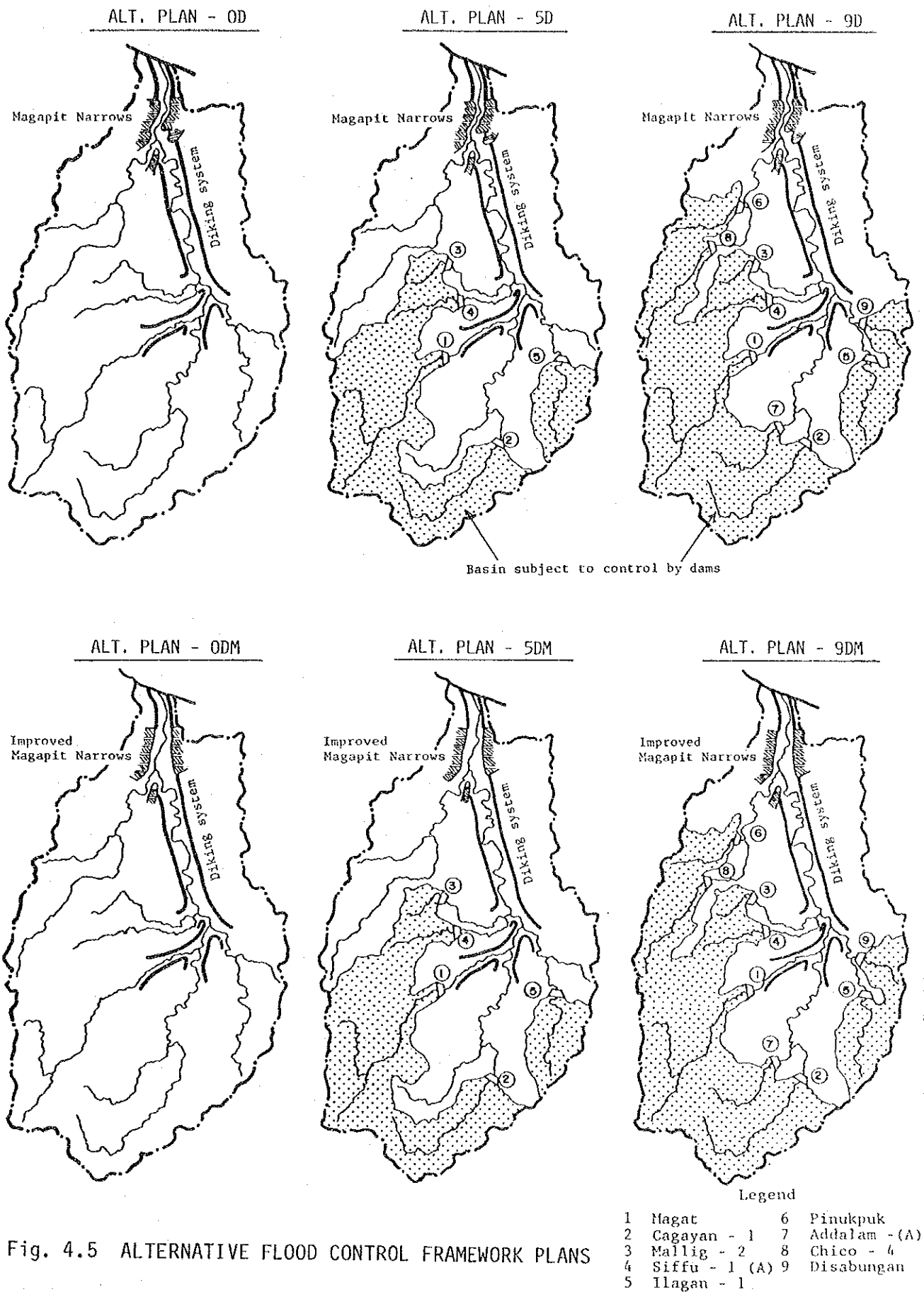


Fig. 4.3 IMPROVEMENT OF UPPER NASSIPING SECTION



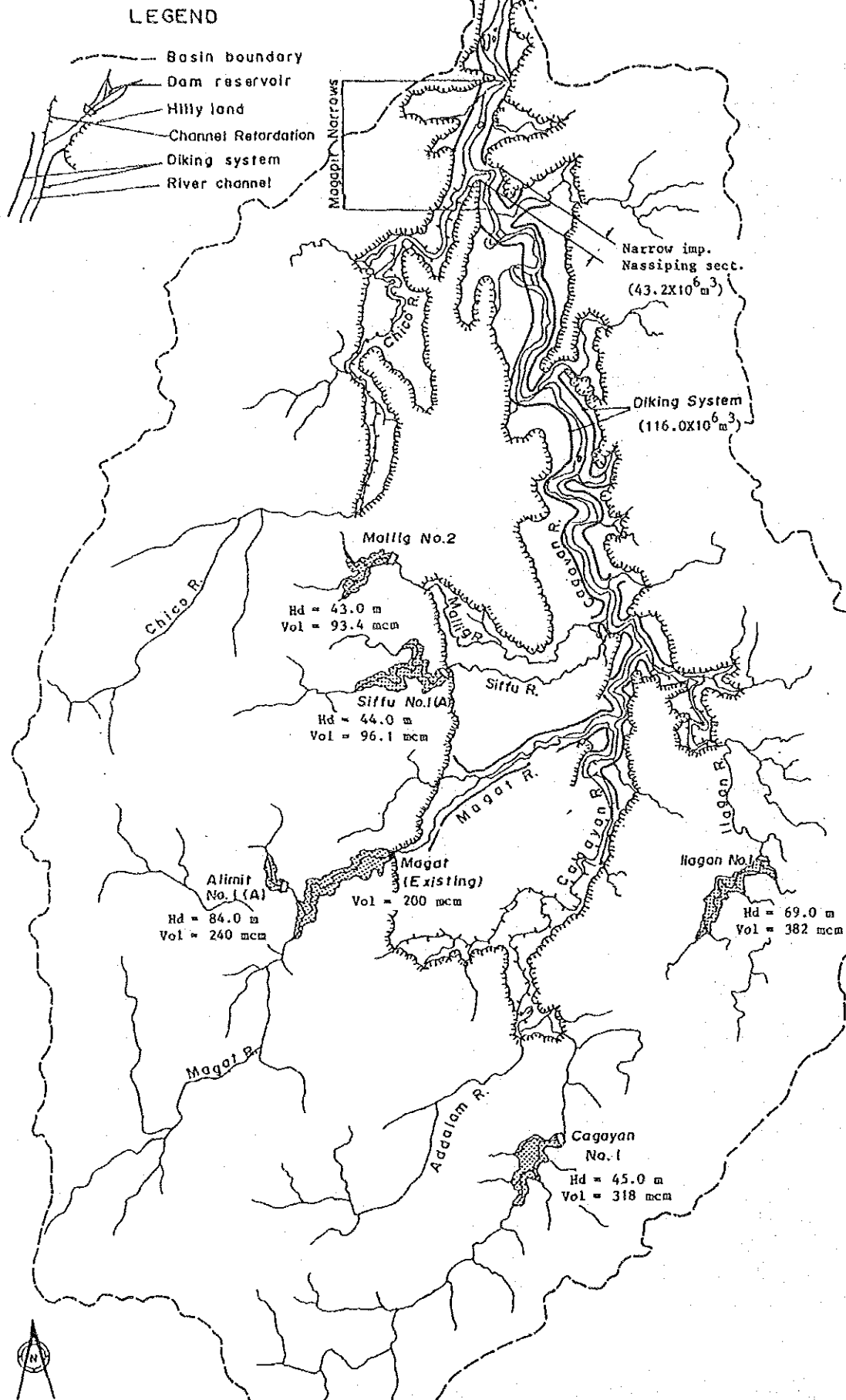
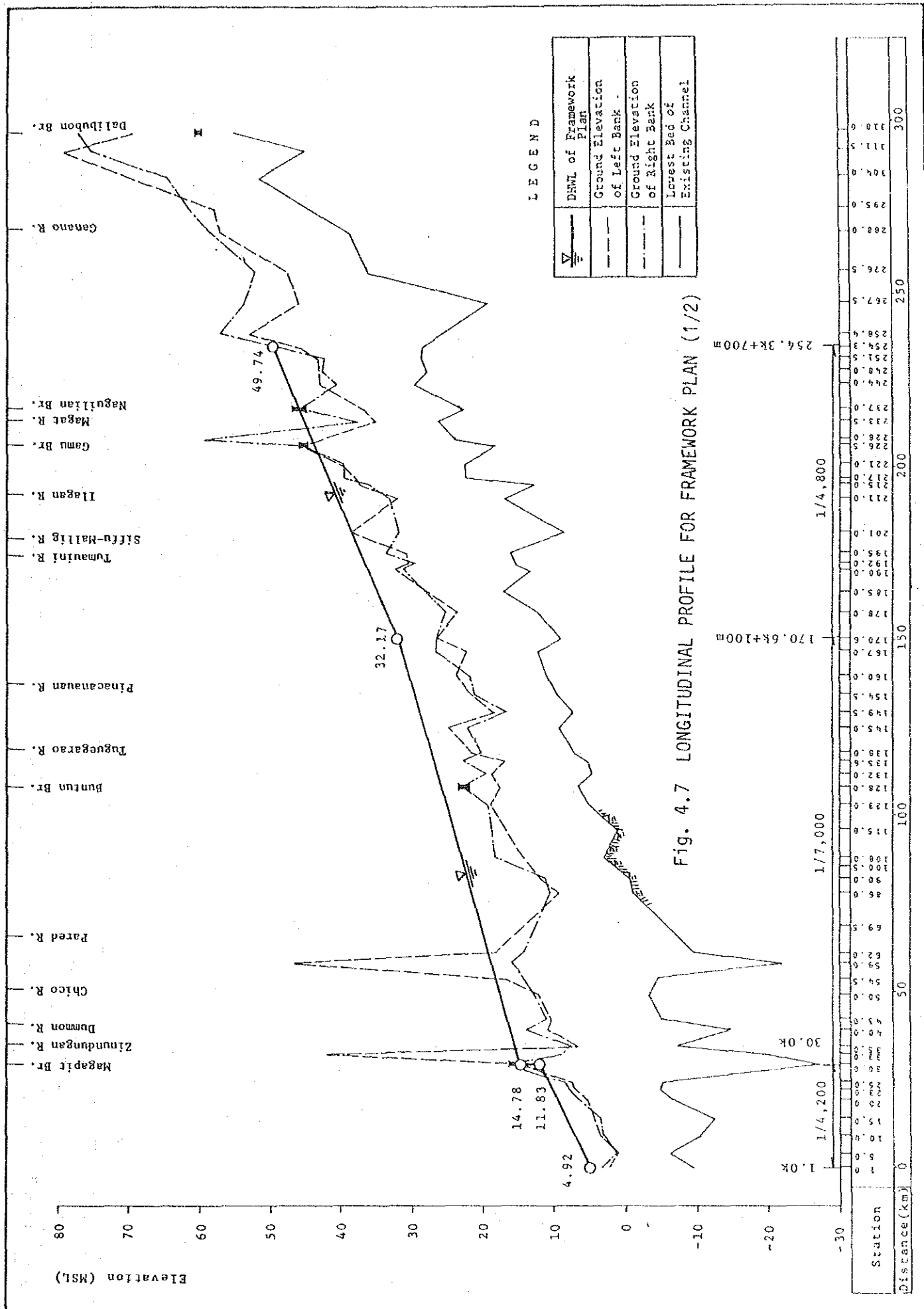
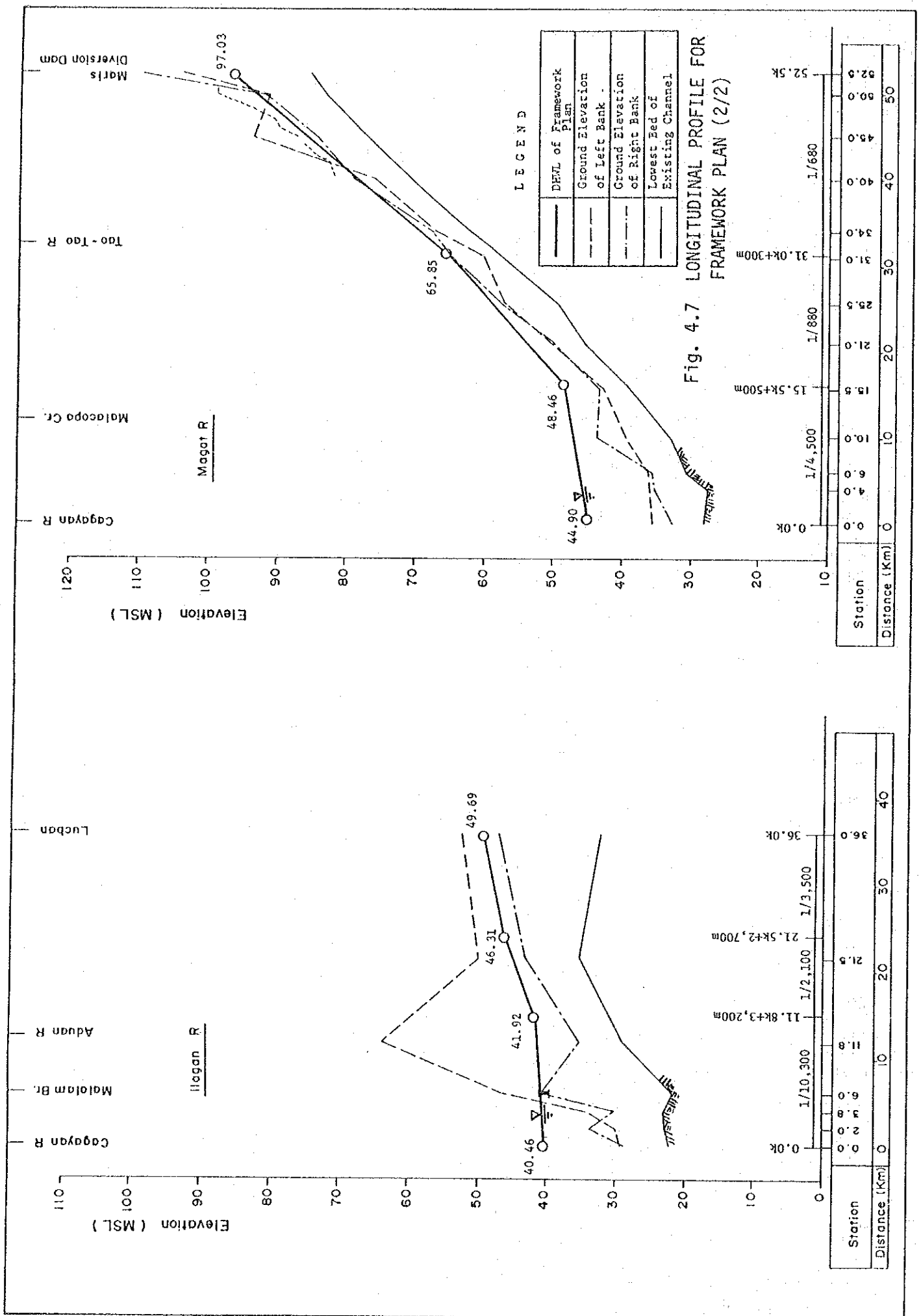


