.1
(7) Upper Ilagan Western BPIP													64.8	194.4	194.4	194.4	194.4	194.4		648.0
(8) Ilagan PIP															118.4	355.1	355.0	355.0		1,183.5
(9) Santa Maria PIS															5.8	17.3	17.3	17.2		57.6
(10) Supporting Measures		52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.4	52.2	943.0
(11) Other projects		500.0	438.8	371.2	321.2	130.2	172.6	156.6	157.6	247.6	177.6	207.2	307.4	242.6	112.9	253.2	129.0	75.2	75.3	4,151.8
Subtotal (3.2)	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	9,500.0
4. Watershed Management Project																				
(1) Reforestation		277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.8	277.4	5,000.0
(2) Sabo Works		547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.2	547.4	5,472.0
Subtotal (4.)	0.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	825.0	827.4	10,472.0
5. Hydropower Project																				
(1) Ibulao Project									165.3	371.9	371.9	371.9	372.0							1,653.0
(2) Tanudan Project												193.8	436.0	436.0	436.0	436.2				1,938.0
(3) Diduyon Project														2,674.5	6,017.6	6,017.6	6,017.6	6,017.6	6,017.7	26,745.0
(4) Matuno No.1 Dam Project (multipurpose)						1,756.5	3,161.7	3,161.7	3,161.7	3,161.7	3,161.7	3,161.7								17,565.0
Subtotal (5.)	0.0	0.0	0.0	0.0	0.0	1,756.5	3,161.7	3,161.7	3,327.0	3,533.6	3,533.6	565.7	808.0	436.0	3,110.5	6,453.8	6,017.6	6,017.6	6,017.7	47,901.0
Total (1.-5.)	500.0	2,477.7	2,962.4	3,399.7	2,862.9	4,983.9	6,131.9	6,470.4	6,592.3	7,152.9	6,780.3	3,243.1	3,380.7	3,358.0	5,511.1	8,799.6	8,386.8	8,210.3	8,149.6	99,353.6

Note : N : National C : Communal P : Pump G : Gravity * : Rehabilitation

Table 11.3.1 Calculation of Water Duty for Higher Plain in AAWPIP

AAWPIP: Alcala Amulung West Pump Irrigation Project

Month		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Cropping Pattern		Dry Season				Wet Season				Legumes, Corn, 50%			
Probable Rainfall (1/5)	R(80) mm	5	1	4	8	60	85	86	119	108	161	83	13
Reference Evapotranspiration	ET _o mm	102	99	140	144	137	124	122	119	121	121	102	94
<u>Dry Season Paddy</u>													
Crop Coefficient	K _c	1.09	1.17	1.11	0.98								1.05
Crop Evapotranspiration	ET _{crop} mm	111.2	115.8	155.4	141.1								98.7
Percolation	P mm	46.5	42.0	46.5	45.0								46.5
Area Factor	f _a	1	1	7/8	1/8								1/2
Land Soaking	LS mm	75.0											75.0
Flooding	Fl mm	15.0											0.0
Effective Rainfall	Re mm	3.5	0.7	2.8	5.6								9.1
Net Irrigation Requirement	mm	244	157	174	23								139
<u>Wet Season Paddy</u>													
Crop Coefficient	K _c				1.05	1.06	1.13	1.16	1.04				
Crop Evapotranspiration	ET _{crop} mm					145.2	140.1	141.5	123.8				
Percolation	P mm					46.5	45.0	46.5	46.5				
Area Factor	f _a				1/8	7/8	1	1	1/2				
Land Soaking	LS mm				18.75	112.5	18.75						
Flooding	Fl mm					7.5	7.5						
Effective Rainfall	Re mm				5.6	42.0	59.5	60.2	83.3				
Net Irrigation Requirement	mm				18	246	152	128	43				
<u>Wet Season Legumes, etc</u>													
Crop Coefficient	K _c								0.40	0.51	1.02	0.89	0.85
Crop Evapotranspiration	ET _{crop} mm								47.6	61.7	123.4	90.8	79.9
Area Factor	f _a								1/16	7/16	1/2	7/16	1/16
Effective Rainfall	Re mm								67.8	64.4	106.0	54.4	10.0
Net Irrigation Requirement	mm								0	0	9	16	4
Net Irrigation Requirement in total	mm	244	157	174	41	246	152	128	43	0	9	16	143
Irrigation Efficiency	E	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Gross Irrigation Requirement	mm	452	291	322	76	456	281	237	80	0	17	30	265
Water Duty	lit/s/ha	1.69	1.20	1.20	0.29	1.70	1.09	0.88	0.30	0.00	0.06	0.11	0.99

Table 11.3.2 Calculation of Water Duty for Lower Plain in AAWPIP

AAWPIP: Alcala Amulung West Pump Irrigation Project

Month		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Cropping Pattern		Dry Season			Wet Season					Legumes, Corn, 50%			
Probable Rainfall (1/5)	R(80) mm	5	1	4	8	60	85	86	119	108	161	83	13
Reference Evapotranspiration	ET _o mm	102	99	140	144	137	124	122	119	121	121	102	94
<u>Dry Season Paddy</u>													
Crop Coefficient	K _c	1.09	1.17	1.11	0.98								1.05
Crop Evapotranspiration	ET _{crop} mm	111.2	115.8	155.4	141.1								98.7
Percolation	P mm	62.0	56.0	62.0	60.0								62.0
Area Factor	f _a	1	1	7/8	1/8								1/2
Land Soaking	LS mm	75.0											75.0
Flooding	Fl mm	15.0											0.0
Effective Rainfall	Re mm	3.5	0.7	2.8	5.6								9.1
Net Irrigation Requirement	mm	260	171	188	24								146
<u>Wet Season Paddy</u>													
Crop Coefficient	K _c				1.05	1.06	1.13	1.16	1.04				
Crop Evapotranspiration	ET _{crop} mm					145.2	140.1	141.5	123.8				
Percolation	P mm					62.0	60.0	62.0	62.0				
Area Factor	f _a				1/8	7/8	1	1	1/2				
Land Soaking	LS mm				18.75	112.5	18.75						
Flooding	Fl mm					7.5	7.5						
Effective Rainfall	Re mm				5.6	42.0	59.5	60.2	83.3				
Net Irrigation Requirement	mm				18	259	167	143	51				
<u>Wet Season Legumes, etc</u>													
Crop Coefficient	K _c								0.40	0.51	1.02	0.89	0.85
Crop Evapotranspiration	ET _{crop} mm								47.6	61.7	123.4	90.8	79.9
Area Factor	f _a								1/16	7/16	1/2	7/16	1/16
Effective Rainfall	Re mm								67.8	64.4	106.0	54.4	10.0
Net Irrigation Requirement	mm								0	0	9	16	4
Net Irrigation Requirement in total	mm	260	171	188	42	259	167	143	51	0	9	16	151
Irrigation Efficiency	E	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Gross Irrigation Requirement	mm	481	317	348	78	480	309	265	94	0	17	30	280
Water Duty	lit/s/ha	1.80	1.31	1.30	0.30	1.79	1.19	0.99	0.35	0.00	0.06	0.11	1.04

