ANNEX VIII :
LAND USE

THE FEASIBILITY STUDY OF
THE FLOOD CONTROL PROJECT FOR THE LOWER CAGAYAN RIVER IN
THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

Volume III-2 SUPPORTING REPORT

ANNEX VIII LAND USE

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PART I GENERAL

CHAPTER 1 GENERAL

This annex consists of three parts, namely 1) general, 2) review of 1987 Master Plan and 3) feasibility study of priority projects. Part I General includes this chapter, present land use in Chapter 2 and present condition of agriculture in Chapter 3. Chapter 4, Land use plan is Part II and Chapter 5 is on land use on priority project for feasibility study is Part III. As important plans on water resources development, basic land use plan, agricultural development plan and irrigation development plan are mainly studied. In addition, spoil bank use plan is required for efficient use of excavated materials in flood control construction works. Resettlement plan assures relocation of affected people by right of way of flood control and irrigation works. Also, the plan is prepared as one of the non-structural countermeasures against flood. Supporting measures for agricultural development or poverty alleviation are presented to realize proposed benefits in the irrigation development project.

CHAPTER 2 PRESENT LAND USE

2.1 Land Classification

The area of the Cagayan River Basin is 27,281 km^2. From viewpoint of land use, land of the basin is classified by topography, weather/inundation, soil, and present land use/vegetation.

(1) Topography

Out of 27,281 km^2 of the Cagayan River Basin, approximately a half of the area is more than 400 m above sea level in elevation (Figure 2.1.1). Area with a land slope over 18% covers more than 60% of the Basin area as seen in Figure 2.1.2 and the table below.

Area by slope in the Cagayan River Basin

Slope	0 – 3%	– 8%	– 18%	– 30%	– 50%	Over 50%	Total
Area (km^2)	5,127	1,449	3,401	4,132	3,844	9,328	27,281
(%)	18.8	5.3	12.5	15.1	14.1	34.2	100.0

Source: converted from BSWM data with adjustment

The land with a slope of not more than 18% is approximately 10,000 km^2 or 37% of the basin.

(2) Weather/Inundation

Three agro-climatic zones (wet, moist and dry zones) are identified in the Region 2 (R-2) by the Bureau of Soil and Water Management (BSWM) of the Department of Agriculture (DA) as below.

Agro-climatic zone	Annual rainfall (mm)	Growing period (day)	Area (%)
Wet	> 2,500	270-320	43
Moist	2,500-1,500	210-270	44
Dry	< 1,500	90-210	13

Source: "Philippine Land and Soils Management Atlas for Cagayan River, Region 2, 1995", BSWM

In the Cordillera Administrative Region (CAR), annual rainfall is high as mentioned in Annex IV, Section 1.1 and 3.4.

The flood-prone areas of R-2 are about 186,000 ha within the inundation areas of the Cagayan River and its tributaries in provinces of Cagayan, Isabela and Nueva Vizcaya, in accordance with "Regional Physical Framework Plan (RPFP), 1993-2022, R-2". It is cited in this RPFP that "the flood-prone areas are presently used as production areas for rice, corn, legumes and vegetables. The establishment of settlements in these areas is not recommended or should be restrained."

Although, many people actually live in the flood-prone area, it is difficult to resettle all the people from a practical viewpoint. Therefore, flood control measures including resettlement and evacuation should be considered.

(3) Soil

In the Cagayan River Basin, low flat lands in the basin are mostly covered with high fertility soils according to BSWM data.

For the lower Cagayan River area of about 50,000 ha, a soil investigation was carried out in this study and a soil map between Alcala and Cabagan is prepared as shown in Figure 2.1.3. It is known from the map that generally clayey soil covers paddy field on the higher plains and silty soil covers corn fields near the river. This suggests higher flood flow velocity on the corn field than on the paddy field.

(4) Present Land Use/Vegetation

Land use in the Basin is derived from (i) the 1987 Master Plan, (ii) detailed back-data for Strategic Agriculture and Fisheries Development Zone (SAFDZ) area distribution compiled by BSWM, R-2 and CAR offices. According to the latest data, forest occupies 42%, grassland 31% and agricultural area is 25% in the Cagayan River Basin (Figure 2.1.4). SAFDZ is explained in 4.1.2.

Land Use in the Cagayan River Basin

(Unit: km^2,%)

	Agricultural area	Grassland	Forest	Others	Total
(i) 1987 MP	4,628	10,702	11,528	423	27,281
(%)	17.0	39.2	42.3	1.6	100.0
(ii) SAFDZ	6,764	8,491	11,384	642	27,281
(%)	24.8	31.1	41.7	2.4	100.0

Source: prepared based on the following
(i); "The Master Plan Survey on The Cagayan River Basin Water Resources Development" 1987,JICA
(ii); "Area Distribution of Specific/Present Land Use by/per SAFDZ", 1999, BSWM, R-2/CAR

After the 1987 Master Plan (1987 MP), agricultural area increased and grassland decreased in the Cagayan River Basin.

2.2 Present Land Use

According to the above SAFDZ data, present land use by category is described as follows:

(1) Agricultural Area

In the Cagayan River Basin, present agricultural area of 676,400 ha consists of paddy field (472,500 ha) in gross, corn field (137,300 ha) and other diversified

crop fields (66,600 ha). Most of the potentially cultivable area is already used as paddy fields, corn fields and other diversified crop field. In the above table, fruit tree areas are categorized as forest.

1) Paddy field and irrigation system

a) Trend and present status of irrigation service area in the country

The irrigated area increased considerably in 1970s and 1980s in the Philippines. In 1990s, the increase rate became smaller. The total service area of national, communal and private irrigation systems in 1999 is reported about to be 1.35 million ha or 43 % of total potential irrigable area of 3.13 million ha (Table 2.2.1).

b) Service area in the Cagayan River Basin

Along the Cagayan River and its tributaries, there are low and gentle sloped lands, which consist of mainly paddy and corn field areas. In CAR, as one of the world heritage, famous paddy terraces are maintained on steep slopes and also as a tourist attraction.

Based on the National Irrigation Administration (NIA), Central Office (CO) data, potential irrigation development area in the Cagayan River Basin is estimated around 475,000 ha. Existing irrigation service area in the basin is obtained to be 218,000 ha or 46% of potential irrigation development area. The remaining area to be developed by irrigation is about 257,000 ha (54%).

Status of Irrigation Development in the Cagayan River Basin

(Unit: 1,000 ha,%)

	Region 2, excl.Batanes	CAR, 4 provinces	Total
- Potential irrigation Development area	412	63	475
- Existing irrigation Service area	188 (46%)	31 (49%)	218 (46%)
-Remaining Non-irrigated area	225 (55%)	32 (51%)	257 (54%)

Source/note: prepared based on the following
"Status of Irrigation Development, Cagayan Valley Region, as of Dec.31,1999", NIA,R-2,
"Inventory of CIS, as of Dec.31,1999", NIA,CAR and etc.

In the Indicative Ten-Year Irrigation Development Program 2000-2009, proposed irrigation developed areas of Region 2 and CAR are 44,121 ha and 6,806 ha, respectively (Table 2.2.2).

2) Upland agricultural land

Corn fields cover the lower area near the Cagayan River channel, where inundation occurs more frequently and undulating land surface is not stable in shape due to erosion and sediment. Vegetable cultivation for the market is

mainly conducted under cooler climate condition in CAR and Nueva Vizcaya Province. Vegetables for self-consumption are planted near villages, in general.

(2) Grassland

The grassland is composed of pasture (103,500 ha), wild grasses (471,400 ha) and brush (274,200 ha). The pasture land is developed mainly in hilly areas. The wild grasses and brush are seen in hilly and mountainous areas.

(3) Forest

After drastic decrease in 1970s and 80s, the forest area is comparatively stable in 1990s. Traditional slash-and-burn shifting cultivation, being continued thousands of years, was sustainable with sufficient fallow. Recently, after logging and following slash-and-burn cultivation, former forest is converted to wild grasses and brush lands in many places because of insufficient period of fallow. The forest here includes the fruit tree areas.

(4) Others

Other areas consist of slash-and-burn shifting cultivation or kaingin (200 ha), artificially developed fishpond (11,900 ha) and built-up areas, etc (52,100 ha). The slash-and-burn cultivation area seems too small due to the site reconnaissance. The built-up areas include settlement, industrial, commercial, institutional areas.

In Region 2, settlement areas are concentrated in municipalities which is located along the national highway and main lateral roads, most of which follow the Cagayan River System from Sta. Fe to Aparri. About 20% of Region 2 population in 1990 (the percentage is the same in 1995) is reported in 6 major urban centers (i.e. Tuguegarao, Santiago, Cauayan, Ilagan, Solano and Bayombong), which are expected to be developed as major institutional, commercial, industrial, financial and/or urban centers. (RPFP, R-2)

2.3 Problems in Land Use

(1) Geographical Condition

Surrounded by mountain ranges on the east, south and west sides, the Cagayan River Basin is an isolated area because of insufficient transportation system. There are main highway transportation routes to and from Metro Manila, namely (i) Dalton Pass route, (ii) Patapat route and (iii) sea route via Irene Port. These routes, however, are insufficient for transportation.

For example, the main route through Dalton Pass (ref. to General Basin Map) was closed down after the Luzon Earthquake in July, 1990. It was not used until December, 1990, according to a report. Traders took the alternative Patapat route through Ilocos Norte, which is longer and less efficient to Manila. The route also became impassable from September to November, 1990. NFA moved its corn stocks via Irene Port in Santa Ana, Cagayan province using the Navy ships. Land slides and temporary closures of Dalton Pass occur commonly in the wet season. So, such serious isolation may happen anytime.

(2) Mountainous Area

1) Erosion and Land Slide due to Deforestation

Erosion and land slide bring loss of useful land and road, and also produce more sediment causing riverbed heightening and reservoir capacity reduction particularly in the upper Magat basin. In 1970, forest covered 53% of the national land, but it decreased to be 21% in 1990, or 32% of forest was lost during that 20 years in the country.

At present, reforestation efforts are performed to deforest the area, but such activities are piecemeal and progress is not sufficient as described in Annex VII, Chapter 3.

2) Settlement

One of the settlement problems in CAR is that poorer migrants tend to build their dwellings on unsafe and environmentally critical areas, government reservations and even lands of absentee owners. (cited from RPFP, CAR)

(3) Hilly Area

1) Deforestation and Insufficient Land Use

The hilly areas are also deforested. These areas seem to be underdeveloped and underused, even though they have high potential of livestock industry. One of the reasons is considered to be the ineffective use of hilly areas occupied by large land possessors.

2) Lack of Infrastructure

The hilly areas have not sufficient infrastructures, such as road networks, water supply systems, electricity supply systems, and so on.

(4) Plain

1) Flood and Drought

Alluvial plains along the Cagayan River and its tributaries are developed to be paddy fields and corn fields. However, due to frequent occurrence of flood and drought, farming in the plain is damageable and unstable.

2) Agriculture

Problems in agriculture are discussed in Chapter 3. Many problems come from the marketing and financing system. These include high post-harvest losses and high production costs due to insufficiency for warehouses, drying facilities, farm to market roads and milling facilities.

One of the important problems is recent rice or paddy importation trend as seen in Table 2.3.1 and Figure 2.3.1.

3) Irrigation

According to NIA, R-2 office, the most serious problem in irrigation development is insufficient financial sources. Frequent flooding is one of the constraints to extend irrigation systems on the alluvial plain along the rivers, because irrigation facilities may be easily damaged by flood. In particular, flood control measures are essentially necessary for irrigation development on lower flood plains that are covered by corn fields on the lower Cagayan River, which has a potential for irrigation. In some of the projects, acquisition of right of way (ROW) is a cause of delay in progress in implementation.

According to NIA, Irrigation System Offices, irrigation water has not reached to a part of the service areas after construction of the irrigation facilities in some of the National Irrigation Systems (NIS). In some irrigation facilities, flow capacity is often insufficient, because of sediment, low canal embankment, and so on.

As seen in Figure 2.3.2, both rate of irrigated land and paddy yield per ha in the Philippines are not so high.

CHAPTER 3 PRESENT CONDITION OF AGRICULTURE

3.1 Present Agricultural Farming Practice

(1) Land Tenure and Agrarian Reform

The regional accomplishment of LAD by DAR as of 1998 is summarized below.

(Unit: 1,000 ha)

Region	Scope	Accomplish-ment (1998)	%
I	140.3	111.3	79.3
II	300.1	260.4	86.8
CAR	77.9	65.7	84.3
III	394.9	306.9	77.7
IV	386.0	226.2	58.6
V	453.8	175.2	38.6
VI	559.7	234.4	41.9
VII	166.8	83.7	50.2
VIII	385.5	244.2	63.3
IX	187.9	189.4	100.8
X	179.9	162.9	90.6
XI	287.5	222.1	77.3
XII	569.9	345.3	60.6
Caraga	200.3	165.0	82.4
Total	4,290.5	2,792.7	65.1

Source: MTPDP 1999-2004.

The progress of CARP in 1998, the country is counted to be at about 65% on average to 4,290,500 ha of the total scope, which is the target of the Agrarian Reform plan through CARP to supply for landless farmers.

From 1972 to June 30, 2000, total accomplishment of land distribution in Region 2 is 88% (excluding Batanes) to working scope or the target of about 319,200 ha as below. The total accomplishment of land distribution in the concerned four provinces in CAR is about 88% of the working scope of about 40,100 ha, and the balance remained at about 4,850 ha.

(Unit: ha)

Province	Working scope	Total accomplishment	%	Workable balance
Cagayan	118,807	111,490	93.8	2,254
Isabela	149,680	120,415	80.5	4,409
N. Vizcaya	28,776	27,914	97.0	445
Quirino	21,934	21,328	97.2	586
Total*	319,197	281,147	88.1	7,694

*Excluding Batanes. Source: CARP Status Brief, 1st September, CY 2000, DAR, Region 2.

The progress of land distribution in provinces concerned in CAR is as summarized below.

(Unit: ha)

Province	Working scope	Total accomplishment	%	Workable balance
Kalinga	11,538	10,519	91.2	1,019
Apayao	6,849	5,710	83.4	1,138
Ifugao	11,071	10,356	93.6	714
Mt. Province	10,643	8,661	81.4	1,982
Total	40,101	35,246	87.9	4,853

Source: DAR-CARP Stuationer as of April 30, 2000, DAR, CAR.

(2) Agricultural Production

In this section, the Cagayan River Basin is represented by the Master Plan Area (M/P Area) consisting of 8 provinces, namely Cagayan, Isabela, Quirino, Nueva Vizcaya of Region 2 and Kalinga, Apayao, Ifugao and Mountain Province of CAR. Major crops in M/P area are rice and corn.

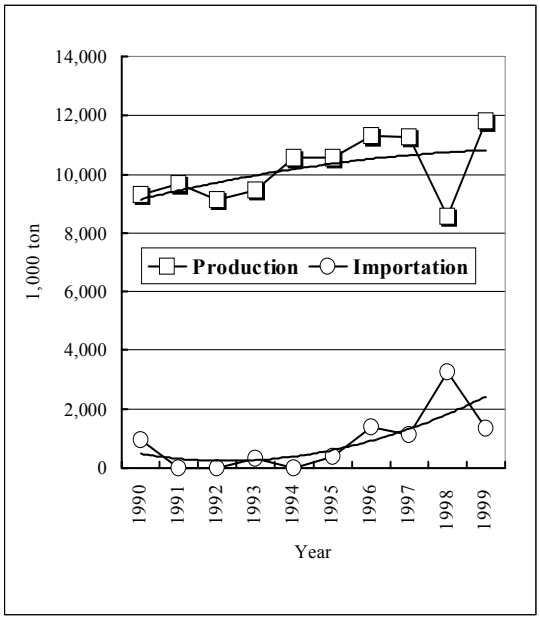
Rice

In M/P Area, average production of paddy from 1990 to1999 is 1.40 million metric tons (MT), which is about 0.91 MT in rice or 14% share of the national production as seen in Table 3.1.1 and summarized as below.

(Unit: 1,000 ton)

Year	Production	Import.	Import. to total (%)	Export.	Total consumption
1990	9,319	955	9.3	0	10,274
1991	9,673	0	0.0	15	9,658
1992	9,127	0	0.0	46	9,083
1993	9,434	323	3.3	0	9,757
1994	10,538	0	0.0	0	10,538
1995	10,541	396	3.6	0	10,936
1996	11,284	1,374	10.9	0	12,657
1997	11,269	1,124	9.1	0	12,393
1998	8,555	3,273	27.7	0	11,827
1999	11,787	1,360	10.3	0	13,147

Data source: Statistical Yearbook 1999. Volume of the imported rice was converted to paddy with conversion rate of 0.65.



Corn

In the M/P Area, average production of corn from 1990 to1999 is 0.63 MT or shares 14% of the national production as shown in Table 3.1.2 and below. Region 2 and Mindanao are major corn supply areas. Two cropping in a year is commonly performed in Region 2.

(Unit: 1,000 ton)

Year	White corn	Yellow Corn	Total production	Import. to total (%)	Total consumption
1990	2,966	1,888	4,854	6.6	5,198
1991	2,906	1,749	4,655	0.0	4,655
1992	2,700	1,919	4,619	0.0	4,620
1993	2,627	2,171	4,798	0.0	4,799
1994	2,090	2,429	4,519	0.0	4,520
1995	1,862	2,266	4,129	4.8	4,337
1996	1,883	2,268	4,151	0.8	4,184
1997	1,879	2,453	4,332	6.5	4,635
1998	1,620	2,203	3,823	10.8	4,285
1999	1,824	2,761	4,585	3.1	4,734

Data source: based on Table 3.1.2.

Self-sufficiency

The self-sufficiency level of cereals in the Philippines during the recent ten years is as shown in the table below. The cereals include rice, corn, wheat, barley, rye and oats. The self-sufficiency level is calculated as the rate of domestic production to the summed up volume of domestic production and the imported cereals.

(Unit: 1,000 ton)

Year	Domestic Production				Import				Total consumption
	Paddy	Corn	Total production	Self-sufficiency level (%)	Paddy *	Corn	Others **	Total importation	
1989	9,459	4,522	13,981	87.3	338	154	1,542	2,035	16,016
1990	9,319	4,854	14,173	85.0	955	344	1,203	2,502	16,675
1991	9,673	4,655	14,328	88.8	0	0	1,806	1,807	16,135
1992	9,129	4,619	13,748	88.5	0	1	1,779	1,779	15,527
1993	9,434	4,798	14,232	88.8	323	1	1,478	1,802	16,034
1994	10,538	4,519	15,057	87.5	0	1	2,158	2,159	17,216
1995	10,541	4,129	14,670	84.4	396	208	2,114	2,717	17,387
1996	11,284	4,151	15,435	82.3	1,374	33	1,911	3,318	18,752
1997	11,269	4,332	15,601	80.3	1,124	303	2,409	3,836	19,437
1998	8,555	3,823	12,378	70.6	3,273	462	1,413	5,147	17,525

* The quantity is calculated from imported rice with conversion rate of 0.65.
** Others include wheat, barley, rye and oats.
Data source: BAS

Livestock Products

Demand for livestock products has been expanded along with the qualitative change of diet in the Philippines. Number of animals in the country during the recent ten years is summarized in table below.

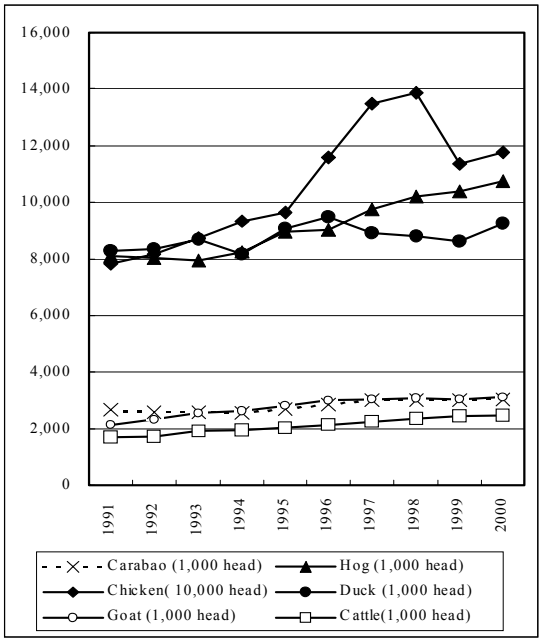
(Unit: 1,000 head)

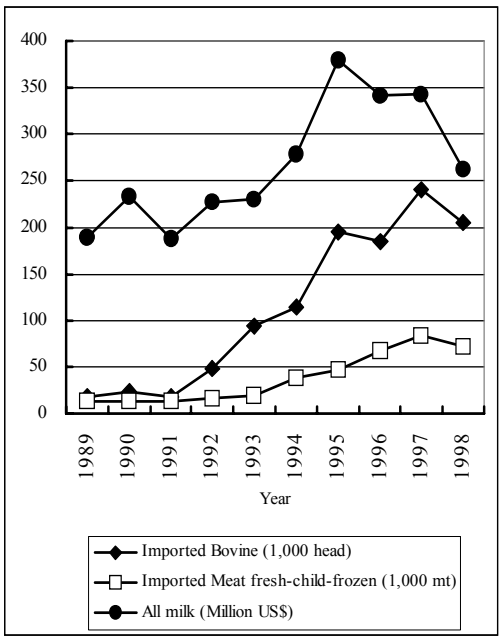
Year	Cattle	Carabao	Hog	Chicken	Duck	Goat
1991	1,677	2,647	8,079	78,240	8,268	2,141
1992	1,731	2,577	8,022	81,525	8,348	2,306
1993	1,915	2,576	7,954	87,158	8,707	2,562
1994	1,936	2,560	8,227	93,201	8,187	2,633
1995	2,021	2,708	8,941	96,216	9,072	2,828
1996	2,128	2,841	9,026	115,782	9,470	2,982
1997	2,266	2,988	9,752	134,963	8,923	3,025
1998	2,377	3,013	10,210	138,521	8,824	3,085
1998	2,426	3,006	10,397	113,718	8,614	3,051
2000	2,479	3,024	10,761	117,658	9,246	3,126
Growth rate (%/year)	4.3	1.0	3.1	5.2	2.5	3.6

Data source: BAS

The change in number of animals in the country is as illustrated below. The number of cattle in the whole country has been increased with a rate of 4.3 %/year, hog with 1.0 %, Carabao with 3.1 %, respectively. The number of Carabao was slightly decreased during the first half of '90s might be due to progressing of farming mechanization, and later it has been increased may be due to expansion of demand of livestock products.

The importation trends of livestock products during the recent ten years in the Philippines is as summarized in table and illustration below.





Year	Bovine (1,000 head)	Meat fresh-child-frozen (1,000 mt)	All milk (Million US$)
1989	18	14	190
1990	24	13	233
1991	18	13	187
1992	49	17	227
1993	94	19	230
1994	114	38	279
1995	195	47	379
1996	185	67	342
1997	240	84	343
1998	205	71	262

Data source: FAO Trade Yearbook.

As seen in these figures, the importation of livestock products has been rapidly increased from the beginning of '90s, and has been slightly declining in these years.

(3) Cropping Pattern

As seen in Figure 3.1.1, present cropping pattern is basically "paddy – paddy" in irrigated paddy field, "paddy – no crop/corn/other upland crop/paddy" in rainfed paddy field and "corn – corn" in corn fields. According to data of Bureau of Agricultural Statistics (BAS), the cropping intensity in the M/P Area is estimated at 184% against the physical area of paddy and corn fields. In the irrigated paddy fields, the cropping intensity is as high as 195%, while in rainfed paddy fields, it is 127% only. Many diversified crops are grown in the rainfed rice fields and corn fields as the secondary crops.

(4) Irrigation intensity in Region 2

Irrigated cropping intensity (ICI) is calculated as a rate of irrigated area divided by irrigation service area based on NIA, Region 2 (R-2) data. Being not so high or 132% in average in R-2, this ICI is comparatively higher in the Isabela province (151%) and lower in the Quirino and Cagayan provinces (91 and 105%). In the Cagayan province, ICI in the wet season is lower than that in the dry season in general.

(5) Marketing and Processing of Agricultural Products

Region 2 has a large capacity to supply paddy/rice and yellow corn to other areas in the country.

1) NFA's Channel

The National Food Authority (NFA) is a government corporation, mandated to promote the integrated growth and development of the food industry. It

has the primary responsibility, of ensuring the nation's food security and assuring stable supply and price of grains, nationwide. According to Office of NFA Region 2, the target volume to be traded through NFA is approximately 6% of the rice produce in the area.

The volume of paddy traded through NFA channel in 1999 is as seen below.

Province/municipality	Traded by NFA (ton)	Total production (ton)	Share of NFA (%)
Cagayan	11,850	457,340	2.6
Allacapan*	11,950	-	
Kalinga-Apayao	7,230	106,250	6.8
Isabela**	41,860	1,019,290	4.1
Nueva Vizcaya	4,800	172,510	2.8
Qurino	3,200	59,670	5.4
Ifugao	540	45,220	1.2
Total	81,430	-	-

Data source: NFA Office of Region 2, Santiago, Isabela Province.
* Allacapan is an area defined in NFA, composed of some municipalities of Apayao and Cagayan provinces.
** The figures of Isabela include the traded volume of NPGC.

The highest share of NFA was 6.8 % of total volume of paddy production in Kalinga-Apayao followed by 5.4 % of that in Quirino province. These figures showing that the major part of paddy produced in the Cagayan River Basin is mostly traded through the private channel.

2) Marketing Flow of Rice and Corn by Private Traders

Paddy/Rice

The market channels of paddy/rice from Region 2 via milling areas to the demand area of National Capital Region (NCR) are composed of a variety of traders and millers. The farmers sell paddy to traders in Barangay, municipal and provincial marketing places. They usually cannot wait for better price to sell but sell immediately because of lack of warehouses. The paddy mainly flows to large millers in Isabela, Nueva Ecija, Bulacan and Pangasinan provinces. Then the milled rice is sent to Metro Manila wholesalers. .

Yellow Corn

The major part of the corn is channeled through the traders at Barangay, municipal and provincial levels. Provincial traders transport corn grains from the supply area to the major demand areas, by order from the integrators, feed-millers, and medium and large hog raisers and poultry growers in the major demand areas of Central Luzon, Southern Tagalog and NCR.

(6) Cooperative

According to data in 2000 from the Cooperative Development Authority (CDA) Tuguegarao Extension Office data in 2000, total number of cooperatives in Region 2 is 2,646, of which about 70% are multipurpose agricultural cooperatives and the remaining are non-agricultural cooperatives. As a whole, 58% of total cooperatives are active, 35% are inactive and 7% are cancelled.

Province	MPA	MPN	Credit	Producer	Consumer	Services	Marketing	Total
Cagayan	620	165	33	9	3	6	3	839
Isabela	925	242	71	6	6	10	3	1,263
Nueva Vizcaya	187	84	43	5	1	5	3	328
Quirino	115	43	7	1	0	4	0	170
Total	1,847	534	154	21	10	25	9	2,600

Source: CDA Tuguegarao Extension Office, August 2000.

MPA: multipurpose Agricultural, MPN: multipurpose non-agricultural

Province	Active		Inactive		Cancelled		Total
	Primary	Secondary	Primary	Secondary	Primary	Secondary	
Cagayan	411	6	342	2	86	0	847
Isabela	670	21	518	9	75	1	1,294
Nueva Vizcaya	281	3	22	2	25	0	333
Quirino	138	2	25	0	7	0	172
Total	1,500	32	907	13	193	1	2,646

Source: CDA Tuguegarao Extension Office.

(7) Agricultural Credit

Formal and informal financial sources serve as important sources of credit for small-scale farmers in the area. The formal sources of credit in the area are Rural Banks, Commercial and Private Development Banks. Land Bank of the Philippines extends credit services for the financial needs of farmers' cooperative or organizations for their working capital and asset acquisition needs at reasonable interest rates.

The traders are the main informal source or private financial source of credit to farmers and playing important role to supplement the shortage of formal credit.

(8) Agricultural Support Services

1) Agricultural Supporting System

Department of Agriculture (DA) is the leading agency to extend agricultural support services such as (i) technology and other agricultural services, (ii) regulatory services. The agencies undertaking research and technology generation in agricultural crops are the Bureau of Agricultural Research

(BAR), Bureau of Plant Industry (BPI), and in collaboration with State Colleges and Universities. Bureau of Animal Industry (BAI), Philippine Carabao Center (PCC), National Dairy Authority (NDA), South East Asian Fisheries Development Center (SEAFDEC) and Bureau of Fisheries and Aquatic Resources (BFAR) tackle livestock and fisheries researches.

ATI, BAR, BAI, PCC, NDA, NMC, NSF, BPI, RFUs and LDC form the Research Extension and Training Committee (RETC). The RETC is tasked with reviewing and formulating a research, extension and training program suitable and relevant to the emerging and changing business and economic environment facing the agriculture sector of the country.

2) Agricultural Institutions at Regional Level

The line agency of DA is Regional Field Unit located in Tuguegarao, Cagayan Province for Region 2, and Regional Field Unit CAR is located in Baguio, Benguet Province in CAR respectively. The regional level office of DA is responsible in the over-all planning, monitoring, and implementing of agricultural programs in the region. It should undertake coordination, monitoring and implementation (through stations) and seed production activities. RFU should coordinate, monitor, and provide technical assistance on small-scale irrigation, credit, post-harvest and marketing. It should ensure proper conduct and timely completion of farmers' master-list in collaboration with BAS and LGUs. It should deploy Subject Matter Specialist (SMS) and provide resource persons in training for Ats.

3) Agricultural Institutions at Provincial/Municipal Level

The Municipal Agriculturist shall be placed under the technical supervision of the Office of the Provincial Agriculturist but remain administratively under the Office of the Mayor. This is to improve program coordination and operationalization in achieving target area and mobilizing resources from DA and LGUs. The LGUs act as the lead-implementing unit of programs at the provincial level. The responsibilities of the Municipal Agriculturist include coordination and monitoring of techno-demo or integrated pest management (IPM) implementors, assisting of production technicians and SMSs in the selection of qualified farmers' organization/participants, and provide resource persons to farmers' training.

4) Agricultural Research System and Institutions

Philippine Council spearheads agricultural research system or R&D direction for Agriculture, Forestry and Natural Resources Research and Development

(PCAARD). It provides stewardship functions of organizing, managing, coordinating, and monitoring activities of the national R&D network-institutions and an R&D consortium in each region. The regional R&D consortium in Region 2 is the Regional Integrated Agricultural Research Center (RIARC) with Research Outreach Stations (ROS) located in all provinces. Its mandate is strengthening the partner ship with the private sector, non-government organizations (NGOs), State colleges and Universities (SCUs), DA, DENR and LGUs. The Cagayan Valley Integrated Agricultural Center in Ilagan with three satellites are mandated to research on crops development, soil and water management and crops, pest and diseases. The R&D institutions in Region 2 are as listed below. The ROS for Fisheries in San Mateo, Isabela is also conducting studies on fresh water fish production and provides fish seeds to the region.

Institutions	Location	Main responsibilities
Cagayan Valley Lowland and Marine Research Outreach Station with three satellites	Iguig, Cagayan -Abulug, Cagayan -Bugey, Cagayan -Claveria, Cagayan	-Studies on lowland crops development -Studies marine fishes, mollusks, other fishery flora and fauna, -Research brackish-water and fresh water fishes
Cagayan Valley Upland Research Outreach Station	Quirino	-Studies on cattle and small ruminants production, pasture development, and crops production in upland situation
Cagayan Valley Hillyland Research Outreach Station	Bagbag, Nueva Vizcaya	-Studies on crop production in hillyland and on livestock and HVCC production

5) Training Services

The Agricultural Training Institute (ATI) with its Regional Center in Cabagan, Isabela, it's Farmers Training Center in San Mateo, Isabela, and it's Regional Fishermen Training Center in Aparri, Cagayan are the training arms of DA in Region 2.

6) Nurseries and Seed

Plant as well as fish nurseries are produced and available at the RIARC-ROS and some are found in the different provinces as well municipalities. For rice foundation, registered and certified seeds, there are some farmers producing in the region, but a few on corn seeds. The various private companies in the country are supplying most of the seed required for rice and corn production.

7) Tools and Equipment

Farm tools, machinery and equipment is being supplied in the region through the private companies.

8) Fertilizer and Pesticide

The Fertilizer and Pesticide Authority has a regional office in the region which cater to the needs for farmers/fishermen, especially on regulatory services. Supply of these products is in the market through private enterprises.

9) Regulatory Services

The region has laboratories for research and testing purposes. There are two soil testing laboratories, two for seed testing (BPI & Philrice -San Mateo), one for vaccine production, and one for animal disease diagnosis. One is also in Aparri for fisheries laboratory- quarantine services.

