D.1.5. Agro-Climate

The agro-climatic zones are defined by moisture availability and wind hazards using the rainfed rice as the reference crop as below;

- Dry Sub-humid Zone (DSH): Two crops of paddy rice may be planted with the irrigation during the dry seasons. Without irrigation, diversified crops including vegetables are possible, but good drainage system is required for these crops.
- Humid Zone (H): Two crops of paddy rice may be planted. In areas not suitable for rice, coconut plantations with intercropping of diversified crops such as rootcrops or legumes may be established.
- Per-humid Zone (PH): Tropical fruit trees may be planted and agro-forestry may be established. The elevation of the area is more than 300 m above sea level.

The agro-climatic zones are further divided by combination with wind regime, i.e., cyclonic or semi-cyclonic. The agro-climatic zones in the Study Area are shown in Figure D.1.4.

D.1.6. Vegetation

The vegetative cover in the Study Area is shown in Figure D.1.5. The large proportion is under dipterocarp forest, evergreen forest and anthropic savanna. Corn, upland rice and rootcrops are cultivated in patches where Kaingin cultivation is practiced.

D.1.7. Soils

According to the Soil Map of the Philippines, the lowlands consisting of alluvial plains and valleys are covered with Eutropepts with Dystropepts. Tropepts are a member of Inceptisols which have pedogenic horizons of alteration but without accumulation of translocated materials other than carbonates or silica;

continuously hot and usually moist. These soils are corresponding to Gleyic Cambisols of FAO/UNESCO Soil Map of the World.

Undulating hills are occupied by Tropudults and Tropudalfs with Tropepts (Dystric Nitosols and Orthic Luvisols of FAO/UNESCO). Tropudults and Tropudalfs are the soils with subsurface horizons of clay accumulation; the former are low base saturation but the latter are medium to high; hot and usually moist.

Interior mountains are left as Mountain soils with various kinds of soils on the Soil Map of the Philippines, while Orthic Acrisols in the FAO/UNESCO Soil Map.

The soils of the Study Area are grouped into soil types based on the parent material, relief, profile development, textual characteristics and drainage condition. The key to the soil type is given in Table D.1.1 and Figure D.1.6 shows the typical profile of each soil type. Physical and chemical properties of the surface soils of each soil type are given in Table D.1.3 and D.1.4. The soil map of the Study Area is given in Figure D.1.7 and Table D.1.2 presents the extent of each soil type by municipality.

Followings are the descriptions of each soils found in the Study Area (from Soil Survey of Samar Provinces, BOS 1975).

1) Soils of tidal flats

a) Hydrosoil (1)

This soil type occupies the tidal swamp located at the mouth of rivers or near bays. The native vegetation consists of salt tolerant water-loving plants such as mangroves and nipa palms. Because of water inundation and high salt concentration, common crops cannot grow on these soils. Mangroves are occasionally cut for firewood. The leaves of nipa palms are used as roofing materials. These areas are also capable sites for fishponds.

b) Beach sand (118)

This type is composed of sands deposited through wave action. It has no developed soil profile. The significant area is

found only in narrow strips along the coast of Marabut municipality. Coconut trees are mainly planted. These lands require the application of a large amount of organic matter to improve its physical condition. Planting of cover crops is advisable.

2) Soils of plains and valleys

"Soils developed from recent alluvial deposits. They have slightly developed profile consisting of medium to coarse texture underlain by unconsolidated materials. Relief is nearly level to gently sloping. Drainage condition is good to partly excessive and permeability is very rapid to moderately rapid."

a) Pulupandan series

This soil series is developed from recent coastal deposits of sands and shells. The relief is nearly level to very gently undulating and the drainage is excessive owing to its coarse texture. The surface soil is black sandy loam containing fairly rich in organic matter. The subsoil is grayish brown calcareous sand layer over a light brown or gray, moderately compact sand mixed with considerable quantity of marine shells. Pulupandan Sandy Loam (255) occupies the area along the coast of Calbayog City. Coconut is the principal crop and other crops grown are camote (sweet potato), cassava and gabi (a kind of taro).

b) Quingua series

This soil series is derived from recent alluvial deposits. The soils are deep, fertile and well-drained; therefore, they are adopted to a wide variety of crops. These soils differ in color throughout their profile. The relief is level to nearly level. The soils have reddish brown streaks in the profile, which is a characteristic of most paddy soils. The surface soil is usually loose clay loam and the subsoil is of finer texture than surface soil. Quingua Clay Loam (109) occupies the floodplains along the national road from Oquendo to Catarman. This soil type is cultivated mainly to paddy rice and galiang (or Palawan gabi, a kind of taro).

c) San Manuel series

This soil series is one of the most productive soils occurring usually along river course or in plains formed by streams. The soils are deep, fertile and have coarse to medium texture with nearly level relief. In general, its water table is fairly low but in some places it is high in which case the drainage

becomes poor. The surface soil is grayish brown to pale brown, fine to medium texture. The subsoil is yellowish brown to brownish gray silt loam having medium to coarse granular structure. The substratum is yellowish brown to light reddish brown, fine sandy loam to fine/medium sand. There are three soil types found in the Study Area, i.e., San Manuel Loam, San Manuel Sandy Loam and San Manuel Clay Loam.

San Manuel Loam (190) is found in Calbayog City and municipalities of Gandara, Matuguinao and Calbiga. Most areas are subject to floods during heavy rainfall. However, external and internal drainage are good. Having inherent fertility and sufficient depth, a wide variety of crops are grown. Rice and corn are most important. Other crops grown are coconut, camote, banana, abaca, cassava, gabi and galiang. Plowing this soil when wet tends to form hard and large clods; therefore, it is advisable to plow and harrow this soil at its optimum moisture content in order to produce good tilth.

San Manuel Sandy Loam (96) is found only in the floodplain along the Jibatan river. The soils are loose, friable and easy to work on, but they have the least water-holding capacity among this soil series. It is devoted, however, to diversified crops including corn, coconut, camote, abaca, cassava as well as rice and gabi.

San Manuel Clay Loam (236) is found in the Gandara river basin extending in the municipalities of Gandara and San Jorge. The soils are one of the most productive soils in Samar but are subject to overflow when the river swell during rainy period. The principal crops grown are paddy rice and galiang.

"Soils developed from recent alluvial deposits. They have slightly developed profile underlain by unconsolidated materials. They are poorly drained due to either high water table or excess water because of position"

d) Dolongan series

This soil series is derived from accumulation of organic materials and fine soil materials washed down from the higher surroundings. The soils are characterized by a very dark gray to black surface soil, consisting of a mixture of well-decomposed organic materials and fine soil material underlain by well-decomposed organic materials. Dolongan Loamy Sand (479) covers nearly level bottom lands at Barangay Dolongan in Basey municipality. The water table is at shallower than 50 cm from the surface. Drainage is poor. The crops grown are rice, gabi, galiang and some pineapple. The soils are fertile but the cultivation of the lands is difficult. The soils cannot support the heavy load such as fully grown carabao.

e) Tingib series

This soil series is a secondary soil developed from local alluvium brought down by water from the higher surroundings. It occurs on nearly level or flat relief slightly above sea level. The water table is commonly at or near the surface during most part of the year. The soils are characterized by a light grayish brown to light gray surface soil with reddish brown streaks. The upper subsoil is light gray clay with reddish brown streaks and mottlings and with black concretions. The lower subsoil is yellowish brown to grayish brown clay with reddish brown mottliags and concretions. The substratum is light grayish brown clay with concretions. Tingib series differs from Bigaa series because the concretions in the former are of manganese while those in the latter are of iron; moreover, the latter is better drained than the former. Tingib Clay Loam (478) is found in the lowlands in the municipalities of Basey, Sta. Rita and Pinabacdao. The areas covered by this soil type are traversed by a number of creeks. The native vegetation is water- loving plants and bamboos. Paddy rice is the principal crop grown. Coconut, banana, fruit trees and vegetables are grown in limited extent on slightly elevated areas. Galiang is also grown in water-logged areas.

"Soils developed from older alluvial forms or terraces. They have moderately developed profile underlain by unconsolidated materials. They are generally deep soils with moderately compact clayey subsoil. Relief is level to slightly sloping or gently undulating. Drainage condition is poor."

f) Bay series

This soil series is a secondary soil that have been carried by streams and washed over by sea waves into its present location. The relief is level to nearly level. The soils are poorly drained. The surface soil is dark brown clay loam over a layer of bluish green to gray sandy clay. Internal drainage is poor. The substratum is bluish green to dark green coarse and gritty sand. Bay Clay Loam (23) occupies the lowlands adjacent to Hydrosoil in Wright municipality. These areas are usually submerged for months during the rainy seasons. The principal crops grown are paddy rice and galiang. Installation of a drainage system and levees for flood control are needed in this area.

g) Bigan series

The soils are deep and moderately fertile and are characterized by a brown to dark brown surface layer with dark yellowish brown or brick red streaks. The subsoil is light gray to dark brownish gray clay with yellowish brown mottlings. The substratum is light gray clay. Iron concretions are present in

all the horizons. Bigaa Loam (913) is found in level lands with poor drainage condition in the municipalities of Gandara, Sta. Margarita, Pasanghan and Wright. The principal crop grown is paddy rice.

h) Palapag series

The soils are deep, fertile but poorly drained. The relief is level to undulating. The surface soil is brown to grayish brown clay loam. The subsoil is silty clay loam with iron concretions and gravels of varying sizes from one to 10 mm in diameter. The concretions increase in size as they go deeper. The substratum is sandy loam to sandy clay loam with gravels. The native vegetation are water-loving plants and second growth forest. Palapag Clay Loam (487) occupies the nearly level narrow strip along the road from Barangay Conception in Motiong municipality to the municipal district of San Jose de Buan. The principal crop grown is upland rice. Other crops grown are coconut, abaca, camote, corn, banana, cassava and gabi.

i) Silay series

The soils are formed of recent alluvial deposits washed down from the surrounding uplands. The surface soil is gray to dark grayish brown loam. Organic matter content is poor, non-calcareous and very acidic (pH 5.5). Subsoil is massive, strongly compact and hard, brown to grayish brown silt loam mottled dark brown. The substratum is light gray sandy loam which is also massive, strongly compact and hard. The relief is nearly level. External drainage is slow, while the internal drainage is impeded due to the presence of a compact and hard layer locally called "bakias", which is a distinguishing characteristics of this soil series. The compact and hard layer is caused by a cementing substance, a siliceous substance. Silay Loam (253) is found in Calbayog and Oquendo. On these soils, paddy rice is principally grown. Owing to the presence of the compact layer beneath the surface layer, the impounding of water is much facilitated, thus, making it highly suitable for paddy field.

3) Soils of uplands, hills and mountains

Most soils of uplands, hills and mountains are not fit for cultivation due to their steepness. They are best suited for permanent vegetation and pasture.

"Soils developed from hard igneous rocks such as basalt and andesite. The soils are reddish brown to red. Relief is rolling to hilly. Internal drainage is good while permeability is moderate."

a) La Castellana series

This soil series is a primary soil developed from a mixture of igneous rocks such as andesite, basalt, breccia and volcanic tuff. The surface soil is brown to black clay. The subsoil is brown to dark grayish brown clay with occasional red mottlings, and contains plenty of pebbles and some boulders. The substratum is gray to reddish brown clay with pebbles and boulders. The outstanding characteristic of this soil series is the presence of numerous boulders on the surface. La Castellana Clay (305) is found in the rolling hills along the northwestern ridge of Calbayog. The crops grown are coconut and camote. The coconut is the principal crop. This land is stony with boulders which hinder tillage operations; therefore, this land should be devoted to permanent crops.

b) Luisiana series

This soil series is developed from igneous rocks, mostly basalt and andesite. External drainage is excessive while internal drainage is good. The soils are deep and absent of mineral fragments in the profile. These soils resemble other red soils which developed from basaltic rocks. It has clayey texture from the surface to the substratum. The surface soil is dark reddish brown to yellowish red, the subsoil is dark reddish brown, and the substratum is yellowish red to red. Luisiana Clay (239) is found in the rolling and rugged areas in the municipalities of Wright and Hinabagan. The Wright-Taft Road passes through this area. The principal crop is coconut. Other crops grown are corn, rice and bananas. Forest occupies the uncultivated areas. Accelerated erosion is main problem in the cultivated areas. This soil type is best suited for permanent crops such as coconut, coffee, cacao etc. Seasonal crops may be grown in gently sloping areas with appropriate soil conservation measures. Bare lands with steep slope should be placed under permanent vegetation and the existing forest cover should be preserved to prevent soil erosion.

"Soils developed from stratified sedimentary rocks such as shale and sandstone. The soils are very sticky and plastic when wet and hardens upon drying. Relief is generally rolling to hilly. Permeability is very slow".

c) Catbalogan series

This soil series is a moderately deep soil derived from weathered stratified shale and sandstone. The soils have slow permeability and excessive surface run-off. The surface soil is brown to dark gray, coarse granular clay loam. The subsoil is of light yellowish brown, coarse granular or blocky clay loam in upper layer; and yellowish gray to light gray blocky clay loam in lower layer with highly weathered crumbs and blocks of shale. The substratum is clay loam over highly weathered stratified shale and sandstone.

Catbalogan Clay loam (492) occupies the major portion of the rolling and hilly lands in the Study Area. The crops grown are upland rice, camote, coconut, abaca, cassava, bananas and some fruit trees. The uncultivated areas are covered with cogon grass and secondary forest. The second growth forests are found mostly in the steeper areas. Due to the unfavorable relief, this soil type should not be utilized for growing of seasonal crops but for permanent crops or for woodlands and pasturelands. Areas with gentle slopes may be used for some seasonal crops with appropriate conservation measures; otherwise, it should be planted to permanent crops like coconut.

Tingib-Catbalogan Complex (493) is composed of Catbalogan soils and Tingib soils which are in intricate pattern. The soils found in the level areas belong to Tingib series possibly Tingib clay; while those in the rolling and hilly portions are of Catbalogan series. This complex is found along the coast of Sta. Rita and Basey municipalities.

d) Tacloban series

This soil series is derived from shale occurring on hilly to mountainous relief. Stones and boulders are not present on the surface. The soils are characterized by a reddish brown to dark brown surface layer over a yellowish brown clay loam subsoil underlain by highly weathered shale. Beneath the weathered shale layer are unweathered consolidated hard igneous rocks. Tacloban Clay Loam (491) is found in the southern municipalities, i.e., Villareal, Talalora, Sta. Rita, Basey and Marabut. The crops grown are rice, coconut, camote, corn and cassava. The uncultivated areas are forested. This soil type is best suited for permanent vegetation and/or pasture. Areas with moderate slopes can be planted to permanent crops such as coconut and fruit trees. Areas devoid of vegetation should be protected, especially those having steep slopes, against erosion by planting forest trees. Existing forest should be preserved.

e) Ubay series

This soil series is derived from weathering of shale, sandstone and conglomerate. It occurs on undulating, rolling and hilly relief. The soil is characterized by light reddish brown to dark brown surface soil that reaches to a depth of 20 to 25 cm. The subsoil is brownish red to dark brown sandy or gravelly clay with concretions underlain by a yellowish brown to brick red gravelly and gritty clay horizon over layers of shale, sandstone and conglomerate. Iron concretions are plenty in both the subsoil and substratum. Severely eroded lands appear due to the exposure of the subsoil or substratum which impart the red color. In places where the slope is gentle, concretions are scattered carpet-like on the surface. Ubay

Clay Loam (172) is found at Barangay Loquilocon in Wright municipality at the vicinity of the road junction. The crops grown are corn and camote. It is suggested, therefore, that appropriate soil conservation measures and good soil management should be employed in order to prevent the lands from becoming submarginal.

"Soils developed from the weathering of limestone. Relief is rolling to hilly."

f) Faraon series

This soil series is shallow soils derived from the weathering of coralline limestone. The soils occur in hilly and mountainous relief. It has an excessive external drainage and fair internal drainage. The limestone in the soils is soft, angular, and coralline in nature. The surface soil is dark gray to black clay; sticky and strongly plastic. Organic matter content is moderate. The subsoil is dark yellowish gray clay, slightly compact with granular structure. Partially weathered limestone rocks are present. The substratum is yellowish gray, highly weathered limestone underlain by light gray to almost white, porous and soft limestone. Faraon Clay (132) covers the strip of lands in the uplands adjacent to Mountain soils, about the center of the Island. Other places where this soil type can be found are along the coast in Catbalogan; between the town of San Sebastian and Calbiga. The cultivated crops are rice, coconut, corn, bananas and gabi. The coconut is the principal crop. The uncultivated areas are covered mostly by secondary and primary forests.

4) Soils of mountains

a) Mountain soils, undifferentiated (45)

These are the soils found on the rough mountainous areas that are inaccessible. They are generally shallow and often stony. They surface drainage is excessive. This land type is not suited for cultivation but for permanent vegetation.

D.1.8. Land Capability

BOS has classified the land capability of the Study Area into seven classes, i.e., Class A to D for croplands, Classes M and N for pasture or forestlands, and Class X for fishponds or woodlands. The

land classification was made by three major factors; erosion, drainage, and shallowness or stoniness. These limitations are basis for the designation of subclasses, that is, "e" for erosion, "w" for drainage, and "s" for shallowness or stoniness.. Figure D.1.8 shows the land capability map of the Study Area and Table D.1.5 presents the recommended land use and necessary conservation measures for each class. The followings are the description of each land capability class.

1) Class A

Very good land; can be cultivated safely; requires only simple but good farm management practices.

- The lands are level to nearly level. The soils are deep, fertile, well-drained, and easy to cultivate. The lands of this class are suitable for intensive cultivation and all crops common in the Study Area can be grown. Having a good permeability, puddling the soil is necessary to minimize seepage in case of paddy rice cultivation. Good farm management practices are required, especially the proper application of fertilizers and farm manure and the observance of crop rotation which should include legumes.

2) Class Bw

Good land; nearly level; occurs in depressions; requires protection from overflow and easily applied conservation practices."

- The lands occur in depressions near streams or on low bottom lands including wetlands that can be easily drained. The soils are deep but subsoil is heavy. Poor external and internal drainage require some means to drain the excess water because the lands are subject to occasional overflow. Paddy rice is especially suited to these lands. When properly drained, corn, legumes and rootcrops can be grown. To protect the lands from occasional overflow of nearby streams, diversion ditches should be constructed as catchment for the excess runoff coming from the adjacent uplands. Proper soil management practices, i.e., application of fertilizers and farm manure must be observed.

3) Class Ce

Moderately good land; moderately sloping; slightly to moderately eroded lands; erosion and fertility problems; requires careful management and intensive conservation practices. Suited for permanent crops with erosion control measures.

- The lands have the slope ranging from 8 to 18%. This slope accelerates soil erosion which depletes the fertility. The soils are deep with effective depth of 90 cm or more, and medium to heavy texture. However, appropriate cropping pattern should be introduced to prevent the soils from runoff and erosion because the crops growing and tillage methods affect the soil conditions. In general, crops common in the area as well as fruit trees can be cultivated. Legumes in the rotation should be supported. Different combination of erosion-prevention and water-control practices such as contour planting, terracing and grassed waterways should be chosen with the crops to be grown. Moreover, to maintain crop productivity, application of lime and fertilizers according to needs should be applied as well as farm manure should be incorporated in the soil.

4) Class Cw

Moderately good land; nearly level; occurs in depressions; requires protection from frequent overflow and carefully designed drainage system.

- The lands have deep soil with medium to coarse textured topsoil. The subsoil is heavy textured and slowly permeable and moderately wet. When properly drained, crops common in the area can be grown. Paddy rice can be grown but well designed irrigation and drainage systems for proper water control in each paddy field are recommended. After the completion of irrigation and drainage facilities, good program including proper crop rotation where in legumes are utilized as green manure and application of lime, fertilizers, and farm manure should be adopted. For green manuring, crops with deep root systems are recommendable because this practice improves the structure of the subsoil and increases the water infiltration rate.

5) Class De

Fairly good land; strongly sloping; severely to very severely eroded; requires erosion control measures and very careful soil management to retain fertility with good crop rotation and complex conservation practices if land is to be cultivated. Suited for pasture or forest.

- Having thin topsoil and heavy-textured, slowly permeable subsoil as well as steep slope, moderate to excessive runoff is induced. Consequently, the soil erosion hazard is increased. The topsoil being thin, accelerated erosion on these lands will be very critical both on the standpoints of effective soil depth and fertility. The lack of soil depth for good root penetration and water storage and added problems to cope with. These lands have definite restrictions and the choice of land use is limited.

  These lands are suitable for agro-forestry where tree crops are planted with cover-crops such as legumes or grasses. Tree crops that can be grown are coconut, abaca, banana and fruit trees. Areas along gullies and streams should be planted to forest trees like ipil-ipil. Proper soil management practices like lime and fertilizer application should be observed in order to give a good start to the cover crops.

6) Class Ds

Fairly good land; nearly level to gently sloping, slightly eroded; very low fertility; very rapid permeablility and low moisture holding capacity; strongly alkaline or saline. Adopt special soil management and complex conservation practices if land is to be cultivated.

- The lands have acute problems regarding tillage operation because of lower fertility or more rapid permeability and lower moisture holding capacity or higher salt content. The surface soil is shallow with sandy to loamy texture and the subsoil is highly permeable. Formation of dune is the main problem in the Study Area. For crop cultivation, these lands require intensive soil conservation measures such as mulching and cover cropping and buffer strip cropping. This

may be devoted to vegetables or track farming and to rootcrops provided water supply is adequate and additional measures are taken to increase the water holding capacity of the soils. Increasing organic matter content of the soils by application of farm manure and by green manuring is necessary.

7) Class M

Steep land; very severely to excessively eroded or shallow for cultivation; suited for pasture or forest with careful management.

- These lands are shallow. Stones and gravels present in some areas. It is not fitted for seasonal cultivation. Where climate conditions are favorable, agro-forestry may be instituted. The tree crops such as citrus and cacao etc. should be planted along the contour and appropriate cover crops are maintained to protect the surface soil from erosion. These lands are best suited to pasture or forest. When devoted to pasture, careful management should be observed. To have a good start for young grasses and legumes, fertilizers should be applied. Newly developed pasture should not be grazed heavily but practice rotation of grazing lands. Stock pond should be constructed to conserve water for the livestock wherever possible. For forest, trees should be protected from fires, that is, Kaingin farming must be prevented. Bare spaces on steep lands should be planted to ipil-ipil.

8) Class N

Very steep land; excessively eroded or shallow rough or dry for cultivation; can be used for grazing with very careful management and definite restrictions. Best suited for forest with careful management.

- These lands are not suited to cultivation due to the very steep slopes and excessive erosion. The lands could be utilized for pasture. Where grasses grow, grazing must be controlled or restricted to a few heads of animals per ha, and the grazing areas be rotated. It is best suited to forest. However, very careful management and restrictions must be observed. Establishment of permanent vegetation like ipil-ipil is recommended, especially in gullied places. Kaingin farming must be stopped by all means.

Table D.1.1. Key to the Soil Types of the Study Area

Symbol	Soil Type	Parent Material	General Relief	Drainage		Land Use / Vegetation	Recommended Conservation Measures
				External	Internal		
Soil of Tidal Flats:							
118	Beach Sand	Marine deposits	Nearly level	Good to excessive	Good to excessive	Coconut	Crop rotation, green manuring, application of organic matter, manure and fertilizers
1	Hydrosols		Depression	Under water	Poor	Wildlife, fishpond and for recreation	N.A.
Soils of Plains & Valley:							
23	Bay Clay Loam	Alluvium	Level	Poor	Poor to very poor	Rice and galiang	Installation of dikes in rice paddies; irrigation system; protection from flood; fertilizer application
913	Digos Loam				Poor		
479	Dolongan Loamy Sand			Waterlogged	Very poor	Rice, galiang and forest	Installation of irrigation and drainage systems, dikes; application of fertilizers.
478	Tingib Clay Loam					Rice, coconut and galiang	
487	Patapag Clay Loam		Nearly level	Poor	Poor	Rice, galiang, coconut, camote, corn, banana, cassava, abaca and gabi	Same as above plus crop rotation and green manuring.
109	Quinge Clay Loam			Good to excessive	Good		Crop rotation, green manuring, application of organic matter, manure and fertilizers
255	Pulupandan Sandy Loam					Coconut, camote, cassava, gabi	
190	San Manuel Loam					Rice, coconut, camote, corn, banana, abaca, cassava, gabi	Fertilization, liming, crop rotation, green manuring, irrigation and drainage, installation of dikes in rice paddies.
96	San Manuel Sandy Loam						
236	San Manuel Clay Loam					Rice and galiang	
253	Silay Loam			Fair	Poor		Same as Bay clay loam
Soils of Upland Hills & Mountains:							
492	Catbalogan Clay Loam	Shale and sandstone	Rolling to hilly and mountainous	Good to excessive	Fair	Rice, corn, coconut, camote, banana, gabi, sugarcane; grasses and forest	Occasional cultivation on rolling lands. Reforestation on steep bare areas. Control grazing on pasture lands. Crop rotation, green manuring and strip cropping or tattracing on crop land. Application of manure, organic matter and fertilizer. Contour planting of fruit trees.
132	Faraon Clay	Coralline limestone					
305	La Castellana Clay	Igneous rocks				Rice, coconut, camote, banana and gabi	
239	Luisiana Clay					Rice corn, coconut, camote, banana, gabi; forest	
491	Talisban Clay Loam	Shale				Rice, corn, coconut, camote, sugarcane, cassava; forest	Strip cropping, contour planting, terracing, crop rotation, green manuring, contour farming, fertilizer application and organic matter addition, manuring and cover cropping.
172	Ubay Clay Loam	Shale, sandstone and conglomerate	Level and rolling to hilly and mountainous	Good		Rice, corn, coconut, camote, sugarcane, cassava, banana and gabi	
493	Tingib-Catbalogan Complex	Alluvium and shale and sandstone		Poor to excessive	Poor to fair	Rice, coconut, camote, banana, corn; forest	Same as Tingib and Catbalogan soils
Soils of Mountains:							
45	Mountain Soils, undifferentiated		Rolling, hilly	Good to excessive	Fair	Forest	Selective logging

Source: Soil Survey of Samar Provinces, 1975

Table D.1.2. Soil Type Distribution by Municipality

(Unit: sq.km)

Municipality	Soil Type Symbol																				Total
	118	1	23	913	479	487	255	109	190	96	236	253	478	492	493	132	305	239	491	172	45	
Calbayog		4.6					9.4	28.7	37.5	8.8		15.9		527.2			226.9					859.0
Sta. Margarita		9.4		21.3			1.9							96.4								129.0
Gandara		4.6		25.1					4.4		7.7			258.8		59.3					18.1	378.0
San Jorge											17.5			145.7		120.4					9.4	293.0
Tarangnan		3.1												86.9								90.0
Pagsanghan		6.9		7.5										20.6								35.0
Hinabangan									1.9					76.3		88.8					207.0	374.0
San Jose de Buan						14.4										13.8					290.8	319.0
Catbalogan														84.2		8.8						93.0
Jiabong		1.3												24.4		47.3						73.0
Motiong		1.0		0.6		11.9								41.4		85.8					44.3	185.0
Wright		8.1	2.5	14.8										49.4		122.4		29.4		7.7	225.7	460.0
San Sebastian		10.8												3.8		9.4						24.0
Hinabagan		3.8												15.6		66.9		30.6			261.1	378.0
Calbiga		2.0							4.4					90.4		67.6					80.6	245.0
Pinabacdao		9.4											5.6	64.0		16.0						95.0
Villareal		4.4											1.3	95.9		18.1			5.8		107.5	231.0
Talalora																			21.0			21.0
Sta. Rita		9.4											13.8	128.3	40.6	23.1			25.8			259.0
Basey		3.8			32.5								80.6	13.8	1.3	108.4			30.1		225.5	494.0
Marabut	4.1																		82.7		30.2	117.0
Total	4.1	82.6	2.5	69.3	32.5	26.3	11.3	28.7	48.2	8.8	25.2	15.9	101.3	1623.1	41.9	856.1	226.9	60.0	161.4	7.7	1498.2	5132.0

Source: BOS, 1976

Table D.1.3. Average Mechanical Analyses of the Surface Soils

Symbol	Soil Type	Particle Size Distribution (%)		
		Sand	Silt	Clay
	Soils of Tidal Flats:			
118	Beach Sand	88.0	12.0	0.0
1	Hydrosols	-	-	-
	Soils of Plains & Valleys:			
23	Bay Clay Loam	36.4	34.0	29.6
913	Bigaa Loam	38.4	36.4	25.2
479	Dolongan Loamy Sand	82.4	9.4	8.2
487	Palapag Clay Loam	40.4	29.6	30.0
255	Pulupandan Sandy Loam	76.4	13.4	10.2
109	Quinga Clay Loam	20.0	51.4	29.6
190	San Manuel Loam	40.8	42.4	16.8
96	San Manuel Sandy Loam	67.2	22.2	10.6
236	San Manuel Clay Loam	33.4	38.4	28.2
253	Silay Loam	33.0	41.4	25.6
478	Tingib Clay Loam	22.0	44.4	33.6
	Soils of Upland Hills & Mountains:			
492	Catbalogan Clay Loam	-	-	-
493	Tingib-Catbalogan Complex	-	-	-
132	Faraon Clay	12.4	39.0	48.6
305	La Castellana Clay	24.4	27.6	48.0
239	Luisiana Clay	36.4	23.0	41.6
491	Tacloban Clay Loam	29.2	36.0	34.8
172	Ubay Clay Loam	33.2	34.0	32.8
	Soils of Mountains:			
45	Mountain Soils, undifferentiated	-	-	-

Notes: 1/ By the Bouyoucos method

2/ Sand: 2-0.5mm, silt: 0.05-0.002mm, clay: below 0.002mm.

Source: Bureau of Soils

Table D.1.4. Average Nutrient Level of Soil Type by Municipality

Municipality	Soil Type	No. of Location	pH	OM %	P ppm	K ppm
Calbayog	Silay loam	3	6.5	3.6	22	217
	Polupandan sandy loam	1	6.1	2.6	1	283
	San Manuel loam	8	5.9	2.5	14	243
	San Manuel sandy loam	2	6.1	2.0	33	833
	Quingua clay loam	2	6.2	3.3	27	366
	Catbalogan clay loam	5	5.8	2.3	23	384
Sta. Margarita	Bigaa loam	8	5.9	2.9	19	283
	Silay loam	1	6.0	3.0	15	48
	Catbalogan clay loam	1	5.8	3.0	16	190
Gandara	Bigaa loam	6	6.2	4.1	22	309
	San Manuel clay loam	5	6.1	3.8	24	388
	Silay loam	1	6.4	4.0	1	300
	Catbalogan clay loam	8	6.0	3.8	25	409
San Jorge	San Manuel clay loam	5	7.1	3.2	25	363
	Bigaa loam	2	7.1	3.9	27	361
	Catbalogan clay loam	8	6.1	2.9	16	262
Tarangnan	Catbalogan clay loam	6	6.1	2.3	11	281
Matuguinao	Catbalogan clay loam	2	5.3	3.0	20	500
Catbalogan	Hydrosol	2	6.5	2.9	20	965
	Catbalogan clay loam	5	6.0	2.5	12	325
	Faraon clay	1	6.7	1.7	17	318
Jiabon	Faraon clay	2	7.3	2.5	7	289
Motion	Hydrosol	1	6.2	1.9	15	338
	Tacloban clay loam	4	6.4	3.4	12	389
	Catbalogan clay loam	1	7.5	2.0	5	140
Wright	Bigaa loam	3	6.3	2.5	15	227
	Catbalogan clay loam	5	6.5	3.2	20	297
Hinabagan	Hydrosols	1	6.0	1.5	5	403
	Faraon clay	1	6.0	2.0	10	372
San Sebastian	Catbalogan clay loam	2	6.2	2.8	8	270
Calbiga	Catbalogan clay loam	3	6.2	2.9	36	335
Pinabacdao	Catbalogan clay loam	1	5.2	3.5	15	282
Villareal	Catbalogan clay loam	2	6.0	3.0	7	86
Talalora	Tacloban clay loam	1	5.7	2.5	12	500
Sta. Rita	Dolongan loamy sand	2	5.2	3.3	4	1157
	Catbalogan clay loam	7	5.1	4.2	22	304
	Catbalogan-Tingib Complex	1	6.4	4.0	21	320
Basey	Tingib clay loam	7	5.5	4.3	15	155
	Dolongan loamy sand	5	5.4	5.8	24	320
	Tacloban clay loam	2	6.1	4.2	94	287
	Catbalogan-Tingib Complex	2	5.1	4.3	14	902
Marabut	Tacloban clay loam	1	5.3	3.5	9	260

Note : 1/ No data available for San José de Buan

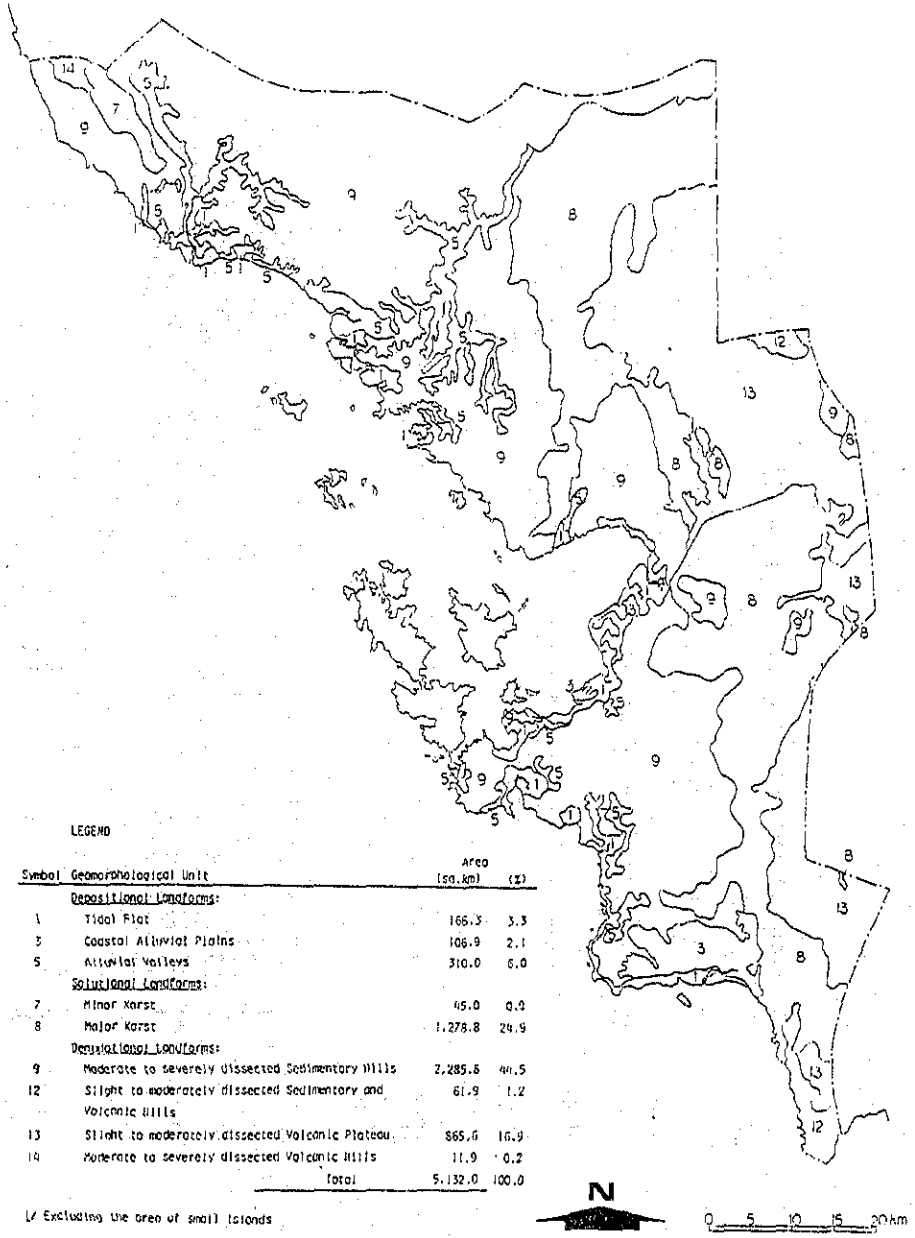
Source: Region VIII Soil Laboratory, BOS

Table D.1.5. Recommended Use and Necessary Conservation Measures for Each Land Class

Table D.1.5. Recommended Use and Necessary Conservation Measures for Each Land Class

Class	Limitations	Slope (%)	Soil Type	Land Use and Conservation
A	-	0 - 8	San Manuel loam San Manuel sandy loam San Manuel clay loam	Cropland (paddy rice and diversified crops) Application of fertilizers and compost/manure
Bw	Occasional overflow	0 - 3	Bay clay loam Bigaa loam Pulapag clay loam Quingua clay loam Silay loam	Cropland (paddy rice, gabi, legumes) Other diversified crops with proper drainage system. Application of fertilizers and compost
Ce	Moderate erosion Low fertility	8 - 18	Catbalogan clay loam Faraon clay La Castellana clay Luisiana clay Tacloban clay loam Ubay clay loam	Cropland (corn, legumes and tree crops) Terracing, strip cropping, contour planting crop rotation. Application of fertilizers and compost/ manure.
Cw	Frequent overflow	0 - 3	Dolongan loamy sand Tingib clay loam	Cropland (paddy rice, gabi, legumes) Proper drainage system, flood protection. Application of fertilizers and compost/manure.
De	Severe erosion Shallow soil depth Poor fertility	18 - 30	Catbalogan clay loam Faraon clay La Castellana clay Luisiana clay Tacloban clay loam Ubay clay loam	Cropland (tree farm) or pasture land and may be used for occasional cultivation with bench terrace, buffer strip cropping, crop rotation, cover cropping, contour planting. Application of fertilizers and compost/manure.
Ds	Low moisture holding capacity (rapid permeability) Very low fertility High salt content	0 - 3	Beach sand Pulpandan sandy loam	Cropland (coconut, vegetables and truck farming, rootcrops) Provide adequate water supply. Increase organic matter by adding compost/manure.
M	Steep sloping Very severe erosion Soil shallowness	30 - 50	Catbalogan clay loam Faraon clay Luisiana clay Tacloban clay loam Ubay clay loam Mountain soils	Pasture land or forest with careful management. Provide adequate water supply Fencing of pasture Provide fire protection by planting forest trees around the area. Apply fertilizer for forage production.
N	Very steep sloping Excessive erosion	> 50	Catbalogan clay loam Faraon clay La Castellana clay Luisiana clay Tacloban clay loam Ubay clay loam Mountain Soils	Forest lands No kaingin farming maintain standing forests or reforest denuded areas Selective logging be observed.
X	Always under water	0 - 3	Hydrosol	Fishponds Maintain trees and palms along coastal boundary for wave protection. Application of fertilizers to produce good growth of algae for fish.