Table 12.2.1 Features of Projects in Feasibility Study

Name of Projects	Project Outlines	Project Cost (Million Pesos)	EIRR (%), a)	b)
(I) Flood Control Schemes				
<i>Structural Measures</i>				
1) Dike embankment including revetment, sluice and riverbank tree zone in the main Cagayan River from river mouth to Tuguegarao				
- Dikes from river mouth to Nassiping	- 4 dikes of Mabanguc, Catugan, Camalaniugan and Lal-lo (Phase 1), - Total dike length of 44.3 km, total embankment volume of 4.2 million m ³ ,	1,505	32.9 c)	■
	- Other 3 dikes of Lasam, Gattaran and Nassiping, - Total dike length of 22.8 km, total embankment volume of 1.9 million m ³ ,	650	38.6	
- Dikes from Alcala to Tuguegarao	- 5 dikes of Alcala-Buntun, Enrile, Amulung, Iguig, and Tuguegarao, - Total dike length of 82.8 km, total embankment volume of 12.1 million m ³ ,	3,642	22.5 c)	
- Riverbank tree zone	Width of 30 m and total length of 68.9 km along Catugan, Alcala-Buntun, Enrile, and Tuguegarao dike (Phase 1)	28	-	■
2) Cut-off channel works in the main Cagayan River				
- Gabut cut-off channel	Length of 0.7 km, excavation volume of 4.3 million m ³ ,	1,090	15.6	
- San Isidro cut-off channel	Length of 1.6 km, excavation volume of 9.6 million m ³ ,	2,025	16.6	
- Tuguegarao cut-off channel	Length of 5.8 km, excavation volume of 19.3 million m ³ ,	3,975	17.0	
3) Bank protection at 21 sites from river mouth to Cabagan in main Cagayan River	Total bank protection area of 306,000 m ² , (Phase 1)	726	19.2	■
<i>Non-structural Measures</i>				
1) Evacuation system				
- Flood forecasting and warning system (FFWS)	Improvement of existing FFWS facilities, strengthening of PAGASA subcenter and local disaster management capacity in Tuguegarao	242	18.0	■
- Evacuation center	Strengthening of existing evacuation center facilities, and capability of DCC staffs and local people	152		■
2) Resettlement	2,776 households, land acquisition of 7,468 ha	1,188	-	■
<i>Supporting Measures</i>				
1) Strengthening of institution and organization	Funding, River administration, People's awareness	168	-	■
(II) Agricultural Development Schemes				
<i>Structural Measures</i>				
1) Alcala Amulung West Pump Irrigation Project (new irrigation project by new fund)				
- Stage 1	Development area of 4,090 ha, 4 sets of intake pump and 2 sets of booster pump,	1,626	16.4	■
- Stage 2	Development area of 2,970 ha, 4 sets of intake pump and 2 sets of booster pump,	982	16.1	
<i>Supporting Measures</i>				
1) Continuation and enhancement of on-going agriculture support services	Agrarian reform and agricultural modernization through CARP and AFMA	(22) d)	-	■
2) Strengthening of support system for Alcala Amulung West Pump Irrigation Project				
- Stage 1	- Rice mill, 4 units with a capacity of 5 ton/ hour/unit, - Multipurpose dry yards of 97,000 m ² ,	(210) d)	-	■
- Stage 2	- Rice mill, 3 units with a capacity of 5 ton/ hour/unit, - Multipurpose dry yards of 73,000 m ² ,	(157) d)	-	

Notes:

a) EIRRs were estimated under future condition.

b) ■ indicates projects recommended to implement urgently.

c) EIRRs were estimated including costs of relevant riverbank tree zones.

d) Costs of supporting measures for agricultural development scheme given in () are included in the project cost of the Alcala Amulung West Pump Irrigation Project (structural measures).

Table 12.5.1 Summary of Quantities for Alcalá Amulung West Pump Irrigation Project

Work item	Unit	Quantity			Remarks
		Phase I	Phase II	Total	
1. General Item					
(1) Mobilization/demobilization	L.S.				
(2) Temporary works	L.S.				
(3) Preparatory works	L.S.				
2. AAWPIP Pump Station					
2.1 Civil works					
(1) Excavation (rock)	m3	20000	-	20,000	
(2) Backfill	m3	14000	-	14,000	
2.2 Electro-Mechanical works					
(1) Transmission line with tower	L.S.	1	-	1	5km, 2 towers
(2) Sub-station	L.S.	1	-	1	
(3) Pump & Motor with appurtenant	L.S.	1	-	1	
(4) Screen	L.S.	1	-	1	
(5) Desilting facilities	L.S.	1	-	1	
2.3 Building and concrete works					
(1) Pump house	L.S.	1	-	1	
(2) Pump sump: concrete "A"	m3	1200	-	1,200	
3. Booster Pump Station					
3.1 Civil works					
(1) Excavation (rock)	m3	300	-	300	
(2) Backfill	m3	50	-	50	
3.2 Electro-Mechanical works					
(1) Transmission line	km	15	-	15	
(2) Sub-station	L.S.	1	-	1	
(3) Pump & Motor with appurtenant	L.S.	1	-	1	
(4) Screen	L.S.	1	-	1	
3.3 Building and concrete works					
(1) Pump house	L.S.	1	-	1	
(2) Pump sump: concrete "A"	m3	120	-	120	
4. Main Irrigation System					
4.1 Main Canal (MC) I: 27.50km, II: 0.00km					
(1) Excavation (indurated)	m3	825,000	-	825,000	
(2) Embankment	m3	824,000	-	824,000	side borrow
(3) Concrete lining (Class "B")	m3	28,300	-	28,300	
(4) Concrete pavement	m3	-	-	-	
(5) Gravel pavement	m3	24,800	-	24,800	
4.2 Related structure for MC					
(1) Head gate	no.	10	-	10	
(2) Turnout	no.	40	-	40	
(3) Syphon	L.S.	2	-	2	
(4) Culvert	L.S.	20	-	20	
(5) Bridge	m2	2,000	-	2,000	
(6) Cross drain	no.	39	-	39	
(7) Others	L.S.	1	-	1	10% of total
4.3 Lateral & Sub Lateral Canals (LC/SLC) I: 29.45km, II: 32.30km					
(1) Excavation (common)	m3	120,400	144,400	264,800	
(2) Embankment	m3	614,200	624,700	#####	1/2: 6km
(3) Concrete lining (Class "B")	m3	11,900	10,700	22,600	
(4) Concrete pavement	m3	-	-	-	
(5) Gravel pavement	m3	18,300	18,800	37,100	
4.4 Related structure for LC					
(1) Head gate	no.			9	
(2) Turnout	no.	40	60	100	
(3) Syphon	L.S.	6	4	10	
(4) Culvert	L.S.	19	3	22	
(5) Cross drain	no.			25	
(6) Others	L.S.				10% of total
5. On-farm System					
(1) Farm Ditch & Drain with related structure	ha	4,090	2,970	7,060	
(2)					
(3) Land levelling	ha	-	150	150	
6. Main Drainage System					
6.1 Main & Lateral Drains (MD-I: 7.60km, II: 0.70km, LD-I: 19.70km, II: 7.50km)					
(1) Excavation (common)	m3			492,000	
(2) Masonry	m3				
(3) Gabion	m3			100	
6.2 Related structure					
(1) Culvert	no.			50	
(2)					
7. Pangul River Training					
7.1 Cut-off channel					
(1) Excavation (common)	m3	-	750,000	750,000	
(2) Gabion	m3	-	200	200	
(3) Bridge	m2	-	400	400	
7.2 Flood dike					
(1) Embankment	m3	-	378,000	378,000	1/5: 6km
(2) Sluice	no.	-	2	2	
8. Supporting Measures					
(1) Rice Mill	no.	4	3	7	
(2) Drying yard	m2	97,000	73,000	170,000	

Table 13.4.1 Project Cost for the Lower Cagayan Flood Control Project, Phase 1 (2002-2007) in 4 Phases including AAWPIP stage 1

US\$ 1.0=Pesos 50.0=JY 120.0

Cost Items	Cost (Pesos million)		
	Total	FC	LC
A Flood control project			
1 Direct construction cost	1,585	960	625
1) Urgent Bank Protection Works	540	270	270
2) Left and Right Dike System reach from river mouth to Magapit w/tree zone	1,045	690	355
2 VAT, 10 % of 1	158	0	158
Sub total, 1+2	1,743	960	784
3 Land Acquisition and Compensation Cost	26	0	26
5 Cost for non-structural measures	319	129	191
6 Cost for supporting measures	30	24	6
7 Government Administration Expenses, 3 % of 1	48	0	48
8 Engineering Services Expenses, 12 % of 1	190	152	38
Sub total, 1+2+3+4+5+6+7+8	2,356	1,265	1,092
9 Price Contingency, 5 % p.a. for LC and 2 % p.a. for FC	224	76	148
Sub total, 1+2+3+4+5+6+7+8+9	2,580	1,340	1,240
10 Physical Contingency, 8 %	206	107	99
Total, Flood Control	2,786	1,448	1,339
B Irrigation project			
1 Direct construction cost			
1) Alucala Amulung West pump irrigation project , stage 1	902	450	452
2 VAT, 10 % of 1		0	90
Sub total, 1+2	992	450	542
3 Land Acquisition, Compensation	20	0	20
4 Supporting measures	210	126	84
5 Government Administration Expenses, 3 % of 1	27	0	27
6 Engineering Services Expenses, 12 % of 1	108	87	22
Sub total, 1+2+3+4+5	1,358	663	695
7 Price Contingency, 5 % p.a. for LC and 2 % p.a. for FC	148	44	104
Sub total, 1+2+3+4+5+6	1,505	706	799
8 Physical Contingency, 8 %	120	56	64
Total, Irrigation	1,626	763	863
G. total, Flood Control and Irrigation	4,412	2,210	2,202