There are two main regional livestock, crops, and fishery quarantine points. One is located in Santa Fe, Nueva Vizcaya--to regulate entry on these commodities from the South, and the other one is located in Santa Praxedes, Cagayan--to guard the northern entry of these goods to the region, especially during epidemic of some diseases of these commodities. Some quarantine checkpoints are also established by the provinces in strategic places in coordination with PNP, LGUs, DENR and other agencies concern.

3.2 Problems in Farming

(1) Frequent Flood Damage

Along the Cagayan River and its tributaries, the relatively lower plains are covered by corn fields or upland crop fields and higher plains are covered by paddy fields. The lower plain experiences flood and inundation frequently or more than once in 5 years but the higher plain not so frequently. Farmers often repeat seeding (sometimes 3 times or more) when flood damage seeds or young plants after seeding on the corn field on the lower plain, resulting in increase of production cost. Also, delay in cropping schedule usually causes pest infestation, which requires additional pesticide cost.

Inundation due to poor drainage condition damages crops and causes delay in the cropping pattern.

(2) Drought and Water Management

In Municipality of Quezon, Isabela, drought occurred nearly every 3 years recently. Harvested area of paddy field was only 1/6 of planted area in dry season of 1995.

As in above (1), delay in cropping schedule usually results in pest infestation requiring additional pesticide cost. The delay in the wet season cropping caused by long dry spell affects not only farmers but also traders, since they have to sell corn at a lower price because of a lot of Mindanao corn in the market by that time.

Often reported is uneven water distribution, which is induced by over-intake of irrigation water in upstream areas or at advantageous positions in an irrigation system. Inter-tribe social conflict is a constraint to solve the problem in certain area.

(3) Power Supply

Frequent blown-outs due to inadequate and unstable power supply are problematic to poultry raisers because of increasing chick mortality, millers operation and so on. High power rates and lack of power in flood prone areas are constraints.

(4) Post-harvest Processing and Marketing

In the country, post-harvest losses are reported to be high, namely 10-37% in rice, 30% in corn and 40% in vegetables, fruits and others (JICA Report on Aid Research, the Philippines, (in Japanese) 1993).

According to information obtained from farmers and officers of DA, in Region 2, as well as concerned reports, the problems regarding marketing and post-harvest activities in the area are;

(i) deficit of working capital and insufficient financing system,
(ii) poor condition of farm to market roads and insufficient bridges,
(iii) shortage of labor for harvesting,
(iv) shortage of trucks, hand tractors and tractors
(v) lack of thresher, sheller, drying floors, mechanical dryers, warehouse and mills,
(vi) low price of products (small farmers are forced to sell their produce to traders at a lower price because of their need for cash and their credit-marketing tie-up with trader-financier),
(vii) high price of inputs.

(5) Cooperative and Information System

The problems identified by CDA for the cooperatives are; poor attendance at committee meetings, poor implementation of policies, lack of cooperation or no enrichment of values, and insufficient capital.

Information on market price in milling and demand areas is not sufficient for farmers.

3.3 Poverty in Rural Area

(1) Poverty in the Philippines

For the nation together with Region 2 and CAR, subsistence incidence is mentioned in Annex I, Section 5.5. That in the Cagayan River Basin by municipality is shown in Figure 3.3.1. The subsistence incidence is mentioned as a percentage of the family unable to meet its subsistence income level.

When small farmers and agricultural labors cannot gain enough income in their villages and are forced to leave them to find better working opportunity, they may move to urban areas or forest. In Metro Manila, a lot of such small and landless farmers live in slums. Some of them go into forest and try slash-and-burn cultivation in denuded areas after commercial logging. Being different from traditional slash-and-burn cultivation with sufficient fallow period, their over-cultivation is usually deprival and induce erosion, land slide and finally sedimentation in downstream rivers. Elevated river beds and reservoirs bottom do increase risk of flood damage, as seen in the upper Magat River basin.

Poverty Incidence in the Cagayan River Basin

The poverty family incidence in Region 2 in 1997 showed the third lowest percentage among the regions in the Philippines, except Metro Manila. The CAR area of which a part is included to the Cagayan River Basin, the incidence is ranked at tenth among the regions.

Region		Annual per capita poverty threshold (Peso)	Magnitude of poor families (family)	Incidence of poor families (%)
Philippines		11,388	4,533,387	32.1
NCR Metro Manila		14,360	140,793	7.1
Areas outside NCR		10,898	4,412,594	36.2
III	Central Luzon	12,837	241,865	16.8
IV	Southern Tagalog	12,507	498,536	25.7
II	Cagayan Valley	9,873	185,768	31.6
VII	Central Visayas	8,726	357,715	34.2
I	Ilocos	11,981	292,764	37.6
XI	Southern Mindanao	10,489	379,344	37.9
IX	Western Mindanao	9,670	221,330	39.8
VIII	Eastern Visayas	8,755	305,750	40.7
VI	Western Visayas	10,558	520,200	41.6
CAR	Cordillera	12,744	109,646	42.3
X	Northern Mindanao	10,455	385,337	46.8
XI	Central Mindanao	11,155	220,526	49.1
V	Bicol	10,497	485,099	50.1
ARMM		11,214	208,714	58.6

Source: Cagayan Valley Statistical Yearbook, Regional Statistical Coordinating Committee 02.

The table below shows that the family income of about 18 % of population in Region 2 could not meet income for food requirements in 1997.

Items	Total	Urban	Rural
1. Poverty incidence			
Threshold (Peso)	9,880	11,654	9,402
Family (%)	32.1	28.0	33.2
Population (%)	38.0	33.6	39.1
2. Subsistence incidence			
Threshold (Peso)	6,985	7,996	6,712
Family (%)	13.5	12.4	13.8
Population (%)	17.8	16.2	18.2

Source: Philippine Poverty Statistics 1997 Final, NSCB

In CAR area, more than 30 % of population could not meet their income for food threshold. About 40 %, 64 % of the population in the rural area was under the subsistence and poverty line respectively.

Items	Total	Urban	Rural
1. Poverty incidence			
Threshold (Peso)	12,836	13,521	12,554
Family (%)	42.5	13.4	55.5
Population (%)	50.1	17.2	63.7
2. Subsistence incidence			
Threshold (Peso)	8,558	8.602	8,540
Family (%)	24.9	5.6	33.4
Population (%)	30.6	7.8	39.9

Source: Philippine Poverty Statistics 1997 Final, NSCB

Results of MBN Survey

The Minimum Basic Needs Community-Based Information System (MBN-CBIS) is a pioneer program of the government, which was officially adopted in 1995. To clarify the poverty incidence in the Cagayan River Basin, among 33 indicators of MBN-CBIS, indicator number 24 was focused on, which shows the family's income is met or not met to the subsistence threshold level.

(2) Low Net Return and Rice Cartel Issue

Existence of agricultural input and product cartel is pointed out commonly by local people and in some reports and documents, while paddy/rice traders deny the existence. It is broadly believed that agricultural input trader cum product buyer cum financier control market price, setting high input price and low product buying price.

(3) Loose Connection in Rural Society Members

It is reported that village/barangay people are relatively loosely connected to one another due to more tight connecting between tenant farmer and land owner living in and out of the barangay, and because agricultural labors look for their jobs in and around their barangays sometimes in other provinces (JICA Report on Aid Research, the Philippines, (in Japanese) 1993). This is a constraint in organizing farmers.

(4) Vicious Cycle in Lower Cagayan River Area

The Study Team summarized poverty related items and problems on farmer's livelihood as a vicious cycle in the Lower Cagayan River area as shown in Figure 3.3.2. Basically the same items in (7) below are common problems here because increase of net farm income is essentially necessary to alleviate farmer's poverty.

(5) Inequity

Equitable distribution of wealth and profit is not attained in the Cagayan River Basin. This inequity discourage farmers intention to improve their farming because they cannot gain their reasonable share of increased profit. It seems that only the minimum amount from the profit is remained to the cultivating farmer but its surplus is taken by others.

(6) Disparity in the Basin

Isabela and Cagayan provinces are main paddy and corn producing and supplying area. In terms of agriculture, Isabela province is more modernized than Cagayan province. Cagayan province has a disadvantageous location with farther distance to transport produce through Dalton Pass to and from Metro Manila. The subsistence incidence by the municipality, shows high poverty in areas coverd mountains and lower Cagayan River area as shown in Figure 3.3.1.

(7) Poverty Alleviation

Poverty alleviation is discussed in Annex V, Subsection 1.2.9.

Countermeasures needed are summarized below.

1) small financing systems for small farmers with reasonable interest and simple and quick procedures,
2) transportation network reinforcement, including farm to market roads, bridges and sea routes via Port Irene.
3) mechanization, including truck, hand tractor, tractor, harvester, etc.

4) improvement of post-harvest facilities: thresher, sheller, drying floors, mechanical dryers, warehouse and mills,
5) promotion of farmers' organization,
6) generation and rehabilitation of irrigation area
7) flood control and drainage improvement

3.4 Existing Land Use Plan

(1) Land Use Plan

According to the draft bill of National Land Use Act mentioned in Section 4.1, the cities and municipalities prepare their respective Comprehensive Land Use Plans (CLUPs). The Provincial Development Council and the Regional Land Use Committee prepare their respective Provincial and Regional Physical Framework Plans (PPFPs and RPFPs). Based on them, the Land Use Policy Administration (LUPA) may formulate the National Physical Framework Plan (NPFP).

In available PPFPs of related provinces and RPFPs of Region 2 (R-2) and CAR, specific and concrete plan cannot be found in industrial, commercial and other sectors.

(2) Agricultural Development Plan

1) Crop Production Programs' Coverage Area

The Region 2 is recognized as one of the important granary of the country. The Cagayan, Isabela, Nueva Vizcaya and Quirino provinces of Region 2, Mountain Province, Kalinga, Apayao, Ifugao provinces of CAR have been covered within the target area of the "Agrikultrang Makamasa" Rice program of Department of Agriculture (DA). The provinces of Cagayan, Isabela, Nueva Vizcaya, and Quirino have been targeted as the strategic areas of Region 2, but no provinces in CAR have been covered in the corn program of DA.

2) Agriculture and Fisheries Modernization Act (AFMA), 1997

The AFMA is established to realize the purposes listed below. It is led by both agencies of DA and Department of Agrarian Reform (DAR).

a) Along the government thrust on food security, measures to modernize the agriculture and fisheries sectors in order to enhance their profitability are being spelled out in AFMA.

b) Through AFMA, the agriculture and fishery sectors are being developed for global competitiveness under an environment of adequate, focused and rational delivery of necessary support services.
c) The agriculture and fishery sector will be transformed from a resource based on technology-based industry.

The AFMA includes the following programs and projects: (a) credit assistance, (b) irrigation and water management, (c) marketing services, (d) national information network, (e) post-harvesting facilities, (f) farm-to-market roads, (g) regulatory services, (h) human resource development, (i) research and development, (j) extension services and training, (k) technical support services and (l) program management.

The AFMA projects are expected to develop the primary sector, particularly agriculture, livestock and fishery sub-sectors. It also supports the development of agro-based industries in the region and increases in the demand for services.

The national government allocated the total sum of 21.67 billion Pesos for AFMA in 2000, accounting for approximately 3.33% of the national budget. Of this total sum, Region 2 has a share of 2.06% or 447.36 million Pesos for the year 2000.

3) Regional Agriculture and Fisheries Modernization Plan (AFMP)

AFMP for year of 2000 -2004 in Region 2 and CAR was drafted in May 2000, and would have been finalized by December 2000. According to the plan, the vision, goal and objectives were proposed consonant with the national policy provided in AFMA.

a) Target of Crop Production

These plans of the both regions envision an improved quality of life of the farmers and fisherfolk by increasing their income and attain self-sufficiency in rice, corn, fish, livestock and vegetables through appropriate and sustainable agricultural technology. The specific objectives and target by 2004 set in the plan for the major crops are as shown in the table below:

Region	Region 2		CAR	
	Present	Target	Present	Target
Paddy				
Area (1,000 ha)	376	599	126	155
Production (1,000 ton)	1,257	3,550	433	723
Corn				
Area (1,000 ha)	278	341	10	12
Production (1,000 ton)	596	2,098	20	32
Vegetables				
Area (1,000 ha)			38	46
Production (1,000 ton)			529	708

Source: AFMA Region 2 and CAR, 2000-2004.
Notes: The area shown is total harvested area.

The target yield of crops in the plan are shown in table below:

(Unit:ton/ha)

Region	Region 2		CAR	
	Present	Target	Present	Target
Poverty incidence (%)	36.9	20	51	25
Yield of Crops:				
Paddy			3.6	5.0
Irrigated	3.6	6.6		
Rainfed	2.6	3.6		
Upland rice	1.5	2.8		
Corn-white	2.1	4.0	1.9	3.0
Corn-yellow (hybrid)	2.6	6.0		
Corn-yellow (OPV)	3.5	5.0		
Corn-yellow			3.4	4.3
Vegetables			9.6	12.3

Source: AFMA Region 2 and CAR, 2000-2004.

As seen in the above tables, the strategies set in AFMP to achieve the development target are expansion of planted/harvested area multiplied with productivity improvement by increase in unit yield of crops. Since the target yield seems to be too high, the Study Team proposes realizable values in Section 4.2.

4) Target of Livestock and Fishery Production

The national target of livestock and fisheries production for 1999 to 2004 set in Medium Term Philippine Development Plan (MTPDP) is summarized in the table below.

	Average target growth rate (%/year)	
	Low	High
1. Livestock		
Carabao	1.3	2.3
Cattle	4.3	4.6
Hog	4.2	5.1
Goat	3.2	3.4
Dairy	0.8	1.3
2. Poultry		
Chicken	3.8	4.6
Duck	3.9	4.7
Chicken eggs	3.4	3.9
Duck eggs	3.9	4.3
3. Fisheries		
ercial	2.3	2.7
Municipal	-0.2	-0.2
Aquaculture	6.9	6.9

Data source: BAS
Low set of scenario that assumes no El Nino will occur in 2001 and 2004, according to MTPDP 1999-2004.

The livestock and fisheries production targets are not set clearly in AFMP of Region 2. But the Region is going to support animal production through health management and dispersing of upgraded breeders as well as to establish the livestock trading posts and auction markets, modern slaughter houses and abattoirs, cold storage facilities, etc. Fisheries production schemes are also programmed to support open-water and marine water culture.

(3) Agricultural Supporting Program

1) Comprehensive Agrarian Reform Program (CARP)

DAR launched to accelerate land distribution and improve land tenure for contributing towards increasing incomes and facilitating access to resources among small farmers and workers with the following principles and policies.

i) Promote social justice and industrialization,
ii) Just compensation for land owners,
iii) Participation of farmers/landowners/cooperatives in planning and program management,
v) Provision of incentives for landowners, and
vi) Leave public lands for capital intensive farms and commercial crops.

DAR as the leading implementation agency of CARP is mandated to improve land tenure and to promote the welfare of program beneficiaries through the support services. In pursuit of CARP objectives DAR is operating two major component programs; Land Tenure Improvement (LTI) and Program

Beneficiaries Development (PBD). LTI deals the land tenure rights in the legalized categories, while PBD is to extend support services for the beneficial farmers with provisions of organization strengthening, particular credit, technology and basic physical infrastructure.

LTI program comprises two sub-components; land transfer and non-land transfer.

i) Land Transfer (Land acquisition and distribution, LAD)
As of June 1998, DAR and DENR had distributed some 2.8 million ha and 1.9 million ha of land respectively (MTPDP 1999-2004).

ii) Non-land Transfer Schemes

CARP includes non-land transfer schemes which does not entail the distribution of land to farmer beneficiaries but instruments for protecting the tenure status of the farmers with the tenure arrangement of Leasehold Operation, Stock Distribution Option, and Production and Profit Sharing.

2) Support Services by DAR

DAR in line with the land distribution program continued the provision of support services to the beneficiaries and extension service through information and education programs on value formation and skills development. The provision of support services for beneficiaries in the area are done in coordination with other agencies such as DA, DENR and DTI, Land Bank, etc. through the projects focused on the communities of beneficiaries of agrarian reform. They have implemented a variety of projects such as Agrarian Infrastructure Support Project (ARISP) financed by JBIC, Agrarian Support Project (ARSP), Belgian Agrarian Reform Support Project (BARSP), Rural Farmers and Agrarian Reform Support Credit Program (RASCP), Agrarian Reform Communities Development Program (ARCDP-WB) and so on.

(4) Irrigation Plan

In the NIA's Indicative Irrigation Development Program from 2000 to 2009 (Table 2.2.2), nationwide target areas are 568 thousand ha for new generation and 761 thousand ha for rehabilitation. The target is considered ambitious considering the past performance and project physical situation as mentioned in Progress Report, Nov., 2000, of the Study on Strengthening of NIA's Management System.

Existing projects/programs include the following.

- IOSP II: Second Irrigation Operation Support Project (IOSP II), assisted by World Bank (WB)

- WRDP: Water Resources Development Project, by WB
- CIDP II: Communal Irrigation Development Project II, by WB
- ARCDP: Agrarian Reform Community Development Project, by WB
- ARISP I & II: Agrarian Reform Infrastructure Support Project-I & II by OECF (now JBIC)

Locally funded projects/programs are;

- EL NINO, LA NINA,
- PIDP: Pump Irrigation Development Project
- SRIP: Small Reservoir Irrigation Project
- CARP-IC: Comprehensive Agrarian Reform Program, Irrigation Component
- SHIP: Self Help Irrigation Project
- BSPP: Balikatan Sagip Patubig Program

For CAR;

- BRTTFF: Banaue Rice Terrace Task Force
- CHARMP: Cordillera Highland Agricultural Resource Management Project

PART II REVIEW OF 1987 MASTER PLAN

CHAPTER 4 LAND USE PLAN

4.1 Basic Land Use Plan

4.1.1 Land Use Policy

(1) General

Regional Physical Framework Plans (RPFPs) of Region 2 (R-2) and CAR include a production land use plan, protection land use plan, settlement plan and infrastructure plan. Referring to these plans, discussed in this chapter are important plans on water resources development, namely basic land use plan, agricultural development plan and irrigation development plan.

(2) National Land Use Act (draft bill)

This is a draft bill prepared in October 2000, instituting a national land use policy, providing the implementing mechanisms therefore, and for other purposes. Policies and principles are stated in the draft bill as summarized below.

(a) Protection of prime agricultural lands for food production activities and highest priority to the completion of CARP;
(b) Food security in basic food commodities with emphasis on self-sufficiency in rice and corn production;
(c) Sustainable development and management of water resources towards water security;
(d) Rational population distribution and settlements development;
(e) Equitable and sustainable economic growth and balanced and dispersed industrial and tourism development guided by the principles of agrarian reform, urban land reform, and rural development;
(f) Sustainable management of natural resources;
(g) Maintenance and preservation of environmental integrity and stability;
(h) Harmony between the rights and the varied interests of every Filipino within the framework of people empowerment, decentralization, social justice and equity;
(i) Respect to and protection of, the sustainable traditional resource rights of the Indigenous Cultural Communities/Indigenous Peoples (ICCS/IPS);
(j) Protection of the rights of basic sectors to ensure equitable access to the country's land and other resources;

(k) An integrated approach to the utilization, allocation, development and management of water as a limited resource that will complement and support sustainable land utilization.

Top three principles include protection of prime agricultural lands, food security for rice and corn production and sustainable development and management of water resources.

(3) Relevant Legislation

As interim guidelines on agricultural land use conversion, Administrative Order (AO) No.20 was promulgated in December 1992. The urbanization pressures have threatened many irrigation systems and agricultural lands are being converted, at a very fast rate, to industrial and urban uses, according to NIA. DAR is authorized to approve such conversion. LGUs are empowered to reclassify agricultural lands. This AO No.20 mandates that irrigated lands and irrigable lands in the near future can not be converted to residential, commercial or industrial uses.

(4) Settlement Policy

For settlement development, rational and sustainable utilization of physical resources is proposed in RPFP of R-2 as summarized below.

1) Priority areas for new settlements or expansion of existing areas shall be lands with marginal suitability to crops located within urban/town centers or its peripheral areas.
2) The location of new settlements in other areas such as prime agricultural lands, protection/rehabilitation/hazardous areas, in places not accessible to road and basic services, etc. shall be discouraged. In their respective zoning plans, LGUs shall identify and delineate these areas not fit for settlement location.
3) Settlements located in protection and rehabilitation areas shall be restrained from further growth. Appropriate control measures shall also be provided to prevent further environmental degradation of the critical areas due to the presence of these settlements.
4) Lands considered as ancestral domain of indigenous communities shall be surveyed and delineated to determine its actual extent. The type of development interventions to be undertaken should consider the rights, livelihood and spiritual integrity of the indigenous communities, and at the same time the protection of the environment.

5) The easement area along the sides of the waterways (e.g. rivers, streams, lakes, etc) shall be strictly implemented to prevent encroachment of settlements. The 20 meter strip is proposed to be segregated from the boundaries of titled lands to enforce its protection and reduce erosion, siltation and pollution of water bodies.
6) Conversion of prime agricultural lands, into settlement purposes shall be rationalized. Irrigated agricultural lands shall be non-negotiable for conversion into other uses. Agricultural lands delineated and proposed as settlements area in town plans shall be reviewed to assess its more appropriate land use.

This proposal seems to recognize the important role of agricultural land. Like in the flood plain of the Cagayan River, on such banks that change their locations along with substantial shift of river channel, river training is considered necessary as a premise of the efficiency of item 5) in the above proposal.

4.1.2 Basic Land Use Plan

Referred in basic land use planning is data on Strategic Agriculture and Fisheries Development Zone (SAFDZ), which is prepared by BSWM, R-2 and CAR in pursuant to Agriculture and Fisheries Modernization Act (AFMA). AFMA is explained in Subsection 3.4 (2).

(1) Strategic Agriculture and Fisheries Development Zone (SAFDZ)

With the approval of the Agriculture and Fishery Modernization Act (AFMA) in 1997, all suitable agricultural lands within A & D land are to be identified, set aside and protected from unreasonable conversion. The Network of Protected Areas for Agriculture and Agro-industrial Development (NPAAAD) areas are portions of privately owned lands (A & D land) that are technically defined prime agricultural lands identified by BSWM. The Strategic Agriculture and Fishery Development Zone (SAFDZ) refers to areas within the NPAAAD identified for production, agro-processing and marketing activities to help develop and modernize with the support of the government, the agriculture and fishery sectors in an environmentally and socio-culturally sound manner. The SAFDZs are strategically located and accessible areas which are identified jointly by DA and LGUs to serve as areas that will showcase modern farming (crops and livestock) and fishing technologies. (“Primer on SAFDZ”, BSWM)

The Cagayan River Basin is divided to SAFDZ area (32 %), future SAFDZ area or remaining NPAAAD area (8 %) and Non-SAFDZ area (60 %).

A basic land use plan is prepared by the Study Team as shown in Figure 4.1.1, which illustrates the process of conversion in land use from present one to a proposed one, in consideration of zoning of SAFDZ.

(2) Present Land Use

Present land use is shown in the left side of Figure 4.1.1 and in Tables 4.1.1 and 4.1.2. As mentioned in Section 2.1, it is derived from SAFDZ data, which were prepared by BSWM, Region 2 and CAR in 1999. The present land use is categorized in reference to SAFDZ, in which Network of Protected Areas for Agriculture and Agro-Industrial Development (NPAAAD) is taken into consideration.

(3) SAFDZ Area

In the middle of Figure 4.1.1, SAFDZ areas are presented in ellipses. Distribution from present land use to SAFDZ can be seen in Table 4.1.1. In SAFDZ categorization, land is divided into SAFDZ and non-SAFDZ areas. SAFDZ areas consist of crop, livestock, fishery and their integration. Non-SAFDZ areas are composed of remaining NPAAAD (or future expansion area for SAFDZ), agro-forestry, watershed/forestry and built-up areas. Value of built-up areas in SAFDZ is unchanged from that at present, which seems impossible considering future development. Of integrated sub-development zones consisting of crop, livestock and fishery, total area is only 0.9 %, most of which is crop/livestock combination. Agro-Forestry shares considerable portion or around 10 %.

(4) Basic Land Use Plan

1) Basic concept

In the basic land use planning, following basic approaches are taken.

The plan was prepared, in principle, based on the concept of SAFDZ together with Regional Physical Framework Plan (RPFP) 1993-2022 of Region 2 (R-2) and Cordillera Regional Physical Framework Plan 1994-2023 of CAR. For forest land, pasture land and fish pond, the same areas are applied as in SAFDZ. The built-up areas are proposed on the basis of those areas in RPFPs of R-2 and CAR. Agricultural area is to be maintained at the same scale in total, taking into consideration of basic land use policy to protect agricultural land.

2) Agricultural area

Area of "Strategic Crop Sub-Development Zone (SDZ)" in SAFDZ is 6,267 km^2. Of such integrated SDZs that include crop, total area is counted up to 245 km^2. Out of 1,943 km^2 of "Remaining NPAAAD", a part or 252 km^2 is proposed for the agricultural areas in the future plan. Details are discussed in Section 4.2.

3) Fishpond

Fishponds are 1,190 km^2 at present and is planned to be 1,390 km^2, which is equal to "Strategic Fishery SDZ" plus "Livestock/Fishery SDZ".

4) Grassland

As the proposed pasture area, "Strategic Livestock SDZ" area of 1,523 km^2 is followed, which needs additional 488 km^2 mainly converted from present wild grass and shrub areas.

The wild grass and shrub areas are projected to reduce to 1,724 km^2 from present 7,456 km^2.

5) Agro-Forestry

Proposed agro-forestry area is 1,051 km^2, which is derived from 854 km^2 and 197 km^2 in RPFP, R-2 and CAR, respectively. "Agro-Forestry" in SAFDZ is set at 2,776 km^2, of which 1051 km^2 is included in the plan by 2020, and the remaining 1,725 km^2 is to be developed after 2020.

6) Forest (not including agro-forestry)

Proposed forest area in 2020 is 13,868 km^2 following "Watershed/Forest" area in SAFDZ. To attain this, forest increase or reforestation of 2,893 km^2 will be necessary. Not including agro-forestry area, this proposed reforestation area differs from that in Annex VII, which includes agro-forestry area.

7) Built-up areas, etc.

The proposed built-up areas, etc. reach 2,212 km^2 from present one of 521 km^2, requiring an increase of 1,691 km^2. The proposed areas are based on the values in RPFP, R-2 and CAR. The increase in the plan will be made, in principle, by conversion from present grassland and agricultural area. It is noted that the total area of the agricultural land should be maintained or unchanged, so conversion from agricultural area to other land must be recovered by generation of agricultural area from other land use area.

4.2 Agricultural Development Plan

4.2.1 Agricultural Development Potential in the Master Plan Area

(1) Land Resources

As in Section 2.1 from topographical viewpoint, such areas that have land slope of less than 18 % is about 1.0 million ha, where basically soil and agro-climatic conditions are not critical constraint. Around 680,000 ha is estimated as possible maximum crop area excluding other competing land use areas such as built-up areas. Land suitable for irrigated paddy field is estimated to be about 528,000 ha in gross based on land slope as well as SAFDZ areas.

(2) Water Resources

In the meteo-hydrological study in Annex IV, for the Cagayan River Basin, the average annual rainfall and runoff are estimated 2,600 mm and 1,550 mm (or 42.4 billion m^3), respectively. So, runoff coefficient and average annual evapotranspiration is calculated at 0.60 and 1,050 mm, respectively.

Annual design water demand at full developed level is estimated at 13 billion m^3, of which over 90 % is irrigation water. Of 80 % dependability, annual gross irrigation water requirement of about 7.12 billion m^3 or 2,400 mm is estimated from water balance study results in Annex IV, 5.3. The fully developed area of irrigated paddy field is regarded as about 530,000 ha in gross.

Certain part of the runoff or larger flood discharge flows directly into sea and cannot be utilized. And in drought years, annual runoff will decrease from average value of 42 billion m^3 but it is considered still sufficient to meet the demand of each sector's design probability. Quantity of water resource can be said to be sufficient in long term basis as a whole. However, from seasonal and spatial point of view, water shortage may occur in drought years and in certain parts of the basin. Reservoir dams and impounding ponds will be required in such cases, to regulate river water.

4.2.2 Basic Concepts of Agricultural Development

(1) Basic Concepts

Review of Agricultural Development Concepts and Strategies

The basic agricultural development concepts and strategies set in the 1987 Master Plan were reviewed by reflecting the new national and regional agricultural development policy and strategies. And the present agricultural conditions and

constraints for development challenges required in the area were fully taken into account for the review.

The basic concepts for agricultural development in the 1987 Master Plan were aiming at:

a. Improvement of the present poor economic position of the basin through full utilization of the endowed land and water resources for increase of agricultural production, and
b. Uplifting of rural living standard and improvement of present income disparity in the area.

The relevancy of the above basic concepts set in the 1987 Master Plan are found exactly conform to the new policy and strategies of AFMA as well as AFMP of the regions.

(2) Outline of 1987 Master Plan

Agricultural development plan was presented in 1987 Master Plan as summarized in Subsection 3.1.4 and in Figure 4.3.2. Out of 1,080,000 ha of the possible maximum agricultural area, the flat low land of 476,000 ha was planned to be developed fully in 2005, consisting of 306,000 ha of irrigated paddy field and 170,000 ha of diversified cropland. The upland or hilly land of 604,000 ha was planned to be the permanent cropland of 57,000 ha (29% of full development of 200,000 ha) and the pasture of 210,000 ha (70% of full development of 300,000 ha) by 2005, remaining 337,000 ha of the idle grassland.

(3) Agricultural Development in the Study

In the long term, present paddy field of 472,500 ha is planned to be 528,000 ha. Of the diversified crop field, corn field is planned to be 113,800 ha and other crop fields 34,600 ha. The pasture area is planned to be 153,000 ha. Agro-forestry area is planned to be 277,600 ha. In the reviewed Master Plan, the same target areas are adopted except agro-forestry area of 105,100 ha.

4.2.3 Agricultural Development Strategy

Considering the basic concepts and availability of endowed resources in the area, the following development strategies for agriculture are reviewed by paying special attention to the strategies based on the market-oriented and agribusiness-oriented policy, and alleviation of poverty in the rural areas. Table 4.2.1 presents basic concept of the development.

(1) Increase in Agricultural Production

1) Expansion of Agricultural Area

The development targets of the crop area are proposed in Figure 4.1.1 and Table 4.1.2. As mentioned in Subsection 4.1.2, total crop area of 676,400 ha is maintained in the land use plan. Proposed area for paddy field is the same as irrigable area or 528,000 ha in gross, though irrigation accomplishment rate will not reach to 100 % by 2020 if on schedule. Area of corn field proposed is 113,800 ha, which is the present corn field portion in "Strategic Crop and Crop/Livestock SDZs" of SAFDZ. Other upland crop fields will cover 34,600 ha. Proposed agro-forest area in SAFDZ is 105,100 ha, which includes area for fruit trees and others.

2) Increase of Cropping Intensity or Planted/Harvested Area

At present, cropping intensity has not yet reached a developed high level. That of rainfed paddy field is around 127 % as in Section 3.1. Proposed cropping intensity is heightened up to 250 % in irrigated paddy field, including diversified crop cultivation.

3) Improvement of Yield and Production Techniques

The proposed target yields of crops were reviewed in a realistic manner taking into account the past trends of yields of crops, as well as reflecting the results obtained from experiments and demonstration farms in the area. Also, general information on yield is considered. The target paddy yield applied in the Reviewed Master Plan is 4.5 and 5.0 ton/ha in the wet and dry seasons on average for the fully irrigated field.

4) Paddy and Corn Production Plan

Table 4.2.2 shows a trial of paddy and corn production plan in the basin. The paddy production will become 2.1 times in 2020 from 1.52 million ton to 3.17 million ton. The corn production will be 1.7 times from 0.51 to 0.85 million ton.

5) Reduction of Losses in Harvesting and Post-harvesting Stages

To reduce losses at the harvesting and post-harvesting stages, the required facilities are; farm to market road, multi-purpose dryer, mechanical dryer, thresher/sheller, rice mill, corn mill, flour mill, warehouses, etc. These facilities are necessary to be installed in the villages to make easy access by farmers together with extension services of post-harvest techniques.

(2) Promotion of Agricultural Income Generation

1) Improvement of Marketing System and Facilities

Agricultural cooperative activities by farmers for buying and selling of agricultural inputs and products will contribute farmers directly to raise income and reduce expenditures. Many farmers' cooperatives have been established but most of them are not functioning well mainly due to low awareness of the farmers themselves and shortage of capital for operation. It is necessary to strengthen the support services for farmers' cooperatives by improving the supporting systems. These have been extended by several agencies in the intricate manner.