Fig. 4.6 GENERAL LOCATION MAP FOR FLOOD CONTROL FRAMEWORK PLAN





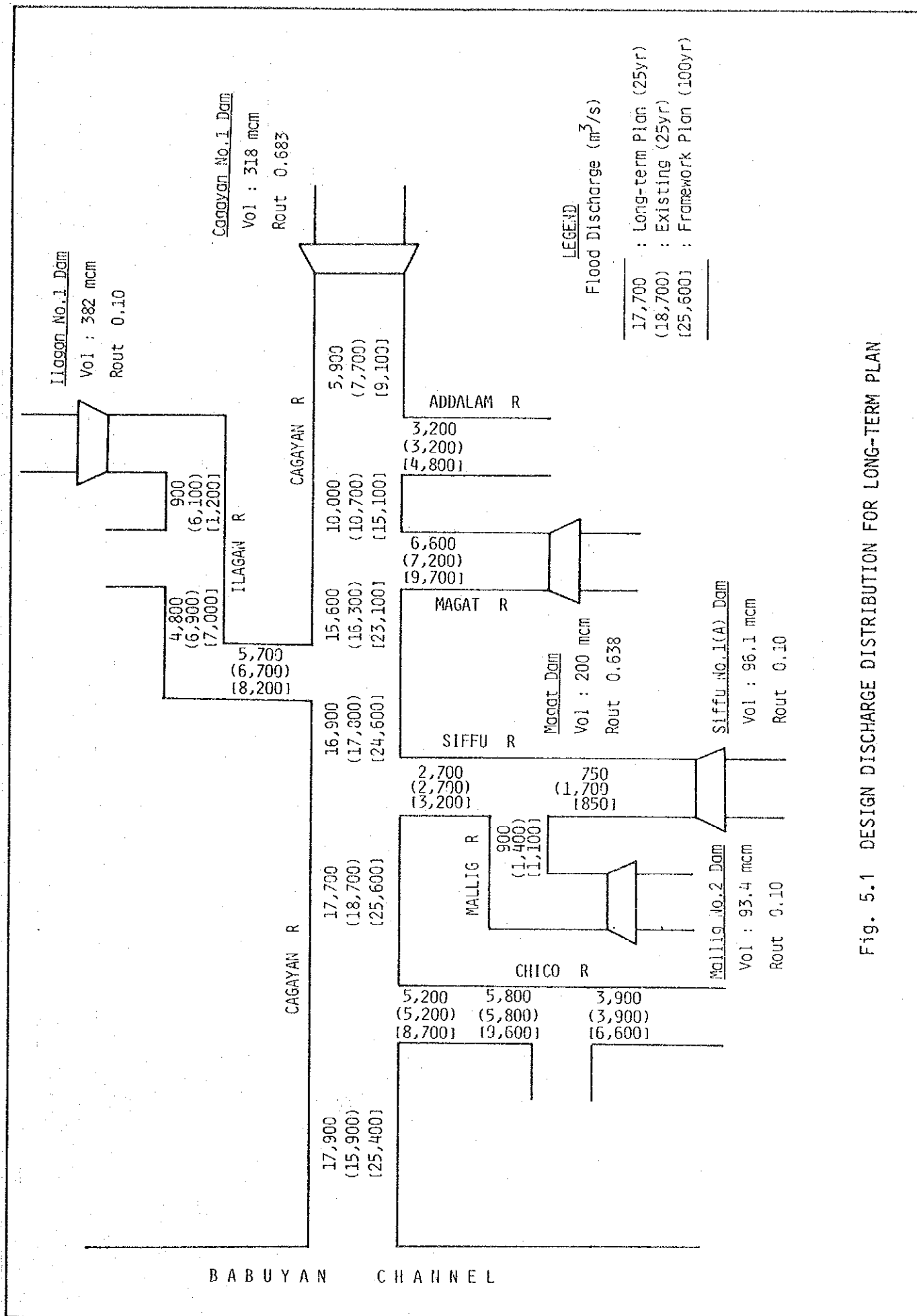


Fig. 5.1 DESIGN DISCHARGE DISTRIBUTION FOR LONG-TERM PLAN

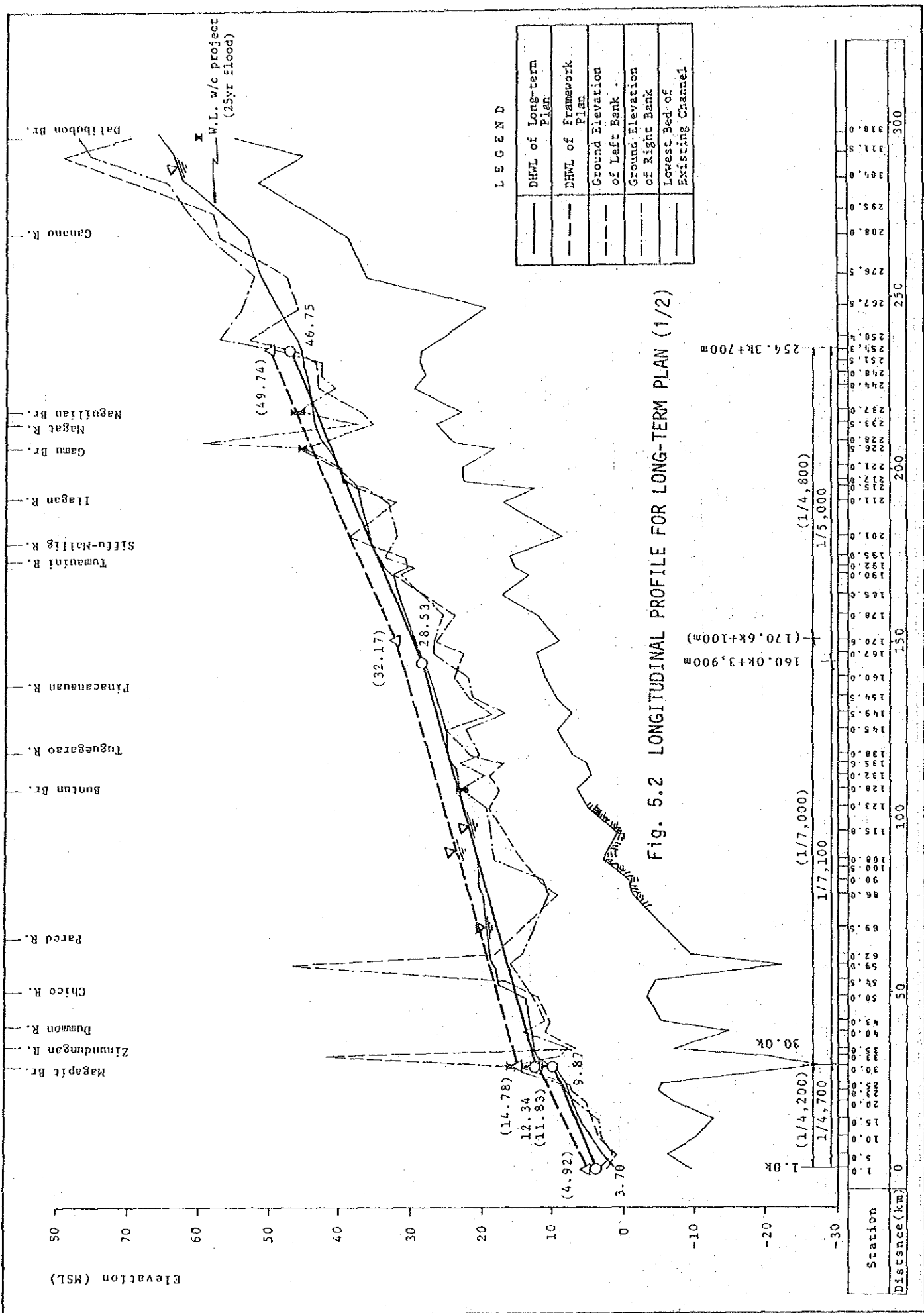
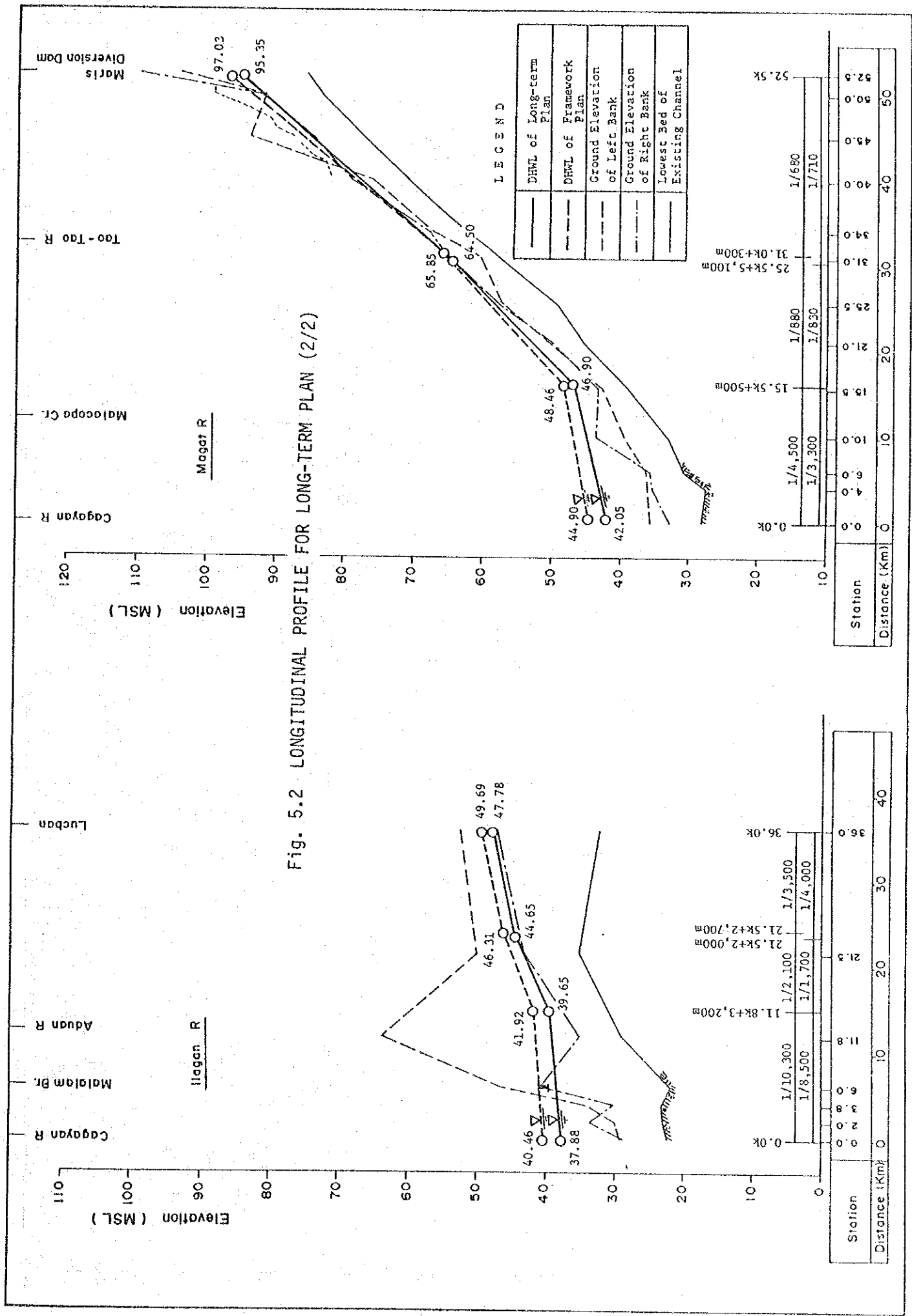


Fig. 5.2 LONGITUDINAL PROFILE FOR LONG-TERM PLAN (1/2)

LEGEND

---	DHWL of Long-term Plan
---	DHWL of Framework Plan
---	Ground Elevation of Left Bank
---	Ground Elevation of Right Bank
---	Lowest Bed of Existing Channel



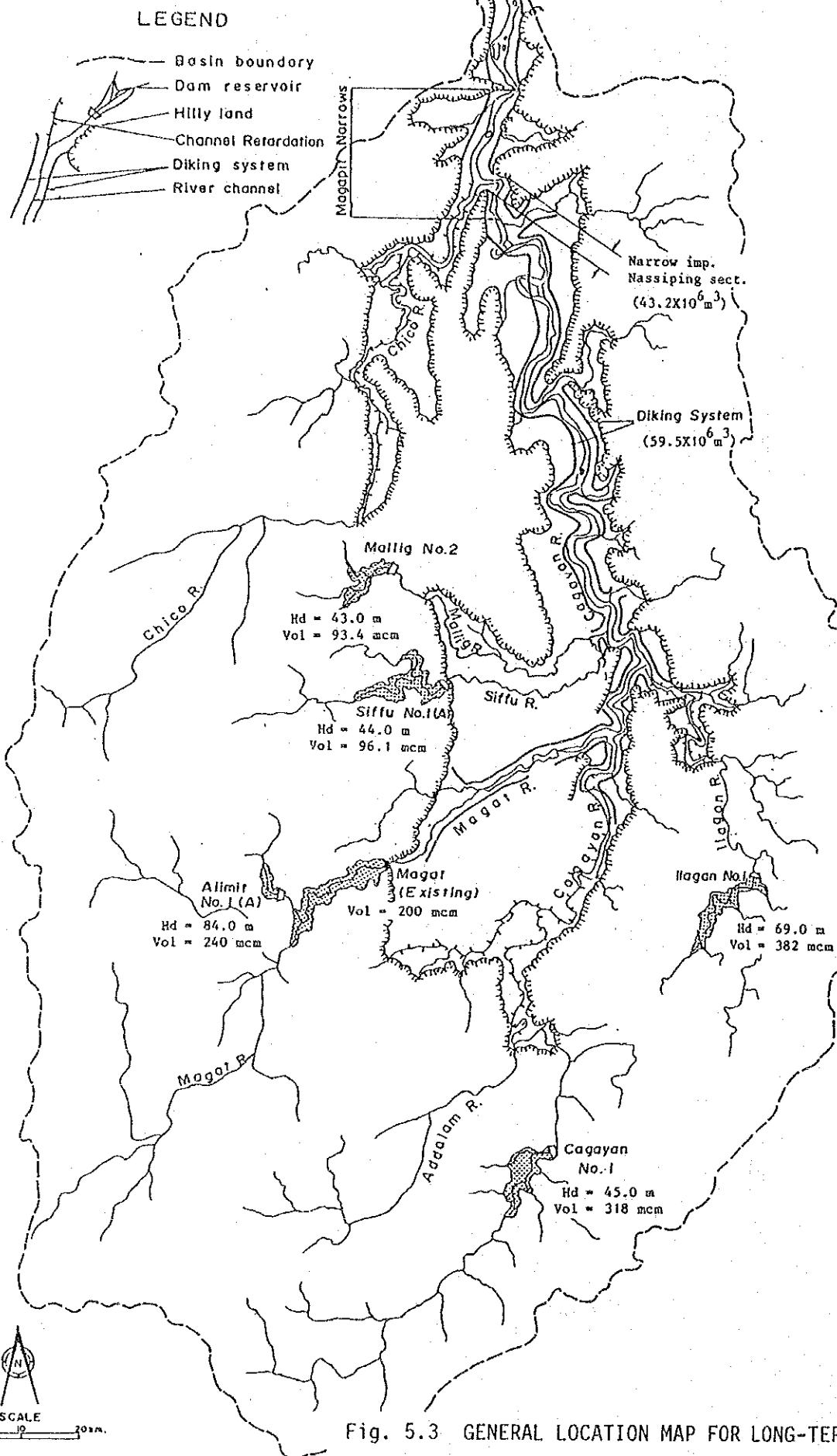


Fig. 5.3 GENERAL LOCATION MAP FOR LONG-TERM PLAN

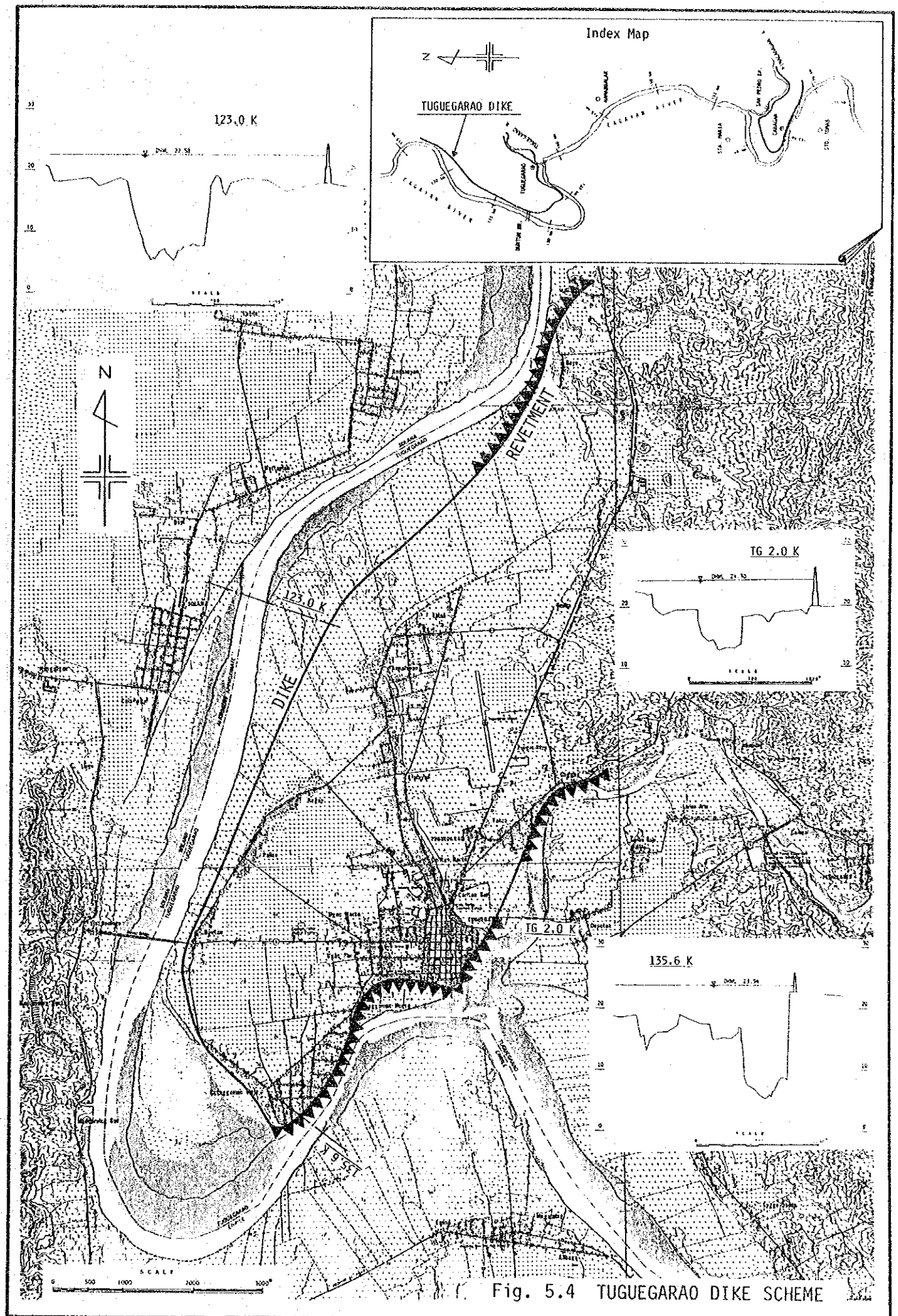
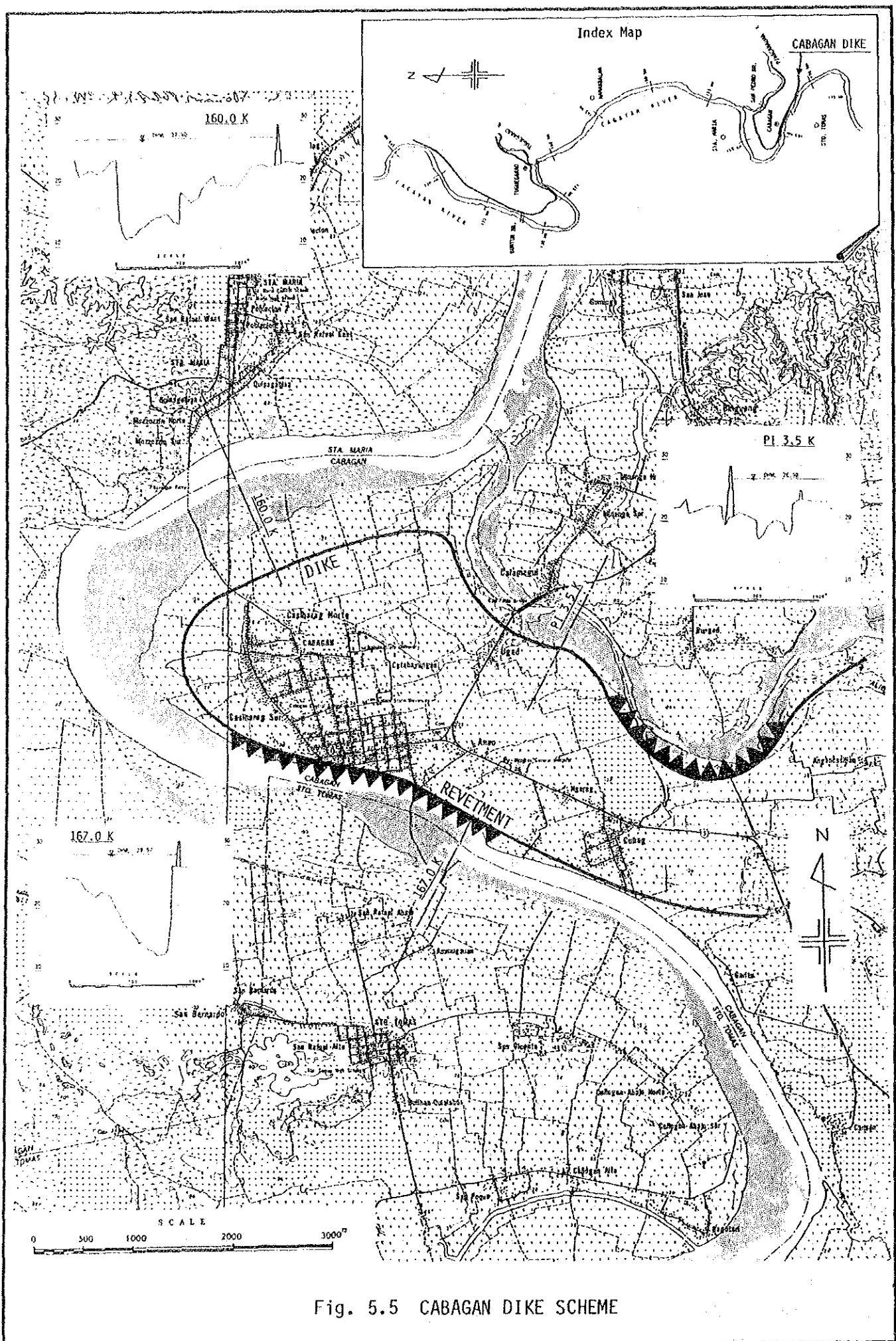
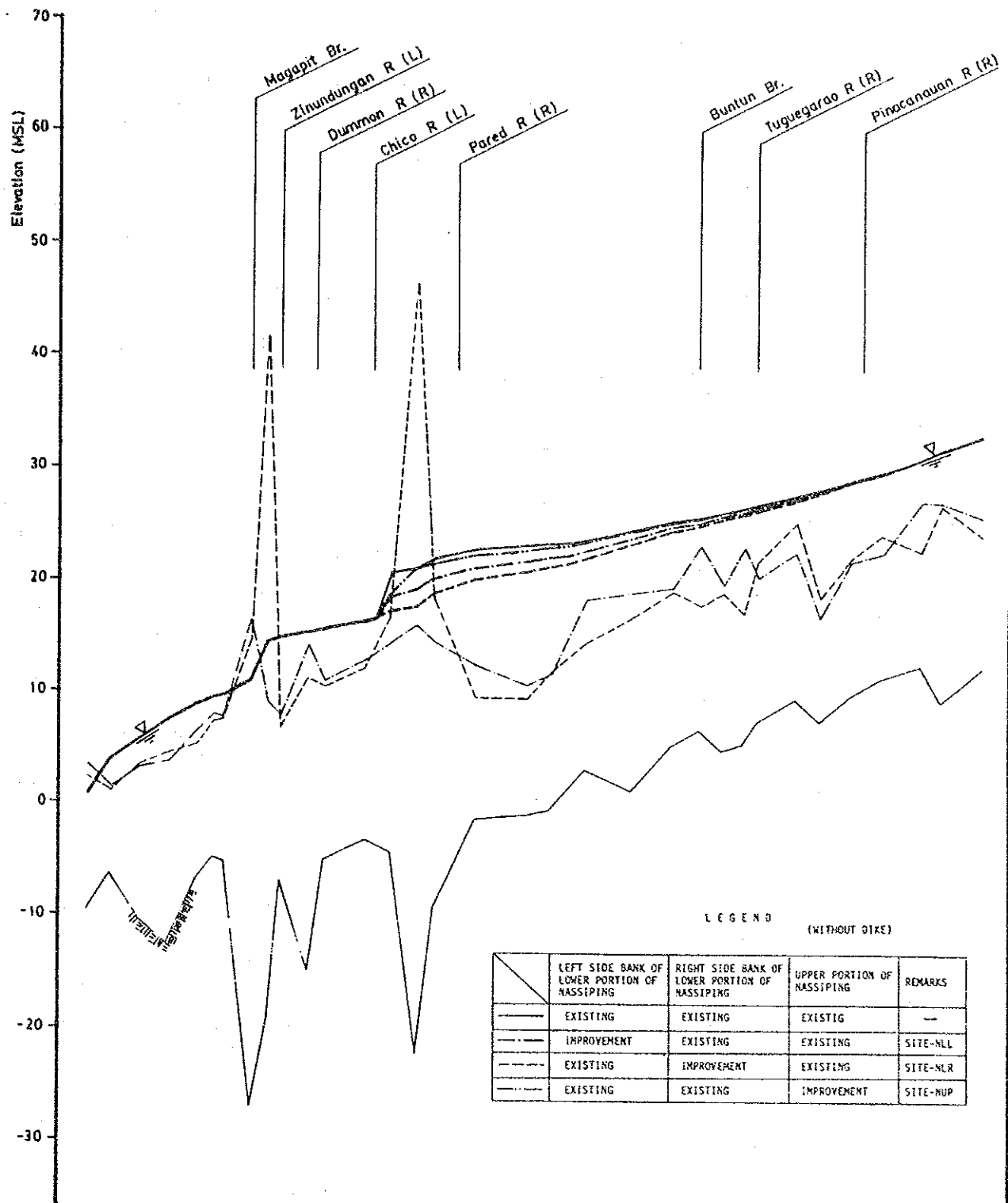