FIGURE D.1.1. GEOMORPHOLOGICAL MAP



LEGEND

Symbol	Geomorphological Unit	Area (sq.km)	(%)
	Depositional Landforms:		
1	Tidal Flat	166.3	3.3
3	Coastal Alluvial Plains	106.9	2.1
5	Alluvial Valleys	310.0	6.0
	Solutional Landforms:		
7	Minor Karst	45.0	0.9
8	Major Karst	1,278.8	24.9
	Denudational Landforms:		
9	Moderate to severely dissected Sedimentary Hills	2,285.8	44.5
12	Slight to moderately dissected Sedimentary and Volcanic Hills	61.9	1.2
13	Slight to moderately dissected Volcanic Plateau	865.6	16.9
14	Moderate to severely dissected Volcanic Hills	11.9	0.2
	Total	5,132.0	100.0

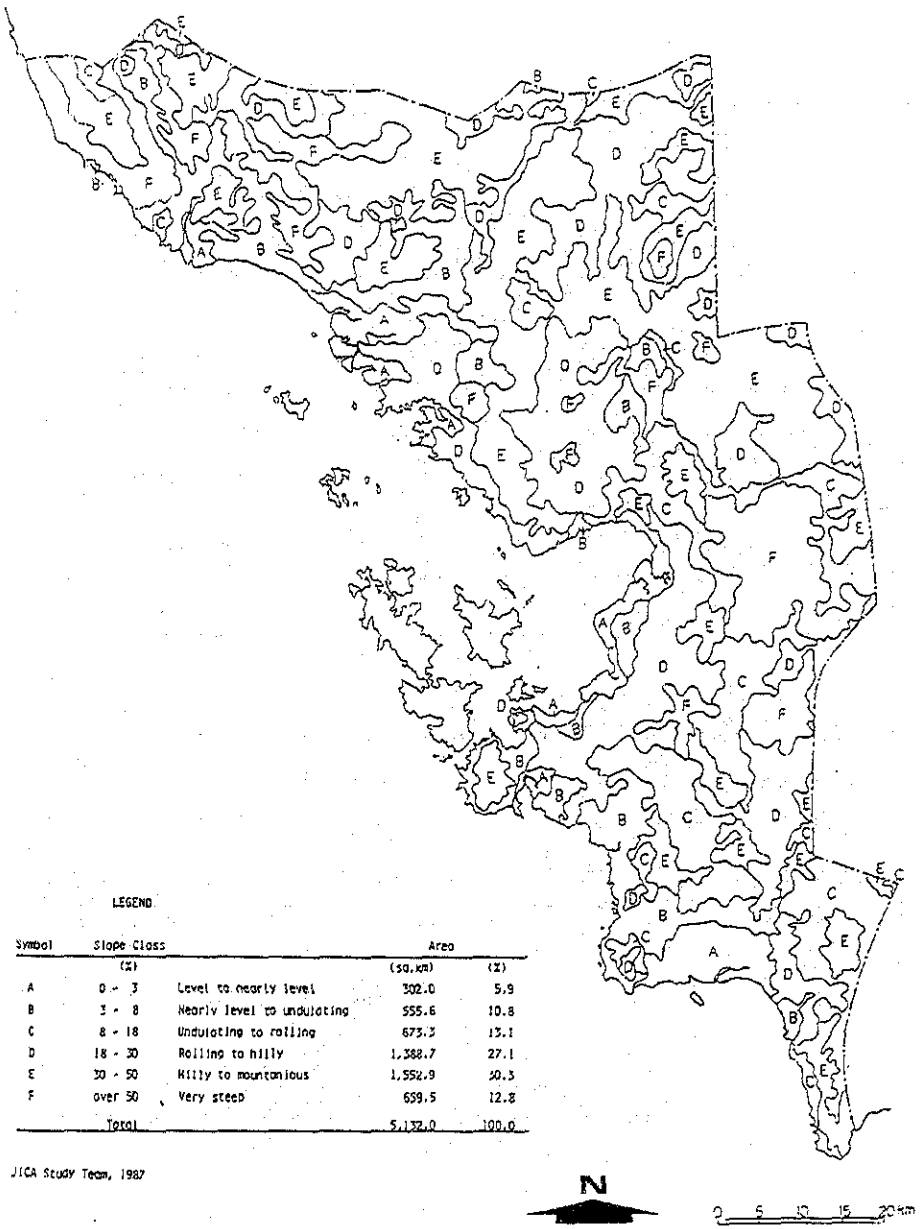
1/ Excluding the area of small islands

Source: Bureau of Soils

N

0 5 10 15 20km

FIGURE D.1.2. SLOPE MAP



LEGEND

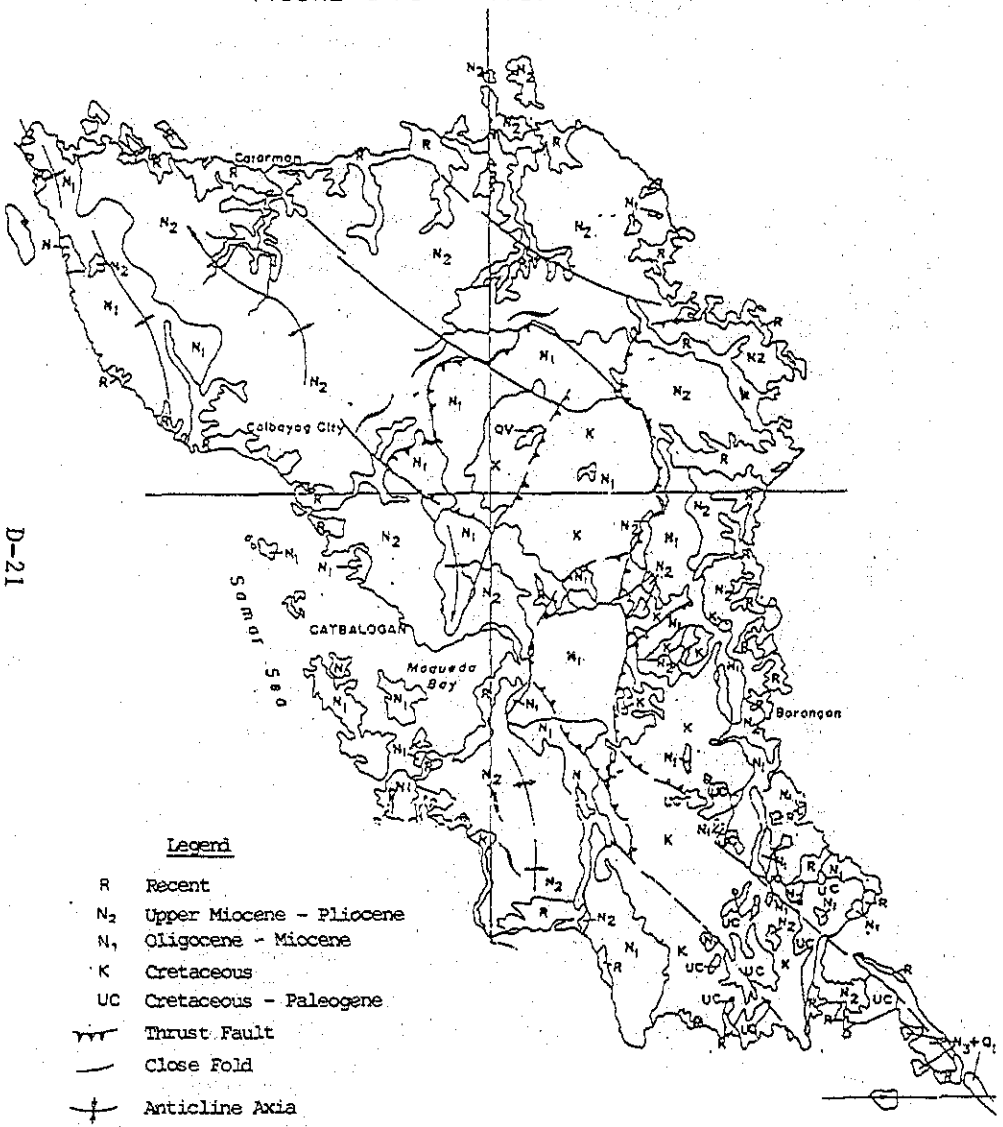
Symbol	Slope Class (%)		Area (sq.km)	(%)
A	0 - 3	Level to nearly level	302.0	5.9
B	3 - 8	Nearly level to undulating	555.6	10.8
C	8 - 18	Undulating to rolling	673.3	13.1
D	18 - 30	Rolling to hilly	1,388.7	27.1
E	30 - 50	Hilly to mountainous	1,552.9	30.3
F	over 50	Very steep	659.5	12.8
	Total		5,132.0	100.0

JICA Study Team, 1987

N

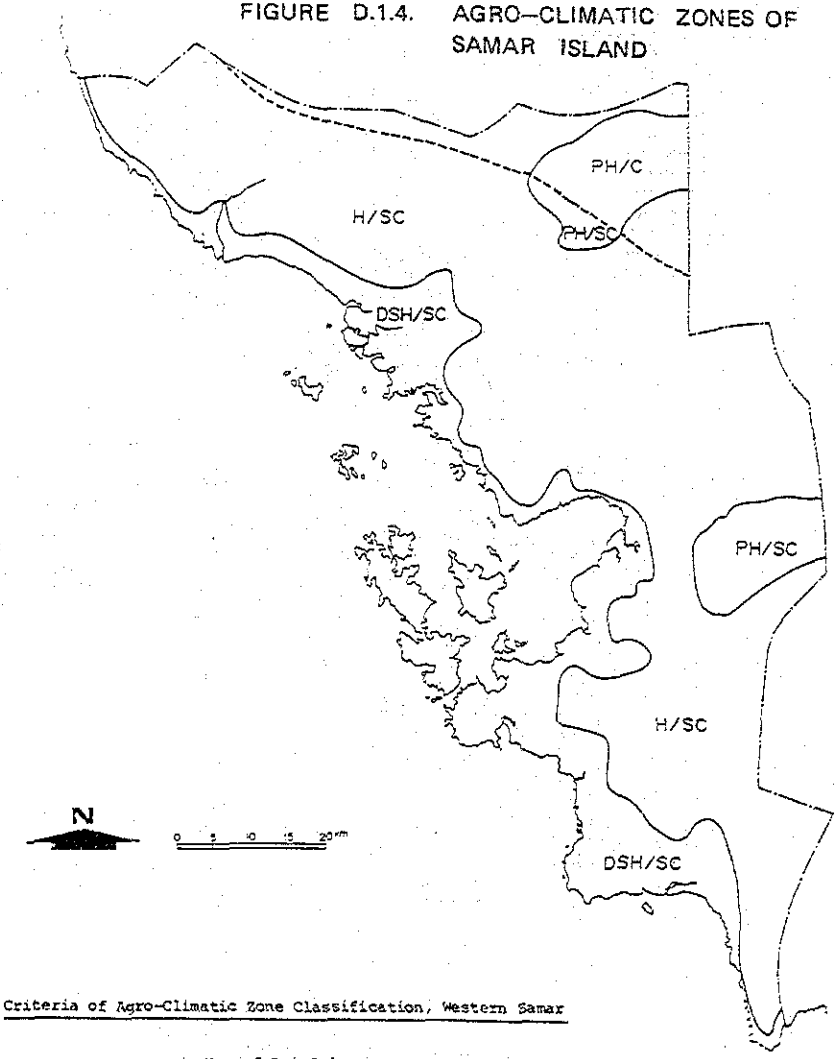
0 5 10 15 20km

FIGURE D.1.3. GEOLOGICAL MAP



Source: Comprehensive Development Study
SIRDP, 1984

FIGURE D.1.4. AGRO-CLIMATIC ZONES OF SAMAR ISLAND



Criteria of Agro-Climatic Zone Classification, Western Samar

Zone	Moisture Regime	No. of Rainfed Rice Crops Possible in 3 out of 4 Years	Wind Regime	Frequency of Typhoon Passage
PH/C	Per-humid	2	Cyclonic	30 - 40 %
PH/SC	Per-Humid	2	Semi-cyclonic	10 - 20 %
H/C	Humid	2	Cyclonic	30 - 40 %
H/SC	Humid	2	Semi-cyclonic	10 - 20 %
DSH/SC	Dry Sub-humid	1	Semi-cyclonic	10 - 20 %

Source: Bureau of Soils

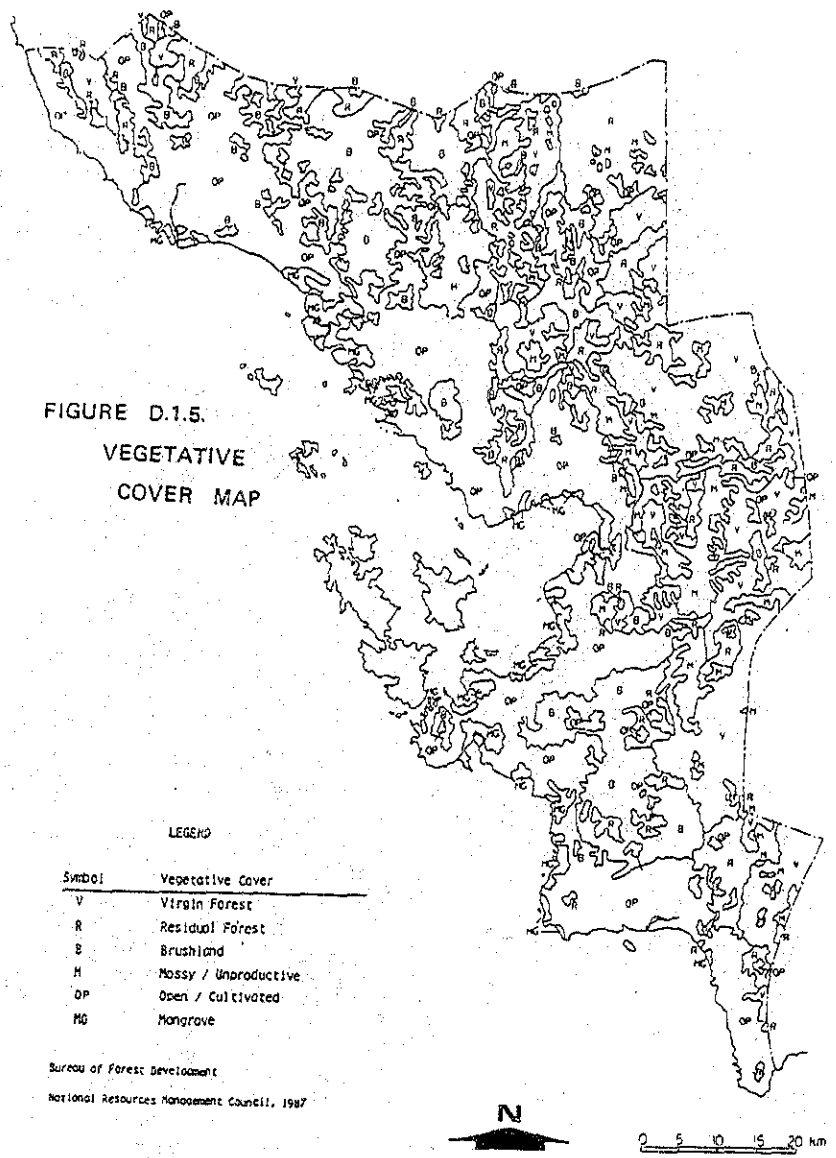


FIGURE D.1.5.
VEGETATIVE
COVER MAP

FIGURE D.1.6. TYPICAL SOIL PROFILE OF EACH SOIL TYPE

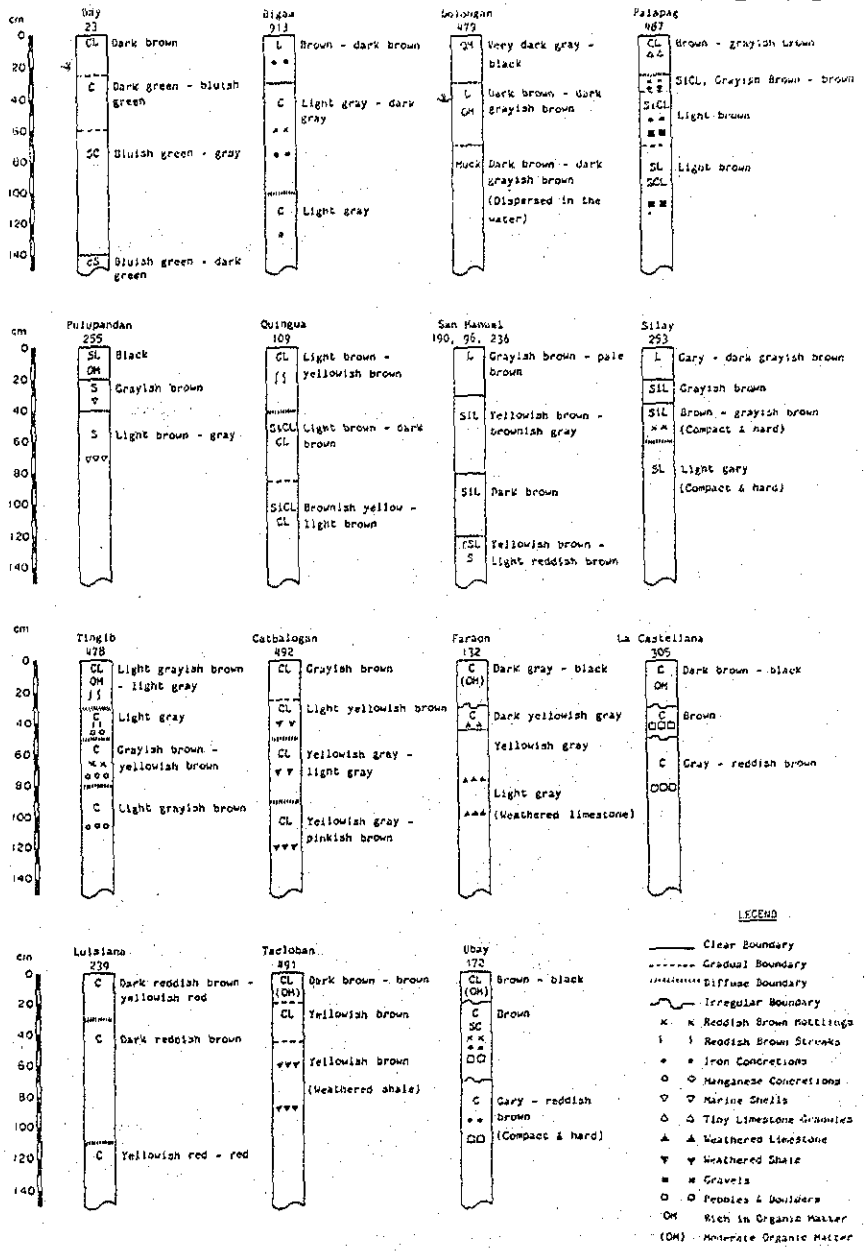
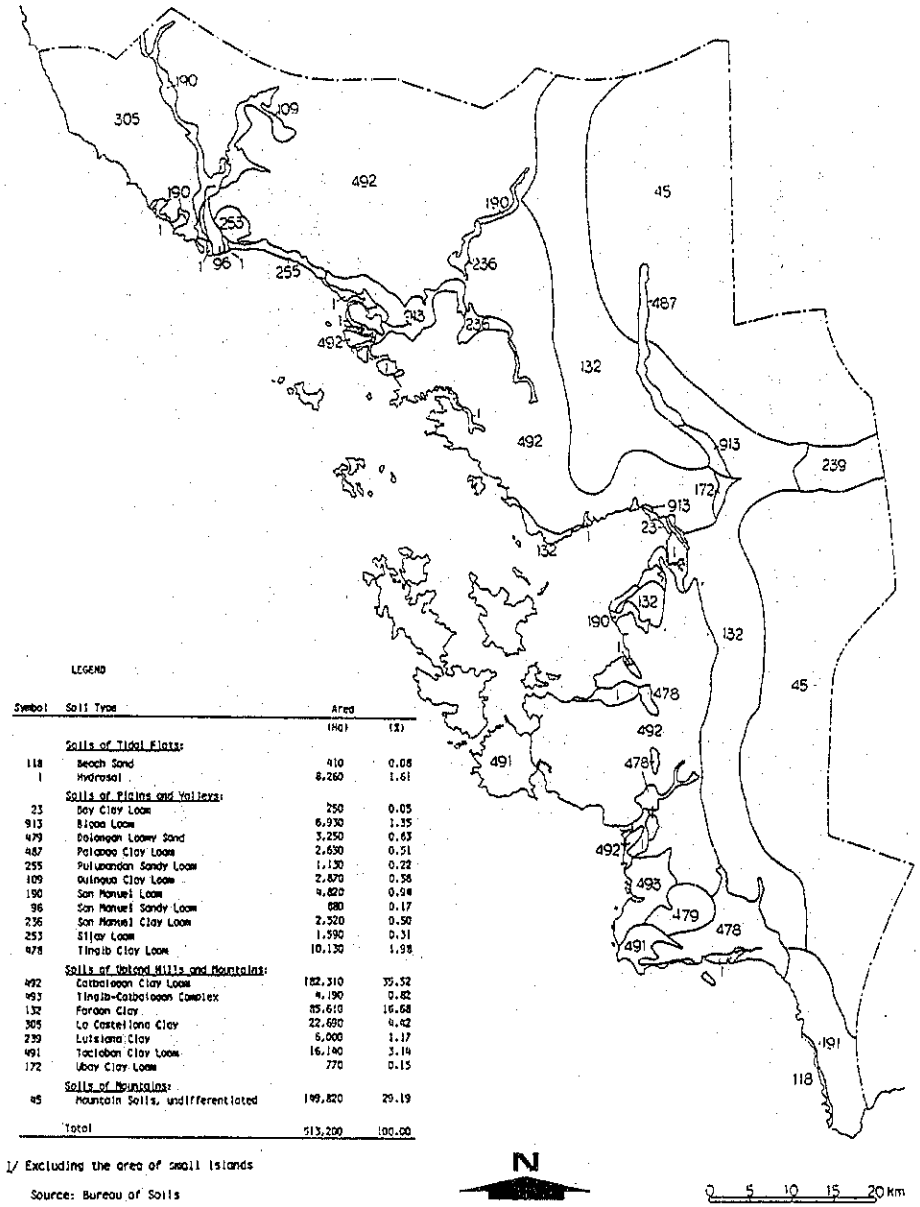


FIGURE D.1.7. SOIL MAP



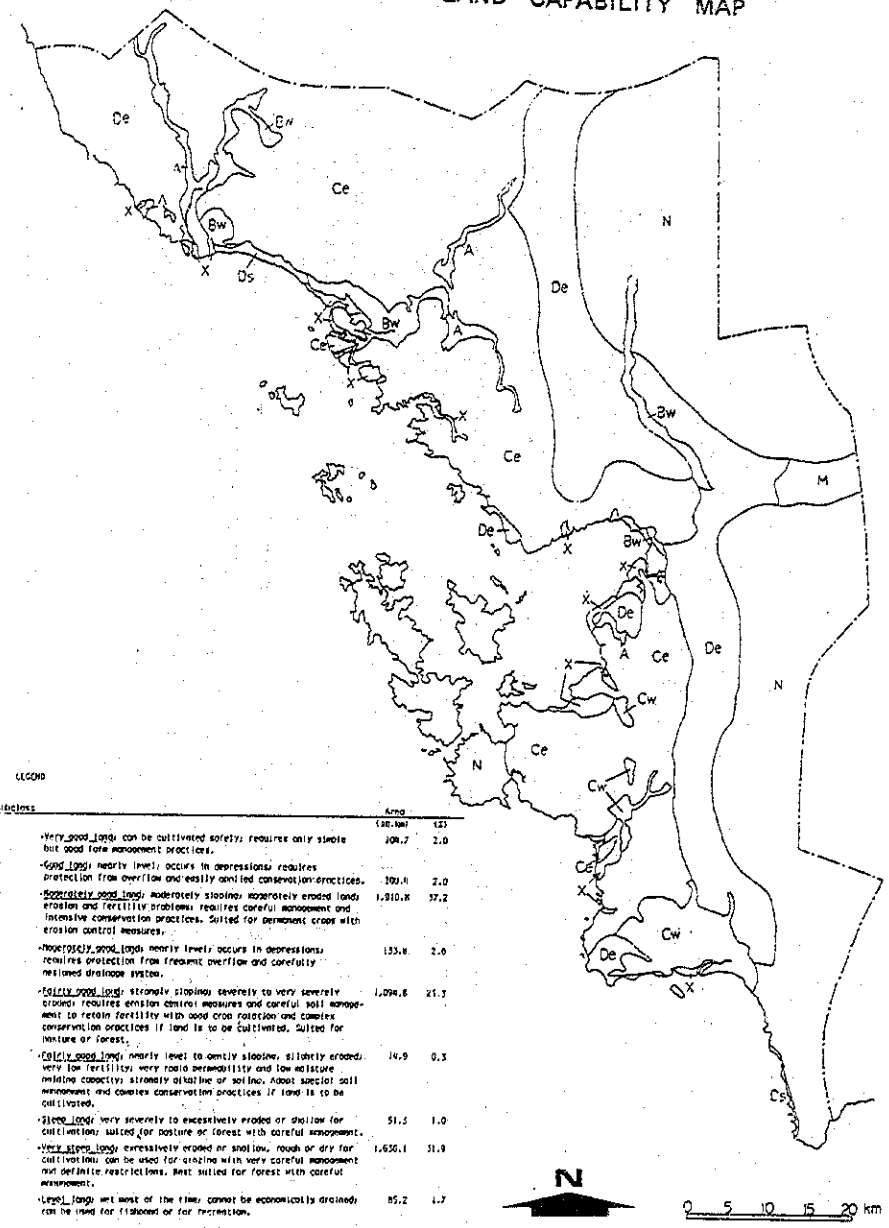
LEGEND

Symbol	Soil Type	Area (Ha)	(%)
	Soils of Tidal Flats:		
118	Beach Sand	410	0.08
1	Hydrosol	8,260	1.61
	Soils of Plains and Valleys:		
23	Bay Clay Loam	250	0.05
913	Bigaa Loam	6,930	1.35
479	Dolongan Loamy Sand	3,250	0.63
487	Palapag Clay Loam	2,650	0.51
255	Pulupandan Sandy Loam	1,130	0.22
109	Quinapa Clay Loam	2,870	0.56
190	San Manuel Loam	4,820	0.94
96	San Manuel Sandy Loam	880	0.17
236	San Manuel Clay Loam	2,520	0.50
253	Sigar Loam	1,590	0.31
478	Tingib Clay Loam	10,130	1.98
	Soils of Upland Hills and Mountains:		
492	Catbalogan Clay Loam	182,310	35.52
493	Tingib-Catbalogan Complex	4,190	0.82
132	Faraon Clay	85,610	16.68
305	La Castellana Clay	22,690	4.42
239	Luisiana Clay	6,000	1.17
491	Tacloban Clay Loam	16,140	3.14
172	Ubay Clay Loam	770	0.15
	Soils of Mountains:		
45	Mountain Soils, undifferentiated	149,820	29.19
	Total	513,200	100.00

1/ Excluding the area of small islands

Source: Bureau of Soils

FIGURE D.1.8. LAND CAPABILITY MAP



LEGEND

Class/Subclass		Area (sq.km)	(%)
A	-Very good land: can be cultivated safely; requires only simple but good farm management practices.	104.7	2.0
Bw	-Good land: nearly level; occurs in depressions; requires protection from overflow and easily applied conservation practices.	100.4	2.0
Ce	-Moderately good land: moderately sloping; moderately eroded land; erosion and fertility problems; requires careful management and intensive conservation practices. Suited for permanent crops with erosion control measures.	1,910.8	37.2
Cw	-Moderately good land: nearly level; occurs in depressions; requires protection from frequent overflow and carefully designed drainage system.	133.6	2.6
De	-Fairly good land: strongly sloping severely to very severely eroded; requires erosion control measures and careful soil management to retain fertility with good crop rotation and complex conservation practices if land is to be cultivated. Suited for pasture or forest.	1,094.6	21.3
Ds	-Fairly good land: nearly level to gently sloping, slightly eroded; very low fertility; very rapid permeability and low moisture holding capacity; strongly alkaline or saline. Adopt special soil management and complex conservation practices if land is to be cultivated.	14.9	0.3
N	-Steep land: very severely to excessively eroded or shallow for cultivation; suited for pasture or forest with careful management.	51.5	1.0
M	-Very steep land: excessively eroded or shallow, rough or dry for cultivation; can be used for grazing with very careful management and definite restrictions. Best suited for forest with careful management.	1,638.1	31.9
X	-Level land: wet most of the time; cannot be economically drained; can be used for fishpond or for recreation.	85.2	1.7
	Total	5,137.8	100.0

Source: Soil Survey of Samar Provinces, 1975

9) Class X

Level land; wet most of the time; cannot be economically drained; can be used for fishpond or for recreation."

- These lands are level or slightly depressed and because of its location and elevation, seawater or fresh water flow into the area. In some places, the water may flow or drain back to its source with the receding tide while in others the water stagnates. Lands along the shore and at the mouth of rivers and creeks which are accessible to seawater are usually covered by mangroves or nipa palms. These lands are suitable for fishponds or recreation. In the construction of fishponds, the trees and palms are cut except for a strip along the shoreline wide enough to protect the ponds from the scouring action of waves. Broadcast organic fertilizer into the ponds to produce good growth of algae, the food for fishes is necessary.

D.2. Land Use and Conservation

D.2.1. Land Categories

Land status classification map of the Study Area is given in Figure D.2.1. This map was drawn based on the data collected from the BFD. The steep lands sloping more than 18% (about 10 degree) are defined to be retained as forest reserve from the aspect of soil and water conservation. The alienable and disposable lands where agricultural development plan will be made cover 1,942.4 km^2 or 37.8% of the total Study Area.

D.2.2. Present Land Use

Present land use in the Study Area is given in Figure D.2.2. The delineation of this map was drawn by the dominant land use with associated ones. The present land use was estimated from the proportion of crops included in each land use category as shown Table D.2.1. As the result, forests and shrubs/grasses mainly comprise of cogon grass cover 3,703 km^2, i.e., 72.2% of the total

Study Area. On the other hand, total agricultural lands constitute an aggregate area of 1,288 km^2 (25.1% of the total Study Area), wherein paddy rice areas were estimated to be about 164 km^2 and diversified crops to be about 146 km^2. Coconut areas are predominant and occupy about 763 km^2.

D.2.3. Proposed Land Use

The proposed land use aims to designate the most beneficial use of lands while conserving the resources for the future. In the course of land use planning, the potentials and limitations of lands through land capability analysis together with the existing land use pattern and the farmers needs and functions were taken into consideration.

Figure D.2.3 shows the proposed land use in the Study Area. On this map, the lands are allocated to six land use patterns as follow;

	(Dominant)		(Associated)	
Tidal Swamp	Mangroves/Nipa	80%	Fishponds	10%
			Coconut	10%
Rice-Based Farming	Paddy rice	85%	Diversified crops	10%
			Coconut	5%
Corn-Based Farming	Diversified crops	60%	Coconut	30%
			Paddy rice	10%
Coconut-Based Farming	Coconut	80%	Pasture	10%
			Diversified crops	5%
			Fruit	5%
Agro-Forestry	Coconut	25%	Fruit	15%
	Forest	25%	Diversified crops	10%
	Pasture	25%		
Forest	Forest	80%	Shrubs/grasses	20%

Based on this map, the agricultural land use in future was estimated as shown in Table D.2.2. By the year of 2007, paddy rice areas shall have increased to approximately 185 km^2. Potential paddy rice areas of the Study Area are concentrated in the river valleys of Jibatan and Gandara.

Since the extent of coastal plains are limited, future agricultural expansion in the Study Area requires crop diversification where the undulating hills are to be used for upland crops and tree crops development with proper soil conservation measures. These areas are presently covered with shrubs and grasses that are left idle can be made productive if planted to coconut and other fruit trees with forest trees, that is, agro-forestry.

In the long-range development plan, Kaingin farming which are promoting soil erosion shall have terminated and major portions of shrubs and cogon grasslands are planned to shift to the grazing lands with nutritious forage crops.

Fishing is one of the major activity in the Study Area. Potential fishing areas include the coastal water of Maqueda Bay. Existing fishponds will be remained as it is and tidal swamps shall leave their natural vegetation to support wildlife.

D.2.4. Soil Conservation

Soil erosion is one of the major problems in the Study Area. About 70% of the Study Area is susceptible to the soil erosion in case of clearing or cultivation of seasonal crops. The soil erosion susceptibility is dependent on various factors such as topography (slope), vegetative cover, rainfall condition and farming practices. In the Study Arec, major cause of soil erosion is regarded as man-made, i.e., Kaingin farming. The BOS has made erosion classification as below;

Erosion Class 1	None	No apparent erosion; no gullies
Erosion Class 2	Slightly	Less than 1/4 of original surface soil eroded; occasional crossable gullies present.
Erosion Class 3	Moderately	From 1/4 to 3/4 of original surface soil eroded.
Erosion Class 4	Severely	From 3/4 of original surface soil to 1/4 of subsoil eroded

Table D.2.1. Present Land Use[1/]

Land Use Category Symbol		Paddy Rice[2/]	Diversified[3/] Crops	Coconut[4/] (Abaca)	Kaingin	Shrubs/ Grasses[5/]	Forest	Mangrove (Fishponds)	Total
2	(%)	(85)	(5)	(5)		(5)			
	sq.km	83	5	5		5			98
3	(%)	(60)	(10)	(10)		(20)			
	sq.km	30	5	5		10			50
4	(%)	(30)	(10)			(60)			
	sq.km	23	8			47			78
5	(%)	(5)	(5)	(85)		(5)			
	sq.km	14	14	243		14			285
6	(%)	(5)	(10)	(70)		(15)			
	sq.km	14	30	206		45			295
10	(%)		(5)	(15)		(80)			
	sq.km		41	122		652			815
11	(%)		(10)	(30)		(60)			
	sq.km		43	128		257			428
12	(%)			(5)	(15)	(60)	(20)		
	sq.km			29	88	353	117		587
13	(%)	(5)						(95)	
	sq.km	-						5	5
16	(%)			(10)				(90)	
	sq.km			15				136	151
18	(%)				(5)		(95)		
	sq.km				97		1,836		1,933
19	(%)			(5)	(5)	(15)	(75)		
	sq.km			20	20	61	306		407
Total	sq.km	164	146	773	205	1,444	2,259	141	5,132
(settlement)[6/]				(10)				(5)	(15)

Notes: 1/ Gross area by planimetric method.
2/ Mainly rainfed by payatak method.
3/ Including corn, legumes, rootcrops, upland rice, vegetables etc.
4/ Including coffee, cacao and fruit bearing trees (citrus).
5/ Primary/secondary partly logged-over area.
6/ Residential, commercial and industrial area.

Table D.2.2. Proposed Land Use (Long-Range Development)

Land Use Symbol		Paddy Rice 1/	Diversified Crops 2/	Coconut Trees 3/	Fruit Trees 4/	Kaigin	Shrubs/ Grasses 5/	Forest 6/	Mangroves/ Nipa	Fishponds	Total
1	(%)			(10)					(80)	(10)	
	sq.km	-	-	15	-	-	-	-	119	15	149
2	(%)	(85)	(10)	(5)							
	sq.km	156	18	9	-	-	-	-	-	-	183
3	(%)	(10)	(60)	(30)							
	sq.km	29	174	87	-	-	-	-	-	-	290
4	(%)		(5)	(80)	(5)		(10)				
	sq.km	-	30	472	30	-	59	-	-	-	591
5	(%)		(10)	(25)	(15)		(25)	(25)			
	sq.km	-	86	217	129	-	217	217	-	-	866
6	(%)						(20)	(80)			
	sq.km	-	-	-	-	-	611	2,442	-	-	3,053
Total sq.km		185	308	800	159	-	887	2,659	119	15	5,132
(Settlement)			(5)		(3)		(10)	(3)	(5)		(26)

Notes: 1/ Including irrigated and rainfed.
2/ Including legumes, rootcrops and vegetables.
3/ Including abaca.
4/ Including citrus, cacao, cashew etc.
5/ Including pasture lands.
6/ Including Ipil-ipil etc.

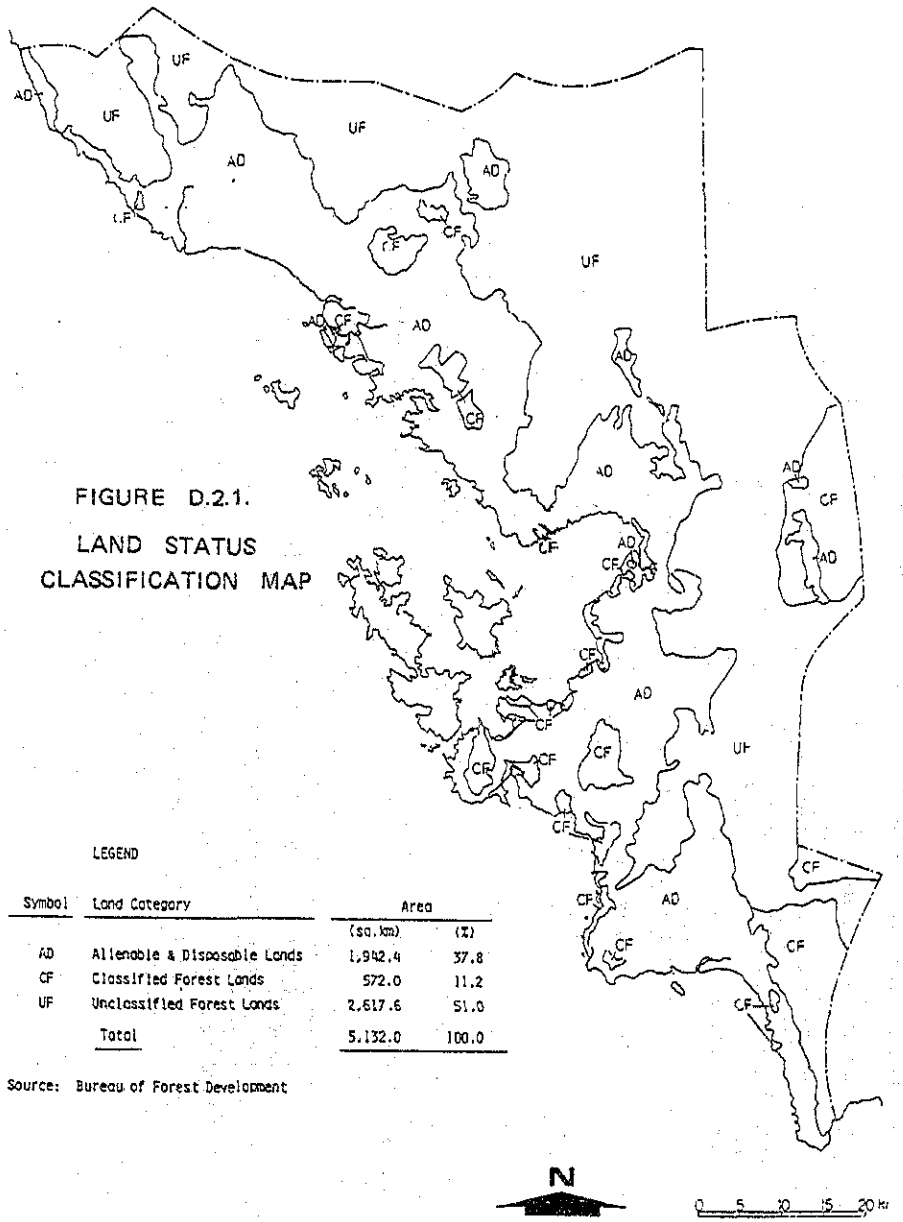


FIGURE D.2.1.