The marketing system of the main products of the region (rice and corn) is mostly traded to Manila, the demand area, after passing through the processing at Pangasinan, Nueva Ecija and Bulacan. It is recommended to change the system to process within the production area and send to the demand area.

2) Promotion of Agri-based Processing and Preservation Industries

As concerning to the above mentioned marketing system improvement, it is essential to promote agri-based processing and preservation industries within the region. The most promising industries are milling of rice and flour/oil-pressing of corn by utilizing the region's products. And the by-products are ideally suited for promoting the livestock industries. The livestock raised in the region is necessary to be packed within the region and sent to the demand area. These activities are for value adding to the agricultural products in the Cagayan River Basin.

(3) Increase of Production in Hilly and Forestry Area

1) Promotion of Cattle Raising in Hilly Grass Land Area

Proposed livestock area or pasture is 152,000 ha from present 103,000 ha, with a net increase of 49,000 ha. Around 43,000 ha of present pasture land is categorized as Remaining NPAAAD to be converted to built-up areas and agricultural areas. There are about 93,000 ha of wild grass and shrub areas suitable for pasture for cattle raising. It is hopeful to promote cattle raising of beef stock for fattening in the feedlot utilizing byproducts; bran of rice and corn, oil cake of corn, molasses of sugar factory, etc. within the region.

2) Promotion of Agro-forestry (fruits)

The wild grass and shrub areas of more than 18 % sloping will be developed to the agro-forestry with fruit trees such as Mango, Citrus, etc. as well as to promote community forestry to preserve and increase the forestry area. Proposed agro-forestry area in 2020 is 105,100 ha or 38 % of SAFDZ area of 277,600 ha. Also, the agro-forestry is a countermeasure against slash and burn agriculture.

4.3 Irrigation Development Plan

4.3.1 Basic Development Concept

(1) Necessity of Irrigation Development

Average rice import rate to national consumption is 12 % for recent 5 years from 1995 to 1999. To make the country sufficient in rice, the "Rice Program 2000" implemented by DA planned to make the country 95 % sufficient in rice by 2000. So, the Philippines seems to accept 5 % import of rice or about 350,000 t of rice at present, which is equivalent to about 220,000 ha of harvested area or more than 110,000 ha of physical area with two croppings per year on present condition. About 500,000 ton of rice import in 2000 was reported, which means around 6 % of the required rice was imported.

In Referring to "Corporate Plan 1993-2002, NIA" and "The Study on Strengthening of NIA's Management System, Draft Final Report, August 2001, JICA", future annual rice supply and demand estimates were evaluated, in which rice deficits were projected to the future during each plan period (1993-2002 and 2001-2010, respectively), even though new projects would be taken into the estimates. In reference to these estimates, a prolonged estimate up to 2020 is tried as in Table 4.3.1 and Figure 4.3.1. In the estimate, the average generation of irrigated area is calculated at 31,000 ha/year or 1.0 % of the irrigable area in the nation. The results presented the similar trend as the former cases, namely future deficit continuation. Therefore, the rice supply-demand balance is anticipated to be serious up to 2020.

As mentioned in Section 3.4, DA identifies important rice supply areas or granary of the country in the "Agrikultrang Makamasa" Rice program. The Cagayan River Basin is one of the areas. The Region 2 is recognized as one of the important granary of the country. The Cagayan, Isabela, Nueva Vizcaya and

Quirino provinces of Region 2, Mountain Province, Kalinga, Apayao, Ifugao provinces of CAR have been covered within the target area of the program.

The Cagayan River Basin has a potential for future irrigation development. As described in Section 2.2 (1), the remaining area to be irrigated is estimated to be about 257,000 ha (Irrigable area 475,000 ha– Existing irrigation area 218,000 ha).

In the country, some other regions have a large potential for irrigation development. However, some of those areas are not stable due to political confusion and social problem or "peace and order" problem. So, constant supply of grains is disturbed sometimes as has happened in 2000, when military action and social confusion interfered grain transportation.

Taking into consideration abovementioned matters as well as food security, promotion of irrigation development in the Cagayan River Basin is strongly recommended.

(2) Constraints and Challenges

A vicious cycle is pointed out by NIA engineers, namely damage by natural calamities and insufficient O&M --- low irrigated cropping intensity --- low production --- low irrigation service fee (ISF) collection rate --- insufficient finance sources --- insufficient O&M --- fragile system against calamities (high potential of damage). It is necessary to cut one or more in the chains of this cycle and change to a favorable cycle.

NIA mentions that the priorities for the short, medium and long-term irrigation development programs are geared to support food production and enhance socio-economic growth in the rural area. The thrusts in project development include accelerating the completion of on-going project, adequate packaging of future projects and introducing improved project management systems and practices. One of the stresses is put on developing a dynamic partnership in O&M between NIA and Irrigators' Association (IA).

4.3.2 Approach to Irrigation Development Plan

(1) Framework Plan

As a framework plan or the ultimate plan, all the remaining irrigable area of about 257,000 ha is the target area for new generation of irrigated area, aiming at 100 % of irrigation accomplishment. At the same time, all the existing irrigation systems should be rehabilitated and be fully operational.

(2) Long Term Plan

In formulating long term irrigation development plan, existing NIA program/plan and that in the 1987 Master Plan are taken into consideration. Many of the schemes in NIA, Region 2 Office are regarded as candidate. Selected 40 candidate schemes are of national level, namely National Irrigation System (NIS) and National Irrigation Project (NIP) together with major Communal Irrigation System (CIS) and Communal Irrigation Project (CIP), as presented in Table 4.3.3. To decide schemes for long term plan, an EIRR calculated by the expert is used. Schemes of less than 15% EIRR are excluded from economical viewpoint as described in Subsection 4.3.6 (2). As the long term plan, thirty eight (38) schemes are proposed.

(3) Reviewed Master Plan

In 1987 Master Plan, fourteen (14) irrigation projects were proposed consisting of 9 new/extension projects and 5 rehabilitation/improvement projects. Irrigation components of 2 multipurpose projects were included in the 9 projects.

For the Reviewed Master Plan, fifteen (15) candidate schemes are selected as a part of package including other sector schemes as described in Annex X, Chapter 7. In addition, thirteen (13) number of economically high graded schemes are selected. In total, twenty eight (28) schemes are the candidate schemes as seen in Table 4.3.4. Based on the criteria in Subsection 4.3.6, twenty four (24) schemes are selected for the Reviewed Master Plan up to 2020, which is composed of two parts. One part is a group of 15 irrigation development schemes to be implemented by new funding sources. Another part is 9 schemes to be implemented by NIA regular funds.

4.3.3 Main Features of Proposed Irrigation Project

Irrigation schemes proposed for long term plan are listed in Table 4.3.2 and Figure 4.3.2. Some of the schemes are explained hereunder.

(1) National Irrigation Project

1) Along Lower Cagayan River from estuary to Cabagan

a) Alcala-Amulung West Pump Irrigation Project (AAWPIP): Total area = 7,700 ha

NIA Cagayan Batanes Provincial Irrigation Office conducted feasibility study on 2,500 ha in north-western part of Alcala Amulung West area in 1997. On the basis of discussions with NIA, R-2, the Study Team proposes enlarged irrigation area of 7,700 ha consisting of Stage I (4,000 ha) and Stage II (3,700

ha). Stage I area includes the above 2,500 ha. Stage I area covers the higher plain and Stage II area is proposed in the lower plain. Located just upstream of the Magapit Narrows on the left or west bank, this area on the alluvial plain is one of the most seriously affected areas by flood. Generally, the lower plain near the river is covered with corn fields and higher plain with paddy fields partly irrigated by groundwater through small pumps and tube wells.

In order to develop this area fully, in particular the lower flood plain, flood control measures are essentially needed in addition to irrigation system.

b) Solana Pump Irrigation System–Rehabilitation and Extension Project (SPIS-REP) : Total area = 7,880 ha, Existing SPIS service area = 2,777 ha, Extension area = 5,103 ha

Located south of above a) area, usual land use practice is similar to similar flood conditions. Being a larger back swamp area, western part of SPIS forms a depression, where inundation occurs frequently due to poor drainage conditions, flood water from the Pangul River (Creek) and backwater effect from the Cagayan River through the Pangul River. Water distribution over the exiting irrigation canal system is insufficient.

Flood control measures are required to expand and improve irrigation service area.

c) Enrile Pump Irrigation Project (EPIP): Total area=3,100 ha

This area is located on the left bank of the Cagayan River and south of SPIS and south-west of Tuguegarao City. Most of the area is covered with rainfed rice field at present.

Suffering from flood influence, this area needs flood control measures as well as irrigation facilities.

This area is a part of former Chico River Irrigation Project – Stage II (CRIP-II) area or a part of its alternative, Chico Mallig Irrigation Project (CMIP).

2) Remaining area in the Basin

a) Chico Mallig Irrigation Project (CMIP) and Related Projects

CMIP is an alternative project of Chico River Irrigation Project (CRIP) Stage II, after social problems stopped the original project implementation. CMIP covers the same irrigation area (31,200 ha) as the CRIP-II. Santa Maria (Communal) Pump Irrigation System (SMPIS, 690 ha) covers a part of the command area. EPIP, Rizal Irrigation Project (RIP, 1,500 ha) and Delfin

Albano Pump Irrigation Project (DAPIP, 2,445 ha) overlap partly on the CMIP area.

In the original planned area of CMIP, nearly 8,000 ha in total are proposed as service area of other projects now. However, CMIP area is not reduced because additional potential irrigable area from CMIP is considered over 8,000 ha.

b) Addalam River Irrigation Project (ARIP)

This is an on-going project with projected service area of 5,830 ha in Quirino and Isabela provinces.

c) Other Projects

Pump Irrigation Project (PIP) includes those of Santa Isabel (SI), Upper Ilagan Wesern Barangay (UIWB), Dammao and San Agustin (SA).

(2) Communal and Other Irrigation Projects

1) Along Lower Cagayan River from estuary to Cabagan

Lallo West Pump Irrigation Project (LWPIP, 900 ha)
Nassiping Pump Irrigation Project (NPIP, 765 ha)
Mamil Pump Irrigation Project (MPIP, 563 ha)

2) Remaining area in the Basin

Laporang Pump Irrigation Project (LPIP, 400 ha), and etc.

(3) Rehabilitation of Irrigation System

Solana Pump Irrigation System (2.777 ha): refer to above SPIS-REP
Pinacanauan River Irrigation System (880 ha)

(4) Irrigation Component in Multi-purpose Project

Tumauini Reservoir Project (TRP): with multipurpose dam for irrigation and hydropower

(5) Shallow Tube Well (STW) and Deepwell Projects

A shallow tube well covers 3 ha irrigation area usually, while a deepwell covers about 10 to 40 ha.

4.3.4 Water Management

The optimum water management is a challenge to distribute water as widely as possible within limited given conditions. For the purpose, technology on not only hardware but also software will be necessary, including IA reinforcement.

To understand hydraulic characteristics as well as problematic points or bottlenecks, profiles of irrigation canal network, is essentially necessary. The profiles or longitudinal sections should include elevations of canal bottom and right and left bank tops with acceptable accuracy. Weak points found in the hydraulic profiles should be repaired or improved.

4.3.5 Cost Estimate

Of the proposed irrigation schemes, project cost is estimated based on the method employed in the 1987 Master Plan (1987 MP). The project cost comprises i) direct construction cost, ii) compensation cost, iii) cost for O & M facilities, iv) engineering cost, v) administration and supporting program cost and vi) physical contingency. Engineering cost is assumed 8 % of the sum of i) to iii) above. Administration and supporting program cost is assumed 7 % of the same sum as above. Physical contingency is assumed to be 15 % of the sum of above item i) to v). The project cost is updated from that prepared in 1987 MP applying an obtained deflator of 3.00 between 1985 and 2000 (ref. to Annex X, Chapter 6). The project cost is estimated for the proposed cropping pattern A, namely rice-rice-beans. Together with annual operation and maintenance cost, the estimated project cost is shown in Table 4.3.3.

4.3.6 Prioritization for Candidate Schemes

(1) Criteria for Prioritization

More effective scheme for poverty alleviation and equitable development should have higher priority. In general, less developed area has disadvantages in economic aspect, so higher benefit is difficult to be gained. However, such area has potential high benefit from lower without-project level to full developed level. Anyway, low developed area should have higher priority for equitable development in accordance with AFMA. Subsistence incidence below subsistence threshold level by the municipality is higher along the lower Cagayan River. So, irrigation projects along the lower Cagayan River should be given higher priority. Such areas that have poor traffic condition should be improved with higher priority.

From practical point of view, on-going and pipeline projects should receive higher priority, since early benefits can be expected by early implementation of such matured project.

Projects with economic internal rate of return (EIRR) of 15 % or higher have higher priority. EIRR is used as one of main indicators.

(2) Prioritization

EIRR is calculated in economic evaluation in Annex X, Chapter 6. Out of 40 candidate schemes in Table 4.3.2 for the long term plan, EIRR of 2 schemes is less than 15% and 38 schemes are remained in the long term plan as introduced in Table 4.3.4 and in Figure 4.3.2. Those schemes are compared according to the criteria presented in above (1). For the Reviewed Master Plan, 28 candidate irrigation schemes are selected as shown in Table 4.3.4 and Figure 4.3.3, from which 24 schemes are proposed as Revised Master Plan in Table 4.3.5, in which on-going two projects are shown though not included in Revised Master Plan.

The first prioritized scheme is Alcala Amulung West Pump Irrigation Project, since it is located on the west bank of the Cagayan River in Cagayan Province and well prepared for implementation.

4.4 Spoil Bank Plan

4.4.1 Basic Concept

(1) Excavated Materials

Considerable amount of excavated materials may be produced in flood control works, such as cut off channel (COC), channel widening, riverbed cutting, dredging, etc. The excavated materials in the basin should be used effectively as much as possible. They can be used as concrete aggregate, for stone masonry, embankment of flood dyke and irrigation canal, backfill to close channel, and so on. The materials are delivered for foundation of house and building and elevating low land for land reclamation and improvement, and are disposed as waste to some area or spoil bank according to the material quality and local conditions.

(2) Spoil Bank and Its Effective Use

The spoil bank area should be used effectively. In selection of the spoil bank, paddy field is excluded in principle not to change required water level, except for swampy paddy field of poor drainage condition. Old river course will be basically to remain as it is, since it is usable as natural fishing area and flood retarding area. One of the uses is for relocation area of resettlement plan. Original and proposed land uses of the spoil bank area are as shown below.

Hilly area	→	Built-up area, upland crop field
Corn field	→	Corn or other upland crop field (better condition)
Swampy paddy field	→	Normal paddy field
Swamp	→	Paddy field

4.4.2 Basic Design

(1) Required Spoil Bank

Basic design and its cost estimate are carried out for reaches along the lower Cagayan River from Alcala to Enrile. In Annex VI, Chapter 4, a lot of volume of excavation is proposed for three cut off channels (COCs) as one of river channel improvement works for flood control. Excavated material is proposed to be used for closing dike and flood dike embankment. Spoil bank will be required only for Tuguegarao COC. In the construction plan and schedule in Annex IX, Chapter 2, estimated earth volume from soil balance study for the spoil bank is about 10 million m^3 or roughly equivalent to 500 ha with 2 m high.

(2) Proposed Candidate Spoil Bank

Some of the probable and suitable spoil bank areas are proposed. An example is an area on the Pared River right and left banks and beside the national highway. Another is Solana depression used as paddy field in back swamp. From preliminary study, proposed candidate spoil bank area is estimated 1,670 ha from Alcala to Enrile

Within the probable and suitable spoil bank areas, swampy paddy field of Solana depression in back swamp is recommendable for Tuguegarao COC, because transportation distance is shorter and drainage improvement, which is desired by the people, is expected in the wet paddy fields. The area can be normal drier paddy fields.

4.4.3 Cost Estimate

Total cost for the above spoil banking is considered in Annex IX, Chapter 4.

It is considered that unit cost of excavation include hauling cost to spoil bank in the cost estimate of flood control works. In case of Tuguegarao COC and Solana area, compaction cost is not necessary because of drainage improvement in swampy paddy field. Required cost is road construction and rehabilitation to connect existing road to the spoil bank, together with land acquisition cost for new road. The estimated cost is about 200 million pesos.

4.5 Resettlement Plan

4.5.1 Basic Concept

Obtained information on the settlement planning so far is presented in following Subsection 9.5.2. Resettlement is recommended or may be ordered as one of the non-structural flood countermeasures for those people who live in hazardous land in various ways. Resettlement is compelled to the resident people living in the proposed right of way of flood dike, river cut-off-channel portion, and so on.

Usually the people wish to resettle to areas near to their original resident places, to continue the same works as before. Essentially necessary is that the people can be sure to have their jobs and to sustain their lives.

Proposed resettlement area is the hilly area near the flood plains, to avoid flood. In the plain, natural levee may be the resettlement area with heightening of the land, if necessary. One of ideas on the proposed area for the resettlement is the use of spoil bank area of excavated materials.

4.5.2 Resettlement Plan

(1) Residents' Intention on Resettlement

According to the Questionnaire Survey on Resettlement conducted by the Study Team, half of residents in the flood prone area show that they agree to move to areas less vulnerable to inundation. Moreover, some 20 % of residents agree to move if enough compensation, livelihood assistance and housing and so on are given. Those who disagree to move, on the other hand, have the following reasons: They cannot leave present houses, jobs and other assets. For even those disagreeing, it is considered that they would agree to move if the causes are removed. Thus, these high agreement rates suggest that residents in the flood prone area are suffering severely from flooding and consequent damages, and they would not hesitate to move to safer areas. Taking into account the residents' intention, resettlement is an effective and practical measure for reducing flood damages if necessary conditions for better understanding of the residents are taken into consideration.

(2) Formulation of Resettlement Plan

Regarding the formulating of resettlement plan, DPWH has a "Policy Framework for Land Acquisition, Resettlement and Rehabilitation (Nov., 1999)" for a road development project. However, such a policy framework or guideline has not been formulated for river improvement projects. Environmental Impact

Assessment Project Office of DPWH, which is in charge of resettlement procedures, suggests that the policy framework can be used for resettlement case of river improvement projects. Therefore, it is the rationale to refer to them in order to formulate a resettlement plan for this project.

The essential components of a resettlement plan are considered as follows:

- Selection of necessary acquisition area
- Formulation of the compensation plan
- Selection of relocation area and formulation of the development plan of relocation

Basically, relevant LGUs are responsible for formulating a resettlement plan, and the study team is currently requesting LGUs to formulate the resettlement plan, through DPWH, Region 2.

(3) Conditions of Relocation

The following items are to be studied and considered as conditions of the relocation site and housing before making a consensus with re-settlers:

- Floor area of houses;
- Surface area of lots;
- Social infrastructure and utilities to be supplied.

Twenty-five (25) m^2 is given as standard floor area by NHA. However, NHA, Region 2, suggests that the standard floor area is to be 30 m^2 for a house.

For the surface area, NHA applied some 100m^2 as surface area of one residential lot for recent 3 resettlement cases implemented in 1997 through 1999, in Region 2.

Regarding the social infrastructures and utilities, the following has to be equipped or developed:

- Access road
- Drainage system
- Sanitary facilities
- Water supply system
- Power supply system
- Community facilities
- Schools (Depending on the number of relocated persons, capacity of existing nearby schools)

The study team is studying conditions of these items on which suggestions and recommendations are given to DPWH and relevant LGUs.

(4) Necessary Considerations for Resettlement

Resettlement cases caused by public works have made big issues in the Philippines so far. There are many resettlement cases that have resulted in greater failures. There are many factors to disturb or adversely affect resettlement procedures. Coping with informal settlers, i.e. squatters, is one example including professional squatters and squatter syndicate.

Regarding basic policy for appropriate resettlement measures, the World Bank's Operational Directive 4.30 on involuntary resettlement should be considered to meet in this resettlement case. In addition to the Operational Directive as well as conditions of relocation described above, the study team is considering the following for better understanding of affected people and for facilitating resettlement procedures.

a) Treatment of Informal Settlers

Setting a cut-off date (refer to the date of commencement of the census of affected persons with the project area boundaries. Persons not covered in the census are not eligible for claims for compensation.) and keeping it strictly during compensation procedures are essential.

b) Public consultation and/or Public Involvement

In order to agree for resettlement, affected persons are to be informed and consulted or involved about the resettlement plan, such as the necessity for resettlement, compensation rates, relocation sites and so on.

c) Relocation

Relocation sites should be set near to the former residential area of re-settlers. In addition, re-settlers should be relocated on the basis of a unit for one sitio or even one barangay because they make a community.

d) Awareness building of Re-settlers

There were such cases where compensation money given to re-settlers has been spent for other purposes such as gambles than resettlement. It is important to remind the people, the purpose of the compensation money or to build the re-settlers' awareness during consultation of the resettlement procedures.

e) Setting of Compensation Rate

Compensation rate must not be changed per person once certain compensation rate, i.e. amount, is fixed set. Some re-settlers would try to raise the compensation rate in order to get more money, but by giving into such pressure to get prompt agreement for resettlement and facilitate the

procedure, the procedure itself would become chaotic and take a long time for settlement.

f) Formulation of the Resettlement Action Plan

It is essential to formulate a resettlement action plan including the following items on which correct procedure should be taken:

- Description of impacts and Socio-economic characteristics of Project affected persons
- Compensation rates and entitlement
- Implementation Schedule
- Monitoring and evaluation plan

4.5.3 Basic Design

Each municipality concerned must prepare resettlement plan according to the development plan performed by LGU. As a reference for that, a reach along the lower Cagayan River from Alcala to Enrile is studied as an example or trial of the cases in the Cagayan River Basin.

Following three relocation or resettlement areas are considered preliminarily assuming that 1,000 households (HH) or about 5,000 persons are included in the resettlement plan. Candidate resettlement areas (CRAs) -A, B and C are assumed. RA-A locates on the right bank of a tributary and along the National Highway. RA-B locates on natural levee in the left bank of the Cagayan River. RA-C locates on the hillside free from flood of the river.

Referring to above Subsection 4.5.2, standard floor area and residential lot area applied here are 25 m^2 and 100 m2, respectively. The whole resettlement area is assumed to be twice that of the residential area. Those who wish to have larger floor than the standard can have it by owing the additionally required cost. The resettlement area must be equipped with necessary infrastructures. Total resettlement area is 20 ha in this case. Typical resettlement area for about 250 households is illustrated in Figure 4.5.1.

4.5.4 Cost Estimate

Total resettlement cost is estimated at 1,185 million Pesos for the Reviewed Master Plan up to 2020.

4.6 Supporting Measures

4.6.1 Basic Concept

(1) Agricultural Supporting Program

In general, supporting programs are necessary for the purpose of improvement of inequitable income distribution to mitigate poverty in the rural area. Mainly performed by DA, the programs include, but not limited to, intensification and activation of irrigators' association (IA), finance and marketing support and so on. In case of CIP, such supports are implemented as usual activities.

In case of NIP also, such supporting programs should be accompanied with hard work. Thus, effective and efficient irrigation farming can be attained more easily.

(2) Strengthening of Agricultural Support Services for Small Scale Farmers

1) Promotion of Agrarian Reform

Promotion of agrarian reform is essential to improve the small-scale farmers not only to vest the right of land ownership but also to apply legal matters such as lease tenant contract, etc.

2) Financial Support Services

Required to promote easy access to the farming loan with reasonable interest and prompt procedure.

3) Promotion of Farmers' Organization

Much efforts are required to promote the farmers' cooperative activities, first necessity is to train and educate the leading farmers and secondly to extend timely support to the farmers.

4) Community-based Agricultural Infrastructure Improvement

The farmers must necessarily to be motivated to participate positively in the community activities not only as the recipient but also as the creator of the community's benefit.

(3) Rural Development Center

It is quite important to reduce production cost of main crops, including cost for post-harvest, marketing, etc. For the purpose, the Study Team proposes to install a kind of base or integrated multi-sectoral center as a core space covering certain scale of area. It consists of agricultural processing facility, storage facility, office and meeting room of farmers' cooperative or irrigators' association,

equipment/machinery/vehicle for farming and transportation with parking area, repairing space and fuel station, power and water supply system, drainage, sewage and recycling systems, information center on market and flood, training and education center, and so on. Also, it may include evacuation facility, resettlement space, shopping zone, recreation facility, green zone or trees, meteo-hydrological observation system and so on, if acceptable and reasonable for the people and LGUs.

The base may be established on spoil bank. Elevation of the base must be high enough to avoid floodwater intrusion and inundation. The base system may be composed of main base and several sub bases depending on local conditions.

In the plains, rice mill or corn mill is a core facility. In the hilly areas, corn and livestock processing facilities have important roles. In the mountainous areas, establishment of experimental center on agro-forestry and spray irrigation with test fields is recommended. One of the purposes is to replace destructive slash and burn cultivation with sustainable and stable production method.

(4) Effect of Rice Milling

It is reported that not small amounts of paddy produced in the Cagayan River Basin are sent to the milling area of Pangasinan, Nueva Ecija and Bulacan. The Study Team proposes to mill rice in the Basin as much as possible. Effect of rice milling in the Basin includes transportation cost saving, use of by-products such as bran, husk, etc., employment generation, and so on. Particularly in northern part of Cagayan Province, milled rice may be delivered to Manila by less costly by sea route.

(5) Improvement of Transportation System

As mentioned in Subsection 2.3 (1), transportation system from the Cagayan River Basin to and from Metro Manila or crop demand area is insufficient. Activation of the sea route via Irene Port, Santa Ana or Aparri is considered necessary for development of the Lower Cagayan River area.

4.6.2 Basic Design

(1) Crop Production in the Plain

1) Rice mill requirement and capacity

According to Bureau of Agricultural Statistics (BAS), recent paddy production is estimated around 1.2 million ton (0.78 million ton in rice) in the Cagayan River basin. In use of 1,600 hr/yr (=200 day/yr and 8 hr/day) in

operation rate, total milling requirement is estimated at 490 t/hr on present condition. According to the 1987 Master Plan, about 23 % of paddy (0.195 / 0.84 million t at that time) was milled outside of the basin. Assuming the same rate, recent outside milled paddy is estimated about 0.28 million ton, equivalent to 0.18 million ton in rice and 113 t/hr requirement.

In future, as paddy production is projected to increase, so rice mill capacity must follow and increase in and outside of the basin.

2) Rice mill for irrigation project in the Lower Cagayan area

For a rice mill with capacity of 5 t/hr, assuming operation rate as 1,600 hr/yr (200 day/yr and 8 hr/day) and efficiency as 0.7, the annual capacity is calculated (5.0 x 1,600 x 0.7) at 5,600 t/yr. Projected yield under irrigation being 4.5 and 5.0 t/ha in the wet and dry seasons, annual production will be 9.5 t/ha in paddy or about 5.7 t/ha in rice. Paddy product from approximately 1,000 ha can be milled by a 5t/hr class mill after irrigated. Required space for the rice mill plant is 1,000 m^2 /plant or less.

3) Rice mill benefit

If quality of rice milled in the basin can be the same level as that in the present milling area (Nueva Ecija, Pangasinan and Blacan), milling in the basin (and transporting to Manila) is more advantageous in transportation cost. Supposing that a truck can deliver 15 t of milled rice from Cagayan Province to Nueva Ecija Province, and that the truck send 15 t of paddy or equivalent to 10 t of rice plus 5 t of husk. Transportation cost is estimated 13,500 P (300 km x 15 t x 3.0 P/t/km). The cost per ton of rice is 900 P for milled rice in Cagayan and 1,350 P for milled rice in Nueva Ecija.

In the case of rice milling in Cagayan province, transportation cost to Manila may be more advantageous by sea route via Irene Port, according to preliminary cost comparisons.

4) Warehouse

Warehouse stores for agricultural inputs, such as fertilizer, pesticide, insecticide, herbicide, etc. as well as produce including by-products, and equipments with their spare parts, etc. Required space and capacity depend upon volume of goods/commodities and number of equipments.

5) Equipment, Machinery and Vehicle

Rice thresher, corn sheller, mechanical dryer, etc. are for processing. Hand tractor, tractor, transplanter, combine-harvester, etc. are for paddling, land preparation, transplanting and harvesting. Car and truck are for transportation, inspection and monitoring of irrigation system, and so on. Boats with and without engine should be prepared against flood.

6) Power and Water Supply System

Infrastructure will be required as a matter of course. Electric power is desirable to be supplied from NPC network. Anyway power generator is needed against blackout. Propane gas or other fuel may be used. Water may be taken from groundwater or irrigation system.

7) Recycling System and Solar Energy

Environmentally rational recycling system will be prepared, including re-use of rain water, waste water, etc. Solar energy will be used to make hot water on the roof of buildings and to supply power for automatic meteo-hydrological observation station.

8) Building and Housing

Built-up areas will consist of cooperative office, office for staff of related agencies including DPWH, DA and NIA, meeting hall to be used as evacuation facility in disaster time, shops, and so on. Resettlement residence may be combined if agreeable.

(2) Livestock in the hilly area

Livestock industry should be closely combined with corn cultivation, formulating systems. Corn fields supply feed and livestock area can return waste as organic fertilizer. This system is supported by another type of rural development base.

(3) Agro-Forestry and Diversified Crop in the Mountainous Area

For agro-forestry and diversified crop cultivation, is recommended at upland development experimental center with test field and spray irrigation system including sprinkler and drip irrigation system. The proposed location should be decided after analysis on SAFDZ on the provincial and more detailed SAFDZ map. Proposed agro-forestry area in 2020 is 105,100 ha.

4.6.3 Cost Estimate

(1) Regular Supporting Measures

Cost for commonly required supporting measures is included in the respective irrigation project cost as administration and supporting program cost (ref. to 4.3.5), which is estimated at 8 % of the summed cost for direct construction, compensation and O & M facilities.

(2) Cost for Rural Development Center

1) Rice Mill

5 t/hr Rice Mill Plant (CIF, Manila)	1 unit	42.0 MP
Inland transportation from Manila to the Basin	1 lot	0.6 MP
Installation of the plant at site	1 lot	7.4 MP
Total		50.0 MP

Not included in the total are civil and building construction work, lightning equipment and the relevant cables, spare parts for the machines, duties and levies in the Philippines.

2) Other processing facilities

Assuming 20 % of the rice mill, cost of other processing facilities is estimated at 10.0 MP.

3) Infrastructure Unit cost = 600 P/m^2, A = 60,000 m^2, C = 36.0 MP

4) Land acquisition Unit cost = 40 P/m^2, A = 60,000 m^2, C = 2.4 MP

5) Building Unit cost = 15,000 P/m^2, A= 6,000 m^2, C =90.0 MP

6) Total cost

In this case, the rural development center can be constructed on a part of the spoil bank area, if possible. Cost for land preparation excluding land acquisition is accounted in the cost of infrastructure. Cost for access road is also included in the cost of infrastructure.

TOTAL 188.4 => 189 million Pesos

(3) Cost for Experimental Center

1) Land preparation

A = 10 ha,	60,000 m^2 x 2.0 m x 200 P/m^3	=	24 MP
	40,000 m^2 x 50 P/m^2	=	2 MP
2) Infrastructure	60,000 m^2 x 350 P/m^2	=	21 MP
3) Building	1,200 m^2 x 15,000 P/m^2	=	18 MP
4) Spray irrigation system	5 ha x 5.0 MP/ha	=	25 MP

5) Total with others

Together with other costs of 30 million Pesos, the total cost is estimated at 120 million Pesos.

PART III EASIBILITY STUDY OF PRIORITY PROJECTS

CHAPTER 5 LAND USE IN PRIORITY PROJECTS FOR FEASIBILITY STUDY

5.1 Pre-Feasibility Study of Alcala Amulung West Pump Irrigation Project

5.1.1 Proposed Project

(1) The Project

In accordance with the terms of reference, pre-feasibility study (pre-F/S) on irrigation project was conducted. Since it is concluded from the Revised Master Plan Study described in Chapter 4 that the Alcala Amulung West Pump Irrigation Project (AAWPIP) is the most optimum irrigation development plan, this project is selected for the study in this chapter.

National Irrigation Administration (NIA) completed a feasibility study (F/S) for a part of the project or 2,120 ha in 1997 including soil and topographical surveys, and prepared topographic map with scale of 1:4,000. Later NIA conducted geological investigation at the proposed site of intake pump station.

From above conditions, the Study Team considers that this study may be regarded in future as a feasibility study on condition that required physical surveys including topographic survey and detailed review of the NIA F/S and this pre-F/S be conducted. In particular, on foundation of siphon in swampy paddy fields, detailed investigation, analysis and study will be required. Change of the main canal alignment may be necessary from the proposed one to a southern route.