Table 13.4.2 Project Cost for the Lower Cagayan Flood Control Project, Phase 2 (2004-2011) in 4 Phases

US\$ 1.0=Pesos 50.0=JY 120.0

Cost Items	Cost (Pesos million)		
	Total	FC	LC
A Flood control project			
1 Direct construction cost	1,635	1,079	556
1) Left and Right Dike System w/tree zone, reach from Magapit to Nassiping, Amulung dike system w/tree zone , and Gabut cut-off channel reach from Nassiping to Amulung	1,635	1,079	556
2 VAT, 10 % of 1	164	0	164
Sub total, 1+2	1,799	1,079	719
3 Land Acquisition and Compensation Cost	4	0	4
4 Cost for non-structural measures	409	0	409
5 Cost for supporting measures	60	48	12
6 Government Administration Expenses, 3 % of 1	49	0	49
7 Engineering Services Expenses, 12 % of 1	196	157	39
Sub total, 1+2+3+4+5+6+7	2,517	1,284	1,233
8 Physical and Price Contingency, 12 % of 1 to 7	311	161	150
Total, Flood Control	2,828	1,445	1,383

Table 13.4.3 Project Cost for the Lower Cagayan Flood Control Project, Phase 3 (2007-2015) in 4 Phases

US\$ 1.0=Pesos 50.0=JY 120.0

Cost Items	Cost (Pesos million)		
	Total	FC	LC
A Flood control project			
1 Direct construction cost	2,857	1,886	971
1) Alcala-Buntun and Iguig Dike System w/tree zone, reach from Amulung to Tuguegarao and San Isidoro cut-off channel	2,857	1,886	971
2 VAT, 10 % of 1	255	0	255
Sub total, 1+2	3,112	1,886	1,227
3 Land Acquisition and Compensation Cost	43	0	43
4 Cost for non-structural measures	517	0	517
5 Cost for supporting measures	30	24	6
6 Government Administration Expenses, 3 % of 1	86	0	86
7 Engineering Services Expenses, 12 % of 1	343	274	69
Sub total, 1+2+3+4+5+6+7	4,131	2,184	1,947
8 Physical and Price Contingency	289	153	136
Total, Flood Control	4,420	2,337	2,083
B Irrigation project			
1 Direct construction cost			
1) Alucala Amulung West pump irrigation project , stage 1	560	280	280
2 VAT, 10 % of 1		0	56
Sub total, 1+2	616	280	336
3 Land Acquisition, Compensation	12	0	12
4 Supporting measures	157	94	63
5 Government Administration Expenses, 3 % of 1	17	0	17
6 Engineering Services Expenses, 12 % of 1	67	54	13
Sub total, 1+2+3+4+5	869	428	441
7 Price and physical contingencies, 12 % of 1-6	91	43	49
Total irrigation 1+2+3+4+5+6+7	961	471	490
Total, Flood Control and Irrigation	5,380	2,808	2,573

Table 13.4.4 Project Cost for the Lower Cagayan Flood Control Project, Phase 4 (2011-2020) in 4 Phases

US\$ 1.0=Pesos 50.0=JY 120.0

Cost Items	Cost (Pesos million)		
	Total	FC	LC
A Flood control project			
1 Direct construction cost	3,696	2,439	1,257
1) Tuguegarao and Enrile Dike System w/tree zone, reach from Tuguegarao to Cabagan and Tuguegarao cut-off channel	3,696	2,439	1,257
2 VAT, 10 % of 1	370	0	370
Sub total, 1+2	4,066	2,439	1,626
3 Land Acquisition and Compensation Cost	28	0	28
4 Cost for non-structural measures	96	0	96
5 Cost for supporting measures	30	24	6
6 Government Administration Expenses, 3 % of 1	111	0	111
7 Engineering Services Expenses, 12 % of 1	444	355	89
Sub total, 1+2+3+4+5+6+7	4,774	2,818	1,956
8 Price and Physical Contingency, 12 % of 1 to 7	573	338	235
Total, Flood Control	5,347	3,156	2,190

Table 13.4.5 Summary of Project Cost for the Lower Cagayan River Flood Control Project, Phase 1, 2, 3, and 4(Flood Control only)

US\$ 1.0=Pesos 50.0=JY120.0 unit:Peso million

	Flood Control system / Work Items	Cost (Pesos million)		
		Total	FC	LC
1	Urgent Bank Protection Works and Left and Right Dike System with Tree Zone reach from River Mouth to Magapit	2,786	1,448	1,339
2	Left and Right Right Dike System, reach from River Magapit to Nassiping, Amulung Dike System w/Tree Zone and Gabut Cut Off Channel, reach from Nassiping to Amulung	2,828	1,445	1,383
3	Alcala-Buntun Dike System w/Tree Zoneand San Isidoro Cut Off Channel, Reach from Amulung to Tuguegarao	4,420	2,337	2,083
4	Tuguegarao and Enrile Dike Systems w/Tree Zone, and Tuguegarao Cut-Off Channel, Reach from Tuguegarao to Cabagan	5,347	3,156	2,190
	Total	15,381	8,385	6,996
	Total, equivalent US\$ (million)	308	168	140

Table 15.1.1 Results of Impact Evaluation of Flood Control Project on Natural Environment

<i>Environmental Components</i>	<i>Conceivable Impacts</i>	<i>Magnitude of Impact*</i>	<i>Characteristics of Impact</i>
<i>Terrestrial Flora</i>	• Vegetation clearance and population decrease by excavation work.	(-1)	Irreversible
	• Genetic disturbance of terrestrial flora caused by planting in forest zone.	(-0)	
<i>Terrestrial Fauna</i>	• Habitat loss due to vegetation clearance.	(-1)	Irreversible
	• Formation of habitat barrier for wild animals due to dikes.	(-0)	
	• Creation of habitat including breeding grounds and foods for terrestrial fauna by forest zone.	(+1)	Permanent
	• Decrease in flood frequency and “drying up effect,” to some species.	(-0)	
<i>Aquatic Ecology</i>	• Turbid water flow and siltation caused by excavation works.	(-1)	Temporal
	• Decrease of habitat diversity of aquatic organisms.	(-0)	
	• Creation of habitat including breeding grounds and foods for aquatic fauna.	(+1)	Permanent
<i>Water Quality</i>	• Water pollution in case of lack of sewage system.	(-0)	
	• Turbid water flow from construction sites.	(-1)	Temporal
<i>Air Quality</i>	• Air pollution caused by heavy construction machinery and transportation vehicles.	(-1)	Temporal
	• Dust from vegetation-cleared land.	(-0)	
<i>Noise</i>	• Noise caused by heavy construction machinery and transportation vehicles.	(-1)	Temporal
<i>Landscape</i>	• Creation of new landscape.	(0)	

* (+2) Major positive impact, (+1) Minor positive impact, (± 0) Negligible impact, (-1) Minor negative impact, (-2) Major negative impact)

Table 15.1.2 Results of Impact Evaluation of Irrigation Development Project on Natural Environment

<i>Environmental Components</i>	<i>Conceivable Impacts</i>	<i>Magnitude of Impact*</i>	<i>Characteristics of Impact</i>
<i>Terrestrial Flora</i>	• Vegetation clearance and population decrease by land preparation work.	(-1)	Irreversible
<i>Terrestrial Fauna</i>	• Habitat loss due to vegetation clearance.	(-1)	Irreversible
<i>Aquatic Ecology</i>	• Turbid water flow and siltation caused by land preparation work.	(-1)	Temporal
	• Habitat loss and population decrease of aquatic organisms.	(-1)	Irreversible
	• Overuse of agricultural chemicals and/or fertilizers.	(-0)	
<i>Water Quality</i>	• Turbid water flow from land preparation sites.	(-1)	Temporal
<i>Air Quality</i>	• Air pollution caused by heavy construction machinery and transportation vehicles.	(-1)	Temporal
	• Dust from vegetation-cleared land.	(-0)	
<i>Noise</i>	• Noise caused by heavy construction machinery and transportation vehicles.	(-1)	Temporal
<i>Landscape</i>	• Creation of new landscape.	(+1)	Permanent

* (+2) Major positive impact, (+1) Minor positive impact, (± 0) Negligible impact, (-1) Minor negative impact, (-2) Major negative impact)