LAND STATUS CLASSIFICATION MAP

LEGEND

Symbol	Land Category	Area (sq.km)	Area (%)
AD	Alienable & Disposable Lands	1,942.4	37.8
CF	Classified Forest Lands	572.0	11.2
UF	Unclassified Forest Lands	2,617.6	51.0
	Total	5,132.0	100.0

Source: Bureau of Forest Development

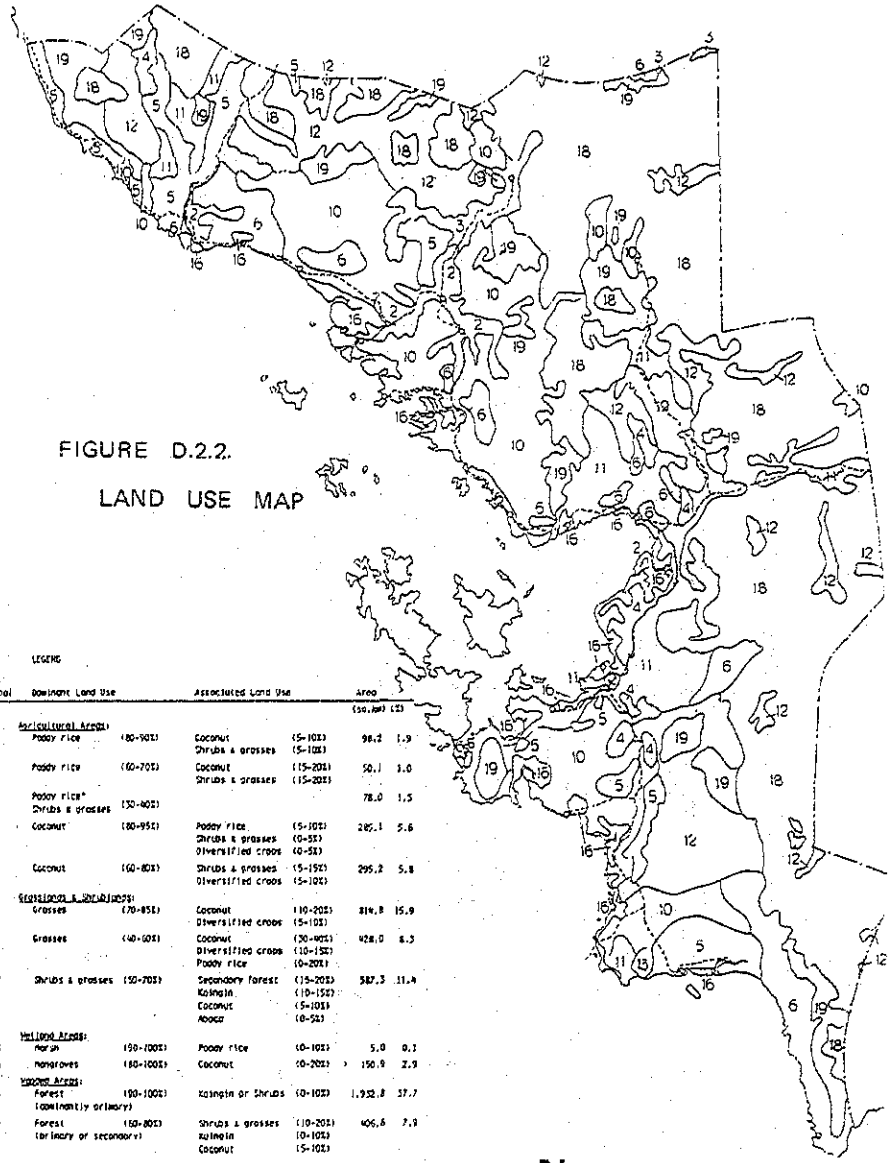


FIGURE D.2.2.

LAND USE MAP

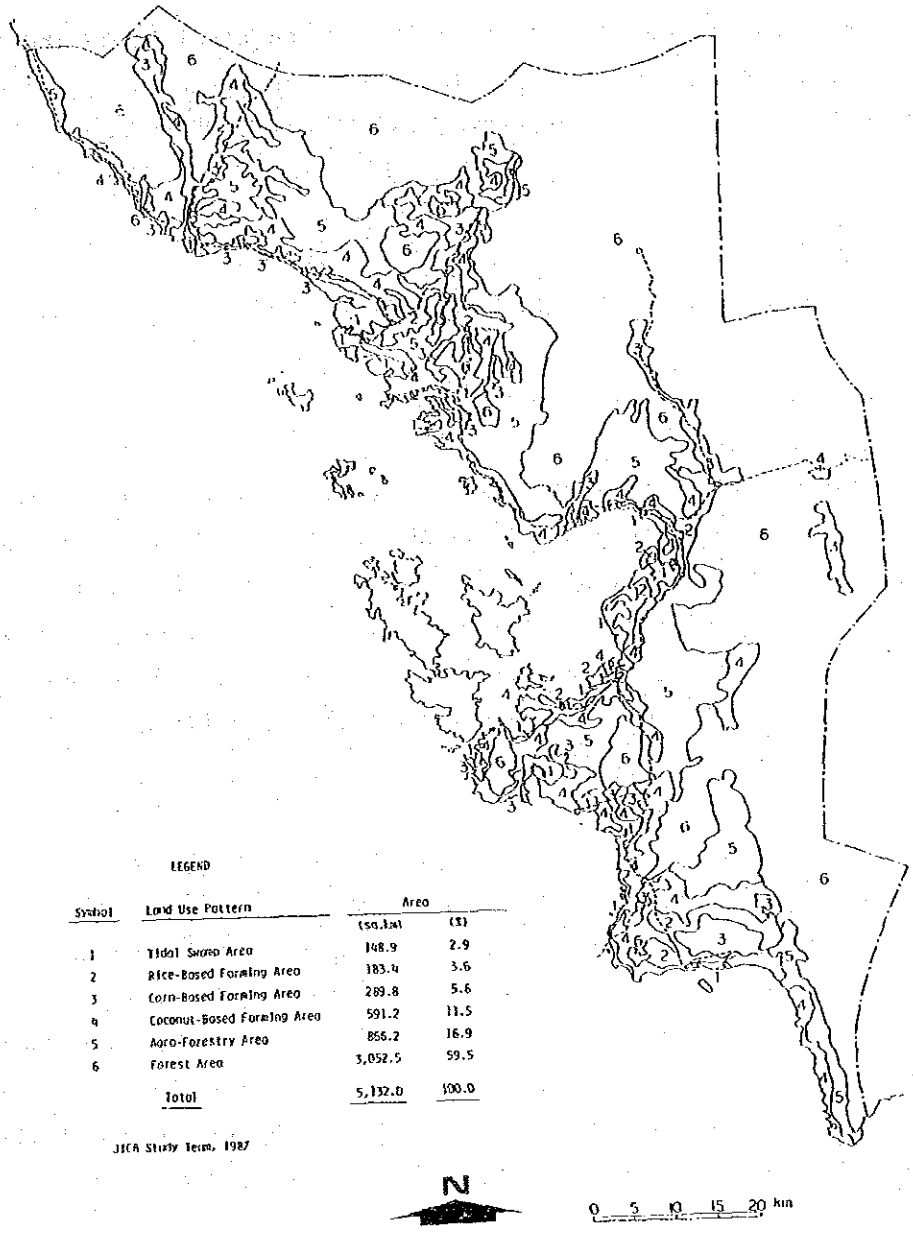
LEGEND

Symbol	Dominant Land Use		Associated Land Use		Area (sq.km)	(%)
	Agricultural Areas:					
2	Paddy rice	(80-90%)	Coconut	(5-10%)	98.2	1.9
			Shrubs & grasses	(5-10%)		
3	Paddy rice	(60-70%)	Coconut	(15-20%)	50.1	1.0
			Shrubs & grasses	(15-20%)		
4	Paddy rice*				78.0	1.5
	Shrubs & grasses	(30-40%)				
5	Coconut	(80-95%)	Paddy rice	(5-10%)	285.1	5.6
			Shrubs & grasses	(0-5%)		
			Diversified crops	(0-5%)		
6	Coconut	(60-80%)	Shrubs & grasses	(5-15%)	295.2	5.8
			Diversified crops	(5-10%)		
	Grasslands & Shrublands:					
10	Grasses	(70-85%)	Coconut	(10-20%)	814.8	15.9
			Diversified crops	(5-10%)		
11	Grasses	(40-60%)	Coconut	(30-40%)	428.0	8.3
			Diversified crops	(10-15%)		
			Paddy rice	(0-20%)		
12	Shrubs & grasses	(50-70%)	Secondary forest	(15-20%)	587.3	11.4
			Kaingin	(10-15%)		
			Coconut	(5-10%)		
			Abaca	(0-5%)		
	Wetland Areas:					
13	Marsh	(90-100%)	Paddy rice	(0-10%)	5.0	0.1
16	Mangroves	(80-100%)	Coconut	(0-20%)	150.9	2.9
	Wooded Areas:					
18	Forest (predominantly primary)	(90-100%)	Kaingin or Shrubs	(0-10%)	1,952.8	37.7
19	Forest (primary or secondary)	(60-80%)	Shrubs & grasses	(10-20%)	406.6	7.9
			Kaingin	(0-10%)		
			Coconut	(5-10%)		
	Total				5,132.0	100.0

*Fallow method.

Source: Bureau of Soils (1981)

FIGURE D.2.3. PROPOSED LAND USE MAP



All soils of tidal flats and plains and valleys are considered as Class 1, that is, no erosion problem. Soils of upland hills and mountains have been classified into Classes 2 to 4 depending on the slope and vegetative cover at present.

It should be noted that about 30% of the total Study Area is considered open grass and shrub lands with no effective protection from soil erosion during heavy rainfall and from fire during dry period.

D.3. Land Resources in Priority Areas

D.3.1. Land Use in the Priority Areas

From the viewpoints of land and water resources, Jibatan, Gandara and Basey river basins as well as the littoral extending between Wright and Sta. Rita seem to have a potentiality of agricultural development (Figure D.3.1). For the four priority areas, the existing land use pattern was surveyed and delineated on the 1:50,000 scale topographical maps during the field survey period (refer to Figures D.3.2 to D.3.5).

The present land use in the Jibatan river basin is characterized by predominant coconut areas. The river valley is occupied by coconut mixed with abaca. In the mid-stream area, paddy rice and coconut are mixed. Considerable extent of paddy rice area can be seen in the down stream area of alluvial plain. On the other hand, the land use in the Gandara river basin is characterized by paddy rice in valleys intricately surrounded by grass and shrubs on undulating hills. This river basin is the major paddy rice area in the Study Area.

D.3.2. Land Systems in Jibatan and Gandara River Basins

Among the four priority areas, both Jibatan and Gandara river basins were further selected for their priority after consideration

of social conditions in addition to the physical conditions, i.e., land and water resources.

Most parts of both river basins were included in the Samar Island Reconnaissance Land Resources Survey of Priority Strips conducted by BOS-UNDP/FAO in 1977.

The land systems, which consist of recurring patterns of landforms, soils and vegetative cover, have been delineated on the 1:50,000 scale topographical maps. Table D.3.1 gives the legend of the land systems. Figures D.3.6 and D.3.7 show the land systems in the Jibatan and Gandara river basins, respectively.

D.4. References

- Comprehensive Development Plan for Samar Island. Final Report, SIRDP-NEDA Region VIII, 1982

  Vol. 1 Executive Summary
  Vol. 3 Land Use Framework

- Samar Island Reconnaissance Land Resources Survey of Priority Strips for Integrated Rural Development: Soil and Land Resources Appraisal and Training Project. BOS-UNDP/FAO, 1977

  Volume 1 Main Text
  Annex 1 Atlas
  Annex 2 Soil Profile Descriptions and Analytical Data of Samples
  Annex 6 Geology
  Annex 7 Land Use (Maps)
  Annex 8 Infiltration, Permeability and Water Holding Capacity of Soils

- Land Resources Inventory of the Gandara, Sta. Margarita, Tarangnan River Valley and Coastal Plains Area, Samar province: Soil and Land Resources Appraisal and Training Project.
  BOS-UNDP/FAO, 1980

  Field Document 3
  Annex 4 Soil Profile Descriptions and Analytical Data of Samples
  Annex 5 Soil Profile Descriptions
  Annex 6 Land Development Cost Analysis
  Annex 8 Sociological Study for Agricultural Development Gandara Municipality

- Soil Survey of Samar Provinces, Philippines: Reconnaissance Soil Survey and Soil Erosion Survey. Soil Report 42 Atanacio Simon, N.M. Natividad, R.M. Amaba and T.P. Demen 1975

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- The Philippines Recommends for Soil Conservation. PCARRD 1977

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- The Philippines Recommends for Cacao. PCARRD 1979

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- Soil Erosion Map of the Philippines (Scale = 1:1,000,000) Bureau of Soils

- Land Use Map of the Philippines (Scale = 1,2,000,000) Land Resources Evaluation Project

- Slope Map of the Philippines (Scale = 1:1,000,000) Training Center for Applied Goodesy & Photogrammetry, UP, 1966

Table D.3.1 Legend of Land Systems

Land Region	Land System	Physiography	Land Form (estimated proportion)	Terrain Parameters: Slope range and average length	Terrain Parameters: Max. elev. / Min. elev. / Prominence	Terrain Parameters: Parent Material	Soils: Effective depth	Soils: Textural profile	Soils: Internal drainage	Soils: Inherent fertility	Soils: Surface stoniness	Soils: Water holding capacity	Soils: Deep percolation	Soils: Soil Classification	Soils: Erosion hazard	Soils: Landslide hazard	Soils: Salinity	Water Resources: Quantity for irrigation (estimated)	Water Resources: Flooding hazard	Climatic Regime	Vegetation and Present Land Use	Suitability: Coconut	Suitability: Rice, Payatak	Suitability: Rice, Rainfed (bunded)	Suitability: Rice, Irrigated	Suitability: Others, Commercial	Suitability: Others, Subsistence
Littoral	1 [illegible]	Tidal mangrove swamp	Tidal mangrove swamp (100%)	0 - 2% 50-300m	1m / 0m / <1m	Marine and estuarine mud and/or dead coral	Variable, shallow to deep	Unripe clay and silt	Very poorly drained	Medium to low	Variable up to 100%	N/A	N/A	Hydraquents, fine and very fine nonacid; inclusions of Sulfaquents.	None	None	High	N/A	Tidal		Mangrove	N	N	N	N	Fp	N
Coastal basins and beaches	4 [illegible]	Coastal basin complex	Coastal alluvial plains and minor levees (50%)	0 - 2% 1500-2000m	5m / 1m / 3m	Former tidal flat deposits partly overlain by alluvium	Deep	Clay loam over clay	Somewhat poorly to poorly drained	High	None	High	Low	Typic and Aeric Tropaquepts, fine and very fine acid and nonacid.	None	None	Low	Probably sufficient	None to slight	MSH/C DSH/SC H/C H/SC	Mainly rice and grasses	N	S	S	S*	Mb	Ca,Pv
			Degraded beach ridges (20%)	2 - 5% 20-40m	6m / 1m / 5m	Coastal sands, loams	Deep	Loams and fine sands	Somewhat excessively to moderately well drained	Medium	None	Low to Moderate	High	Typic and Aquic Tropopsamments, Typic and Aquic Tropopsamments, loamy soil	Low	None	Low	N/A	None		Mainly coconut	S	N	N	N	Ca,Pa	Cn,Ca,Vt
			Swales (10%)	0 - 2% 10-30m	3m / 1m / 2m	Coastal sands, loams + organic matter	Deep	Clays, loam over fine sand	Somewhat poorly to poorly drained	Medium	None	Moderate	Moderate to high	Tropaquents, sandy and loamy nonacid	None	None	Low to moderate	None	Slight		Grasses, rice and coconut	S or N (Depends locally on drainage)	S or N (Depends locally on drainage)	S or N (Depends locally on drainage)	N	N	Ca,Pv
			Outwash fans (10%)	2 - 8% 50-25m	20m / 1m / 8m	Alluvial and colluvial fan material overlying residual sediments	Deep	Clay loam over clay	Somewhat poorly to moderately well drained	High	None	Moderate to High	Low to moderate	Aquic Tropudalfs and Aquic Eutropepts, fine and loamy.	Low	Low	None	Probably insufficient	None		Mainly rice and some coconut	S	S	S	S*	Co,Mb, Ca,Pa	Ca,Pn Ba,V,Fc
			Tidal nipa creeks (5%)	0% 10-30m	0m / 0m / 0m	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	High	N/A	Tidal		Nipa margins	N	N	N	N	Np	N
			Infilled swamps (5%)	0 - 2% 50-200m	5m / 1m / 3m	Former swamps infilled with alluvium	Deep	Clay	Somewhat poorly to poorly drained	High	None	High	Low	Tropaquents, fine and very fine non-acid.	None	None	Low	Probably sufficient	Slight		Mainly grasses, rice and some sedges	N	S	S	S*	N	Ca,Pv
	5 [illegible]	Small complex coastal alluvial areas	Small coastal plains (25%)	0 - 2% 50-200m	5m / 1m / 3m	Former tidal flats partly overlain by alluvium	Deep	Loams, clay loams and clays	Poorly, somewhat poorly and moderately well drained	Medium to very high	None	High	Low	Typic and Aeric Tropaquepts, fine loamy and fine acid and nonacid; Aquic Eutropepts, fine	None	None	Moderate	Probably sufficient	None	MSH/C DSH H/C H/SC	Mainly rice and grasses	N	S	S	S*	Mb	Ca
			Mangrove swamps (20%)	0 - 2% 50-200m	1m / 0m / <1m	Marine and estuarine mud and/or dead coral	Variable, shallow to deep	Unripe clay and silt	Very poorly drained	Medium to low	Variable up to 100%	N/A	N/A	Hydraquents, fine and very fine nonacid; inclusions of Sulfaquents.	None	None	High	N/A	Tidal		Mangrove	N	N	N	N	Fp	N
			Small alluvial valleys (20%)	0 - 5% 20-200m	20m / 1m / 5m	Recent alluvium	Deep	Loams, clay loams and clays	Somewhat poorly and moderately well drained	Medium to very high	None	High	Low	Aeric Tropaquepts, fine acid and nonacid; Aquic Eutropepts, fine.	None	None	None to low	Probably insufficient	None to slight	MSH/C DSH/SC	Mainly rice and grasses	N	S	S	S*	Mb	Ca
			Beach deposits (15%)	0 - 8% 50-200m	3m / 0m / 2m	Coastal sands	Deep	Stratified coarse and fine sand and loamy sands	Somewhat excessively, well and moderately well drained	Medium to low	None	Low	High	Typic and Aquic Tropopsamments	None	None	High	N/A	None		Some halophytic grasses and shrubs and coconut	S or N	N	N	N	Ca,Pa	Ca
			Nipa swamps (10%)	0 - 2% 10-30m	2m / 0m / <1m	Marine and estuarine mud	Variable, shallow to deep	Unripe clay and silt	Very poorly drained	Medium to low	None	N/A	N/A	Hydraquents, fine and very fine nonacid; inclusions of Sulfaquents	None	None	High	N/A	Tidal		Nipa and some coconut	N	N	N	N	Np,Fp	N
			Outwash fans (10%)	2 - 8% 50-230m	20m / 1m / 6m	Alluvial & colluvial fan material overlying residual sediments	Deep	Clay loam over clay	Moderately well-drained	Medium to very high	None	Moderate to high	Low to moderate	Aquic Tropudalfs, fine	Low	Low	None	Probably insufficient	None	H/C H/SC	Mainly rice & some coconut	S	S	S	S*	Co Mb,Ca,Pa	Ca,Pn Ba,V,Fc
Major alluvial	7 Gandara	Well developed alluvial valleys and basins	Alluvial flats and minor basins (> 80%)	0 - 2% 500-1500m	10m / 1m / 3m	Alluvium	Deep	Clay over heavy clay	Somewhat poorly to poorly drained	Medium to high	None	Moderate to high	Low	Typic and Aeric Tropaquepts, fine and very fine non-acid	None	None	None	Probably sufficient in some areas	Moderate	DSH/SC	Rice and grasses	N	S	S	S	Mb	Ca,Pv
			Outwash fans (10%)	2 - 8% 50-230m	20m / 1m / 8m	Alluvial & colluvial fan material overlying residual sediments	Deep	Clay loam over clay over clay loam	Moderately well-drained	Medium to high	None	Moderate to high	Low to moderate	Aquic Tropudalfs, fine	Low	Low	None	Possibly sufficient in some areas	None to slight		Mainly rice, some coconut	S	S	S	S	Co, Ca,Mo Ab,Mb	Ca,Pn Ba,V,Fc
			Levees (5%)	0 - 2% 0-30m	10m / 1m / 3m	Alluvium	Deep	Clay loam over clay	Moderately well drained	Medium to high	None	Moderate to high	Low to moderate	Aquic Eutropepts, fine	None	None	None	Probably sufficient in some areas	Slight		Settlements, coconut, vegetables and fruit gardens.	S	S	S	S	Co, Ca,Mb Pa,Ab	V,Ba Fc,Ca
			Back swamps (<5%)	0 - 2% 50-200m	3m / 1m / 2m	Alluvium	Deep	Heavy clay	Very poorly drained	Medium to high	None	Moderate to high	Very low	Tropaquents, very fine non-acid	None	None	None	N/A	Severe		Bushes, sedges, grasses	N	N	N	N	N	Ca,Pv
Minor alluvial	8 Gadaan	Minor alluvial valleys, poorly drained	Alluvial flats (70%)	0 - 2% 100-500m	10m / 1m / 3m	Alluvium	Deep	Clay loam or clay over clay & heavy clay	Somewhat poorly to poorly drained	Medium to High	None	Moderate to high	Low to moderate	Aeric and Typic Tropaquepts, fine loamy and fine nonacid and acid; inclusions of Aquic Eutropepts, fine loamy.	None	None	None	Some small diversion dams possible	Slight to moderate	MSH/C H/C DSH/SC H/SC MSH/SC	Mainly rice, settlements	N	S	S	S*	Mb	Ca,Pv
			Outwash fans (20%)	2 - 8% 50-200m	20m / 2m / 6m	Alluvial & colluvial fan material overlying residual sediments	Deep	Silty clay loam or clay loam over clay over clay loam	Moderately well drained	Medium to High	None	Moderate to high	Low	Aquic Tropudalfs, fine	Low	Low	None	Very limited	None to slight		Mainly rice, some coconut	S	S	S	N	Co Ca,Mb Pa,Ab	Ca,Pn Ba,V,Fc
			Back swamps (10%)	0 - 2% 50-150%	3m / 1m / 2m	Alluvium	Deep	Clay over heavy clay	Very poorly drained	Medium to High	None	Moderate to high	Very low	Tropaquents, very fine acid and non-acid	None	None	None	N/A	Severe		Bushes, sedges and swamp specific trees and shrubs.	N	N	N	N	N	Ca,Pv
	9 Polangi	Minor alluvial valleys	Alluvial flats (70%)	0 - 3% 100-500m	10m / 1m / 4m	Recent more or less stratified alluvium	Deep	Clay loam over clay with layers of sandy clay loam and sandy loam	Somewhat poorly and moderately well drained	Medium to High	None	High	Moderate	Typic Fluvaquents and Aquic Tropofluvents, fine loam nonacid and inclusions of Typic Tropofluvents, fine loamy nonacid.	None	None	None	Limited	Slight	H/C H/SC MSH/SC	Mainly coconut, some rice, settlements	S	S	S	N	Mb,Pa	Ca,Ba Ca,V
			Outwash fans (30%)	2 - 8% 50-200m	20m / 2m / 4m	Alluvial & colluvial fan material overlying residual sediments	Deep	Silty clay loam or clay loam over clay	Moderately well and well drained	Medium to High	None	High	Moderate	Aquic Tropudalfs, fine, Typic Eutropepts, fine	Low	Low	None	Very limited	None to slight		Mainly coconut, some settlements	S	S	S	N	Co Ca,Mb Pa,Ab	Ca,Pn Ba,V,Fc
Low sedimentary hills	14 Caramas	Dissected foothills	Hills (90%)	5 - 50% 20-200m	160m / 20m / 80m	Sandstone shale & conglomerate, some calcareous layers	Deep	Clay loam over clay	Well drained	Medium to High	None	High	NA	Typic Eutropepts & Dystropepts, fine	High	Moderate	None	N/A	None	MSH/C H/C DSH/SC H/SC	Coconut, abaca and secondary forest	S	N	N	N	Cf/Co, Ab/Co.	Ca,Ba,Fc,Pn on lesser slopes
			Valleys (10%)	0 - 8% 20-200m	30m / 1m / 20m	Alluvium	Deep	Clay loam and clay over clay	Somewhat poorly to moderately well drained	Medium	None	Moderate to high	Low to moderate	Aquic Tropudalfs, fine and Aeric Tropaquepts, fine non-acid	Low	None	None	N/A	None to slight		Rice, grasses & some coconut	S	S	S	N	Ab/Co, Mb	Ca,Pv, V,Ba
Medium sedimentary hills	20 [illegible]	Steep hills and zig-zag ridges	Hills and ridges (90%)	15-100% 20-250m	250m / 20m / 40m	Sandstone shale and conglomerate	Deep	Clay loam over clay	Well drained	Medium to High	None	High	NA	Typic and Ultic Tropudalfs, fine	High	Moderate to high	None	N/A	None	H/C H/SC DSH/SC	Secondary and primary forest with coconut, abaca and some root crops	S	N	N	N	Ab/Co, Fo,Cf/Co	Ca,Ba,Fc,Pn on lesser slopes
			Valleys (10%)	0 - 8% 20-200m	30m / 1m / 15m	Alluvium	Deep	Clay loam over clay	Somewhat poorly and moderately well drained	Medium to High	None	High	Low	Aeric Tropaquepts, fine nonacid, Aquic Eutropepts, fine and inclusions of Tropofluvents, fine nonacid	Low	Non to low	None	N/A	None to slight		Coconut, grasses and some rice and root crops	S	S	S	N	Mb	Ca,Pv V,Ba
High sedimentary hills	23 Agda	Steep hills and ridges with major relief	Hills and ridges (60%)	8 - 100% 20-500m	400m / 20m / 250m	Shale and sandstone	Deep to moderately deep	Clay loam over clay	Well drained	Medium	None to low	High	NA	Typic Dystropepts, fine acid and nonacid; Typic and Ultic Tropudalfs, fine	High	High	None	N/A	None	H/C H/SC DSH/SC	Secondary and primary forest, some abaca and coconut	S	N	N	N	Ab/Co, Fo,Cf/Co	Ca,Ba,Fc,Pn on lesser slopes
			Steep sideslopes and valley walls (30%)	30-100% 20-150m	300m / 20m / 200m	Shale and sandstone	Shallow to moderately deep	Clay loam over clay	Well drained	Medium	Low	Moderate to high	NA	Ultic and Lithic Tropudalfs, fine, Typic and Lithic Dystropepts, fine	High	High	None	N/A	None		Secondary forest, coconut and abaca	S	N	N	N	Ab/Co, Fo,Cf/Co	N
			Valley bottoms (10%)	0 - 8% 20-150m	40m / 5m / 20m	Alluvium	Deep	Clay loam over clay	Somewhat poorly to moderately well drained	Medium	None	High	Low	Aeric Tropaquepts, fine acid and non-acid; Aquic Dystropepts, fine and Tropofluvents, loamy nonacid and acid	None	None to low	None	N/A	None to slight		Rice and grasses, coconut and some root crops	S (on better drained soils)	S	S	N	Mb	Ca,Pv V,Ba
Major karst	41 [illegible]	Typical karst of major relief	Limestone outcrops (80%)	40-100% 50-200m	450m / 5m / 100-250m	Limestone	Soil material in pockets between outcrops	Stony clay	Well drained	Medium to High	High (50%)	Low	High (rapid)	Lithic Troporthents, clayey-skeletal, calcareous	High	Rockfall	None	None	None	H/C H/SC DSH/SC MSH/SC	Forest, some coconut	S (only in soil pockets between limestone outcrops)	N	N	N	Ip,Fo	N
			Sinkholes (20%)	0 - 2% 100-500m	200m / 2m / 20-60m	Limestone residual clay	Deep	Clay over heavy clay	Well drained	Medium to High	None	High	Low to moderate	Typic Tropudalfs, very fine	None	None	None	None	Slight to moderate (only for short period)		Upland crops, banana, some degraded forest	S	N S (in larger sinkholes)	N S (in larger sinkholes)	N	Cn,Ca, Pa,Mb,Ip	Fc,Ba,V
Medium to high volcanic hills	46 [illegible]	Steep, volcanic hills and valleys	Hills (95%)	15-100% 70-250m	400m / 70m / 150m	Intermediate and basic (lower andesite, basalt)	Moderately deep	Clay loam or clay over clay loam	Well drained	Medium to High	Low	Moderate to high	NA	Typic Troporthents, fine loamy acid	Moderate to high	Moderate	None	N/A	None	H/SC	Cogon grassland, coconut, shifting cultivation plots with root crops	S	N	N	N	Cf/Co,Fo Ab/Co,Ip	Fc,Ca on lesser slopes
			Valleys (5%)	0 - 8% 70-150m	40m / 10m / 20m	Alluvium	Deep	Clay loam or clay	Somewhat poorly to moderately well drained	Medium to High	Low	Moderate to high	NA	Typic and Aquic Tropofluvents, fine and fine loamy, acid	Low	None	None	N/A	None to slight			S	N	S	N	Ab/Co, Mb	Co,V, Ca