(2) Irrigation Service Area

The project area is located in Northern Luzon, Cagayan Province of Region 2 at around 25 km north from Tuguegarao as shown in Figure 5.1.1. Altitude of the area is mostly between 10 and 20 m above sea level. Demarcation of the irrigation service area is basically determined by the following aspects into consideration; 1) topographic condition, 2) soil conditions and existing land use. Based on the assessment, the irrigation service area is determined to be 7,060 ha net.

On the basis of the results of the field investigation and flood analysis, the higher plain which are currently cultivated with paddy is mostly inundated less frequently or probably less than 1/5. On the other hand, lower plain presently used as cornfield is affected by flood more frequently or 1/5 years or more (Figure 5.1.2). The paddy field area is named Area A and the corn field Area B, except

that a part of paddy field in a back-swamp which is included in Area B. Area A can be implemented early in the near future. Area B needs flood control measures before implementation.

(3) Present and Proposed Cropping Pattern and Land Use

The basic concept for irrigated agriculture development is to increase rice production as well as promoting crop diversification to secure food production and increase cash income of the beneficiaries. Proposed cropping pattern is designed taking into consideration the climate, irrigation water supply, agronomic characteristics, farmers' intention as well as national policy and other relevant issues. (Figure 5.1.3)

Proposed Cropping Pattern

Classification	Period	Area (ha)	Cropping Intensity
Paddy			
- Wet season	April to August	7,060	100
- Dry season	December to April	7,060	100
Upland Crops	August to November	3,530	50
Total		17,650	250

Presently the project area is cultivated with paddy and corn mixed. After the implementation of the project, land use pattern in the area will change as shown below.

Present and Proposed Land Use

Classification	Present	Proposed
Paddy	4,730	7,060
Corn	2,820	0
Irrigation Canal	0	790
O&M Road		
Non-Irrigable Area (Village and Highland)	1,200	1,200
Grass/Shrub	300	0
River	700	700
Others	450	450
Total	10,200	10,200

(4) Anticipated Crop Yield and Production

Proper farming practice is the most essential factor for realizing full exploitation of the agricultural potentiality in the area. Proper amount of fertilizer and chemicals will be applied through improved farming practices with project condition. Unit yield of paddy in the future conditions is estimated on the basis of the past trends of unit yield, the results of unit yield on well managed irrigation area in and around the project area. For the achievement of the anticipated crop yield and production, optimum application of farm inputs will be required

together with effective water management. Total production of the farm crops is estimated by multiplying the anticipated unit yield with the future cultivation area for both future "with project" and "without project" conditions. The future area of paddy and corn fields are assumed to be the same as those at present. The anticipated unit yield, production and increment of crops in "with and without project" conditions is tabulated as follows:

Incremental Production - With and Without Project

Item	Without Project	With Project	Increment
1. Total Area (ha)			
Paddy field	4,730	7,060	2,330
Diversified cropland	2,820	0	-2,820
Grass and brush	300	0	-300
Total	7,850	7,060	-790
2. Harvested Area (ha)			
Paddy-Wet season	4,500	7,060	2,560
-Dry season	470	7,060	6,590
(Total)	4,970	14,120	9,150
Corn	4,850	1,150	-3,700
Tobacco	100	120	20
Vegetables	240	980	740
Beans	200	800	600
Peanuts	180	400	220
Sweet potatoes	30	0	-30
Total	10,470	17,650	7,180
3. Unit Yield (ton/ha)			
Paddy-Wet season	2.50	4.50	2.00
-Dry season	3.10	5.00	1.90
Corn	2.50	3.75	1.25
Tobacco	1.00	2.00	1.00
Vegetables	6.00	13.00	7.00
Beans	1.00	1.50	0.50
Peanuts	0.70	1.00	0.30
Sweet potatoes	5.00	-	-
4. Production (ton)			
Paddy-Wet season	11,250	31,770	20,520
-Dry season	1,457	35,300	33,843
(Total)	12,707	67,070	54,363
Corn	11,875	4,313	-7,563
Tobacco	100	400	300
Vegetables	1,440	12,740	11,300
Beans	200	1,200	1,000
Peanuts	126	800	674
Sweet potatoes	150	0	-150

5.1.2 Irrigation Plan

(1) Water Sources

The water source for the project area is the discharge of the Cagayan River. The maximum discharge of 25 years return period is 18,700m^3/sec while the minimum of 5 years return period is 304 m^3/sec. Although the seasonal fluctuation of the river surface water level is very large from EL. 17.33 m in 25-year return period to EL. 1.38 m in 5-year period, the water can be consecutively used for irrigation purposes by pumps. In the project area, some communal and private irrigation systems (approx. 200ha) are operating at present by use of groundwater. Since the shallow tube well and deep well cannot supply enough water during drought, they can be neglected for formulating of the irrigation development plan.

(2) Irrigation Plan

Pump Station Site

Tamban site is selected for proposed intake pump station after comparative study with Solana site.

Due to the high elevation of the project area comparing with the water level of the river, pump irrigation system is proposed as an intake method. The site of main pump station should be selected basically where the water channel of the river is stable as well as foundation of the station is rigid. Based on this condition, i) Tamban site and ii) Solana site is the candidate of proposed pump site. Of the two alternatives, Solana site is distant from the project area located approximately 24 km from the project area so that the construction of main canal connecting to the field will be more costly than the Tamban site which is closer to the area. Additionally, in case of Solana site, it is required to resettle the inhabitant because the main canal course will disturb the resident area. From these points of view, Tamban site is selected for proposed main pump station.

Pump Type

In order to select the optimum pump intake method, the following three (3) alternative types are examined from technical and economical viewpoint:

- Vertical shaft pump
- Horizontal shaft pump
- Submersible pump

Judging from easier operation and maintenance as well as lower initial investment and operation cost, it is proposed to select the submersible pump plan.

Irrigation Water Requirement

Irrigation Water Requirement is calculated in accordance with the proposed cropping pattern by the following manner;

- Crop evapotranspiration (ETcrop) is estimated on the basis of FAO Penman-Monteith method together with crop coefficient.
- Net irrigation requirement (NIR) is calculated by adding percolation water and water required for a nursery period and land preparation to ETcrop and reducing effective rainfall.

- Diversion water requirement or water duty is calculated by adding operation and conveyance loss to NIR.

The calculation is made in monthly base as shown in Table 5.1.2 and 5.1.3, in use of following.

- Percolation: 1.5 and 2.0 mm/day for higher and lower plain, respectively
- Land soaking and flooding: 150 mm and 15 mm
- Effective rainfall: 5-year probability of non-exceedance
- Irrigation efficiency: 0.54 (application: 0.8, conveyance: 0.8, operation: 0.85)

On this basis, peak irrigation water requirement for determining the design capacity of irrigation facilities is calculated to be 1.7 lit/sec/ha in existing paddy field (higher plain) in Table 5.1.2 and 1.8 lit/sec/ha in the field previously used as corn field (lower plain) in Table 5.1.3. Proposed irrigation diagram is shown in Figure 5.1.4.

5.1.3 Drainage Plan

General

Present flooding condition of the project area is so serious that it cause not only inundation of a wide area especially on a present corn field but also low productivity and crop damage of paddy during flood time.

The drainage plan in the irrigation development area is proposed by means of improving the existing Pangul river through relocation, flood dike construction and drainage network construction. Additionally crossing drain should be provided to securely drain runoff water from the outside of the project area.

Drainage Requirement

In accordance with NIA criteria, the drainage requirement for the paddy filed is estimated to be 8.6 lit/sec/ha for the excess water in 10-year return period, which

is generally applied for drainage plan in Northern Cagayan. Accordingly this value is applied for this pre-feasibility study.

Additionally the excess water drained from surrounding mountainous side across the irrigation canals should be considered in the drainage plan. The unit runoff is estimated by the flood analysis. In accordance with the analysis, this value is estimated at 19.4 lit/sec/ha and thus needs to be considered in the drainage plan. Proposed drainage diagram is presented in Figure 5.1.5.

Inundation

An example of inundation in the Drainage Area 2 (D2) during the Cagayan River flood time of 25-year probability is presented in Figure 5.1.6. Old river courses function as flood retarding basin. Results of inland inundation and the Pangul River flooding are summarized in Table 5.1.4.

5.1.4 River Relocation and Flood Dike Construction Plan

The Pangul River flowing south-east of the project area has wide catchment area of some 350km^2, which inundate the field particularly lower part of present cornfield. This will be the constraints for future irrigation development. To alleviate the damages by flooding in the area to materialize the target, it is proposed to relocate existing Pangul River channel to the outside of the irrigation area. In addition, flood protection dike is to be constructed surrounding the proposed irrigation area. An inundation analysis in the lower Pungul River area at the time of the Cagayan River flood with 25-year probability is presented in Figure 5.1.7.

5.1.5 Farm Road Plan

The farm road and farm to market road in the project area is rehabilitated and newly constructed for the purpose of O&M of the irrigation and drainage facilities, transportation and marketing of farm products and inputs.

5.1.6 Water Management and Operation & Maintenance Plan

The irrigation service area is located in alluvial plain just upstream of the narrows from Magapit through Nassiping to Tupang. The service area of 7,060 ha are served by intake pump station, booster pump station, main canal 28 km, lateral / sub-lateral canal 61 km, main drain 8 km, lateral drain 28 km and other related structures.

The purpose of operation of these facilities is to attain the maximum efficiency of irrigation water to meet with the crop water requirements, in other words, to distribute irrigation water by how much, when and where, it is required.

(1) Water Management

In general, a delivery and application program is prepared based on the various data and information, because it should be well-fitted in to the local and current conditions. In order to realize effective water use, such data and information as listed below should firstly be prepared and/or collected before the operation.

- Detailed topographic maps
- Detail soil maps
- Cropping patterns and cropped areas
- Physical conditions of soils such as water holding capacity, basic intake rate, etc.
- Meteorological data such as rainfall, temperature, related humidity, sunshine, wind speed and evaporation
- Canal seepage loss
- H-Q Curve for each measuring device

In water management, another important issue is to monitor, analyze and evaluate the actual activities, and to reflect the results on the water delivery and application program in the next year. Hence staffing and organization should be ensured for effective execution of monitoring activities.

Establishment and strengthening of Irrigators' Association (IA) is important for effective collection of irrigation service fee (ISF) and operation and maintenance of irrigation system.

(2) Operation and Maintenance Plan

Operation of the project facilities in irrigation project means the execution of water management program mentioned above. It includes activation of pumps and gates so that the desired discharge can be supplied at the appropriate time, which is considered as the "hardware" of the water management action.

In this project, a continuous water supply method is proposed, though further study should be made at the next stage. In the continuous water supply method, supply amount will be regulated by opening and closing the gates in the light of water delivery and application program. To simplify the gate operations, a measuring device is indispensable, and it should be provided.

In parallel with proper operation, suitable and continuous maintenance of the project facilities are essential to secure proper stable function of the facility as well as to ensure the realization of economic life of the facility. The maintenance work as well as its system is important.

5.1.7 Preliminary Design

(1) Intake and Booster Pump Station

The required number and capacity of pumps are determined on the basis of the irrigation area and design irrigation water requirement, also taking lifting capacity, the cost and weight of a pump into consideration. Intake and booster pump stations are illustrated in Figures 5.1.8 and 5.1.9. The proposed pump description is tabulated as follows:

Main Features of Proposed Pump

	Intake Pump		Booster Pump	
	Stage-1	Stage-2	Stage-1	Stage-2
- Required Number	4 – D900	4 – D800	2 – D800	2 – D900
- Design Capacity (m^3/min)	7.0	5.3	2.7	3.5
- Total head (m)	20	20	5	5
- Type	Submergible pump		Submergible pump	

Total electric power input capacity is estimated about 4.0 MW. Annual average pumping quantity is estimated at 140 and 73 million m3 for the intake and booster pump stations, respectively. The required annual energy is estimated at around 12.3 MWH in total (Table 5.1.5).

(2) Irrigation Canals

Layout of irrigation network

The irrigation network will consist of main system (main, lateral, sub-lateral canals) and on-farm system (main and supplementary farm ditch), and canal related structures, and are provided completely separated from the drainage system for effective O&M of the facilities. The irrigation canals are of open-channel type of canals so as to connect each of the irrigation blocks. The lateral canals and sub-lateral canals are branched off from the main canal and farm ditches diverge from lateral canals and sub-lateral canals as seen in Figure 5.1.4. The area of each irrigation block is from 70 ha to 700 ha and averaging 200 ha. (Figure 5.1.1)

Irrigation Canals

All the main canal, lateral canals and sub-lateral canals are lined with concrete with trapezoidal flow section in terms of easy O&M and smaller hydraulic head

loss as well as for effective use of water with a minimum loss due to leakage, while farm ditch is of earthen type. The cross sectional scale of the irrigation canals is determined by use of the Manning Formula (Figure 5.1.10). The roughness coefficient is assumed to be 0.015 for concrete surface and 0.030 for earth surface. Table 5.1.6 presents list of irrigation canal with related structures.

Hydraulic profile design is important and must be practical. Design energy head loss at each structure on the irrigation canal is set at least 5 – 10 cm in the main canal system and 2 – 5 cm in the on-farm canal system.

Canal-related structures

Necessary and indispensable facilities like headgate, turnout, drop, siphon (Figure 5.1.11), culvert and etc. are installed on the canals and washing basins are installed at the convenient points for the beneficiaries along the canals.

(3) Drainage Canals

Drainage Network

The drainage system consists of drains to evacuate the excess water from the irrigated land and collector drain to flow out the rainwater from outside the project area. The drains are classified into farm drain, which is provided to drain the excess water from the irrigation block, lateral drain to collect excess water from the farm drains and main drain and collector drain to collect drain water from lateral drain to drain into natural stream directly as in Figure 5.1.5.

Drainage Canals

All of the drainage canals are of earthen type with trapezoidal flow section. The cross sectional scale of the drainage canals is determined by use of the Manning Formula. The roughness coefficient is assumed to be 0.030.

Primary features of canals and drains and related structures are summarized as follows:

Proposed Canals, Drains and Related Structures

Canal Name		Canal Length (m)	Structures (nos)			
			Culvert	Siphon	Cross Drain	Footpath
Irrigation	Main Canal	27,500	20	2	39	16
	Lateral/sub-LC	61,750	22	10	25	57
Drainage	Main	8,300	10			
	Lateral	27,200	40			
TOTAL		124,750	92	12	64	73

(4) Land Development

Topographical conditions of the project area are basically flat. Land development works, namely rough leveling, is required only where the average land slope is more than 1 % while the area sloping less than 1 % can be gradually leveled under farming practices. The area required for land development is approximately 150 ha, which is 5 % of existing cornfield, estimated by site investigation and using 1/10,000 topographic maps.

(5) Farm Road

The proposed farm roads are divided into three types in terms of their design, inspection roads (two types) and footpath. The inspection road has function of connecting the main facilities and for O&M of the main irrigation system and access to the public road network. The footpath is mainly used for transportation of farm products and inputs, and are aligned so as to enclose a unit farming block. The following table shows the outline of the proposed road network:

Proposed Farm Road

Classification	Width (m)	Total Length (km)
Inspection Road		
- main	6	27.5
- lateral/sub-lateral/FD	4	202.5
Footpath	2.5	494.2

5.1.8 Post-Harvest Facilities

To reduce losses at the harvesting and post-harvesting stages, rice mill, and multi-purpose dryers are required in the villages to make easy access by farmers together with extension services of post-harvesting techniques. The facilities are designed as shown below:

Rice Mill

For the incremental production of paddy of 54,000 ton, required rice mill capacity is calculated at 7 units of 5 ton/hour as presented in Figure 5.1.12.

As described in 5.1.1, the incremental production of paddy is 54,000 ton. The capacity is determined based on the following conditions:

- Rice quantity to be milled : 33,000 ton
- Operation hour : 8 hours /day
- Operation day : 200 days / year
- Coefficient of work efficiency : 0.7

Based on these conditions, required rice mill capacity is calculated at about 6 – 7 times of 5 ton/hour scale rice mill.

Multi-purpose Dry Yard

The dry yard is required for treatment of paddy and other crops for storage and marketing. Under the project it is proposed to provide to five villages within the project area as demonstration. The proposed design conditions is as follows:

- Volume of paddy to be treated : 56,000 ton, which is incremental production under the project
- Work Volume : 8 ton (10 m^3)/day
- Drying period : 2 days x 30 cycles
- Average drying layer (at one time) : 0.135 m

On this basis, the total required floor space is estimated at 17,000 m^2.

5.1.9 Implementation Schedule

The implementation schedule of the project is prepared based on the assumption that the project mobilization, which includes financing, legalization and establishment of the project organization, will be completed by year 2002. The project is to be divided into 2 stages as shown below. Details are in Annex IX, Chapter 2 and 3.

Proposed Implementation Schedule - Irrigation Component

Stage	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Review of F/S& pre-												
Stage-I (Area-A)			D/D									
Stage-II (Area-A)												

5.1.10 Work Quantities

The work quantities under the project is tabulated in Table 5.1.7.

5.2 Soil Bank Plan

Soil Bank Plan for the flood control feasibility study is described in Section 4.4.

5.3 Resettlement Site Development Project

In accordance with information from related municipalities, there are 6 resettlement sites to be developed, namely Lasam, Alcala East, Alcala West,

Amulung East, Amulung West and Iguig. In other municipalities, resettlement can be conducted near the original resident area without particular plans.

Resettlement area may be placed on spoil bank areas. However, there is no such case in the F/S area, because surplus of excavated material is proposed only at the Tuguegarao COC site.

Estimated resettlement area and the informed candidate resettlement sites are in Table 5.3.1 and as below.

Lasam : 872 HH, 17.4 ha
Alcala : 359 HH, 7.2 ha, northern hill of poblacion and western hill of Tamban
Amulung : 918 HH, 18.4 ha, eastern hill of Anquiray and corn field between Annabuculan and Unag
Iguig : 784 HH, 15.7 ha, southern hill

In case of Lasam, no suggestion is obtained. The site may be along the proposed flood dike.

Typical resettlement site development layout is shown in Figure 9.5.1.

There are 9 households to be resettled due to the project implementation as shown in Table 5.3.2 As number of the household is small and there is enough space near the site, resettlement can be conducted near the original resident area without particular plan.

5.4 Supporting Measures

Supporting measures for the AAWPIP is basically the same as those in Section 4.6.

Tables

Table 2.2.1 Status of Irrigation Development by Region

Region	Potential irrigable area (ha)	Irrigation development as of December 1999		Remaining area to be irriated (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 2.2.2 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 2.3.1 Recent Rice Production and Import in the Philippines

(Unit: 1,000 t)

Year	Production		Imported rice (3)	Exported rice (4)	Assumed consumpt'n (5) =(2)+(3)-(4)	Import rate (%) (6) =(3)/(5)
	Paddy (1)	equiv. Rice (2) =(1)*0.65				
1990	9,319	6,057	593	0	6,650	8.9
1991	9,672	6,287	0	10	6,277	0.0
1992	9,129	5,934	1	30	5,905	0.0
1993	9,434	6,132	202	0	6,334	3.2
1994	10,538	6,850	0	0	6,850	0.0
1995	10,541	6,852	263	0	7,115	3.7
1996	11,284	7,335	862	0	8,197	10.5
1997	11,269	7,325	722	0	8,047	9.0
1998	8,555	5,561	2,171	0	7,732	28.1
1999	11,787	7,662	884	0	8,546	10.3
av.1990-99	10,153	6,599	570	4	7,165	7.4
av.1995-99	10,687	6,947	980	0	7,927	12.3

Source: BAS 2000, Statistical Year Book 1999

Table 3.1.1 Paddy Production

Estimated Production, Area Harvested and Yield per Hectare, by Farmtyp
in the Philippines and Cagayan River Basi
(Calendar Year 1990-1999)

ITEM	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Average	%	Basin area/Philippines
PHILIPPINES													
PRODUCTION (MT)	**9,319,276**	**9,673,262**	**9,128,940**	**9,434,208**	**10,538,054**	**10,540,649**	**11,283,568**	**11,268,963**	**8,554,824**	**11,786,625**	**10,152,837**	**100**	100
Irrigated	**6,604,826**	**6,831,737**	**6,611,732**	**6,729,559**	**7,511,096**	**7,598,555**	**8,233,633**	**8,476,448**	**6,681,158**	**8,917,882**	**7,419,663**	**73.1**	100
Rainfed	**2,714,450**	**2,841,525**	**2,517,208**	**2,704,649**	**3,026,958**	**2,942,094**	**3,049,935**	**2,792,515**	**1,873,666**	**2,868,743**	**2,733,174**	**26.9**	100
AREA HARVESTED (Ha)	**3,318,720**	**3,424,960**	**3,198,070**	**3,282,350**	**3,651,530**	**3,758,691**	**3,951,136**	**3,842,270**	**3,170,042**	**3,999,839**	**3,559,761**	**100**	100
Irrigated	**2,009,930**	**2,060,430**	**1,980,420**	**2,017,180**	**2,219,380**	**2,334,373**	**2,484,509**	**2,496,887**	**2,181,534**	**2,664,629**	**2,244,927**	**63.1**	100
Rainfed	**1,308,790**	**1,364,530**	**1,217,650**	**1,265,170**	**1,432,150**	**1,424,318**	**1,466,627**	**1,345,383**	**988,508**	**1,335,210**	**1,314,834**	**36.9**	100
YIELD/HECTARE (MT)	**2.8**	**2.8**	**2.9**	**2.9**	**2.9**	**2.8**	**2.9**	**2.9**	**2.7**	**2.9**	**2.9**		100
Irrigated	**3.3**	**3.3**	**3.3**	**3.3**	**3.4**	**3.3**	**3.3**	**3.4**	**3.1**	**3.3**	**3.3**		100
Rainfed	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**2.1**	**1.9**	**2.1**	**2.1**		100
THE BASIN* (%)	**13.9**	**12.0**	**13.3**	**10.9**	**13.2**	**14.3**	**14.2**	**15.3**	**14.5**	**15.9**	**13.8**		
PRODUCTION (MT)	**1,298,742**	**1,156,841**	**1,217,114**	**1,025,554**	**1,394,201**	**1,504,610**	**1,606,758**	**1,718,953**	**1,240,356**	**1,876,521**	**1,403,965**	**100**	14
Irrigated	**1,202,548**	**1,074,432**	**1,153,381**	**982,357**	**1,250,073**	**1,404,284**	**1,467,705**	**1,601,700**	**1,208,358**	**1,717,333**	**1,306,217**	**93.0**	18
Rainfed	**96,194**	**82,409**	**63,733**	**43,197**	**144,128**	**100,326**	**139,053**	**117,253**	**31,998**	**159,188**	**97,748**	**7.0**	4
(%)	**11.8**	**10.7**	**11.5**	**10.2**	**11.7**	**12.2**	**11.8**	**12.6**	**12.9**	**13.4**	**11.9**		
AREA HARVESTED (Ha)	**392,000**	**366,250**	**368,370**	**336,320**	**428,500**	**457,936**	**468,185**	**483,979**	**408,564**	**537,287**	**424,739**	**100**	12
Irrigated	**332,420**	**320,250**	**329,580**	**300,040**	**359,650**	**397,157**	**398,726**	**425,077**	**384,941**	**458,618**	**370,646**	**87.3**	17
Rainfed	**59,580**	**46,000**	**38,790**	**36,280**	**68,850**	**60,779**	**69,459**	**58,902**	**23,623**	**78,669**	**54,093**	**12.7**	4
YIELD/HECTARE (MT)	**3.3**	**3.2**	**3.3**	**3.0**	**3.3**	**3.3**	**3.4**	**3.6**	**3.0**	**3.5**	**3.3**		114
Irrigated	**3.6**	**3.4**	**3.5**	**3.3**	**3.5**	**3.5**	**3.7**	**3.8**	**3.1**	**3.7**	**3.5**		106
Rainfed	**1.6**	**1.8**	**1.6**	**1.2**	**2.1**	**1.7**	**2.0**	**2.0**	**1.4**	**2.0**	**1.8**		86

Data source: BAS, 2000.

* Cagayan River Basin area includes provinces of Cagayan, Isabela, Qurino, Nueva Vizcaya of Region II and Kalinga, Apayao, Ifugao and Mountain Province of CAR.
Production MT in paddy form.

Table 3.1.2 Corn Production

Estimated Production, Area Harvested and Yield per Hectare, by Croptype,
in the Philippines and Cagayan River Basi
(Calendar Years 1990-1999)

ITEM	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Average	%	M/P area /Philippines
PHILIPPINES													
PRODUCTION (MT)	**4,853,891**	**4,655,026**	**4,618,854**	**4,797,977**	**4,519,246**	**4,128,510**	**4,151,332**	**4,332,417**	**3,823,184**	**4,584,593**	**4,446,503**	100	100
White	**2,965,557**	**2,905,691**	**2,699,589**	**2,627,049**	**2,089,905**	**1,862,423**	**1,883,087**	**1,879,209**	**1,620,465**	**1,823,834**	**2,235,681**	50	100
Yellow	**1,888,334**	**1,749,335**	**1,919,265**	**2,170,928**	**2,429,341**	**2,266,087**	**2,268,245**	**2,453,208**	**2,202,719**	**2,760,759**	**2,210,822**	50	100
AREA HARVESTED (Ha)	**3,819,560**	**3,589,460**	**3,331,410**	**3,149,340**	**3,005,820**	**2,692,332**	**2,735,723**	**2,725,875**	**2,354,208**	**2,642,208**	**3,004,594**	100	100
White	**2,738,540**	**2,583,370**	**2,350,890**	**2,098,370**	**1,865,870**	**1,670,318**	**1,695,615**	**1,698,964**	**1,451,249**	**1,607,755**	**1,976,094**	66	100
Yellow	**1,081,020**	**1,006,090**	**980,520**	**1,050,970**	**1,139,950**	**1,022,014**	**1,040,108**	**1,026,911**	**902,959**	**1,034,453**	**1,028,500**	34	100
YIELD/HECTARE (MT)	**1.3**	**1.3**	**1.4**	**1.5**	**1.5**	**1.5**	**1.5**	**1.6**	**1.6**	**1.7**	**1.5**		100
White	**1.1**	**1.1**	**1.1**	**1.3**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**		100
Yellow	**1.7**	**1.7**	**2.0**	**2.1**	**2.1**	**2.2**	**2.2**	**2.4**	**2.4**	**2.7**	**2.1**		100
THE BASIN*(%)	**11.7**	**10.3**	**14.6**	**9.7**	**11.8**	**15.4**	**11.9**	**16.3**	**15.8**	**23.8**	**14.0**		
PRODUCTION (MT)	**568,391**	**479,260**	**672,396**	**465,438**	**533,182**	**634,239**	**494,175**	**704,790**	**604,706**	**1,089,025**	**624,560**	100	14
White	**111,618**	**125,752**	**161,114**	**94,698**	**55,780**	**35,719**	**34,559**	**46,363**	**34,674**	**86,168**	**78,645**	13	4
Yellow	**456,773**	**353,508**	**511,282**	**370,740**	**477,402**	**598,520**	**459,616**	**658,427**	**570,032**	**1,002,857**	**545,916**	87	25
(% in the country)	**9.4**	**8.8**	**10.3**	**8.4**	**8.6**	**9.9**	**8.9**	**10.2**	**10.8**	**13.3**	**9.8**		
AREA HARVESTED (Ha)	**359,430**	**316,200**	**342,480**	**265,680**	**259,090**	**265,520**	**242,440**	**278,909**	**253,269**	**351,687**	**293,471**	100	10
White	**122,630**	**116,370**	**121,310**	**78,810**	**47,140**	**28,922**	**28,171**	**35,614**	**29,076**	**47,767**	**65,581**	22	3
Yellow	**236,800**	**199,830**	**221,170**	**186,870**	**211,950**	**236,598**	**214,269**	**243,295**	**224,193**	**303,920**	**227,890**	78	10
YIELD/HECTARE (MT)	**1.6**	**1.5**	**2.0**	**1.8**	**2.1**	**2.4**	**2.0**	**2.5**	**2.4**	**3.1**	**2.1**		140
White	**0.9**	**1.1**	**1.3**	**1.2**	**1.2**	**1.2**	**1.2**	**1.3**	**1.2**	**1.8**	**1.2**		109
Yellow	**1.9**	**1.8**	**2.3**	**2.0**	**2.3**	**2.5**	**2.1**	**2.7**	**2.5**	**3.3**	**2.4**		114
CAR													
PRODUCTION (MT)	17,551	13,465	24,308	22,117	26,804	29,369	27,947	34,969	33,498	59,162	28,919		
White	3,976	2,717	4,492	3,305	4,492	5,278	4,525	7,268	10,810	16,217	6,308		
Yellow	13,575	10,748	19,816	18,812	22,312	24,091	23,422	27,701	22,688	42,945	22,611		
AREA HARVESTED (Ha)	12,040	11,680	14,100	13,040	14,630	15,511	15,529	17,656	15,749	20,320	15,026		
White	2,910	2,080	2,700	2,300	3,130	3,427	3,026	4,213	5,789	7,315	3,689		
Yellow	9,130	9,600	11,400	10,740	11,500	12,084	12,503	13,443	9,960	13,005	11,337		
YIELD/HECTARE (MT)	1.5	1.2	1.7	1.7	1.8	1.9	1.8	2.0	2.1	2.9	1.9		
White	1.4	1.3	1.7	1.4	1.4	1.5	1.5	1.7	1.9	2.2	1.7		
Yellow	1.5	1.1	1.7	1.8	1.9	2.0	1.9	2.1	2.3	3.3	2.0		
REGION II													
PRODUCTION (MT)	550,840	465,795	648,088	443,321	506,378	604,870	466,228	669,821	571,208	1,029,863	595,641		
White	107,642	123,035	156,622	91,393	51,288	30,441	30,034	39,095	23,864	69,951	72,337		
Yellow	443,198	342,760	491,466	351,928	455,090	574,429	436,194	630,726	547,344	959,912	523,305		
AREA HARVESTED (Ha)	347,390	304,520	328,380	252,640	244,460	250,009	226,911	261,253	237,520	331,367	278,445		
White	119,720	114,290	118,610	76,510	44,010	25,495	25,145	31,401	23,287	40,452	61,892		
Yellow	227,670	190,230	209,770	176,130	200,450	224,514	201,766	229,852	214,233	290,915	216,553		
YIELD/HECTARE (MT)	1.6	1.5	2.0	1.8	2.1	2.4	2.1	2.6	2.4	3.1	2.1		
White	0.9	1.1	1.3	1.2	1.2	1.2	1.2	1.2	1.0	1.7	1.2		
Yellow	1.9	1.8	2.3	2.0	2.3	2.6	2.2	2.7	2.6	3.3	2.4		

Data source: BAS, 2000.

* The figure of the Cagayan River Basin includes provinces of Cagaayn, Isabela, Quirino, Nueva Vizcaya of Region II, and Kalinga, Apayao, Ifugao and Mountain Province of CAR
Production in metric ton in paddy form.