Fig. 5.4 TUGUEGARAO DIKE SCHEME





Distance (m)	0	4,000	8,000	12,000	16,000	20,000	24,000	28,000	32,000	36,000	40,000	44,000	48,000	52,000	56,000	60,000	64,000	68,000	72,000	76,000	80,000	84,000	88,000	92,000	96,000	100,000	104,000	108,000	112,000	116,000	120,000	124,000	128,000	132,000	136,000	140,000	144,000	148,000	152,000	156,000
Station	1.0	5.0	9.0	13.0	17.0	21.0	25.0	29.0	33.0	37.0	41.0	45.0	49.0	53.0	57.0	61.0	65.0	69.0	73.0	77.0	81.0	85.0	89.0	93.0	97.0	101.0	105.0	109.0	113.0	117.0	121.0	125.0	129.0	133.0	137.0	141.0	145.0	149.0	153.0	157.0

Fig. 5.6 SURFACE PROFILE FOR EXCAVATION OF NASSIPING SECTION

Attachment A. List of Collected Data

Ref. No.	Title	Author	Date of issue
FC-101	River Cross Sections Data	MPWH	1986
FC-102	Profile of River Cross Sections	MPWH	1986
FC-103	Tropical Cyclone Summaries	PAGASA	-
FC-104	Damages of Typhoons Associated with Floods in Region II from 1970 to 1985	OCD	1985
FC-105	Flood Control and Drainage Project Proposal	MPWH	-
FC-106	Construction Cost Data	MPWH	-
FC-107	Prices of Construction Materials	MPWH	1985
FC-108	Base Unit Market Values (Provinces of Cagayan, Isabela and Nueva Vizcaya)	Provincial Assessor's Office of Cagayan, Isabela and Nueva Vizcaya	-
FC-109	Reservoir Monitoring of Magat Multi-purpose Dam	NIA	1983/85
FC-110	Drawings of Major Bridges	MPWH	-

Attachment B. List of Collected Project Reports

Ref. No.	Title	Author	Date of issue
FC-201	Frame Work Plan, Cagayan Valley	NWRC	1980
FC-202	Nation Wide Flood Control Plan and River Dredging Program	MPWH	1982
FC-203	Cagayan River Flood Control Basin-Wide Study	MPWH	1983
FC-204	Panay River Basin-Wide Flood Control Study	MPWH	1985
FC-205	Magat River Integrated Irrigation System Operation, Maintenance and Dam Safety Manual	NIA	1982/85
FC-206	Magat Watershed Feasibility Sutdy	NIA	1985

Attachment C. List of Collected Publications

Ref. No.	Title	Author	Date of issue
FC-301	Infrastructure Program	MPWH	1983/86
FC-302	National Water Resources Council Annual Report	NWRC	1981
FC-303	Cagayan Integrated Agricultural Development Project Annual Report	CIADP	1984
FC-304	Tide and Current Tables, Philippines	BCGS	1986

ANNEX AG
AGRICULTURE

ANNEX AG

Table of Contents

	<u>Page</u>
I INTRODUCTION	AG-1
II SOIL AND LAND CLASSIFICATION	AG-2
2.1 Physiographic Land Units	AG-2
2.2 Slope Complex	AG-3
2.3 Soil and Land Classification	AG-4
III PRESENT CONDITION OF AGRICULTURE	AG-6
3.1 General Agricultural Situations	AG-6
3.2 Agricultural Land Use	AG-6
3.3 Agricultural Production	AG-7
3.4 Cropping Pattern and Farming Practices	AG-11
3.5 Marketing and Processing	AG-12
3.6 Agricultural Support System	AG-14
3.7 Present Agricultural Production Value	AG-16
3.8 Present Farm Economy	AG-16
IV BASIC CONCEPT OF AGRICULTURAL DEVELOPMENT	AG-18
4.1 Current Situation and Constraints	AG-18
4.2 New Agricultural Development Policy	AG-19
4.3 Existing Development Plan under DA	AG-20
4.4 Concept of Agricultural Development	AG-21
V AGRICULTURAL LAND USE PLAN	AG-24
5.1 Maximum Development Potential in Agricultural Sector ..	AG-24
5.2 Agricultural Land Use Plan	AG-25

	<u>Page</u>
VI DEVELOPMENT PLAN FOR IRRIGATION AREA	AG-27
6.1 Present Condition of Objective Area	AG-27
6.2 Proposed Farming Development	AG-28
6.3 Estimate of Irrigation Benefits	AG-31
6.4 Evaluation of Objective Area	AG-33
6.5 Priority Ranking	AG-34
VII AGRICULTURAL DEVELOPMENT IN THE OTHER SECTOR	AG-36
7.1 Rainfed Diversified Crop Development in Lowland	AG-36
7.2 Dairy/Beef Cattle Development in Upland	AG-36
7.3 Tree Crop Development in Upland	AG-39
7.4 Fishery and Forestry Development	AG-40
7.5 Recommendation for Improvement of Agricultural Support System	AG-41
VIII FUTURE CONDITION OF AGRICULTURE	AG-43
8.1 Future Agricultural Production and Production Value	AG-43
8.2 Future Agricultural Labor Requirement	AG-44

List of Tables

		<u>Page</u>
2.1	Predominat Characteristics of Major Land-Form	
	Categories in the Cagayan River Basin	AG-46
2.2	Soil and Land Classification	AG-49
3.1	Agricultural Demographic Features in the	
	Cagayan River Basin	AG-50
3.2	Present Agricultural Situation of the Basin	AG-51
3.3	Agricultural Land Use in the Cagayan River Basin	AG-52
3.4	Present Agricultural Production in the Basin (1985)	AG-53
3.5	Number of Livestock and Poultry in the Basin (1985)	AG-54
3.6	Estimated Data on Meat Production of	
	Livestock and Poultry in the Basin	AG-55
3.7	Fish Production in the Basin (1985)	AG-56
3.8	DA Facilities Profile in Region II (1985)	AG-57
3.9	Agricultural GVA in the Basin (1985)	AG-58
3.10	Present Farm Economy of Average Size Farmers	AG-59
4.1	Foreign Assisted Agricultural Development Projects	
	in Region II	AG-60
5.1	Estimate of Potential Maximum	
	Agricultural Production (GVA)	AG-61
6.1	Soil Classification and Present Land Use	
	in New Irrigation Schemes	AG-62
6.2	Present Population and Household in	
	New Irrigation Schemes	AG-63
6.3	Present Crop Production in New Irrigation Schemes	AG-64
6.4	Present Crop Production in Rehabilitation/	
	Improvement Schemes	AG-65
6.5	Present Population and Household in	
	Rehabilitation/Improvement Schemes	AG-65
6.6	Future Land Use and Harvested Area in	
	Irrigation Development Schemes	AG-66
6.7	Production Cost per Hectare	AG-68
6.8	Crop Production under without and with Project	
	Conditions in Irrigation Development Schemes	AG-70

	<u>Page</u>
6.9 Economic Price for Agricultural Outputs and Inputs, 1995 (1985 Constant Price)	AG-73
6.10 Summary of Financial and Economic Prices for Agricultural Outputs and Inputs	AG-77
6.11 Irrigation Benefits in Irrigation Development Schemes	AG-78
6.12 Annual Incremental Benefits in Irrigation Development Schemes	AG-93
6.13 Annual Equivalent Flood Damages in Irrigation Development Schemes	AG-94
6.14 Summary of Annual Equivalent Flood Damages in Irrigation Development Schemes	AG-100
6.15 Annual Production Foregone in Irrigation Development Schemes	AG-100
6.16 Economic Cost and Benefit Flow for Irrigation Development Schemes	AG-101
6.17 Economic Internal Rate of Returns for Irrigation Development Schemes	AG-116
6.18 Farm Budgets of Irrigation Development Schemes	AG-117
6.19 Net Farm Income per ha of Irrigation Development Schemes (Financial Price)	AG-132
6.20 Number of Beneficiaries per ha of Irrigation Service Area	AG-133
6.21 Priority Ranking of Irrigation Development Schemes	AG-134
7.1 Grass Yield and Total Digestible Nutrients	AG-135
7.2 Cattle Herd Composition in the Average Cattle Farm of 280 ha	AG-135
7.3 Outlines of Pasture Management and Calf Production	AG-136
7.4 Outlines of Feedlot Management	AG-136
8.1 Future Agricultural Production in the Basin (2005)	AG-137
8.2 Future Agricultural GVA in the Basin (2005)	AG-138
8.3 Monthly Labor Requirement for Agriculture (2005)	AG-139

List of Figures

	<u>Page</u>
1.1 WORK FLOW FOR AGRICULTURAL DEVELOPMENT PLAN	AG-140
2.1 PHYSIOGRAPHIC LAND-FORM MAP	AG-141
2.2 GENERAL SLOPE MAP	AG-142
2.3 LAND CLASSIFICATION FOR PADDY PRODUCTION	AG-143
2.4 LAND CLASSIFICATION FOR DIVERSIFIED CROPS PRODUCTION	AG-144
3.1 PRESENT CROP PRODUCTIONS OF REGION II (1982-1984 AVERAGE)	AG-145
3.2 AVERAGE CROP YIELD PER HA (1974-1984)	AG-146
3.3 PRESENT AGRICULTURAL LAND USE MAP	AG-147
3.4 HARVESTED AREA OF PALAY	AG-148
3.5 PRODUCTION OF PALAY	AG-148
3.6 HARVESTED AREA OF CORN	AG-148
3.7 PRODUCTION OF CORN	AG-148
3.8 PRESENT CROPPING PATTERN IN CAGAYAN RIVER BASIN	AG-149
3.9 BEEF AND PORK MARKETING CHANNEL	AG-150
3.10 MARKETING FLOW CHART OF RICE AND CORN	AG-151
3.11 FARMGATE PRICE OF PALAY IN THE CAGAYAN RIVER BASIN	AG-152
3.12 LIVESTOCK STATIONS UNDER DA-BAI	AG-153
4.1 LOCATION OF SMALL SCALE WATER IMPOUNDING PROJECT	AG-154
4.2 DEMAND AND SUPPLY PROJECTIONS FOR MAJOR AGRICULTURAL COMMODITIES IN THE PHILIPPINES	AG-155
6.1 PRESENT CROPPING PATTERN IN NEW IRRIGATION SCHEMES	AG-157
6.2 PRESENT CROPPING PATTERN IN REHABILITATION/IMPROVEMENT SCHEMES	AG-158
6.3 PROPOSED CROPPING PATTERN (A) IN THE PADDY FIELD AREA	AG-159
6.4 PROPOSED CROPPING PATTERN (B) IN THE PADDY FIELD AREA	AG-159
6.5 PROPOSED CROPPING PATTERN (C) IN THE DIVERSIFIED CROP AREA	AG-159
7.1 BODY-WEIGHT GAIN CURVE OF CATTLE	AG-160
8.1 GROWTH OF AGRICULTURAL GVA	AG-161

List of Attachment

A.	List of Collected Data	AG-162
B.	List of Collected Project Reports	AG-165
C.	List of Collected Publications	AG-169

I INTRODUCTION

This sectoral study report presents the results of agricultural and agro-economic study covering the present condition of agriculture and the future agricultural development plan in the basin. Agricultural development plan was primarily made on irrigation development based on the future agricultural land use plan which was formulated according to Economic Development Macro-Framework. Agricultural development in the non-irrigable areas was conceptually studied in this report. Outlines of work flow for agricultural development plan are presented in Fig. 1.1.

Data and information used in this study were provided by the following government authorities and private associations.

- a. Department of Agriculture (DA)
- b. Bureau of Soils (BS)
- c. Bureau of Agricultural Economics (BAECON)
- d. Bureau of Plant Industry (BPI)
- e. Bureau of Animal Industry (BAI)
- f. Bureau of Fisheries and Aquatic Resources (BFAR)
- g. National Food Authority (NFA)
- h. Bureau of Forestry Development (BFD)
- i. Bureau of Lands (BL)
- h. National Irrigation Administration (NIA)
- k. National Economic and Development Authority (NEDA)
- l. National Census and Statistics Office (NCSO)
- m. Department of Agrarian Reform (DAR)
- n. Philippine Crop Insurance Corporation (PCIC)
- o. Northern Philippine Grain Complex (NPGC)
- p. Cagayan Sugar Corporation (CASCO)
- q. Philippine Cotton Corporation (PCC)
- r. Cagayan Valley Development Corporation (CVADECO)

II SOIL AND LAND CLASSIFICATION

2.1 Physiographic Land Units

The Cagayan river basin is broadly classified into the following ten (10) landform categories from physiographic point of view:

1. Alluvial Land System
 - a. Tidal Swamp
 - b. Recent River Terraces
 - c. Alluvial Terraces
 - d. Swamp and River Scar
2. Alluvial-Colluvial Land System
 - e. River-Cut Plain
 - f. Alluvial Fan/Piedmont/Interhill Miniplain
3. Hill Land System
 - g. Hillslope
 - h. Peak/Terraces/Valley Floors
4. Mountain Land System
 - i. Mountainside
 - j. Peak/Plateau/Valley Bottom

The landform categories are identified, basically following the preliminary study given in "Landforms in the Rice-Growing Areas of the Cagayan River Basin" prepared by IRRI, 1981. The study on identified landforms are made on the basis of the topographic maps scaled 1 to 25,000. Major characteristics of each landform are summarized in Table 2.1. Predominant landform units are mapped as shown in Fig. 2.1.

Major agricultural lands are developed on (i) recent river terrace (480 km²), (ii) alluvial terrace (3,300 km²) and (iii) river-cut plain (1,160 km²). Pasture lands for cattle grazing occupy only a part of hillslopes (7,270 km²).

2.2 Slope Complex

The Cagayan river basin is classified into four (4) general slope categories by the Bureau of Soils (BS), prepared from topographic maps scaled 1 to 250,000. The slope grouping is generally utilized for defining total cultivable area and specially potentially irrigable areas. These slope categories with the corresponding description are as follows:

Slope Categories	Description	Area (km ²)	Proportional Extent (%)
0 - 3%	Most suitable for irrigation; 3% is about the maximum slope if the land is to be used for lowland rice.	4,200	15.4
3 - 8%	Suitable for irrigation but require slight terrain modification by contouring or terracing; 8% is about maximum slope for upland crops	2,600	9.5
8 - 18%	Irrigation will not be feasible; intensive soil conservation measures are required if cultivated; and tree crops should be recommended.	9,000	33.0
More than 18%	Not suited to any type of cultivated crops; should be left unutilized and be covered with forests.	11,500	42.1
Total		27,300	100.0

The potentially cultivable area in terms of topography is limited to the lands with slope less than 18%. Such lands constitute about 58% of the basin area, or 15,800 km² gross. The potentially irrigable area of 539,000 ha net which have been identified by NIA and are repeatedly quoted in publications and reports, nearly corresponds to the area with less than

8% slope.