FIGURE D.3.1. LOCATION OF PRIORITY AREAS

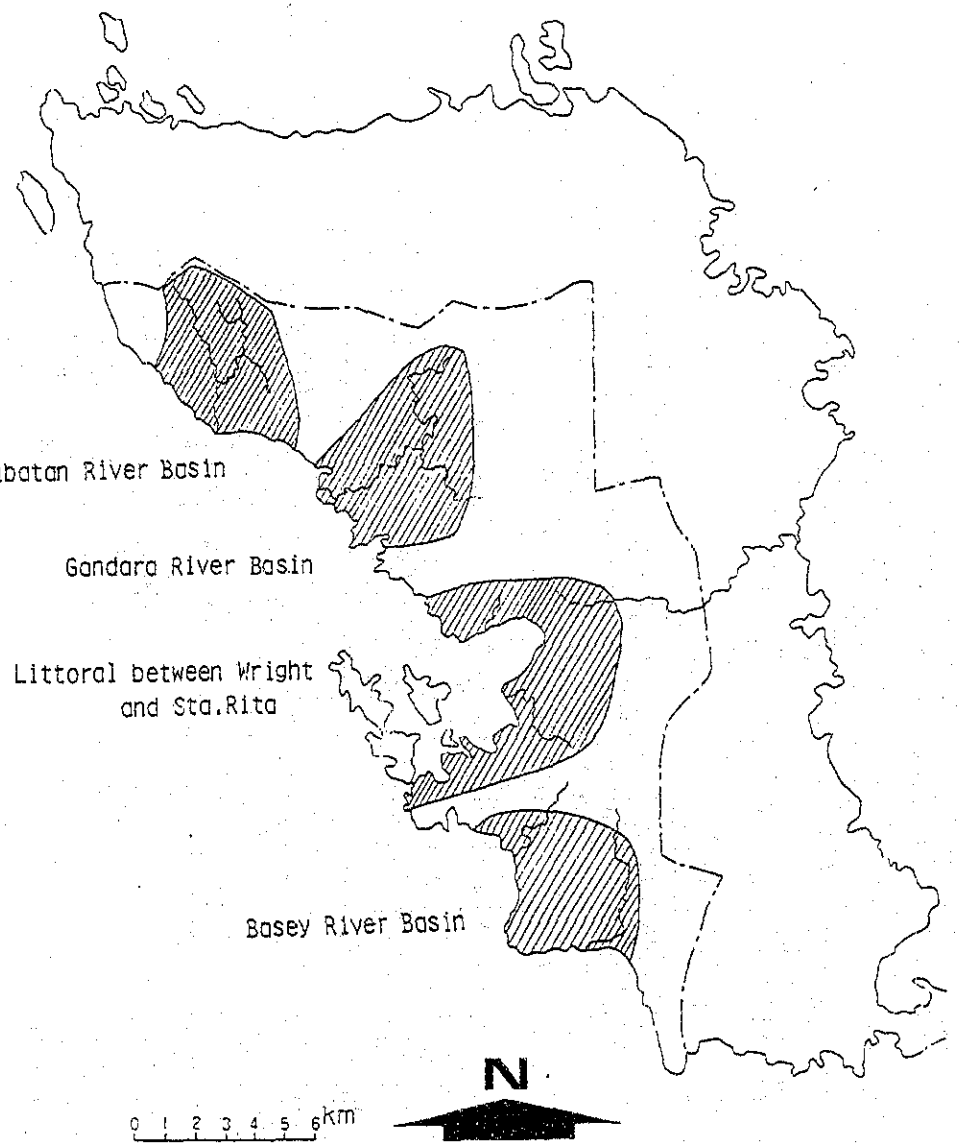

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FIGURE D.3.2. LAND USE MAP OF JIBATAN RIVER BASIN

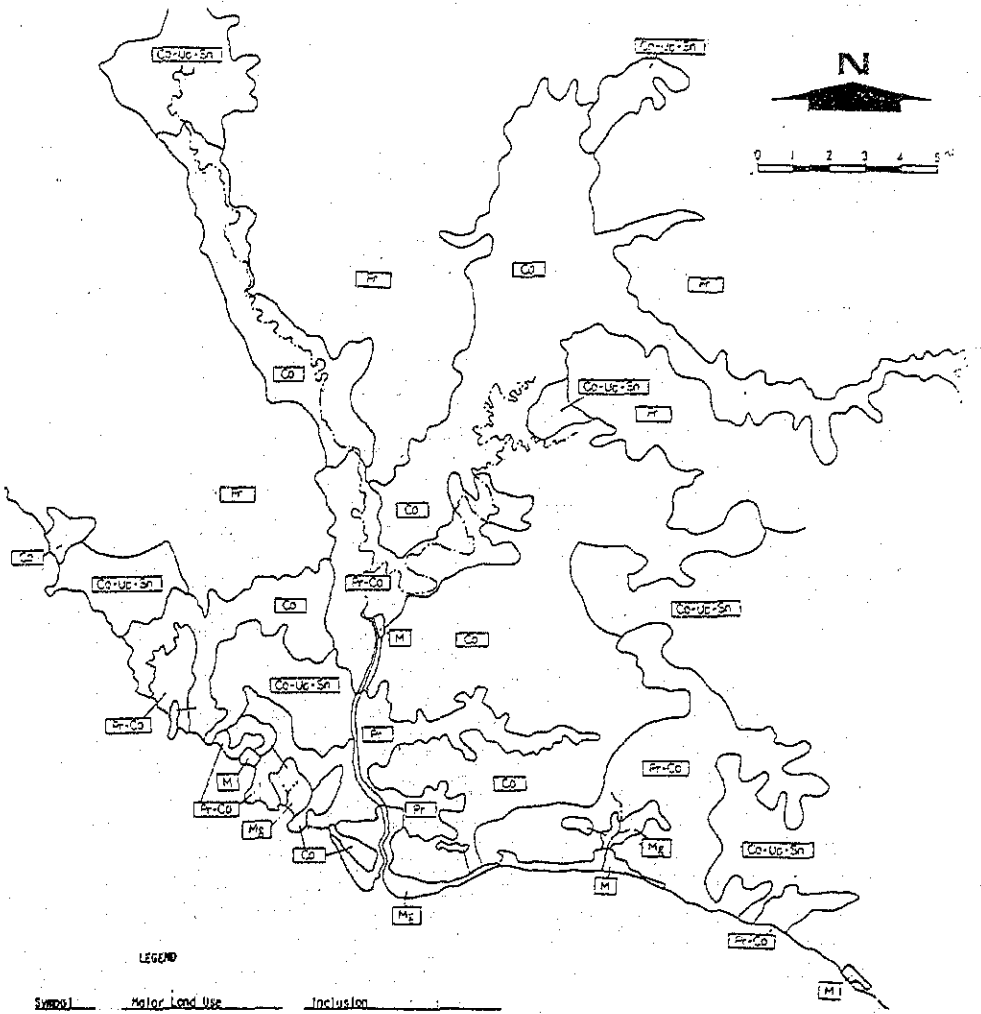

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FIGURE D.3.3. LAND USE MAP OF GANDARA RIVER BASIN

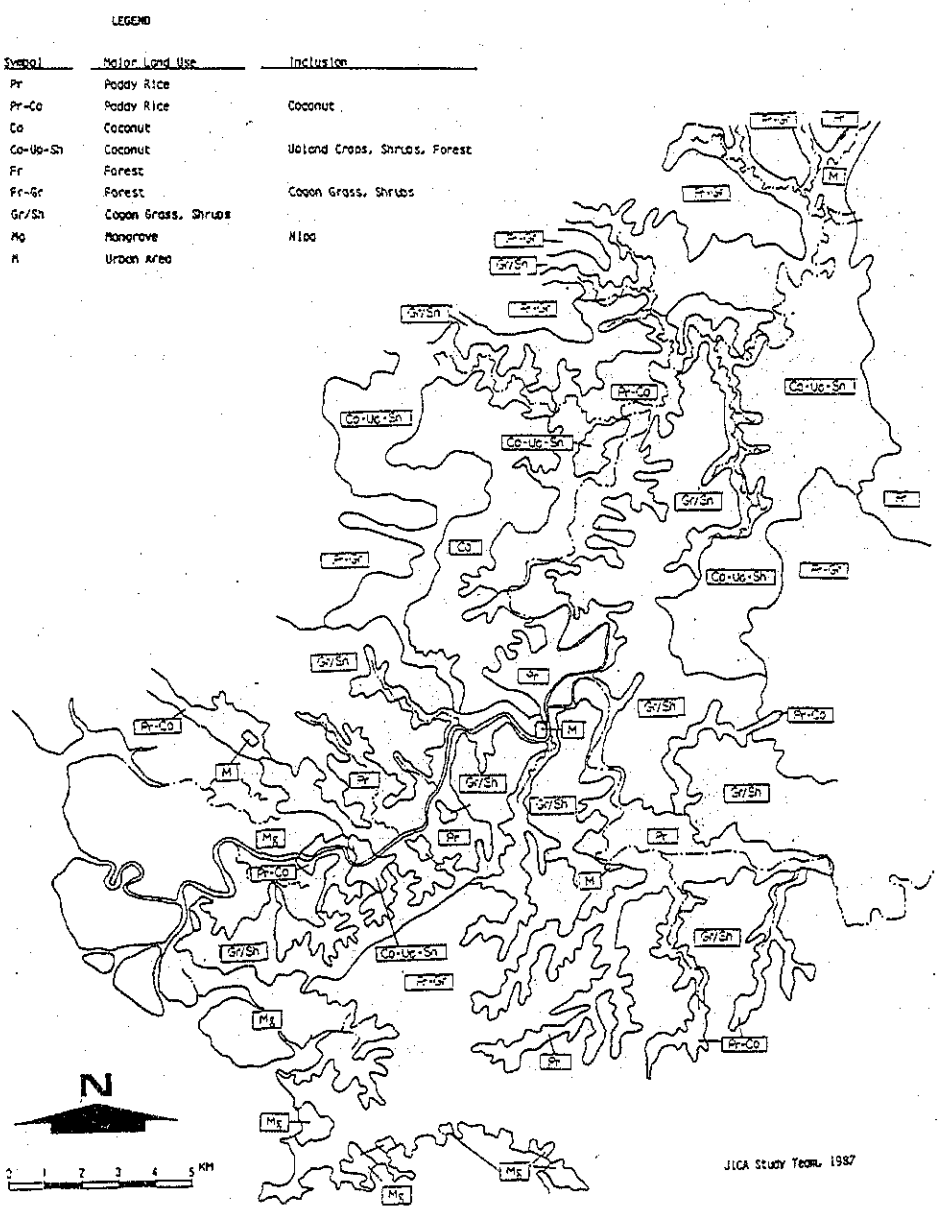

FIGURE D.3.4. LAND USE MAP OF BASEY RIVER BASIN

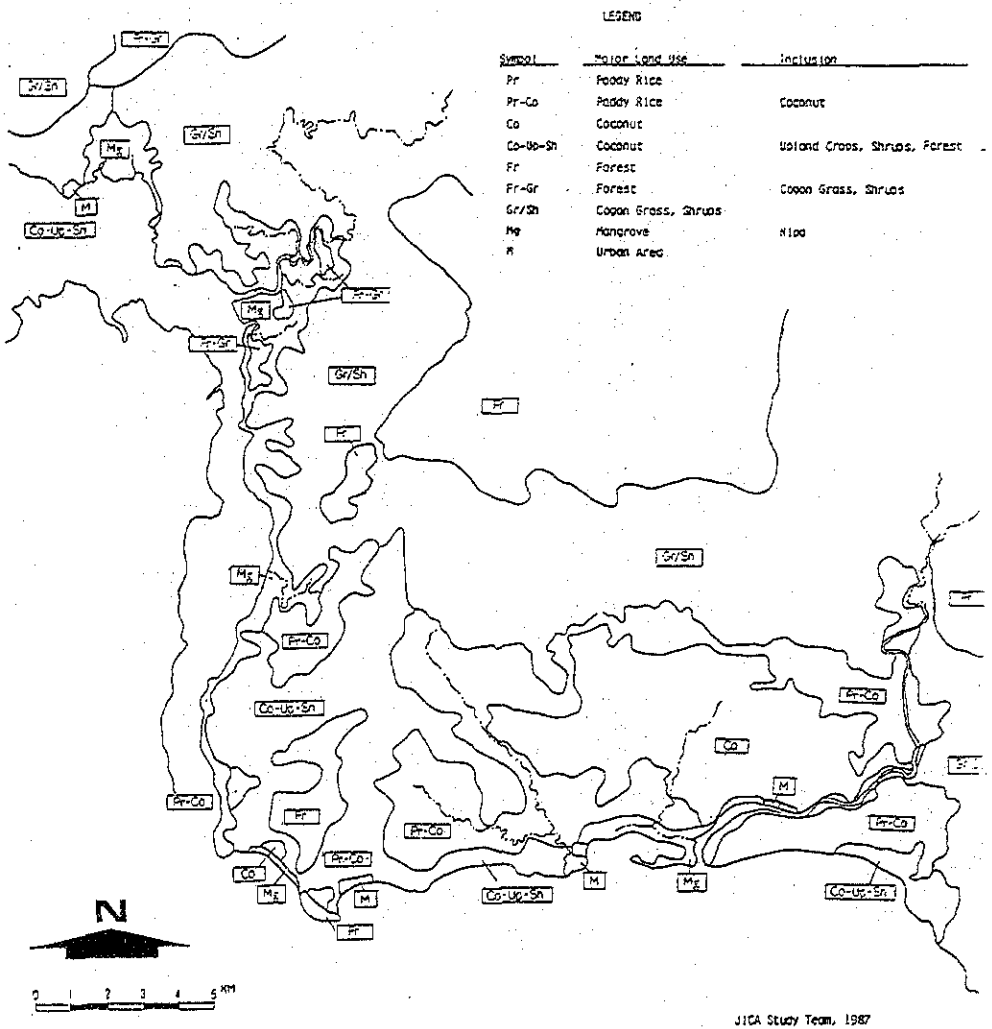

FIGURE D.3.5. LAND USE MAP OF LITTORAL BETWEEN WRIGHT AND STA. RITA

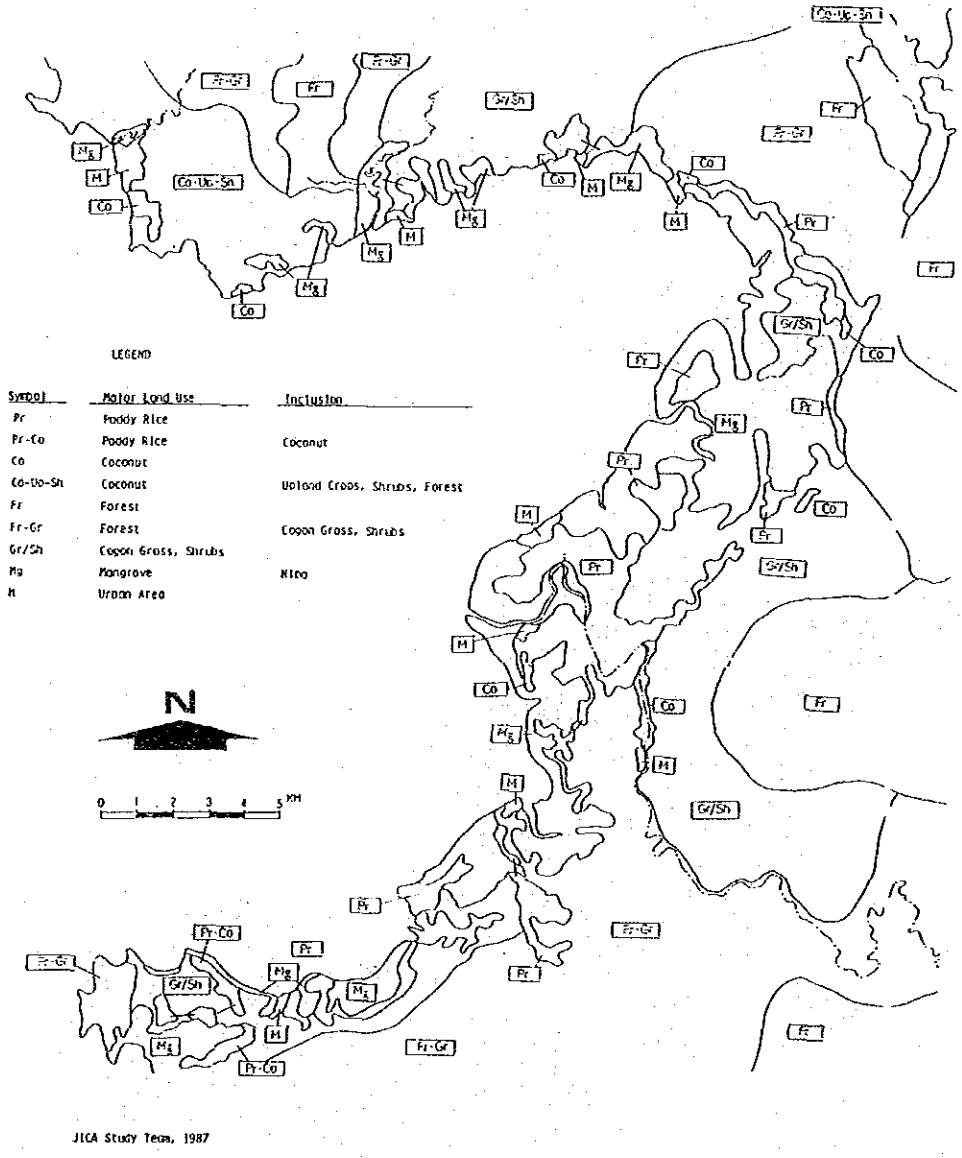

FIGURE D.3.6. LAND SYSTEMS MAP OF JIBATAN RIVER BASIN

LEGEND

Land Region	Symbol	Land System	Major Soils	Inclusion
Littoral	1	Antipolo	Hydraquents	Sulfaquents
Coastal Basins & Beaches	4	Macaptos	Typic/Aeric Tropaquepts	Typic/Aquic Tropaquepts Troporthents Hydraquents Typic/Aquic Tropaquepts
	5	Makiwalo	Typic/Aeric Tropaquepts Aquic Eutropepts	
Major Alluvial	7	Gandara	Typic/Aeric Tropaquepts	
Minor Alluvial	8	Gadaan	Aeric/Typic Tropaquepts	Aquic Eutropepts
	9	Palangi	Tropic Fluvaquents Aquic Tropofluvents	Typic Tropofluvents
Low Sedimentary	14	Caranas	Typic Eutropepts Typic Dystropepts	
Medium Sedimentary Hills	20	Stansa	Typic/Ultic Tropudalfs	
High Sedimentary Hills	23	Agda	Typic Dystropepts Typic/Ultic Tropudalfs	
Major Horst	41	Malubago	Lithic Troporthents	
Medium to High Volcanic Hills	48	Alas-as	Typic Troporthents	

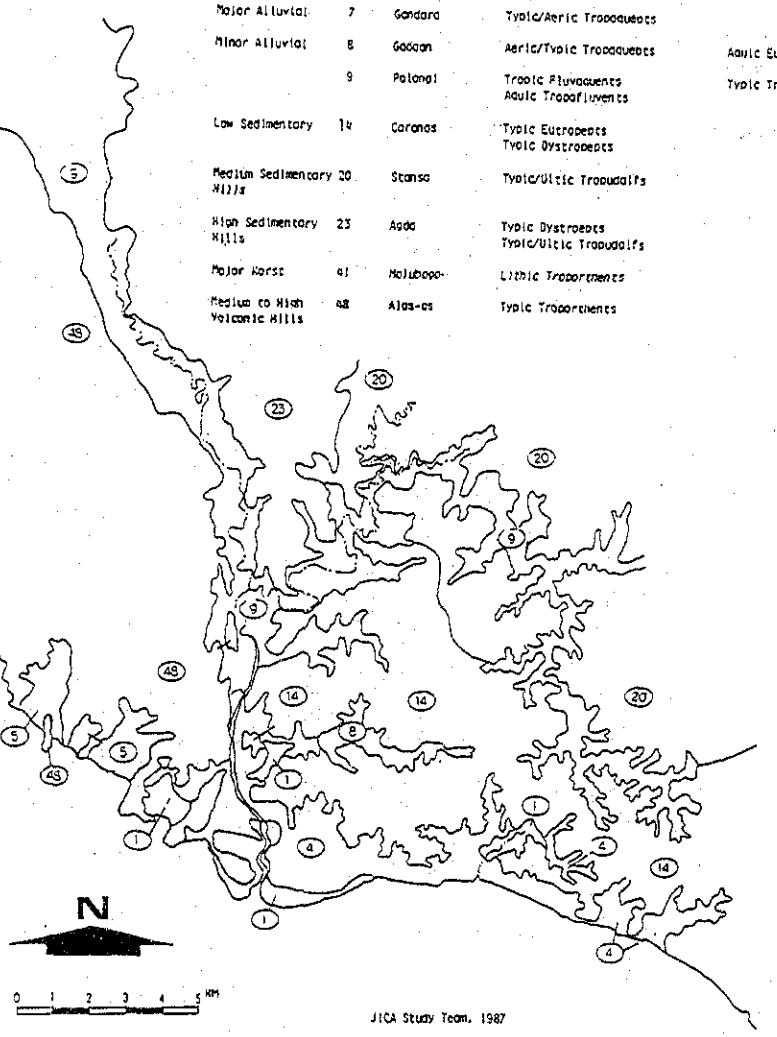

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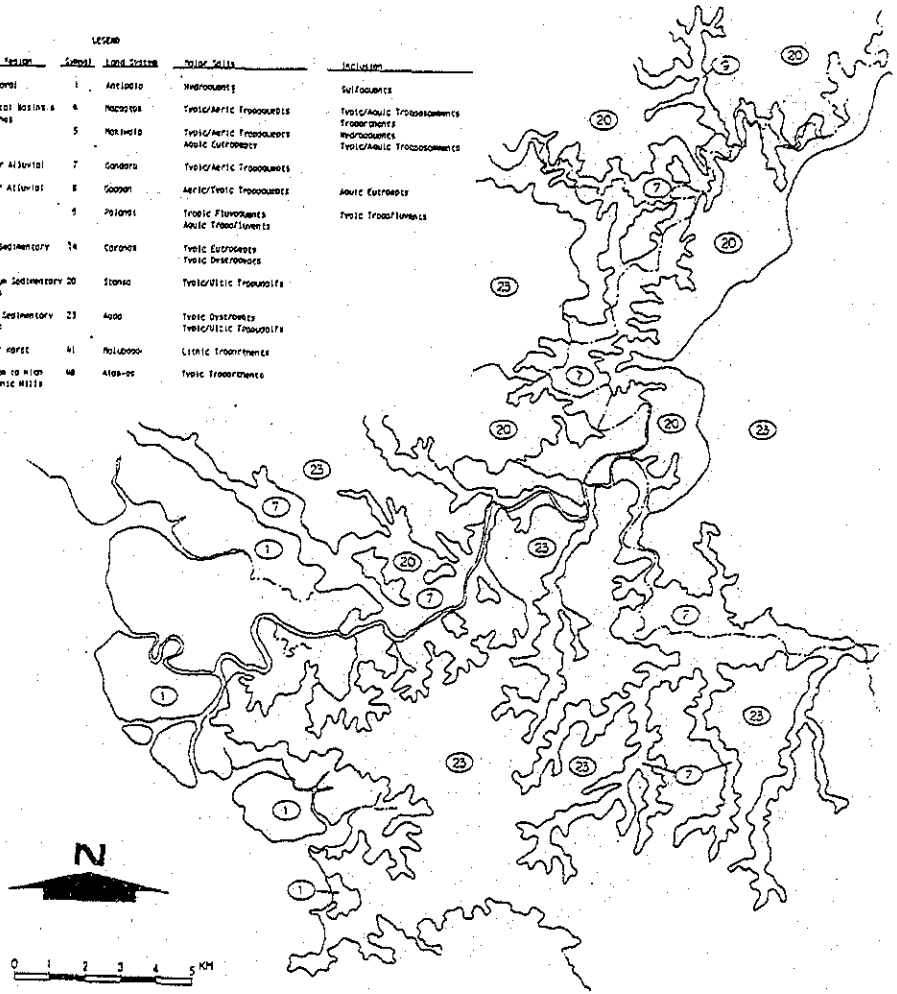
FIGURE D.3.7. LAND SYSTEMS MAP OF GANDARA RIVER BASIN



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APPENDIX E. AGRICULTURE

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E.1. Present Agricultural Status

E.1.1. Land Holding

Tables E.1.1 to E.1.3 show that there are 91,999 households in the Samar province, including 46,734 of farm households with an average farm size of 2.57 ha, 13,545 of fishing households, 44 of fishpond operators and, 2,933 of forestry occupants. Tables E.1.4 to E.1.6 show the data of the progress on land reform on the basis of 1981 census of Agriculture and DAR data, revealing a decrease in the number of owner farms during the period from 1971 to 1980.

E.1.2. Farm Production

Tables E.1.7 to E.1.17 shows that the yields of most crops in the Samar province are lower than those of national and regional average. The total crop damages of major crops amount 15 percent of the total production in the province during 1980 to 1986, where about 60 percent of crop damages are caused by typhoon damage according to Table E.1.19.

About 35 tons of certified paddy seeds are produced by the Seeds Grower Association in 1986. On the other hand, seven tons of corn seeds are produced in the Gandara Seed Farm in 1987 (refer to Table E.1.20). Table E.1.22 shows that there are only 17,848 heads of carabos and 732 heads of cattle while the total farm households amount 46,734 in the province in 1981. The province-wise total heads of carabao, cattle, goat, hog chicken and ducks in 1986 are recorded respectively at 33,130 head, 1,400 heads, 5,500 heads, 256,280 heads and 14,470 heads according to Table E.1.21.

E.1.3. Extension Services and Research Activities

The total of agricultural/fishery extention staff are 115 staff as of August in 1987 in the Samar province according to Table E.1.23.

E.1.4. Agro-Related Production

The province-wise log and fish production per year are respectively recorded at 50,000 m^3 and 14,000 tons on the average for the period of 1982 to 1986 and 1980 to 1985, as shown in Table E.1.24 and E.1.25.

E.1.5. Post Harvest Facilities

The total rice capacities of NFA warehouses and rice mills are estimated at 5,600 tons and 2,400 tons per year, based on the Table E.1.27.

E.1.6. Demand-Supply Balance of Agricultural Products

The result of analysis on the demand-supply balance of the agricultural products at the national to province levels shows that Samar province is deficient in supply of rice, livestocks and poultry products, fruits and vegetables as shown in Table E.1.28 to E.1.29.

E.1.7. Result of Farm Economic Survey

The opinion of 83 sample farmers in the farm management survey which was conducted by the JICA-SIRDP team during the field survey of this study, was summarized in Table E.1.31, where all respondents desire to expand farming scale, especially in the sector of crop production and animal husbandry.

E.2. Agricultural Development Plan and Schemes

E.2.1. Improvement of Farming System

The general concept on the improvement of farming system together with infrastructure requirement is formulated on the basis of the proposed land use pattern as illustrated for each category of land in Table E.2.1.

E.2.2. Improvement of Cropping Pattern

The proposed cropping pattern is indicated in Table E.2.2, based on the general concept on the improvement of farming system together with agricultural infrastructure.

E.2.3. Crop Production

The crop production in the Study Area is estimated in Table E.2.3 and also the total labor requirement of crop production is computed in Table E.2.4. The paddy production will be increased by 1.6 times of present total production when the proposed projects will be fully implemented, while the production of other major crops, namely corn, sweet potato, cassava, mungbean, and peanut will be increased by about two to three times of the present production levels.

E.2.4. Livestock Production

It is assumed the number of livestock and poultry will increased to two times of the present number of them in the Study Area. In that case, the labor requirement of livestock and poultry at the end of the long term development plan is estimated at 1,344 thousand man-day as shown in Table E.2.5, including the labor requirement of freshwater fishculture.

E.2.5. Agricultural Development Schemes

The objective and requirement of facilities/equipment for the each proposed agricultural development schemes are described in Table E.5.6. The location of the agricultural development schemes are indicated in Table E.5.7.

Table E.1.1. Number of Farm by Type and by Tenure in Samar Province (1980)

(All Farm = 100%)

Type of Farm	Total Farm (%)	Tenure of Farm: Owned: Fully-Owned (%)	Owned: Ownerlike Possession (%)	Rented or Leased: For Share (%)	Rented or Leased: Lessee (%)	Other Farms: Rent Free (%)	Other Farms: Others (%)
1. All Type	100.0	63.4	15.6	29.5	3.7	6.5	0.8
2. Paddy	39.3	24.9	7.8	13.5	1.5	2.7	0.5
3. Corn	13.9	7.0	1.4	5.0	0.6	1.1	0.1
4. Coconut	37.2	27.2	5.0	8.3	0.8	0.8	0.2
5. Tabacco	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6. Vegetables	0.3	0.3	0.0	0.0	0.0	0.0	0.0
7. Root Crops	8.2	3.2	0.1	2.5	0.8	1.5	0.0
8. Banana	0.2	0.2	-	0.0	-	0.0	-
9. Pineapple	0.0	0.0	0.0	-	-	-	-
10. Fiber Crops	0.2	0.2	0.0	0.0	-	-	-
11. Other Crops	0.0	0.0	0.0	-	0.0	-	-
12. Hog	0.3	0.2	0.1	-	0.0	0.0	-
13. Other Livestock	0.0	0.0	-	-	-	-	-
14. Chicken & Poultry	0.1	0.1	0.0	-	-	-	-
15. Others & Unclassified	0.3	0.2	0.1	-	-	-	-

Source: 1981 Census of Agriculture

Table E.1.2. Number of Households, Farm Households, Fishery Household and Forestry Occupants (1980)

City/Municipality	No. of Barangay	No. of Households	Farm Household		Fishing Households		Fishpond Operators		Forestry Occupants	
			Number	%	Number	%	Number	%	Number	%
	*1	*1	*2		*3		*3		*4	
I. Excluding Islands	811	78,789	37,884	48.0	8,844	11.2	44	0.0	2,993	3.8
1. Basey	52	7,290	4,243	58.2	1,603	22.0	-	-	579	7.9
2. Calbayog City	161	19,590	9,867	50.3	1,548	7.9	17	0.8	180	0.9
3. Calbiga	39	2,584	598	23.1	225	8.7	-	-	369	14.2
4. Catbalogan	57	10,254	1,878	18.3	1,628	15.9	5	0.5	4	0.0
5. Gandara	64	4,565	2,638	57.8	65	1.4	2	0.1	499	10.9
6. San Jorge	42	1,743	1,129	64.8	-	-	-	-	8	0.5
7. Hinabangan	19	1,839	570	31.0	8	0.4	-	-	368	20.0
8. Jiabong	34	2,073	1,537	74.1	192	9.3	5	0.2	191	9.2
9. Marabut	24	2,260	1,311	58.0	790	35.0	-	-	175	7.7
10. Matuginao	23	843	393	46.6	-	-	-	-	10	1.1
11. Motiong	30	1,951	1,224	62.7	50	2.6	2	0.1	32	1.6
12. Pinabacdao	25	1,860	419	22.5	87	4.6	-	-	56	3.0
13. San Jose de Buan	14	1,087	804	74.0	-	-	-	-	53	4.9
14. San Sebastian	14	833	561	67.3	290	34.8	-	-	13	1.6
15. Sta. Margarita	36	3,135	1,930	61.6	652	20.8	8	0.2	5	0.2
16. Sta. Rita	34	3,991	7,394	60.0	110	2.8	-	-	382	9.6
17. Talalora	11	1,136	641	56.4	354	31.2	-	-	25	2.2
18. Tarangnan	41	2,837	902	31.7	422	14.9	-	-	-	-
19. Villareal	38	3,708	1,611	43.4	640	17.3	-	-	27	0.7
20. Wright	46	4,023	2,918	72.5	94	2.3	-	-	16	0.4
21. Pagsanghan	14	1,187	316	26.6	86	7.2	5	0.4	1	0.0
II. Islands	113	13,210	8,850	67.0	4,701	35.6	-	-	902	6.8
1. Almagro	14	1,871	1,546	82.6	994	53.1	-	-	320	17.1
2. Daram	48	5,448	3,721	68.3	914	16.8	-	-	160	2.9
3. Sto. Ninō	13	2,111	1,639	77.6	1,174	55.6	-	-	158	7.5
4. Zumarraga	23	2,306	816	35.4	777	33.7	-	-	6	0.3
5. Tagapul-an	15	1,474	1,128	76.5	842	57.1	-	-	258	17.5
III. Total	931	91,999	46,734	50.8	13,545	14.7	44	0.0	3,895	4.2

Source: *1... 1980 Census of Population and Housing (Rerised)
*2... 1981 Census of Agriculture
*3... 1980 Census of Fisheries
*4... Forest Occupancy Census Report, 1986 Bureau of Forestry Development

Table E.1.3. Farm Area by Land Use (1980)

(unit: ha)

Municipality	No. of Farms	Farm Area							Farm Size						
		Total	Planted under Temporary Crops	Planted under Permanent Crops	Lying Idle	Under Permanent Meadows/ Posture	Covered with Forest Growth	Others	Total	Planted under Temporary Crops	Planted under Permanent Crops	Lying Idle	Under Permanent Meadows/ Pasture	Covered with Forest Growth	Others
I. Excluding Islands	37,884	105,721	35,514	55,984	8,083	1,381	3,100	2,159	2.79	0.92	1.48	0.21	0.04	0.08	0.06
1. Basey	4,243	10,033	3,085	6,281	225	98	208	26	2.36	0.72	1.48	0.08	0.02	0.05	0.06
2. Calbayog City	9,867	35,765	8,069	24,886	1,463	400	819	128	3.62	0.82	2.52	0.15	0.04	0.08	0.01
3. Calbiga	598	1,089	826	211	44	-	4	4	1.82	1.38	0.35	0.07	-	0.06	0.06
4. Catbalogan	1,878	3,596	1,865	1,287	204	38	179	23	1.91	0.99	0.68	0.11	0.02	0.09	0.01
5. Gandara	2,638	7,844	3,174	2,325	1,201	342	681	121	2.97	1.20	0.88	0.45	0.13	0.26	0.05
6. San Jorge	1,129	1,346	782	194	300	1	3	66	1.19	0.69	0.17	0.27	0.00	0.03	0.06
7. Hinabangan	570	2,583	766	963	833	6	12	3	4.53	1.34	1.69	1.46	0.01	0.02	0.05
8. Jiabong	1,537	4,121	2,096	1,599	36	109	62	219	2.68	1.36	1.04	0.02	0.07	0.04	0.14
9. Marabut	1,311	3,008	611	2,307	17	67	-	6	2.29	0.46	1.76	0.01	0.05	-	0.05
10. Matuginao	393	1,008	395	357	78	6	157	15	2.56	1.01	0.91	0.20	0.02	0.40	0.04
11. Motiong	1,224	2,244	1,386	739	50	-	43	26	1.83	1.13	0.60	0.04	-	0.04	0.04
12. Pinabacdao	419	1,475	615	225	597	11	4	23	3.52	1.47	0.57	1.42	0.03	0.09	0.05
13. San Jose de Buan	804	1,899	1,035	431	137	81	21	194	2.36	1.29	0.54	0.17	0.10	0.03	0.24
14. San Sebastian	561	1,157	639	494	6	-	-	18	2.06	1.14	0.88	0.01	-	-	0.03
15. Sta. Margarita	1,930	4,865	1,388	2,766	438	5	172	96	2.52	0.70	1.43	0.23	0.03	0.09	0.05
16. Sta. Rita	2,394	8,359	2,587	4,147	306	82	322	915	3.49	1.08	1.73	0.13	0.03	0.13	0.38
17. Talalora	641	1,588	446	965	171	3	-	3	2.48	0.70	1.51	0.27	0.05	-	0.05
18. Tarangnan	902	3,732	655	1,838	1,159	65	14	1	4.14	0.73	2.04	1.28	0.07	0.02	0.00
19. Villareal	1,611	2,961	1,633	1,035	110	7	50	126	1.84	1.01	0.64	0.07	0.04	0.03	0.08
20. Wright	2,918	6,348	2,725	2,529	539	60	349	146	2.18	0.93	0.87	0.18	0.02	0.12	0.05
21. Pagsanghan	316	700	236	405	59	-	-	-	2.25	0.75	1.28	0.18	-	-	-
II. Islands	8,850	14,456	5,816	7,005	1,123	192	136	184	1.63	0.66	0.79	0.13	0.02	0.02	0.02
1. Almagro	1,546	1,971	708	1,199	24	10	29	1	1.27	0.46	0.78	0.02	0.01	0.06	0.00
2. Daram	3,721	6,376	2,743	2,585	953	-	2	93	1.71	0.73	0.69	0.26	-	0.00	0.02
3. Sto. Niño	1,639	2,765	1,008	1,644	2	13	86	12	1.69	0.61	1.00	0.01	0.07	0.05	0.07
4. Zumarraga	816	2,181	780	1,132	109	63	19	78	2.67	0.96	1.39	0.13	0.08	0.02	0.10
5. Tagapul-an	1,128	1,163	577	445	35	106	-	-	1.03	0.51	0.39	0.03	0.09	-	-
III. Total	46,734	120,177	40,880	62,989	9,206	1,573	3,236	2,343	2.57	0.87	1.35	0.20	0.03	0.07	0.05

Source: 1981 Census of Agricultural

Table E.1.4. Progress of Cadastral Survey (W. Samar)

Municipality	A & D[*1] (ha)	Disposed[*2] (ha)	Surveyed[*3] (ha)
I. Total	560,930	119,802	26,163
II. Excluding Islands	330,880	105,721	16,141
1. Basey	31,822	10,033	0
2. Calbayog City	59,898	35,765	674
3. Calbiga	16,378	1,089	0
4. Carbalogan	8,726	3,596	1,660[*4]
5. Gandara	27,523	7,844	3,024
6. San Jorge	24,120	1,346	
7. Hinabangan	16,241	2,583	0
8. Jiabong	5,384	4,121	
9. Marabut	9,809	3,008	0
10. Matuginao	20,475	1,008	1,777
11. Motiong	12,251	2,244	
12. Pinabacdao	5,826	1,475	
13. San Jose de Buan	13,358	1,899	0
14. San Sebastian	1,242	1,157	
15. Sta. Margarita	7,760	4,865	2,730
16. Sta. Rita	16,169	8,359	2,886[*5]
17. Talalora	2,252	1,588	149
18. Tarangnan	8,150	3,732	151
19. Villareal	12,210	2,961	174
20. Wright	28,286	6,348	2,916[*6]
21. Paasanghan	3,000	700	
III. Islands	22,860	14,456	10,022
22. Almagro	2,800	1,971	112[*7]
23. Daram	10,340	6,376	7,780
24. Sto. Nino	3,170	2,765	1,973
25. Zumatraga	3,760	2,181	157
26. Tagapul-an	2,790	1,163	

Source: *1 ..... 1986 Annual Report, BFD
*2 ..... 1980 Census of Agriculture
*3 ..... Bureau of Land, Samar Province (As of 1986)
*4 ..... Including San Jorge
*5 ..... Including Pinabacdao
*6 ..... Including Jiabong, Motiong and San Sebastian
*7 ..... Including Tagapul-an

Table E.1.5. Number and Area of Farms by Tenure of Farm, 1971 and 1980 (W. Samar)

Tenure of Farm	Number of Farms 1971	(%)	1980	(%)	Area of Farm 1971	(%)	1980	(%)
All Forms	37,080	(100.0)	46,734	(100.0)	112,080	(100.0)	118,877	(100.0)
Owned	29,940	(80.7)	29,490	(63.1)	90,962	(81.1)	81,217	(68.3)
Partly-Owned	1,583	(4.3)	3,771	(8.1)	5,897	(5.2)	11,826	(9.9)
Tenanted/Leased	4,695	(12.7)	10,089	(21.6)	10,114	(9.0)	19,794	(16.7)
Other Forms	862	(2.3)	3,384	(7.2)	5,108	(4.6)	6,040	(5.1)

Source: 1981 Census of Agriculture

Table E.1.6. Progress of Land Reform for Rice and Corn Land (As of May 1987)

	(1)	(2)	(3)	(4)	(5)=(4)/(2)	(6)	(7)	(8)	(9)	(10)=(9)/(8)
	Operation of Land Transfer					Operation of Leasehold				
	Target		Accomplishment			Target		Accomplishment		
Team No.	No. of Tenant	Area (ha)	No. of Tenant	Area (ha)	Ratio (%)	No. of Tenant	Area (ha)	No. of Tenant	Area (ha)	Ratio (%)
229	1,585	1,364	108	66	4.4	1,500	1,000	1,392	884	88.4
229-A	467	678	13	30	4.4	1,250	1,456	1,992	1,587	109.0
230[*1]	1,199	1,388	110	95	6.8	2,109	2,442	1,539	1,466	60.0
Total (District)	3,251	3,431	231	190	5.5	4,859	4,898	4,923	3,938	80.4

Note : *1 ..... Calbayog DAR District Office which covers ADPP area.
Source: DAR, District No. 27, Region VIII

Table E.1.7. Comparison of Crop Productivity
(Average for 1980/81 - 1984/85)

Crop	Philippines (National)			Region VIII				Samar Province			
						Yield				Yield	
	Harvest Area	Production	Yield	Harvested Area	Production	Yield	% Equivalent to National Yield	Harvested Area	Produciton	Yield	% Equivalent National Yield
	('000 ha)	('000 ton)	(ton/ha)	('000 ha)	('000 ton)	(ton/ha)	(%)	('000 ha)	('000 ton)	(ton/ha)	(%)
1. Paddy	3,300.7	7,923.2	2.40	191.3	344.4	1.80	75.0	33.6	55.0	1.64	68.3
2. Corn	3,282.8	3,262.2	1.00	193.6	240.8	1.06	106.1	12.2	12.9	1.05	105.0
3. Sweet Potato	186.0	889.4	4.78	44.2	176.3	3.99	83.5	8.4	15.5	3.44	28.9
4. Cassava	213.7	1,659.9	7.77	30.1	124.9	4.15	53.4	6.1	27.5	4.51	58.0
5. Gabi	31.2	101.8	3.25	8.6	24.0	2.79	85.9	0.20	0.32	4.10	126.2
6. Mungbean	41.9	29.3	0.70	0.3	0.2	0.67	95.7	0.0	0.0	0.50	71.4
7. Peanut	47.9	40.3	0.84	2.1	1.1	0.50	59.5	0.5	0.4	0.80	95.2
8. Coconut (Copra)	3,189.2	3,473.2	1.09	349.4	274.9	0.78	71.6	64.7	78.6	0.44	40.3
9. Abaca	190.4	190.9	0.54	60.4	25.8	0.43	79.6	4.0	1.7	0.40	74.1

Source: Bureau of Agriculture Statistics. (Refer to Appendix E. Table E.3.8 to E.3.17)

Table E.1.8. Crop Production, Paddy

Year	Philippines			Region 8 *1			Samar Islands			Western Samar		
	Harvested Area	Yield	Production	Harvested Area	Yield	Production	Harvested Area	Yield	Production	Harvested Area	Yield	Production
	(1000 ha)	(t/ha)	(1000 ton)	(1000 ha)	(t/ha)	(1000 ton)	(1000 ha)	(t/ha)	(1000 ton)	(1000 ha)	(t/ha)	(1000 ton)
1. 1973/74	3,527.8	1.66	5,840.7	162.0	1.26	204.0	68.9	1.01	69.9	31.4	1.32	41.6
2. 74/75	3,632.5	1.63	5,909.5	182.0	1.19	216.0	101.7	1.18	119.5	35.1	0.95	33.3
3. 75/76	3,674.0	1.75	6,431.0	181.0	1.25	227.0	94.8	1.03	97.8	34.6	0.99	33.9
4. 76/77	3,641.4	1.85	6,740.6	180.0	1.29	233.0	107.3	1.04	112.1	31.3	1.00	31.3
5. 77/78	3,601.7	2.00	7,198.8	173.0	1.36	236.0	103.0	1.05	107.9	28.1	1.04	29.3
6. 78/79	3,560.7	2.11	7,514.8	176.0	1.51	266.0	100.2	1.22	121.5	26.1	1.20	31.4
7. 79/80	3,636.8	2.15	7,835.8	178.0	1.64	292.0	97.7	1.47	143.6	26.4	1.23	32.4
8. 80/81	3,459.1	2.23	7,722.8	185.8	1.81	337.2	103.7	1.41	146.1	29.6	1.49	44.2
9. 81/82	3,442.8	2.36	8,121.7	181.4	1.76	319.5	104.8	1.37	143.8	35.2	1.52	53.3
10. 82/83	3,239.6	2.39	7,730.5	192.2	1.50	288.2	75.2	1.29	97.3	26.4	1.48	39.1
11. 83/84	3,140.0	2.50	7,840.9	191.2	1.98	378.2	82.8	1.71	141.3	35.9	1.76	63.1
12. 84/85	3,221.8	2.55	8,200.1	205.8	1.94	398.9	92.0	1.82	167.2	41.1	1.83	75.2
Mean	3,481.5	2.08	7,257.3	182.4	1.55	283.0	94.3	1.30	122.3	31.8	1.33	42.3
(1980/81 - 1984/85)	(3,300.7)	(2.40)	(7,923.2)	(191.3)	(1.80)	(344.4)	(91.7)	(1.51)	(139.1)	(33.6)	(1.64)	(55.0)

Note: *1 ..... The average paddy production in Lyte Islands for 1980/81 to 1984/85 is as follows,

Harvested Area (1000 ha)	Yield (ton/ha)	Production (1000 ton)
99.6	2.06	205.3

Source: BAS

Table E.1.9. Crop Production, Corn (Shelled)