Table 4.1.1 Present Land Use to Proposed Land Use Plan in 2020 by SAFDZ Zoning

SAFDZ No.	SAFDZ No. / Proposed : 2020 / Present Land Use	1 Crop	2 Livestock	3 Fishery	8 Remaining NPAAAD	x Grasses /Shrubs	9 Agro-Forestry	10 Watershed /Forestry	11 Built-up areas	Total
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/Shurubs	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 4.1.2 Proposed Land Use Plan

(Unit: 1,000 ha)

Land Use	Present	Proposed (2020)	Increase/ decrease (-)	Remarks
Agricultural area				
Rice field	472.5	528.0	55.5	in gross
Corn field	137.3	120.8	-16.5	
Other diversfied cropland	66.6	41.2	-25.4	
Fruit tree, etc.	40.9	27.3	-13.6	
Sub-total	717.3	717.3	0.0	
Grassland				
Pasture	103.5	152.3	48.8	
Wild grass	471.4	83.1	-388.3	
Shrub	274.2	48.4	-225.8	
Sub-total	849.1	283.8	-565.3	
Agro-Forest		105.1	105.1	
Forest	1,097.5	1,386.8	289.3	
Others				
Slash and Burn Cultivation	0.2	0.0	-0.2	Kaingin
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 4.2.1 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			
Present condition 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)
	several times/year ..... once/several years period: 2-7 days / depth: 2-5 m in 1973						
related problem	channel course change siltation*[2]					slope slide	
Land use plan	with flood control*[3]						*3: inundation less than 3-day = not so serious (DA-02, APC)
	by irrigation/extension			by rehabilitation /improvement	improved	by spray/drip irrigation	
example	paddy-paddy, paddy-paddy-veg. corn- water melon/vegetable		paddy-paddy-bean/vegetables paddy-paddy-corn		pasture	vegetable/fruits	*4: Alcala-Amulung West PIP *5: IAAPIS, SPIS
	*4			*5			
agr-intensity	middle	high	high	high	low	very 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 weir from tributary					natural	
distribution	gravity				gravity/pump	gravity/pump	

Table 4.2.2 Paddy and Corn Production Plan

	Present (1)	Proposed (2020) (2)	(2)/(1)
Paddy			
Physical area (1,000 ha): Ap			
gross	473	528	1.12
net	331	396	1.20
irrigated	218	298	1.37
rainfed	113	98	0.87
Cropping Intensity (%): CI			
irrigated	170	250	1.47
rainfed	110	130	1.18
Harvested area (1,000 ha): Ah			
irrigated	371	745	2.01
rainfed	124	127	1.02
Total	495	872	1.76
Yield (t/ha)			
irrigated	3.5	4.75	1.36
rainfed	1.8	2.2	1.22
Production (1,000 t): P			
irrigated	1,297	3,539	2.73
rainfed	224	280	1.25
Total	1,521	3,819	2.51
Corn			
Ap (1,000 ha)			
gross	137	114	0.83
net	123	103	0.83
CI (%)	195	220	1.13
Ah (1,000 ha)	240	226	0.94
Yeild (t/ha)	2.1	3.75	1.79
P (1,000 t)	505	846	1.68

Source: Present = Estimate based on data from BAS, 2000
Proposed = by the Study Team

Table 4.3.1 Projected Paddy Production and Rice Supply under NIA Corporate Plan 1993-2002

for the whole country (The Philippines

Year		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Yield	(MT/ha)										
Irrigated		3.46	3.52	3.59	3.66	3.73	3.80	3.87	3.94	4.02	4.10
Rainfed		2.17	2.21	2.24	2.27	2.30	2.33	2.35	2.37	2.39	2.41
		2.92	2.98	3.04	3.11	3.17	3.24	3.31	3.37	3.45	3.50
Annual Rice Area	(1,000 ha)										
Irrigated		1,976.78	2,017.62	2,063.92	2,111.36	2,150.81	2,205.00	2,257.32	2,307.51	2,357.14	2,407.32
Rainfed		1,433.23	1,405.47	1,373.85	1,341.21	1,313.92	1,276.25	1,239.72	1,204.37	1,169.22	1,133.47
Total		3,410.01	3,425.36	3,444.88	3,462.86	3,483.22	3,504.91	3,522.85	3,540.81	3,560.46	3,596.45
Palay Production	(1,000 MT)										
Irrigated		6,839.67	7,102.03	7,409.47	7,727.59	8,022.52	8,379.00	8,735.83	9,091.59	9,475.70	9,870.00
Rainfed		3,110.10	3,106.08	3,077.41	3,044.54	3,022.02	2,973.66	2,913.35	2,854.36	2,794.44	2,731.66
Total		9,949.77	10,208.11	10,486.88	10,772.13	11,044.54	11,352.66	11,649.18	11,945.95	12,270.14	12,601.66
Seeds, feeds, wasted (9.5 %)	(1,000 MT)	945.23	969.77	996.25	1,023.35	1,049.23	1,078.50	1,106.67	1,134.87	1,165.66	1,197.16
Palay for Consumption	(1,000 MT)	9,004.54	9,238.34	9,490.63	9,748.78	9,995.31	10,274.16	10,542.51	10,811.08	11,104.48	11,404.50
Miling Recovery Rate		0.66	0.66	0.66	0.66	0.66	0.67	0.67	0.67	0.67	0.67
Rice for Consumption	(1,000 MT)	5,943.00	6,097.30	6,263.81	6,434.19	6,596.90	6,883.69	7,063.48	7,243.43	7,440.00	7,641.02
Demand											
Population	(Million)	64.72	66.13	67.56	69.03	70.54	72.07	73.64	75.24	76.88	78.55
Per Capita Demand	(kg)	98.55	98.99	99.42	99.86	100.30	100.74	101.18	101.63	102.07	102.52
Total Demand	(1,000 MT)	6,377.96	6,545.82	6,717.29	6,893.81	7,074.83	7,260.46	7,450.83	7,646.79	7,846.98	8,053.05
Surplus(+)/Deficit(-)	(1,000 MT)	(434.96)	(448.52)	(453.48)	(459.62)	(477.93)	(376.77)	(387.35)	(403.36)	(406.98)	(412.03)

Source: "Corporate Plan, 1993-2002", Jun. 1993, NIA, p.62 Table 6.1

Table 4.3.2 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 (11) = (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)	Rehabili-tation (5)	NIS (6)	converted to CIS (7)	Rehabili-tation (8)	Extension (new) (9)	Restored (10)	listed NIP (11)	Rehabili-tation (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	SPIS: Solana PIS
Pinacanauan River Irrigation System	PRIS	1,200				1,200	880		305					-320	
Tumauini Irrigation System	TIS	3,987				3,987	3,615		1,130		91	6,600		-372	Multipurpose Project: FS/IP prepared
Chico River Irrigation System	CRIP	20,108					1,856 9,842 7,709							-701	LCRIS: Lower Chico RIS UCRIS: Upper Chico RIS-Quezon Phase I: 17,551ha fm NIA CAR
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	IAAPIS: Iguig Alcala Amulung PIS MPIS: Magapit PIS
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		 2,010	650 323				12,600		2,010	 Nueva Vizcaya Bagabag Irr,Sys.?
Dabubu River IrrigationProject					1,000							1,000			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 Irrgation 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 4.3.3 List of Candidate Scheme for Proposed Irrigation Development in Long Term Plan

FC=Flood Control

Candidate Scheme for Long Term Plan		*1	Location		Irrigation Area				Without FC	Additional to FC
			Province	Municipality	Total (ha)	New/ extension (ha)	Rehabili./ improve't (ha)	Cost (mil.P)	Financial 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	Tumauini	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	EPIP		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								376	215	324
13. Magapit Pump Irrigation System	MPIS	*	Cagayan	Lallo	10,914		10,914			
14. Iquig-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. Pinacanuan River Irrgation 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. Tumauini Multipurpose (Reservoir) Project	TRP	(*)	Isabela	Tumauini	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 IrrigationProject	IPIP		Isabela	Ilagan	5,000	5,000		1,184	276	292
25. Napaccu 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	SMPIP		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 4.3.4 List of Candidate Scheme for Proposed Irrigation Development in Long Term Plan and Reviewed Master Plan

FC=Flood Control

Candidate Scheme for Long Term Plar		*1	Location Province	Municipality	EIRR (%) Without FC (1)	Additional to FC (2)	Both (1) and (2) < 15 %	Long Term Plan	Candidate for Reviewed M/P ref. to Subsec.10.8.3 (3) (Package 1- irrigation component) IL	IS	Without FC in Rev.MP	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 New fund	NIA regular fund
I. Affected by Flood (Need Flood Control)																			
1. Alcala Amulung West Irrigation Projec	AAWPIP		Cagayan	Alcala, Amulung	15.5*2	22.8		O	O	-				O	--->	--->	O	O	-
2. Solana Pump Irrigation System-Reh. & Ext. Projec	SPIS-REP	(*)	Cagayan	Solana	26.7*2	25.0		O	O	-					--->	--->	O	O	-
3. Mamil Pump Irrigation Projec	MPIP		Cagayan	Enrile	11.1	19.9		O	-	O	y	11.1	X				-	-	-
4. Santa Isabel Pump Irrigation Projec	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	Tumauini	9.6	19.0		O	-	-	y	9.6	X				-	-	-
7. Lulutan Pump Irrigation Projec	LAPIP		Isabela	Gamu	12.3	18.1		O	-	-	y	12.3	X				-	-	-
8. Gamu Pump Irrigation Projec	GPIP		Isabela	Gamu	10.9	18.5		O	-	-	y	10.9	X				-	-	-
9. Enrile Pump Irrigation Projec	EPIP		Cagayan	Enrile	17.8	23.1		O	O	-					--->	--->	O	O	-
10. Zinundungan Irrigation Extension Projec	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 Projec	NPIP		Cagayan	Gattaran	18.5	21.8		O	-	O				O	--->	--->	O	O	-
Rehabilitation of CIADP (Magapit & Iguig-Alcala-Amulung PIS					26.7	31.0								O	--->	--->	O	O	-
13. Magapit Pump Irrigation Systen	MPIS	*	Cagayan	Lallo				O	-	O									
14. Iguig-Alcala-Amulung Pump Irrigation Syster	IAAPIS	*	Cagayan	Iguig, Amulung				O	O	-									
15. Dummun River Irrigation Systen	DRIS	*	Cagayan	Gattaran	8.6	10.3	X	-									-	-	-
16. Pinacanuan River Irrgation Systen	PRIS	*	Cagayan	Penablanca	28.2	31.9		O	-	O	y	28.2			-	O	O	O	-
17. San Pablo-Cabagan Irrigation Systen	SPCIS	*	Isabela	San Pablo	23.1	27.0		O	-	O	y	23.1			-	O	O	O	-
18. Santa Maria Communal Pump Irrigation Systen	SMPIS	*	Isabela	Sta. Maria	23.1	27.3		O	-	O	y	23.1			-	O	O	-	O
19. Delfin Albano Pump Irrigation Projec	DAPIP		Isabela	Delfine Albano	18.5	21.8		O	-	O	y	18.5		O	--->	--->	O	O	-
20. Tumauini Multipurpose (Reservoir) Project	TRP	(*)	Isabela	Tumauini	17.8	20.4		O	-	O	y	17.8		O	--->	--->	O	O	-
21. Upper Chico River Irrigation Systen	UCRIS	*	Kal./Isa.	Tabuk/Quezon	27.8	31.4		O	-	-	y	27.8			-	O	-	-	-
22. Mallig River Irrigation Systen	MRIS	*	Isabela	Mallig. Quezon	31.5	35.5		O	-	-	y	31.5			-	O	O	O	-
23. Nueva Vizcaya Bagabag Irrigation Systen	NVBIS	*	N. Viz.	Bagabag	33.0	37.1		O	-	-	y	33.0			-	O	O	O	-
24. Ilagan Pump IrrigationProjec	IPIP		Isabela	Ilagan	16.5	17.2		O	-	-	y	16.5			O	-	O	-	O
25. Napaccu Pump Irrigation Projec	NAPIP		Isabela	Reina Mercedes	15.2	18.2		O	-	-	y	15.2			X	-	-	-	-
26. Tagaran Pump Irrigation Projec	TPIP		Isabela	Cauayan	15.2	17.7		O	-	-	y	15.2			X	-	-	-	-
27. Reina Mercedes Pump Irrigation Projec	RMPIP		Isabela	Reina Mercedes	15.0	17.5		O	-	-	y	15.0			X	-	-	-	-
28. Sto. Nino Pump Irrigation Projec	SNPIP		Cagayan	Sto Nino	16.8	17.6		O	-	-	y	16.8			O	-	O	O	-
Total								27	4	11							16	14	2
II. No Need of Flood Control																			
1. Upper Ilagan Western Brgy. Pump Irrigation Projec	UIWBPIP		Isabela	Ilagan	16.8	-		O	-	-	-	16.8			O	-	O	-	O
2. San Agustin Pump Irrigation Project	SAPIP		Isabela	San Agustin	16.1	-		O	-	-	-	16.1			X	-	-	-	-
3. Dibuluan River Irrigation Projec	DRIP		Isabela	San Agustin	19.8	-		O	-	-	-	18.4		O	--->	--->	O	-	O
4. Dabubu Irrigation Projec	DIP		Isabela	San Agustin	18.6	-		O	-	-	-	18.6			O	-	O	O	-
5. Rizal Irrigation Projec	RIP		Kalinga	Rizal	19.1	-		O	-	-	-	16.6		O	--->	--->	O	-	O
6. Baggao Irrigation Systen	BIS	*	Cagayan	Baggao	7.0	-	X	-									-	-	-
7. Lower Chico River Irrigation Systen	LCRIS	*	Cagayan	Tuao	29.0	-		O	-	-	-	29.0			-	O	O	-	O
8. Bantug Pump Irrigation Systen	BPIS	*	Isabela	Angadanan	22.8	-		O	-	-	-	22.8			-	X	-	-	-
9. San Mariano Pump Irrigation Projec	SMPIP		Isabela	San Mariano	17.8	-		O	-	-	-	17.8		O	--->	--->	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	-	O
12. Villaverde IP	VIP		N.Viz.	Villaverde	17.0	-		O	-	-	-	16.1		O	--->	--->	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 4.3.5 List of Proposed Irrigation Development Scheme in Reviewed Master Plan and Selection of Pre-Feasibility Study Project

FC=Flood Control

Proposed Scheme for Reviewed Master Plan		*1	Location		Irrigation Area		Without FC	Additional to FC	Selection of Pre-FS Project (if yes, 1 point)						
							Financial		Related	Preparedness		Equitable develop't		Total point	Pre-FS
			Province	Municipality	(ha)	Cost (mil.P)	Benefit (mil.P/yr)	Benefit (mil.P/yr)	FC: proposed in Rev.MP	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 Projec	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										
Iquig-Alcala-Amulung Pump Irrigation Systen	IAAPIS	-	Cagayan	Iguig, Amulung	2,306										
8. Pinacanuan River Irrgation 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. Tumauini Multipurpose (Reservoir) Project	TRP	(*)	Isabela	Tumauini	6,600	2,349	524	654	0	1	1	0	0	2	
12. Mallig River Irrigation Systen	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 IrrigationProject	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	1	0	1	1	3	
7. Villaverde IP	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 5.1.1 Reference Crop Evapotranspiration

Method : FAO Penman Monteith method
Project : Alcala Amulung West Pump Irrigation Project

Year : averaged year

Longitude: E 121□40'
Latitude : N 17□50'
Altitude : EL 10 - 20 m.amsl

	Data and elements		Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
	Tuguegarao															
1.	Temperature	Tmax	□C	29.6	30.3	33.8	35.9	36.8	35.7	34.9	34.2	33.6	32.2	30.1	28.8	33.0
		Tmin	□C	22.8	22.7	20.9	22.6	23.7	23.8	23.6	23.6	23.3	22.5	21.6	20.3	22.6
2.	Relative humidity	RH	%	81	82	73	69	69	72	74	76	77	79	82	82	76
3.	Sunshine hour	n	hour	4.0	4.6	7.1	7.8	7.4	7.3	6.6	5.7	5.6	4.8	3.8	3.1	5.7
4.	Wind velocity	U2	km/day	59	52	104	117	104	106	100	82	82	108	99	102	93
	Reference Crop	ETo	mm/day	3.3	3.5	4.5	4.8	4.4	4.1	3.9	3.8	4.0	3.9	3.4	3.0	3.9
	Evapotranspiration		mm/month	102	99	140	144	137	124	122	119	121	121	102	94	1426

Source : FAO Irrigation and Drainage Paper No.56, "Crop vapotranspiration", 1998

Table 5.1.2 Calculation of Water Duty for Higher Plain in AAWPIP

AAWPIP: Alcala Amulung West Pump Irrigation Projec

Month			Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Cropping Pattern			Dry Season				Wet Season Paddy				Legumes, Corn, 50%			
Probable Rainfall (1/5)	R(80)	mm	5	1	4	8	60	85	86	119	108	161	83	13
Reference Evapotranspiration	ETo	mm	102	99	140	144	137	124	122	119	121	121	102	94
Dry Season Paddy														
Crop Coefficient	Kc		1.09	1.17	1.11	0.98								1.05
Crop Evapotranspiration	ETcrop	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	fa		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
Wet Season Paddy														
Crop Coefficient	Kc					1.05	1.06	1.13	1.16	1.04				
Crop Evapotranspiration	ETcrop	mm					145.2	140.1	141.5	123.8				
Percolation	P	mm					46.5	45.0	46.5	46.5				
Area Factor	fa					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				
Wet Season Legumes, etc														
Crop Coefficient	Kc									0.40	0.51	1.02	0.89	0.85
Crop Evapotranspiration	ETcrop	mm								47.6	61.7	123.4	90.8	79.9
Area Factor	fa									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 5.1.3 Calculation of Water Duty for Lower Plain in AAWPIP

AAWPIP: Alcala Amulung West Pump Irrigation Projec

Month			Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Cropping Pattern			Dry Season				Wet Season Paddy				Legumes, Corn, 50%			
Probable Rainfall (1/5)	R(80)	mm	5	1	4	8	60	85	86	119	108	161	83	13
Reference Evapotranspiration	ETo	mm	102	99	140	144	137	124	122	119	121	121	102	94
Dry Season Paddy														
Crop Coefficient	Kc		1.09	1.17	1.11	0.98								1.05
Crop Evapotranspiration	ETcrop	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	fa		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
Wet Season Paddy														
Crop Coefficient	Kc					1.05	1.06	1.13	1.16	1.04				
Crop Evapotranspiration	ETcrop	mm					145.2	140.1	141.5	123.8				
Percolation	P	mm					62.0	60.0	62.0	62.0				
Area Factor	fa					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				
Wet Season Legumes, etc														
Crop Coefficient	Kc									0.40	0.51	1.02	0.89	0.85
Crop Evapotranspiration	ETcrop	mm								47.6	61.7	123.4	90.8	79.9
Area Factor	fa									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 5.1.4 Summary of Inundation Analysis for AAWPIP

Drainage Area (DA)	Catchment area	Max. drainage discharge	Highest outside water level	Longest Inundation duration	Highest inside water level	Max. inundation area	Max. inundation volume	Design capacity of sluice	Remarks
	CA (ha)	Qin-max (m3/s)	WLo-max (masl)	Ti-max (hour)	WLi-max (masl)	Amax (ha)	Vmax (million m3)	Oout-cap (m3/s)	
DA 1	1,520	23.3	17.89	107	12.43	114	1.16	20.5	
DA 2	12,500	191.2	18.10	130	11.12	749	13.06	131.8	Figure 5.1.4
DA 3	770	11.8	18.59	126	12.45	199	0.82	15.0	
DA 4	2,260	34.6	20.04	217	9.66	514	4.17	60.0	
DA LP*	35,000	535.4	20.04	223	14.19	2,036	61.67	200.0	Figure 5.1.5

Note: This calculation is made to the Cagayan River flood of 25-year probability
* Lower Pangul River area after proposed river training and outside of the Project are
Qin and WLo are derived from hydrological study

Table 5.1.5 Estimate of Monthly Pumping Quantity and Operation Cost for AAWPIP

AAWPIP: Alcala Amulung Pump Irrigation Proje

		Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
1. Gross Irrigation Requiremen															
for present paddy fiel		mm	435	274	293	61	387	191	94	6	0	0	0	154	1,895
		lit/s/ha	1.62	1.13	1.09	0.24	1.44	0.74	0.35	0.02	0.00	0.00	0.00	0.57	
for present corn fiel		mm	463	300	319	65	411	219	124	20	0	0	0	167	2,088
		lit/s/ha	1.73	1.24	1.19	0.25	1.53	0.84	0.46	0.07	0.00	0.00	0.00	0.62	
2. Average Irrigation Water (million m3															
Intake Pump Statior															
Stage 1	4,090	ha	17.79	11.21	11.98	2.49	15.83	7.81	3.84	0.25	0.00	0.00	0.00	6.30	77.50
Stage 2	2,970	ha	13.75	8.91	9.47	1.93	12.21	6.50	3.68	0.59	0.00	0.00	0.00	4.96	62.00
Stage 1 & 2	7,060	ha	31.54	20.12	21.45	4.42	28.04	14.31	7.52	0.84	0.00	0.00	0.00	11.26	139.50
Booster Pump Statior															
Stage 1	1,700	ha	7.4	4.66	4.98	1.04	6.58	3.25	1.6	0.1	0	0	0	2.62	32.23
Stage 2	1,960	ha	9.07	5.88	6.25	1.27	8.06	4.29	2.43	0.39	0	0	0	3.27	40.91
Stage 1 & 2	3,660	ha	16.47	10.54	11.23	2.31	14.64	7.54	4.03	0.49	0.00	0.00	0.00	5.89	73.14
3. Pump Operation Power (MWH															
Intake Pump Statior															
Stage 1			1,389	875	935	194	1,237	611	299	20	0	0	0	491	6,051
Stage 1 & 2			2,464	1,572	1,676	346	2,191	1,116	587	66	0	0	0	878	10,896
Booster Pump Statior															
Stage 1			145	91	97	20	129	63	31	2	0	0	0	51	629
Stage 1 & 2			322	206	219	45	286	147	79	9	0	0	0	115	1,428
4. Estimated Pump Operation Cost (million Peso															
Intake Pump Statior															
Stage 1			3.33	2.10	2.24	0.47	2.97	1.47	0.72	0.05	0.00	0.00	0.00	1.18	14.52
Stage 1 & 2			5.91	3.77	4.02	0.83	5.26	2.68	1.41	0.16	0.00	0.00	0.00	2.11	26.15
Booster Pump Statior															
Stage 1			0.35	0.22	0.23	0.05	0.31	0.15	0.07	0.01	0.00	0.00	0.00	0.12	1.51
Stage 1 & 2			0.77	0.49	0.53	0.11	0.69	0.35	0.19	0.02	0.00	0.00	0.00	0.28	3.43
Stage 1 total			3.68	2.32	2.48	0.51	3.28	1.62	0.79	0.05	0.00	0.00	0.00	1.30	**16.03**
Stage 1& 2 total			6.69	4.27	4.55	0.94	5.94	3.03	1.60	0.18	0.00	0.00	0.00	2.38	**29.58**

Table 5.1.6 List of Main and Lateral/Sublateral Canal with Related Structure

Canal Name	Point/ section	Irrigation Area (ha)	Design Discharge (m3/s)	Length (m) Total	Stage I	Stage II	Botom width b (m)	Related structure (no.) Culvert	Siphon	L (m)	Cross-drain	Footpath
Main Canal	P/S											
	HG1	7,063	12.29	4,500	4,500	-	5.00	5	0		16	0
	HG2	6,520	11.34	4,500	4,500	-	5.00	2	0		6	0
	HG3	4,278	7.47	6,000	6,000	-	4.00	4	1	*50*	7	0
	HG4	3,836	6.72	1,500	1,500	-	4.00	3	0		2	0
	B-P/S	3,656	6.41	0	0	-	-	0	0		0	0
	HG5	3,656	6.41	0	0	-	-	0	0		0	0
	HG6	2,837	5.02	2,500	2,500	-	3.00	2	1	*500*	2	0
	HG7	2,657	4.71	2,500	2,500	-	3.00	1	0		2	5
	HG8	1,676	2.95	2,500	2,500	-	2.50	0	0		2	5
	HG9/10	1,362	2.41	3,500	3,500	-	2.50	3	0		2	6
										50		
Total of MC				27,500	27,500	-		20	2	*500*	39	16
LC1	HG1									*20*		
	EP	404	0.71	5,900	5,900	-	1.20	2	2	*200*	2	12
LC2	HG2											
	HG2-1	1,877	3.25	2,300	2,300	-	2.00	0	1	*150*	0	5
	HG2-2	1,649	2.86	2,100	2,100	-	2.00	0	0		0	4
	HG2-3	670	1.14	1,000	1,000	-	2.00	1	0		1	2
	EP	507	0.86	2,500	2,500	-	1.20	1	0		0	5
sub-total				7,900				2	1	*150*	1	16
SLC2-1	HG2-1											
	EP	228	0.39	750	750	-	1.00	1	0		0	1
SLC2-2	HG2-2											
	EP	683	1.22	3,800	3,800	-	1.50	0	0		5	8
SLC2-3	HG2-3											
	EP	162	0.28	1,400	1,400	-	1.00	1	0		0	3
LC3	HG3											
	EP	190	0.32	1,000	1,000	-	1.00	0	0		0	2
LC4	HG4											
	EP	67	0.11	1,000	1,000	-	1.00	0	0		2	2
LC5	HG5											
	HG5-1	819	1.39	1,800	1,800	-	2.00	0	0	*20*	3	3
	EP	462	0.79	3,900	3,900	-	1.50	5	2	*50*	3	0
sub-total				5,700				5	2	*20*	6	3
SLC5-1	HG5-1									*50*		
	EP	356	0.61	5,500	5,500	-	1.20	6	3	*20X3*	2	0
LC6	HG6											
	EP	181	0.31	2,800	2,800	-	1.00	3	0		3	6
LC7	HG7											
	HG7-1	981	1.77	2,100	-	2,100	2.00	0	0		2	4
	HG7-2	572	1.03	2,400	-	2,400	1.50	0	0		0	5
	HG7-3	363	0.65	1,700	-	1,700	1.20	0	0		0	3
	EP	106	0.19	1,000	-	1,000	1.00	0	0		0	2
sub-total				7,200				0	0		2	14
SLC7-1	HG7-1											
	EP	309	0.56	3,000	-	3,000	1.00	0	0		1	6
SLC7-2	HG7-2											
	EP	209	0.38	1,000	-	1,000	1.00	0	0		0	2
SLC7-3	HG7-3											
	EP	257	0.46	3,000	-	3,000	1.00	0	0		0	6
LC8	HG8											
	EP	154	0.26	900	900	-	1.00	0	0		0	1
LC9	HG9											
	HG9-1	463	0.83	900	-	900	1.50	0	0		0	2
	EP	217	0.39	2,300	-	2,300	1.00	0	0		0	4
sub-total				3,200				0	0		0	6
SLC9-1	HG9-1											
	EP	71	0.13	1,000	-	1,000	1.00	1	0		0	2
LC10	HG10											
	HG10-1	441	0.78	1,600	1,600	-	1.50	1	1	*150*	0	3
	EP	146	0.26	1,900	-	1,900	1.00	0	0		0	4
sub-total				3,500				1	1	*150*	0	7
SLC10-1	HG10-1											
	EP	199	0.36	3,200	-	3,200	1.00	0	1	20	1	6
Total of LC/SLC				61,750	38,250	23,500		22	10		25	103
TOTAL of Main System				**89,250**	**65,750**	**23,500**		**42**	**12**		**64**	**119**

Table 5.1.7 Summary of Quantities for Alcala Amulung West Pump Irrigation Project

Work item	Unit	Quantity			Remarks
		Phase I	Phase II	Total	
1. General Item					
(1) Mobilization/demobilizatior	L.S.				
(2) Temporary works	L.S.				
(3) Preparatory works	L.S.				
2. AAWPIP Pump Statior					
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 towe	L.S.	1	-	1	5km, 2 towers
(2) Sub-station	L.S.	1	-	1	
(3) Pump & Motor with appurtenan	L.S.	1	-	1	
(4) Screen	L.S.	1	-	1	
(5) Desiliting facilities	L.S.	1	-	1	
2.3 Building and concrete work					
(1) Pump house	L.S.	1	-	1	
(2) Pump sump: concrete "A	m3	1200	-	1,200	
3. Booster Pump Statior					
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 appurtenan	L.S.	1	-	1	
(4) Screen	L.S.	1	-	1	
2.3 Building and concrete work					
(1) Pump house	L.S.	1	-	1	
(2) Pump sump: concrete "A	m3	120	-	120	
4. Main Irrigation Systen					
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 pavemen	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 drair	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	1,238,900	I/2: 6km
(3) Concrete lining (Class "B"	m3	11,900	10,700	22,600	
(4) Concrete pavemen	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 drair	no.			25	
(6) Others	L.S.				10% of total
5. On-farm Systen					
(1) Farm Ditch & Drain with related structur	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 channe					
(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	I/5: 6km
(2) Sluice	no.	-	2	2	
8. Supprting Measures					
(1) Rice Mill	no.	4	3	7	
(2) Drying yarc	m2	97,000	73,000	170,000	

Table 5.3.1 Resettlement Area for Flood Control Project

Municipality	Household to be relocated	Area (ha)	Resettlement Plan				
			Location	Bank*	Topography	Phase	Time
Lasam	872	17.4	Minanga Sur	Left	along dike	2	2007-2010
			Callao Norte	Left	along dike		
			Callao Sur	Left	along dike		
			Aggunetan	Left	along dike		
			Calapangan Norte	Left	along dike		
Alcala	359	7.2	Poblacion	Right	hill	2	2007-2010
			Tamban	Left	hill		
Amulung	918	18.4	Anquiray	Right	hill	3	2010-2014
			Annabuculan/Unag	Left	corn field		
Iguig	784	15.7	Mallabac or adjacent area	Right	hill	3	2010-2014

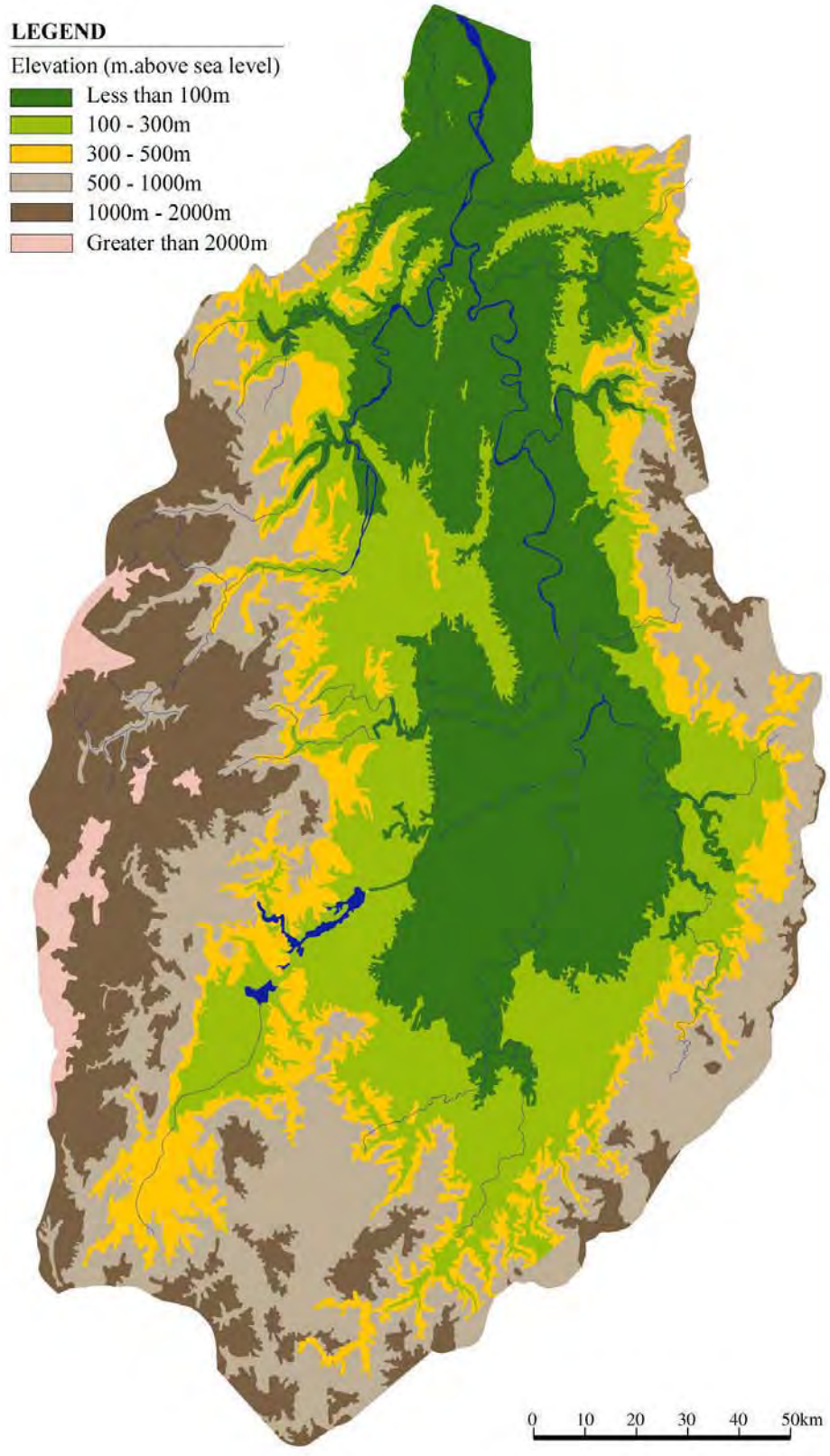
Note: * = left or right bank of the Cagayan Rive

Table 5.3.2 Resettlement Plan for Alcala Amulung West Pump Irrigation Project

Phase	Location	Household to be relocated	Proposed Resettlement site*1			Proposed Time	Estimated Compensation (1,000 Peso)
			Distance (km)	Municipality	Barangay		
Phase 1	Main Canal	2	< 0.5	Alcala	Tamban	2003-2004	120
	Main Canal	1	< 0.5	Alcala	Afusing Daga*2	2003-2004	60
	Main Canal	1	< 0.5	Amulung	Bayabat	2003-2005	60
	Main Canal	3	< 0.5	Amulung	Casingsingan Norte	2003-2005	180
	Sub-Lateral Canal 2-2	1	< 0.5	Amulung	Masical	2003-2005	60
sub-total		8					480
Phase 2	Lateral Canal 9	1	< 0.5	Amulung	Unag	2010-2011	60
Total		9					540