Table 15.1.3 The Number of Households and Public Facilities to Be Relocated

Municipality/ City	Alignments of Dikes and Cut-off Channels			River area between right and left bank		
	Affected Barangays	Households	Public Facility *	Affected Barangays	Households	Public Facility *
Appari	Catalungan	46	-	-	0	-
Camalaniugan	-	0	-	Dammang Sure	30	-
Allacapan	-	0	-	-	-	-
Lal-lo	San Jose	10	-	-	0	-
	Santa Maria	11	-			
	Magapit	1	-			
	Sub-total	22	-			
Gattaran	Sentro Sur	24	-	-	0	-
	Nassiping	4	-			
	Sub-total	28	-			
Lasam	-	0	-	Callo Norte	162	SeSh(1), ElSc(1), Ch(2)
				Callo Sur	162	
				Aggunitan	190	ElSc(1), Ch(1)
				Calapangan Norte	165	Ch(1)
				Calapangan Sur	30	
				Minanga Norte	61	PrSc(1)
				Minanga Sur	102	PrSc(1)
				Tagao	0	-
				Cataliganan	0	
Sub-total	872	SeSh(1), ElSc(2), PrSc(2), Ch(4)				
Sto. Nino	-	0	-	-	0	-
Alcala	-	0	-	Tanban	70	-
				Damurog	180	ElSc(1), Ch(1), BH(1)
				Sub-total	250	ElSc(1), Ch(1), BH(1)
Amulung	-	0	-	Gabut	173	ElSc(1), Ch(1), BH(1), DCC(1)
				Dugayong	226	ElSc(1), Ch(1), BH(1), DCC(1)
				Dufunganay	55	ElSc(1), Ch(2), DCC(1)
				Bacuit	103	
				Bauan	21	
				Plalli (Palacu)	32	ElSc(1), Ch(1), DCC(1)
				Abolo	128	
				Sub-total	738	ElSc(4), Ch(5), BH(2), DCC(4)
Iguig	San Isidro	247	ElSc(1), Ch(2), BH(1)	San Isidro	537	ElSc(1), Ch(2), BH(3), DCC(4)
	San Vicente					
	Sta. Rosa					
	Minanga Norte					
Solana	-	0	-	Basi	6	-
Tuguegarao	-	0	-	-	0	-
Enrile	-	0	-	-	0	-
Total	-	343	ElSc(1), Ch(2), BH(1)	-	2,433	SeSh(1), ElSc(8), PrSc(2), Ch(13), BH(6), DCC(8)

* SeSc: Secondary School, ElSc: Elementary School, PrSc: Primary School, Ch: Church including Chapel BH: Barangay Hall, DCC: Daycare Center

Table 15.1.4 Results of Impact Evaluation of Flood Control Project on Social Environment

<i>Environmental Components</i>	<i>Conceivable Impacts</i>	<i>Magnitude of Impact*</i>	<i>Characteristics of Impact</i>
<i>Resettlement</i>	<ul style="list-style-type: none"> Involuntary resettlement. Livelihood change at relocated site. Living environmental change at relocated site. Community split as a result of relocation. 	(-2)	Irreversible
<i>Public Health</i>	<ul style="list-style-type: none"> Impact on public health caused by air pollution, noise and traffic accidents. 	(-1)	Temporal
	<ul style="list-style-type: none"> Reduce of water related diseases accompanied by alleviation of flood risks. 	(+1)	Permanent
<i>Economic Activities</i>	<ul style="list-style-type: none"> Procurement of nursery trees for planting. 	(+1)	Temporal
	<ul style="list-style-type: none"> Contracts and employment of laborer for planting and construction works. 	(+2)	Temporal
	<ul style="list-style-type: none"> Bi-products as fruits, fuel, and herbs from forest plants. 	(+1)	Permanent
	<ul style="list-style-type: none"> Increase in potential for a tourism spot. 	(+0)	
	<ul style="list-style-type: none"> Boost of local economy due to alleviation of flood risks. 	(+2)	Permanent
<i>Navigation</i>	<ul style="list-style-type: none"> Impact on navigation by run-off regime change. 	(-0)	
<i>Fisheries</i>	<ul style="list-style-type: none"> Turbid water flow and siltation in the Cagayan river. 	(-0)	
<i>Water Rights</i>	<ul style="list-style-type: none"> Impact on existing water rights. 	(-0)	
<i>Community Split</i>	<ul style="list-style-type: none"> Community split by dikes and cut-off channels. 	(-1)	Irreversible

* (+2) Major positive impact, (+1) Minor positive impact, (± 0) Negligible impact, (-1) Minor negative impact, (-2) Major negative impact)

Table 15.1.5 Results of Impact Evaluation of Irrigation Development Project on Social Environment

<i>Environmental Components</i>	<i>Conceivable Impacts</i>	<i>Magnitude of Impact*</i>	<i>Characteristics of Impact</i>
<i>Resettlement</i>	<ul style="list-style-type: none"> Involuntary Resettlement. 	(-1)	Irreversible
<i>Public Health</i>	<ul style="list-style-type: none"> Adverse effect to public health caused by air pollution, noise and traffic accidents. 	(-1)	Temporal
<i>Economic Activities</i>	<ul style="list-style-type: none"> Contracts of geologic, topographic, and hydrological surveys and employment of local laborers. 	(+2)	Temporal
	<ul style="list-style-type: none"> Traffic disturbance and effect on local economy. 	(-1)	
	<ul style="list-style-type: none"> Improvement of agricultural productivity. 	(+2)	Permanent
<i>Navigation</i>	<ul style="list-style-type: none"> No significant impacts. 	(0)	
<i>Fisheries</i>	<ul style="list-style-type: none"> Turbid water flow and siltation in the Cagayan river. 	(-1)	Temporal
	<ul style="list-style-type: none"> Impacts on fisheries caused by overuse of agricultural chemicals and/or fertilizers. 	(-0)	
<i>Water Rights</i>	<ul style="list-style-type: none"> Impacts on existing water rights due to water intake for irrigation. 	(-0)	
<i>Other</i>	<ul style="list-style-type: none"> Conflict between landowners and tenant farmers caused by supporting measures. 	(-0)	

* (+2) Major positive impact, (+1) Minor positive impact, (± 0) Negligible impact, (-1) Minor negative impact, (-2) Major negative impact)

Table 15.1.6 Environmental Monitoring Plan and Schedule

<i>Type of monitoring</i>	<i>Monitoring site</i>	<i>Frequency/ Timing of Monitoring</i>	<i>Parameters to be monitored</i>
1. Compliance Monitoring	All construction and monitoring sites	Quarterly during construction phase and twice a year during initial operation phase	All specified mitigation measures
2. Environmental Surveillance/Monitoring			
2.1 Terrestrial Flora and Fauna	River area	When deemed necessary	Plant species and wildlife species
2.2 Aquatic Ecology	Lower Cagayan River	Annually, during migratory season	The number of Ludong by an experimental catch
2.3 Water Quality	Downstream of excavation sites of cut-off channels, Cagayan River	Several times a year, during rainy season	Turbidity and depth of siltation
2.4 Ambient Air Quality	Residential area near construction sites and along transportation routes	At the peak periods of each phase of construction work	TSP, NO ₂ , CO, Lead(Pb)
2.5 Noise	-ditto-	-ditto-	Noise level

Table 15.1.7 Environmental Monitoring Plan and Schedule

<i>Type of Monitoring</i>	<i>Monitoring Sites</i>	<i>Frequency/ Timing of Monitoring</i>	<i>Parameters to be Monitored</i>
1. Compliance Monitoring	All construction and monitoring sites	Quarterly during construction phase and twice a year during initial operation phase	All specified mitigation measures
2. Environmental Surveillance/Monitoring			
2.1 Resettlement			
a) Compensation and relocation of affected households	Affected barangay/ Relocated sites	Quarterly during resettlement procedure and up to completion of resettlement	Compensation rate, reflection of peoples' intention on unity of community, and physical conditions (surface area of a lot, public facilities, etc) in resettlement area
b) Employment	Contractor's administrative record	-ditto-	Rate of hiring local laborers and affected people
c) Livelihood Assistance	Relocated sites	-ditto-	Livelihood program and livelihood training offered
2.2 Economic Activities			
a) Fisheries	Lower Cagayan River	Annually, up to target year, 2020	Annual fish catch, by secondary data
b) Navigation	-ditto-	As noted, up to target year, 2020	Water level at ferry boat terminal
2.3 Public Health and Sanitation	Concerned municipalities of Cagayan Province	Annually, during construction period only.	Morbidity and mortality of water related diseases, number of traffic accident case, etc
2.4 Education	Cagayan Province	As noted, up to target year, 2020	Basic performance ratio, including participation rate, completion rate, etc.