Year	Philippines			Region 8 *1			Samar Islands			Western Samar		
	Harvested Area	Yield	Production	Harvested Area	Yield	Production	Harvested Area	Yield	Production	Harvested Area	Yield	Production
	(1000 ha)	(t/ha)	(1000 ton)	(1000 ha)	(t/ha)	(1000 ton)	(1000 ha)	(t/ha)	(1000 ton)	(1000 ha)	(t/ha)	(1000 ton)
1. 1973/74	2,726.4	0.83	2,257.5	134.0	0.72	97.0	7.3	0.69	5.1	5.4	0.70	3.8
2. 74/75	3,009.9	0.84	2,513.9	140.0	0.70	99.0	27.5	0.56	13.7	25.3	0.49	12.3
3. 75/76	3,193.2	0.81	2,717.3	143.0	0.75	107.0	24.2	0.85	20.7	18.8	0.93	17.4
4. 76/77	3,242.5	0.86	2,774.8	150.0	0.81	121.0	11.3	0.55	10.1	9.6	0.94	9.0
5. 77/78	3,158.1	0.89	2,796.1	145.0	0.85	124.0	14.2	0.44	12.9	12.0	0.95	11.4
6. 78/79	3,252.4	0.95	3,090.3	155.0	0.88	136.0	11.3	0.59	14.5	9.5	1.40	13.3
7. 79/80	3,201.1	0.98	3,122.8	167.0	0.96	161.0	13.0	0.88	11.3	11.0	0.90	9.9
8. 80/81	3,238.7	0.96	3,109.7	187.8	1.01	189.8	15.0	1.10	16.6	13.4	1.16	15.6
9. 81/82	3,442.8	0.98	3,290.2	181.1	1.07	219.1	18.3	1.00	18.3	16.1	1.04	16.7
10. 82/83	3,157.5	0.99	3,125.9	200.9	0.95	190.3	13.0	0.83	10.8	11.0	0.82	9.1
11. 83/84	3,270.2	1.02	3,346.2	198.8	1.01	201.4	13.2	1.08	14.3	10.7	1.15	12.3
12. 84/85	3,314.6	1.04	3,438.8	199.3	1.12	223.4	12.0	1.08	12.9	9.8	1.12	11.0
Mean	3,184.0	0.93	2,965.3	166.8	0.93	155.8	15.0	0.89	13.4	12.7	0.93	11.8
(1980/81 - 1984/85)	(3,282.8)	(1.00)	(3,262.2)	(193.6)	(1.06)	(204.8)	(14.3)	(1.02)	(14.6)	(12.2)	(1.05)	(12.9)

Note: *1 ..... The average corn production in Lyte Islands for 1980/81 to 1984/85;

Harvested Area (1000 ha)	Yield (ton/ha)	Production (1000 ton)
179.3	1.06	190.2

Source: BAS

Table E.1.10. Crop Production, Sweet Potato

Year	Philippines			Region 8			Samar Islands			Western Samar		
	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)
1. 1973/74	181.0	4.50	807.0				14.0	2.56	35.8	5.1	1.27	6.4
2. 74/75	195.7	5.0	986.0				22.7	2.12	48.2	11.5	0.92	10.6
3. 75/76	208.7	3.97	829.5				29.9	1.46	43.7	16.9	0.89	15.0
4. 76/77	221.7	4.02	893.3	Not Available			27.2	1.31	35.7	16.9	0.86	14.6
5. 77/78	227.6	4.56	1,037.0				31.7	4.22	133.8	17.8	2.73	48.5
6. 78/79	238.0	4.72	1,122.9				38.3	3.93	150.5	27.2	3.15	85.7
7. 79/80	235.8	4.44	1,047.8				36.4	3.90	141.8	24.5	3.03	74.2
8. 80/81	211.4	4.78	1,010.3	53.1	3.94	209.3	32.3	4.53	146.3	21.1	3.34	70.6
9. 81/82	209.3	4.96	1,037.6	45.3	4.40	199.4	25.4	8.40	213.4	11.7	3.60	42.1
10. 82/83	174.7	4.59	801.5	40.8	3.28	134.0	17.7	3.79	67.1	2.4	2.60	6.1
11. 83/84	170.1	4.82	820.3	41.2	4.27	175.8	20.5	3.64	74.7	3.5	3.67	12.8
12. 84/85	164.3	4.74	777.2	40.5	4.08	163.1	19.7	5.05	99.5	3.2	3.95	12.7
Mean	203.2	4.58	930.9	44.2	3.99	176.3	26.3	3.77	99.2	8.4	3.44	28.9
(1980/81 - 1984/85)	(186.0)	(4.78)	(889.4)	(44.2)	(3.99)	(176.3)	(23.1)	(6.43)	(148.6)	(8.4)	(3.44)	(9.9)

Source: BAS

Table E.1.11. Crop Production, Cassava

Year	Philippines			Region 8			Samar Islands			Western Samar		
	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)
1. 1973/74	96.7	4.96	480.0				7.9	1.92	15.2	5.0	1.23	6.2
2. 74/75	119.3	5.74	684.5				13.3	1.57	20.9	11.0	0.99	10.8
3. 75/76	144.7	8.00	1,154.0				19.2	2.42	46.5	12.2	1.28	15.6
4. 76/77	179.3	9.54	1,710.8	Not Available			19.9	1.79	35.7	12.2	1.28	15.5
5. 77/78	181.8	9.80	1,782.0				14.5	4.74	68.8	6.3	3.08	19.5
6. 78/79	192.4	11.72	2,253.8				15.8	4.51	71.2	9.2	4.56	41.9
7. 79/80	204.2	11.14	2,277.3				14.9	4.48	66.7	8.3	4.45	37.0
8. 80/81	211.4	10.67	2,255.1	27.4	4.88	133.5	13.6	4.40	59.9	7.1	3.92	27.7
9. 81/82	224.3	8.86	1,987.5	31.0	3.74	148.0	16.8	5.57	93.6	7.6	4.68	37.8
10. 82/83	207.8	8.00	1,169.0	30.2	3.60	107.6	13.6	4.78	65.0	4.3	3.77	16.1
11. 83/84	208.8	6.40	1,336.6	31.6	3.81	122.1	15.2	5.08	77.2	5.9	4.71	27.8
12. 84/85	216.3	7.18	1,551.1	30.2	3.77	113.2	13.9	4.76	66.1	5.7	4.95	28.2
Mean	182.2	8.53	1,553.5	30.1	4.15	124.9	14.9	3.84	57.2	7.9	3.00	23.7
(1980/81 - 1984/85)	(213.7)	(7.77)	(1,659.9)	(30.1)	(4.15)	(124.9)	(14.6)	(4.96)	(72.4)	(6.1)	(4.51)	(27.5)

Source: BAS

Table E.1.12. Crop Production, Gabi

Year	Philippines			Region 8			Samar Islands			Western Samar		
	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)
1. 1973/74	26.3	3.21	84.3									
2. 74/75	26.0	3.57	92.7									
3. 75/76	36.7	3.06	112.4	Not Available								
4. 76/77	36.8	3.36	123.6									
5. 77/78	38.3	3.66	140.0				Not Available			Not Available		
6. 78/79	37.2	3.99	148.3									
7. 79/80	33.6	3.26	109.4									
8. 80/81	32.1	3.28	105.4	7.5	3.28	23.1						
9. 81/82	33.8	3.32	112.9	8.8	2.67	23.7						
10. 82/83	30.3	3.32	100.4	8.3	2.67	23.7						
11. 83/84	29.7	3.33	96.4	9.0	3.00	25.9						
12. 84/85	30.2	3.10	92.8	9.3	2.67	23.6						
Mean	32.6	3.37	109.9	8.6	2.79	24.0				0.2	4.10	4.3
(1980/81 - 1984/85)	(31.2)	(3.25)	(101.6)	(8.6)	(2.79)	(24.0)				(0.2)	(4.10)	(0.9)

Source: BAS

Table E.1.13. Crop Production, Mungbean

Year	Philippines			Region 8			Samar Islands			Western Samar		
	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)
1. 1973/74	37.5	0.40	16.1	0.2	0.46	0.1		0.44		0.0	0.49	0.0
2. 74/75	39.3	0.60	21.7	0.2	0.55	0.1		0.23		0.0	0.20	0.0
3. 75/76	43.3	0.60	24.4	0.2	0.43	0.1		0.34		0.0	0.35	0.0
4. 76/77	43.8	0.60	25.3	0.2	0.55	0.1		0.50		0.0	0.49	0.0
5. 77/78	45.1	0.58	26.2	0.1	0.59	0.1		0.61		0.0	0.44	0.0
6. 78/79	47.9	0.61	29.0	0.1	0.49	0.1		0.50		0.0	0.46	0.0
7. 79/80	50.4	0.65	32.8	0.1	0.49	0.1		0.65		0.0	0.61	0.0
8. 80/81	51.8	0.65	33.5	0.2	0.50	0.1		0.69		0.0	0.52	0.0
9. 81/82	52.2	0.66	34.3	0.2	0.50	0.1		0.64		0.0	0.50	0.0
10. 82/83	32.8	0.77	25.2	0.3	0.67	0.2		0.76		0.0	0.44	0.0
11. 83/84	35.5	0.75	26.5	0.4	0.50	0.2		0.77		0.0	0.55	0.0
12. 84/85	37.4	0.72	26.9	0.3	0.67	0.2		0.77		0.0	0.50	0.0
Mean	43.1	0.62	26.8	0.3	0.67	0.2		0.57		0.0	0.46	0.0
(1980/81 - 1984/85)	(41.9)	(0.70)	(29.3)	(0.3)	(0.67)	(0.2)		(0.72)		(0.0)	(0.50)	(0.0)

Source: BAS

Table E.1.14. Crop Production, Peanut

Year	Philippines			Region 8			Samar Islands			Western Samar		
	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)
1. 1973/74	36.7	0.61	21.6	1.5	0.74	1.1	0.2	1.44	0.3	0.0	0.52	0.0
2. 74/75	54.8	0.66	36.2	1.4	0.67	1.0	0.1	1.18	0.2	0.0	0.53	0.0
3. 75/76	60.6	0.67	40.8	1.3	0.67	0.9	0.0	0.59	0.0	0.0	0.53	0.0
4. 76/77	62.7	0.74	46.2	1.3	0.67	0.9	0.0	0.59	0.0	0.0	0.53	0.0
5. 77/78	47.9	0.79	37.8	2.3	0.71	1.6	1.0	0.75	0.8	1.0	0.75	0.8
6. 78/79	53.8	0.92	49.2	2.8	0.69	1.9	1.1	1.09	1.2	1.6	0.75	1.2
7. 79/80	55.1	0.91	49.9	2.6	0.69	1.8	1.4	0.76	1.1	1.4	0.77	1.1
8. 80/81	38.7	0.76	29.6	2.5	0.63	1.6	1.3	0.76	1.0	1.2	0.77	0.9
9. 81/82	56.5	0.86	48.7	2.2	0.59	1.3	0.8	0.77	0.6	0.7	0.80	0.6
10. 82/83	47.9	0.74	35.9	2.0	0.40	0.8	0.6	0.29	0.2	0.2	0.67	0.1
11. 83/84	46.1	0.91	42.2	1.9	0.42	0.8	0.6	0.40	0.2	0.2	0.90	0.2
12. 84/85	50.2	0.90	45.2	1.8	0.44	0.8	0.5	0.51	0.3	0.2	0.88	0.2
Mean	50.1	0.80	40.3	2.0	0.50	1.2	0.6	0.83	0.5	0.5	0.75	0.2
(1980/81 - 1984/85)	(47.9)	(0.84)	(40.3)	(2.1)	(0.50)	(1.1)	(1.3)	(0.38)	(0.5)	(0.5)	(0.80)	(0.4)

Source: BAS

Table E.1.15. Crop Production, Coconut (Copra Term)

Year	Philippines			Region 8			Samar Islands			Western Samar		
	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)
1. 1973/74	1,713	1.07	1,846.9				172.3	0.34	59.4	28.7	0.17	5.0
2. 74/75	1,866	1.00	1,861.4				185.2	0.41	76.8	47.2	0.29	13.6
3. 75/76	2,123	0.98	2,081.8				200.0	0.43	85.8	47.2	0.39	18.3
4. 76/77	2,270	1.11	2,511.4	Not Available			236.9	0.31	74.4	53.5	0.45	23.9
5. 77/78	2,957	0.90	2,663.5				237.9	0.50	119.2	38.9	1.05	40.8
6. 78/79	2,486	1.33	3,306.7				228.0	0.47	107.8	40.9	0.98	39.9
7. 79/80	2,576	1.29	3,326.2				229.2	0.43	99.4	37.1	0.77	28.5
8. 80/81	2,562	1.38	3,540.2	333.9	0.83	277.5	232.4	0.49	114.8	42.3	0.91	38.5
9. 81/82	2,664	1.34	3,582.9	345.4	0.76	262.1	211.9	0.47	100.2	61.8	0.61	37.7
10. 82/83	2,666	1.16	3,097.4	356.3	0.91	324.0	223.9	0.42	94.2	73.7	0.39	28.7
11. 83/84	2,717	1.05	2,846.5	356.0	0.66	234.9	219.0	0.38	83.1	73.7	0.28	20.6
12. 84/85	2,767	0.89	2,471.5	355.6	0.77	276.2	208.1	0.34	71.5	72.0	0.24	17.3
Mean	2,447	1.13	2,761	349.4	0.78	274.9	198.7	0.45	90.6	51.4	0.51	26.1
(1981 - 85)	(3,189.2)	(1.09)	(3,473.2)	(349.4)	(0.78)	(274.9)	(219.1)	(0.42)	(92.8)	(64.7)	(0.44)	(28.6)

Source: BAS

Table E.1.16. Crop Production, Abaca

Year	Philippines			Region 8			Samar Islands			Western Samar		
	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)	Harvested Area (1000 ha)	Yield (t/ha)	Production (1000 ton)
1. 1973/74	170.1	0,74	125.9				19.3	0.47	9.1	5.9	0.45	2.7
2. 74/75	179.7	0.74	133.6				17.6	0.52	9.1	5.9	0.45	2.7
3. 75/76	243.8	0.57	139.3				24.2	0.37	9.0	5.4	0.41	2.2
4. 76/77	250.3	0.60	150.5	Not Available			23.4	0.38	9.0	5.4	0.41	2.2
5. 77/78	243.8	0.53	129.8				25.0	0.47	11.7	6.8	0.48	3.3
6. 78/79	234.9	0.63	148.3				23.1	0.29	6.8	5.9	0.43	2.5
7. 79/80	235.9	0.66	157.2				21.7	0.35	7.7	4.9	0.45	2.2
8. 80/81	230.1	0.56	128.3	66.7	0.49	32.6	21.0	0.35	7.4	4.6	0.45	2.1
9. 81/82	206.8	0.58	119.7	61.4	0.46	28.2	16.7	0.33	5.5	4.8	0.40	1.9
10. 82/83	175.4	0.51	89.3	58.8	0.40	23.6	15.4	0.34	5.3	3.4	0.40	1.4
11. 83/84	170.3	0.52	88.7	58.3	0.41	24.0	15.3	0.34	5.2	4.2	0.42	1.7
12. 84/85	169.5	0.49	83.7	56.7	0.36	20.6	15.8	0.34	5.3	3.2	0.43	1.4
Mean	209.2	0.59	124.5	60.4	0.43	25.8	19.9	0.38	7.6	5.0	0.44	2.2
(1981 - 85)	(190.2)	(0.54)	(101.9)	(60.4)	(0.43)	(25.8)	(16.8)	(0.34)	(5.7)	(4.0)	(0.40)	(1.7)

Source: BAS

Table. E.1.17. Yearly Paddy Production in Samar Province

Year	Total			Irrigated			Rainfed			Upland		
	Harvested Area (ha)	Production (ton)	Yield (ton/ha)	Harvested Area (ha)	Production (ton)	Yield (ton/ha)	Harvested Area (ha)	Production (ton)	Yield (ton/ha)	Harvested Area (ha)	Production (ton)	Yield (ton/ha)
1. 1973/74	31,384	41,578	1.32	334	507	1.52	20,358	22,838	1.12	10,692	8,233	0.77
2. 74/75	35,071	33,281	0.95	720	1,332	1.85	23,881	23,696	0.99	10,470	8,253	0.79
3. 75/76	34,292	33,860	0.99	430	663	1.54	16,347	16,404	1.00	17,815	16,793	0.94
4. 76/77	31,314	31,297	1.00	430	704	1.64	14,347	15,084	1.05	16,537	15,509	0.94
5. 77/78	28,146	29,281	1.04	333	623	1.87	12,145	14,882	1.23	15,668	13,776	0.88
6. 78/79	26,088	31,435	1.20	440	1,237	2.81	12,622	19,416	1.54	13,026	10,782	0.83
7. 79/80	26,353	32,390	1.23	761	2,218	2.91	16,692	22,956	1.38	8,900	7,216	0.81
8. 80/81	29,585	44,178	1.49	1,233	3,877	3.14	18,131	29,587	1.63	10,221	10,714	1.05
9. 81/82	35,162	53,280	1.52	1,460	4,802	3.29	24,013	39,837	1.66	9,689	8,641	0.89
10. 82/83	26,369	39,077	1.48	1,300	3,860	2.97	20,451	30,983	1.52	4,618	4,234	0.92
11. 83/84	35,898	63,098	1.76	1,460	4,918	3.37	25,868	49,498	1.91	8,570	8,682	1.01
12. 84/85	41,060	75,202	1.83	1,380	5,555	4.02	80,180	59,898	2.97	9,500	9,749	1.03
13. 85/86	38,580	63,298	1.64	1,380	5,106	3.70	29,800	51,045	1.71	7,400	7,147	0.97
Average	32,254	43,943	1.36	897	2,723	3.04	20,372	30,469	1.50	11,008	9,979	0.91

Note: BAS conversion ratio from cavan to kg ... 44 kg per cavan
Source: BAS Region VIII

Table E.1.18. Number of Equipment and Facilities (1980)
(Samar Province)

Equipment/Facilities	Total No. of Farm Reporting	(%)	No. of Equipment/Facilities Used			
			No. of Operators Owned	Owned Solely By Operators or Jointly with Others	Owned by Land-Load or Borrowed From Others	Rented From Others
1. Cultivation Equipment						
(1) Plow	(40.5)	18,973	15,452	14,942	2,086	5,037
(2) Harrow	(23.7)	11,116	8,819	8,723	1,401	2,816
(3) Cultivator & Weeder	(3.4)	1,571	1,356	1,124	250	337
(4) Fertilizer Distributor	(0.5)	241	258	223	38	54
(5) Sprayer and others	(4.1)	1,892	1,139	1,020	351	639
(6) Others	(0.4)	188	219	214	20	25
2. Harvesting & Post-Harvest Equipment						
(1) Mower	(0.0)	3	2	7	-	-
(2) Combined Harvester-Thresher	(0.0)	12	11	11	2	-
(3) Powered Thresher	(0.0)	14	11	16	-	1
(4) Copra Dryer	(3.4)	1,592	1,982	1,997	263	24
(5) Paddy Dryer	(0.0)	15	11	11	1	4
(6) Others	(4.8)	2,276	4,720	3,757	1,194	251
3. Tractor Wheel						
(1) Four Tractor	(0.0)	27	23	21	-	5
(2) Power Tiller	(0.7)	351	111	30	30	242
4. Power Producting Machinery						
(1) Prime Movers	(0.0)	1	-	-	-	1
(2) Electric Generators	(0.0)	14	14	14	-	-
(3) Electric Motor	(0.0)	3	3	3	-	-
(4) Others	(0.0)	12	12	12	-	-
5. Transport Means						
(1) Wheel Barrow	(0.0)	16	20	20	-	1
(2) Cart/Sled	(4.4)	2,052	1,719	1,640	182	441
(3) Car/Jeep/Truck	(0.2)	116	34	29	13	74
(4) Trailer	(0.0)	3	3	2	-	1
(5) Tricycle	(0.0)	54	7	2	12	38
(6) Boat or Banca	(4.9)	2,295	1,932	2,023	121	271
6. Other Equipment						
(1) Abaca Stripping Machine	(0.0)	26	26	26	-	-
(2) Incubator	(0.0)	2	4	4	-	-
7. Storage Facilities						
(1) Independent Structure	(0.9)	448	443	410	36	11
(2) Parts of Operator's House		238	206	229	-	-

Source: 1980 Census of Agriculture

Table E.1.19. Average Annual Crop Damage in Samar Province (1980/81 - 1985/86)

Crop	Total Area (ha)	Total Damage (ton)	Typhoon Area (ha)	Typhoon Damage (ton)	Pest & Diseases Area (ha)	Pest & Diseases Damage (ton)	Drought Area (ha)	Drought Damage (ton)	Others Area (ha)	Others Damage (ton)
1. Rice (Total)	63,767	7,507	1,519	1,688	4,237	1,640	57,985	4,157	26	22
(1) Lowland 1st Crop	2,536	2,164	1,146	1,414	203	81	1,187	669	-	-
(2) Lowland 2nd Crop	6,490	4,150	245	211	2,505	935	3,740	3,004	-	-
(3) Upland	2,555	1,193	128	63	1,529	624	872	484	26	22
2. Corn (Total)	4,416	2,087	550	434	1,711	652	2,155	1,001	-	-
(1) 1st Crop	1,036	527	434	346	349	101	253	80	-	-
(2) 2nd Crop	3,084	1,434	-	-	1,292	533	1,792	901	-	-
(3) 3rd Crop	296	126	116	88	70	18	110	20	-	-
3. Commercial Crops	2,701	4,661	2,701	4,661	-	-	-	-	-	-
(1) Coconut	2,129	503	2,129	503	-	-	-	-	-	-
(2) Abaca	158	59	158	59	-	-	-	-	-	-
(3) Banana	414	4,099	414	4,099	-	-	-	-	-	-
4. Vegetables	-	-	-	-	-	-	-	-	-	-
5. Root Crops (Total)	799	4,849	799	4,849	-	-	-	-	-	-
(1) Camote	307	1,641	307	1,641	-	-	-	-	-	-
(2) Cassava	492	3,208	492	3,208	-	-	-	-	-	-

Source: BAS, Region VIII

Table E.1.20. Seed Production in Samar Province (1986)

	No. of Member	Area Harvested (ha)	Production (ton)	Certified Quantity (ton)	Seeds Value (₱1000)
I. Excluding Islands (Total)	13	24	35	35	275
1. Basey	1	2	4	4	20
2. Calbayog					
3. Calbiga					
4. Catbalogan	1	(No production)			
5. Gandara	2	2	7	7	35
6. San Jorge	2	15	26	26	130
7. Hinabangan	1	1	2	2	10
8. Jiabong					
9. Marabut					
10. Matuguinao					
11. Motiong					
12. Pinabacdao	3	1	4	4	20
13. San Jose du Buan					
14. San Sebastian					
15. Sta. Margarita	1	1	6	6	30
16. Sta. Rita	1	1	3	3	15
17. Talalora					
18. Tarangnau					
19. Villareal	1	1	3	3	15
20. Wright					
21. Pagsanghan					
II. Islands (Total)					
22. Almagro	-	-	-	-	-
23. Daram	-	-	-	-	-
24. Zumarraga	-	-	-	-	-
25. Tagapul-an	-	-	-	-	-
III. Total	13	24	35	35	35

Source: DA, Samar Province

Table E.1.21. Number of Livestock in Samar Province (As of December)

Year	Carabao	Cattle	Goat	Hog	Chicken	Ducks
1975	16,550	1,660	5,180	68,970	160,200	9,680
1976	15,120	1,740	3,690	50,020	134,580	19,760
1977	17,850	1,880	2,180	47,300	162,290	18,340
1978	22,270	1,250	3,500	63,820	144,820	11,190
1979	21,970	1,500	1,650	53,830	158,940	16,040
1980	19,210	1,920	1,190	47,890	146,820	13,930
1981	23,790	1,950	1,170	53,960	154,160	14,090
1982	24,570	1,721	2,860	65,360	194,250	16,980
1983	28,110	1,492	4,450	68,690	234,750	19,870
1984	30,040	1,990	6,220	76,990	275,250	15,100
1985	32,170	1,490	7,990	63,600	243,790	23,660
1986	33,130	1,400	5,500	66,860	256,280	14,470

Source: BAS, Samar Province

Table E.1.23. Number of Agricultural/Fishery Extension Staff (as of August in 1987)

Municipality	Total	National-Paid		Provincial -Paid
		MAFO	AFT	
I. Total	115[1*]	26	73	16
II. Excluding Islands	104	21	68	15
1. Basey	6	1	5	-
2. Calbayog	5[*2]	1	4	-
3. Calbiga	6	1	2	3
4. Catbalogan	9	1	5	3
5. Gandara	10[*3]	1	9	-
6. San Jorge	7[*4]	1	5	1
7. Hinabangan	3	1	2	-
8. Jiabong	6	1	4	1
9. Marabut	3	1	1	1
10. Matuginao	1	1	-	-
11. Motiong	6	1	5	-
12. Pinabacdao	4	1	1	2
13. San Jose de Buan	1	1	-	-
14. San Sebastian	3	1	2	-
15. Sta. Margarita	7	9	5	1
16. Sta. Rita	8	1	6	1
17. Talalra	1	1	-	-
18. Tarangnan	6	1	5	-
19. Villareal	4	1	2	1
20. Wright	6	1	5	-
21. Pagsanghan	2	1	-	1
III. Islands	11	5	5	1
22. Almagro	2	1	1	-
23. Daram	3	1	1	1
24. Sto. Niño	2	1	1	-
25. Zumarraga	3	1	2	-
26. Tagapul-an	1	1	-	-

Note: *1 ... Including two fishery staff
*2 ... Excluding five staff who are paid by City Goverment
*3 ... Decreased to nine staffin July, 1988
*4 ... Decreased to four staff in July, 1988

Table E.1.22. Number of Draft Animals per Farm

Municipality	Number of Farm (1)	Working Animal			Ratio (5)=(2)/(1)
		Total (2)	Carabao (3)	Cattle (4)	
I. Excluding Islands	37,884	16,763	16,678	85	0.44
1. Basey	4,243	1,708	1,708	-	0.40
2. Calbayog City	9,867	3,346	3,322	24	0.34
3. Calbiga	598	918	914	4	1.54
4. Catbalogan	1,878	337	324	13	0.18
5. Gandara	2,638	1,368	1,362	6	0.52
6. San Jorge	1,129	338	338	-	0.30
7. Hinabangan	570	201	201	-	0.35
8. Jiabong	1,537	1,063	1,047	16	0.69
9. Marabut	1,311	650	648	2	0.50
10. Matuginao	393	31	31	-	0.08
11. Motiong	1,224	489	489	-	0.40
12. Pinabacdao	419	325	325	-	0.78
13. San Jose de Buan	804	187	187	-	0.23
14. San Sebastian	561	503	503	-	0.90
15. Sta. Margarita	1,930	461	460	1	0.24
16. Sta. Rita	2,394	953	952	1	0.40
17. Talalora	641	151	151	-	0.24
18. Tarangnan	902	376	376	-	0.42
19. Villareal	1,611	1,289	1,275	14	0.80
20. Wright	2,918	1,761	1,757	4	0.60
21. Pagsanghan	316	308	308	-	0.97
II. Islands	8,850	1,817	1,170	647	0.20
1. Almagro	1,546	114	35	79	0.07
2. Daram	3,721	702	693	9	0.19
3. Sto. Niño	1,639	118	118	-	0.07
4. Zumarraga	816	227	227	-	0.28
5. Tagapul-an	1,128	659	97	559	0.58
III. Total	46,734	18,580	17,848	732	0.40

Source: 1981 Census of Agriculture

Table E.1.24. Log and Rattan Production

Year	Log Production: No. of Licens Region 8	No. of Licens W. Samar	Allowable Region 8 ('000 m^3)	Allowable W. Samar ('000 m^3)	Actual Region 8 ('000 m^3)	Actual W. Samar ('000 m^3)	Rattan (Unsplit) Region 8 ('000 LM)	Rattan (Unsplit) W. Samar ('000 LM)
1982					201	46	3,998	757
1983					170	39	849	1,213
1984	14 (1982)	4 (1986)	756 (1982)	180 (1986)	245	77	5,119	1,011
1985					151	29	2,205	136
1986					N.A.	61	159	804
Average	14	4	756	180	192	50	2,466	784

Source: BFD, Region 8

Table E.1.25. Volume of Fish Production by Type of Fishing

(Unit: ton)

Area	1980	1981	1982	1983	1984	1985	Average
1. Region 8 (Total)	66,506	N.A	58,056	N.A	N.A	N.A	48,752
(1) Marine Fish (Subtotal)	48,189	47,267	43,746	43,828	41,927	44,483	44,906
- Commercial	12,650	11,342	9,184	9,124	9,717	11,083	10,516
- Municipal	35,539 *1	35,925	34,562	34,704	32,210	33,400	34,390
(2) Fishpond	2,988 *1	N.A	4,703	N.A	N.A	N.A	3,846
2. Samar Province							
(1) Marine Fish (Subtotal)	18,317	19,525	14,310	12,281	10,949	10,134	14,252
- Commercial	2,943	3,271	2,626	2,331	1,999	2,080	2,541
- Municipal	15,374 *1	16,254	11,684	9,950	8,950	8,054	11,711
(2) Fishpond	2,004 *1	N.A	1,709	N.A	N.A	N.A	1,857

Note : *1... 1980 Census of Fisheries
Source: BFAR, Region 8

Table E.1.26. Quantity of Harvest from Fishpond (1980)

Municipality	Number of Operators	Area Operated (ha)	Quantity of Harvest: Total (ton)	Milkfish (ton)	Shrine (ton)	Prawn (ton)	Crab (ton)	Tilapia (ton)	Others (ton)
Total	44	1,891	2,004	1,855	3	113	-	33	-
1. Calbayog City	17	217	413	348	-	65	-	-	-
2. Catbalogan	5	260	165	140	-	25	-	-	-
3. Gandara	2	25	33	-	-	-	-	33	-
4. Jiabong	5	55	80	80	-	-	-	-	-
5. Pagsanghan	5	418	279	279	-	-	-	-	-
6. Motiong	2	25	13	-	-	13	-	-	-
7. Sta. Margarita	8	639	1,021	1,008	3	10	-	-	-

Source: 1980 Census of Fisheries

Table E.1.27. Post-Harvest Facilities

Facilities	No. of Location	Total Capasity: Unit	Capasity	
1. NFA *1				
(1) Buying Station	1			Pinabacdao
(2) Thresher	2	ton/hr	1.05	
(3) Paddy Cleaner	1	- do -	1.00	Catbalogan
(4) Corn Cleaner	1	- do -	0.30	Catbalogan
(5) Dryer	9	- do -	2.25	
(6) Warehouse (Total)	2	ton	5,600	
- Catbalogan	1	- do -	3,350	1,300 m^2
- Calbayog	1	- do -	2,250	1,008 m^2
(7) Rice mill (Total)		ton/hr	1.50	
- Catbalogan	1	- do -	0.75	
- Calbayog	1	- do -	0.75	
2. Private *2				
(1) No. of Grain Miller	65	-	-	
(2) No. of Warehouse Operator	25	-	-	
(3) No. of Grain Transporter	11	-	-	
(4) Warehous	25	ton	1,208	
(5) Rice Mill (Total)	74	ton/hr	15.16	
- Kiskisan	76	- do -	13.10	
- Cono	5	- do -	2.06	
(6) Corn Mill	26	- do -	6.88	
(7) Transportation	31	ton	236	

Source: *1 ... 1985 Annual Report, NFA Region VIII
*2 ... 1977 - 1981 Regional Grains Industry Profile, NFA

Table E.1.28. Agricultural Production and Use Estimates, Whole Country and Region VIII
(Average, 1980/81 - 1984/85)

(unit: '000 tons)

Crops	Philippines					Region VIII (Eastern Visaya)		
	Domestic Use *1	Production	Surplus, Deficit	Quantity Traded Import	Export	Regional Use *1	Production	Surplus, Deficit
1. Grains								
1.1. Rice (milled rice)	5,314	5,166	-148	78	45	309.8	223.9	-85.9
1.2. Corn (shelled)	3,566	3,262	-304	340	-	204.6	204.8	-0.2
1.3. Wheat (grains)	827	-	-827	821	-	48.2	-	-48.2
2. Starchy Roots and Tubers								
2.1. Sweet Potato (Comote)	904	904	-	-	-	59.1	176.3	117.2
2.2. Taro (Gabi)	105	105	-	-	-	8.8	24.0	15.2
2.3. Irish Potato	39	39	0	0	-	1.9	-	-1.9
2.4. Cassava	1,687	1,687	0	0	-	44.6	124.9	80.3
2.5. Yam (Ubi)	16	16	-	-	-	0.8	0.9	0.1
3. Beans, Seeds and Nuts								
3.1. Mungbeans	30	30	0	0	0	1.5	0.2	-1.5
3.2. Soybeans *2	440	9	-431	412	-	0.5	-	-0.5
3.3. Peanuts (shelled)	29	28	-1	1	-	1.6	0.8	-0.8
3.4. Other Drybeans	8	5	+3	4	0	0.4	-0.3	-0.4
4. Vegetable								
4.1. Cabbage and Pechay	98	98	-	-	-	5.3	1.8	-3.5
4.2. Tomato	127	126	-1	1	0	6.9	1.6	-5.4
4.3. Eggplant	112	112	-	-	-	6.1	1.9	-4.2
4.4. Garlic	18	18	0	0	0	0.9	-	-0.9
4.5. Onion	38	44	+6	0	6	1.8	-	-1.8
4.6. Radish	10	10	-	-	-	0.6	0.1	-0.6
4.7. Ginger	38	38	-	-	-	2.1	1.4	-0.7
4.8. Other Vegetable	348	348	-	-	-	19.3	8.6	-10.8
5. Fruits								
5.1. Banana	3,171	3,981	+810	-	810	164.2	227.9	63.7
5.2. Mango	377	385	+8	-	8	20.6	0.3	-20.4
5.3. Papaya	92	92	-	-	-	5.3	3.8	-1.5
5.4. Pineapple	906	1,484	+578	-	578	50.8	2.5	-48.3
5.5. Calamansi	44	44	-	-	-	2.5	1.9	-0.6
5.6. Mandarin	28	28	-	-	-	1.5	0.1	-1.4
5.7. Pomelo	36	36	-	-	-	1.9	0.5	-1.5
5.8. Guava (Guyabano)	10	10	-	-	-	0.5	0.5	0.0
5.9. Avocado	23	23	-	-	-	1.3	1.5	0.3
5.10. Jack Fruit	84	84	-	-	-	4.9	5.3	0.4
5.11. Water Melon	145	145	-	-	-	8.0	-	-8.0
5.12. Pili	3	3	-	-	-	0.1	0.6	0.5
6. Sugarcane Products								
6.1. Centrifugal Sugar	1,090	2,387	+1,297	-	1,217	61.5	68.6	13.9
6.2. Panocha	21	21	-	-	-	1.2	-	1.2
6.3. Malasses	388	916	+528	-	579	1.3	30.4	29.1
7. Coconuts (Copra Term)	1,280	3,108	+1,828	-	1,651	96.5	274.9	178.4
8. Tobacco	42	49	+7	12	24	2.4	-	2.4
9. Fiber Crops								
9.1. Cotton (lint)	26	5	-21	21	-	-*2	2.8	*2
9.2. Abaca (fiber)	76	107	+31	-	32	4.3	25.8	22.7
10. Coffee (green beans)	37	133	96	-	24	2.1	0.4	-1.7
11. Cacao (beans)	5	5	0	12	12	0.3	0.1	-0.2
12. Fish	1,973	1,965	-8	72	64	109.1*3	78.2	-49.9
13. Livestock, Poultry and Dairy								
13.1. Cattle/Water Buffalo	117	111	-6	6	-	103	13.9	-3.6
13.2. Hog	565	565	0	1	0	31.4	29.5	-1.9
13.3. Goat	11	11	-	-	-	0.7	0.3	-0.4
13.4. Chicken	171	171	0	1	0	10.1	4.0	-6.1
13.5. Ducks	12	12	0	0	-	0.7	0.3	-0.4
13.6. Eggs	142	142	-	-	-	7.7	3.4	-4.3
13.7. Dairy	98	3	-95	99	2	6.5	N.A	N.A

Note: *1 ... estimated on the basis of the average per capita demand in the Philippines
*2 ... including soybean meal
*3 ... estimated on the basis of data in 1980 census of fisheries

Table E.1.29. Demand-Supply Balance of Food in Samar Province (1)
(1980/81 - 1984/85)

Crop	Demand (ton)	Supply (ton)	Surplus/ (Deficit) (ton)	Self-Sufficiency Ratio (%)	Remarks
1. Grains					
1.1. Rice (Milled)	67,481	33,000	(-) 34,481	48.9	
1.2. Corn	25,300	12,900	(-) 12,400	50.9	
1.3. Wheat	8,590	-	(-) 8,590	0.0	
2. Starchy Roots & Tubers					
2.1. Sweet Potato	9,410	9,900	490	105.2	
2.2. Taro (Gabi)	1,074	3,690	(-) 2,616	343,6	
2.3. Irish Potato	343	-	(-) 343	0.0	
2.4. Cassava	9,354	27,500	18,146	294.0	
2.5. Yam (Ubi)	154	93	(-) 61	60.4	
3. Beans, Seeds & Nuts					
3.1. Mungbeans	295	93	(-) 263	31.5	
3.2. Soybeans	95	-	(-) 95	0.0	
3.3. Peanuts (Shelled)	264	336	(-) 72	127.3	
3.4. Other Dry Beans	100	3	(-) 97	3.0	
4. Vegetables					
4.1. Cabbage & Pechay	939	52	(-) 887	5.5	
4.2. Tomato	1,214	110	(-) 1,100	9.0	
4.3. Eggplant	1,071	40	(-) 1,060	3.7	
4.4. Garlic	239	4	(-) 235	1.7	
4.5. Onion	327	40	(-) 327	12.2	
4.6. Radish	100	2	(-) 98	2.0	
4.7. Ginger	343	16	(-) 327	4.7	
4.8. Other Vegetables	3,341	216	(-) 3,125	6.4	
5. Fruits					
5.1. Banana	43,672	48,000	53,801	110.0	
5.2. Mango	3,672	11	(-) 3,661	0.3	
5.3. Papaya	906	181	(-) 725	20.0	
5.4. Pineapple	8,706	3	(-) 8,703	0.1	
5.5. Calamansi	433	142	(-) 291	32.7	
5.6. Mandarin	374	19	(-) 355	5.1	
5.7. Pomalo	348	25	(-) 323	7.2	
5.8. Guava	100	155	55	155.0	
5.9. Avacado	264	703	439	266.3	
5.10. Jock Fruit	823	-	(-) 823	0.0	
5.11. Water Melon	1,425	-	(-) 1,425	0.0	
5.12. Pili	26	38	12	146.2	
6. Sugarcane	11,185	-	(-) 11,185	0.0	Centifugal Sugar

Table E.1.30. Demand-Supply Balance of Rice (1986)

