

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DEPARTMENT OF AGRARIAN REFORM
REPUBLIC OF THE PHILIPPINES

THE FEASIBILITY STUDY
ON
THE DEVELOPMENT OF VIABLE AGRARIAN
REFORM COMMUNITIES
IN
SOUTHERN PALAWAN

FINAL REPORT
APPENDIX II

MARCH 1995

SANYU CONSULTANTS INC.

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REFORM COMMUNITIES IN SOUTHERN PALAWAN

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APPENDIX II

MARCH 1995

SANYU CONSULTANTS INC.

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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REPUBLIC OF THE PHILIPPINES**

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FINAL REPORT ²⁷⁶⁹³
APPENDIX II

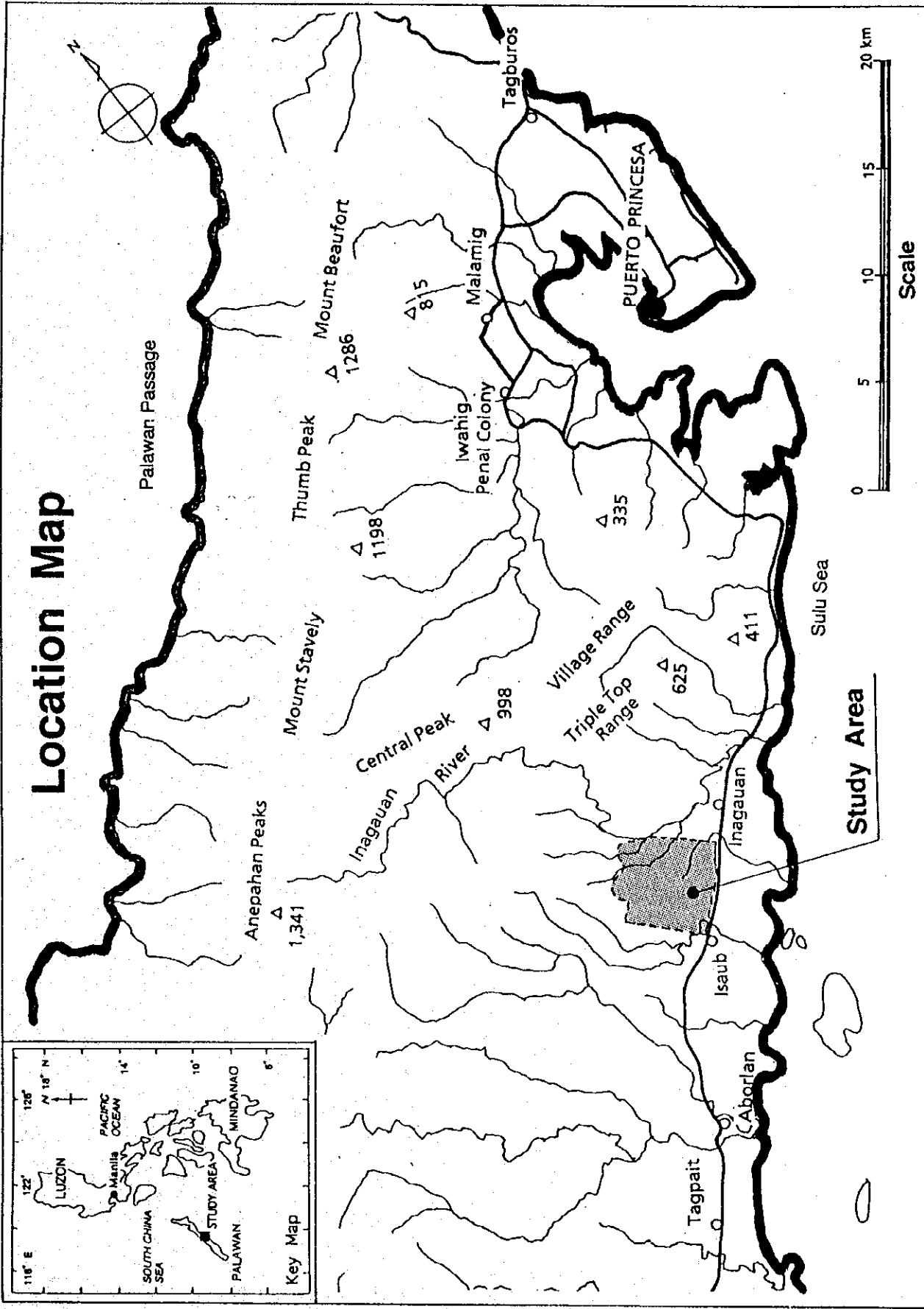
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Location Map



パラワン南部農地開発計画一般平面図

GENERAL DEVELOPMENT PLAN OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

(FIRST STAGE DEVELOPMENT)

ITEM	DESCRIPTION
1) AREA	
STUDY AREA	1,929 ha
BENEFICIAL AREA	1,341 ha
IRRIGABLE AREA	590 ha
2) RESERVOIR	13.9 sq.km
RESERVOIR	0.31 MCM
N.W.S	45.0 m M.S.L
L.W.S	41.0 m M.S.L
3) IRRIGATION & DRAINAGE & ROAD FACILITIES	
IRRIGATION CANAL	
DESIGN DISCHARGE	: MAX 0.843 cum/s
CANAL LENGTH	: MAIN 4.21 km
DRAINAGE CANAL	
CANAL LENGTH	: 1.8 km
FARM TO MARKET ROAD	
ROAD LENGTH	: MAIN 11.8 km
4) VILLAGE WATER SUPPLY	
LEVEL II	: 3 VILLAGES (8 Blocks)
5) POST HARVEST FACILITIES	
WAREHOUSE, RICEMILL, TRANSPORTATION etc.	