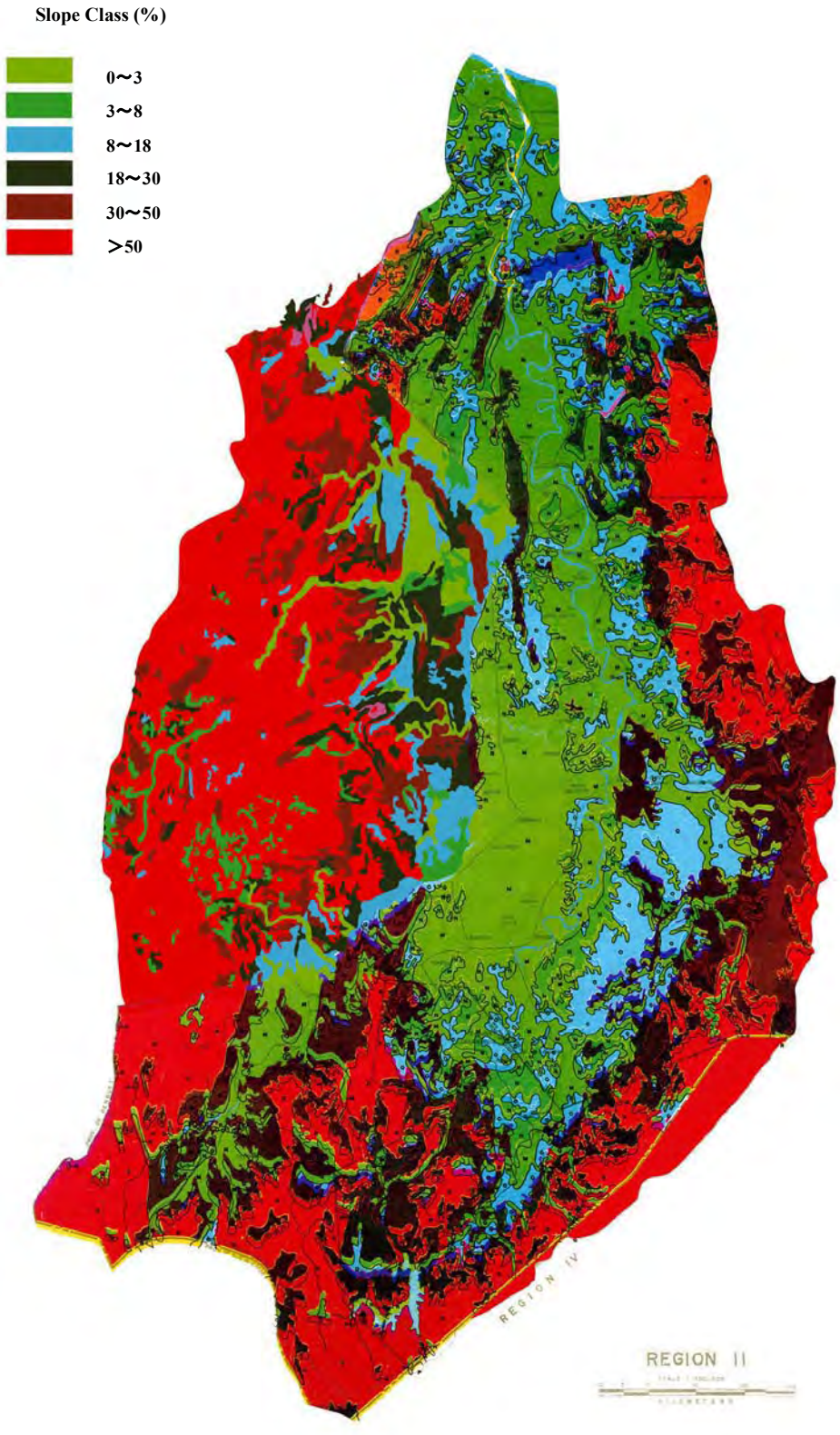
*1: Distance = distance from original location
Municipality and Barangay are the same as before resettlement
*2: or Malalatan

Figures



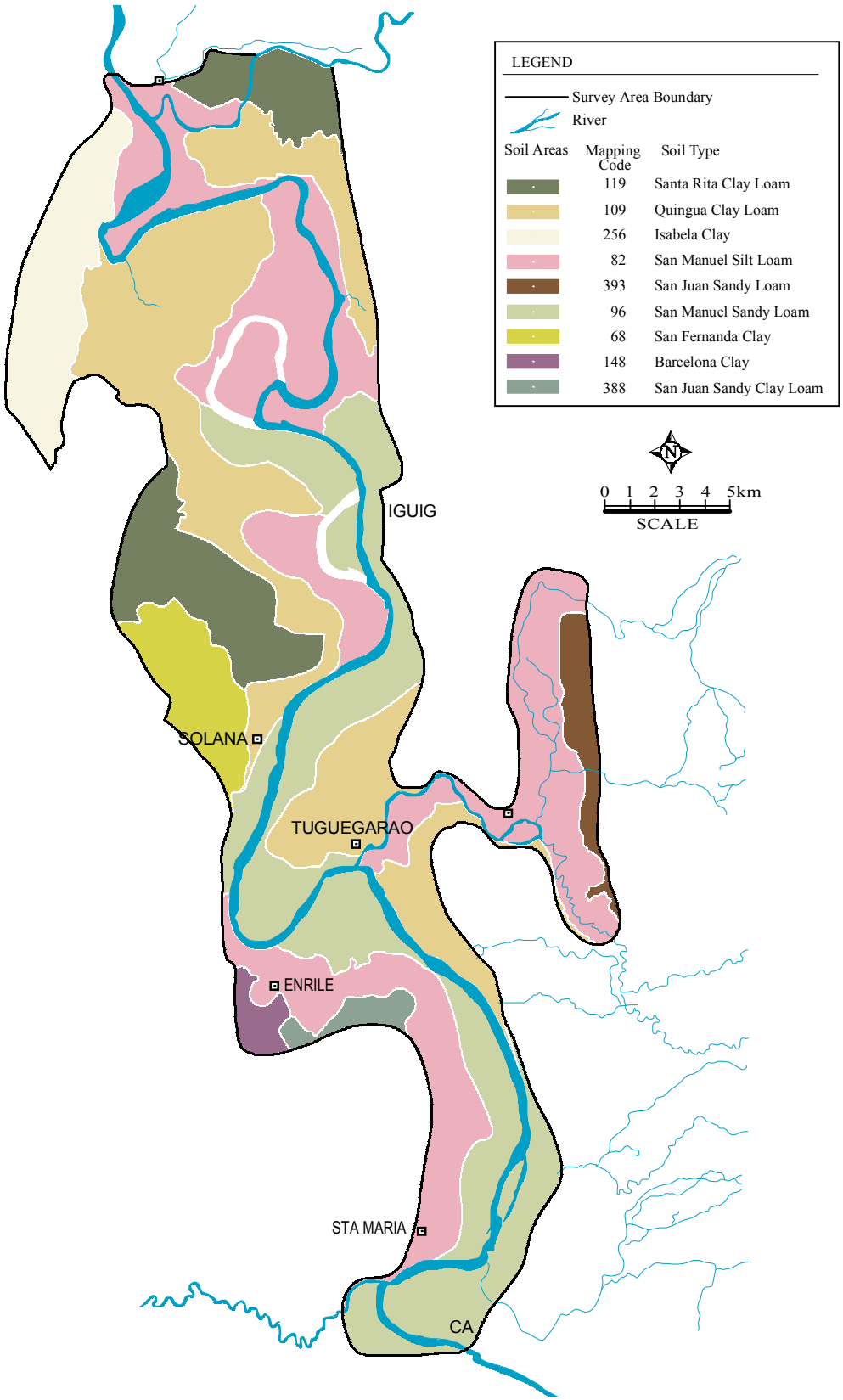
Source: "Philippine Land and Soils Management Atlas for Cagayan Valley, Region II, 1995" BSWM and "Elevation Map, Land Use Assessment for Potential Agri-Environmental Development and Investment for CAR", Nov. 1990, BSWM. CAR

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.1.1**
JAPAN INTERNATIONAL COOPERATION AGENCY	**Elevation Map**



Source: "Philippine Land and Soils Management Atlas for Cagayan Valley, Region II, 1995" BSWM and "Slope Map, Land Use Assessment for Potential Agri-Environmental Development and Investment for CAR", Nov. 1990, BSWM. CAR

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.1.2**
JAPAN INTERNATIONAL COOPERATION AGENCY	**Slope Map**



Source: Prepared by the JICA Study Team in 2000

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

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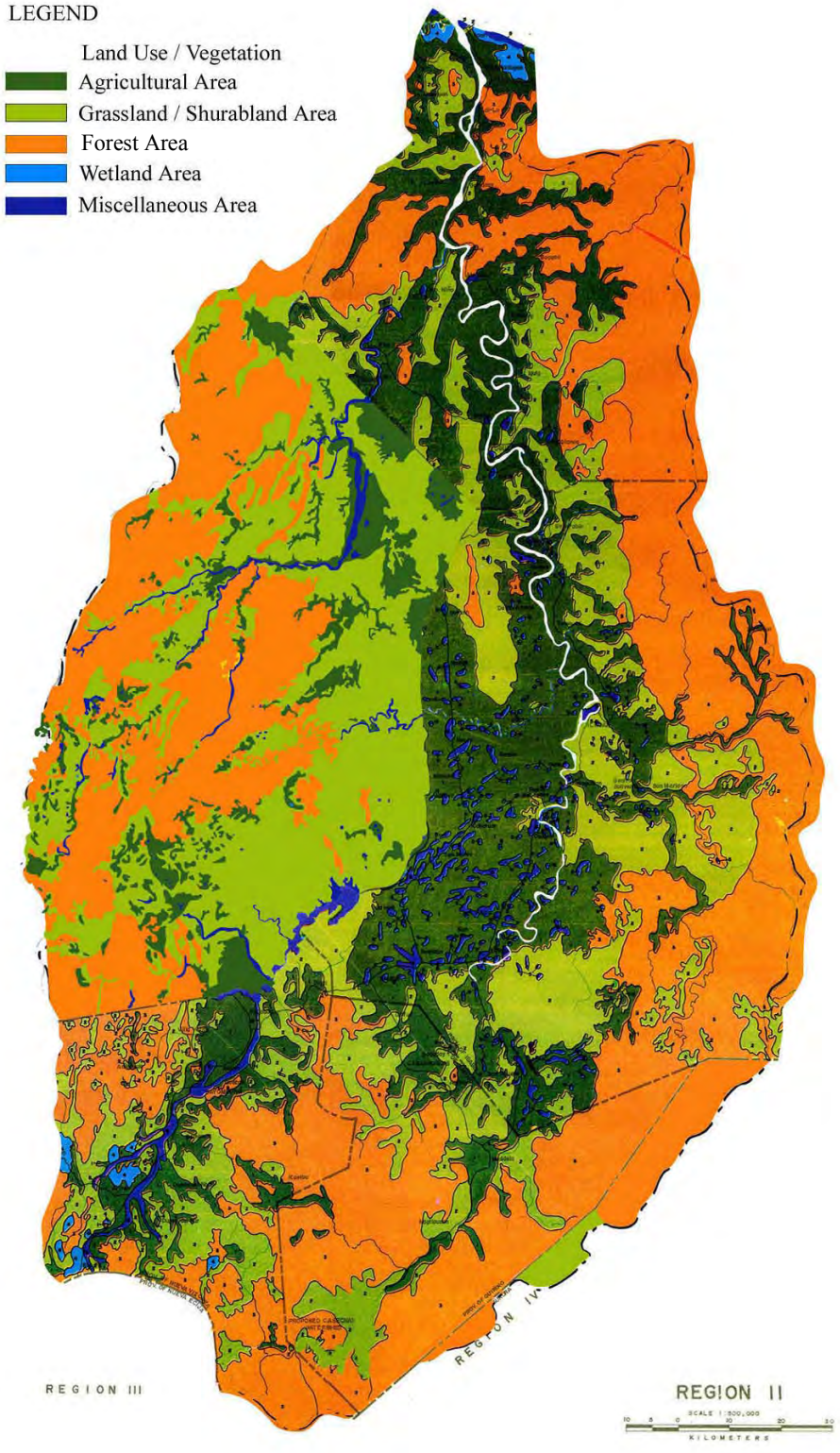
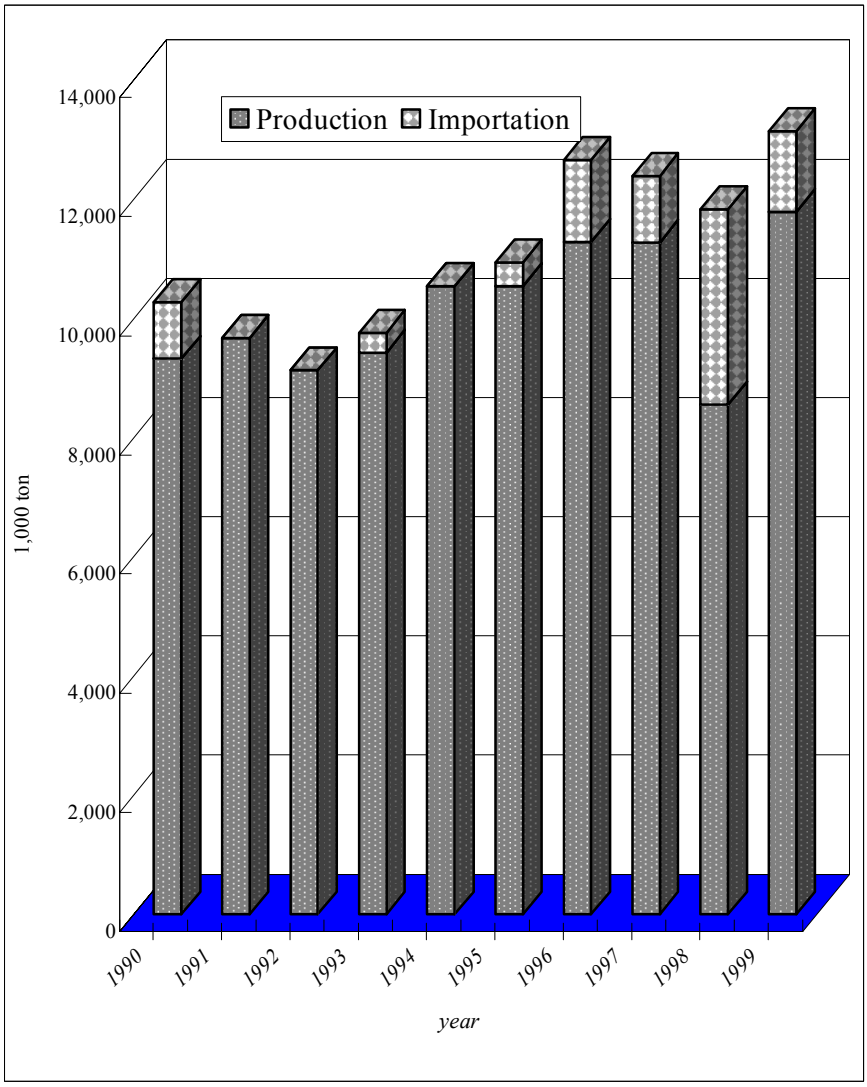
Figure 2.1.3

Soil Map between Alcala and Cabagan

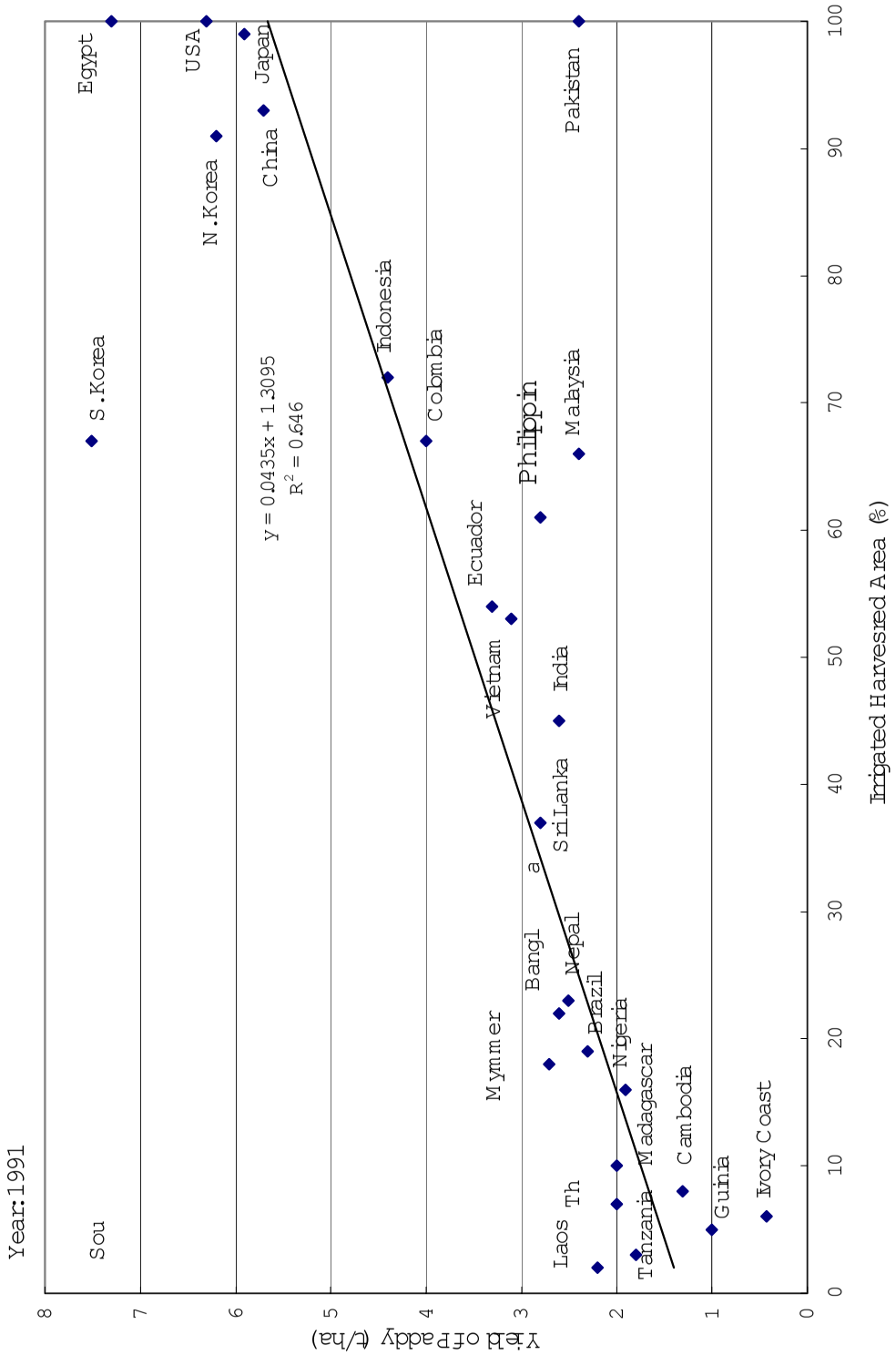


Source: "Philippine Land and Soils Management Atlas for Cagayan Valley, Region II, 1995" BSWM and "Land Use/Vegetation Map, CAR", BSWM. CAR

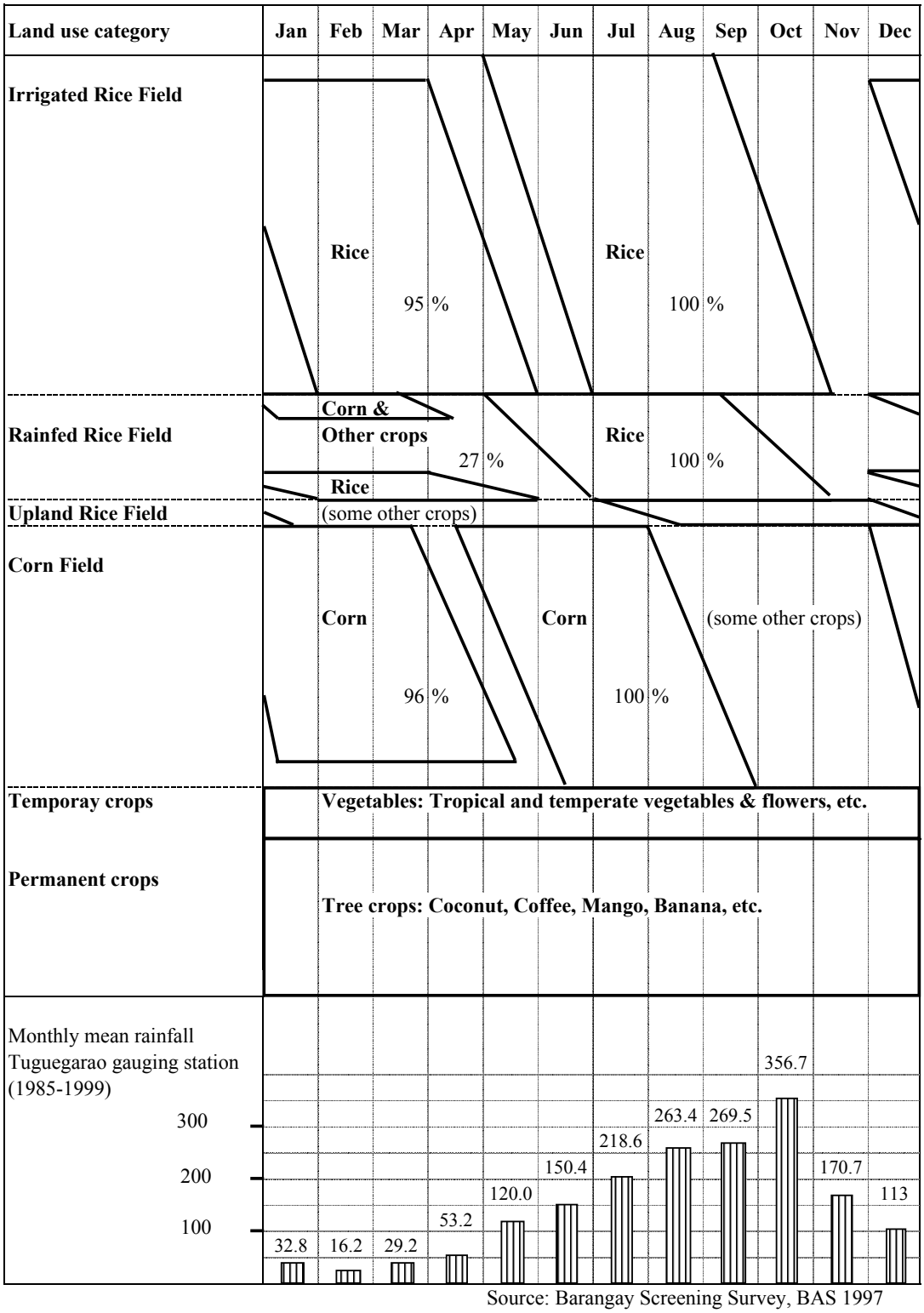
The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.1.4**
JAPAN INTERNATIONAL COOPERATION AGENCY	**Land Use Map**



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.3.1 Paddy Production, Import and Consumption in Philippines**
JAPAN INTERNATIONAL COOPERATION AGENCY	



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 2.3.2** **Relation between Irrigated Harvested Area and Yield**
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source: Barangay Screening Survey, BAS 1997

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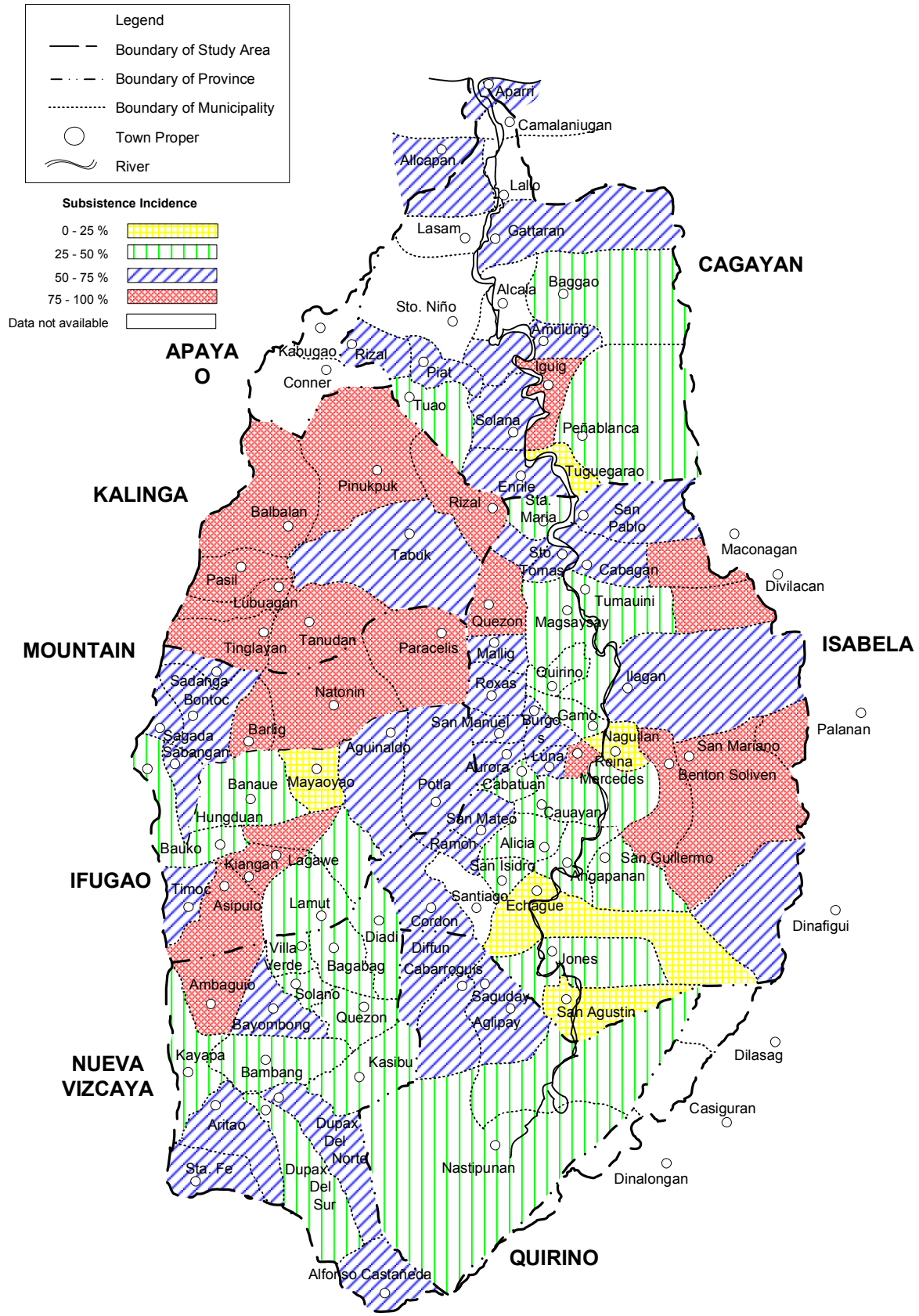
Figure 3.1.1
Present Cropping Pattern in the Cagayan River Basin



Source:
The Minimum Basic Needs survey (1997) results obtained form the PPDO concerned

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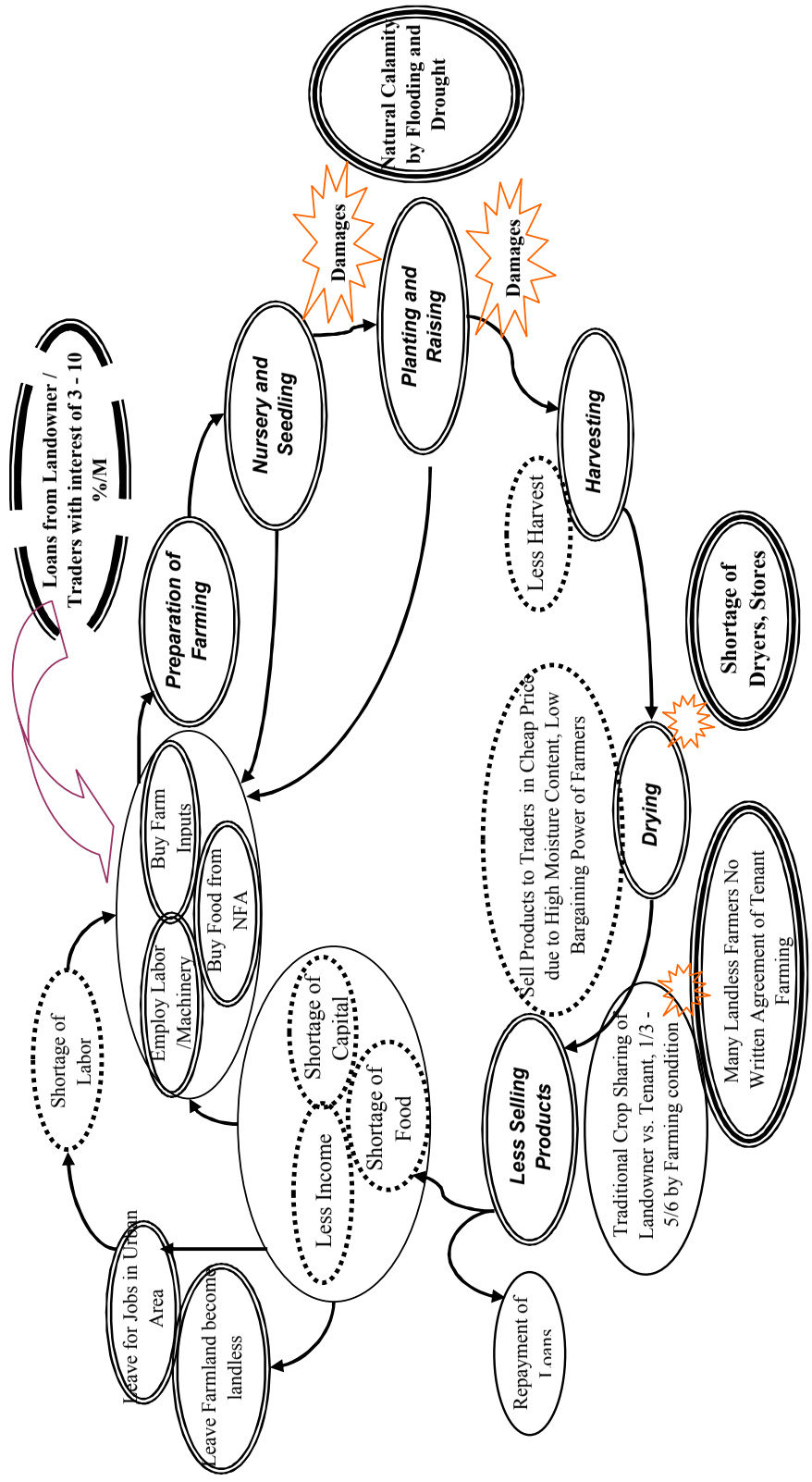
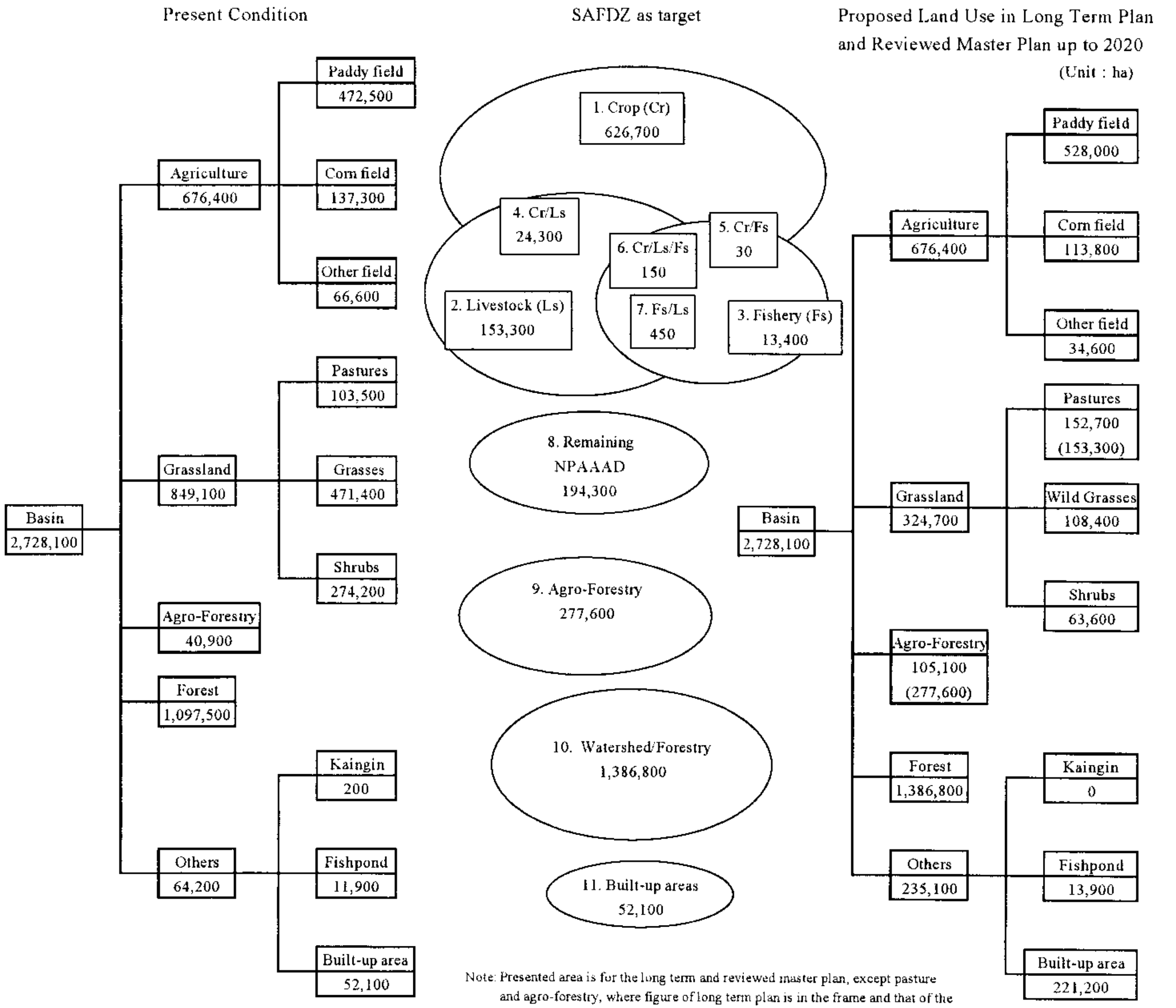
Figure 3.3.1