Municipality	Demand (ton)	Supply (ton)	Surplus/ (Deficit) (ton)	Self-Sufficiency Ratio (%)
I. Excluding Islands	60,345	39,674	(-) 20,671	65.7
1. Basey	5,177	4,629	(-) 548	(-) 89.4
2. Calbayog City	14,744	5,873	(-) 8,871	(-) 39.8
3. Calbiga	1,948	3,460	1,512	(-) 177.6
4. Catbalogan	8,262	418	(-) 6,844	(-) 5.0
5. Gandara	3,601	4,640	1,039	128.9
6. San Jorge	1,287	2,017	730	156.7
7. Hinabangan	1,392	65	(-) 1,327	(-) 4.7
8. Jiabong	1,587	1,464	(-) 123	(-) 92.2
9. Marabut	1,840	49	(-) 1,791	(-) 2.7
10. Matuginao	699	176	(-) 523	(-) 25.1
11. Motiong	1,452	1,888	436	130.0
12. Pinabacdao	1,402	3,113	1,711	222.0
13. San Jose de Buan	859	142	(-) 717	(-) 58.8
14. San Sebastian	642	454	(-) 188	(-) 70.7
15. Sta. Margarita	2,355	1,226	(-) 1,129	52.0
16. Sta. Rita	2,923	3,578	655	(-) 122.4
17. Talalora	858	150	(-) 708	(-) 17.5
18. Tarangnan	2,215	533	(-) 1,682	(-) 24.0
19. Villareal	2,918	2,701	(-) 217	(-) 92.6
20. Wright	3,127	2,509	(-) 618	(-) 80.2
21. Pagsanghan	977	589	(-) 388	(-) 60.3
II. Islands	9,848	646	(-) 9,202	6.6
1. Almagro	1,399	-	(-) 1,399	(-) 0.0
2. Daram	4,180	424	(-) 3,756	(-) 10.1
3. Sto. Niño	1,500	112	(-) 1,388	(-) 7.4
4. Zumarraga	1,718	110	(-) 1,608	(-) 6.4
5. Tagapul-an	1,051	-	(-) 1,051	(-) 0.0
III. Total	70,193	40,320	(-) 29,873	57.4

Source: Master Plan Study Team

Table E.1.31. Result of Farm Economy Survey (Opinion on Farm Management)

11.1 Plan on Farm Management Size and Scope within Fire Years from Now

No. of Sample Barangay	No. of Samples	Maintain Present Size and Scope	Expand Size and Scope				Reduce Size and Scope				
			Total	Crop Production	Animal Husbandry	Forestry	Fisheries	Total	High Cost of Production Inputs	Lack of Man Power	Unfavorable Sharing Arrangement
01	12	6	5	5							
02	10	2	8	7		1					
03	11	6	7	6	1						
04	10	4	8	8							
05	10	0	12	10	2						
06	10	4	6	6							
07	10	1	9	9							
08	10	3	9	9							
Total	83 (100.0)	26 (31.3)	64 (77.1)	60 (72.2)	3 (3.6)	1 (1.2)					

11.2 Obstacles to Improve Farm Management, Crop Production

No. of Sample Barangay	No. of Samples	Unfavorable Tenancy Arrangement	Inadequate Irrigation Water Supply	Flooding/ Ill-drainage	Poor Accessibility to farm Land	Inadequate formal Credit	Deficient Farm Machineries	Inadequate Extension Service	Water Pollution by Schisto Somiasis	Deficient Draft Animal	Inadequate Drying Pavement
01	12	1	8	7	3	3	6	5	7	5	5
02	10	1	8	8	4	6	6	1	7	6	5
03	11	-	3	6	3	1	2	1	4	5	5
04	10	2	8	2	1	1	7	3	-	6	5
05	10	1	5	5	6	1	5	3	4	7	2
06	10	-	8	8	5	5	4	6	5	4	4
07	10	5	4	10	4	7	3	-	-	9	5
08	10	-	8	7	10	3	6	6	1	9	2
Total	83 (100.0)	10 (12.0)	52 (62.3)	53 (63.9)	36 (43.4)	27 (32.5)	39 (47.0)	25 (30.0)	28 (33.7)	51 (61.4)	33 (39.8)

11.3 Obstacles to Improve Farm Management, Fisheries Production

No. of Sample Barangay	No. of Samples	Non-powered Fishing Boats	Poor Land Port Facilities and Access to Port	Inadequate Ice Supply and Cold Facilities	Inadequate Fishpond	Deficient Improved Nets	Poor Facilities of Fishpond	Others (Specify)
01	12							
02	10			1	1			
03	11							
04	10							
05	10							
06	10							
07	10							
08	10							
Total	83 (100.0)			1 (1.2)	1 (1.2)			

12. No. of Recipients of Governmental Extension Services

No. of Sample Barangay	No. of Sample	Crop Production	Livestock and Poultly	Forestry	Marine Fishing	Fish Culture	Cottage Industry	Cooperatives	Nutrition	Schistosomiasis Control	Others
01	12	7							4	8	
02	10	8							7	8	
03	11	6							8	3	
04	10	10	3						9	1	
05	10	6							7	8	
06	10	4							5	6	
07	10	1	1						-	-	1
08	10	3	2				1	2	5	-	
Total	83	45 (54.2)	6 (7.2)				1 (1.2)	2 (2.4)	45 (54.2)	34 (41.0)	1 (1.2)

Source: Master Plan Survey Team

Table E.2.1. Farming System and Infrastructure Requirement

Slope	Farming System		Infrastructure			Proposed Cropping Pattern
	Present	Proposed	Road	Irrigation	Drainage	
(%)	Paddy-Based (Rainfed, partially Irrigated)	Paddy-Based (Irrigated)	○	○	○	Paddy + Paddy, Paddy + Diversified crops Paddy fish culture
0 – 3		Paddy-Based (Rainfed)	○		○	Paddy + Diversified crops
	Coconut-Based (organic soil)	Coconut-Based	○			Coconut intercropping with paddy, root crops
3 – 8	Corn-Based	Corn-Based	○			Corn + Legumes/Root crops
	Coconut-Based	Coconut-Based (with Intercropping)	○			Coconut intercropping with root crops, pineapple, coffee, cacao, black pepper, banana, etc.
8 – 15	Shifting Farming	Coconut-Based	○			
15 – 18	Shifting Farming	Agro-Forestry	○			Root crops, Corn, Upland Rice, Fruit trees, Pili, Abaca, Coffee, Salago, Citronella, etc., Fast growing trees
	Grass/Shrub Land	Improved Pasture	○			Napier, Guinea grass, Desmodium ovalifolium Desmodium Heterophilum, Centrosema, Kudzu etc.
18 –	Grass/Shrub Land	Agro-Forestry				Same to Agro-forestry in 15 – 18 % slope area
	Forest	Forest				

Note: * Canarium ovatum ENG
** Thymelaeaceae wikstroemia SPP

Table E.2.2. Proposed Cropping Pattern

Cropping Pattern	Proposed			
	Medium Term		Long Term	
	Intensity (%)	Area (ha)	Intensity (%)	Area (ha)
1. Rice-Based, Irrigated	100	(7,000)	100	(11,800)
- Paddy + Paddy	55	3,900	55	6,500
- Paddy + Diversified crops*1	15	1,000	15	1,800
- Paddy + Fallow	30	2,100	30	3,500
2. Rice Based, Rainfed	100	(11,500)	100	(6,700)
- Paddy + Paddy	40	4,600	40	2,700
- Paddy + Diversified crops*2	10	1,100	10	700
- Paddy + Fallow	50	5,800	50	3,300
3. Corn-Based	100	(19,600)	100	(21,700)
- Corn + Other diversified crops*3	80	15,700	60	13,000
- Corn + Other diversified crops*3 with buffer strips*4	20	3,900	40	1,400
4. Coconut-Baced	100	(80,000)	100	(80,000)
- Coconut inter-cropping with annual crops*4	30	24,000	30	24,000
- Coconut inter-cropping with perennial crops*5	10	8,000	30	24,000
- Coconut mono cropping	60	48,000	40	32,000
5. Agro-forestry	100	(15,900)	100	(64,600)
- Diversified crops*3	10	11,600	10	6,400
- Abaca & Fruit trees*5	20	3,000	20	12,800
- Forest trees/shrub/	70	11,300	70	45,400
Total		(134,000)		(184,800)

Note: *1 ... Including stringbean, ampalaya, eggplant, etc.
*2 ... Including mungbean, peanut, corn, root crops, etc.
*3 ... Including corn, root crops, legumes, upland rice, vegetables, pineapple, pasture crops, etc.
*4 ... Including ipil-ipil, madre de cacao, etc.
*5 ... Including abaca, banana, black pepper, coffee, cacao, pili, lanzones, rambutan, guavano, citrus, salago, citroneda.

Table E.2.3. Crop Production

Crop	Future, With Project		
	Harvested Area ('000 ha)	Yield (ton/ha)	Production (ton)
1. Rice-Based, Irrigated (Subtotal)	20.1		91,200
(1) Paddy (Wet)	11.8	4.0*8	47,200
(2) Paddy (Dry)	6.5	4.0*8	26,000
(3) Diversified Crops*1	1.8	10.0	18,000
2. Rice-Based Rainfed (Subtotal)	11.3		19,360
(1) Paddy (Wet)	6.7	2.0*9	13,400
(2) Paddy (Dry)	2.7	2.0*9	5,400
(3) Diversified Crops (Dry)*2	0.7	0.8	560
3. Corn-Based (Subtotal)	36.9	3.4	146,600
(1) Corn	17.4	2.0*10	34,800
(2) Legumes*3	6.5	1.2	7,800
(3) Root Crops & Others*4	13.0	8.0	104,000
4. Coconut-Based (Subtotal)	105.5	29.0	314,400
(1) Coconut	73.6	1.5	110,400
(2) Corn/Legunes/Upland Rice	8.0	2.0*10	16,000
(3) Root Crops*5	12.0	12.0	144,000
(4) Pineapple	4.0	10.0	40,000
(5) Coffee/Cacao	4.0	0.5	2,000
(6) Black Pepper & Others	4.0	0.5	2,000
5. Agro-Forestry	19.2		27,520
(1) Abaca	6.4	0.8	5,120
(2) Diversified Crops*6	6.4	2.0	12,800
(3) Fruit Trees & Others*7	6.4	1.5	9,600
Total			507,080

Note: *1 ... Represented by stringbean
*2 ... Represented by mungbean
*3 ... Represented by peanut
*4 ... Represented by sweet potato
*5 ... Represented by cassava
*6 ... Represented by corn
*7 ... Represented by pili
*8 ... 3.5 ton/ha "without flood control"
*9 ... 1.8 ton/ha "without flood control"
*10 ... Average yield in the corn-based area and other areas

Table E.2.4. Total Labor Requirement of Crop Production

Crop	Present: Planted Area ('000 ha)	Present: L.R*8 (man-day/ha)	Present: Total of L.R ('000 man-day)	Future, With Project: Planted Area ('000 ha)	Future, With Project: L.R (man-day/ha)	Future, With Project: Total of L.R ('000 man-day)
1. Rice-Based, Irrigated (Subtotal)			428			1,928
(1) Paddy (Wet)	3.0	95	285	11.8	90	1,062
(2) Paddy (Dry)	1.5	95	143	6.5	100	650
(3) Diversified Crops (Dry)*1	-			1.8	120	216
2. Rice-Based Rainfed (Subtotal)			1,786			986
(1) Paddy (Wet)	13.4	95	1,273	6.7	100	670
(2) Paddy (Dry)	5.4	95	513	2.7	100	270
(3) Diversified Crops (Dry)*2	-			0.7	65	46
3. Corn-Based (Subtotal)			1,985			2,648
(1) Corn	11.7	80	936	17.4	70	1,218
(2) Legumes*3	4.4	100	440	6.5	90	585
(3) Root Crops & Others*4	8.7	70	609	13.0	65	845
4. Coconut-Based (Subtotal)			4,469			5,860
(1) Coconut	70.2	55	3,861	73.6	50	3,680
(2) Corn/Legumes/Upland Rice	3.8	80	304	8.0	70	560
(3) Root Crops*5	7.6	70	304	12.0	65	780
(4) Pineapple				4.0	90	360
(5) Coffee/Cacao				4.0	60	240
(6) Black Pepper & Others				4.0	60	240
5. Agroforestry			980			1,888
(1) Abaca	4.0	245	980	6.4	185	1,184
(2) Diversified Crops*6	-			6.4	70	448
(3) Fruit Trees & Others*7	-			6.4	40	256
Total			9,648			13,310

Note: *1 ... Represented by Stringbean
*2 ... Represented by Mungbean
*3 ... Represented by Peanut
*4 ... Represented by Sweet Potato
*5 ... Represented by Cassava
*6 ... Represented by Corn
*7 ... Represented by pili
*8 L.R ... Labor Requirement

Table E.2.5. Total Labor Requirement of Animal Husbandry and Freshwater Fish Culture

Item	Present (1986): Unit	Amount ('000)	L.R (man-day)	Total of L.R ('000 man-day)	Future, With Project: Unit	Amount ('000 head)	L.R (man-day)	Total ('000 man-day)
1. Animal Husbandry				658				1,316
(1) Carabao	Head	33.1	15	497	Head	66.2	15	993
(2) Cattle	- do -	1.4	15	21	- do -	2.8	15	42
(3) Goat/Sheep	- do -	5.5	5	27	- do -	11.0	5	55
(4) Swine	- do -	66.9	20/25	27	- do -	133.8	20/25	54
(5) Chicken	- do -	256.3	100/315	81	- do -	512.6	100/315	163
(6) Ducks	- do -	14.5	100/315	5	- do -	29.0	100/315	9
2. Freshwater Fish Culture	ha				ha	1.0	28	28
3. Total				65.8				1,344

Table E.2.6. Proposed Agricultural Development Schemes (Master Plan)

Subproject	Description per Site	Location	Stage
1. Demonstration of Paddy-Based Farming System			
1.1. Irrigated Paddy/Diversified Crops Cultivation	- Objective: demonstrate the improved cultivation of irrigated paddy/diversified crops - Scale: ten (10) to twenty (20) ha, a group of five (5) to ten (10) farmers (one turn-out area) - Major facilities/Equipments ° On-farm development: ten (10) to twenty (20) ha ° Power tiller: two (2) to three (3) units ° Knap-sack typed power sprayer: two (2) to three (3) units ° Power thresher: one (1) unit ° Planting materials/ farm inputs: L.S	Four (4) sites, each one site in A, B, C and D areas, where these areas are as follows hereafter; A ... Jamonmi area B ... Gandara - San Jorge area C ... Calbiga area D ... Basey area	I
1.2. Rainfed Paddy/Diversified Crops Cultivation	- Objective: demonstrate the improved cultivation of rainfed paddy/diversified crops - Scale: five (5) to ten (10) ha, five (5) to ten (10) farmers - Major facilities/Equipments ° Planting materials/farm inputs: L.S.	Four (4) sites, each one site in in A, B, C, and D areas	I
2. Demonstration of Corn-Based Farming System			
2.1. Corn Cultivation	- Objective: demonstrate the improved corn cultivation with soil amendment by tractor - Scale: five (5) to ten (10) farmers - Facilities/Equipments ° Tractors: two units (70 and 30HP classes) ° Powered corn sheller(10-20 kg/hr): one (1) unit ° Mini workshop: one (1) unit ° Planting materials/farm inputs: L.S	One (1) site in B area Two (2) sites, each in A and C area	I II
3. Demonstration of Coconut-Based Farming System			
3.1. Development of coconut Intercropping	- Objective: demonstrate coconut intercropping together with planting in the suited vacant land with coconut improved varieties or replanting with improved varieties - Scale: ten (10) to twenty (20) ha, five (5) to ten (10) farmers - Facilities/Equipments: ° Development of farm: ten (10) to twenty (20) ha ° Planting materials/Farm inputs: L.S	Each one site in 21 municipalities	I
3.2. Pest/Disease Control Laboratory	- Objectives: pest control by biological method for Rhinoceros beetles (baculo virus and green muscardine fungus.) - Scale: province-wise - Facilities/Equipment: ° Laboratory and equipments: one (1) set ° Laboratory materials: L.S	Catbalogan	II
4. Development of Abaca and Other Fiber Crops			
4.1. Abaca Seed Bank	- Objective: multiply and and supply the seedlings of improved varieties - Scale: five (5) ha of nursery - Facilities/equipments: ° Nursery five (5) ha ° Office/warehouse building one (1) unit ° Tractor & equipment: one (1) unit ° Stripping machine & others: L.S		I

Subproject	Description per Site	Location	Stage
4.2. Development of Abaca Farming	- Objective: demonstrate the improved Abaca cultivation and multiply the improved variety seedlings	Three (3) sites, each, A, B and and areas	I
	- Scale: ten (10) to twenty (20) ha, of demonstration farm	Three (3) sites in A, B, C and D areas	II
	- Facilities/Equipments: ° Stripping machine (10-20 kg/hr): one (1) unit ° Planting materials/farm inputs: L.S		
4.3. Introduction of Other Fiber Crops than Abaca	- Objective: trial and demonstration of other fiber crops than Abaca, ramie and others - Scale: five (5) to ten (10) ha, five (5) to ten (10) farmers - Facilities/Equipments: ° Planting materials/farm inputs: L.S	Three (3) sites, each in A, B and C areas	II
5. Trial/Demonstration of Agro-Forestry			
5.1. Demonstration of Contour/ Hillside Farming	- Objective: demonstrate contour/hillside farming - Scale: five (5) to ten (10) ha, five (5) to ten farmers	Four (4) sites, each in, A, B, C and D areas	I
	- Facilities/Equipments: ° Development of contour/hillside farm land five (5) to ten (10) ha ° Planting materials/farm inputs	Six (15) sites in A, B, C and D areas	II
5.2. Development of Agro-forestry	- Objectives: trial/demonstration of agro-ferestry - Scale: ten (10) to twenty (20) ha - Facilities/Equipments: ° Development of land: ten (10) to twenty (20) ha ° Planting materials/farm inputs: L.S	Four (4) sites, each in A, B, C D areas Ten (10) sites in A, B, C and D areas	I II
6. Livestock Development			
6.1. Carabao Dispersal	- Objective: disperse female carabaoes to carabao-less farmers - Scale: five (5) to ten (10) recipients - Facilities/Equipments: ° Stock carabao (two to three years female carabao): five (5) to ten (10) heads ° Stall: one (1) unit	21 municipalities	I
6.2. Strengthening of Gandara Breeding Station (Large Animal Artificial Insemination)	- Objective: render artificial insemination services to large animal raisers. (Province-wise) - Facilities/Equipments: ° Semen processing facilities and other equipments : L.S ° Vehicles (Pick-up, 125 cc motor cycle): each one (1) unit	One (1) site, attached to Gandara	I
6.3. Swine Artificial Breeding Center (SABC)	- Objective: render artificial insemination services to swine raisers (one-third of province) - Facilities/Equipments: ° Pig pen: one (1) unit ° Equipment for insemination ° Stock: two (2) boars	One (1) site in Calbayog One (1) site in Calbiga	I I
6.4. Swine Breeding Center	- Objective: produce piglets for selected recipient farmers - Facilities/Equipments: ° Pig pen: one (1) unit ° Stock: ten (10) sows and one (1) boar ° Building and equipments: one (1) unit	One (1) site, attached to Calbayog SABC	II
6.5. Sheep/Goat Dispersal	- Objective: disperse sheep/goat - Scale: ten (10) to twenty (20) bucks to five (5) to ten (10) recipients	Two (2) sites in B area	I
	- Facilities/Equipments: ° Goat/Sheep breeding module: one (1) unit ° Stock: ten (10) to twenty (20) bucks and one doe.	Six (6) sites in A, C and D areas	II

Subproject	Description per Site	Location	Stage
6.6. Sheep/Goat Stock Production Center	- Objective: produce stock sheep/goat for dispersal program - Scale: One hundred (100) sheep and one hundred (100) goat (breeder stock) - Facilities/Equipments: ° Sheep/Goat house: each one (1) unit ° Pasture establishment: 10 ha ° Building and equipments: L.S	One (1) site, attached to the Gandara Breeding Station One (1) site, Calbayog	I I
6.7. Duck Dispersal	- Objective: produce of ducklings for dispersal and disperse four (4) female and one (1) male ducklings to forty (40) farmers per Barangay - Scale: one hundred (100) duck - Facilities/Equipment: ° Duck house: one (1) unit ° Incubator and equipments: L.S ° Stock: 100 heads	One (1) site Same site to the Gandara Breeding Station	I
6.8. Broiler Cockerel Dispersal	- Objective: produce five (5) to six (6) months cockerels for dispersal program and disperse each two (2) head of cockerel to five (5) to ten (10) recipients per Barangay - Scale: 1,000 heads of hen - Facilities/Equipments: ° Poultry house: one (1) unit ° Hen stock: 1,000 heads ° Building and equipments: one (1) unit	One (1) site (126 Barangays) Same site to the Gandara Breeding Station	I
6.9. Egg Farm	- Objective: demonstrate the improved egg farm management - Scale: 2,000 heads - Facilities/Equipments ° Poultry house (2,000 heads): one (1) unit ° Building and equipment: one (1) set	One site	III
6.10. Cattle Raising	- Objective: demonstrate the improved cattle raising - Scale: 50 heads - Facilities/Equipments: N.A ° Stall and equipments: one (1) unit ° Improved pasture: fifteen (15) ha	Five (5) sites two site in B Area, three sites in A, C, and D areas	III
6.11. Slaughter House Remodelling	- Objective: remodel municipal slaughter house - Scale: N.A - Facilities/Equipments: ° Slaughter house one (1) unit ° Building and equipment one (1) unit	Five (5) sites (municipalities) Sixteen (16) sites (minici-palities)	II III
6.12. Animal Diagnostic and Treatment Center	- Objective: extend the animal diagnostic treatment services - Scale: N.A - Facilities/Equipment ° Dispensary building one (1) unit ° Medical equipment and materials L.S	One (1) site Same site to the Gandara Breeding Station	I
7. Inland Fishery Development			
7.1. Establishment of Inland Fishery Hatchery and Integrated Fishing Model (Fish-Livestock-Crops)	- Objective: produce fry of tilapia, carp etc. and demonstrate the integrated - Scale: 1,500 breeders stock - Facilities/Equipments: ° Pond unit system: four (4) units ° Concrete hatching/breeding tanks: four (4) units ° Integrated fish farm: one (1) set ° Office building for training and laboratory work with equipments: one (1) set	One Site	I
7.2. Nursery Pond and Integrated Fish Model	- Objective: raise fry to fingerlings and demonstrate the integrated fishing model - Scale: 500 m^2 of nursery pond - Facilities/Equipments: ° Nursery pond (500 m^2): one (1) unit ° Integrated fish farm: one (1) set	Three (3) sites in A, B and C areas	II

Subproject	Description per Site	Location	Stage
7.3. Demonstration of Freshwater Fishuculture	- Objective: demonstrate freshwater fishculture - Scale: 50 m^2 of backyard - Facilities/equipment ° Backyard fishponds (50 m^2) ° Fish cage	Two (2) sites each in A, B, C and D areas five (5) units five (5) units	I
8. Municipal Nursery Station	- Objective: produce/supply the improved fruit trees, trees for soil conservation etc. - Scale: five (5) to ten (10) ha - Facilities/Equipments: ° Nursery farm: five (5) to ten (10) ha ° Farm tools and facilities: one (1) set ° Office building and equipments: L.S ° Vehicles (pick-up): one (1) unit	Four (4) sites (municipalities) Fifteen (15) sites (municipalities)	I II
9. Soil Test and Inoculants Production Laboratory	- Objective: conduct soil test and produce soil inoculants and mashroom spawn - Facilities/Equipments: ° Laboratory and office building: one (1) unit ° Equipments for soil analysis, and for production of soil inoculants and mashroom spawn: one (1) set ° Vehicles one (1) unit	One (1) site	I
10. Development of Seed Production Facilities			
10.1. Seed Analysis Laboratory	- Objective: test seed quality - Facilities/Equipments: ° Laboratory and Office building: one (1) unit ° Equipments: L.S	One (1) site	I
10.2. Strengthening of Gandara Seed Farm	- Objective: complete the warehouse building of the seed processing equipment and renew farm machinery - Scale: 200 m^2 - Facilities/equipment ° Warehouse building one (1) unit ° Tractor and attachment	One (1) site, Gandara seedn farm	
11. Crop Protection System Development with Emphasis on Surveillance and Early Warning System	- Objective: detect pest infection before pest control activities for the economic control - Scale: sixty-eighty (68) Observation Station with fifty (50) ha. per Observation Station - Facilities/Equipments: ° Farmer Center: four (4) units ° Vehicles (pick-up): one (1) unit ° Motor cycle: eighteen (18) units ° Surveillance equipments: L.S	Province-wise	I
12. Barangay Management Development Project	- Objective: develop Barangay management through training Barangay officials and people - Facilities/Equipment: ° Vehicles (micro-bus): one (1) unit ° Audio visual equipments: one (1) set	Province-wise	I to III
13. Barangay-Based Multi-Purpose Agricultural Cooperative Development	- Objective: organize and develop Barangay-Based Multi-Purpose Agricultural Cooperative Development through revitalization of Samahang Nayon - Facilities/Equipments:	Province-wise	I to III
14. Development of Post Harvest			
14.1. Post-Harvest of Rice	- Objective: demonstrate the improved post-harvest - Scale: 300 ha, two(2) to three(3) Barangays - Facilities/Equipments: ° Dry pavement: 1,500 m^2 ° Mechanical dryer: one (1) unit ° Platform scale and other equipments: L.S ° Warehouse: 300 m^2 ° Rice mill (1 ton/hr): one (1) unit ° Trucking facilities: one (1) unit	One (1) site in B area Three (3) sites, each in A, C, and D area	I II

Subproject	Description per Site	Location	Stage
14.2. Post-Harvest of Coconut	- Objectives: demonstrate the improved coconut post-harvest - Scale: 100 ha - Facilities/Equipment: ° Copra dryer (2,000 nut/day): two (2) units ° Charcoal kiln (7,000 nut/48 day): one (1) unit	Four (4) sites, each in A, B, C and D areas	I
14.3. Coconut Timber Utilization	- Objectives: demonstrate the utilization of coconut timber - Scale: one (1) Banangay - Facilities/Equipments: ° Chain saw (33 cc): five (5) set ° Circular saw: five (5) set	Two (2) sites, each in A and B areas	I
15. Marketing Assistance Center	- Objective: assistant the marketing of farm inputs and produces - Scale: Agricultural marketing organization at municipal level - Facilities/Equipment: ° Office Building and Office equipments ° Vehicles (Jeep, Truck, Pick-up)	Four sites, each one in A, B, C and D areas	I
16. Functional Farmers' Dwelling Development	- Objective: demonstrate functional farmers' dwellings - Scale: one (1) unit of model dwelling - Facilities/Equipment ° Model dwellings: one (1) units	One (1) site in B area Each one site in A, C and D areas	I II
17. Agricultural Development and Promotion Center	- Objective: promote agricultural development with implementation of the Samar Integrated Agricultural/Rural Development - Scale: one Center in Gandara with three Sub-Centers in Calbayog, Calbiga and Basey - Facilities/Equipments: (Center) ° Building, workshop and warehouse: 1,700 m^2 ° Office and audio-visual equipments: L.S ° Farm machineries and farm inputs: L.S ° Training room, and Laboratory: L.S ° Vehicles L.S (Sub-Center) ° Building, workshop, and warehouse ° Office and equipment ° Training room ° Vehicles	One center and three Sub-Centers	I

Table E.2.7. Location of Agricultural Development Schemes (Master Plan)

	Municipality	1 Rice-Based, Irrigated Demo.	2 Rice-Based, Rainfed Demo.	3 Corn-Based Demo.	4 Coconut-Intercropping Demo.	5 Abaca Seed Bank	6 Abaca Farming Demo.	7 Pest Control (Coconut)	8 Other Fiber Crops Demo.	9 Countour/Hillside Farming	10 Agro-Forestry	11 Carabao Dispersal	12 Artificial Insemi. (Large)	13 Artificial Insemi. (Small)	14 Swine Breeding Center	15 Sheep/Goat Dispersal	16 Sheep/Goat Stock	17 Duck Dispersal	18 Broiler Cockerel	19 Egg Farm	20 Cattle Raising	21 Slaughter House	22 Diagonostic and Treatment	23 Hatchery Station	24 Nursery Pond	25 Freshwater Fisheulture Demo.	26 Municipal Nursery	27 Soil Test Labo.	28 Seed Analysis Labo.	29 Gandara Seed Farm	30 Crop Protection	31 Barangay Management	32 Multi-purpose Agri. Coop.	33 Post-Harvest (Paddy)	34 Post-Harvest (Coconut)	35 Timber Utilization (Coconut)	36 Marketing Assistance	37 Farmers' Dwelling	38 ADPC (Center)	39 ADPC (Sub-Center)
1.	Total	4	4	3	21	8	6	1	3	4	4	21	1	2	1	8	2	1	1	1	5	21	1	1	3	8	19	1	1	1	4	4	4	4	4	2	4	4	1	3
2.	Gandara/San Jorge Area	1	1	1	7	2	3	1	1	1	1	7	1			2	1	1	1		2	7	1	1		2	5	1	1	1	1	1	1	1	1	1	1	1		
	(1) Gandara		1		1	1	1		1			1	1			1	1	1	1		1	1				1					1	1	1				1	1	1	
	(2) San Jorge	1		1	1	1				1	1	1				1					1	1	1	1		1	1			1				1	1	1				
	(3) Tarangnan				1							1										1					1													
	(4) Pagsanghan				1							1										1																		
	(5) Matuguinao				1		1					1										1					1													
	(6) San Jose de Buan				1		1					1										1					1													
	(7) Catbalogan				1			1				1										1					1	1	1											
3.	Calbayog Area	1	1	1	2	2	2		1	1	1	3		1	1	2	1		1		1	3			1	2	2				1	1	1	1	1	1	1		1
	(1) Calbayog	1		1	1	1	1	1	1	1	1	1		1	1	1	1					1			1	1	1				1	1	1	1	1	1	1		1
	(2) Sta. Margarita		1		1	1	1					1				1					1	1				1	1												
4.	Calbiga Area	1	1	1	9	2	1		1	1	1	9		1		2				1	1	9			1	2	9				1	1	1	1	1	1	1		1
	(1) Jiabong				1							1								1		1					1												
	(2) Motiong				1							1										1			1		1												
	(3) Wright				1	1						1										1				1	1												
	(4) San Sebastran				1							1										1					1												
	(5) Hinabangan				1		1					1				1						1					1				1	1	1				1	1		1
	(6) Calbiga	1		1	1	1			1	1	1	1		1		1						1				1	1							1	1				
	(7) Pinabacdao		1		1							1										1					1												
	(8) Villareal				1							1									1	1					1												
	(9) Taralora				1							1										1					1												
5.	Basey Area	1	1		3	2				1	1	3				2					1	3			1	2	3				1	1	1	1	1	1	1		1
	(1) Sta. Rita											1										1					1												
	(2) Basey	1	1		1	1				1	1	1				1						1			1	1	1				1	1	1	1	1	1	1		1
	(3) Mrabut				1	1						1				1						1				1	1												

APPENDIX F. IRRIGATION AND DRAINAGE

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F.1. Irrigation Plan

F.1.1. Present Condition

1) Irrigation system

The acreage of about 18,000 ha, is used as paddy fields based on 1980 census. In the northern and central part of the area the terrain of the land is mountainous such that paddy fields are laid on a narrow gorge. On the other hand, many paddy field were observed in the low laying area on the southern part. The paddy field which is located at an alluvial plain, has an elevation less than five meter.

The total potential irrigable area of 1,827 ha is paddy fields under 29 CISs undertaken by the NIA which each CIS has a gross acreage from 20 to 270 ha. However, only 271 ha are actually irrigated in dry and wet seasons as of June 1986 due to some reasons (refer to Table F.1.1). Furthermore, there are also 1,589 ha of the potential irrigable area by another system, under the former FSDC which was reorganized in 1987. Under this system only 5% from the gross area were actually irrigated as of June 1986.

2) On-farm facilities

There are some on-farm facilities in the CISs and PISs areas. After big flood gave severe damages on an intake facility, those facilities were not maintained by farmers because of no water reaching to a field. On the general plan of CISs, the proposed density is 9.3 m/ha on an average. After they are damaged, these facilities became idle. The density of the existing on-farm facilities is quite small compared with the standard which is 60 m/ha (refer to Table F.1.2). In the present operational CIS area,

the small scale on-farm facilities are observed to be well functioning. These on-farm facilities are not lined in the area.

The farm drains and farm roads were not constructed for draining excess water on the field which causes the stagnation of shallow water. So, this is one of the reasons why the schistosomiasis is spreading over in the Study Area. These stagnant water presents the conditions to multiply snails as an intermediate host of cercaria.

F.1.2. Problems on Existing Irrigation System

1) CIS

Based on the results of the field investigation, out of 23 CISs confirmed by the Study Team, only three CISs were partly functional, which have a stable water source of a spring or a stream flow. Three CISs are Danao CIS located in the northern part, Calapi and Aporonia CISs are in the central part of the Study area (refer to Figure F.1.1). In those CISs, comparatively adequate amount of irrigation water is available even in the drought year 1986/87 (the estimated drought probability is about 1/25 based on the hydrological analysis and the information from the farmers), therefore, the farmers in those areas can enjoy double cropping in a year.

However, those CISs have also some problems, such as; Danao CIS has sedimentation problem at the diversion dam; water source of Calapi CIS has high content of lime-element, the elements scaled on the concrete structures and the insides of a reinforced concrete pipes as part of the main irrigation canal. The scaled limes will absolutely reduce the flow area of irrigation water intaked for the irrigation fields. In Aporonia CIS, rehabilitation and extension of a concrete lined canal is deemed necessary to be more effective.

Whereas, about 20 more remaining CISs were reportedly completed but still not in operational due to the following reasons based on the informations gathered from farmers as results of the field investigation. The CISs indicated in Figure F.1.1, are under following reasons.

Reason A - Damaged intake facility by flood during typhoon (CIS No. 5, 10, 12, 13, 14, 15, 18 and 21)

Since farmers are cultivating the mountainous slopes by means of KAINGIN system, all vegetation were cut down and burned in order to convert to an upland field. The drainage conditions changed to nearly bare land. Therefore, the present flood discharge designed with a probability of 1/50 do not matched the actual flood discharge amount. Thus, land sliding and scoring of the apron at downstream of the diversion dam were founded. The over flooding of the dam structures and the floating logs and debris gave damages the intake facilities. There were also due to small capacity of a spill way.

Reason B - Pumping facilities without maintenance and operation (CIS No. 7 and 17)

Since a pump-house, equipment and other facilities were submerged during floods and spare parts of the pump and machines were unavailable in domestic trade, the pump to lift irrigation water from a river or a stream was not in operational. The high operation cost due to high fuel price or high electricity are also inviting no operational condition in pump irrigation system.

Reason C - Problems on conceptual stage versus construction stage. (CIS No. 11, 12, 17, 18, 19, 26 and 30)

The project was objectively designed for optimum irrigation purposes, but due to careless actual implementation some projects became unoperational. In this case, the project might have not been properly inspected before it was designed.

The site location of the intake facility, the elevation of the highest possible flood and actual instrumentation survey between intake and outlet for distribution structures were not properly investigated on the field, thus, rendering some projects unoperational.

Reason D - Poor appurtenant structures on irrigation system (CIS No. 12, 13, 15, 18, 25, 27 and 29)

One problem to point out also was no substructure of an irrigation system, such as; foot bridges and animal crossings thus, a canal are easily be damaged after the construction.

Reason E - No water right system (CIS No. 20)

The water right for any purposes was, at present, not established in Philippines. The existing facility can not, therefore, intake irrigation water for the reason that farmers living upstream of the river intercept the water flowing downstream to irrigate their fields.

Reason F - Shortage of found for construction and rehabilitation (CIS No. 9, 10, 12, 26 and 30)

Some CISs need enough amount of budget to implement the project and to rehabilitate the facilities in the CIS area. The farmers in the beneficial area are waiting for the found in order to complete the irrigation project. The some CIS was interrupted on the construction stage because of shortage of fund.

Reason G - Non-well active Irrigators' Association (CIS No. all systems described in the above items)

Irrigators' Association (IA) was usually organized by farmer's themselves after completion of the irrigation system. However, they have poor knowledge of management of facilities and water management on the system. Consequently, the expected benefit could not obtained from the irrigation system.

2) PIS

FSDC had constructed 21 PISs in Samar province from 1979 to 1982. However, those systems are placed on the poor conditions because of the following reasons (refer to Figure F.1,2).

- All pump irrigation projects have a combination of both engine and pump. These are provided with a pump shade and an engine house. The pump foundation is separated from the engine foundation installed alongside the river bank.

The pump irrigation projects were not secured by riprap alongside of pump-house on the river bank to insure the possible erosion caused by flooding of the river.

- Engine house is made up of semi concrete structure, quite big enough to accommodate the whole engine components. Maintenance of the engine needs a technical man having an expertise to fully supplement the need of operation.

- Projects are on remote areas which cannot be reached immediately whenever needs for fuel and other are an immediate necessity.

- In behalf of ogee concrete dam structure are secured by flash boards to impound water whence provising a small opening to maintain the control of water on the upper stream. Concrete baffles block were not so secured by rubble concrete to a certain distance so as to ensure the scorned effect by water turbulence.

- Some road crossings were only utilized by an undersized concrete pipes where maintenance cannot be possible done by persons. To generally pinpoint the very main effect of all this project that does not so productive of what is supposed to expect was that all main canals are just constructed by an earth canal.

All of the above defects stated herein may be in due consideration of some financial constraints that proper distribution of water to irrigable areas were not highly technical in completion. In view of this defects and contrary to being a weakness of this irrigation on to that materialization of benefits, quality of construction and advanced design would be an interesting concept for a conventional irrigation management systems.

F.1.3. Basic Concept to Rehabilitate Existing Facilities

For rehabilitation of existing irrigation systems and for propose of the new irrigation project, the present facilities should be reviewed specifically on the point of view in the planning on conceptual stage. In all proposed irrigation projects, following ideas would be considered based on review and field investigation of existing facilities conducted.

As for the paddy fields without the irrigation system, it is the most necessary that the irrigation project will be carried out the soonest possible time to get stable and high farm income from the rice production and agricultural cultivation and other related countermeasures.

1) Gravity irrigation system

Availability of gravity irrigation system should be firstly considered in order to minimize operation and maintenance fee of the system by the farmers.

2) Hydro-pump for irrigation or rural water supply

Hydro-pumps may be used at the place where exists the hydraulic head at a small fall and on a rapid stream. This system also get irrigation water with lower cost for O & M. When the irrigation system is introduced in a farm land, upland crop irrigation system and rural water supply system will be easily produced in the area because of high pressured water. However, the amount of lifted water is comparatively limited.