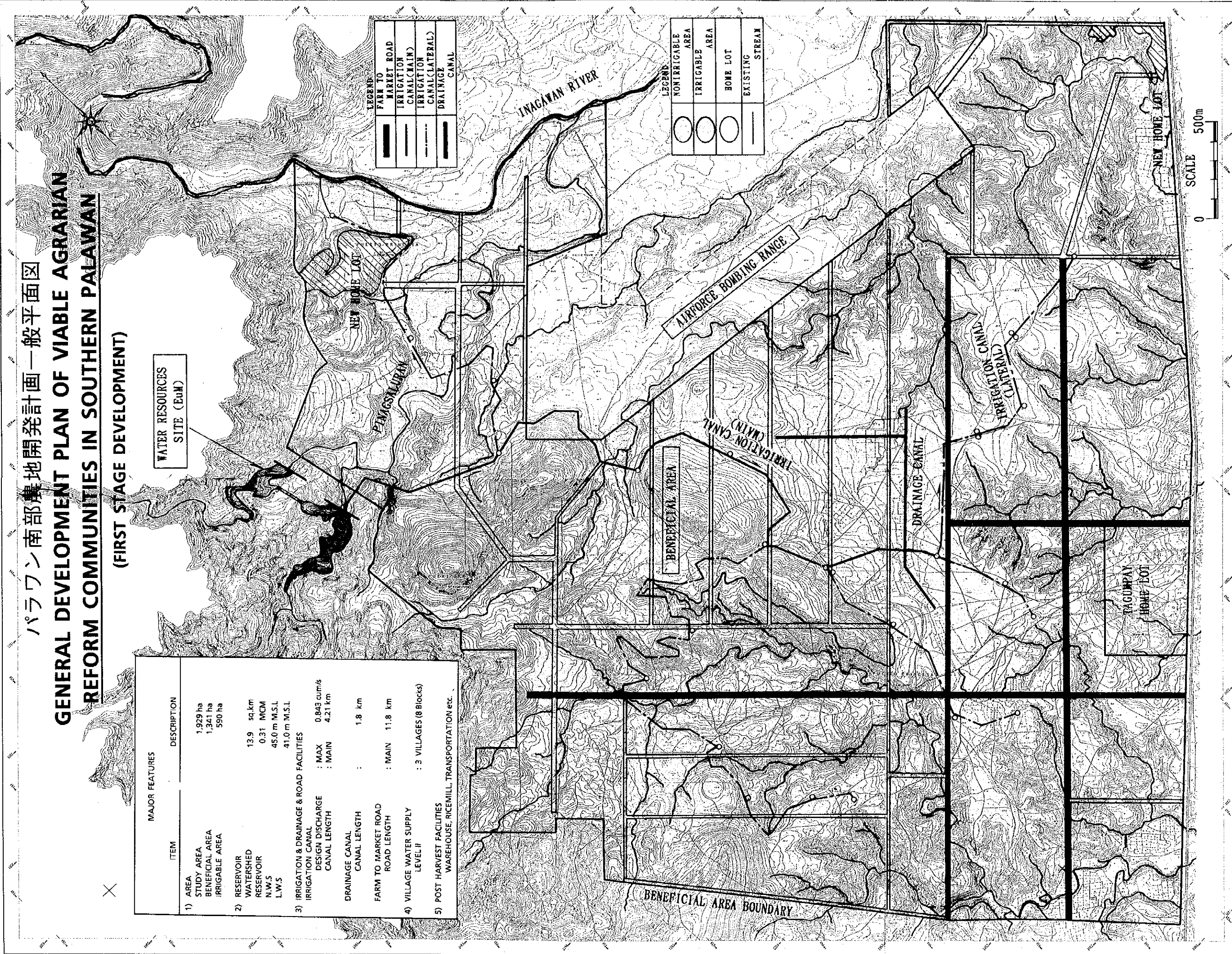
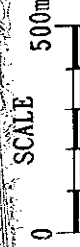
WATER RESOURCES SITE (EUM)

LEGEND

	FARM TO MARKET ROAD
	IRRIGATION CANAL (MAIN)
	IRRIGATION CANAL (LATERAL)
	DRAINAGE CANAL

LEGEND

	NON IRRIGABLE AREA
	IRRIGABLE AREA
	HOME LOT
	EXISTING STREAM



パラワン南部農地開発計画一般平面図

GENERAL DEVELOPMENT PLAN OF VIABLE AGRARIAN REFORM COMMUNITIES IN SOUTHERN PALAWAN

(SECOND STAGE DEVELOPMENT)

ITEM	DESCRIPTION
1) AREA	1,929 ha
STUDY AREA	1,341 ha
BENEFICIAL AREA	590 ha
IRRIGABLE AREA	
2) RESERVOIR	14.5 sq.km
WATERSHED	2.09 MCM
RESERVOIR	54.0 m M.S.L
N.W.S	45.6 m M.S.L
L.W.S	
3) IRRIGATION & ROAD FACILITIES	
IRRIGATION CANAL	LATERAL 10.5 km
FARM TO MARKET ROAD	ROAD LENGTH : LATERAL 29.2 km
4) POST HARVEST FACILITIES	
WAREHOUSE, RICEMILL, TRANSPORTATION etc.	

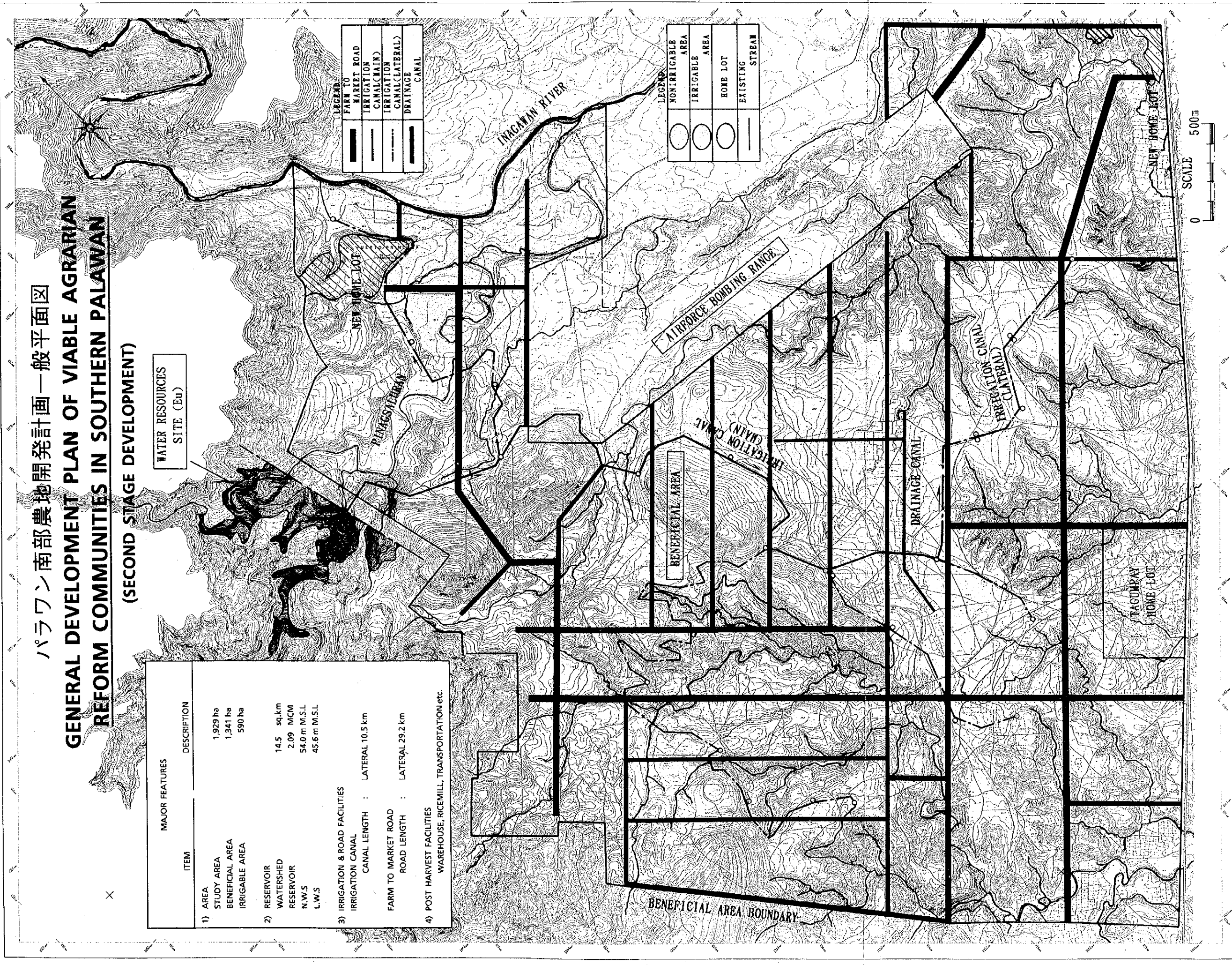
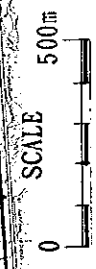
WATER RESOURCES SITE (Ed)