Table 15.3.1 Economic Value of Damageable Assets

Asset	Damageable Value				
	Building (Pesos)	Durable Assets (Pesos)	H. Effects/ Stock (Pesos)	Value Added*1 (Pesos/day)	Crop Production (Pesos/ha)
1. Residence					
a. Residential Unit	56,000		42,000	200 *2	
2. Industrial, Educational and Medical Facilities					
a. Manufacturing	22,000	291,000	38,000	840	
b. Wholesale & Retail Trade	108,000	266,000	116,000	860	
c. Education	4,150,000	1,162,000	166,000	0	
d. Health & Social Work	2,407,000	664,000	830,000	0	
3. Crop Production					
a. Irrigated New Fields (ha)					32,200
b. Irrigated Rehabilitated Fields (ha)					32,200
c. Irrigated Farm Land (ha)					17,500
d. Rainfed Paddy Field (ha)					12,300

Note: *1 VA is calculated based on not actual business days of 250 days but 365 calendar days.

*2 In residence, the daily amount for cleaning damaged house is equivalent to daily income of an average family

Table 15.3.2 Damage Rate

(1) Direct Damage

Item	Inundation Depth					
	Below Floor Level	Less than 0.5 m	0.5-0.99 m	1.0-1.99 m	2.0-2.99 m	More than 3.0 m
1. Building						
a. Building*1	0	0.092	0.119	0.266	0.380	0.834
2. Residence						
a. Household Effects	0	0.145	0.326	0.508	0.928	0.991
3. Industrial, Educational and Medical Facilities						
a. Depreciable Assets	-	0.232	0.453	0.789	0.966	0.995
b. Inventory Stock	-	0.128	0.267	0.586	0.897	0.982
4. Crop Production						
	Water Depth (m)	Inundation Time (days)				
		1 to2	3 to 4	5 to 6	More Than 7	
a. Lowland Crop	Less than 0.5	0.21	0.30	0.36	0.50	
	0.5 to 0.99	0.24	0.44	0.50	0.71	
	More than 1	0.37	0.54	0.64	0.74	
b. Upland Crop	Less than 0.5	0.27	0.42	0.54	0.67	
	0.5 to 0.99	0.35	0.48	0.67	0.74	
	More than 1	0.51	0.67	0.81	0.91	

Note: *1 In case of residence, a floor level is 15cm higher than the ground level.

However, a floor level of business establishments is the same as the ground level.

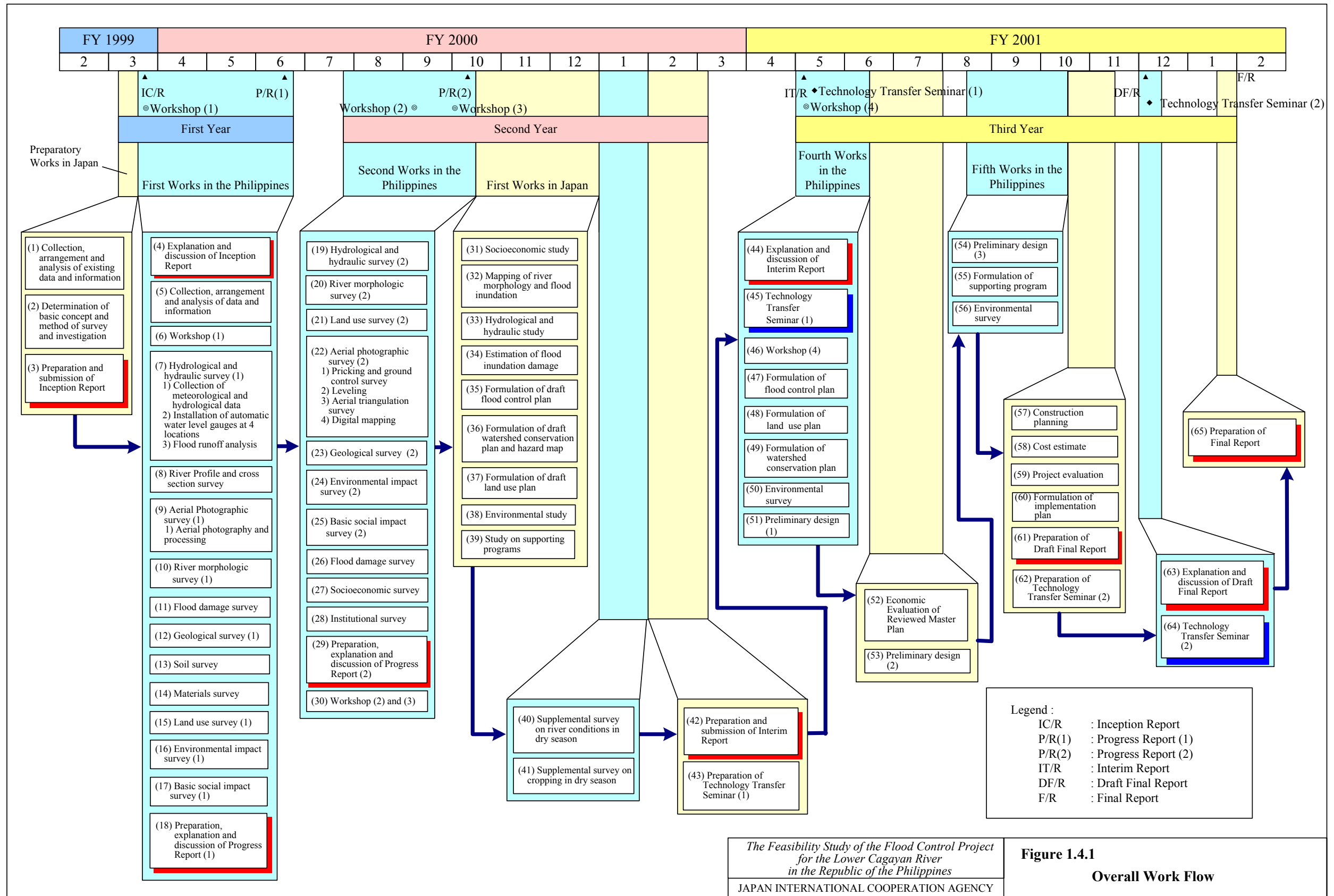
(2) Indirect Damage

Item	Inundation Depth					
	Below Floor Level	Less than 0.5 m	0.5-0.99 m	1.0-1.99 m	2.0-2.99 m	More than 3.0 m
1. Residence *1						
Works for Cleaning (days)		7.5	13.3	26.1	42.4	50.1
2. Industrial, Educational and Medical Facilities *2						
Stoppage of Business (days)		4.4	6.3	10.3	16.8	22.6
Stagnant Days of Business after Stoppage		2.2	3.15	5.15	8.4	11.3
Total		6.6	9.45	15.45	25.2	33.9

Source: Manual for Economic Study on Flood Control, 1999, Ministry of Land, Infrastructure and Transport in Japan