3) Dual purpose pumping station

During the period of crop growing months from January to June, the stable and adequate amount of rainfall will not be expected in every year. On the other hand, there are many poor drainage areas which provided favorable condition for growing snails as an intermediate host of schistosomiasis. In order to solve these problems and minimize construction cost, it is useful to propose the dual purpose pumping station in the problem area such as rainfed and the schistosomiasis endemic area. Dual purpose pumping irrigation and drainage system may use electric power generated by a proposed mini hydro-power station.

4) Tidal gates

Since rivers and streams are tidal in the low laying area, the farmers can not use water of the rivers and streams for irrigation and other purposes. When the fresh water resources are not found in and around the area, the proposed irrigation system by gravity or pump on the existing tidal streams may be provided with a tidal gate or a weir in order to store fresh water in the upper stream, to rise water level up and specially to protect salt water intrusion.

5) Lined canal

In the schistosomiasis endemic areas, main canal and canal structures should be concrete-lined in order to protect leakage of water and to interrupt multiply circumstances of snails (Oncomelania quadrasi) as an intermediate host of cercaria (infective stage) and in order to reduce conveyance loss of irrigation water because lifted water under pumping irrigation systems is very costly.

6) Small water impounding management reservoir

The details are described in Appendix F.5.

F.1.4. Irrigation Planning

1) Effective rainfall

According to the results of analysis in Appendix C.4.2, for the first crop the effective rainfall ratio of 68% and for second crop the ratio of 70% were calculated.

2) Cropping calendar

In order to increase farm income and to reach self sufficient of rice, double cropping system would be recommended (refer to Figure F.1.3).

3) Irrigation efficiency

Irrigation efficiency (0.51), generally, consists of conveyance efficiency (0.85), field canal efficiency (0.8) and field application efficiency (0.75), considering the irrigation system through main and lateral irrigation canals which would be provided to deliver irrigation water to a farm ditch or a farm land.

4) Evapotranspiration

The monthly evapotranspiration of crops would be calculated by the Penman Method. The basic data such as mean temperature, humidity, wind velocity, cloudiness and so on at the Catbalogan observatory, PAGASA, were used for calculation of evapotranspiration. The maximum and minimum ratios of evapotranspiration of 6.1 and 2.9 mm/day were occurred on April and January, respectively (refer to Tables F.1.3 and F.1.4).

5) Water requirement on preparatory works

Irrigation water will be necessary for the preparatory works such as ploughing, harrowing and land leveling before transplanting of paddy when the farmers meet no adequate amount of rainfall. The amount of water requirement on the preparatory work (WR) would be calculated by a following equation.

$$WR = SW + S1 + S2 + EV + P + SL$$

- A standing water depth (SW) of 50 mm is assumed for transplanting of paddy.
- The thickness of the surface soil is an assumed value of 100 mm and a porous content of 15%. Therefore, the amount of water (S1) to saturate the top-soil is 15 mm (= 100 x 0.15).
- The thickness of the sub-surface layer is assumed 150 mm and a porous content of 10%, therefore, the water to be required for saturation (S2) of sub-surface soil is 15 mm (= 150 x 0.10).

- The preparatory works will be done in December and January for the first crop and May to June for second crop. During this periods, the evapotranspiration rates (EV) are 3.3 mm/day =(3.6 + 2.9)/2 for former and 5.4 mm/day = (5.9 + 4.9)/2 for latter, respectively. A duration of the preparatory works is fixed at 30 days before transplanting. During the period, supplemental water should be given to the field to protect drying-up of soil. The percolation (P) and seepage loss (SL) of one millimeter per day was assumed. So, the total amount of water of this item is estimated at 130 mm ((3.3 + 1.0) x 30 = 129 mm, say 130 mm) for the first crop and 190 mm ((5.4 + 1.0) x 30 = 192 mm, say 190 mm) for the second crop, respectively.

- The amount of water depth of 210 mm (= 50 + 15 + 15 + 130) would be necessary for the preparatory works of the first crop, and also 270 mm for the second crop.

- Water for the preparatory works will be given on a field at three times.

Application	First Crop	Second Crop
First application of water at 30 days before transplanting	80 mm	110 mm
Second application at 15 days before transplanting	80 mm	110 mm
Third application of water at one day before transplanting	50 mm	50 mm

6) Irrigation return flow

Considering the location of the irrigable area and irrigation method of paddy cultivation, some amount of return flow of irrigation water would be expected in the area. There is no observation data to estimate and amount of return flow. From viewpoint of the irrigation efficiency of 51% for paddy irrigation, the rate of more than 30% of the amount of irrigation water will be expected to re-use water for irrigation. For the study, the rate of 30% of the amount of the paddy irrigation would be assumed and applied for irrigation planning. In this case, some suitable facilities would be required to catch water at the downstream of the irrigation system.

7) Irrigation method

In order to give easy operation of irrigation system to farmers in the irrigable area, the rotational irrigation system would be adviced.

F.1.5. Proposed Irrigation Acreage of Paddy Field

The proposed acreage of a paddy field to be irrigated to meet the self sufficient of milled rice in the target year would preliminary calculated. Based on the 1980 census, 58,000 tons in paddy was produced. On the other hand, milled rice consumption of 100 kg per capita would be assumed based on the agricultural statistic data by NSCO. The total consumptions in paddy in 1985 and the tentative target year when the population will reach at 20% increment of the present one, are 86,000 and 103,000 ton in paddy, respectively. The annual shortage in paddy in 1985 and in the target year would become at 28,000 and 45,000 ton in paddy, respectively.

The total proposed irrigation area by using the tentatively proposed yield of 3.5 ton/ha would be calculated at 7,400 ha in 1985 and 11,800 ha in the target year (refer to Table F.1.5).

F.1.6. Water Quality

Water of almost all rivers and springs in the Study Area has no problem for irrigation purpose without salinity (about 200 to 300 ppm) and also has a small amount of alkalinity of PH 7.5. However, water near the river mouth shows a high salt concentrations of 1,500 to 30,000 ppm. These water cannot be used for irrigation and other purposes. The nipa palm is one of the sign of the salty water, because these plants cannot exist without salt. Sapinit River which is one of the tributaries of said Gandara River, has a small quantity of acidity of PH 6.6 which might be caused by peat soils or rotten glasses because of sub-mergence (refer to Table F.1.6 and Figure F.1.1).

Table F.1.1. Present Condition of Existing CISs by NIA in Samar Province

Item	Number	Potential Area (ha)	Irrigated Area Dry Season (ha)	Irrigated Area Wet Season (ha)
Total CISs	30	1,937	271	271
a. Constructed CIS	29	1,827	233	233
a.1. Investigated by the Team	23	1,612	233	233
Operational	3	430	233	233
Non-operational	20	1,182	-	-
a.2. Non-Investigated	6	215	38	38
Operational	1	60	38	38
Non-operational	5	155	-	-
b. Underconstruction	1	110	-	-

Table F.1.2. Present Condition of CIS's Facilities

No.	Name of CIS	Potential Area (ha)	Irri. Area (ha)	Type of Diversion	Irrigation Facilities M. Canal (km)	L. Canal (km)	On-farm (km)	Total (km)	Density (m/ha)
1	Danao	125	53	Ogee	2.3	1.8	3.4	7.5	60
2	Calapi	270	170	Intake	2.2	-	1.5	3.7	14
3	Camaroboan	120	46	Ogee	0.5	0.3	1.1	1.9	16
4	San Andres	60	38	-do-	2.2	-	-	2.2	37
5	Mambog-Tadcan	47	20	Pump	0.7	-	-	0.7	15
6	Tagalog	45	15	Ogee	1.4	-	2.1	3.5	78
7	Lanagan	60	20	Pump	0.6	-	0.6	1.2	20
8	Placer	20	15	Ogee	1.0	0.4	-	1.4	70
9	Tabucan	70	5	Reservoir	1.2	-	-	1.2	17
10	Panaruan	75	-	C. Gate	2.6	1.0	-	3.6	48
11	San Antonio	20	-	Ogee	1.2	-	-	1.2	60
12	Pagsolhogon	100	-	C. Gate	3.5	1.6	6.1	11.2	112
13	Hinikaan	20	-	Intake	0.6	-	-	0.6	30
14	Quezon	20	-	Ogee	0.4	0.3	-	0.7	35
15	Lapaz	180	-	C. Gate	3.1	2.7	-	5.8	32
16	Tatabuan	75	-	Ogee	1.9	-	-	1.9	25
17	Natimonan	40	-	-do-	1.4	2.3	1.2	4.9	122
18	Cadaragan	70	-	-do-	3.2	0.8	-	4.0	57
19	San Agustin	35	-	-do-	1.6	-	0.6	2.2	63
20	Aurora	35	-	-do-	1.5	-	-	1.5	43
21	Basey	20	-	-do-	1.3	-	-	1.3	65
22	Loog	40	-	-do-	1.4	-	1.5	2.9	72
23	Sulpn	30	-	-do-	1.4	0.5	-	1.9	63
24	Basyao	20	-	-do-	0.6	-	-	0.6	30
25	Salukigue	30	-	-do-	0.8	-	-	0.8	27
26	Mawasat	60	-	-do-	0.3	-	-	0.3	5
27	Casandig-Lawaan	100	-	-do-	1.7	-	-	1.7	17
28	Hilaba	20	-	-do-	0.4	-	-	0.4	20
29	Apolonia	20	-	-do-	1.0	0.4	-	1.4	70
30	Tutubigan	110	-	-do-	6.1	-	-	6.1	55
	Total	1,937	382		47.3	12.1	18.1	77.5	
				Density	24.4	6.2	9.3	40.0	(m/ha)

Source: Based on General Plan of CIS by NIA.

Table F.1.3. Calculation of Evapotranspiration by Penman Equation

Item	Unit	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mean Temperature	C	25.8	26.3	27.3	28.3	28.9	28.5	28.1	28.6	28.1	27.7	27.1	26.4
ea	mbar	33.2	34.2	36.3	38.5	39.9	39.0	38.0	39.2	38.0	37.2	35.9	34.4
PH mean	%	82.6	80.8	77.8	75.7	76.8	79.5	79.1	78.0	81.2	82.8	83.7	83.8
ed	mbar	27.4	27.6	28.2	29.1	30.6	31.0	30.1	30.6	30.9	30.8	30.0	28.8
ea-ed	"	5.8	6.6	8.1	9.4	9.3	8.0	7.9	8.6	7.1	6.4	5.9	5.6
U_2	km/day	65	65	79	79	72	65	65	92	68	65	61	58
f(u)		0.45	0.45	0.48	0.48	0.46	0.45	0.45	0.52	0.45	0.45	0.43	0.43
1-W		0.25	0.25	0.24	0.23	0.23	0.23	0.23	0.22	0.23	0.23	0.24	0.25
(1-w)·f(u)·(ea-ed)	mm/day	0.7	0.7	0.9	1.0	1.0	0.8	0.8	1.0	0.7	0.7	0.6	0.6
Ra (12|N)	"	12.8	13.9	15.1	15.7	15.7	15.5	15.5	15.6	15.2	14.4	13.3	12.5
n/N		0.19	0.31	0.44	0.46	0.40	0.25	0.23	0.17	0.21	0.23	0.25	0.21
(0.25 + 0.5 n/N)		0.35	0.41	0.47	0.48	0.45	0.38	0.37	0.34	0.36	0.37	0.38	0.36
Rs	mm/day	4.5	5.7	7.1	7.5	7.1	5.9	5.7	5.3	5.5	5.3	5.1	4.5
Rns	"	3.4	4.3	5.3	5.6	5.3	4.4	4.3	4.0	4.1	4.0	3.8	3.4
f(T)		15.9	16.0	16.2	16.4	16.5	16.4	16.3	16.4	16.3	16.2	16.1	16.0
f(ed)		0.11	0.11	0.11	0.11	0.10	0.11	0.11	0.10	0.11	0.11	0.11	0.11
f(n/N)		0.27	0.38	0.50	0.51	0.46	0.33	0.31	0.25	0.29	0.31	0.33	0.29
Rnl		0.5	0.7	0.9	0.9	0.8	0.6	0.6	0.4	0.5	0.6	0.6	0.5
Rn		2.9	5.0	6.2	6.6	6.3	5.3	5.1	4.9	5.0	4.7	4.5	4.0
W		0.75	0.75	0.76	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.76	0.75
W.Rn		2.2	3.8	4.7	5.1	4.9	4.1	3.9	3.8	3.9	3.6	3.4	3.0
Eto (c = 1.0)		2.9	4.5	5.6	6.1	5.9	4.9	4.7	4.8	4.6	4.3	4.0	3.6

Table F.1.4. ETcrop of Paddy

Month	Eto (mm/day)	First Crop Kc	First Crop ETcrop (mm/day)	Second Crop Kc	Second Crop ETcrop
January	2.9	1.1	3.2	-	-
February	4.5	1.05	4.7	-	-
March	5.6	0.95	5.3	-	-
April	6.1	0.95	5.8	-	-
May	5.9	-	-	1.1	6.5
June	4.9	-	-	1.1	5.4
July	4.7	-	-	1.25	5.9
August	4.8	-	-	1.25	6.0
September	4.6	-	-	1.0	4.6
October	4.3	-	-	-	-
November	4.0	-	-	-	-
December	3.6	1.1	4.0	-	-

Table F.1.5. Proposed Acreage of Paddy Field to be Irrigated

1. Present Situation

(1) Cropping acreage of paddy and production

First crop in wet season 20,000 ha x 1.6 ton/ha = 32,000 ton
Second crop in dry season 16,000 ha x 1.6 ton/ha = 25,600 ton
Total 57,600 ton
(say 58,000 ton)

(2) Consumption of rice

	at present (1985)	in future (2007)
Population	560,000	672,000 (20% up)
Consumption (kg/person)	100	100
Total Consumption (rice in ton)	56,000	67,200
" " (paddy in ton)	86,000	103,000

(3) Balance of paddy

(unit; ton)

	at present	in future
Production	58,000	58,000
Consumption	86,000	103,000
Balance	-28,000	-45,000

2. Acreage of Paddy Field to be Irrigated

(1) Proposed yield under irrigation system

First and second cropping of paddy = 3.5 ton/ha/crop

(2) Total acreage to be irrigated

under present condition 28,000/(3.5 x 2 - 1.6 x 2) = 7,400 ha
under future condition 45,000/(3.5 x 2 - 1.6 x 2) = 11,800 ha

(3) Paddy acreage to be irrigated

		Present Condition	Future Condition
Case-1	First crop (100%)	3,700 ha	5,900 ha
	Second crop (100%)	3,700 ha	5,900 ha
Case-2	First crop (100%)	4,600 ha	7,400 ha
	Second crop (60%)	2,800 ha	4,400 ha
Case-3	First crop (100%)	6,200 ha	9,800 ha
	Second crop (100%)	1,200 ha	2,000 ha
Case-4	First crop (100%)	7,400 ha	11,800 ha
	Second crop (- %)	- ha	- ha

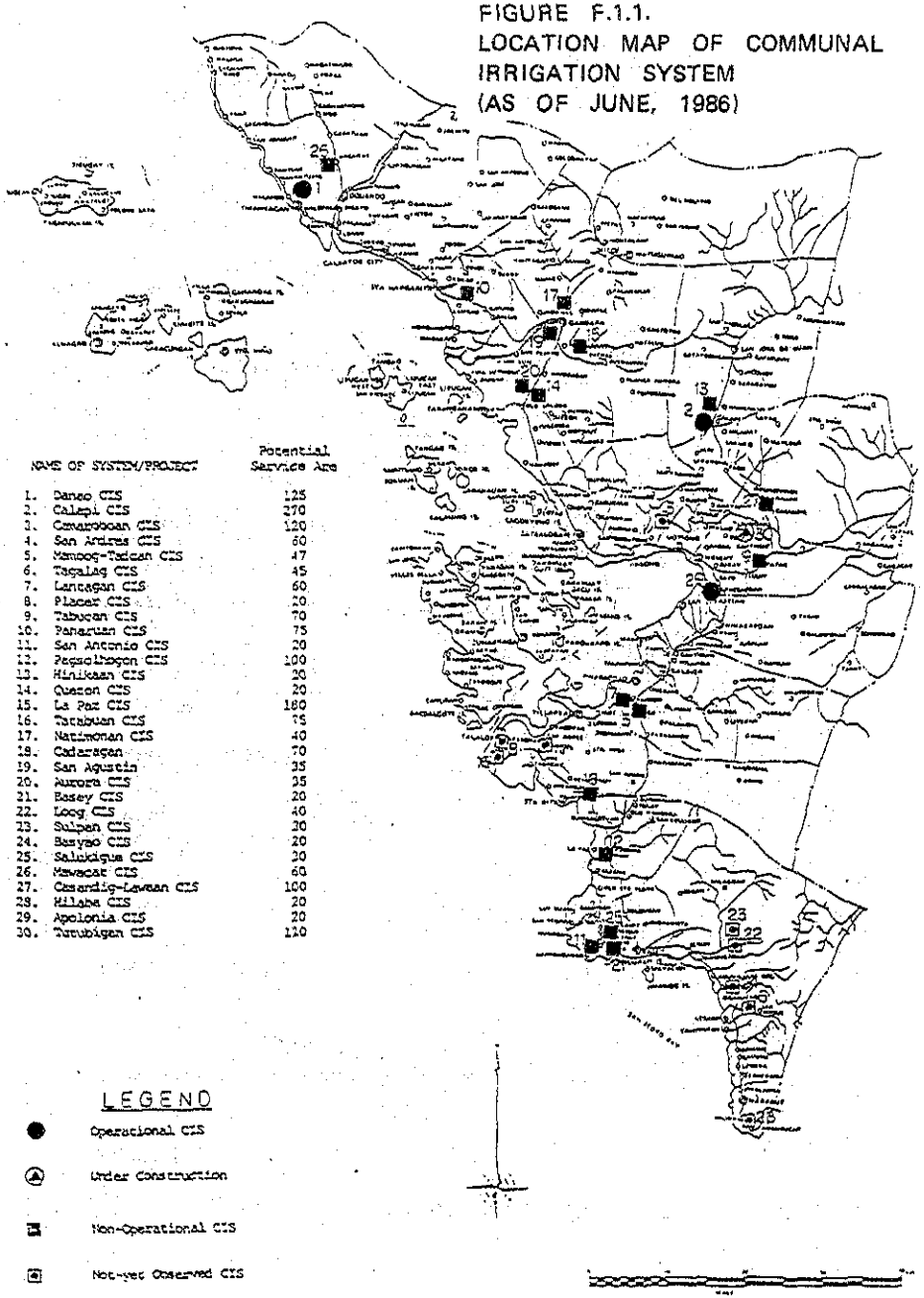
Table F.1.6. Results of Water Quality Analysis of Gandara River

27th August, 1987

SAMPLE No.	Barangay	PH	NH_4 (mg/e)	Fe (mg/e)	EC (ms/cm)	Turbidity unit Estimate	Color unit Estimate	Odor
1	Gandara Poblacion	7.6	0.8	0.1	300	50	30	little
2	Gandara Junction	7.2	0.5	0.1>	300	50	30	do
3	San Miguel	7.3	0.7	0.1>	300	30	20	none
4	Erenas	7.2	0.7	0.1>	300	30	20	do
5	San Jorge Sapinit River	7.3	0.8	0.1	300	30	20	little
6	San Juan Gandara River	7.3	0.6	0.1	300	30	20	none
7	San Juan Backwater point	7.7	0.4	0.1>	280	20	10	do
8	La Paz Gandara River	7.6	0.3	0.1>	280	10	5	do
9	Bulawi Gandara River	7.6	0.3	0.1>	280	10	5	do
10	Buena Vista	7.6	0.3>	0.1>	280	5	5	do
11	Buena Vista	7.7	0.3>	0.1>	280	5	5	do
12	Buena Vista	7.6	0.3>	0.1>	280	3	3>	do
13	San Jorge Sapinit Bridge	6.6	1.5	0.4	280	100	30	Spoiled Odor
14	San Jorge Sapinit Deepwell	7.6	0.3	0.1>	300	3	3	none

Source: By JICA Study Team, 1987.

FIGURE F.1.1.
LOCATION MAP OF COMMUNAL IRRIGATION SYSTEM
(AS OF JUNE, 1986)



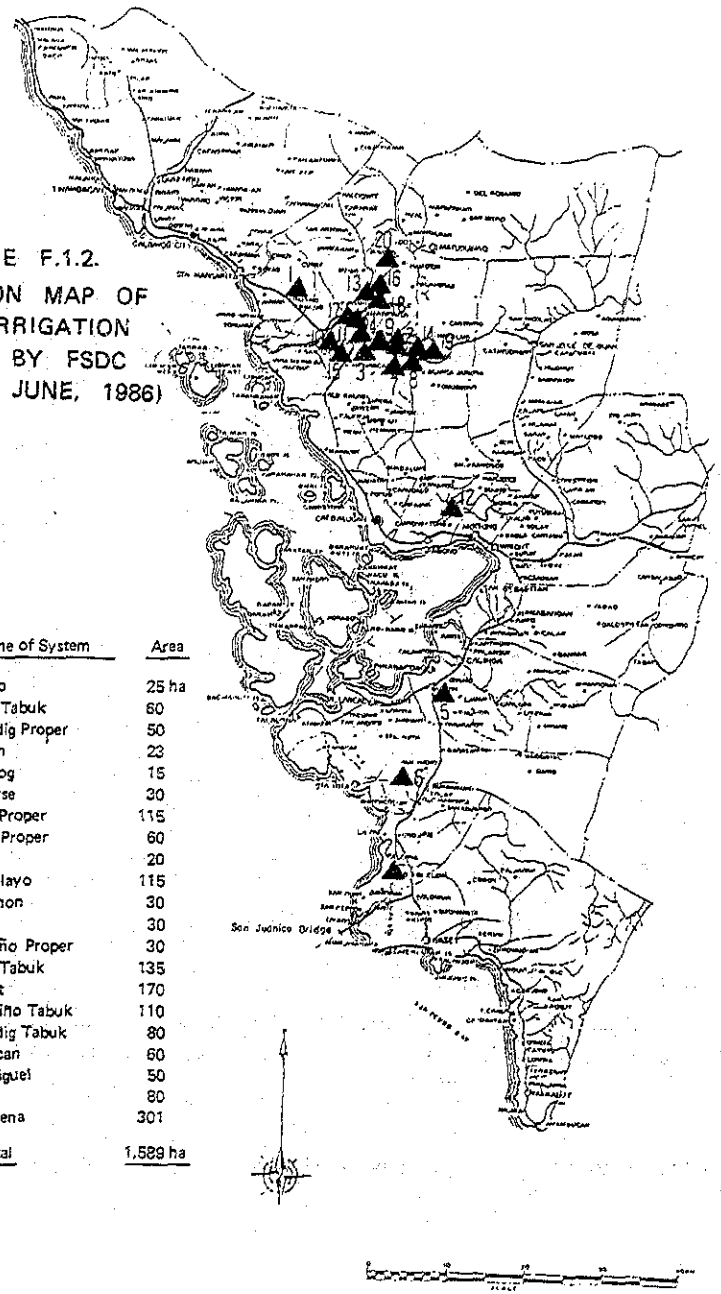
NAME OF SYSTEM/PROJECT	Potential Service Area
1. Daneo CIS	125
2. Calepi CIS	270
3. Camarobcan CIS	120
4. San Andres CIS	60
5. Mamoog-Tadcan CIS	47
6. Tagalag CIS	45
7. Lantagan CIS	60
8. Placer CIS	20
9. Tabucan CIS	70
10. Paharuan CIS	75
11. San Antonio CIS	20
12. Pegsalbogon CIS	100
13. Hinlugan CIS	20
14. Quezon CIS	20
15. La Paz CIS	180
16. Tatabuan CIS	75
17. Natimonan CIS	40
18. Caderagan	70
19. San Agustin	35
20. Aurora CIS	35
21. Basey CIS	20
22. Loog CIS	40
23. Sulpan CIS	30
24. Basyao CIS	20
25. Salukigue CIS	20
26. Mawacat CIS	60
27. Casandig-Lawaan CIS	100
28. Hilaba CIS	20
29. Apolonia CIS	20
30. Tutubigan CIS	110

LEGEND

- Operational CIS
- Under Construction
- Non-Operational CIS
- Not-yet Observed CIS

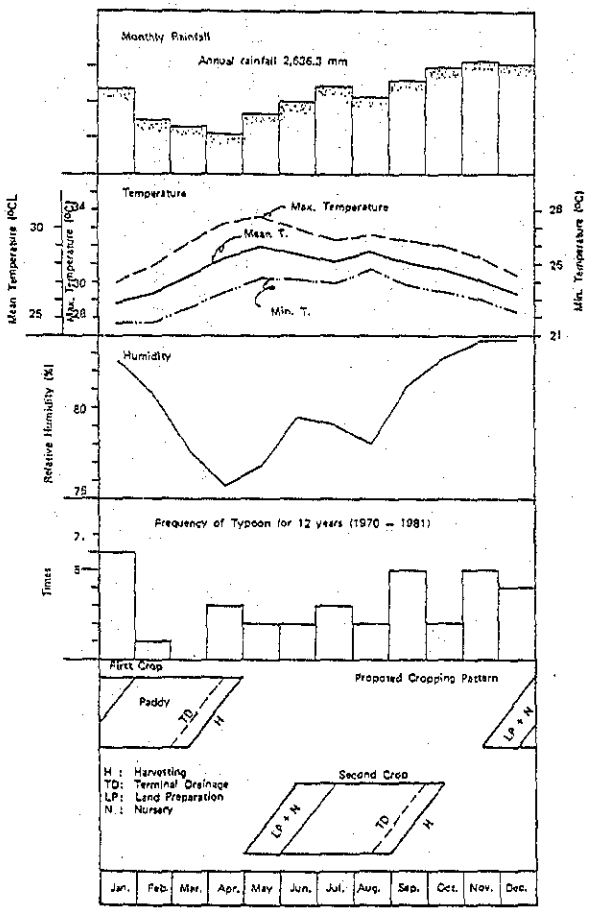
Source: made by the JICA Study Team

FIGURE F.1.2.
LOCATION MAP OF PUMP IRRIGATION SYSTEM BY FSDC
(AS OF JUNE, 1986)



No.	Name of System	Area
1.	Napuro	25 ha
2.	Lapaz Tabuk	60
3.	Casandig Proper	50
4.	Bangon	23
5.	Mambog	15
6.	Camayse	30
7.	Bulao Proper	115
8.	Lapaz Proper	60
9.	Erenas	20
10.	San Pelayo	115
11.	Bangahon	30
12.	Parina	30
13.	Sto Niño Proper	30
14.	Bulao Tabuk	135
15.	Sapinit	170
16.	Sto. Niño Tabuk	110
17.	Casandig Tabuk	80
18.	Calirucan	60
19.	San Miguel	50
20.	Rawis	80
21.	Sta. Elena	301
	Total	1,589 ha

FIGURE F.1.3. PROPOSED CROPPING PATTERN



Source: made by the JICA Study Team, 1987

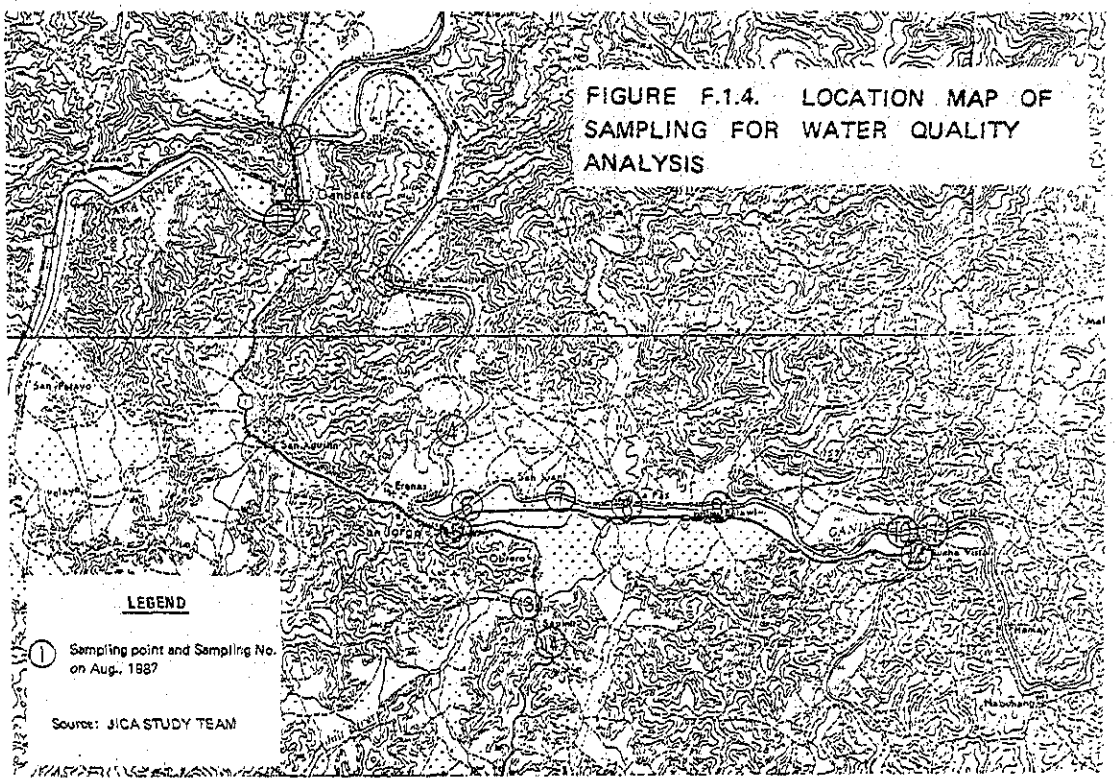


FIGURE F.1.4. LOCATION MAP OF SAMPLING FOR WATER QUALITY ANALYSIS

F.2. Proposed Irrigation Projects

Many types of irrigation system are proposed in the Study Area by considering topographic, hydrological and other conditions. The rehabilitation works of existing CISs and PISs have high priority to re-develop the service areas because farmers had already experiences and knowledges for irrigation.

In the irrigation development schemes under the Master Plan, the rehabilitation works of CISs would be firstly carried out during a period of the short term development. After completing the works, farmers could enjoy the quick return from the irrigation systems with rather small amount of the investment. For the medium term development, the rehabilitation works of the PISs would be implemented to solve a problem of power supply etc. Within the long term development, new irrigation projects will be implemented since more investigations and surveys should be necessary for implementing the projects. In case of existing CISs or PISs located in the Project area, the construction works including rehabilitation of CISs or PISs should be listed in the short or medium term development programs (refer to Tables F.2.1 and F.2.2 and Figures F.2.1 to 7).

The total number of the proposed irrigation projects in the Study Area is planned at 89 or 11,830 ha of a paddy field. Mainly gravity irrigation systems of 28 sites or 2,140 ha, is developed in the short term development. By the end of medium term development, many rehabilitation of pumping irrigation system of another 23 projects or 3,110 ha, are listed, and the remaining 38 projects or 6,580 ha will be developed in the long term development.

The type of the proposed intake facility is classified into three, normally diversion dam type for gravity irrigation system, lifting up type for pumping irrigation and pumping station with a tidal regulator structure.

Table F.2.1. Proposed Irrigation/Drainage Project by Stage

No.	Name of Project	Irrigable Area (ha)	Intake Type	L/B Ratio	Drainage Improvement (ha)	Devel't Stage	Remarks
C 1	Danao	110	D.D	1.3	-	S	
C 10	Pararuan	60	D.D	5.0	60	S	Pogosorgon SWIP
C 15	Lapaz	150	D.D	1.1	150	S	
C 20	Aurora	30	D.D	1.2	30	S	
C 14	Quezon	20	D.D	1.2	20	S	
C 3	Camaroboan	100	D.D	1.0	-	S	
C 13	Hinikaar	20	D.D	1.0	-	S	
C 2	Calapi	230	D.D	1.0	-	S	
C 27	Casandig Lawaan	90	P	1.0	-	S	
C 30	Tutubigan	100	D.D	1.0	-	S	
C 9	Tabucan	60	D.D	1.0	-	S	
C 29	Apotonia	20	D.D	1.0	-	S	
C 5	Mambog Tadcan	40	P	2.0	-	S	
C 7	Lantagan	50	P	1.0	-	S	
C 8	Placer	20	D.D	1.2	-	S	
C 4	Sn Andres	50	D.D	1.3	-	S	
C 28	Hilaba	20	D.D	1.0	-	S	
C 6	Tagalog	40	D.D	1.0	-	S	
C 24	Basyao	20	D.D	1.0	-	S	
C 23	Sulpan	30	D.D	1.2	30	S	
C 22	Lo-og	30	D.D	1.6	30	S	
C 21	Basey	20	D.D	1.2	20	S	
C 11	Sn Antonio	20	D.D	1.2	20	S	
	Sub-total	1,330			360		
P 1	Napuro	20	D.D	3.0	20	M	Napuro SWIP
P 17	Casandik - T	70	P	3.2	70	M	
P 3	Casandik - P	40	P	2.0	40	M	
P 11	Bangahon	30	P	1.2	30	M	
P 18	Calirocan	50	P	2.4	50	M	
P 10	Sn Pelago	100	P	1.2	100	M	
P 9	Elenas	20	P	1.2	20	M	
P 14	Bulao - T	120	P	9.7	120	M	
P 19	Sn Miguel	50	P	1.3	50	M	
P 12	Parina	30	P	1.0	-	M	
P 8	Lagas - P	60	P	1.0	60	M	
P 4	Bangon	30	P	1.0	30	M	
P 5	Mambog	20	P	1.0	20	M	
	Sub-total	640			610		
	Total	1,970			970		

Note: D.D: Diversion Dam or Intake Gate
P : Pump
S : Short Term Development
M : Medium Team Development
L/B: Length (L) of the proposed area/width (B) of the area
CI : Communal Irrigation System by NIA
PI : Pump Irrigation System by FSDC

Table F.2.2. Proposed New Irrigation/Drainage Project

No.	Name of Project	Irrigable Area (ha)	Intake Type	L/B Ratio	Drainage Improvement (ha)	Devel't Stage	Remarks
1	Bayo	230	D.D	1.1	230	L	
2	Pilar	270	D.D	4.5	270	L	
3	Sigo	100	D.D	1.3	100	L	
4	Ton-ok	260	D.D	16.0	260	M	C 26
5	Tabokno	80	D.D	4.0	80	L	
6	Nobang	20	D.D	3.0	20	L	
7	Alang-Alang	20	D.D	7.5	20	L	
8	Sn Joaquin	20	D.D	1.2	20	L	
9	Canipulan	20	D.D	2.0	20	L	
10	Naga	100	P+Ti	4.2	100	L	
11	Carayman	60	P+Ti	1.1	60	L	
12	Obrero	60	P+Ti	5.0	60	L	
13	Maglawawaan	30	P+Ti	2.5	30	L	
14	Navarro	120	D.D	11.3	120	L	
15	Gaboy	130	D.D	15.0	130	L	
16	Sinantan	90	D.D	10.0	90	L	
17	Ayolito	170	D.D	8.3	170	L	
18	Rawas	380	D.D	1.4	380	M	P 20
19	Peñaplata	100	P	7.0	100	L	
20	Pizaro	100	P	1.5	100	M	P 16
21	St. Niño	280	P	1.7	280	M	C 17, P 13
22	Giras	40	P	1.1	40	L	
23	Sn Agustin	130	D.D	11.3	130	M	C 19
24	Sapinit	160	D.D	23.3	160	S	P 15
25	Bulao	170	P+Ti	3.8	170	S	P 7, P 2
26	Bulao South	110	D.D	10.0	110	S	
27	Naghituiman	210	D.D	18.8	210	S	
28	Janipon	160	D.D	30.0	160	S	
29	Barayong	260	P+Ti	2.1	-	L	
30	Sta. Rosa	30	P+Ti	4.0	30	L	
31	Binoongan	70	P+Ti	3.6	70	L	
32	Sta Rita	370	P+Ti	2.2	370	L	
33	Silaga	450	D.D	2.6	-	M	C 18, P 6
34	Tagaca	90	P+Ti	3.3	90	L	
35	Catabanan	90	D.D	2.5	-	M	C 16

No.	Name of Project	Irrigable Area (ha)	Intake Type	L/B Ratio	Drainage Improvement (ha)	Devel't Stage	Remarks
36	Hinangutdan	50	P+Ti	2.0	50	L	
37	Bagolis	140	D.D	7.3	140	M	C 12
38	Sta. Elena	160	P+Ti	2.5	160	M	P 21
39	Damoigan	180	P+Ti	1.2	180	L	
40	Canmada	480	P+Ti	2.0	480	M	C 25
41	Dolongan	340	P+Ti	5.0	340	L	
42	Cantaba	260	P+Ti	4.6	260	L	
43	Basey	1,340	P+Ti	1.8	1,340	L	
44	Inumtan	50	D.D	3.0	50	L	
45	Lo-og	340	D.D	1.4	-	L	
46	Independence	40	D.D	1.0	-	L	
47	Karanas	60	D.D	1.0	60	L	
48	Inungayan	70	D.D	1.0	70	L	
49	Kalayaan Patong	600	D.D	1.0	600	L	
50	Lawaan	70	D.D	1.0	70	L	
51	Loncepcion	30	D.D	1.0	30	L	
52	Casandig	170	D.D	1.0	170	L	
53	Camsotabao	500	D.D	2.0	-	L	
	Total	9,860			8,180		
	G. Total*	11,830			9,150		

Note: D.D: Diversion Dam or Intake Gate
P : Pump
Ti : Tidal Regulator
M : Medium Term Development
L : Long Term Development
* : Total of Tables F.2.1 and F.2.2

Table F.2.3. Proposed Irrigation Project by Intake Type

Development Stage	Diversion Dam	Pump	Pump + Tidal Regulator	Total
Short Term Development	24 (1,790 ha)	3 (180 ha)	1 (170 ha)	28 (2,140 ha)
Medium Term Development	7 (1,470 ha)	14 (1,000 ha)	2 (640 ha)	23 (3,110 ha)
Long Term Development	22 (3,200 ha)	2 (140 ha)	14 (3,240 ha)	38 (6,480 ha)
Total	53 (6,460 ha)	19 (1,320 ha)	17 (4,050 ha)	89 (11,830 ha)