LEGEND

—	FARM TO MARKET ROAD
—	IRRIGATION CANAL(CHAIN)
—	IRRIGATION CANAL(LATERAL)
—	DRAINAGE CANAL

LEGEND

○	NON-IRRIGABLE AREA
○	IRRIGABLE AREA
○	HOME LOT
—	EXISTING STREAM



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ABBREVIATION, CONVERSION TABLE AND GLOSSARY

ABBREVIATION

ADB	Asian Development Bank
ATI	Agricultural Training Institute
BPA	Bureau of Power Association
BAS	Bureau of Agricultural Statistics
BAT	Bureau of Air Transportation
BCGS	Bureau of Coast and Geodetic Survey
BDT	Bureau of Domestic Trade
BFT	Bureau of Foreign Trade
BIR	Bureau of Internal Revenue
BL	Bureau of Lands
BMGS	Bureau of Mines and Geosciences
BOI	Board of Investment
BOP	Bureau of Posts
BSWM	Bureau of Soils and Water Management
BSMSI	Bureau of Small and Medium Scale Industries
BSP	Bangko Sentral ng Pilipinas
BUTEL	Bureau of Telecommunication
CARP-IC	Comprehensive Agrarian Reform Program - Irrigation Component
CARP-SIP	Comprehensive Agrarian Reform Program - Small Irrigation Project
CB/CBP	Central Bank of the Philippines
CDA	Cooperative Development Authority
CENRO	Community Environmental and Natural Resources Office - DENR
CFI	Crocodile Farming Institute, JICA
CHD	City Health Department
DA	Department of Agriculture
DAR	Department of Agrarian Reform
DARCO	Department of Agrarian Reform, Central Office
DARPO	Department of Agrarian Reform, Provincial Office
DARRO	Department of Agrarian Reform, Regional Office
DARMO	Department of Agrarian Reform, Municipal Office
DBM	Department of Budget and Management
DECS	Department of Education, Culture and Sports
DENR	Department of Environment and Natural Resources
DFA	Department of Foreign Affairs
DILG	Department of Interior and Local Government

DOF	Department of Finance
DOH	Department of Health
DOLE	Department of Labor and Employment
DOTC	Department of Transportation and Communication
DPWH	Department of Public Works and Highways
DSWD	Department of Social Welfare Development
DTI	Department of Trade and Industry
EMB	Environmental Management Bureau, DENR
FRSO	Fishery Regulatory Service Office
FORI	Forest Research Institute
IBRD	International Bank for Reconstruction and Development
IRRI	International Rice Research Institute
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
JSPS	Japan Society for Promotion of Science
LBP	Land Bank of the Philippines
LWUA	Local Water Works and Utilities Administration
MCSO	Malaria Control Services Office
MWSS	Metropolitan Waterworks and Sewerage System
NACIDA	National Cottage Industries Development Authority
NAMRIA	National Mapping and Resources Information Authority
NDC	National Development Corporation
NCSO	National Census and Statistic Office
NEA	National Electrification Administration
NEDA	National Economic and Development Authority
NEPC	National Environmental Protection Council
NFA	National Food Authority
NHA	National Housing Authority
NIA	National Irrigation Administration
NIST	National Institute of Science and Technology
NLUC	National Land Use Committee
NMYC	National Manpower and Youth Council
NNC	National Nutrition Council
NPC	National Power Corporation
NPCC	National Pollution Control Commission
NRCP	National Research Council of the Philippines

NWRB	National Water Resources Board
OEA	Office of Energy Affairs
OECE	Overseas Economic Cooperation Fund
PAES	Palawan Agricultural Experimental Station
PAF	Philippine Air Force
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PNAC	Philippine National Agricultural College
PCA	Philippine Coconut Authority
PCARRD	Philippine Council for Agricultural Resources Research and Development
PCCI	Philippine Chamber of Commerce and Industry
PCIERD	Philippine Council for Industry and Energy Research Development
PCGG	Presidential Commission on Good Government
PCGR	Presidential Commission on Government Reorganization
PCSDS	Palawan Council for Sustainable Development Staff (formally PIADPO)
PDC	Provincial Development Council
PEO	Provincial Engineering Office
PIADPO	Palawan Integrated Area Development Project Office
PHILRICE	Philippines Rice Institute
PHILVOCS	Philippine Institute of Volcanology and Seismology
PALECO	Palawan Electrification Corporation
PENRO	Palawan Environmental and Natural Resources Office, DENR
PNB	Philippine National Bank
PNOC	Philippine National Oil Corporation
PPA	Philippine Ports Authority
PPH	Palawan Provincial Hospital
RDC	Regional Development Council
RWDC	Rural Waterworks Development Corporation
SPIADP	Second Palawan Integrated Area Development Project
SSS	Social Security System
TBAC	Technical Board for Agricultural Credit
UP	University of the Philippines

CONVERSION TABLE

LENGTH

mm	: millimeter(s)
cm	: centimeter(s)
m	: meter(s)
km	: kilometer(s)
inch	: inch(s) = 2.54 cm
mile	: mile(s) = 1.6093 m

AREA

sq.mm	: square millimeters(s)
sq.cm	: square centimeter(s)
sq.m	: square meter(s)
sq.km	: square kilometer(s)
ha	: hectare(s)

WEIGHT

mm.gr	: milligram(s)
gr	: gram(s)
kg	: kilogram(s)
ton	: ton(s)
ounce	: ounce(s) = 28.350 gr

CAPACITY

lit	: liter(s)
cu.m	: cubic meter(s)
gallon	: gallon(s) = 3.785 lit
MCM	: million cubic meter(s)
cavan	: cavan(s) = 50 kg of palay