The areas of each slope grouping are demarcated on the General Slope Map (Fig. 2.2). Comparison between the present agricultural land use map (Fig. 3.3) and slope map (Fig. 2.2) indicates that the existing agricultural lands nearly overlap with the area with less than 3% slope. The lands with the slopes between 3-8% having smaller areas, compared with other slope categories, are also partly utilized for agricultural production. It means the best suitable lands for agriculture have already been fully developed and only undulating lands are left for further expansion of agricultural land.

2.3 Soil and Land Classification

Several kinds of soil maps are available. These are:

- a. Detailed soil maps scaled 1/20,000 covering 33 municipalities,
- b. Semi-detailed maps prepared by Land Resources Evaluation Project sponsored by DA/BS, covering Nueva Vizcaya Province,
- c. Semi-detailed maps for major irrigation areas surveyed by NIA, and
- d. Reconnaissance soil maps scaled 1/250,000 in Region-II.

Only the reconnaissance soil maps prepared by BS during 1960s cover the entire area of the basin. Others are of detailed nature, but cover only very limited parts of the basin. The reconnaissance soil maps show some discrepancies in topography and land use because the detailed topographic maps were not available when the area was surveyed. The soil study was therefore made on the basis of the physiographic landform map (Fig. 2.1), in reference to the reconnaissance soil maps in general and, in part, to the detailed maps mentioned above.

The results of the soil study are summarized in Table 2.2. Land capability both for rice and upland crops is also studied for each soil series on the basis of the modified form of USBR Standard. The land capability classifications for paddy and diversified crops are mapped as shown in Fig. 2.3 and Fig. 2.4 respectively and summarized as follows:

(Unit: km ²)		
Suitability	For Paddy	For Diversified Crop
1. Highly suitable	3,110	490
2. Moderately suitable	660	2,270
3. Marginally suitable	530	5,220
4. Limitedly Arable	460	2,820
5. Non-Arable	22,540	16,500
Total	27,300	27,300

III PRESENT CONDITION OF AGRICULTURE

3.1 General Agricultural Situations

The Cagayan river basin is primarily an agricultural region. About 1.7 million or 81% of total population in 1985 live in the rural area and are engaged in agricultural activities. Rate of rural population to the total is rather high, compared with that of the country which is about 60%. The number of farm household in the basin area is estimated at about 316,000 as of 1985. Average family size of farm household is around 5.5 per family. About 65% of rural population are living in two provinces, Cagayan and Isabela, where broad agricultural lands are developed along the Cagayan river. The demographic features of the basin area are summarized in Table 3.1.

Agriculture in the Cagayan river basin is characterized by (i) high rate of rural population, (ii) high contribution of agriculture to GRP, (iii) limited agricultural land use, (iv) significantly high share of idle grassland, (v) heavy reliance on temporary crops like rice and corn and (vi) low productivity. Comparison between the country and the basin (or Region II) is given in Table 3.2. Comparison in crop production is also made as illustrated in Fig. 3.1. Crop yields per ha are also compared with the country average as given in Fig. 3.2. All these comparisons indicate that in spite of extreme importance of agriculture in the basin area, its productivity is generally low.

3.2 Agricultural Land Use

Agricultural area of the Cagayan river basin is estimated at 5,339 km² in total, on the basis of the topographic maps scaled at 1 to 25,000 and also various statistics obtained from BAECON, DA, BS, BFAR, NIA, etc. The estimated physical areas of each land use are as follows:

Agricultural Land Use	Area (km ²)	Proportional Extent (%)
a. Paddy Field	2,470	46.3
- Irrigated	(1,467*)	(27.5)
- Rainfed	(1,003)	(18.8)
b. Diversified Crops Area	1,303	24.4

sub-total	3,773	70.7
c. Permanent Crops Area	270	5.1
d. Fish Pond	27	0.5
e. Pasture under cattle ranch	1,269	23.7
Total	5,339	100.0

*Actually cultivated area during the wet season.
(For details, see Table 3.3)

The areal distribution of paddy fields and diversified crops area is shown in Fig. 3.3. Such agricultural lands utilized for cultivation of temporary crops are narrowly developed on the alluvial terraces which extend along the Cagayan river, and occupy about 70% of the total agricultural land. The cattle ranches have been rapidly expanding in recent years. They extend over the hilly areas. Permanent crops include banana, citrus, coconuts and coffee. These tree crops are sporadically observed over the hilly and mountainous areas.

3.3 Agricultural Production

3.3.1 Crop Production

Major crops grown in the basin are rice and corn, followed by peanuts, tobacco, sugar cane, sweet potato, beans and vegetables. Production of these crops in 1985 is estimated as follows:

Crops	Harvested Area (ha)	Unit Yield (ton/ha)	Production (10 ³ ton)
Paddy	364,400	2.52	918
- Irrigated	(264,100)	(2.63)	(694)
- Rainfed	(100,300)	(2.23)	(224)
Corn	224,000	0.94	211
Peanuts	23,700	0.74	18
Tobacco	14,200	0.60	9
Sugar Cane	10,000	39.20	392
Sweet Potatoes	7,200	4.76	34
Beans	2,500	0.34	1
Vegetables	4,400	4.02	18
Banana	7,700	6.71	52
Coconuts	4,100	2.12	9
Citrus	3,100	3.06	9
Coffee	6,500	0.37	2

(For details, see Table 3.4)

Rice and corn are extremely important in the Cagayan area. However, the planted/harvested area and production of these crops are largely fluctuating year by year as shown from Fig. 3.4 to Fig. 3.7.

Major reasons for such large fluctuation in harvested area and production are attributed to (i) unstable and uneven distribution of rainfall, (ii) typhoons resulting in serious damages caused by floods and strong winds, and (iii) unstable prices and marketing channels.

3.3.2 Livestock Production

A large number of livestock are observed in the basin as follows:

Livestock	(Unit: 10^3 head)	
	Philippines	Basin
Cattle	1,786	128 (7%)
Carabao	2,983	344 (12%)
Hog	7,304	454 (6%)
Goat	2,191	47 (2%)
Chicken	52,098	2,720 (5%)
Duck	5,276	302 (6%)

Most of these livestock animals are raised by small farmers or backyard raisers. Large scale commercial production is still underdeveloped:

Livestock	(Unit: 10^3 head)	
	Backyard	Commercial
Cattle	82 (64%)	46 (36%)
Carabao	342 (100%)	1 (0%)
Hog	428 (94%)	26 (6%)
Goat	43 (91%)	4 (9%)
Chicken	2,599 (96%)	121 (4%)
Duck	288 (95%)	14 (5%)

(For details, see Table 3.5.)

Annual potential meat production is estimated as follows:

Livestock	(Unit: 10 ³ head)	
	Potential for slaughter (10 ³ heads)	Meat Production (tons)
Cattle	10	1,470
Carabao	28	4,400
Hog	276	12,700
Goat	5	70
Chicken	7,050	7,200
Duck	270	270

The present livestock industry is characterized by low productivity which is evidenced by (i) low slaughter live weight, (ii) low percentage of carcass dressing, (iii) high mortality rate and long breeding interval (Detailed data on meat production are given in Table 3.6).

The present low productivity of livestock industry results from (i) the high rate of backyard production, (ii) the high rate of native breeds (vary low introduction rate of improved breeds), (iii) the high probability of diseases occurrence (No serious diseases have been observed in this area. Dominant diseases are hemorrhagic septicemia and blackleg which can be prevented by vaccination), (iv) low utilization of hay, silage and high energy feeds, and (v) lack of technical guidelines for the pasture land development.

3.3.3 Fish Production and Forestry Production

Aquaculture is still underdeveloped in the basin. Natural swamps and river scar are generally utilized as fish ponds. Major species are milkfish and mudfish. Large scale fish ponds are observed in the northern coastal areas of the Cagayan province. There are about 1,600 fish ponds in the basin, with a total area of 2,700 ha. Annual fish production is estimated at about 1,500 tons in total, or 0.57 ton per ha. (for details, see Table 3.7)

Logwood production in 1985 is estimated at 715,000 m³ on the basis of forestry statistics prepared by BFD.

3.4. Cropping Pattern and Farming Practices

The present cropping pattern for the areas utilized for annual crops' cultivation is given in Fig. 3.8. In the irrigated paddy field of 146,700 ha actually irrigated during the wet season, high yielding varieties of IR 36, 42, 58, 60, 62 and 64 are adopted on most of the areas. The commonest cropping pattern in this area is paddy-paddy. The cropping intensity is about 180%. The planted areas in the dry season generally become lower due to insufficient supply of irrigation water. Advanced rice cultivation techniques are widely applied in the irrigated area. Use of fertilizers and agro-chemicals is common. In most of the areas, paddy is planted in May-June and harvested in October-November during the wet season. The second paddy starts immediately after the first harvest and is harvested in April-May. In some areas where constant water supply is assured, the farmers practice three crops a year, using short-duration rice varieties. In high-elevated areas, cold climate is a common problem because suitable varieties have not been selected yet. The farmers in such area adopt a different cropping pattern; planting in March and harvesting in July (First paddy), and planting in August and harvesting in December (Second paddy).

In the rainfed paddy field of about 100,300 ha, paddy is grown only once in the wet season. The use of improved varieties is limited in this area. About 60% of the area is planted with nameless local varieties. Most of the farmers do not apply fertilizers and agro-chemicals. About 20% of the rainfed paddy fields is cultivated for corn during the dry months from January to May. The remaining 80% of the fields is left unutilized in the dry season due to lack of water.

In the diversified crops area of about 130,300 ha, corn is grown as a primary crop. None of the area is provided with irrigation water. All the crops are cultivated under rainfed condition. Corn is grown twice a year. Major corn area extends along the Cagayan river and over the undulating

upland areas extending near the hillslopes. More than 90% of corn grown in the basin is white corn of native varieties. Hybrid yellow corn is not popular yet. Corn yield is generally very low. Sugar cane is grown in Piat area of Cagayan province. Farm product is exclusively sent to the sugar factory at Piat. Sugar cane yield is very low due to unstable rainfall condition. The factory is facing a serious problem of raw materials shortage. Peanuts are usually intercropped with dry season corn. Major root crop is sweet potato which is grown in undulating upland area. Tobacco is mostly grown in the river terraces in Isabela province.

Major tree crops in the basin are banana, coconut, citrus and coffee. No significant activities on tree crop plantation are observed. Major constraints to tree crop development are solely attributable to the limited market outlets.

3.5 Marketing and Processing

3.5.1 Marketing and Prices

Only rice and corn have a country-wide marketing channel. Other minor crops are generally consumed locally. Marketing channel for beef and pork are as shown in Fig. 3.9. No government control is extended to marketing of livestock products. It is solely operated by private dealers. The marketing systems for rice and corn are illustrated in Fig. 3.10. A number of local dealers (about 1,700) play an important role in marketing of rice and corn. It is reported that about 90% of the marketable surplus of rice is handled by the local dealers. The National Food Authority (NFA), a government food marketing agency created to ensure adequate and constant supply of foods at reasonable prices, also functions as a marketing leader for rice, handling about 10% of the marketable surplus. Most of the surplus corn (about 55% of basin's production or about 145,000 tons) are transported by the local dealers mainly to Manila. Average paddy production in recent years amounts to about 840,000 tons. With a population of about 2.1 million, the basin consumes about 350,000 tons of paddy including seed, feeds and storage loss and damages which are estimated at 94,000 tons. After meeting the local consumption, about

490,000 tons are available for transport to the other regions.

Farmgate price of paddy directly influences the farmer's livelihood because paddy is grown by most of the farmers and constitutes a major source of farm income. The farmgate price of paddy for the last five (5) years indicates (Fig. 3.11 to be referred to):

- a. paddy price has remarkably increased at an average rate of 23% per annum,
- b. real value of paddy has not significantly increased due to a hike in general prices, and
- c. seasonal fluctuation of paddy price is remarkable.

The reasons for remarkable fluctuation in paddy price are complicated; manifold factors are interrelated collectively. However, one of the decisive factors should be unstable supply of paddy to the market.

Unstable farmgate prices of paddy leave the farmer's livelihood also unstable. Stabilization of paddy price will give an enormous benefits to the farmers. Various measures are conceived; however, the most important prerequisite for price stabilization will be stable production of paddy and constant supply to the market; these could be realized, to a certain extent, by irrigation development, minimization of flood damages to crops and roads, and improvement of existing farm-to-market roads.

3.5.2 Processing

The basin has a total milling capacity of about 800,000 tons per annum. Bulk of this capacity is locally called "kiskisan" type which processes paddy in a one-pass operation that removes the husk and bran at the same time. Quality of milled rice is therefore considered rather poor and unsuitable for marketing. The capacity of the other modern rice mills which produce a better quality of milled rice, is about 295,000 tons per annum which nearly corresponds to only 60% of marketable surplus. The rest of the surplus (about 195,000 tons) is therefore moved to Central Luzon for milling. The total quantity of paddy processed within the basin is about

551,000 tons inclusive of the basin's consumption for food of 256,000 tons, which corresponds to about 70% of total milling capacity.

Agro-processing facilities other than rice mills are represented by CASUCO and CAVADECO. The former is sugar mill with a capacity of 4,000 tons per day and the latter is processing feeds for livestock with a capacity of 6 tons per hour. Neither of them have realized the full operation of their design capacity due to difficulties involved in procurement of raw materials.

3.6 Agricultural Support System

DA plays a leading role in the agricultural support system, having 6 provincial agricultural officers (PAO), 112 municipal agricultural officers (MAO), and 850 agricultural food technicians (AFT) under the regional director. DA has its regional office at Tuguegarao and provincial offices at each provincial capital. Major Facilities under control of DA are listed in Table 3.8. Most of them are research and/or extension oriented facilities in the fields of soil, crops and livestock. These facilities are fully utilized for execution of agricultural support services. DA provides the farmers with following services through its various channels:

- a. propagation of new technologies which have been established through the DA's researches and trials,
- b. supply of registered seeds,
- c. promotion of cooperative movement,
- d. execution of special national program like Masagana 99 and Maisagana, and
- e. technical training to cattle breeders and artificial insemination services, etc.

Research: DA has an agricultural experiment station at Ilagan. The station specializes in rainfed upland crop experiments and trials. Cagayan Valley Experiment Station is organized under Ilagan Experiment Station. It is located within the Magat Irrigation Project area and specializes in irrigated rice trials. The agricultural research and trials are also

carried out by other institutions which include (i) Cagayan State University (ii) Integrated Agricultural Development Project (CIADP), and (iii) Isabela State University. All the research works are coordinated under DA regional office.

Seed Multiplication: The seed multiplication has been carried out by three institutions i.e., (i) Luna-Abulug Seed Farm Complex, (ii) Ilagan Experiment Station, and (iii) Cagayan Valley Experiment Station. These institutions mainly work on rice, under BPI/Seed Board, Manila. The foundation seeds of recommendable varieties come from BPI/Seed Board for multiplication at the seed institutions. The multiplied seeds are called registered seeds which will be distributed to the contract seed growers for multiplication in the farmer's fields. These institutions are responsible for technical guidance to the seed growers, processing of multiplied seeds, storage and distribution. The seed growers organized under the three institutions totals to 175, covering a total area of 870 ha. These institutions however are not capable of supplying enough registered seeds to the seed growers and also of certified seeds to the farmers due to their limited facilities and equipment.

Cooperative Movement: A total of 934 farmers' associations (Samahang Nayan) are registered in Region II, among which only 144 associations (15%) are actually operating. Organization is not so strong. Most of the members are not small farmers.

Extension: The government rice programs (Masagana 99 and Intensified Rice Production Program - IRPP) cover about 84,000 ha or 34% of the total paddy fields. About 34,000 farmers participate in the programs. The government corn program called "Expanded Corn Program (ECP)", which is modified program of Maisagana, covers about 10,600 ha or 10% of the planted area. These production programs have credit services of which loan amounts per ha are ₱3,000 for rice and ₱4,200 for corn together with technical assistances. Interest rate of those credit is 15% per annum.

Livestock extension services by DA include (i) production of breeders' stock and artificial insemination (A.I.) services, (ii) production and

supply of pasture seeds, (iii) technical training, and (iv) arrangement of credit services, etc. The DA facilities for livestock development are shown in Fig. 3.12.

3.7 Present Agricultural Production Value

Agricultural production in term of Gross Value Added (GVA) for the year 1985 is estimated as follows:

GVA/ ¹ (10 ⁶ ₱)		
(1) Crops	631	(73%)
a. Palay	(430)	
b. Corn	(94)	
c. Others	(107)	
(2) Livestock	77	(9%)
(3) Fishery	7	(1%)
(4) Forestry	147	(17%)
Total	862	(100%)

¹ : GVA at 1972 constant price

Rice and corn are major crops grown in the basin area, accounting for 60% of total GVA. Calculation of agricultural GVA is shown in Table 3.9.

3.8 Present Farm Economy

Farm economy of average size farmer in the basin is compared with that of the national average size farmer as follows:

Description	Philippines	Basin
a. Average Farm Size	0.8 ha	1.2 ha
b. Cropping Intensity	173%	165%
c. Gross Farm Income	₱ 9,760	₱12,680
d. Production Cost	₱ 5,360	₱ 8,450
e. Net Farm Income	₱ 4,400	₱ 4,230
f. Living Expenses	₱23,400	₱17,800
g. Net Farm Profit per ha	₱ 5,500	₱ 3,530

The farm income is not sufficient enough to cover the living expenses. Large portion of living expenses is reportedly compensated by off/non-farm income. The above analysis indicates low productivity of agriculture in the basin. The details of present farm budget analysis are given in Table 3.10.

IV BASIC CONCEPT OF AGRICULTURAL DEVELOPMENT

4.1 Current Situation and Constraints

Agriculture in the Cagayan river basin is of extensive nature, being endowed with large arable land. Major crops grown in the basin are paddy rice and corn which account for 87% of the total harvested area and 83% of Gross Value Added (GVA) for all the crops. The farmers heavily rely on these two primary crops economically. However, unit yields of these crops are generally low, and the planted/harvested areas of the crops largely fluctuates every year. This makes the farm economy unstable and keeps it lower. The situation is clearly indicated by a large lag in per capita earning in agricultural sector which amounts to only ₱1,702 as against the country's average of ₱3,004.