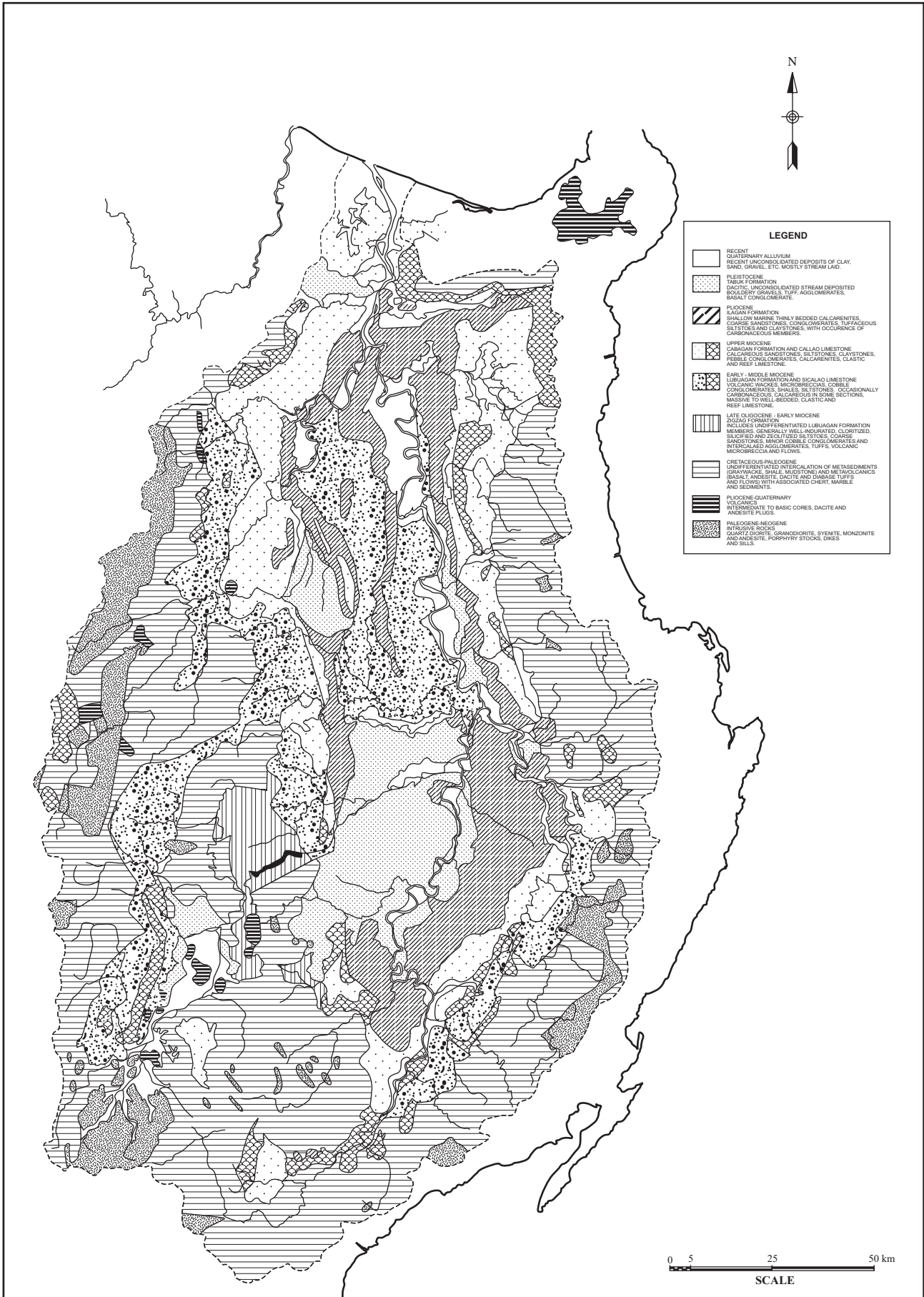
*The Feasibility Study of the Flood Control Project for
the Lower Cagayan River in the Republic of the Philippines
Final Report
Main Report*

Figures



The Feasibility Study of the Flood Control Project
for the Lower Cagayan River
in the Republic of the Philippines
JAPAN INTERNATIONAL COOPERATION AGENCY

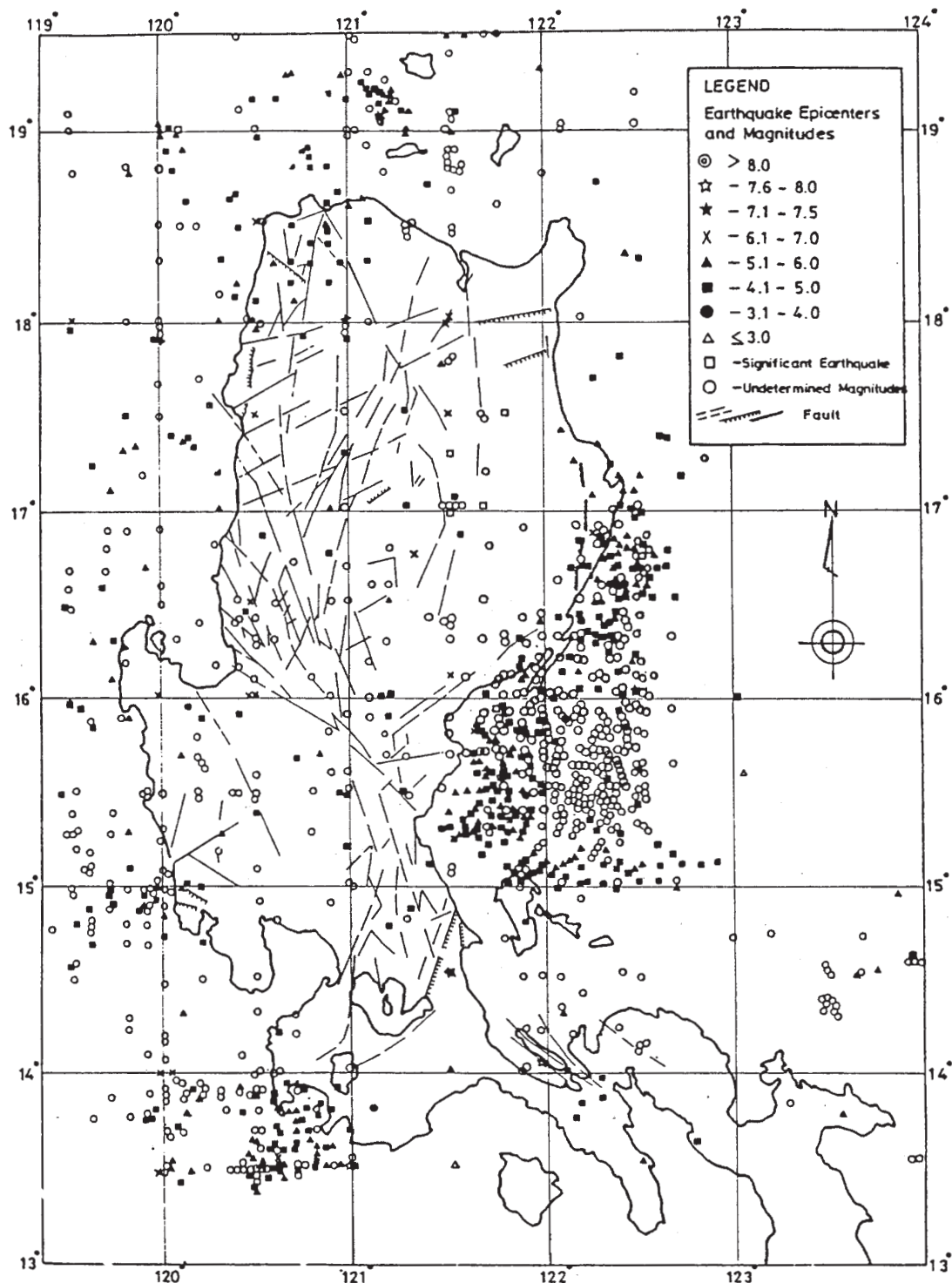
Figure 1.4.1
Overall Work Flow



The Feasibility Study of the Flood Control Project
for the Lower Cagayan River
in the Republic of the Philippines