DISCHARGE

lps	: liter per second
cms	: cubic meter per second (or cu.m/sec)
cu · fsec	: cubic foot per second
lpd	: liter per day

VELOCITY

mm/sec	: millimeter per second
cm/sec	: centimeter per second
m/sec	: meter per second
km/hr	: kilometer per hour
knot	: knot(s) = 1.86 km/hr

sec	: second(s)
min	: minute(s)
hr	: hour(s)
Max. or max.	: maximum
Min. or min.	: minimum

%	: percent
No.	: number
°C	: degree(s) centigrade
Hp	: horse power(s)
w	: watt(s)

KW	:	kilowatt(s)
MW	:	megawatt(s)
WH	:	watt(s) hour
KWH	:	kilowatt(s) hour
EL	:	elevation
MSL	:	mean sea level
FWL	:	full water level
HWL	:	high water level
LWL	:	low water level
ET	:	evapotranspiration
mm/day	:	millimeter(s) per day
ETcrop	:	evapotranspiration of crop
N	:	nitrogen
P	:	phosphate
K	:	potassium
LV	:	local variety
LIV	:	local improved variety
HYV	:	high yielding variety
O&M	:	operation and maintenance
EIRR	:	economic internal rate of return
MT	:	metric ton(s)
B/S	:	benefit - cost ratio
FY	:	fiscal year (1st of January to end of December)
Peso	:	peso(s), unit of local currency
		peso = US\$ 0.03891 (as of September 27, 1994)
US\$:	dollar(s) = 25.70 pesos (as of September 27, 1994)

GLOSSARIES

Study Area	: Area of about 2,000 ha consisting of the Tagumpay and its outlying areas
Province	: Political subdivision of the country comprising municipality(s) and city(s)
Municipality	: Political subdivision of a province comprising barangay
Barangay	: Political subdivision of a municipality comprising sitio
Sitio	: Minimum unit of political subdivision
Poblacion	: Political center of a town
Monsoon	: Predict wind that blows from the sea to the continent and opposite in Winter
Trade Wind	: One of three Philippines air currents, comprising from a generally easterly direction reaching the island during the period from February to April
IR	: High yielding variety of palay which bears variety from IRRI
Palay	: Paddy, unhusked rice, sometimes called rough rice (<i>Oryza Sativa</i>)
Cogon	: Coarse grass which usually covers idle land or abandoned clearing (<i>Imperata cylindrica</i>)
Ganta	: Common unit of volume for rice equivalent to 2.24 kg of milled rice
Nipa	: Heavy leafed type of palm used in hatching huts
Share tenant	: A practice where operators rent the land they work and pay as rent a share of a cash or crops grown
Carabao	: The animal that most farmers use for plowing and other farming works. It is about the size of an ox and is similar to the water buffalo in other countries.
Fiesta	: Spanish term for feast, celebrated pompously once a year to honor the patron saint.
Kaingin	: Deforestation by shifting cultivation with slashing and burning forest/brush
Survival Rate	: The number who graduate/the number who enroll

CHAPTER 1. INTRODUCTION

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1.1 Background of the Project

The Feasibility Study on the Development of Viable Agrarian Reform Communities in Southern Palawan in the Republic of Philippines is conducted in accordance with the Implementation Arrangement agreed upon between the Department of Agrarian Reform (hereinafter referred to as "DAR") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") in 24, March, 1993.

Despite the contribution and importance to the Philippines economy, household incomes in the rural areas accounts at about one half of that in the urban areas. The poverty incidence of the Philippines as of 1991 is 41%, and 71% of the families living on the income less than poverty threshold lives in the rural areas.

CARP is the agrarian reform system distributing three (3) hectares to the landless farmers and farmers who own less than three (3) hectares, in order to increase their income through agricultural production and to alleviate poverty. The agrarian reform system has been continued since 1955 but CARP itself commenced on June 1988. This Project in Palawan Province forms a link in the chain of CARP.

The Tagumpay Settlement area is one of the top priority ARC project for development by DAR, encompassing not only land transfer but also the provision of necessary rural and social infrastructures to increase farmer's income and improve conditions of living. The area is placed on the model project of the ARC on the government owned land. The farmers beneficiaries in the area can not live in the settlement area due to lack of agricultural and rural infrastructures in the area.

Specifically, the objectives of the project are as follows:

- a) To settle the farmer beneficiaries in the area with sustainable assistance and support;
- b) To preserve the environmental conditions of the area by determining proper land use;
- c) To generate productive lands by providing irrigation and drainage facilities and farm-to-market roads;

- d) To strengthen productive activities by developing agricultural support institutions such as the provision of necessary post harvest facilities, training and extension services and the like; and,
- e) To improve the environmental and health conditions of the area by providing domestic water supply.

1.2 Location and Area

1.2.1 Location

The Study Area is located at the southernmost part of Puerto Princesa City, which is about 550 km southwest of Manila and 55 km away from the national road from the town proper of the city. The Study Area is bounded by the city/municipal boundary at the south-west, by the counter line of 100 m at the north-west, by the national road at the south-east, and by the Inagawan river and the Inagawan penal colony farm at the north-east. (refer to General Map)

1.2.1 Area

The acreage of the Study Area is 1929 ha excluding the 137 ha bombing range of the PAF. Of this area, 1,067 ha of Tagumpay Area was already released to the 332 beneficiaries by DAR. The outlying area is not yet released to the beneficiaries.

Item	Tagumpay		Total
	Settlement Area	Outlying Area	
	(ha)	(ha)	(ha)
Gross Area	1,067	999	2,066
PAF Area	44	93	137
Study Area (Net)	1,023	906	1,929

In the Area, 80 ha in dry season and about 440 ha in wet season are cultivated depending on rainfed condition.

1.2.3 Climatic Conditions

The annual mean, mean maximum and mean minimum temperatures are 27.2, 31.3 and 22.9 degrees, respectively. The annual mean relative humidity is calculated at 87.3% which indicate a higher humid condition. The annual mean cloudiness of 5.1 oktas is recorded, which seems to be a high value comparatively.

Mean annual rainfall is measured at 1,587.1 mm based on the observed data at Aborlan station, of which 1,454.7 mm (about 90% of the annual rainfall) is measured in wet season from May to December. During the dry season of four (4) months from January to April, 132.4 mm of rainfall is recorded. However, the beginning of the wet season fluctuates frequently.

1.2.4 Geological Conditions

The Study Area is mostly occupied by gentle sloped diluvial hills, which are composed of diluvial fan deposits, ranging in elevation from 15 to 40 m on its surface of hills. This hill area has somewhat a rolling and undulating topography and many small valleys formed due to long-continued subaerial erosion. The difference of elevation between the bottom of the valley and surrounding area ranges from 10 to 20 m.

Alluvial plain extends widely starting near the national highway to the coastal area ranging in elevation less than 10 m. Furthermore, fluvial flood plain similar to alluvial plain are distributed mainly along the Inagawan river and its tributaries.