The reasons for unstable and low productivity are manifold; however, major constraints are considered as follows:

- a) rainfall with wide range of fluctuation and its uneven seasonal distribution; the existing irrigation service area covers about 228,600 ha or about 93% of the existing paddy field, however, actually irrigated paddy field is only 146,700 ha, the rest of 81,900 ha is not actually irrigated due to various reasons; even irrigated lands are not serviced with sufficient water throughout the year, as indicated by the average cropping intensity of 180%, the rainfed cropland amounts to 230,600 ha.
- b) flood damages caused by occasional typhoons; an estimated flood prone area is about 174,000 ha for 1980-flood, most of which the existing croplands; it means about 46% of the total annual cropland (377,300 ha) are more or less damaged by floods.
- c) insufficient provision of agricultural support services; other constraints such as limited use of fertilizers, insufficient practices of crop protection, wide use of unnamed native varieties, etc. are also important.

4.2 New Agricultural Development Policy

New government has given to the highest priority for the economic development to agricultural sector. Based on the new policy, DA prepares "A Short-Term Recovery Plan for the Rural Sector." The specific objectives of the plan are as follows:

- a) create jobs for the landless workers,
- b) redistribute land rental income to the poorest farmers,
- c) raise output prices at the farmgate level,
- d) lower input prices, and
- e) increase productivity.

The following fifteen (15) emergency measures are proposed in the plan to achieve the above objectives:

- 1) launch a massive rural infrastructure program (roads, ports, irrigation, flood control and drainage) with the quickest pay off and giving priority to the poorest regions:
- 2) assist in the immediate land reform and land titling program, particularly in the poorest area,
- 3) supply more comprehensive and effective support services,
- 4) reduce the real interest rate through appropriate monetary policies, and improve the credit delivery system,
- 5) continue dismantling of government or government-supported monopolies,
- 6) abolish export taxes on all agriculture based products except logs,
- 7) lowering fertilizer price as an effective, essential short term instrument for raising yields per hectare,
- 8) support the price of rice and corn,
- 9) mobilize research and extension systems including state colleges and universities of agriculture and non-governmental and farmer organizations,

- 11) reorient the Agricultural Incentives Priorities Plan; the plan to assist the large agribusiness firms needs to be modified to more closely match the primary goal of assisting the small farmers,
- 12) implement new policies that will improve incomes in fishing, and provide more equitable access,
- 13) closer control of the use of pesticides if needed,
- 14) relax the bar on inter-provincial transport of carabaos and of slaughter of male carabao, and
- 15) decentralize administration - the DA is responsible for the rural sector - it must operate in the rural sector.

4.3 Existing Development Plan under DA

Regional office of DA has prepared the operational plan for fiscal year of 1986. The total amount of budget requirement is about ₱27.0 million. The plan covers manifold fields of agricultural services. Most of the programs listed in the plan exactly follow the national policy and constitute a part of the national agricultural programs and projects. The programs pertaining to the peculiarity of the area are also included in the plan. Most of them are related to researches, survey and study on crops, soils and livestock. Only one program named "small scale water impounding project" is related to the water resources development. This project aims at livestock development in hillslope area, by damming up the very small streams. DA has proposed 25 sites in the basin area. The locations of the proposed sites are indicated on Fig. 4.1

DA has also executed several foreign assisted projects in Region II. These are listed in Table 4.1. Most of the projects aim at improvement of marketing and agricultural support systems in the fields of crop production, fishery and livestock development. There is no project directly related to water resources development.

4.4 Concept of Agricultural Development

Agricultural development basically aims at:

- a) improvement of 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 basic principles exactly conform to the new government policy given in "A Short-Term Recovery Plan for Rural Sector." Considering the above principles and availability of endowed resources, the following strategies for agricultural development have been conceived:

- 1) Improvement of land productivity on the existing agricultural land through irrigation development and flood protection works.

- The existing agricultural lands are mostly developed in the lowland area which narrowly extends along the Cagayan river. Further expansion of cropland in the lowland is quite limited. Major crops in the lowland are rice and corn which account for 87% of the total crops area and 83% of the total crop production value. These crops, however, give the farmers only unstable and low results of yields due to occasional floods and irregular availability of water.

- For irrigation development, priority will be given to the existing paddy field. Drastic change in the prevailing paddy-paddy cropping pattern will not be considered, because of the projected future shortage of paddy rice (see Fig. 4.2). In the diversified crop areas, corn will continue to be the primary crop. The planted area of yellow corn will, however, be increased, instead of white corn, due to the mushrooming demand for feeds (see Fig. 4.2). Flood protection works will directly

affect the corn production because most of the corn fields are located within the flood prone area.

2) Expansion of agricultural land through development of undulating uplands and hillslopes.

- Large area of undulating uplands and hillslopes still remain unutilized. Development of the idle grassland will be a key determinant in the regional economy of the basin. These lands could be utilized for tree crops plantation and cattle grazing as well as diversified crop production.

- In particular, cattle grazing will have a great potential considering the increasing demand for beef (see Fig. 4.2) and the extensive suitable land for pasture. The problems to be encountered in these aspects are (i) supply of feeds during the dry season, (ii) water supply for cattle, (iii) prevention of animal diseases, (iv) selection of suitable species including process of breeding, and (v) establishment of marketing channel. Small scale water impounding project which DA has proposed may give a solution to the first two problems.

3) Amplification of agricultural support services, particularly to the small farmers who form the majority of rural society.

- Agricultural support services will become more important for sustaining high level of production. The research should be oriented to appropriate technology that could readily be adopted by the farmers with lower cost inputs. Seed production and distribution channels should be strengthened. For effective extension services, more dialogues with the people will be required. Massive and effective information dissemination system should be created to give all the necessary information needed by the farmers so that positive changes in their attitudes could be made. Cooperative movement among small farmers should be encouraged.

- Expansion of agricultural support services will be required both for the improvement of productivity in lowland and the expansion of agricultural land in upland.

V AGRICULTURAL LAND USE PLAN

5.1 Maximum Development Potential in Agricultural Sector

5.1.1 Land Resources for Agricultural Development

Potential area for agricultural development in the basin is estimated to be 1.08×10^6 ha as follows:

	Area (10^3 ha)
Forestry	1,150
Built-up area, bare land and others	500
Potential area for agricultural use	1,080
- Lowland (slope <8%)	(476)
- Upland (8%<slope<18%)	(604)
Total	2,730

5.1.2 Future Land Use Pattern in Potential Maximum Area

Future land use patterns in the potential area of 1.08×10^6 ha is established on the basis of the analysis of the present land use pattern, soil conditions and land classification (see Table 5.1).

5.1.3 Present and Future Production in Potential Area

It is assumed on the basis of the present agricultural productivity and the agricultural experiment data that if all the necessary measures will be taken up in the fields of flood control, irrigation and other agricultural development, the area will attain double productivity in terms of GVA per ha at 1972 constant price. Potential maximum GVA to be produced from the potential maximum agricultural land is estimated at $\text{₱}2,408 \times 10^6$ in the basin as shown in Table 5.1.

5.2 Agricultural Land Use Plan

5.2.1 Agricultural Development Target up to the Year 2005

According to Economic Development Macro-Framework, the agricultural sector excluding forestry is expected to produce the GVA of around ₦1,700 x 10⁶ by the year 2005, which corresponds to 28% of expected GRDP (as of 2005) in the basin and is almost equivalent to 70% of the potential maximum production of ₦2,408 x 10⁶.

5.2.2 Strategies for Agricultural Land Use Plan

In view of the present agricultural situation mentioned above, the following strategies have been applied to make the agricultural land use plan:

- 1) The potential paddy field of 306 x 10³ ha will fully be irrigated, through realization of the following measures:
 - Immediate construction of on-going projects
 - Rehabilitation/improvement of existing NIS and CIS schemes
 - Development of new irrigation schemes
- 2) Productivity of rice production will be increased by extension of improved farming practices under irrigated condition.
- 3) The potential diversified cropland of 170 x 10³ ha will fully be developed, and the increased cropland will mainly be allocated to corn production.
- 4) Productivity in the diversified cropland will be increased by the improved farming practices under rainfed condition.
- 5) Upland area will be utilized mainly for the production of permanent crops and cattle grazing.
- 6) Recommended permanent crops will be cashew nuts, mango and citrus fruits.
- 7) Cattle will be grazed in the pasture and be fattened in the feedlot.

- 8) Fresh water aquaculture will be the main source of fishery products. The increase in production of fishery products will be set at 4.5% per annum based on "The Medium-Term Plan of BFAR".
- 9) Forestry production will be maintained at the present level in due consideration of the government policy on environmental conservation.

5.2.3 Proposed Agricultural Land Use Plan

Based on the strategies mentioned above, agricultural land use plan for the year 2005 is made as follows:

Land Use	(Unit: 10 ³ ha)			
	Present Land Use (1985)	Future Land Use (2005)	Land Use Plan in P.M.A.*	Ratio of Attainment in 2005(%)
		(1)	(2)	(1)/(2)
<u>Lowland</u>				
1. Paddy field	247	306	306	100
2. Diversified - Corn field	102	142	142	100
cropland - Others	28	28	28	100
3. Grassland (idle)	99	-	-	-
Sub-total	476	476	476	-
<u>Upland</u>				
1. Permanent cropland	27	57	200	29
2. Pasture	127	210	300	70
3. Grassland (idle)	450	337	104	-
Sub-total	604	604	604	-

* Potential maximum area.

VI DEVELOPMENT PLAN FOR IRRIGATION AREA

6.1 Present Condition of Objective Area

6.1.1 New Irrigation Schemes

None (9) schemes with a total area of about 65,300 ha have been taken up as new development schemes. The area comprises about 45,100 ha of paddy fields (69%), 14,200 ha of diversified cropland (22%) and 6,000 ha of idle grassland (9%). In the area, 16 soil series are identified and grouped into six textural classes:

1) Clay Loam	34,100 ha
2) Sandy Clay Loam	17,200 ha
3) Silty Loam	5,000 ha
4) Silty Clay Loam	4,600 ha
5) Clay	2,700 ha
6) Sandy Loam	1,700 ha
<hr/>	
Total	65,300 ha

These soil condition are suitable for irrigated paddy cultivation and an kinds of upland crops. Most of these soils are graded as "A" in DA land capability classification. Soil and land use conditions are summarized in Table 6.1.

The total population in the new development areas is estimated at about 269,400. Households total to 47,700, of which farm household accounts for 74% or 35,100 in number. Demographic information is given in Table 6.2.

The present cropping pattern is shown in Fig. 6.1. The present cropping intensity is estimated at 129% on average as shown in Table 6.3.

6.1.2 Rehabilitation/Improvement Schemes

Five (5) existing irrigation schemes will be put under the rehabilitation/improvement program. The irrigation service area totals about 12,200 ha. The actually irrigated area, however, is only 3,815 ha (32%) in the wet season and 2,965 ha (25%) in the dry season as shown in Table 6.4. Unit yield of paddy ranges from 3.1 tons/ha to 3.8 tons/ha with an average of 3.4 tons/ha for wet season paddy and 3.5 tons/ha for dry season paddy.

A total of 5,950 farmers participates in the irrigated agriculture at present. This corresponds to about 57% of the total number of farm households in total service areas. The scheme will benefit about 4,600 farmers additionally. Demographic feature of the area is given in Table 6.5. Present cropping pattern is illustrated in Fig. 6.2.

6.2 Proposed Farming Development

6.2.1 Future Land Use and Proposed Cropping Pattern

After the implementation of the irrigation and rehabilitation/improvement projects, the present rainfed paddy will be irrigated and the irrigated paddy fields will be improved. Present grassland will be also opened as irrigated paddy fields. Diversified croplands under the rainfed condition will be developed as irrigated diversified cropland because drastic change in land use is difficult.

Three types of the cropping patterns are proposed as shown in Fig. 6.3 through Fig. 6.5. Pattern A and B are proposed for paddy fields and Pattern C is proposed for the diversified cropland. Pattern A is a paddy-paddy-beans type and designed so as to get the maximum benefits and the stable production. Pattern B is a paddy-paddy type and designed to reduce the total irrigation water requirement and construction costs for dam and irrigation facilities. Two types of cropping pattern are applied to the economic evaluation for paddy fields of each scheme.

Early-maturing varieties of paddy like IR36, IR56, IR58 and IR60 will be adopted to Pattern A and B. These varieties matured within 110 days after seeding. Wet season paddy in Pattern B will be delayed from that in Pattern A by a half month for seeding, transplanting and harvesting. A half of the harvesting paddy in Pattern B will be exposed to typhoon in October. The dry season paddy in Pattern B will be ahead of Pattern A for a half month. The period between two crops of paddy in Pattern A will span over 3 months from September to November. Mungo beans or other legumes will be grown in this period as a third crop in Pattern A. Irrigation will be shut down during the month of April in Pattern A and April/May in Pattern B for the maintenance of irrigation facilities.

Pattern C is designed for irrigated diversified croplands. Major crops are corn, vegetables, Mungo beans and tobacco. Open-pollinated corn will be adopted because of its lower production costs as compared with hybrid corn. Pattern C will be introduced to the areas with sandy soils and/or the existing diversified cropland.

Future land use and harvested areas under with project condition are as shown in Table 6.6 for new irrigation and rehabilitation/improvement schemes.

6.2.2 Proposed Farming Practices

Proper farming practice is one of the essential factor for realizing full exploitation of the agricultural potential in the project area. Based on the data prepared by Ilagan Experiment Station, San Mateo Experiment Station, and Agricultural Pilot Center under CIADP and PCARRD, the proposed farming practices and farm inputs in the future with project condition are designed. With regard to the future without project condition, no substantial changes in the farming practices are forecast.

Production costs, and labor, animal power and mechanical power requirements under with and without conditions are shown in Table 6.7.

6.2.3 Anticipated Yield and Production

Present crop yields in the basin are lower than the national average and fluctuate year by year under the rainfed and unstable irrigated conditions. After completion of the irrigation projects, the crop yields will be stabilized and increased through supply of sufficient irrigation water, improved farming practices, and strengthened and expanded agricultural support services.

Anticipated crop yields under with project and without flood conditions are conservatively estimated on the basis of data from the experiment stations in the basin. The yield will gradually increase from the present level and reach the target yield in the 5th year after completion of irrigation facilities.

Crops	(Unit: ton/ha)	
	Without ^{/1} Project	With Project
1. Paddy		
Irrigated - wet season	3.40	4.50 (4.10) ^{/2}
- dry season	3.50	5.00
Rainfed - wet season	2.23	-
- dry season	-	-
2. Corn	0.90	3.75
3. Tobacco	0.60	2.00
4. Vegetables	4.02	13.00
5. Beans	0.34	1.50

^{/1}: Irrigated paddy yields are averages of the rehabilitation/improvement schemes. Other crop yields are averages in the basin.

^{/2}: Paddy yields for the proposed cropping pattern B.

Future crop productions for each schemes under without project condition are estimated on the basis of the present cropping patterns, harvested areas and crop yields. Future crop productions under with

project condition are estimated on the basis of the harvested areas and the anticipated crop yields in the cases of the proposed cropping pattern A, B and C.

The crop productions under without and with project conditions are as shown in Table 6.8 for the new irrigation and rehabilitation/improvement schemes.

6.3 Estimate of Irrigation Benefits

6.3.1 Price Forecast

The economic price for trade goods such as paddy, corn, beans, peanuts, tobacco, sugar cane and fertilizer is estimated on the basis of the projected world market prices of the World Bank in the long term range for the period of 1985 to 1995. The details of those forecast are presented in Table 6.9. Non-trade goods such as sweet potatoes, vegetables and animal power, etc. are valued at their financial prices. Financial and economic prices of all outputs and inputs are summarized in Table 6.10.

6.3.2 Irrigation Benefits

Incremental irrigation benefits of each scheme are estimated as the differences in the net production values between the future with and without project conditions. The net production values under with and without project conditions are calculated on the basis of gross production value and production cost. The details on calculation of incremental irrigation benefits are presented in Table 6.11. Annual incremental benefits of each scheme in the cases of proposed cropping pattern A & C and B & C are summarized in Table 6.12.

6.3.3 Negative Benefit

Crop damage by flood and production foregone by the construction of irrigation facilities and dams are taken as negative benefits in this study.

Flood damages in each scheme are estimated according to "the Engineering of River and Sabo Projects, Ministry of Construction of Japan". The gross production values under with project conditions in each irrigation scheme are considered as the damageable values. Floods in the basin are occurring in 6 months from June to November. Standing crops during these months and the damageable values per ha are estimated as follows:

Land/Crops	Unit Yield (ton/ha)	Unit Price (¥/ton)	Planted Area (ha)	Damageable Value (¥/ha)
I Irrigated Paddy Field				
(1) Pattern A				
Wet Season Paddy	4.50	3,800	1.0	17,100
Beans	1.50	5,300	1.0	8,000
(Total)				(25,100)
(2) Pattern B				
Wet Season Paddy	4.10	3,800	1.0	(15,600)
II Irrigated Upland				
Corn	3.75	2,700	0.9	9,100
Beans	1.50	5,300	0.5	4,000
Vegetables	13.00	3,700	0.1	4,800
(Total)				(17,900)

Annual equivalent damages up to 100-year design flood of each irrigation scheme in the cases of proposed cropping pattern A & C and B & C are calculated in Table 6.13 on the basis of the results of hydraulic analysis and damageable value, and summarized in Table 6.14.

The annual production foregone is defined as an annual net return under the future without project condition in the cropland which will be occupied by the dam reservoirs and irrigation facilities. Annual

production foregone in the rehabilitation/improvement scheme is disregarded in this study because the reservoir area is mostly occupied by non-farmland such as forest land, grassland, etc., and the irrigation facilities are already constructed in the project area. Production foregone in the dam reservoir of Matuno RIP is also disregarded because of the same condition. Estimation of the production foregone in the cases of proposed cropping pattern A & C and B & C is summarized in Table 6.15.

6.4 Evaluation of Objective Area

6.4.1 Economic Evaluation

The economic evaluation is based on the following basic assumptions:

- a) The project life is set at 50 years from the initial year of project implementation,
- b) Only direct benefits are counted in the economic evaluation, and any indirect and intangible benefits are not taken into account,
- c) Where a storage dam is conceivable as the alternative water source development, the dam cost is estimated as an allocated construction cost of multipurpose dam, and
- d) Constant prices at 1985 level are used in the economic evaluation.

The project benefits comprise irrigation benefits and negative benefits which are flood damages and production foregone. The project costs consist of construction costs for dam and irrigation facilities, replacement cost, and operation and maintenance cost (O&M cost).

Based on the annual economic cost and benefit flows for each scheme according to the construction schedule for dam and irrigation facilities, Economic Internal Rate of Returns (EIRRs) for each scheme are calculated in Table 6.16 and summarized in Table 6.17. Economic efficiency of each scheme in the case of proposed cropping pattern A & C is superior to that

of pattern B & C.