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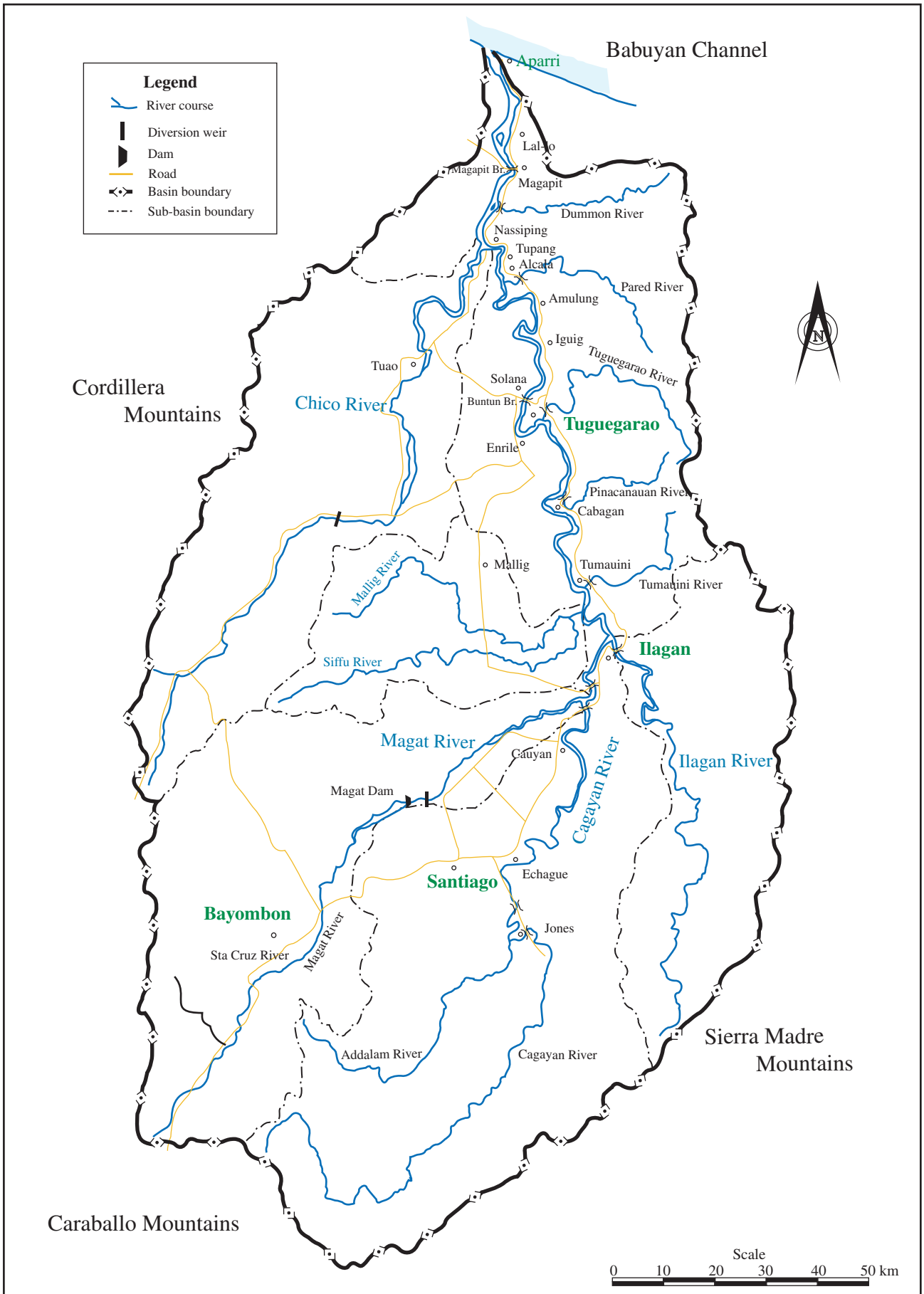
Figure 2.3.1
Geological Map of Cagayan River Basin



(quoted from the report of "Diduyon Hydroelectric Project", Oct. 1980)

Figure 2.3.2

Earthquake Epicenter and Magnitude



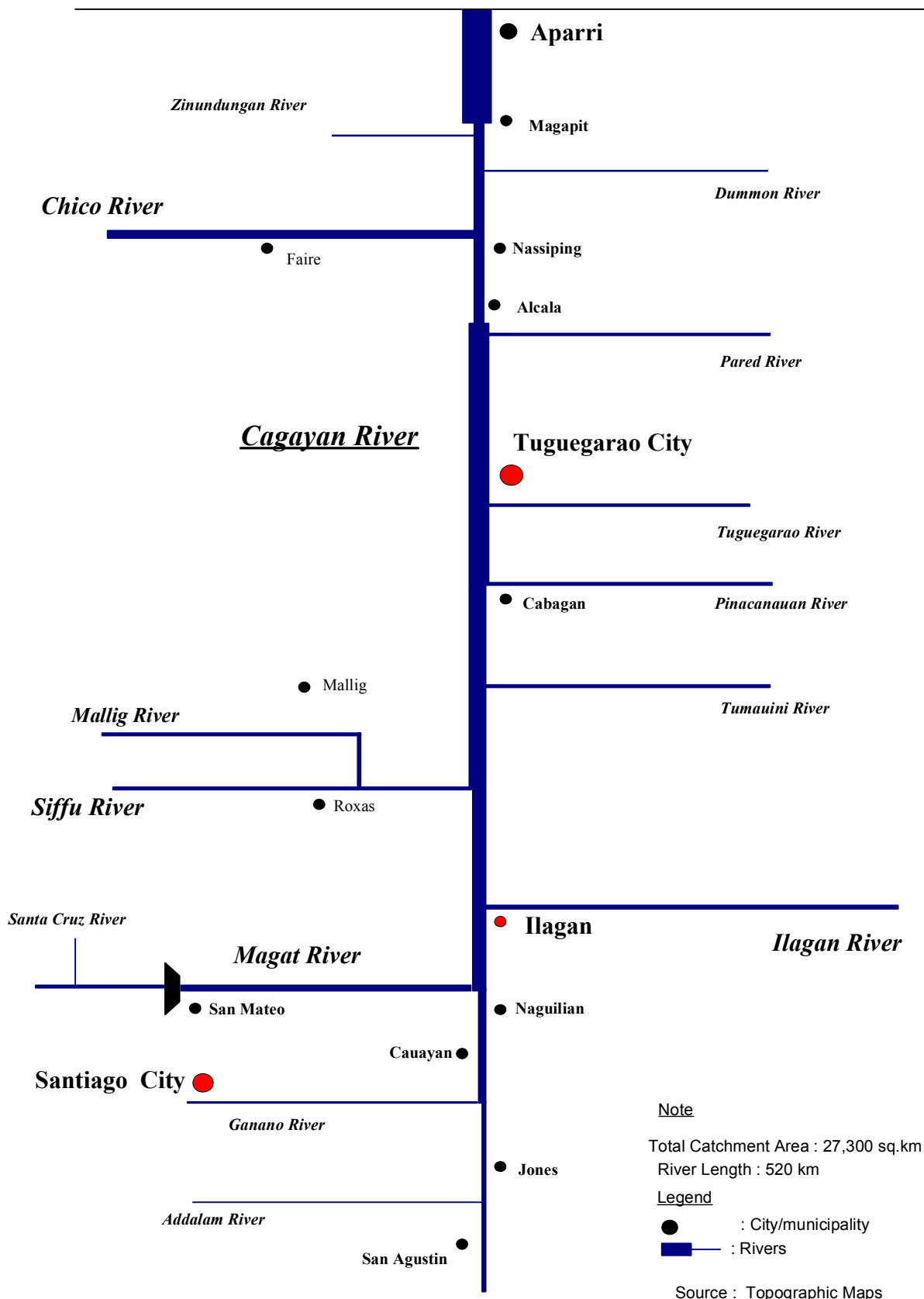
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Figure 2.5.1