1.3 Priority Project

The agriculture in the Area is a countermeasure for the settlers to sustainably earn the necessary income to make their living. However, rural and agricultural infrastructures to secure their living and agricultural activities have not been implemented despite of land distribution to the beneficiaries.

Taking into consideration the present condition followings are proposed to be implemented;

- Water Resources facility;
- Irrigation facility;
- Village water supply;
- Farm-to-market road; and,
- Post harvest facilities

1.4 Outline of the Project

1.4.1 Water resources Facility

- a. Closure Dam
- | | | |
|-----------------|---|----------------------|
| Water Resource | : | Pinagsaluran River |
| Dam Type | : | Earth Fill Type |
| CA | : | 13.9 sq.km |
| Length & Height | : | 240 m and 20 m |
| Storage Volume | : | 310,000 cu.m (gross) |
- b. Spillway
- | | | |
|------------------|---|---------------|
| Type | : | Concrete Type |
| Length | : | 40 m |
| Design Discharge | : | 420 cu.m/sec |

1.4.2 Irrigation and Drainage Facilities

- a. Main Irrigation Canal
- | | | |
|-----------------|---|--------------------------------|
| Irrigation Area | : | 590 ha |
| No. of Canal | : | 1 no. |
| Length | : | 4.21 km |
| Q max. | : | 0.843 cu.m/sec |
| Canal Type | : | Open and Concrete lining canal |
- b. Lateral Irrigation Canal
- | | | |
|--------------|---|----------------------|
| No. of Canal | : | 5 nos. |
| Length | : | 10.5 km |
| Q max. | : | 0.202 cu.m/sec |
| Canal Type | : | Open and Earth canal |

c. Drainage Canal	
No. of Canal	: 2 nos.
Length	: 1.8 km
Q max.	: 0.635 cu.m/sec
Canal Type	: Open and Earth canal

1.4.3 Farm-to-Market Road

Total Length	: 11.8 km
Pavement	: Gravel pavement (t = 20 cm, W = 6.0 m)
Road Width	: 8.0 m (road way width 6.0 m)

1.4.4 Village Water Supply

Level	: Level II
Deep Well	: 8 nos. (100 mm dia. and 50 m each)
Elevated Delivery Tank	: 8 nos. (about 7 cu.m)
Feeder pipe	: 0.34 km (SPGW 40 mm)
Distribution Pipe Line	: 6.0 km (PVC, 25 to 100 mm)
Communal Faucet	: one unit for 6 houses

1.4.5 Post Harvest Facility

Warehouse	: 1 no. 25 by 14 m (350 sq.m)
Motor Pool	: 1 no. 25 by 14 m (350 sq.m)
Solar Dryer	: 1 no. 20 by 30 m (600 sq.m)
Rice Thresher	: 2 nos. (1.0 ton/hr)
Rice Mill	: 1 no. (0.5 ton/ha)
Transportation Vehicles	: 3 nos. (4.0 ton Diesel)
Other Facilities	: 1 set

CHAPTER 2. AGRICULTURE

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CHAPTER 2 AGRICULTURE

2.1 Agricultural Development Plan related to Palawan Province

In the "The Medium-Term Agricultural Development Plan", 1993 to 1998, the national government introduced the Key Production Area approach. The Key Production Area is composed of four (4) sub-areas, namely, Key Grains Production Area (KGPA), Key Livestock Development Area (KLDA), Key Fisheries Development Area (KFDA) and Key Commercial Crop Area (KCCA). Two of the programs, the KLDA and KCCA, are applied in Palawan province. As for the KLDA in Palawan province, it aims to breed and increase cattle production in the very near future. As for the KCCA in Palawan province, it aims to expand mango and cashew orchard by 8,000 ha each.

In the provincial "Medium Term Development Plan 1994-2000", paddy and corn fields for grains production and cashew, mango, coconut, banana, coffee, cacao and pineapple orchards for commercial crops production will be expanded. For livestock, it plans to increase the heads of cattle, carabao, goat, swine and poultry population.

Based on the Puerto Princesa City Land Use Plan (Jan. 1994), the whole city area is divided into eight (8) clusters, and development potentials are set for each cluster. For Cluster-7, where the Study Area is included, the development potential strategies are enhanced rice production and intensified tree crop production (mango, cashew, jackfruit, guyabano, etc.). The Study Area is classified as a suitable area for agricultural development.

As for mango, there is now a ban to transport the fruit outside of Palawan province. This is to prevent the expansion of the harmful insects, the pulp weevil, although the area mainly infected is only on the southern part of Palawan province. In Puerto Princesa City, there is a plan to construct a mango processing plant for dried mango, juice, and puree. When the plant is established, mango will be very promising as a commercial and agro-industrial crop. The city already has a distribution program of mango seedling. The PAES produce a lot of mango seedlings and loan them out for 20 pesos per tree to the farmer. The repayment starts after the trees bear fruits and the farmer gains profit from these fruits.

Cashew is one of the special products of Palawan province. Climate is suitable and production is the highest among all provinces. One of the merits of fruit production in Palawan province is the rarity of typhoon attack. Production of fruits is, therefore, stable.

2.2 Proposed Crops

As for the determination of the proposed crops, the climate conditions, land slope, availability of irrigation water, farmers technique level, population and consumption projection and production trend were examined.

1) Climate Limitation

Climate factors like temperature, radiation, typhoon and rainfall have to be considered. In tropical zone areas, temperature is high thus not conducive to crops that would require cool conditions. Rain decreases radiation, and crops that would require lots of radiation for growth can not survive during the rainy season. Strong wind induced by typhoons causes fruit falling. All these climatic factors will affect agricultural production. In the Study Area, the average monthly rainfall from January to April is less than 50 mm. As a consequence, river discharge decreases up to May. From April to May, crops that would need irrigation water, therefore, would be avoided. Only crops requiring limited water for growth would be introduced for this period.

2) Land Slope Limitation

Land slope conditions relate to reclamation and top soil erosion. The Bureau of Soils and Water Management classifies five (5) land slope categories, as follows: (1) level to very gently sloping: 0 to 3 %, (2) very gently sloping to gently sloping: 3 to 8 %, (3) gently sloping to sloping: 8 to 15 %, (4) steep: 15 to 18 %, (5) severely steep : more than 18 %. Each category has a basic conception for land use as follows:

(1) Level to very gently sloping (0 to 3 %)

Suitable for paddy unless other limitations exist.

- (2) Very gently sloping to gently sloping (3 to 8 %)
Suitable for upland field. Upland field is better than paddy, because reclamation for paddy costs more.
- (3) Gently sloping to sloping (8 to 15 %)
Environmental disaster like soil erosion may occur. Avoid large scale land development. Use for orchard and inter-crop with some vegetables.
- (4) Steep (15 to 18 %)
Use for timber forest and for fire wood forest with reforestation.
- (5) Severely steep (more than 18 %)
Preserve for protected forest. Development may invite serious environmental disaster like soil erosion, land slide. Thus there is a need to preserve the forest, ban logging and reforestation of areas with no vegetative cover.