6.4.2 Financial Evaluation

In order to assess the projects from farmers' economic view point, farm budgets under without and with project conditions are financially examined. Net farm income is got by the gross farm income minus production cost, flood damaged value and irrigation service fee. Net farm income per ha in each irrigation scheme in the cases of proposed cropping pattern A & C and B & C is calculated in Table 6.18 and summarized in Table 6.19.

After implementation of the projects, drastic increase in net farm income can be expected. Net farm income of each scheme in the case of proposed cropping pattern A & C under with project condition becomes larger than that of pattern B & C. Net farm income per ha of pattern A & C for each scheme under with project condition will be increased 2.1 to 8.0 times of that under without project condition.

6.4.3 Socio-Economic Impacts

It is considered that the project beneficiaries are not only farmers but also the other inhabitants who are employed by the other industries or unemployed in the area. The number of population around the irrigation service area is considered as the project beneficiaries and one of the parameters on the efficiency of the socio-economic impacts. The number of beneficiaries per ha of irrigation service area are ranging from 1.9 to 8.4 persons and 4.4 persons on an average as shown in Table 6.20.

6.5 Priority Ranking

The ranking of irrigation development schemes is based on the Economic Internal Rate of Returns (EIRRs), the net farm income per ha and the number of beneficiaries per ha of irrigation service area in the case of proposed cropping pattern A & C. The irrigation development schemes over 15% of EIRRs are considered economically feasible in the Philippines according to NEDA criteria and can be identified as the higher priority projects than

the other schemes under 15% of EIRRs. It is recommended that the former projects will be implemented earlier than the latter projects.

The overall rankings both the schemes over and under 15% of EIRRs are primarily based on the net farm income per ha of irrigation service area. If the net farm income is same among the schemes, one with a larger number of beneficiaries per ha is a higher position in the overall rankings. The results of the overall rankings are presented in Table 6.21.

VII AGRICULTURAL DEVELOPMENT IN THE OTHER SECTOR

7.1 Rainfed Diversified Crop Development in Lowland

Rainfed diversified crop area will be expanded up to 170×10^3 ha. Main crop will be corn and the area increased will be developed as corn field. The other recommendable crops are vegetables, beans and tobacco.

Corn cultivation will be needed to avoid typhoon damages. Cultivation of hybrid corn varieties is required high cost and is very risky because of frequent typhoon and floods. Short matured and open pollinated corn is recommended to avoid the damage risks and to cultivate by low input.

7.2 Dairy/Beef Cattle Development in Upland

7.2.1 Cattle Breed

The cross breeding production of dairy/beef cattle is recommended in the basin. First cross of Brahman, Holstein and Sahiwal will be used for the foundation stock. Cow-calf production will be done by three-way-cross or back-cross breeding. These breeding aims at the development of capabilities on heat-tolerant and high production of milk and meat.

Cross breeding cattles must be purebred in order to combine the best characteristics and express hybrid vigour such as increased mothering ability in female. Cow will be crossed with a bull of a third breed to introduce further qualities.

7.2.2 Cattle Farm Management

Cattle farm management system will consist of grazing and fattening. The cattle will be rotationally grazed and feeder stock will be produced in the pasture land. The steers will be raised in the feed lots which will be newly established in the basin. Main income source of cattle farm will consist of beef cattle fattened in the feedlots, cow and milk. The advantages of rotational grazing are as follows:

- 1) More efficient cropping of the forage will be ensured.
- 2) The spread of parasites, particularly internal worms, will be prevented. If the pasture is fallowed without cattle grazing, the life cycle of most internal worms will be broken up and these worms will be reduced or eliminated.
- 3) Rotational grazing will conserve cattles from taking excess roughage, particularly during the wet season, and
- 4) Fertilizer application and replacement of the pasture land will be easily done.

7.2.3 Selection of Pasture Grasses and Forage Crops

The natural grassland will be improved to the grazing pasture land by sowing grass seeds. Pasture will be established by mix-seeding of Guinea grass, Para grass, Centro, Stylo, etc. Ipil-ipil will also be used for livepost for fencing and pasture shade. Forage crops like Napier grass, Guinea grass, Para grass, Centro, Stylo, Ipil-ipil, etc., will be introduced to the meadow for production of beef cattle feeds.

Mix-seeding of more than two kinds of pasture grasses which are tufted and creeping grasses will prevent the soil erosion and the rapid loss of soil moisture in the pasture land. It is recommended that legumes must be introduced to the pasture land in order to improve the nutrient status of the grasses. Centro and Stylo which are legume grasses are suitable to the humid area and drier area of the basin respectively.

7.2.4 Unit Yield of Grasses

Average yields of grasses are estimated at 47.5 tons/ha in the pasture and 80.0 tons/ha in the meadows as shown in Table 7.1. Possible feed intake ratio is estimated at 55% for pasture and 85% for meadow.

7.2.5 Cattle Herd Composition

Cattle herd composition on the averaged size farm of 280 ha is estimated as shown in Table 7.2 on the basis of body-weight gain curve (Fig. 7.1). The ratio of feeder stock will be 26% of the total.

7.2.6 Cow-Calf Production and Feedlot Management

The existing continuous grazing system will be changed to the rotational system. Grazing intensity will be increased from 0.4 head/ha at present to 1.3 head/ha in the future. An outlines of the pasture management and calf production are summarized in Table 7.3.

Beef cattle will be fattened primarily in the feedlots. The live weight target of fattening cattle will be 400 kg/head or more. For attainment of this target, a meadow of 2.8 ha will be required for the fattening 41 head of beef cattle on the average size farm of 280 ha. The proposed feedlot management method is outlined in Table 7.4.

7.2.7 Disease Control

Dominant diseases in the basin are hemorrhagic septicemia and blackleg. No serious diseases have been observed in this area. These diseases can be prevented by vaccination. However, the expansion and establishment of disease control facilities and the increase in the number of veterinarians are required because the present facilities and staffs are insufficient. Artificial insemination centers will also be needed to improve the existing beef cattle industry and to set up new type of beef-dairy cattle production.

7.2.8 Utilization and Development of Grassland

Most of the present grassland is leased to private investors as pasture lease where beef cattle grazing is practiced. The pasture lease will be expanded to the maximum extent with possible assistances from the Government. The small farmers will also be involved in the future cattle

industry through the organization of farmers' cooperatives.

Master plan study on the dairy/beef cattle production is necessary to develop the upland in orderly way and effectively. The following items will be studied by the master plan on the cattle production:

- 1) Evaluation of upland soil and land capabilities for cattle grazing,
- 2) Delineation of potential development areas for cattle grazing,
- 3) Formulation of detailed cattle farm management plan,
- 4) Study on the drinking water supply measures and facilities for cattle such as small dams, ponds, wells, water distribution pipelines, etc.,
- 5) Preparation of the development projects in the selected potential areas,
- 6) Evaluation of the selected projects, and
- 7) Preparation of the implementation schedule on the dairy/beef cattle development.

7.3 Tree Crop Development in Upland

Permanent cropland will be expanded up to 57×10^3 ha. The recommendable crops will be cashew nuts, mango and citrus fruits. For the expansion of the permanent crops in the upland area, the following measures will be required:

- 1) Selection of the most suitable varieties to the climatic condition and consumers' taste,
- 2) Experiment on cropping pattern and farming practices taking typhoon damages into consideration,
- 3) Construction of seedling production and distribution centers,
- 4) Construction of collection and processing facilities,
- 5) Credit services for the cultivation of permanent crops, and
- 6) Preparation of the master plan on the permanent crop production in upland of which study is needed to implement effectively together with the master plan study on the cattle production.

7.4 Fishery and Forestry Development

7.4.1 Fishery

For the future development of fishery in the basin, brackish water aquaculture development could be neglected in this study for the following reasons:

- 1) The potential development area of about 3,800 ha for brackish water aquaculture which is delineated by BFAR's study is out of the basin.
- 2) Diversion of water from the Cagayan river to the potential development area above mentioned will not be required because extensive fish farming is suited to the area and high input-high output culture will not be profitable due to acid-sulphate soils, low-lying and low drained land, and occasional floods.

Development potential area for fresh water aquaculture is abundant because the basin has many superior sites for dam reservoirs and fish ponds. Development of fresh water aquaculture will be implemented in these potential dam reservoirs and fish ponds. Present average yield of aquaculture in the basin is 0.57 ton/ha and lower than the national average of 1.1 ton/ha. This means that production techniques are very low and extensive fish farming is predominant in the basin. The following measures are required for the fresh water aquaculture development:

- 1) Strengthening of the experiment on the fresh water aquaculture,
- 2) Increase in number of extension personnels and intensive extension services,
- 3) Careful management on the pollution of fresh water inflow by agro-chemicals,
- 4) Construction of necessary facilities on experiment, cold storage and processing, and
- 5) Preparation of the development plan on the freshwater aquaculture in the basin for the successful implementation.

7.4.2 Forestry

JICA Forestry Study Team delineates the land with slopes over 18% as a forest reserve. Our land use plan on the forestry follows this delineation. Definite plans and projects for the reforestation and the proper forest management will be prepared by Forestry Study Team.

7.5 Recommendation for Improvement of Agricultural Support System

Improvement of the present agricultural support system is essential for the achievement of the agricultural development target. The following measures are recommended:

(1) Irrigated lowland

- a) Extension of short matured varieties and new cropping patterns for the decrease of typhoon damage, especially on paddy and corn,
- b) Extension of intensive farming to get high yields,
- c) Expansion of seed multiplication facilities and increase in production of registered and certified paddy seeds,
- d) Research on irrigated diversified crops, such as corn, vegetables, beans and tobacco, and their seed/seedling multiplication and distribution,
- e) Strengthening and expansion of the seed growers association,
- f) New credit service programs for the production of vegetables, beans and tobacco,
- g) Activation of Samahang Nayan, especially for the raising of farmers' bargaining power in the market, and
- h) Propagation of marketing information to the farmers.

(2) Rainfed lowland

- a) Research on rainfed diversified crops, such as corn, vegetables, beans, peanuts, tobacco and sugar cane to get sufficient yields by low inputs under rainfed condition, and their seed/seedling

multiplication and distribution,

- b) New credit service programs for the production of rainfed diversified crops, and
- c) Activation of Samahang Nayon and diffusion of marketing information.

(3) Upland

- a) Establishment of an integrated upland agricultural development center for the research on dairy/beef cattle and tree crops,
- b) Improvement of the existing DA facilities for beef cattle development, and
- c) Establishment of more artificial insemination and vaccination units.

VIII FUTURE CONDITION OF AGRICULTURE

8.1 Future Agricultural Production and Production Value

Agricultural production in the year 2005 is assumed on the basis of the following data and informations:

- 1) Agricultural land use plan of the Basin in the year 2005,
- 2) Agricultural experimental data, and
- 3) Implementation schedule of the irrigation development

Projected agricultural production in the year 2005 is presented in Table 8.1.

Agricultural production value is estimated on the basis of the projection of future agricultural production. Growth of agricultural GVA is assumed as shown in Fig. 8.1. GVA for each agricultural sector in the year 2005 is given in Table 8.2 and summarized as follows:

(Unit: 10 ⁶ ₱)				
Agriculture Sector	GVA (1985)	GVA (2005)	Future GVA* in P.M.A.	Ratio of Attainment in 2005(%)
		(1)	(2)	(1)/(2)
<u>I. Agriculture & Fishery</u>				
<u>Lowland</u>				
1. Paddy field	439	986	1,089	91
2. Diversified - Corn field	120	226	335	67
cropland - Others	35	49	70	70
(Sub-total)	<u>549</u>	<u>1,261</u>	<u>1,494</u>	<u>84</u>
<u>Upland</u>				
1. Permanent cropland	37	156	548	29
2. Pasture	77	256	366	70
(Sub-total)	<u>114</u>	<u>412</u>	<u>914</u>	<u>45</u>
<u>Fishery</u>	<u>7</u>	<u>17</u>	-	-
Total of Agriculture & Fishery	<u>715</u>	<u>1,690</u>	<u>2,408</u>	<u>70</u>
<u>II. Forestry</u>	<u>147</u>	<u>147</u>	-	-
Total (I & II)	<u>862</u>	<u>1,837</u>	-	-

* : Future GVA in potential maximum area.

8.2 Future Agricultural Labor Requirement

Monthly labor requirement for agriculture in the year 2005 is estimated as shown in Table 8.3 on the basis of the following basic data:

- 1) Available laborers for agricultural production activities which is estimated based on the assumption for rural population, ratio of age distribution and ratio of available laborer for agriculture,

- 2) Future agricultural land use and production plans,
- 3) Labor requirements by agricultural products and work items such as land preparation, seedling, harvesting, etc., and
- 4) Cropping patterns by crop assumed.

Monthly peak labor requirement is estimated at around 10×10^6 man-days from April to June and 8×10^6 man-days in October. Workable days on the basis of available laborers are estimated at around 12×10^6 man-days per month. As a result, agricultural labor requirement in the year 2005 will be sufficiently supplied with the available laborers.

Table 2.1 Predominant Characteristics of Major Land-Form Categories in the Cagayan River Basin

Land-Form Categories	Mode of Formation or Development	Occurrences	Topography	Vegetation/ Land Use	Flood Hazard	Water Availability	Suggested Land Use
<u>Alluvial Land System</u>							
1. Tidal Swamp	Alluvial deposition by streams and marine sedimentation due to uplifting and recession of sea level	Tidal marsh near Aparri. limited areal extent	Low, depressed situation, almost no microrelief, level with very slight difference in elevation	Grasses and reeds surrounding central water surface; fish ponds are common	Severe	Easily available; water quality is questionable	Commercial aquaculture of shrimps and/or valuable fishes
2. Recent River Terraces	Recent alluvial deposits by major streams	Close to Cagayan river; present valley floor abandoned as the river cuts down to the new and lower base level	Level, relatively narrow strip along the river at elevation slightly higher than river water surface	Mostly cultivated with upland crops like maize, tobacco, mungo bean, peanuts and vegetables	Easily and deeply flooded	Greatly influenced by the river water level	Suited to most upland field crops due to sandy nature of soils; flood protection works will be inevitable for sustained production
3. Alluvial Terraces	Consist of old flood plains formed by the Cagayan river and other major tributaries	Wide, flat, low-elevated areas in the basin extending along the Cagayan and Magat rivers	Overall level surface, generally constant slope; difference in elevation due to irregularities is minor compared to its broad extent	Extensively cultivated with lowland rice as dominant crop, irrigated and rainfed; other crops includes beans and peanuts	Seasonally flooded, depending on local conditions; flood depth is generally moderate less than 1.0 m	Variable, depending on locality: surface water generally available from the streams dissecting the areas; quantity available for irrigation is questionable	Irrigated paddy cultivation (two or three crop under year round irrigation system); In some areas, irrigated cash crops cultivation recommended

(To be continued)

(Continuation)

Land-Form Categories	Mode of Formation or Development	Occurrences	Topography	Vegetation/ Land Use	Flood Hazard	Water Availability	Suggested Land Use
4. Swamp and River Scar	Former meander now partly filled with deposits	Scattered in limited areal extent along the Cagayan river	Level, depressed area, oxbow shaped, slightly concave slope	Fish pond in water-covered area; paddy and/or vegetable cultivation in outer margins	Always deeply flooded during the rainy season	Easily available, water standing on surface at times	Mudfish production; however, swamps are better left unutilized to serve as buffer strips or reservoir for floods
Alluvial-Colluvial Land System							
5. River-Out Plain	Stream dissection, flat or rolling erosion surface produced by streams; in parts, sheet form accumulation of alluvium at the base of slope	Extensive, elevated plains of low relief between hills and alluvial land systems	Relatively flat to undulating interfluves with intermediate elevations, moderately to highly dissected	Generally covered with grasses; large area is planted to maize; In Nueva-Vizcaya, rice is grown under irrigation	None	Confined to valley floors and concave areas fringing alluvial areas	Paddy cultivation in places where irrigation water is available; generally suited to upland crops cultivation; free crops also recommendable.
6. Alluvial fan, Drainage way, Piedmont and inter-hill mini-plain	Alluvial deposition in rapid stream action in combination with Colluvial deposition	At the base of hillslopes; small valley floors between hills	Relatively small and narrow, slightly sloping from head downwards	In valley floors, mostly utilized for rice; other areas are generally left unutilized covered with grasses	Seasonally flooded in valley floors, none in other areas	Usually available at the margin of fans and valley floors	Suitable for rice in valley floors and lower margins with small dam for reservoir. Tree crops and upland crops in upper margins

(To be continued)

(Continuation)

Land-Form Categories	Mode of Formation or development	Occurrences	Topography	Vegetation/ Land Use	Flood Hazard	Water Availability	Suggested Land Use
<u>Hill Land System</u> 7. Hillslope	Uplifted denudational (erosional) process or mass wasting	Connection between hilltops and valley bottoms, broad extent	Rectilinear, concave or convex slopes in plan and profile; many closed contour lines indicating isolated hilltops	Generally covered with grasses; patches of trees are observed near streams	None	No major streams; mostly intermittent tributaries; generally not available except at footslopes or by damming	Forestation in most of the areas; cattle grazing near streams, with small earth dams; tree crops also recommended in southern part of the Basin
8. Peaks, Bench/Terrace and Valley Floors	- do -	Highest part of hill land system (Peak), on hill sides (Bench/Terraces) and valley bottoms	Relatively flat or gently sloping, discontinuous small area	Mostly covered with grasses; in valley bottom, rice is partly grown	Mostly none; in valley floors, periodically flooded	Not available except valley floors	Forestation; in valley floor, rice and other field crops
<u>Mountain Land System</u> 9. Mountainside	Uplifted, denudational process of great volume; mass wasting and slope wash	Connection between mountain peaks and bottom lands, largest area among other land categories	Steep slopes; Rectilinear, concave or convex slopes in plan and profile	Mostly forest; many areas are denuded and covered with grasses	None	Same as hill-slopes	Mostly forest; in some parts near existing towns, coffee plantation and possibly sericulture be recommended.
10. Peak, Plateau, Intermontane valley bottom land	- do -	At highest elevation(peak), on mountainsides (plateau) and narrow valley bottoms	Steep slope (peak), flat to gently sloping (plateau) and flat with concave margin (bottomland)	Mostly forest; some upland crops in plateau, paddy rice in valley bottom	Mostly none except valley bottomland where flashy floods occur periodically	Not available except intermontane valley bottoms	Mostly forest; in valley bottom-land, short-season upland crops be recommended.