Subsistence Incidence in the Area by Municipality



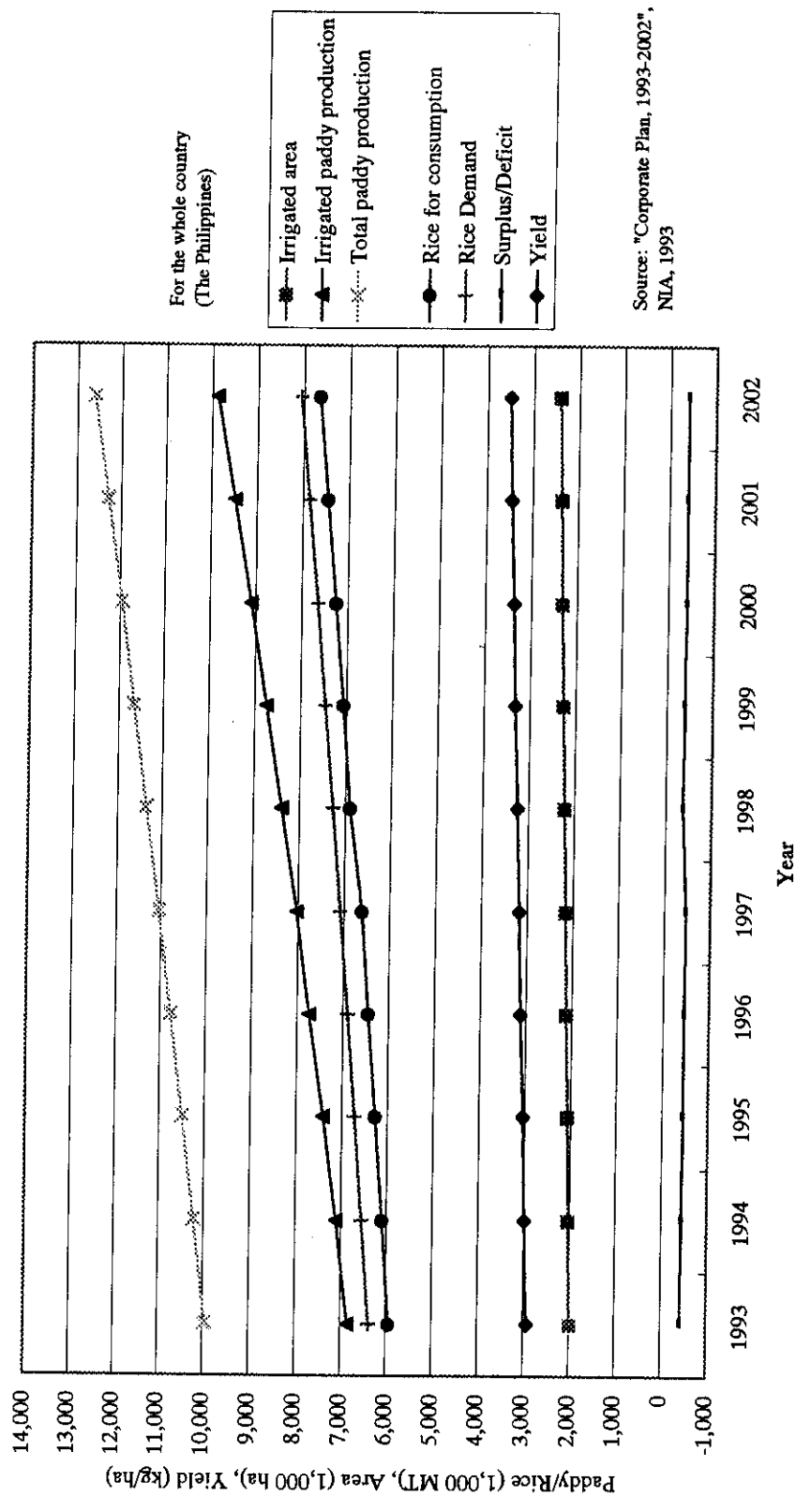
The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	Figure 3.3.2 Vicious Cycle of Farmer's Livelihood in Lower Cagayan River Area
JAPAN INTERNATIONAL COOPERATION AGENCY	



Note: Presented area is for the long term and reviewed master plan, except pasture and agro-forestry, where figure of long term plan is in the frame and that of the reviewed master plan is in the parenthesis.

Source: Present condition and SAFDZ=SAFDZ data 1999 BSWM

Figure 4.1.1
Present Land Use, SAFDZ and Proposed Land Use Plan



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

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Figure 4.3.1
Example of Projected Paddy Production and Rice Supply by NIA

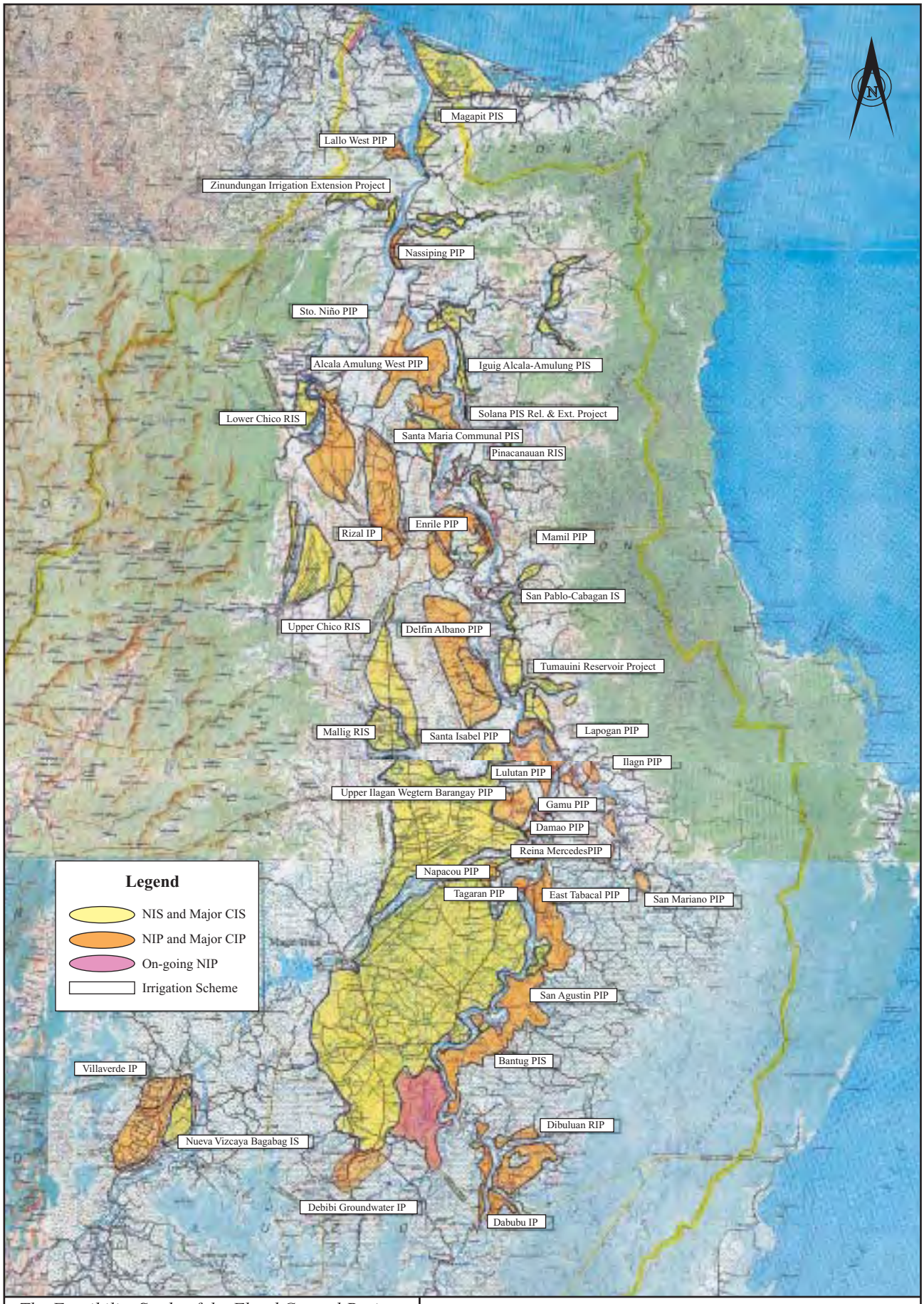

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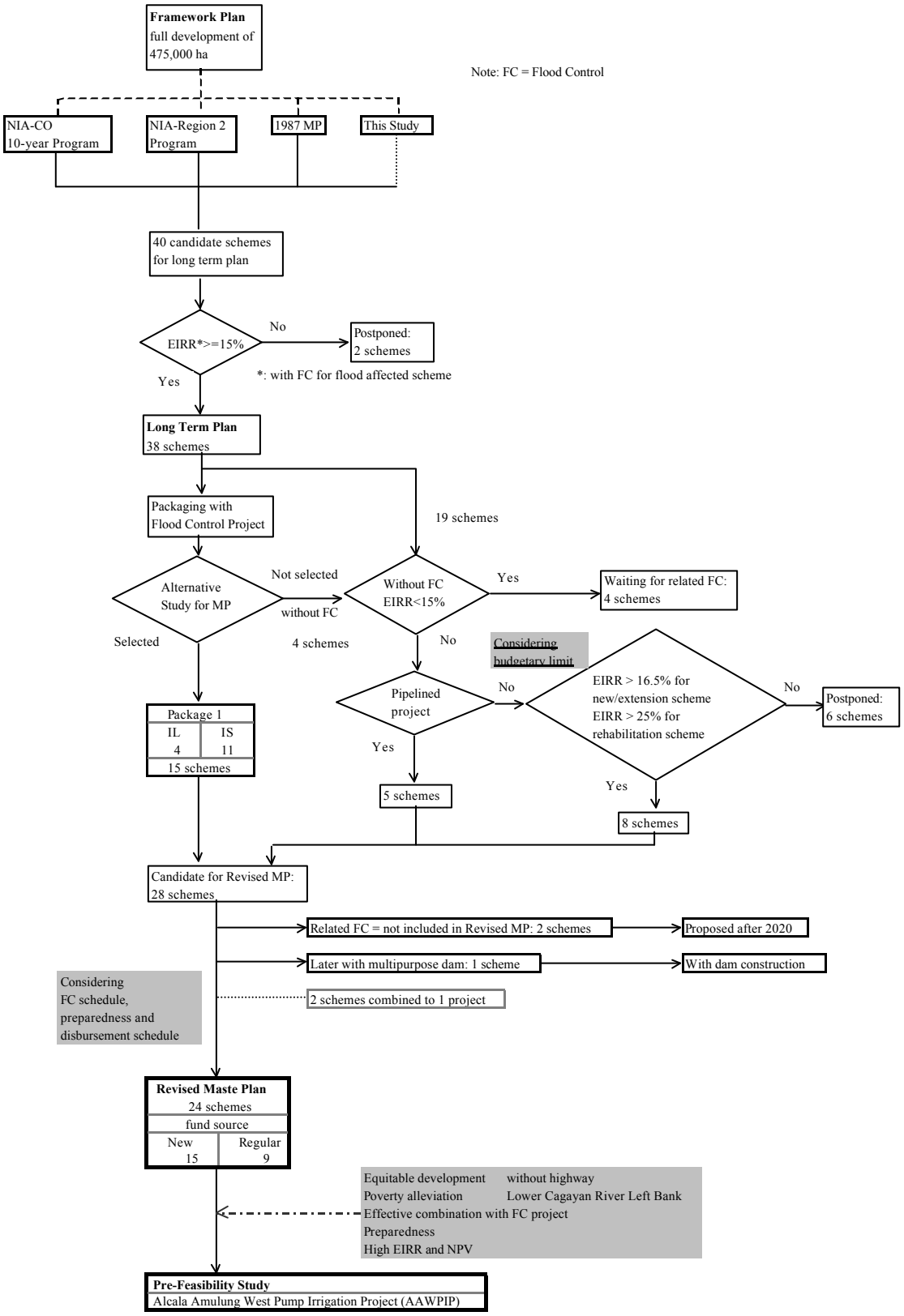
Figure 4.3.2
Irrigation Development Scheme in Long Term Plan



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

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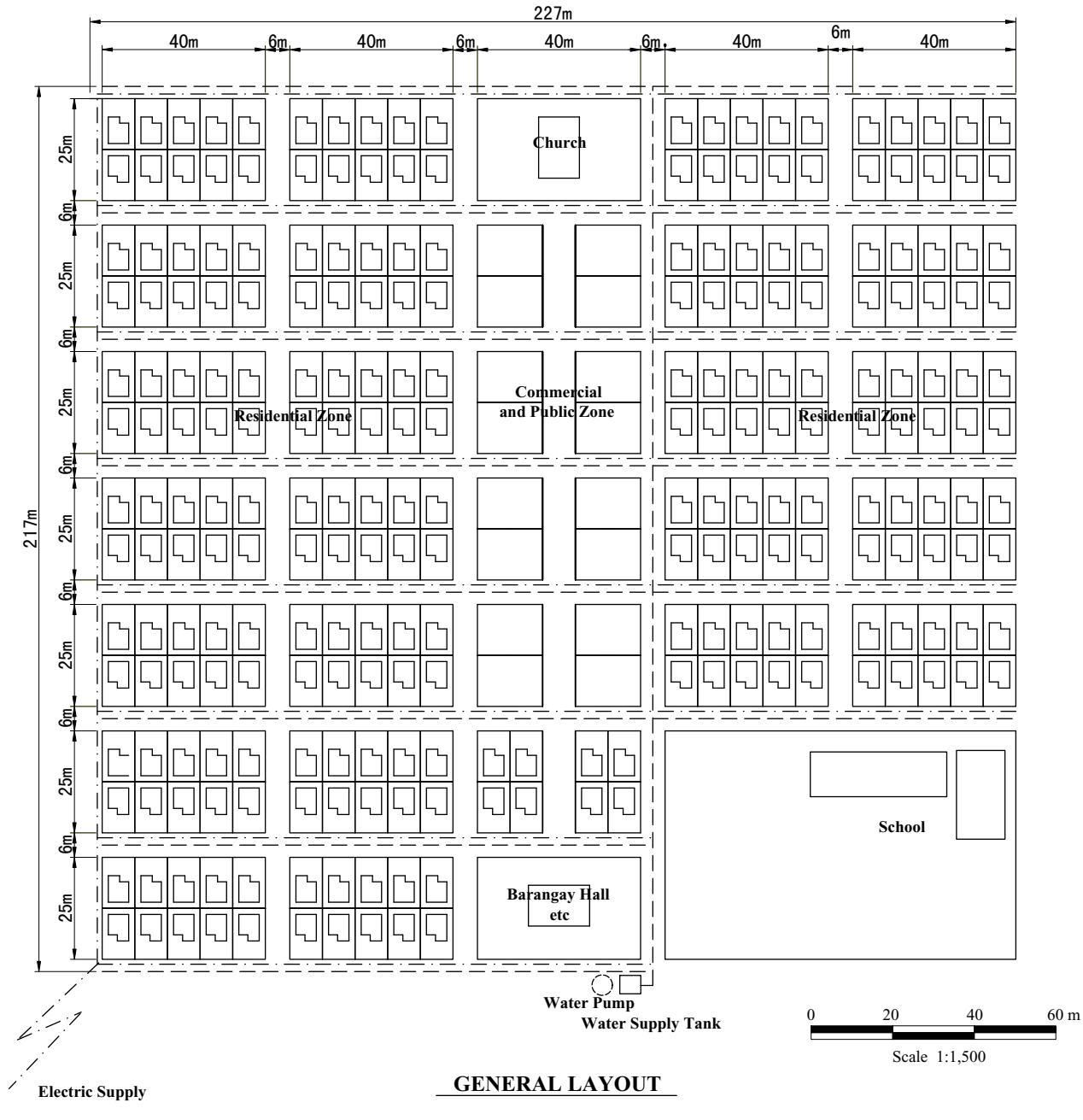
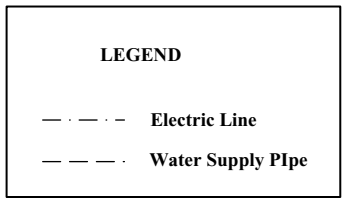
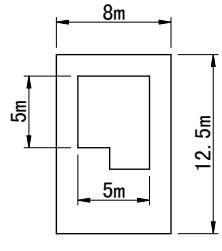
Figure 4.3.3
Irrigation Project Selection for Long Term Plan, Revised Master Plan and Pre-Feasibility Study



GENERAL LAYOUT





HOUSE LAYOUT

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

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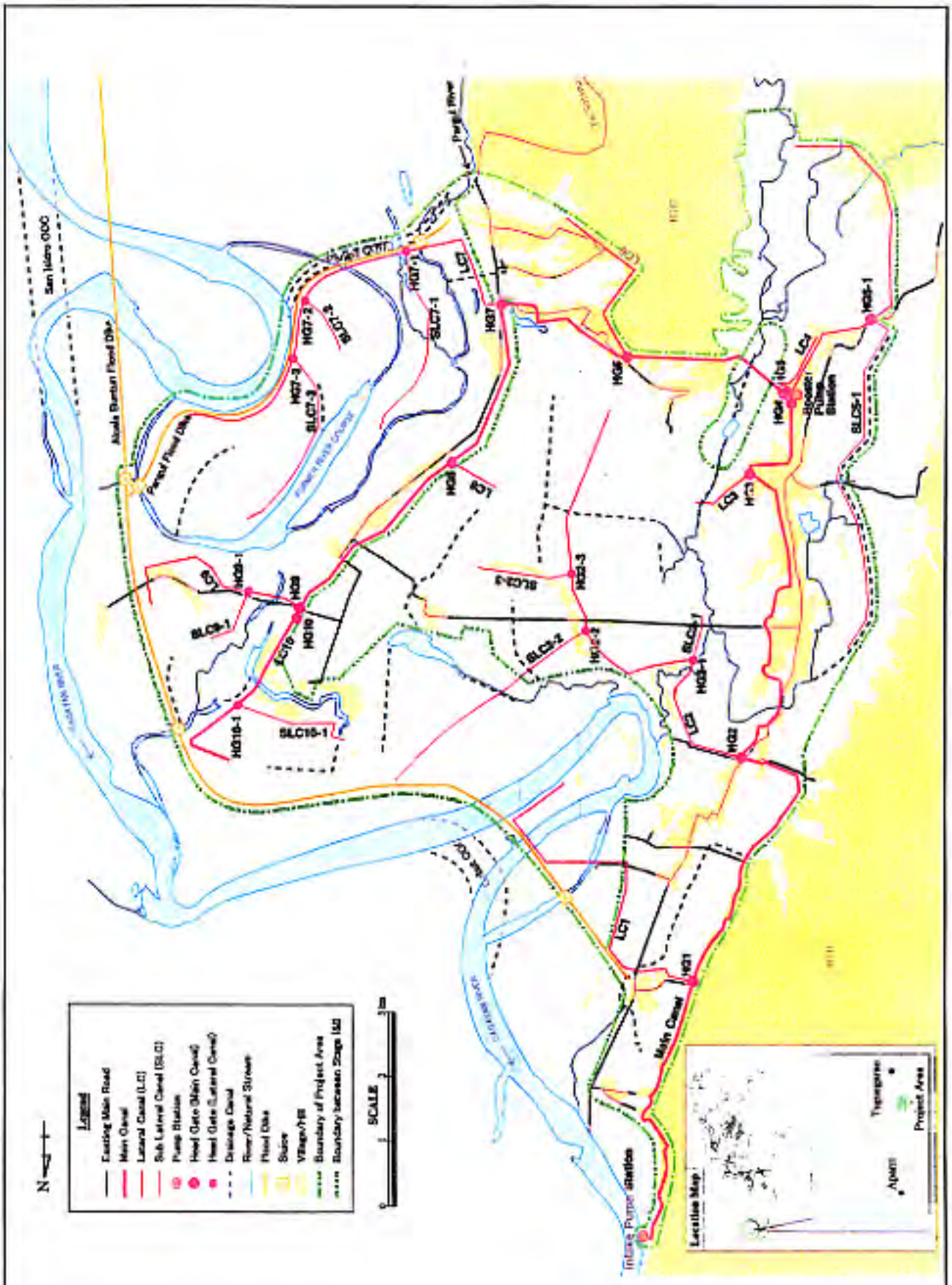
Figure 4.5.1
Layout Plan of Typical Resettlement Area



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

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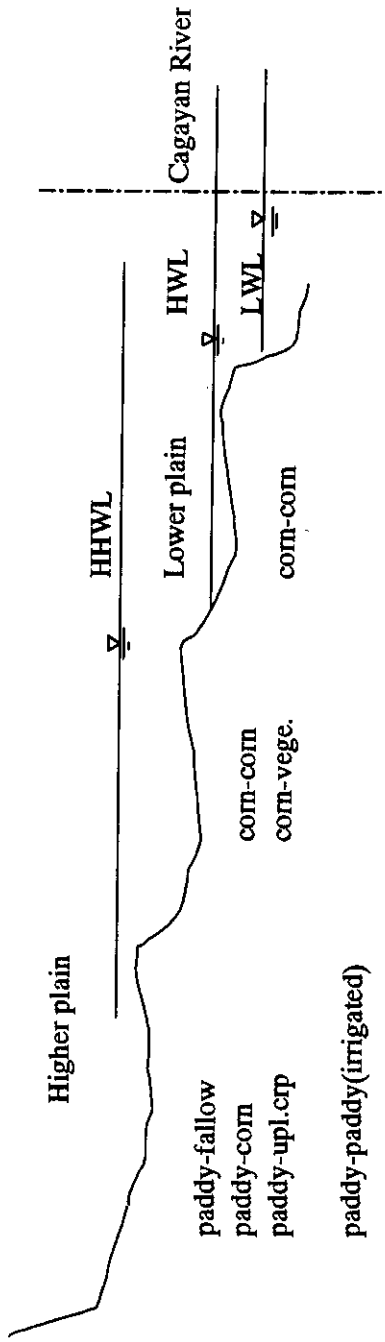
Figure 5.1.1
General Layout of Alcala Amulung West Pump Irrigation Project



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

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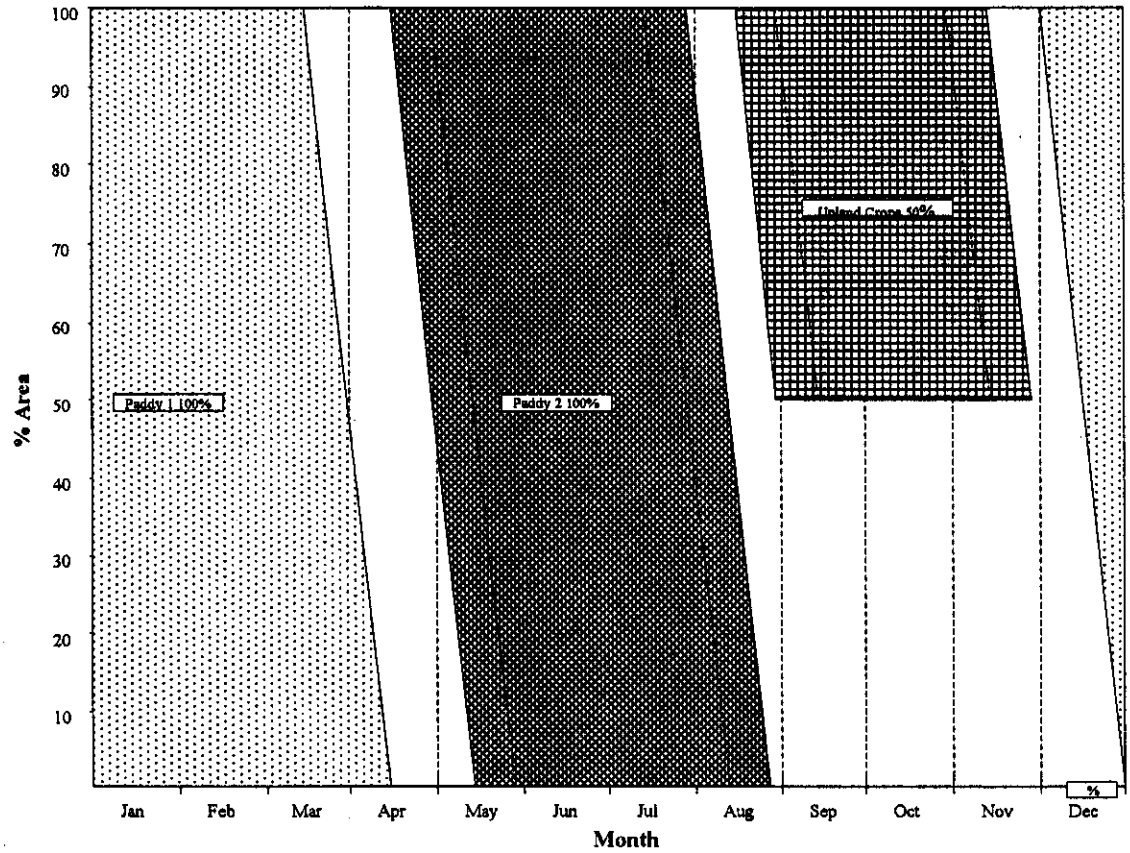
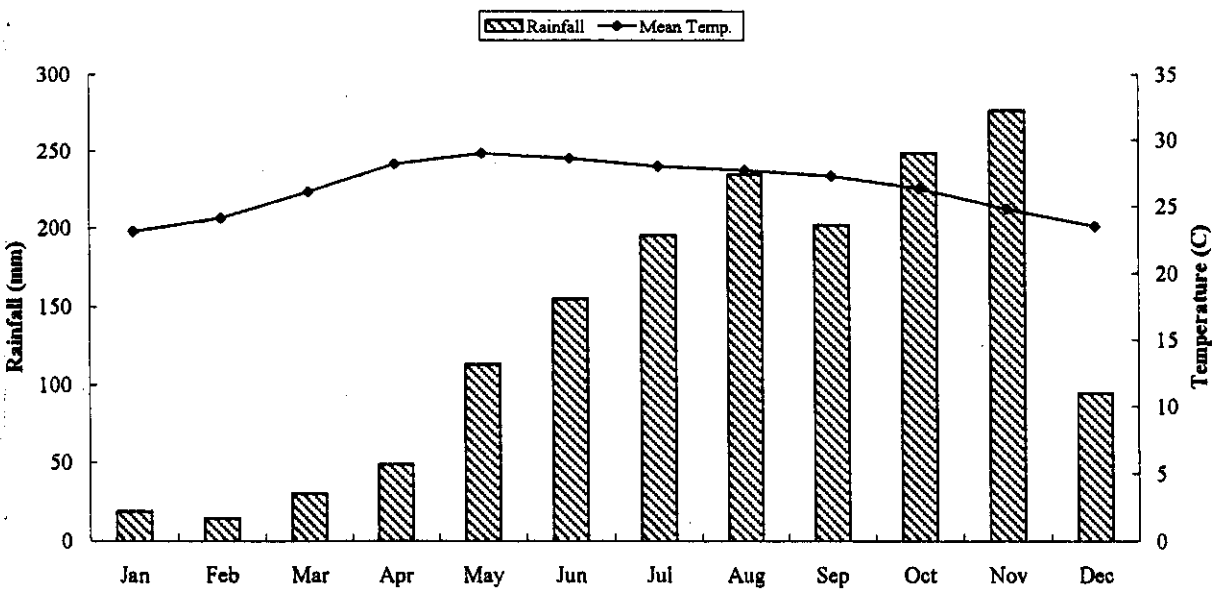
Figure 5.1.2
Typical Land Use along the Lower Cagayan River





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

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Figure 5.1.3
Proposed Cropping Pattern