General Basin Map

Babuyan Channel

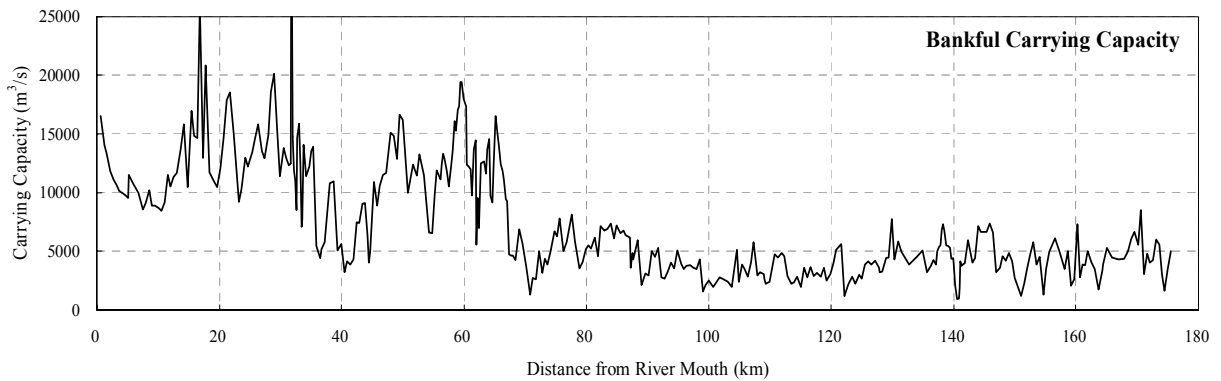
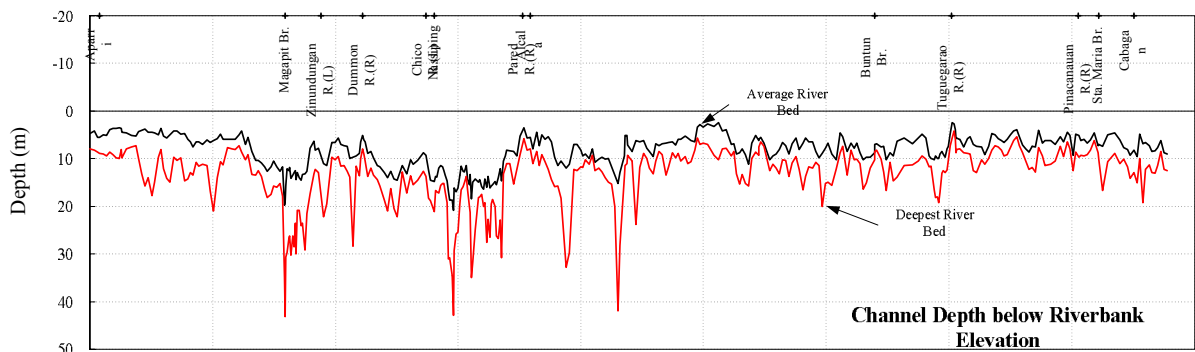
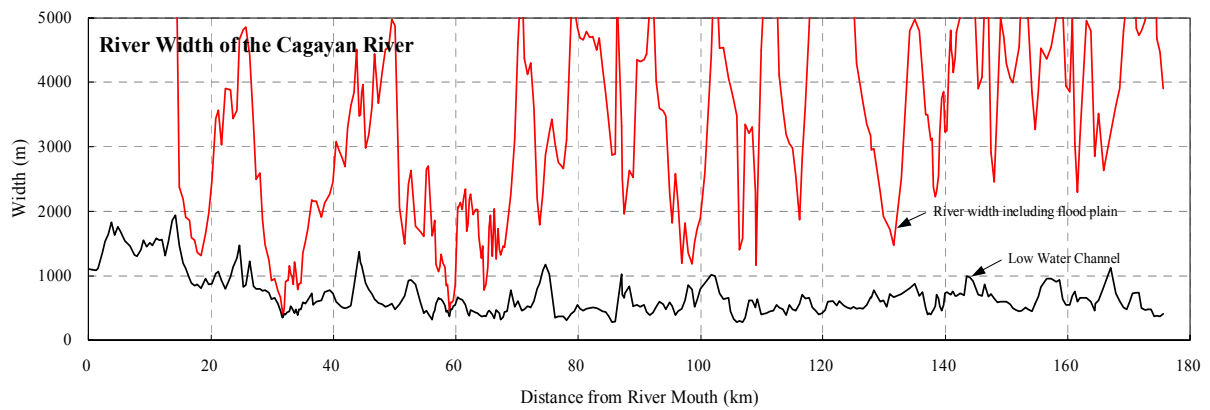
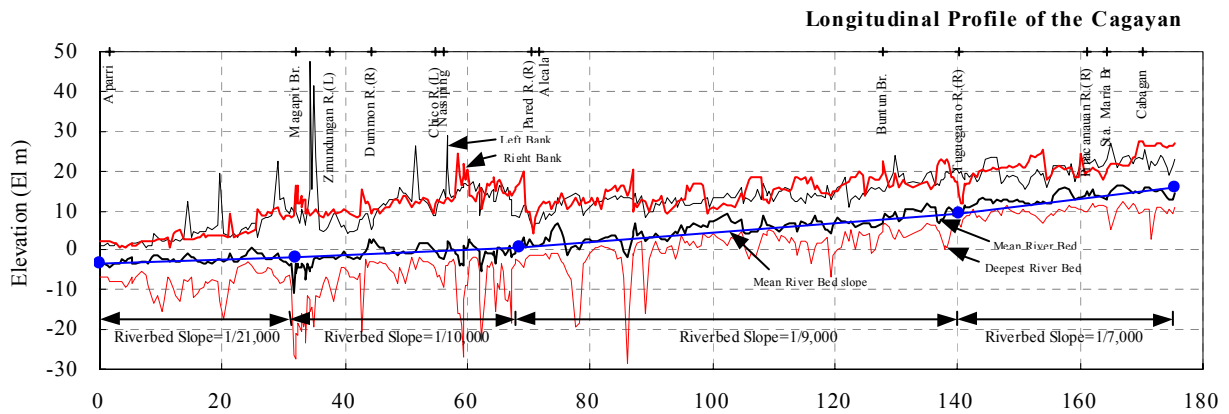


Note
 Total Catchment Area : 27,300 sq.km
 River Length : 520 km

Legend
 ● : City/municipality
 — : Rivers

Source : Topographic Maps

Figure 2.5.2
Schematic River System of the Cagayan River

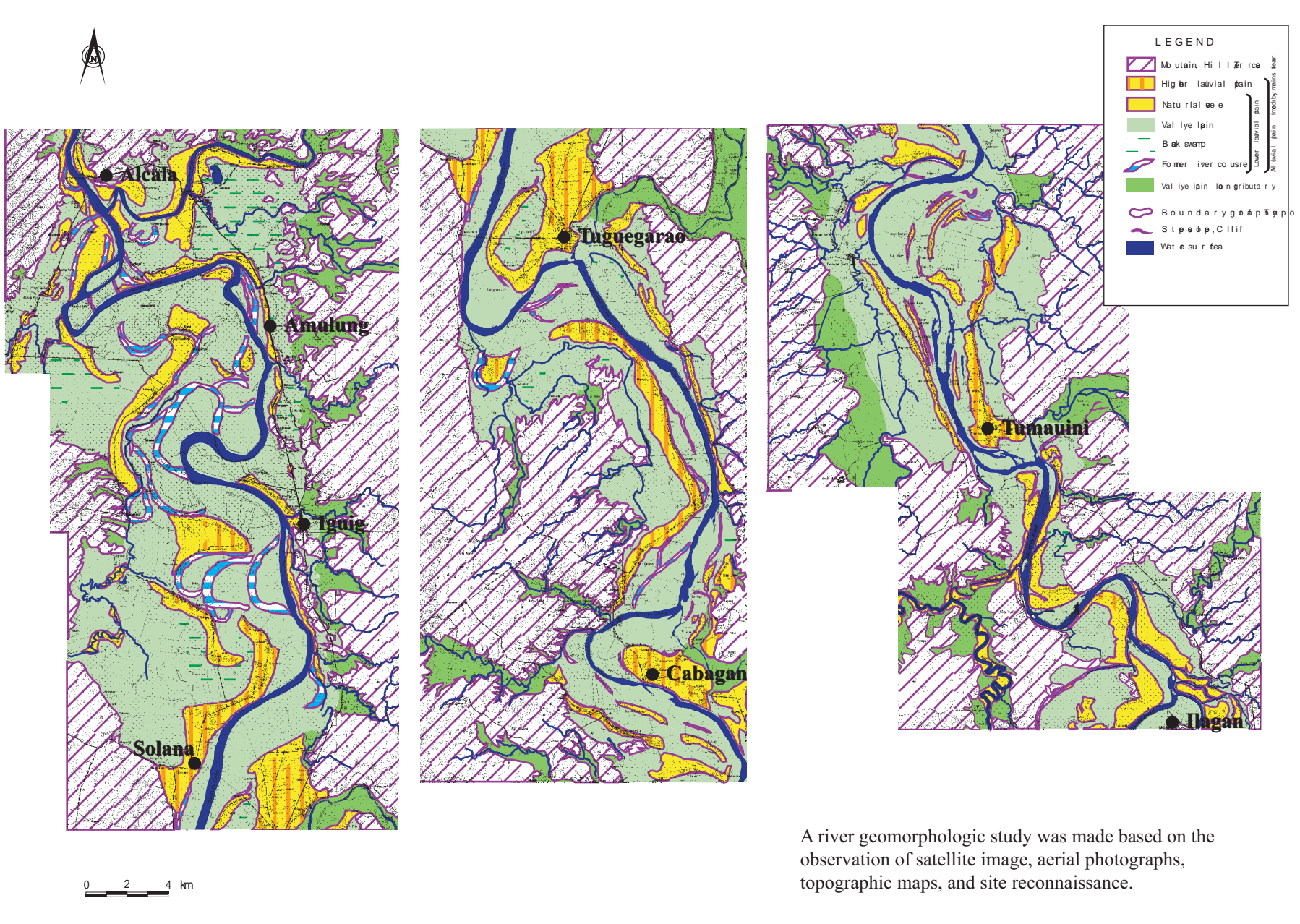


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Figure 2.5.3
Characteristics of Existing River Channel
(Cagayan River)

Figure 2.5.4
Geomorphological Survey Map
of the Cagayan River



A river geomorphologic study was made based on the observation of satellite image, aerial photographs, topographic maps, and site reconnaissance.

Figure 2.5.5
River Course Shifting