Table 2.2 Soil and Land Classification

(Unit: Km ²)				
Land Categories	Soil Series	Textural Class	Land Capability Class	Areas
1. Tidal Swamp		undifferentiated		170
2. Recent River Terraces	Agustin	sandy loam	R6/U3sf	27
	San Manuel	sandy loam	R6/U3sf	152
	San Manuel	fine sandy loam	R3sf/U2sf	93
	San Manuel	silt loam	R3sf/U2sf	75
	Cauayan	fine sandy loam	R3sf/U2sf	133
sub-total				480
3. Alluvial Terraces	Toran	clay	R1/U3df	146
	Bigaa	clay	R1/U3df	820
	Bantog	clay	R1/U3df	37
	Bantog	clay loam	R1/U2d	77
	Pada-pada	clay	R1/U3df	29
	Tagulod	clay	R1/U3df	321
	Tagulod	clay loam	R1/U2d	1,130
	Cauayan	clay loam	R1/U2d	815
	Quingua	clay loam	R2s/U1	55
sub-total				3,330
4. River cut plain Piedmont	Quingua	clay loam	R2s/U1	167
	Quingua	silty clay loam	R2s/U1	172
	Quingua	silt loam	R2s/U1	132
	Rugao	clay loam	R2t/U1	87
	Bago	sandy clay loam	R4st/U3st	401
	Guibalaon	clay loam	R3st/U2st	39
	Nambaran	clay loam	R3st/U2st	42
	Maligaya	clay loam	R3st/U2st	75
	Umingan	loam	R3st/U2st	45
sub-total				1,160
5. Hill Slopes	Alaminos	clay loam	R6/U3ste	1,960
	Alaminos	sandy clay loam	R6/U4ste	330
	Cauayan	clay loam	R6/U3ste	120
	Bolinao	clay loam	R6/U3ste	152
	Ilagan	sandy clay loam	R6/U4ste	2,377
	Guimbalaon	clay loam	R6/U3ste	555
	Guimbalaon	clay loam gravelly	R6/U4ste	482
	Rugao	clay loam	R6/U3ste	662
	Bauang	clay loam	R6/U3ste	367
	Aroman	clay loam	R6/U3ste	60
	Alimodian	clay loam	R6/U3ste	105
sub-total				7,270
6. Mountainside		undifferentiated		14,890
Total				27,300

Note: Land Capability Classifications

R - Rice
U - Upland Crops

1 - Highly suitable
2 - Moderately suitable
3 - Marginally suitable
4 - Limited arable
6 - Not arable

Limitations

1. s - soils
2. t - topography
3. d - drainage
4. f - flood
5. e - erosion

Source: Soil description for soil series, BF in Manila
Soil map prepared by consultants

Table 3.1 Agricultural Demographic Features in the
Cagayan River Basin

Province	No. of Municipality	Population		Annual Population Growth Rate 1970-85 (%)	Area (Km ²)	Population Density in 1985 (person/km ²)	No. of Total Household in 1985	Average Family Size		No. of Farm Household in 1985	Percentage of Farm Household (%)
		1970	1985					Total Household	Farm Household		
Cagayan	19	360,821	473,565	1.8	4,251	111	87,700	5.4	5.4	70,700	80.6
Ifugao	7	92,487	122,898	1.9	2,518	49	25,600	4.8	4.7	23,500	91.8
Isabela	37	610,764	938,317	2.9	8,237	114	164,600	5.7	5.7	131,500	79.9
Kalinga-Apayao	11	94,063	141,657	2.8	3,676	39	25,300	5.6	5.5	21,500	85.0
Nueva-Vizcaya	15	163,144	265,016	3.3	3,301	80	49,100	5.4	5.4	37,900	77.2
Quirino	5	49,767	100,339	4.8	3,057	33	18,900	5.3	5.3	14,800	78.3
Mt. Province	8	70,993	86,364	1.3	1,844	47	17,600	4.9	4.9	16,700	94.9
Aurora	4	4,979	7,713	3.0	397	19	1,300	5.7	5.7	1,300	100
Total	106	1,447,018	2,135,869	2.6	27,281	78	390,100	5.5	5.5	317,900	81.5

Note: /1/ Estimation

Source: Census of Population and Housing - Philippines and related Provinces, NCSO

Table 3.2 Present Agricultural Situation of the Basin

Item	Unit	Country	Basin	Share (%)	Item	Unit	Country	Basin	Share (%)
I. Population (1985)									
1) Total	10 ³	54,668	2,136	3.9	IV. Agricultural Production (1982-84 Average)				
2) Rural Population	10 ³	32,847	1,733	5.3	1) Harvested Area	10 ³ ha	3,268	352	10.8
3) Share of the above in total	%	60.1	81.1	-	- Palay	10 ³ ha	3,263	301	9.2
4) Total Labor Force	10 ³	16,110	611	3.8	- Corn	10 ³ ha	50	25	50.0
5) Agricultural Labor Force /1					- Peanut	10 ³ ha	458	10	2.2
- Agriculture	10 ³	7,095	416	5.9	- Sugar cane	10 ³ ha	59	16	27.1
- Forestry	10 ³	771	7	0.9	- Tobacco	10 ³ ha	3,189	7	0.2
- Fishery	10 ³	80	9	11.3	- Coconut	10 ³ ha	1,581	41	2.6
- Others	10 ³	1	-	-	- Others	10 ³ ha	11,868	752	6.3
Total	10 ³	7,947	432	5.4	Total				
6) Share of the above in total	%	49.3	70.7	-	2) Production	10 ³ ton	7,898	837	10.6
II. GDP (1985 at 1972 constant price)									
1) Total	P106	90,469	1,650	1.8	- Palay	10 ³ ton	3,254	256	7.9
2) Contribution to GDP	P106				- Corn	10 ³ ton	42	18	42.9
- Agriculture	P106	16,336	631	3.9	- Peanut	10 ³ ton	458	10	2.2
(Paddy)	P106	(4,370)	(430)	(9.8)	- Sugar cane	10 ³ ton	53	12	22.6
(Corn)	P106	(1,539)	(84)	(5.5)	- Tobacco	10 ³ ton	3,403	23	0.7
(Others)	P106	(10,427)	(117)	(1.1)	- Coconut	10 ³ ton	13,105	201	1.5
- Livestock	P106	4,974	77	1.5	- Others	10 ³ ton	28,213	1,357	4.8
- Fishery	P106	4,224	7	0.2	Total				
- Forestry	P106	702	147	20.9	3) Value (Current price)	10 ⁶ P	12,319	1,290	10.5
Total		26,236	862	3.3	- Palay	10 ⁶ P	4,367	402	9.2
3) Share of the above in total GDP	%	29.0	52.2	-	- Corn	10 ⁶ P	307	94	30.6
4) Agricultural Labor /2 productivity	P	3,004	1,702	56.7	- Peanut	10 ⁶ P	8,417	115	1.4
III. Land Use									
1) Total Area	Km ²	300,000	27,300	9.1	- Sugar cane	10 ⁶ P	520	123	23.7
2) Forestry	Km ²	111,330	11,500	10.3	- Tobacco	10 ⁶ P	7,192	29	0.4
3) Grassland (idle)	Km ²	81,000	10,000	12.3	- Coconut	10 ⁶ P	14,688	274	1.9
4) Agricultural Land	Km ²	44,880	3,773	8.4	- Others	10 ⁶ P	47,810	2,327	4.9
- Temporary crops	Km ²	33,130	270	0.8	4) Yield	ton/ha	2.41	2.38	98.8
- Permanent crops	Km ²	6,100	1,269	20.8	- Palay	ton/ha	1.00	0.85	85.0
- Pasture	Km ²	6,230	27	0.4	- Corn	ton/ha	0.84	0.74	88.1
- Others	Km ²				- Peanut	ton/ha	7.35	4.56	62.0
Total		90,340	5,339	5.9	- Sugar cane	ton/ha	0.88	0.71	80.7
5) Share of the above in total area		30.1	19.6	-	- Tobacco	ton/ha	1.07	3.29	307.5

Notes: /1: Gainful workers 15 years old and over
/2: GDP of Agriculture and Livestock divided by Agricultural Labor force of Agriculture

AG-51

Table 3.3 Agricultural Land Use in the Cagayan River Basin

Province	Annual Crop Area					Permanent Crops Area	Fish Pond	Cattle Ranch	Total
	Paddy Field		Diversified Crops Area	Total Area under annual Crops	Total				
	Irrigated	Rainfed							
Cagayan	149	625	774	276	1,050	14	18	83	1,165
Kalinga-Apayao	150	64	214	14	228	45	1	274	548
Isabela	870	160	1,030	839	1,869	49	6	253	2,177
Ifugao	45	25	70	32	102	24	-	161	287
Nueva-Vizcaya	206	63	269	43	312	42	1	241	596
Quirino	18	53	71	62	133	19	1	246	399
Mt. Province	29	13	42	37	79	77	-	11	167
Total	1,467	1,003	2,470	1,303	3,773	270	27	1,269	5,339

Source: Estimated from land use map prepared by consultants and data from NIA, BAECON & BFAR in Region II

Table 3.4 Present Agricultural Production in the Basin (1985)

A. Crop Production					
Crops	Physical ^{/2} Area (10 ³ ha)	Cropping ^{/2} Intensity (%)	Harvested ^{/2} Area (10 ³ ha)	Average ^{/2} Yield (ton/ha)	Pro- ^{/2} duction (10 ³ ton)
1) Palay - Irrigated	146.7 ^{/1}	180	264.1	2.63	694
Rainfed	100.3	100	100.3	2.23	224
(Total)	247.0		364.4		918
2) Corn - Diversified Area	102.0	200	204.0	0.94	192
After rainfed Paddy	20.0	100	20.0	0.94	19
(Total)	122.0		224.0		211
3) Peanut	-	-	23.7	0.74	18
4) Tobacco	14.2	100	14.2	0.64	9
5) Sugar cane	10.0	100	10.0	39.20	392
6) Root Crops (Sweet Potato)	4.1	175	7.2	4.76	34
7) Vegetables	-	-	4.4	4.02	18
8) Beans	-	-	2.5	0.34	1
9) Fruit & Nuts	14.4	100	14.4	4.80	69
10) Coffee	6.5	100	6.5	0.37	2
11) Coconut	4.1	100	4.1	2.12	9
12) Others	2.0	100	2.0	3.00	6
Crops Total	404.3 ^{/3}				
B. Livestock Production					Unit: 10 ³ head
Livestock, Poultry & Dairy Product	Total Population	Annual Change in No. of Head (1984/85)	No. of Slaughtered	Annual Production	
1) Carabao	344	10	28	38	
2) Cattle	128	4	9	13	
3) Hog	454	16	276	292	
4) Goat	47	2	5	7	
5) Chicken & Duck	3,023	105	7,317	7,422	
6) Egg	-	-	-	6.55	(10 ³ ton)
7) Milk	-	-	-	472	(10 ³ l)
C. Fishery Production					
		Area (ha)	Unit Yield (t/ha)	Production (ton)	
Total Fishery Product		2,725	0.57	1,547	
D. Forestry Production					
		Area (km ²)		Logwood Production (10 ³ m ³)	
Total Forestry Product		11,500		715	

Source: /1 : Actually cultivated area under irrigation during wet season.
 /2 : Estimated based on data from BAECON Statistics Division, DA, RIARS in Ilagan,
 NEDA Region II and field inspection survey.
 /3 : Excluding corn area after rainfed paddy cultivation.

Table 3.5 Number of Livestock and Poultry in the Basin (1985)

(Unit: head)						
Province	Carabao	Cattle	Hog	Goat	Poultry	Duck
<u>Cagayan</u>	<u>147,690</u>	<u>22,030</u>	<u>155,960</u>	<u>9,910</u>	<u>653,560</u>	<u>58,030</u>
- Backyard	147,310	17,070	154,270	9,510	648,060	54,180
- Commercial	380	4,960	1,690	400	5,500	3,850
<u>Ifugao</u>	<u>10,150</u>	<u>13,350</u>	<u>34,890</u>	<u>5,230</u>	<u>315,590</u>	<u>3,980</u>
- Backyard	9,840	4,570	34,720	2,670	313,990	3,980
- Commercial	310	8,780	170	2,560	1,600	-
<u>Isabela</u>	<u>102,640</u>	<u>41,410</u>	<u>138,650</u>	<u>9,860</u>	<u>1,028,250</u>	<u>116,650</u>
- Backyard	102,640	28,610	118,400	9,530	950,300	109,950
- Commercial	-	12,800	20,250	330	77,950	6,700
<u>Kalinga Apayao</u>	<u>33,120</u>	<u>18,900</u>	<u>31,310</u>	<u>3,750</u>	<u>129,380</u>	<u>41,180</u>
- Backyard	32,870	10,030	30,250	3,750	127,130	40,580
- Commercial	250	8,870	1,060	-	2,250	600
<u>Nueva Vizcaya</u>	<u>20,890</u>	<u>15,630</u>	<u>42,610</u>	<u>9,920</u>	<u>300,980</u>	<u>51,120</u>
- Backyard	20,890	8,620	39,810	9,600	266,680	49,430
- Commercial	-	7,010	2,800	320	34,300	1,690
<u>Quirino</u>	<u>15,170</u>	<u>7,820</u>	<u>26,580</u>	<u>6,670</u>	<u>170,650</u>	<u>22,710</u>
- Backyard	15,170	4,630	26,500	6,580	170,650	21,650
- Commercial	-	3,190	80	90	-	1,060
<u>Mt. Province</u>	<u>13,200</u>	<u>8,090</u>	<u>22,550</u>	<u>860</u>	<u>121,300</u>	<u>8,130</u>
- Backyard	13,140	7,800	22,500	860	121,300	8,130
- Commercial	60	290	50	-	-	-
<u>Aurora</u>	<u>440</u>	<u>370</u>	<u>1,250</u>	<u>500</u>	<u>790</u>	<u>600</u>
- Backyard	440	370	1,250	500	790	600
- Commercial	-	-	-	-	-	-
<u>Total</u>	<u>343,300</u>	<u>127,600</u>	<u>453,800</u>	<u>46,700</u>	<u>2,720,500</u>	<u>302,400</u>
- Backyard	342,300	81,700	427,700	43,000	2,598,900	288,500
- Commercial	1,000	45,900	26,100	3,700	121,600	13,900

Source: BAECON

Table 3.6 Estimated Data on Meat Production
of Livestock and Poultry in the Basin

	Slaughter Live weight Per Animals	Carcass Dressing Percentage	Age at Slaughter	Age at			Breeding Intervals
				First Offspring Production	Mortality of Baby Animals	Months	
Carabao	kg 350-450	% 40-50	Years 5-10	Months 45-50	% 25-30	Months 20-25	
Cattle (Native)	250-300	40-45	Years 3-5	35-40	10-15	20-24	
Cattle (Grade)	350-400	45-55	Years 3-4	26-30	8-10	16-20	
Hog (Native)	40-50	35-50	Months 9-12	12-18	20-30	8-10	
Hog (Grade)	80-90	65-75	Months 6-8	10-12	15-20	6-8	
Poultry (Native)	0.8-0.9	45-50	Months 6-8	-	15-30	-	
Poultry (Grade)	1.0-1.5	55-65	Months 15-2	-	15-20	-	
Goat	25-45	40-45	Months 9-12	18-20	5-10	7-10	

Source: Data obtained on the Spot Investigation in the Study Area, July 1986.

Table 3.7 Fish Production in the Basin (1985)

Province	Area (ha)	Brackish			Area (ha)	Fresh Water			Number of Operators	Total Production (ton)
		Production (ton)		Per ha		Production (ton)		Per ha		
		Total	Number of Operators			Total	Number of Operators			
Cagayan	1,510	755	0.5	158	332	166	0.5	187	921	
Ifugao	0	0	0	0	34	24	0.7	132	24	
Isabela	0	0	0	0	551	331	0.6	375	331	
Nueva-Vizcaya	0	0	0	0	101	162	1.6	176	162	
Kalinga-Apayao	0	0	0	0	88	44	0.5	344	44	
Quirino	0	0	0	0	109	65	0.6	218	65	
Mt. Province	-	-	-	-	-	-	-	-	-	
Aurora	-	-	-	-	-	-	-	-	-	
Total	1,510	755	0.5	158	1,215	792	0.7	1,432	1,547	

- : Data to be collected

Source: BFAR, Region II

Table 3.8 DA Facilities Profile in Region II (1985)

Facility	Number of Station	Location		Number of Regular Staff
		Province	Municipality	
I. Livestock	20			107
1. Stock Farm	3	Cagayan	Gattaran	12
		Quirino	Aglipay	12
		Kalinga-Apayao	Tabuk	12
2. Breeding Station/Sub-Station/Center	12	Cagayan	Solana	6
			Gattaran	4
			Ballesteros	5
		Ifugao	Lamut	4
			Potia	5
		Isabela	Cabagan	6
			Gamu	8
		Kalinga-Apayao	Tabuk	6
		Nueva-Vizcaya	Bayombong	3
			Dupax Del Norte	5
		Quirino	Aglipay	3
3. Artificial Insemination Center/Unit	3	Cagayan	Solana	2
		Kalinga-Apayao	Tabuk	3
		Nueva-Vizcaya	Bayombong	3
4. Animal Diagnostic Laboratory/Feed Analysis Laboratory	1	Cagayan	Tuguegarao	3
5. Beef & Carabeef Training Center	1	Quirino	Aglipay	5
II. Plants/Crops	7			81
1. Experimental Station	2	Isabela	Ilagan	19
			San Mateo	20
2. Crop Protection Center	1	Isabela	Ilagan	6
3. Seed Farm	2	Cagayan	Abulug	11
		Kalinga-Apayao	Luna	11
4. Seed Testing/Seed Quality Laboratory	2	Cagayan	Tuguegarao	7
		Isabela	San Mateo	7
III. Soils	3			24
1. Regional Soil Laboratory	1	Cagayan	Tuguegarao	9
2. Soils Laboratory	1	Isabela	Ilagan	5
3. Soil Conservation and Research Station	1	Isabela	Ilagan	10
Total	30			212

Source: DA, Region II

Table 3.9 Agricultural GVA in the Basin (1985)

Item	Production ^{/1} (10 ³ ton) (1)	Farmgate Price ^{/2} at 1972 Constant Price (P/kg) (2)	GVA ^{/2} Ratio (3)	GVA at 1972 Constant Price (10 ⁶ P) (1)x(2)x(3)
I. Crops				
1. Lowland				
1) Paddy Field				
- Palay	918	0.62	0.7547	430
- Corn	19	0.53	0.8372	9
				439
2) Corn Field				
- Corn	192	0.53	0.8372	85
- Peanut	18	1.33	0.9800	24
- Vegetables	18	0.64	0.9060	10
- Beans	1	1.75	0.8507	1
				120
3) Other Annual Cropland				
- Tobacco	9	1.77	0.9341	15
- Sugar cane	392	0.05	0.8013	16
- Root crops	34	0.16	0.8249	4
				35
2. Upland				
1) Permanent Cropland				
- Fruits & Nuts	69	0.35	0.8906	22
- Coffee	2	3.54	0.9516	7
- Coconuts	9	0.45	0.8129	3
- Others	6	0.80	0.9663	5
				37
Crop Total				631
II. Livestock*				
1) Carabao	38	730.21	0.6750	19
2) Cattle	13	612.13	0.5687	5
3) Hog	292	134.66	0.4757	19
4) Goat	7	27.95	0.6750	-
5) Chicken & Duck	7,422	4.21	0.3969	12
6) Egg	6.55	4.52	0.7432	22
7) Milk	472	1.00	0.9980	-
				77
Livestock Total				77
III. Fishery	1.5	7.46	0.6078	7
IV. Forestry *	715	248.60	0.827	147
Total				862

Note: *Units of production and price are as follows:

	Production	Price
Carabao, Cattle, Hog, Goat	10 ³ head	P/head
Chicken & Poultry		
Egg	10 ³ ton	P/kg
Milk	10 ³ l	P/l
Forestry	10 ³ m ³	P/m ³

Source: /1 Estimated based on the data from BAECON Statistics Division, MAF, RIARS in Ilagan, NEDA Region II, field inspection survey.