3) Availability of Irrigation Water

The availability of irrigation water will determine the crops to be introduced. In areas where water is not available during dry season like the Study Area, the availability of irrigation water becomes a vital factor in deciding the crops to be introduced. For areas with no irrigation water, the introduction of drought tolerant crops is suitable.

4) Farmer's Technique Level

Farmer's agricultural technical know-how and extension level in the area influence the type of crops to be introduced. Studies show that farmer's technique level on farming in the Study Area is not high. Introduction, therefore, of crops which require special farm techniques should be avoided at the present.

5) Population and Consumption Projection

The annual population growth rate of 3.58 % of Palawan province from 1980 to 1990 is considered high due to in-migration from other

provinces. At the same period, the annual growth rates of the nation and the region are 2.35 % and 3.04 %, respectively. Annual growth rates, however, are less than the data of the previous ten (10) years (1970-1980) period, especially in Palawan province, the decrease is much bigger than that of the national and provincial data. This fact shows that in-migration from other provinces to Palawan started to slow down in recent years as compared with the 1970's (refer to Table 2.1).

The Provincial Planning and Development Office of Palawan province estimated the population projection from 1990 to 2000. They estimate that in-migration to Palawan province will continue for the next decade at 3.58 % rate, which is the annual growth rate from 1980 to 1990. For projections from 1990 to 2000, it will be a little bit too high to apply the same rate (3.58 %), because the annual growth rate though increasing, has decreased during the past decade. On the other hand, the annual growth rate of Region IV population projection gradually decreases year by year. So the population projection using the 3.58 % is a safe projection. When the same annual growth rate is adopted, population of Palawan province will be 895,000. The food consumption is forecasted to increase in accordance with population increase. (refer to Table 2.2)

In 1987, daily food consumption per capita is 869 grams, which consists of 659 grams originating from vegetables and 210 grams originating from animals. The consumption of rice which is the most important staple food is 303 grams per capita per day. It is equivalent to 110.6 kilograms of rice as annual consumption per capita. The whole rice consumption will be about 83,000 tons in 2005, converted to about 127,800 tons of palay. (refer to Table 2.3)

6) Other Considerations

In the recent past years, production of palay in Palawan province is relatively stable, so palay is transported from Palawan to other provinces. The annual production for these periods ranged from 70,000 to 100,000 tons. Hence, if palay production will stagnate, deficiency of palay will occur. For this situation it is possible to meet palay demand with only a paddy field area of 47,000 ha, if the present

yield of palay in Palawan province (average in 1992: 1.94 ton/ha) lifts up to the national average yield (average in 1989: 2.7 ton/ha) through intensified extension and guidance. In 1992, there were 46,200 ha of paddy field including 15,790 ha of irrigated paddy in the province. If the yield would be improved, expansion of paddy field would no longer be necessary. (refer to Table 2.4)

On the other hand, vegetables are imported from other provinces because of the limited supply. However, for the past years, the provincial production of tomato and eggplant increased every year by 10 to 20 %, depending on consumption growth. Also, the growth of mungo bean production had increased during the same years.

The agricultural development plan of the nation and the province tend to emphasize the production of paddy and fruits. However, there is still no possibility that the province will meet the demand on vegetable. It is important that vegetable production should be developed to meet the demand not only of the Study Area but also of the whole province due to high population growth rate.

7) Proposed Crops

In addition, production trend and other related data which include price trend and planting period, etc. are to be considered in determining the proposed crops. Among these crops, it is indispensable to intensify extension and guidance activities on vegetable production.

Paddy:

To acquire and maintain self-sufficiency in rice, paddy will be planted in wet season in irrigated areas. Price of paddy is stable and cultivation can easily be introduced to the farmers. The farming operation techniques are already established, and paddy has been already adopted in the plan by the city and provincial government.

Beans:

Beans like mungo bean and peanut can contribute to the maintenance of nitrogen in soil through the rhizobium action. In recent years, mungo bean production has increased. Duration of mungo bean cultivation is short and harvest is moderate even on poor soil, which is very suitable for double cropping. Mungo bean can be stored up longer duration after drying.

Corn:

Corn is the largest planted crop in Palawan province, most especially at the southern part of the island, at Brook's Point, Narra and Aborlan. The farm techniques for corn is already established, and it would be easy for the farmers to accept the technology. The extension worker is also familiar with corn technology. Furthermore, in the provincial and city development plans, corn production is encouraged. The demand for animal feeds is also increases, and it is expected that feed demand shall be self sustaining.

Tomato:

The production of tomato in Palawan province increased from 10 to 20 % annually in the recent years. Consumption of said product is also expected to increase in the future. Cultivation of tomato in dry season is recommended because of lower disease probability.

Watermelon:

It is possible to grow watermelon throughout the year. Production increases in recent years and the demand is constant.

Taro (Gabi):

Cultivation is suitable in wet season because it can grow under high humid condition and is shade tolerant. At Region IV level, the price has a tendency to rise.

Eggplant:

This crop is a perennial crop but economic plantation period is one (1) year. It can be cultivated throughout the year. Production increases in the recent years with an increase in demand.

Squash:

Cultivation in wet season is possible. The price in Region IV is increasing. In Aborlan and Narra, squash is planted, hence, there will be less problems to the extension of farming techniques.

Cashew:

It is one of the special products of Palawan province. In the national, provincial and city plans, cashew production is encouraged. If quality is improved, the fruit can become one of the most promising commercial crops and exports of the province.

Mango:

Mango production is also included in the national, provincial and city plans. The price of mango has a tendency to increase. There are already seedling distribution programs of the city and the experimental station located in the city. It is therefore easy for the farmers to adopt the program and technology for mango production.

In the future, after the farmers have obtained the required farm and production management techniques, it will be possible to introduce other cash crops, such as the leafy vegetables, that need higher technology.

2.3 Proposed Cropping Pattern**1) Cropping Types**

Generally, the cropping types are divided into following three types according to the main crops.

Type A: Cropping type based on paddy

Type B: Cropping type based on upland crops

Type C: Cropping type based on fruits trees

Type A is suitable for flat areas (0 to 3 %), Type B for gently sloping areas (3 to 8 %) and Type C for sloping area (8 to 15 %). Each type is further classified into two sub-types, based on the availability of irrigation water. (For example, even flat area where it is higher than the irrigation facilities belongs to non-irrigated area.)

- Type A: Cropping type based on paddy (Irrigated)
- Type A': Cropping type based on paddy (Non-irrigated)
- Type B: Cropping type based on upland crops (Irrigated)
- Type B': Cropping type based on upland crops (Non-irrigated)
- Type C: Cropping type based on fruits trees (Irrigated)
- Type C': Cropping type based on fruits trees (Non-irrigated)

Present vegetation of undulating area with more than 15 % slope should be maintained and preserved. If and when areas with more than 15 % slope are already utilized for some purposes by farmers, land conservation technique such as contour farming techniques should be introduced to avoid devastation and soil erosion.