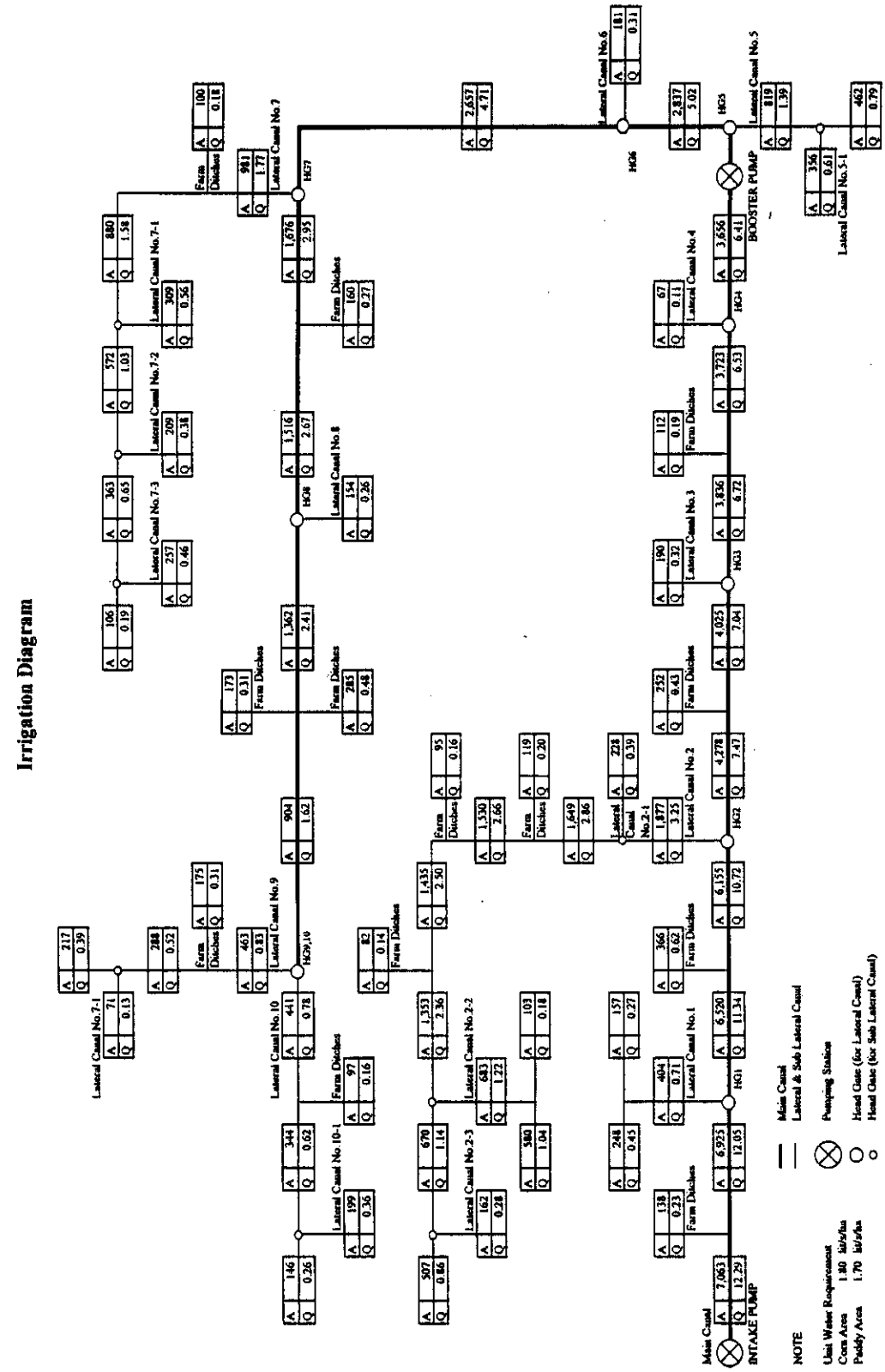

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Figure 5.1.4

Irrigation Diagram

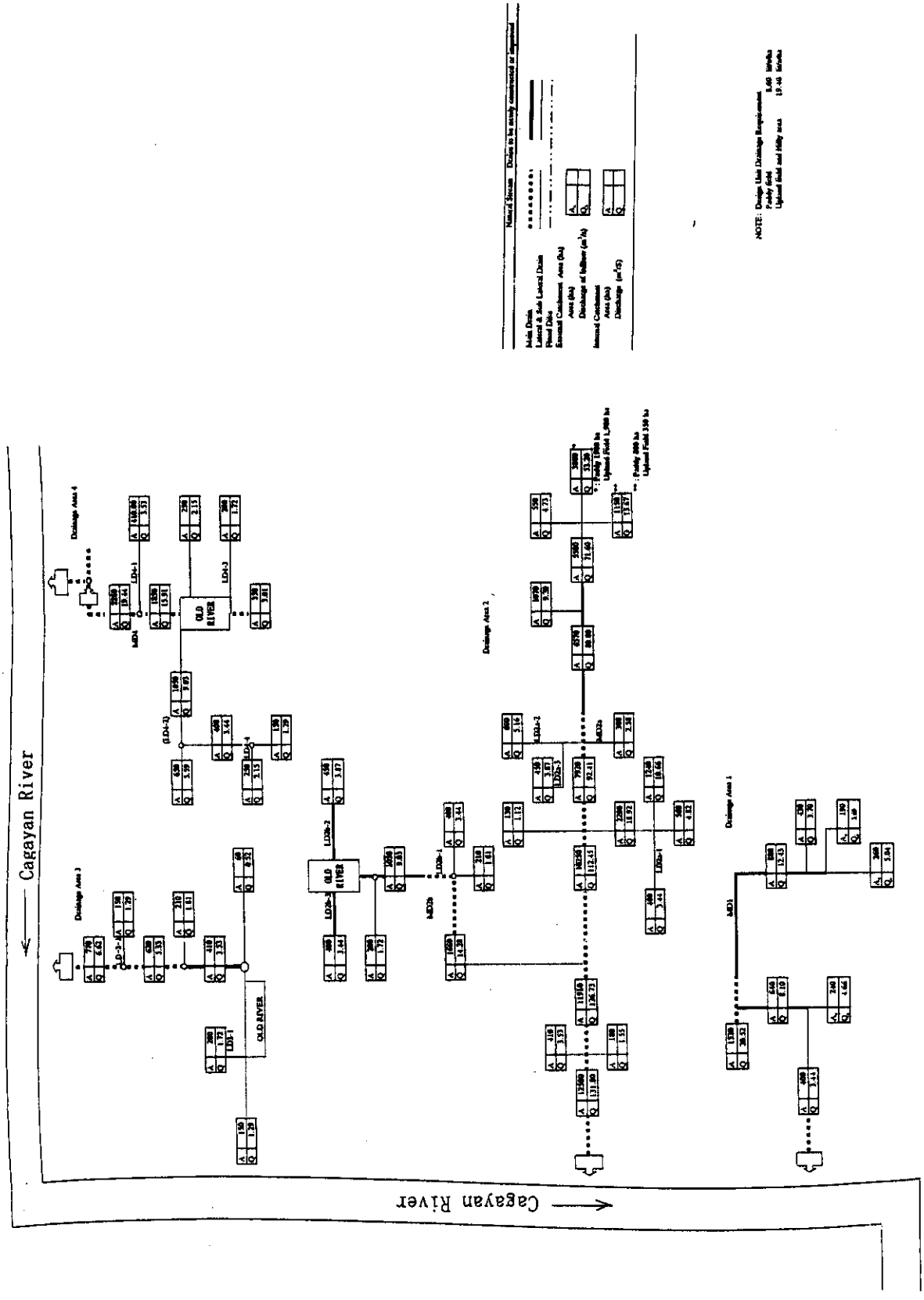

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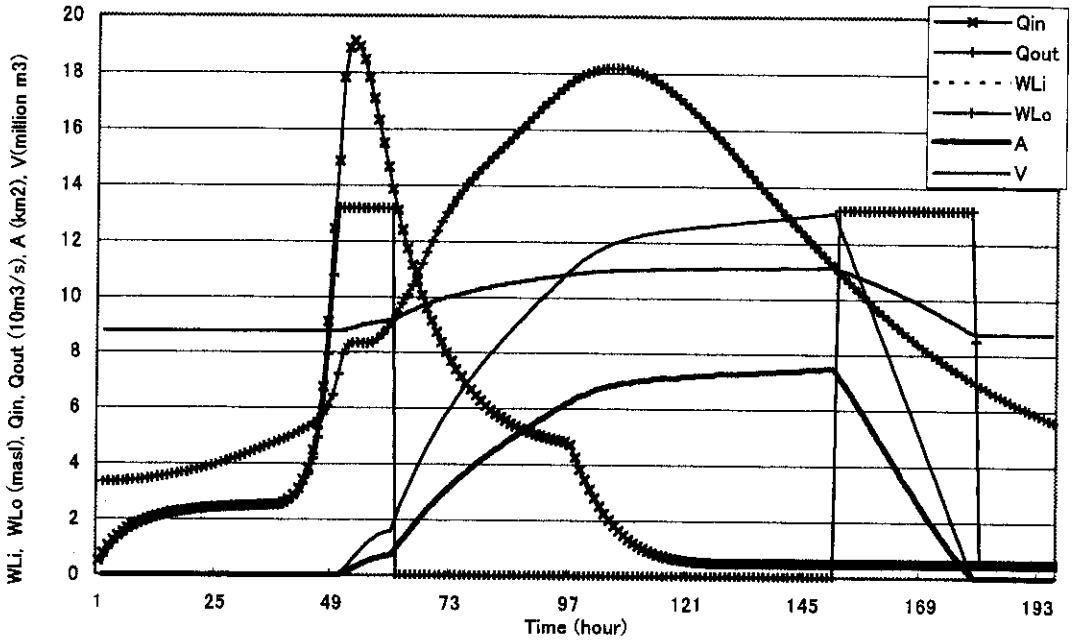
Figure 5.1.5

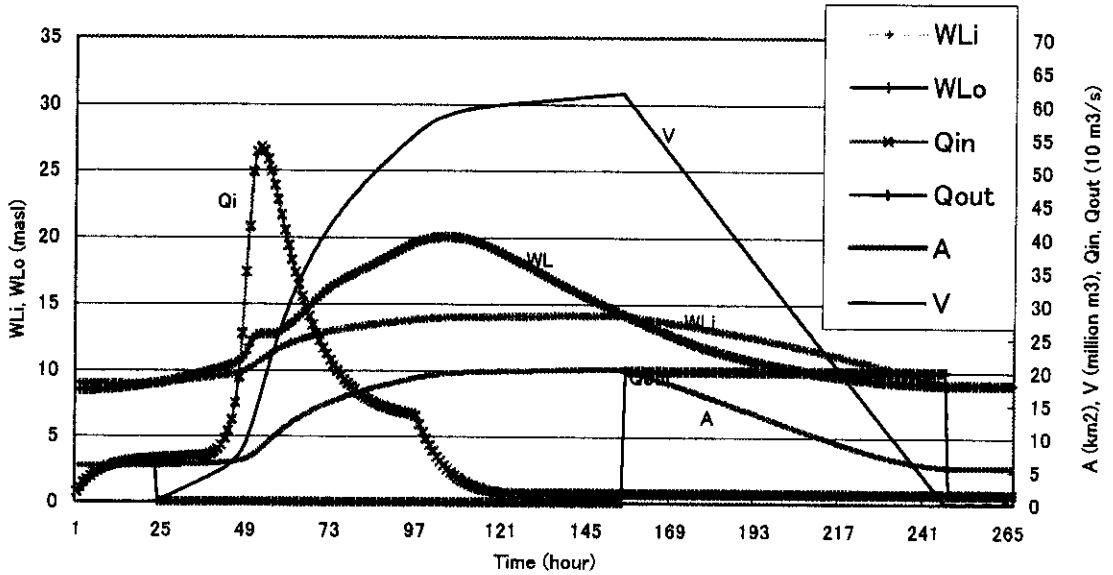
Drainage Diagram



Inundation in D2 Area at the time of the Cagayan River flood with 25-year probability
Alcala Amulung West Pump IrrigationProject

Qin: Discharge flowing into Drainage Area (DA)
Qout: Discharge drained from DA through sluice
WLi, H: Inside inundation water level
WLo: Outside or Cagayan River flood water level
A: Inundated area
V: Inundated volume

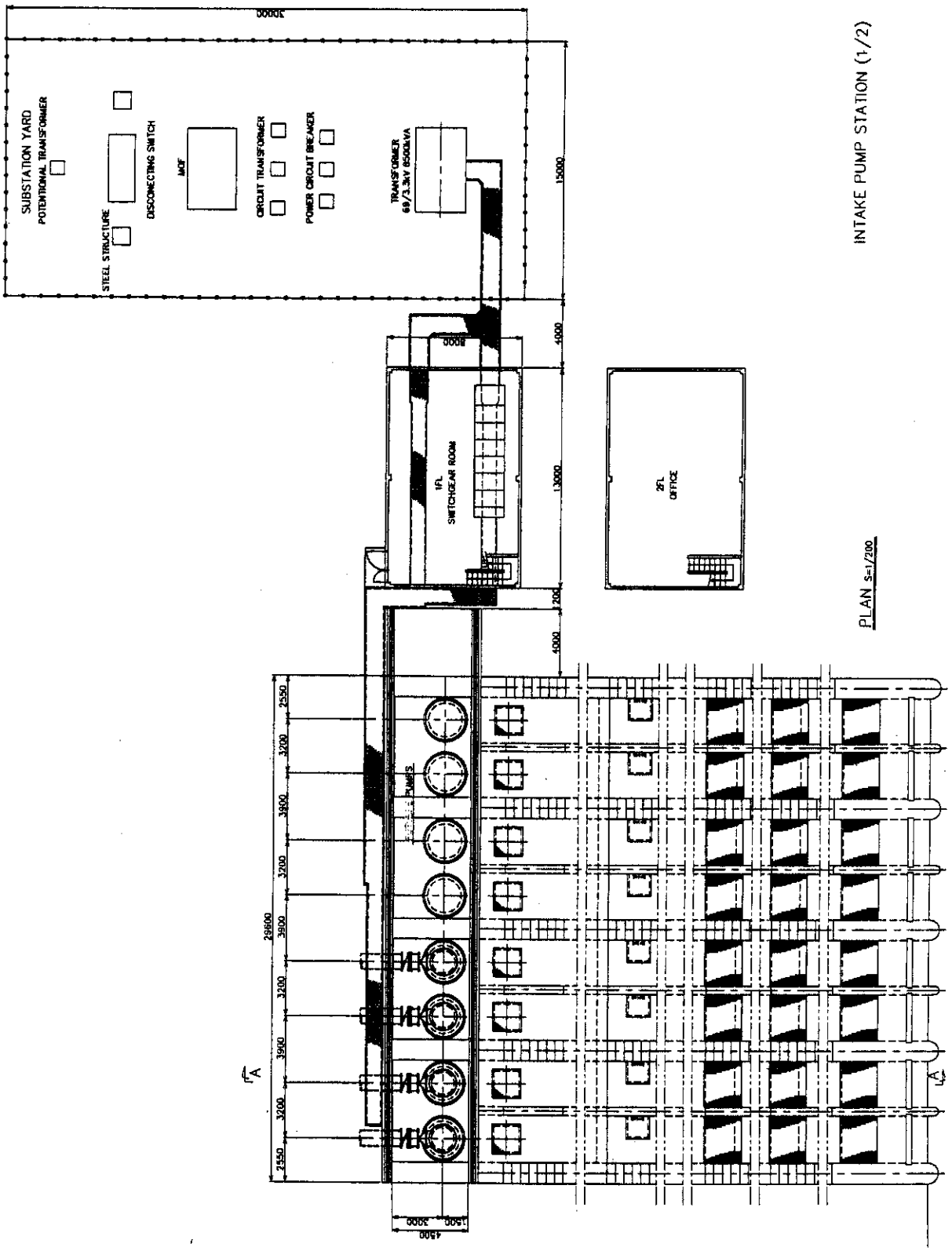
The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 5.1.6**
JAPAN INTERNATIONAL COOPERATION AGENCY	**Inundation In Drainage Area 2 of AAWPIP**



Inundation in the Lower Pangul River area at the time of Cagayan River flood time with 25-year probability
Alcala Amulung West Pump Irrigation Project

Qin: Discharge flowing into Drainage Area (DA)
Qout: Discharge drained from DA through sluice
WLi, H: Inside inundation water level
WLo: Outside or Cagayan River flood water level
A: Inundated area
V: Inundated volume

The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 5.1.7** **Inundation In Lower Pangul Area beside AAWPIP Area**
JAPAN INTERNATIONAL COOPERATION AGENCY	



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

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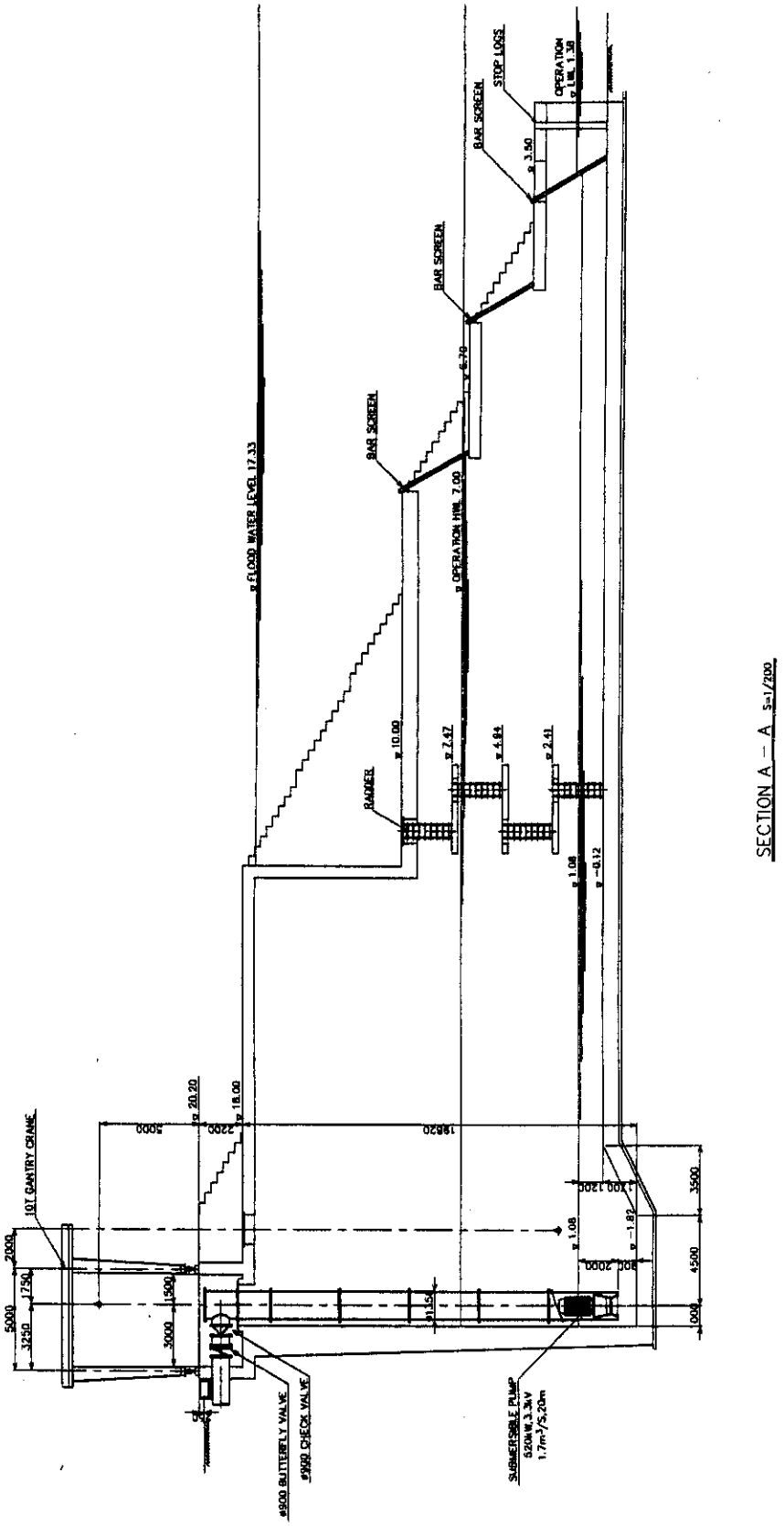
Figure 5.1.8

Intake Pump Station (1/2)



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

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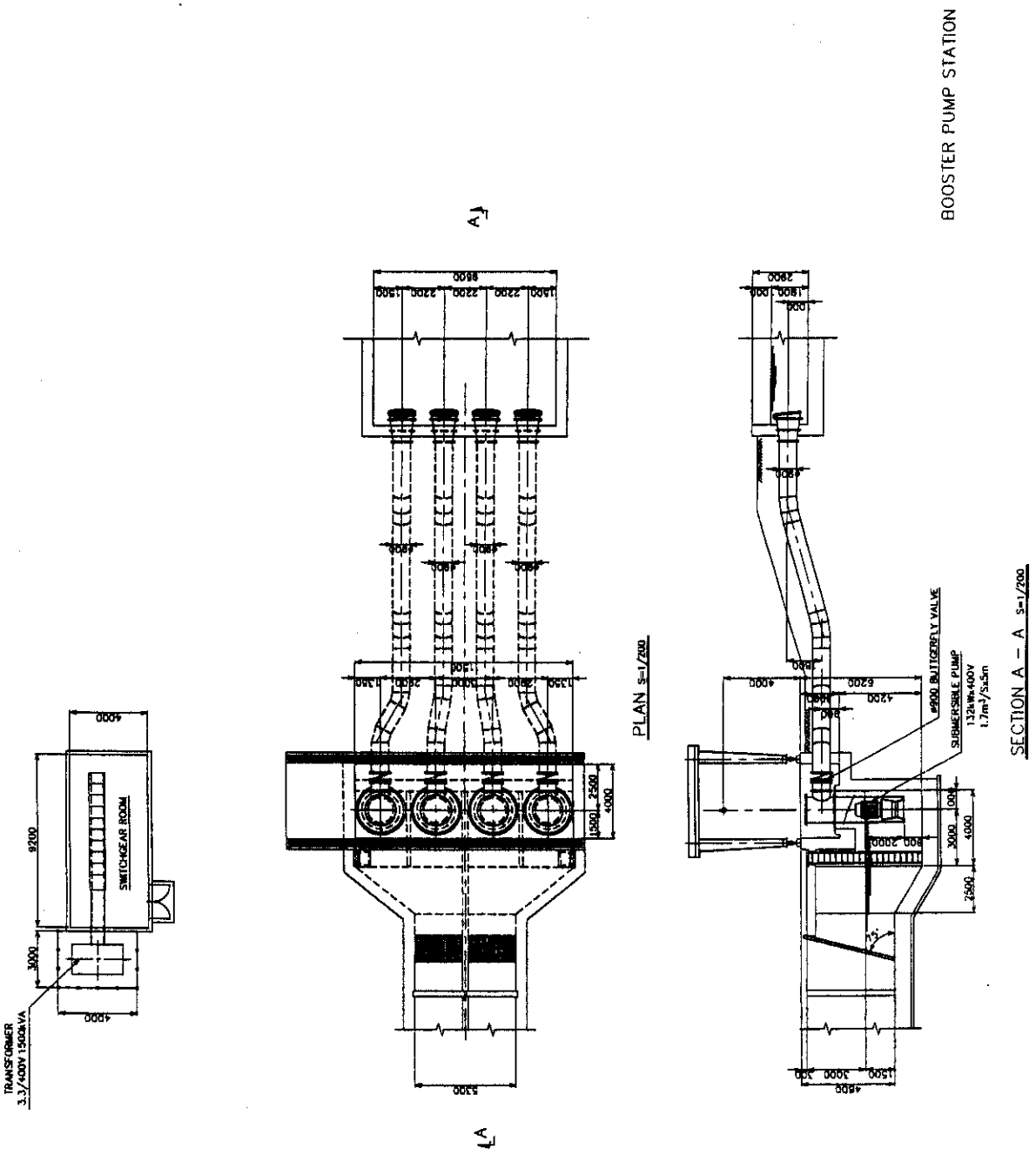
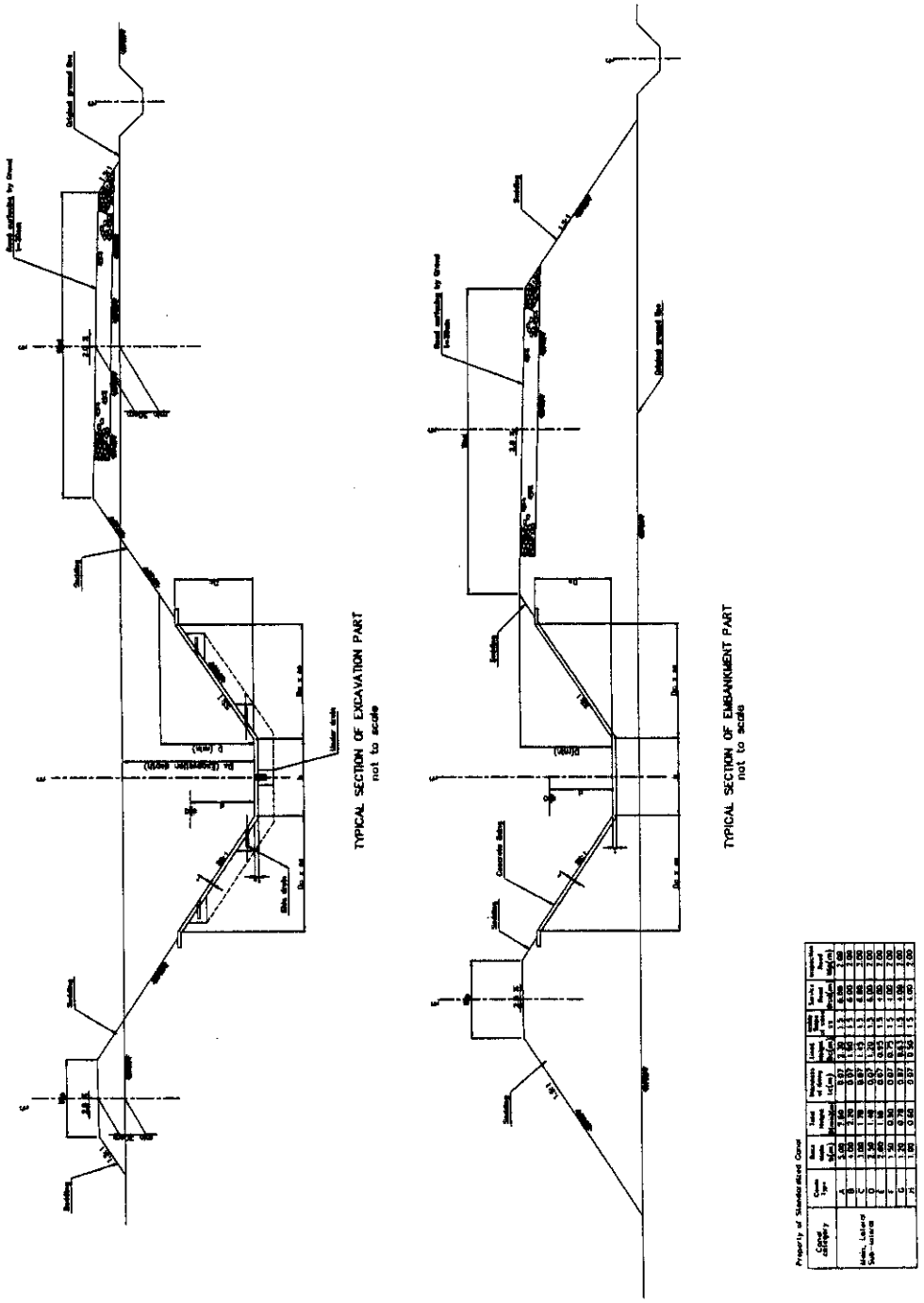
Figure 5.1.8

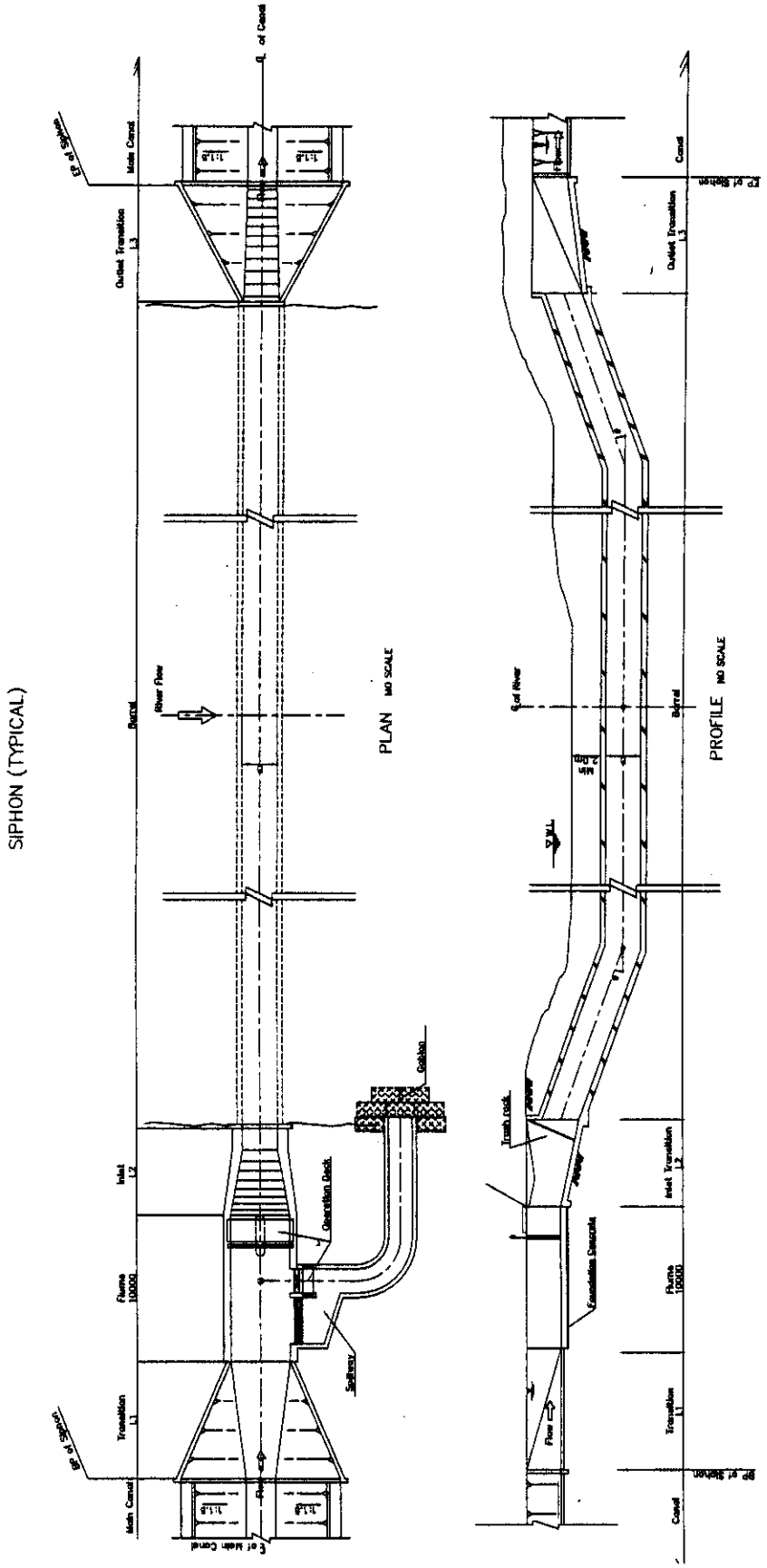
Intake Pump Station (2/2)



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 5.1.9**
JAPAN INTERNATIONAL COOPERATION AGENCY	**Booster Pump Station**



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 5.1.10** **Typical Cross Section of Irrigation Canal**
JAPAN INTERNATIONAL COOPERATION AGENCY	



The Feasibility Study of the Flood Control Project for the Lower Cagayan River in the Republic of the Philippines	**Figure 5.1.11**
JAPAN INTERNATIONAL COOPERATION AGENCY	**Siphon**

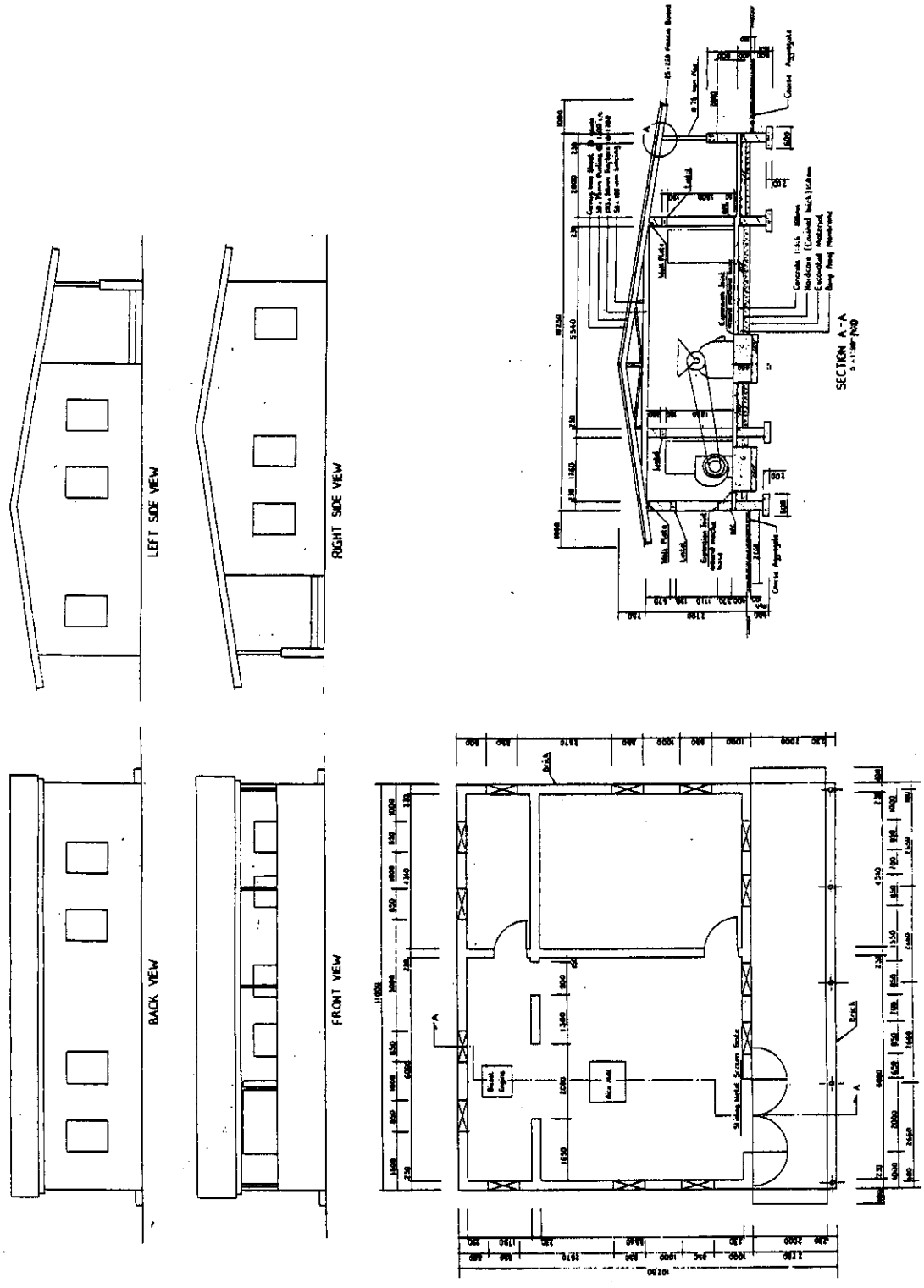


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Figure 5.1.12

Rice Mill