/2 NEDA National Account Staff

Table 3.10 Present Farm Economy of Average Size Farmers

Description	Unit	Philippine	Basin
<u>I. Average Farm Size & Land Use</u>			
(1) Average Farm Size	ha	0.80	1.20
(2) Harvested Area	ha		
- Palay		0.60	1.12
- Corn		0.60	0.69
- Others		0.18	0.17
(Total)		1.38	1.98
(3) Cropping Intensity	%	173	165
<u>II. Present Farm Budget</u>			
(1) Gross Farm Income	P		
- Palay		5,400	9,750
- Corn		1,980	1,860
- Others		2,380	1,070
(Total)		9,760	12,680
(2) Production Cost	P		
- Palay		2,840	5,830
- Corn		1,100	1,780
- Others		1,420	840
(Total)		5,360	8,450
(3) Net Farm Income	P	4,400	4,230
(4) Living Expenses	P	23,400	17,800
(5) Expected off/Non Farm Income	P	19,000	13,570
<u>III. Profitability of Crop Production</u>			
(1) Profit Cost Ratio			
- Palay		0.90	0.67
- Corn		0.80	0.05
- Others		0.68	0.27
(Total)		0.82	0.50
(2) Net Profit per ha		5,500	3,530

Source: Handbook on Production Costs of Selected Crops, BAECON, Philippine Year Book, 1985.

Table 4.1 Foreign Assisted Agricultural Development Projects in Region II

Project	Duration	Location	Implementing Agency	Objectives/Components	Financial - Project Source - Cost
1. Agricultural Support Services Project	Nov. 1981-Dec. 1986	Nationwide	MAF UPLB PCARRD FHRI	<ol style="list-style-type: none"> ① Upgrading of agricultural research capability, function of regional offices ② Improvement of the project planning, implementation and monitoring capability of MAF ③ Implementation of the second nutrition survey 	GOP - P440 M WB - \$30 M
2. National Fisheries Development Project	Mar. 1983-Dec. 1989	Nationwide	MAF PFDA BFAR	<ol style="list-style-type: none"> ① Increase of the income of small scale fisherman ② Institutional strengthening ③ Increase in supply of fishery products through marketing improvement 	GOP - P 87 M WB - \$ 22.402 M
3. Smallholder Livestock Development Project	On-going	Nationwide	PDC MAF	<ol style="list-style-type: none"> ① Improvement of livestock production (pilot farm for milks plant, cattle fattening) ② Credit and marketing services 	GOP - P 50 M WB - \$ 16.0 M
4. Aquaculture Development Project	On-going	Nationwide	MAF BFAR	<ol style="list-style-type: none"> ① Assistance for fishpond operator (Information; Training, Credit) 	GOP - P280 M WB - \$ 16.4 M
5. Cotton Development Project	On-going	Region I, II, III, X XI & XII	Phil. Cotton Corporation	<ol style="list-style-type: none"> ① Provision of farm inputs and irrigation pumps ② Installation of seed processing unit, seed cotton and handling system, storage facility, oil mill and gin plant ③ Cotton research 	GOP - P 88 M WB - 26.70 M
6. Crop Protection Program	1981-87	Nationwide	MAF BPI	<ol style="list-style-type: none"> ① Crop protection research and implementation 	GOP - P116 M FRG/EEC - \$166.38 M
7. Strengthening & Expanding the Mainnutrition Prevention Project through leader's training	1983-87	Nationwide	MAF BAEX	<ol style="list-style-type: none"> ① Training of local leaders ② Integration of the early childhood enrichment 	UNICEF Grant GOP - P 9 M UNICEF - \$ 0.821 M
8. Highland Agricultural Development Project I	-	Mt. Province Kalinga-Apayao Ifugao	MAF	<ol style="list-style-type: none"> ① Construction of infrastructure for vegetable and tree crop production ② Agricultural supporting services (credit, research and extension) 	GOP - P416 M ADB - \$ 23.10 M

Source: MAF, Manila

Table 5.1 Estimate of Potential Maximum Agricultural Production (GVA)

	1 9 8 5			Future		
	Physical Area (103ha)	GVA per ha (£/ha)	Total GVA (103)	Physical Area (103ha)	GVA per ha (£/ha)	Total GVA (103£)
<u>Lowland</u>						
1. Paddy Field (Paddy) (Corn)	247	1,780	439 (430) (9)	306	3,560	1,089
2. Corn Field (Corn) (Peanut, Vegetables, & Beans)	102	1,180	120 (85) (35)	142	2,360	335
3. Other Annual Crop Land (Tobacco, Sugarcane, & Root Crops)	28	1,250	35	28	2,500	70
4. Grassland (idle)	99					
(Total)	476		594	476		1,494
<u>Upland</u>						
1. Permanent Crop Land (Fruits & Nuts, Coffee, Coconut & Others)	27	1,370	37	200	2,740	548
2. Pasture Land	127	610	77/2	300	1,220	366
3. Grassland (idle)	450			104		
(Total)	604		114	604		914
Total	1,080		708	1,080		2,408

Note: /1 : See Table 2.7.2

/2 : Total GVA of livestock

Table 6.1 Soil Classification and Present Land Use
in New Irrigation Schemes

(Unit: ha)												
Description	Name of Scheme	Zinundungan Extension	Alcala- Amulung West	Tuguegarao	Lulutan	Ilagan	Gappal	Dabubu	Chico Mallig	Matuno	Total	
1. Irrigation Area												
	1,750	6,750	1,400	2,950	3,200	4,400	1,000	31,200	12,680	65,330		
2. Soil Classification												
(1) Tagulod Clay Loam	1,450	3,360	380	2,270	-	2,640	-	12,800	-	22,900		
(2) Tagulod Clay	-	-	-	-	-	660	-	-	-	660		
(3) Quingua Silty Clay Loam	-	850	-	-	2,400	750	-	640	-	4,640		
(4) Quingua Clay Loam	300	680	220	500	240	350	-	-	-	2,290		
(5) Quingua Silty Loam	-	-	-	-	560	-	-	1,600	-	2,160		
(6) San Manuel Silty Loam	-	470	620	180	-	-	-	-	1,600	2,870		
(7) San Manuel Sandy Loam	-	670	-	-	-	-	-	-	-	670		
(8) Bontog Clay	-	720	-	-	-	-	-	-	-	720		
(9) Carig Sandy Clay Loam	-	-	90	-	-	-	-	6,160	-	6,250		
(10) Cauayan Sandy Loam	-	-	-	-	-	-	1,000	-	-	1,000		
(11) Bigaa Clay	-	-	90	-	-	-	-	780	-	870		
(12) Isabela Clay	-	-	-	-	-	-	-	470	-	470		
(13) Bago Sandy Clay Loam	-	-	-	-	-	-	-	8,010	2,920	10,930		
(14) Bago Clay Loam	-	-	-	-	-	-	-	740	-	740		
(15) Prenza Clay Loam	-	-	-	-	-	-	-	-	3,060	3,060		
(16) Maligaya Clay Loam	-	-	-	-	-	-	-	-	5,100	5,100		
T o t a l	1,750	6,750	1,400	2,950	3,200	4,400	1,000	31,200	12,680	65,330		
3. Present Land Use												
(1) Paddy Field	1,450	3,850	250	2,410	200	3,300	550	22,060	11,050	45,120		
- Irrigated	150	0	0	0	60	0	0	2,100	9,230	11,540		
- Rainfed	1,300	3,850	250	2,410	140	3,300	550	19,960	1,820	33,580		
(2) Diversified Farmland	300	2,900	1,150	540	3,000	1,100	450	3,170	1,630	14,240		
(3) Grassland	-	-	-	-	-	-	-	5,970	-	5,970		
T o t a l	1,750	6,750	1,400	2,950	3,200	4,400	1,000	31,200	12,680	65,330		

Table 6.2 Present Population and Household in New Irrigation Schemes

Name of Scheme	Irrigation Area (ha)	Related Municipality	Total Population	No. of Total Household	No. of Farm Household	Average Irrigation Area per Farm (ha/farm) Household
1. Chico Mallig IP						
- Chico East	8,100	Piat & Tuao	20,700	3,800	3,500	2.31
- Liwan Gadu Area	9,000	Enrile & Sta. Maria	22,900	3,800	2,900	3.10
- Enrile Area	4,100	Solana, Enrile & Rizal	23,500	4,100	3,800	1.08
- Magsaysay Area	10,000	Magsaysay, Sto. Tomas & Cabagan	30,200	5,300	4,800	2.08
(Total)	31,200		97,300	17,000	15,000	2.08
2. Matuno RIP	12,680	Bagabag, Solano, Bayombong, Bambang & Villaverde	79,300	14,300	7,200	1.76
3. Dabubu RIP	1,000	San Agustin	5,100	900	800	1.25
4. Zinundungan IEP	1,750	Lasam	5,100	1,000	800	2.18
5. Alcala Amulung West IP	6,750	Alcala, Amulung & Solana	12,900	2,400	2,200	3.07
6. Tuguegarao IP	1,450	Tuguegarao	8,800	1,600	900	1.61
7. Lulutan IP	2,950	Ilagan	13,000	2,200	1,800	1.64
8. Ilagan IP	3,200	Ilagan & Benito Soliven	26,900	4,700	3,800	0.84
9. Gappal IP	4,400	Naguilian, Cauayan & Angadanan	21,000	3,600	2,600	1.69
Total	65,330		269,400	47,400	35,100	1.86

Source: Barangay Population Statistics 1980 and Urban and rural population projection 1980, NCSO

Table 6.3 Present Crop Production in New Irrigation Schemes

Name of Scheme	Paddy	Corn	Peanuts	Sweet Potato	Tobacco	Sugar Cane	Total Cultivated Area (ha)	Irrigation Area (ha)	Cropping Intensity (%)
1. Chico Mallig IP									
a. Cultivated Area (ha)	22,060	7,800	630	100	-	500	31,090	31,200	100
b. Unit Yield (ton/ha)	2.3	0.9	0.7	5.0	-	39			
c. Production (tons)	50,740	7,010	440	500	-	19,500			
2. Matuno RIP									
a. Cultivated Area (ha)	17,050	2,970	320	50	-	-	20,390	12,680	161
b. Unit Yield (ton/ha)	2.6	1.0	0.7	5.0	-	-			
c. Production (tons)	44,300	2,970	220	250	-	-			
3. Dabubu RIP									
a. Cultivated Area (ha)	500	820	90	-	50	-	1,460	1,000	146
b. Unit Yield (ton/ha)	2.2	0.9	0.7	-	0.6	-			
c. Production (tons)	1,100	730	60	-	30	-			
4. Zinundungan IEP									
a. Cultivated Area (ha)	1,750	770	60	-	-	-	2,580	1,750	147
b. Unit Yield (ton/ha)	2.5	1.1	0.7	-	-	-			
c. Production (tons)	4,380	850	40	-	-	-			
5. Alcala Amulung West IP									
a. Cultivated Area (ha)	3,850	5,410	580	60	-	230	10,130	6,750	150
b. Unit Yield (ton/ha)	2.2	0.9	0.7	5.0	-	39			
c. Production (tons)	8,470	4,870	410	300	-	8,970			
6. Tuguegarao IP									
a. Cultivated Area (ha)	250	1,890	230	-	-	-	2,370	1,400	169
b. Unit Yield (ton/ha)	2.2	1.2	0.7	-	-	-			
c. Production (tons)	550	2,270	160	-	-	-			
7. Lulutan IP									
a. Cultivated Area (ha)	2,410	1,340	110	-	60	-	3,920	2,950	133
b. Unit Yield (ton/ha)	2.2	1.0	0.7	-	0.6	-			
c. Production (tons)	5,300	1,340	80	-	40	-			
8. Ilagan IP									
a. Cultivated Area (ha)	200	4,840	600	60	300	-	6,000	3,200	188
b. Unit Yield (ton/ha)	2.3	0.9	0.7	5.0	0.6	-			
c. Production (tons)	460	4,360	420	300	180	-			
9. Gappal									
a. Cultivated Area (ha)	3,300	2,420	220	-	110	-	6,050	4,400	138
b. Unit Yield (ton/ha)	2.2	0.9	0.7	-	0.6	-			
c. Production (tons)	7,260	2,180	150	-	70	-			
10. Total									
a. Cultivated Area (ha)	51,370	28,260	2,840	270	520	730	83,990	65,330	129
b. Unit Yield (ton/ha)	2.4	0.9	0.7	5.0	0.6	39			
c. Production (tons)	122,590	26,580	1,980	1,350	310	28,470			

Table 6.4 Present Crop Production in Rehabilitation/Improvement Schemes

Name of Scheme	Irrigated Paddy			Rainfed Paddy	Corn	Peanuts ¹	Total Cultivated Area (ha)	Irrigation Service Area (ha)	Cropping Intensity (%)	No. of ² Irrigated Farmers
	Wet	Dry	Total							
1. Dummun R.I.S.										
a. Cultivated Area (ha)	870	470	1,340	1,200	640	(150)	3,180	2,070	1.54	1,320
b. Unit Yield (ton/ha)	3.7	3.8	3.7	2.4	1.0	0.7				
c. Production (tons)	3,219	1,786	5,005	2,880	640	105				
2. Baggao I.S.										
a. Cultivated Area (ha)	800	870	1,670	940	190	(40)	2,800	1,812	1.55	970
b. Unit Yield (ton/ha)	3.3	3.5	3.4	2.3	1.1	0.7				
c. Production (tons)	2,640	3,045	5,685	2,162	209	28				
3. Solana I.S.										
a. Cultivated Area (ha)	445	695	1,140	2,130	430	(100)	3,700	2,829	1.31	1,300
b. Unit Yield (ton/ha)	3.1	3.1	3.1	2.2	1.2	0.7				
c. Production (tons)	1,380	2,155	3,535	4,686	516	70				
4. Pinacanauan R.I.S.										
a. Cultivated Area (ha)	270	260	530	930	190	(40)	1,650	1,200	1.38	520
b. Unit Yield (ton/ha)	3.2	3.8	3.5	2.3	1.2	0.7				
c. Production (tons)	864	988	1,852	2,139	228	28				
5. Tumauni I.S.										
a. Cultivated Area (ha)	1,430	670	2,100	2,550	1,270	(290)	5,920	3,987	1.48	1,840
b. Unit Yield (ton/ha)	3.4	3.4	3.4	2.3	0.9	0.7				
c. Production (tons)	4,862	2,278	7,140	5,865	1,143	203				
6. Total										
a. Cultivated Area (ha)	3,815	2,965	6,780	7,750	2,720	(620)	17,250	11,898	1.45	5,950
b. Unit Yield (ton/ha)	3.4	3.5	3.4	2.3	1.0	0.7				
c. Production (tons)	12,965	10,252	23,217	17,732	2,736	434				

¹: Intercropping with corn.²: The average for recent five years of after completion of the System

Table 6.5 Present Population and Household in Rehabilitation/Improvement Schemes

Name of Scheme	Irrigation ¹ Area (ha)	Related Municipality	Total ² Population	No. of ² Total Household	No. of ² Farm Household	Average Irrigation Area per Farm Household (ha)
1. Dummun R.I.S.	2,070	Cattaran	6,600	1,200	1,100	1.88
2. Baggao I.S.	1,812	Baggao	8,600	1,500	1,300	1.39
3. Solana I.S.	2,829	Solana	22,900	4,100	3,500	0.81
4. Pinacanauan R.I.S.	1,200	Peñablanca	10,000	1,800	1,400	0.86
5. Tumauni I.S.	3,987	Tumauni	23,800	4,000	3,200	1.25
Total	11,898		71,900	12,600	10,500	1.13

Source: ¹: NIA Regional Office, Cauayan.²: Barangay Population Census, NCSO.

Table 6.6 Future Land Use and Harvested Area in Irrigation Development Schemes

I. New Irrigation Scheme

Name of Schemes		Future Land Use										Harvested Area in Paddy Field and Diversified Cropland										(Unit: ha)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		Paddy Field					Diversified Cropland					Paddy Field (Pattern A or B)					Diversified Cropland (Pattern C)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		Paddy Field	Diversified Cropland	Total Service Area	Total		Paddy	Total		Beans	Total	Cropping Intensity (%)	Wet	Dry	Total	Wet	Dry	Total	Tobacco	Beans	Total			Cropping Intensity (%)	Total Harvested Area	Total Cropping Intensity (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
					Wet	Dry		Wet	Dry																		Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
1. Chico Mallig IP (Pattern A&C) (Pattern B&C)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
28,030	3,170	31,200	28,030	28,030	56,060	28,030	84,090	300	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,060	28,030	28,030	56,0

(to be continued)

(continuation)

II. Rehabilitation/Improvement Scheme

(Unit: ha)

Name of Schemes	Future Land Use			Harvested Area				Cropping Intensity (%)	
	Paddy Field	Diversified Cropland	Total Service Area	Paddy					
				Beans		Total	Cropping Intensity (%)		
				Wet	Dry				Total
1. Dummun RIS (Pattern A) (Pattern B)	2,070	-	2,070	2,070	2,070	4,140	2,070	6,210	300
				2,070	2,070	4,140	-	4,140	200
2. Baggao IS (Pattern A) (Pattern B)	1,812	-	1,812	1,742	1,812	3,554	1,812	5,366	296
				1,812	1,812	3,624	-	3,624	200
3. Solana IS (Pattern A) (Pattern B)	2,829	-	2,829	2,829	2,829	5,658	2,829	8,487	300
				2,829	2,829	5,658	-	5,658	200
4. Pinacanauan IS (Pattern A) (Pattern B)	1,200	-	1,200	1,200	1,200	2,400	1,200	3,600	300
				1,200	1,200	2,400	-	2,400	200
5. Tumauni IS (Pattern A) (Pattern B)	3,987	-	3,987	3,730	3,160	6,890	3,987	10,877	273
				3,987	3,890	7,877	-	7,877	198
* Zinundungan RIS (Pattern A) (Pattern B)	1,760	-	1,760	1,760	1,760	3,520	1,760	5,280	300
				1,760	1,760	3,520	-	3,520	200