The largest area in the Study area is 0 to 3 %, which forms 35 % of the total area. Second largest is more than 15 %, which constitutes 24 % of the total followed by 8 to 15 % (forms 21 %) slope. Judging only on the slope factor, 730 ha area is possible for Type A cropping pattern, 420 ha area is possible for Type B cropping pattern, 440 ha area is possible for Type C cropping pattern, and 490 ha area is basically for a preservation area. (refer to Table 2.5)

2) Proposed Cropping Pattern

Basically, irrigation facilities development for sloping area (8 to 15 %) is not introduced, because the system will become more complex and costly, hence, O/M labor and cost will increase. Therefore, the introduction of irrigation facilities is only for the area, where the slope is less than 8 %.

Considering the site and elevation of water source and the canal alignment, about 430 ha flat area, which is 59 % of 0 to 3 % slope area, will be suitable for irrigated paddy. Of the total 3 to 8 % sloping area,

160 ha area is capable of irrigation. Totally, 590 ha is for irrigated area. Taking into account the distribution and hilly topography, the total upland crops area without irrigation is summed up to 265 ha, and the area for fruit trees is 271 ha.

Considering the present agriculture situation in the Study Area, rapid alteration on farming system could not be feasible from the viewpoints of farmer's technique level, facility condition for irrigation, post-harvest, budgetary situation for development plan, etc. Moreover, the available water resource for irrigation is hydrologically limited, not infinitely abundant. However, the practical cropping intensity for the Study Area is proposed as 130% for initial goal.

Proposed cropping pattern is determined, so as not to need high farming techniques, considering duty of irrigation, the farm labor intension, water balance studies and climate conditions. The farmer's technique level is not high. So the labor intensive cropping pattern should be avoided, and the crops that the farmers are familiar with and eager to plant should be introduced preferentially. Therefore, the proposed cropping pattern is based on three main crops, such as paddy, grains and mungo bean.

The periods between harvesting and following seeding/planting are made to be apart more than 30 days if possible, in consideration of field preservation as well as farm labor condition. But some of them become less than 30 days, as a result of studies on the relations between the amount of irrigation water for paddy and that of natural water like available rainfall, between length of dry season and growth period of introduced crops. Even less than 30 days, neither the labor shortage nor the water shortage will occur, because the planted area is not large comparing with main crops like paddy.

For areas with a slope of 0 to 3 %, irrigated paddy is introduced in wet season. Paddy is proposed to be cultivated only in wet season, because supply of rice is already sufficient in Palawan province in the recent years. Hence, there is no urgent need to expand paddy field, specially if yield is improved through extension and guidance activities.

For upland areas with a slope of 3 to 8 %, vegetables and beans are proposed to be introduced in wet season. In the slope area ranging from 0 to 8 % without irrigation system, wet season crops like grains, beans, eggplant and root crops are proposed. At the end of wet season, from November to December, beans like mung bean and peanut can be planted.

For areas with slope of 8 to 15 %, cashew and mango are proposed considering land condition. In fruit garden, inter-cropping shall be introduced to use farm land efficiently and to increase farm incomes. (refer to Table 2.6 and Figure 2.1)

2.4 Agricultural Production

1) Cultivated Area

Based on the topo-map prepared by JICA, the potential arable land in the Study Area is estimated to be 1,125 ha with slope ranging from 0 to 15 % excluding the northern and western hilly areas. Out of these area, 525 ha has slope ranging from 0 to 3 %. Taking into account the irrigation facility plan, land condition, etc., 430 ha area with elevation below 40 m are suitable for irrigated paddy in wet season (Type A). For dry season crops, beans of 65 ha, corn of 38 ha, tomato of 13 ha and watermelon of 13 ha are recommended with the aim to increase farm income through higher land productivity. For the area of 160 ha which is below 40 m elevation and with slope ranging from 3 to 8 % and where irrigation water is available, 130% double cropping of vegetables and beans is planned. (Type B) (refer to Figure 2.1)

For the area of 265 ha with elevation above 40 m, with slope ranging from 0 to 8 % and without irrigation facility, upland farming is proposed even in wet season. (Type A', B') This area (265 ha) is consisted of 95 ha of grains, 50 ha of beans, 80 ha of vegetables represented by eggplant, etc. and 40 ha of root crops.

The area with slope ranging 8 to 15 % is about 270 ha. Even if some of the areas are below 40 m elevation, they are excluded from the

irrigation service areas. (Type C,C') From the viewpoint of land conservation, cashew and mango orchard with some inter-cropping is planned for this area.

2) Target Yield and Production

For the above-mentioned crops, target yield will be determined based on the national and provincial plans, the yield trend of Region IV and Palawan province. Production is also calculated based on the yield and the area. (refer to Table 2.7)

2.5 Marketing and Credit

Most grains, which are harvested from the Study Area and relying on rainfall, are consumed within the area. Only a few are sold. After completion of agricultural facilities and institutional development through intensive extension and training, the agricultural production will considerably increase. Consequently, the products, except for home consumption, which can be sold will increase.

To sell the agricultural products remuneratively in the market, good quality products and establishing the cooperative is important. For good quality products not only before harvesting, cultivation management, but also after harvesting, post harvest process are important. For example, the farmgate price of paddy depends on the moisture content and it differs from three to six pesos per kilogram. Therefore it is important for farmers to maintain the moisture content around 14 %, because it induces more income.

In terms of selling products in the market, transportation is necessary. For the Study Area, the main market is Puerto Princesa City. At present, some farmers bring their agricultural products by jeepney at a fairly high charge, i. e., 20 to 25 pesos per 50 kg bag. So to save such high cost, transportation of products can be done by farmers themselves or can manage their own transportation vehicle, through the cooperative.

Most of the farmers in the Study Area do not have enough capital to buy agricultural inputs. However in order to obtain credit from local or public

banks, some kind of bank deposit or cooperative guarantee is required. So the farmers who could not obtain credit from banks are forced to borrow money from traders, relatives, neighbors and wholesalers at higher interest rates. For the agricultural growth in the Study Area, the new institution or composite institutional groups, that extends credit under more lenient conditions, are necessary.

After the farmers have obtained some earnings, a comprehensive cooperative can be established. Through this cooperative, both marketing and credit activities shall be provided in the future.

Table 2.1 Population Enumerated in Various Censuses(1970-1990)

Region/Province	1970	1975	1980	(1988)	1990
Philippines	36,684,486	-	42,070,660	-	60,684,887
(Ratio)	-	-	114.7%	-	144.2%
(Annual Growth Rate)	-	-	2.71%	-	2.35%
Region IV	4,458,008	5,214,143	6,118,620	-	8,259,794
(Ratio)	-	117.0%	117.3%	-	135.0%
(Annual Growth Rate)	-	3.18%	3.25%	-	3.04%
Palawan	236,635	300,065	371,782	471,058	528,287
(Ratio)	-	126.8%	123.9%	-	142.1%
(Annual Growth Rate)	-	4.86%	4.38%	-	3.58%
Puerto Princesa City	37,774	45,709	60,234	82,058	92,147
(Ratio)	-	121.0%	131.8%	-	153.0%
(Annual Growth Rate)	-	3.89%	5.67%	-	4.34%

Source: Statistical Yearbook 1992, NSCB
1990 Census of Population and Housing, NCSO

Table 2.2 Population Projection by Region IV and Palawan(1991-2000)

Year	Population Projection		Annual Growth Rate (%)	
	Region IV	Palawan	Region IV	Palawan
1991	-	547,200	-	-
1992	-	566,789	-	3.58
1993	8,990,000	587,080	-	3.58
1994	9,240,000	608,098	2.79	3.58
1995	9,490,000	629,868	2.71	3.58
1996	9,740,000	652,417	2.63	3.58
1997	9,990,000	675,774	2.56	3.58
1998	10,240,000	699,966	2.48	3.58
1999	-	725,025	-	3.58
2000	-	750,981	-	3.58

Source: Southern Tagalog Regional Development Plan,
1993-1998, Regional Development Council
Palawan Facts and Figures, PPDO

**Table 2.3 Per Capita Daily Food Consumption
by Food Group(1987)**

Food Group	Food consumption (AP,grams) /1
Grand Total	869
I.Vegetable Origin	659
1.Cereals	345
a.Rice and products	303
b.Corn and products	24
c.Cereal products	18
2.Roots and tubers	22
3.Sugar and Syrups	24
4.Pulses and nuts	10
5.Vegetables	111
6.Fruits	107
7.Fats and Oils	14
8.Miscellaneous	26
II.Animal Origin	210
1.Meat and Poultry prods.	46
2.Fish and products	111
3.Milk and products	43
4.Eggs	10

1_/Intake of edible portion converted to A.P.(As Purchased) obtained from the table of mean one-day Capita Food Intake in the Philippines, 1987 released by the Food and Nutrition Research Institute as of May 1989.

Source:1987-1989 Food Balance Sheet of the Philippines, NSCB

**Table 2.4 Estimated Production and Yield of Paddy and Corn
(Paddy 1984-1992, Corn 1981-1989)**

Item	1984	1985	1986	1987	1988	1989	1990	1991	1992	Average
Palay										
Area Harvested(ha)	31,460	32,880	33,050	34,530	34,780	39,190	33,530	44,820	46,200	-
Irrigated	13,120	15,290	13,300	11,290	10,740	9,370	10,120	15,540	15,790	-
Rainfed	18,340	17,590	19,750	23,240	24,040	29,820	23,410	29,280	30,410	-
Production(M.T.)	51,468	58,324	68,808	66,338	69,957	73,333	71,696	102,232	89,640	-
Irrigated	25,059	34,402	34,048	28,225	26,205	28,389	26,514	38,695	30,948	-
Rainfed	26,409	23,922	34,760	38,113	43,752	44,944	45,181	63,538	58,691	-
Yield(M.T./ha)	1.64	1.77	2.08	1.92	2.01	1.87	2.14	2.28	1.94	1.97
Irrigated	1.91	2.25	2.56	2.50	2.44	2.70	2.62	2.49	1.96	2.38
Rainfed	1.44	1.36	1.76	1.64	1.82	1.80	1.93	2.17	1.93	1.76
Item	1981	1982	1983	1984	1985	1986	1987	1988	1989	Average
Corn										
Area Harvested(ha)	8,170	9,330	12,890	12,080	12,480	13,320	13,720	12,680	12,700	-
White	5,670	660	0	450	10	0	20	0	0	-
Yellow	2,500	8,670	12,890	11,630	12,470	13,320	13,700	12,680	12,700	-
Production(M.T.)	10,846	11,960	19,463	16,493	22,825	23,176	22,204	21,302	21,336	-
White	7,371	950	0	328	5	0	10	0	0	-
Yellow	3,475	11,010	19,463	16,165	22,820	23,176	22,194	21,302	21,336	-
Yield(M.T./ha)	1.33	1.28	1.51	1.37	1.83	1.74	1.62	1.68	1.68	1.58
White	1.30	1.44	0.00	0.73	0.50	0.00	0.50	0.00	0.00	1.27
Yellow	1.39	1.27	1.51	1.39	1.83	1.74	1.62	1.68	1.68	1.60

Source: BAS, Palawan

Table 2.5 Land Slope Classification in the Study Area

Slope(%)	Area(ha)	Distribution(%)	Remark
0-3	733	35.1	Class-I
3-8	419	20.1	Class-II
8-15	439	21.0	Class-III
15-	495	23.7	
Total	2,086	100.0	

Source: Measuring of 1/4,000 topo-map.

Table 2.6 Proposed Cropping Pattern
(for the Study Area)

Condition	Slope	Wet Season	Dry Season
With Irrigation Facilities	Class-I	Irrigated Paddy	Corn
	Class-II	Beans(Mungo,Peanut etc.) Squash(Ampalaya etc.)	Beans(Mungo,Peanut etc.) Tomato(Okra etc.) Watermelon(Cucumber etc.) Eggplant(Bell Pepper etc.)
Without Irrigation Facilities	Class-I	Grains(Corn,Rainfed and Upland Paddy etc.)	Beans(Mungo,Peanut etc.)
	Class-II	Beans(Mungo,Peanut etc.) Eggplant(Cucumber, Ampalaya,Upo etc.) Root Crops(Taro,Camote Ubi etc.)	
	Class-III	Cashew+Intercropping Mango+Intercropping	Cashew Mango

Note:Class-I:0-3%, Class-II:3-8%, Class-III:8-15%

Table 2.7 Proposed Yield and Production

Crop	Target Yield(ton/ha)	Area Planted(ha)	Production(ton)	
Paddy	wet(irrigated)	4.00	387	1,548
Beans(Mungo)	wet(irrigated)	1.00	72	72
	wet(not irrigated)	0.75	45	34
	dry(irrigated)	1.00	102	102
	dry(not irrigated)	0.90	238	214
Squash	wet(not irrigated)	19.00	72	1,368
Grains(maize)	wet(not irrigated)	2.00	86	172
	dry(irrigated)	2.10	34	71
Eggplant	wet(irrigated)	10.00	72	720
Taro(Gabi)	wet(not irrigated)	3.50	36	126
Tomato	dry(irrigated)	10.00	12	120
Watermelon	dry(irrigated)	25.00	12	300
Cashew	(not irrigated)	6.90	170	1,173
Mango	(not irrigated)	0.90	74	67