FIGURE F.2.1.
LOCATION MAP OF PROPOSED IRRIGATION AND DRAINAGE PROJECT

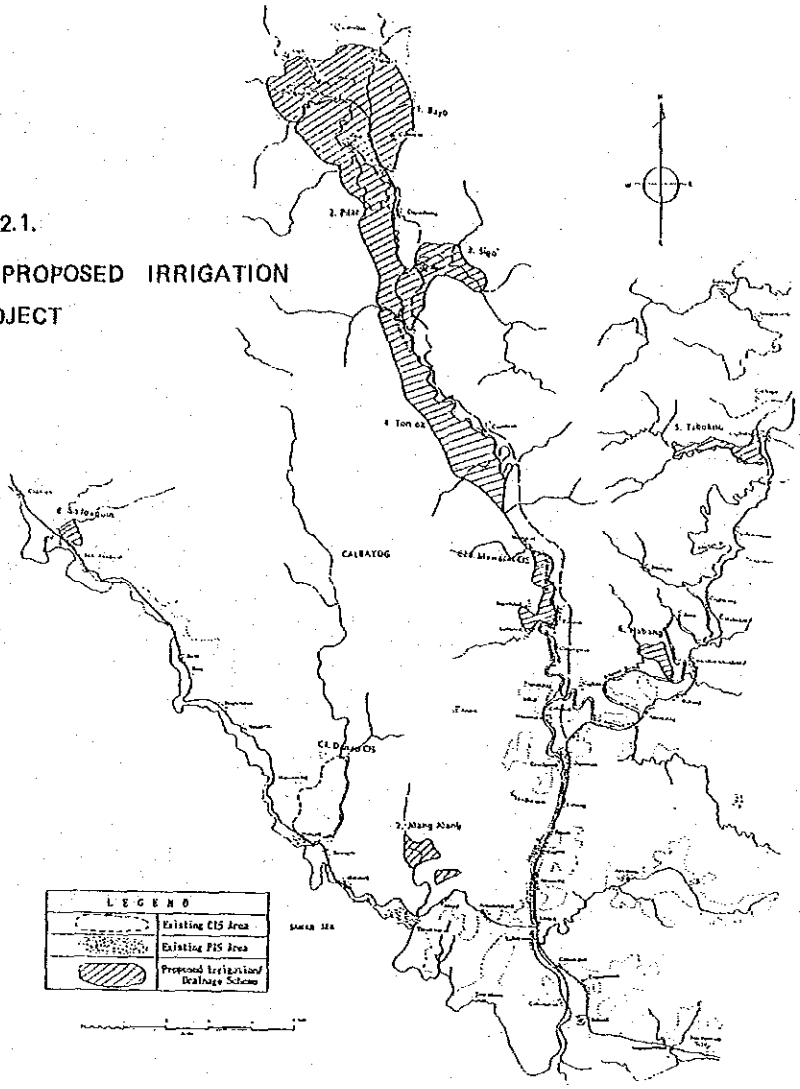


FIGURE F.2.2. LOCATION MAP OF PROPOSED IRRIGATION AND DRAINAGE PROJECT

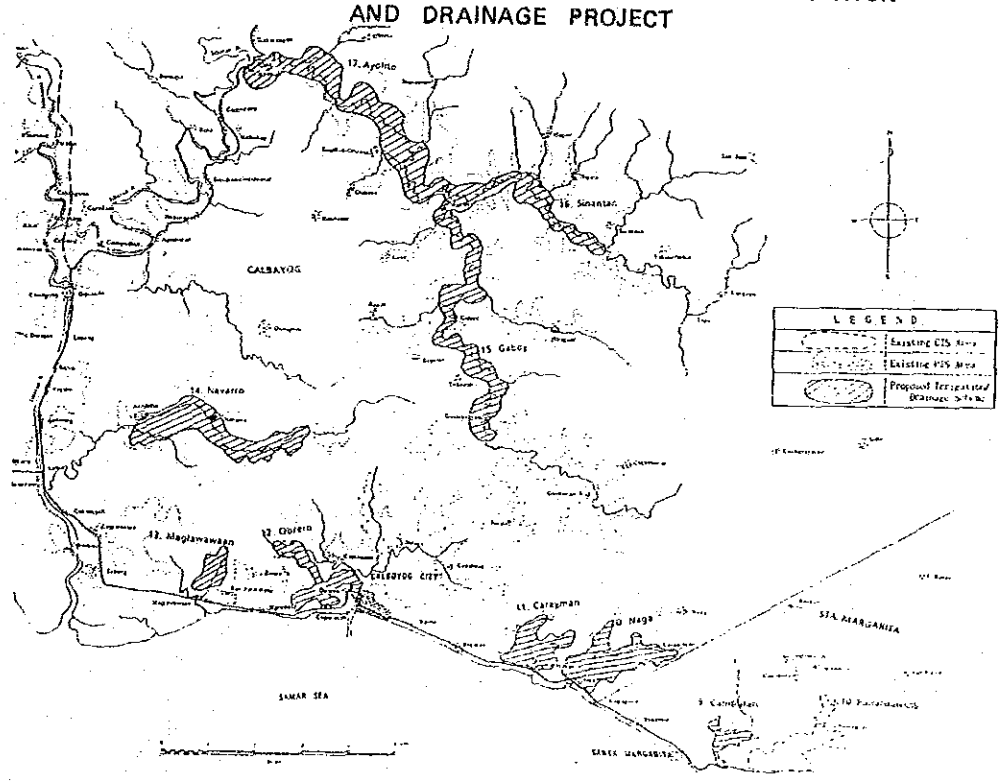


FIGURE F.2.3. LOCATION MAP OF PROPOSED IRRIGATION AND DRAINAGE PROJECT

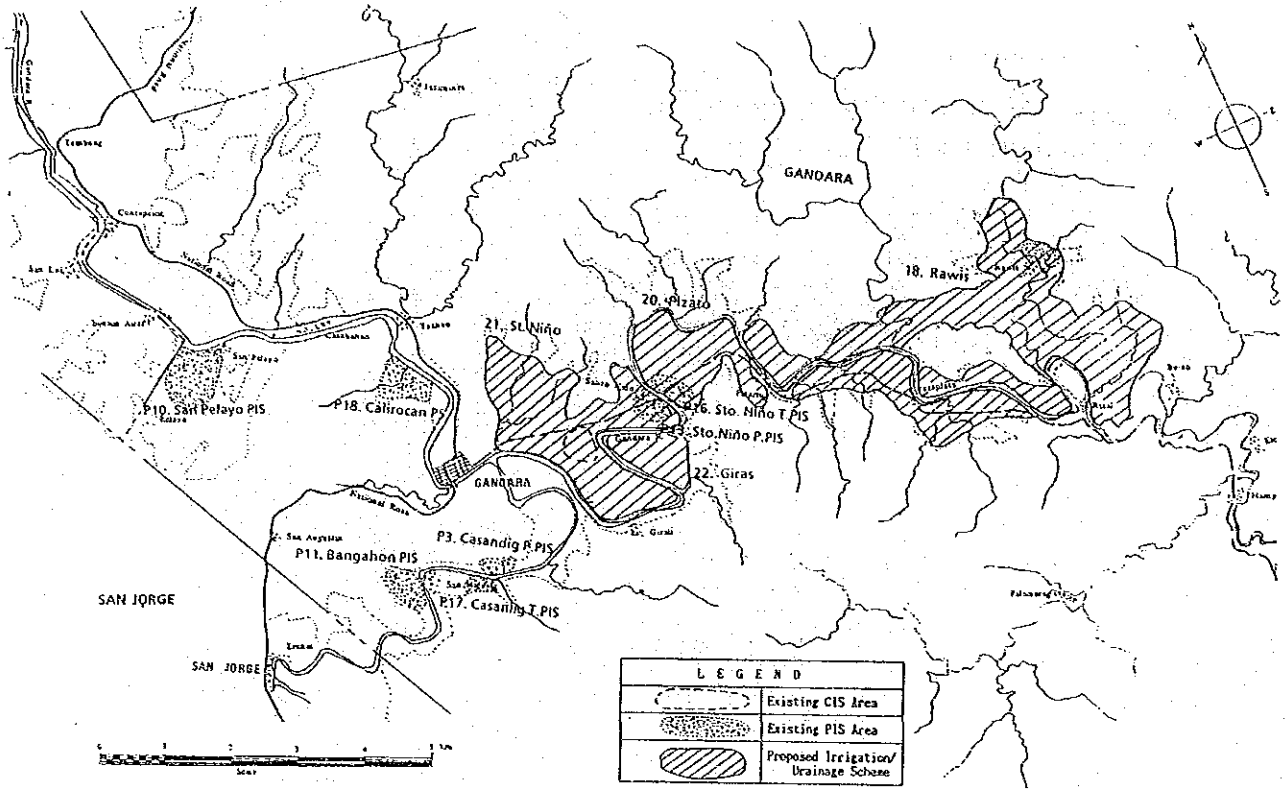


FIGURE F.2.4. LOCATION MAP OF PROPOSED IRRIGATION AND DRAINAGE PROJECT

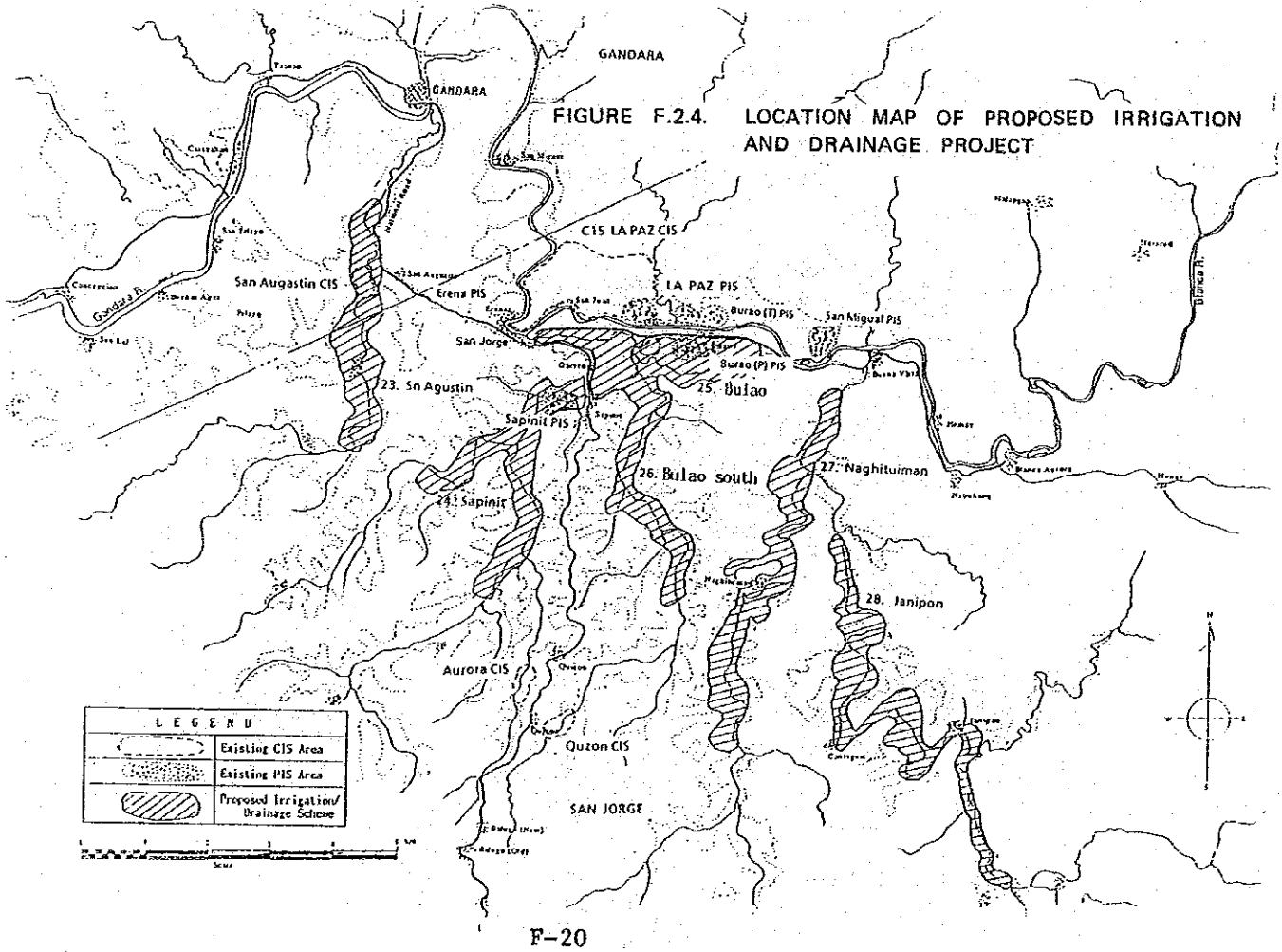


FIGURE F.2.5. LOCATION MAP OF PROPOSED IRRIGATION AND DRAINAGE PROJECT

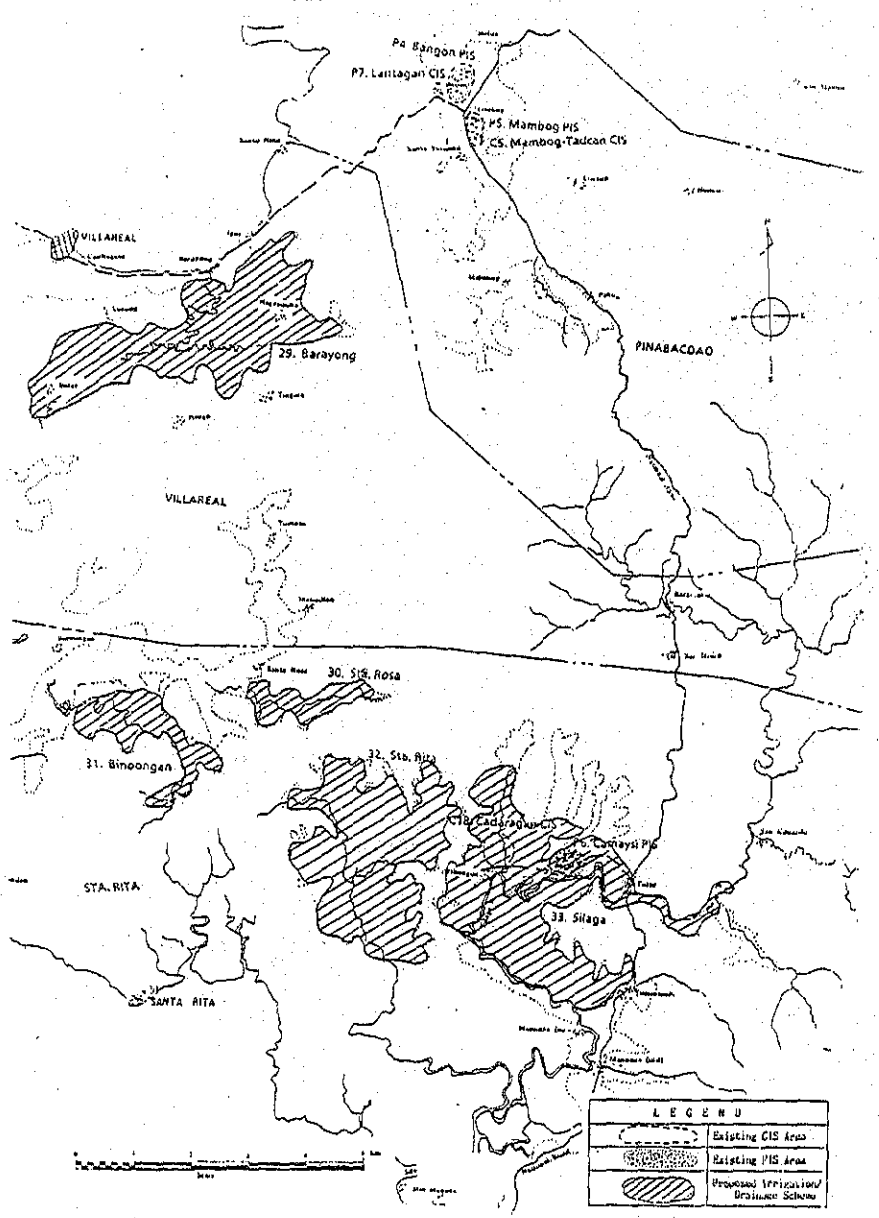
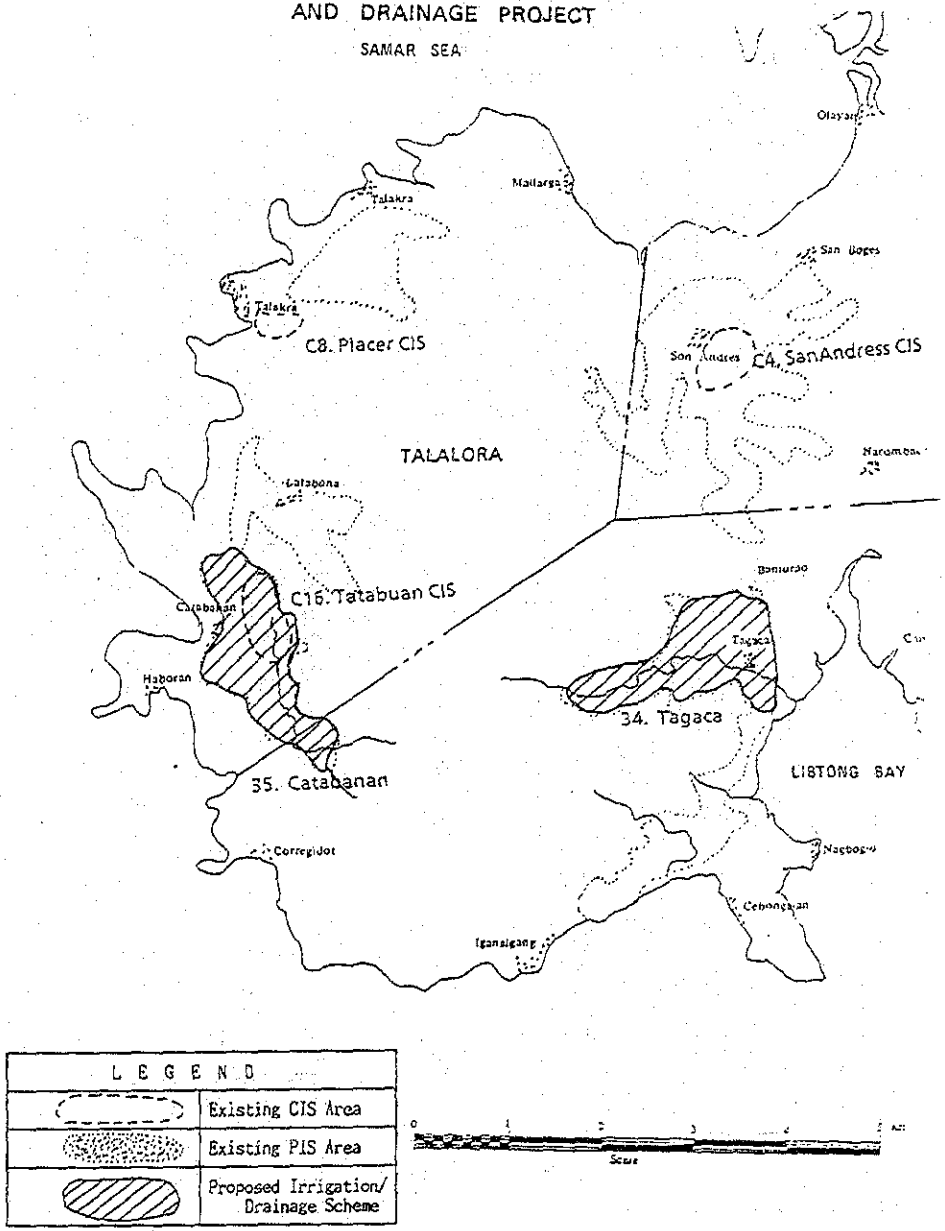


FIGURE F.2.6. LOCATION MAP OF PROPOSED IRRIGATION AND DRAINAGE PROJECT



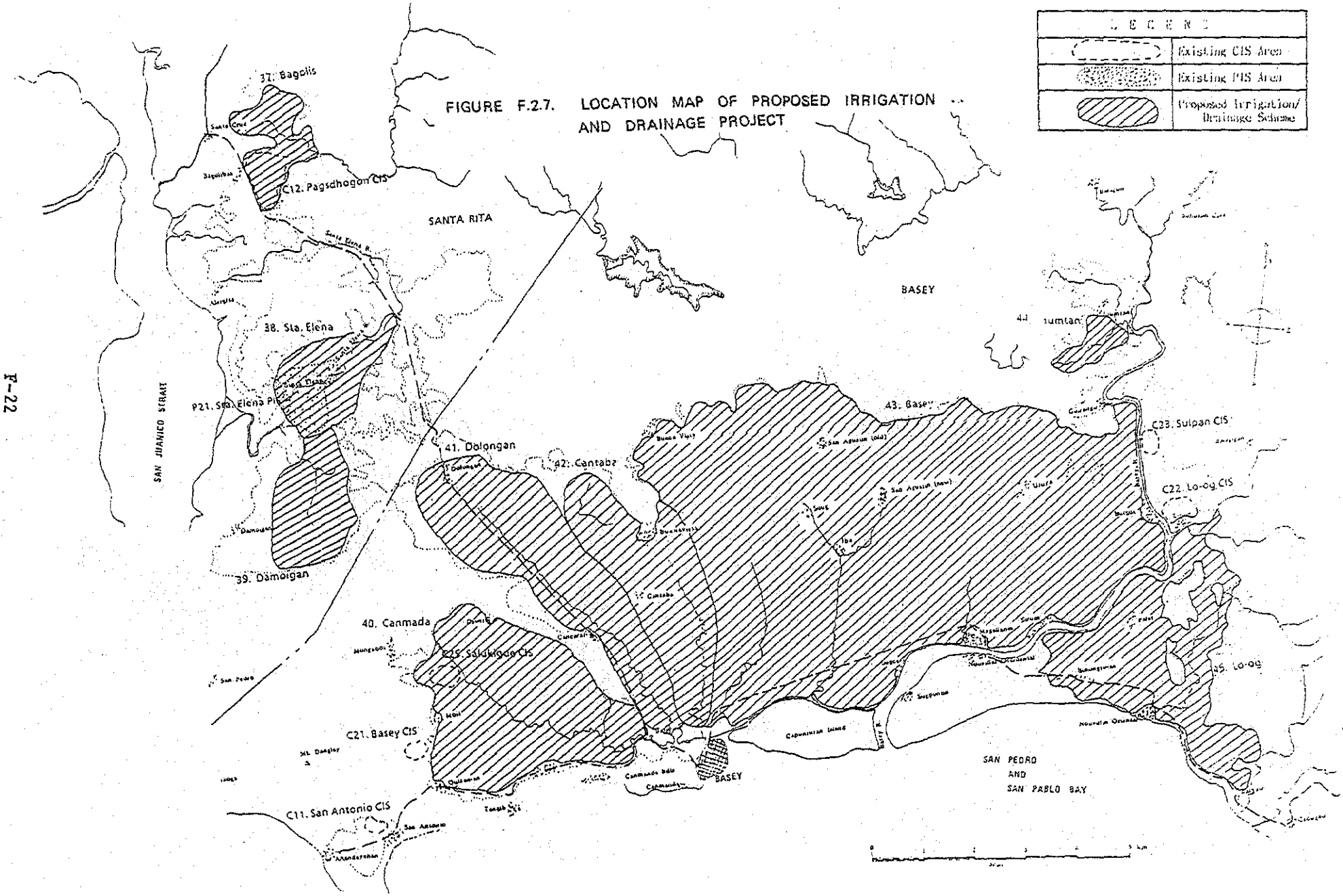


FIGURE F.2.7. LOCATION MAP OF PROPOSED IRRIGATION AND DRAINAGE PROJECT

F.3. Drainage

F.3.1. Present Condition

The river and stream in the Study Area have topographical features of steep slope of river bed in the mountainous area and very flat slope of river bed in the plain area. These water courses in the plain areas, therefore, are meandering and are affected by tide.

As a result of interviews with the farmers and flood marks in the river and stream, the peak flood during a tropical cyclone with heavy rainfall was occurred in a short period only for two to three days. The difference of the water level between the normal and high in the flood period will reach to between six and ten meters in the water course. The continuous time of the peak flood was continued for two to three days. Likewise, the KAINGIN system which cause poor vegetation is the main reason that makes the hydrological condition irregular.

In the plain area, flood discharge was always overtopping the river banks to the field due to no river revetment works. The maximum depth of the standing water on the field was recorded at one to two meters in one to three continuous days.

Flood water affects the properties of inhabitants. The actual amount of flood damages on crop production and other facilities, caused by tropical cyclone, were recorded by Office of Civil Defence. The latest strong Typhoon "Herming" in August, 1987, brought about very big damages of 18 million pesos as of sept., 1987 (refer to Table F.3.1).

To the property of housings, flood damages were not so severe because of the traditional house with an elevated floor. However, the farmer's house is recently modernizing from a wooden house to a

modern house with bricks. In the modern house, the ground floor is also used for living of his family. When that house is submerged, the flood damage will become severe.

On the other hand, the present drainage system has no sufficient drainage canal density and its structures to drain stagnant water. Stagnant water in the depressed area invites the possibly existing of harmful snails like schistosomiasis. The present countermeasures to prevent schistosomiasis are only medical check-up, medicine prescription to exterminate flakes and theoretical education for schistosomiasis prevention to the farmers. The farmers, however, can not buy a materials to prevent schistosomiasis and also not improve the endemic area, and not provide drainage canals because of budgetary constraints (refer to Appendix F.4).

F.3.2. Drainage System

Considering the farm income from agricultural products, hydrological conditions such as tidal, flood damages and occurrence of flooding in Jibatan, Gandara and Basey River basins, the gravity drainage system would be advisable, because of the low cost of O & M compared with the mechanical drainage system.

1) Gravity drainage system

In order to minimize the cost of operation and maintenance on the proposed drainage system, the gravity drainage system is the best idea compared with other systems.

2) Adverse flow facilities

The facilities to prevent adverse flow from the main river coursed during and after the flood time, are also important to reduce the stagnant water depth and duration on the proposed area. The flood arrival time is different between the wide and small

drainage areas. Usually, flood discharge from the small drainage area will reach to a certain point quicker than that from the wide area. After or during drainaging discharge from the small area, the flood with a high water level from the wide area arrives the point. The high flood will make back water to the small drain and poor drainage conditions. It is efficient that the proposed facilities will protect the adverse flow from the main water course.

3) Dual purpose pumping facility for irrigation and drainage

The details are described in Appendix F.1.3.

4) Pumping drainage system

Pumping drainage system including the pumping station and drainage canals should be introduced to the problem area. However, careful attention in the items of operation and maintenance cost should be paid. When the proposed site of the pumping station is located at near the hydropower station, it may become the most suitable site. Because during the rainy time the necessity of drainage is occurred to drain excess water on the fields. In that period discharge of the streams will become bigger and the amount of hydropower will also become large. Thus, the operation and maintenance cost will be more cheaper than oil energy.

5) Flood protection dike

Flood protection dikes are also very useful to solve the drainage problems. But this idea is usually performed with the other facilities such as the pumping station of adverse flow facilities etc.

6) Others

On plain areas, new flood damages will be originated due to proposed facilities when flood discharge will strike at the any

proposed point. And also in present schistosomiasis endemic areas, a deeper drainage canal with a steeper canal bed slope, to drain excess water at the recommended design velocity of 30 cm/sec or more, should be considered to kill or eradicate existing of snails.

F.3.3. Drainage Planning

The design rainfall is adopted 304 mm/2-day on a probability of 1/5 based on the Catbalogan rainfall data (refer to Appendix C.1.4.). By using the runoff coefficient of 0.8 and the design rainfall, the drainage module of 14 lit/sec/ha would be calculated for design of proposed drainage facilities.

F.3.4. Proposed Drainage Facilities

The proposed drainage facilities consist of a main drainage canal, lateral canals and many appurtenant structures such as road crossings, bridges, drops if necessary, etc. The operation and maintenance road would be planned at one side of the dike and it will play also the important role as the farm-to-market road.

F.3.5. Drainage Improvement

The drainage improvement would be implemented in the schistosomiasis endemic area (refer to Appendix K.3). The total acreage of the area would be measured at about 9,150 ha based on the topo-maps on a scale of 1:50,000. In those area, the drainage facilities of main, lateral and on-farm drainage canals should be constructed (refer to Appendix F.2).

F.4. Flood Control in Sapinit River Basin

The low lying area in the Sapinit River basin, a tributary of Gandara River, is receiving flood during heavy rainfall. The

following are analyzed based on the actual data from JICA gauging station.

F.4.1. Estimated Flood Discharge of Gandara River

Flood discharge of Gandara River was estimated based on the actual data of rainfall and water level records at Blanca Aurora by the typhoon "Herming" on August 12,1987. According to the data of hourly rainfall and flood marks, the maximum flood discharge is calculated at about 1,100 m^3/sec. Based on theoretical estimation by using the Rational equation, the amount is 1,300 m^3/sec (run off coefficient of 0.8, hourly rainfall of 20 mm/hr., drainage area of 300 km^2). Therefore, the maximum estimated discharge would be determined at 1,200 m^3/sec. The specific discharge is 4.0 $m^3/sec/km^2$ (refer to Figure F.4.1).

F.4.2. Adversed Flow to Sapinit River Basin

The total amount of discharge by daily rainfall of 260 mm in the Sapinit River basin is calculated at ten (10) MCM. On the other hand, based on the cross section of the river, the adversed flow volume would be estimated at eight (8) MCM (= 90 sq.m x 0.7 m/sec x 1.5 days). The total volume of 18 MCM is stagnanted in the low lying area of the basin. The maximum water depth of the sub-mergence is calculated at 2.4 m.

Based on 20 m^3/sec of the present drainage capacity of the Sapinit River, the inundation period would theoretically be estimated at about ten days. However, the actual inundation period is more than two weeks, since the lateral drainage canals are not existing in the area and the small capacity of the present canal.

The adversed flow facilities to protect inflow of eight (8) MCM would be introduced in the area, the inundation period will be reduced by roughly six days. And also, after enlargement of the present capacity by 40 m^3/sec, the inundation period will be reduced by two days.

Accordingly, the enlargement of the river capacity and the adversed facility which is proposed at the river mouth of the Sapinit River in San Jorge, would be more effective to improve the present ill drainage conditions under the careful meteoro-hydrological study by using the long term observation data for at least 20 years.

F.4.3. Alternative Plan of Drainage Development

A proposed tunnel at the end point of the Sapinit River basin, as alternative drainage improvement plan, will be effective to reduce the said inundation condition. The proposed tunnel can short-cut the drainage way from the inundation area to the sea. According to the preliminary study, the tunnel will add the drainage capacity up to about two times of the present one. Ratio = $(1/1200)^{1/2}/(1/43000)^{1/2} = 1.9$ The inundation period with a proposed adversed flow facility would also be shorten by three days (refer to Figure F.4.2).

F.4.4. Drainage Improvement of Buena Vista River Basin

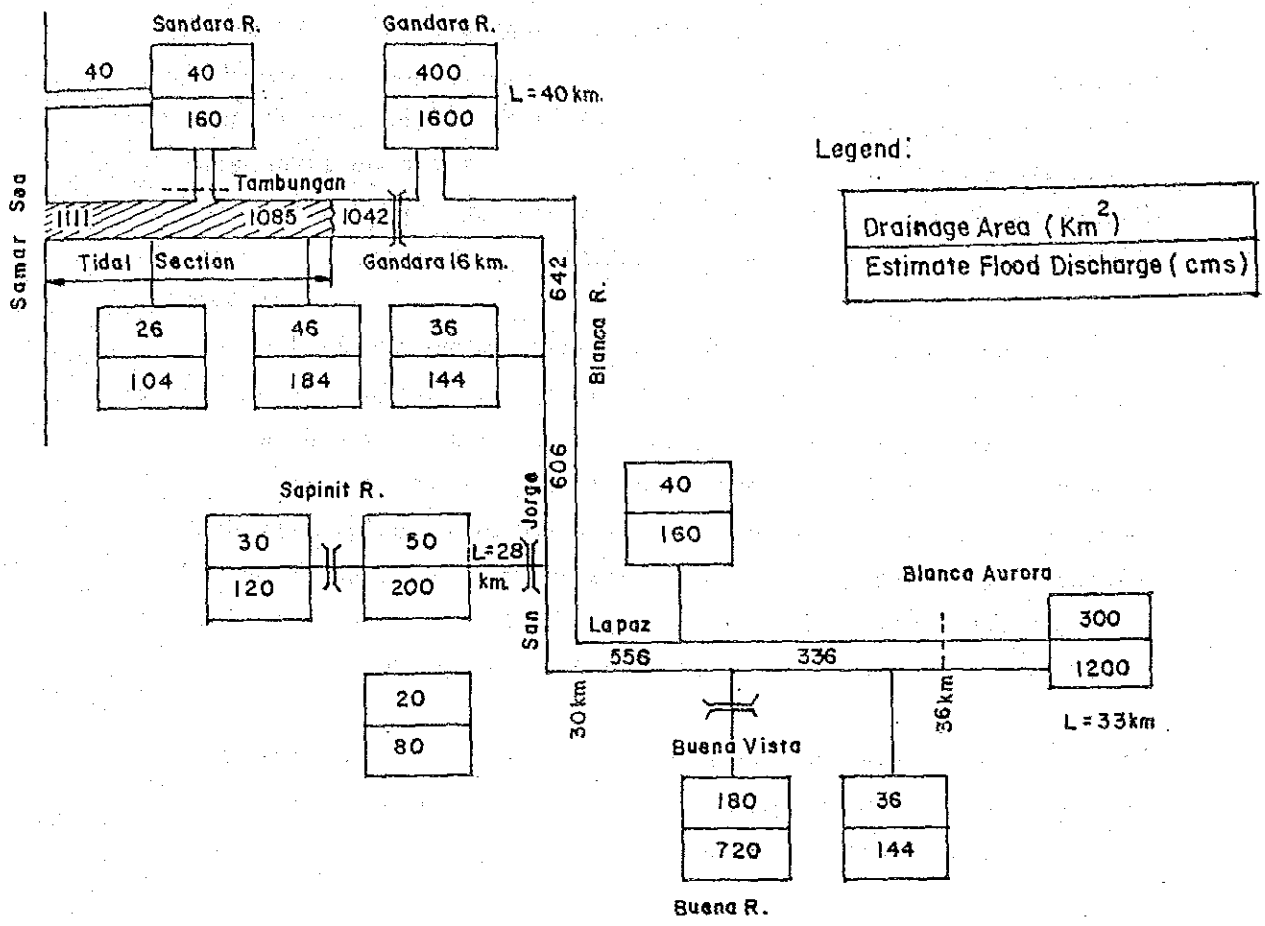
According to the hearing to the farmers, the inundation period of the area is not so long. After the proposed feeder drainage canals would be provided, the drainage improvement will be expected.

F.5. Small Water Impounding Project (SWIP)

F.5.1. Location

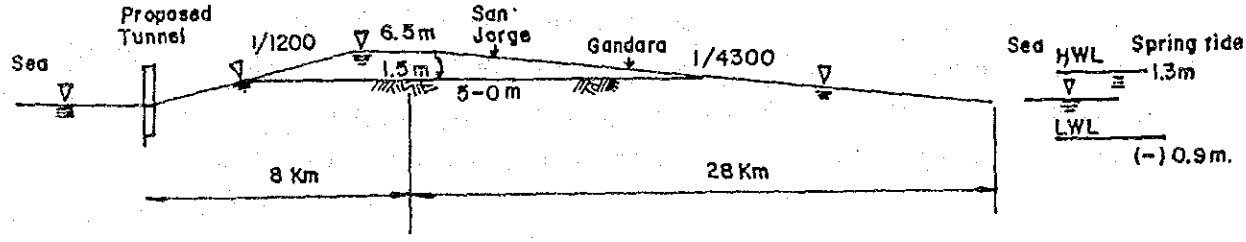
There are two sites of a small scale water impounding project in the municipality of Sta. Margarita. Both places were improved by CIS under NIA and FSDC, namely, Panaruan (Sorsogon) CIS and Napuro CIS. The proposed dam site of the Sorsogon CIS is located at about 2 km north-east of barangay Sorsogon. Another proposed dam site of the Napuro CIS is only 700 m NNE of barangay Napuro (refer to Figures F.5.1 and F.5.2).

FIGURE F.4.1. SKELTON MAP ON PRESENT DRAINAGE SYSTEM
(BY TYPHOON "HERMING" ON AUG. 11, 1987)



Source: made by the JICA Study Team

FIGURE F.4.2. HYDRAULIC PROFILE OF SAPINIT RIVER



Source: made by the JICA Study Team

F.5.2. Hydrological and Geological Conditions

The catchment areas of Sorsogon and Napuro proposed reservoir are measured at 5.8 and 2.9 km^2 based on the topo-map of 1/50,000. The catchment areas of both sites are located in the run-off zone of "C" in the run-off zone map in Westen Samar. The annual run-off discharges are calculated at 7.0 MCM at Sorsogon and 3.5 MCM at Napuro under the provability ratio of 1/10.

Sedimentation data available in Samar island are limited to Catubig River at Las Navas, Northern Samar, and the period of record is short. It is estimated that the annual sediment yield per square kilometer of Catubig River would be 273 m^3. In the reservoir operation studies the sediment annual yield of Catubig River was adapted. The estimated 100-year sediment volume for the proposed reservoir was considered and assumed to be the dead storage of about 159,000 m^3 of Sorsogon and about 80,000 m^3 of Napuro.

The field investigation on the river source of the proposed reservoir shows that the water quality is not a major problem and is suitable for agricultural purposes.

The proposed dam sites belongs to Pliocene-Miocene layers. The mark and sandstone are mainly found at the sites, however, prior to the implementation, the detail geological surveys and investigations should be done at the proposed sites and in the reservoir areas because limestone formation is predominant in Samar island.

The proposed both reservoir operations were preliminary carried out on the year of 1968 with probability of 1/10. According to the results of the operation, the maximum capacity of 2.5 MCM on Sorsogon and 1.9 MCM on Napuro will be enough to irrigate the maximum area of 150 and 100 ha, respectively if the area is available near the both sites (refer to Figures F.5.3 to F.5.5).

F.5.3. Preliminary Design of Dam

The dam height are proposed at 13.5 m and 14.5 m for Sorsogon and Napuro, respectively. The dam type is homogeneous earth fill type with the slope of 1:2.5 (V:H) on the down stream side and 1:3.0 on the upper stream side. The dam length would be required about 250 m. In this case, the embankment volume of Sorsogon and Napuro would estimated at 150,000 m^3 and 170,000 m^3, respectively.

FIGURE F.5.1. LOCATION MAP OF SORSOGON DAM

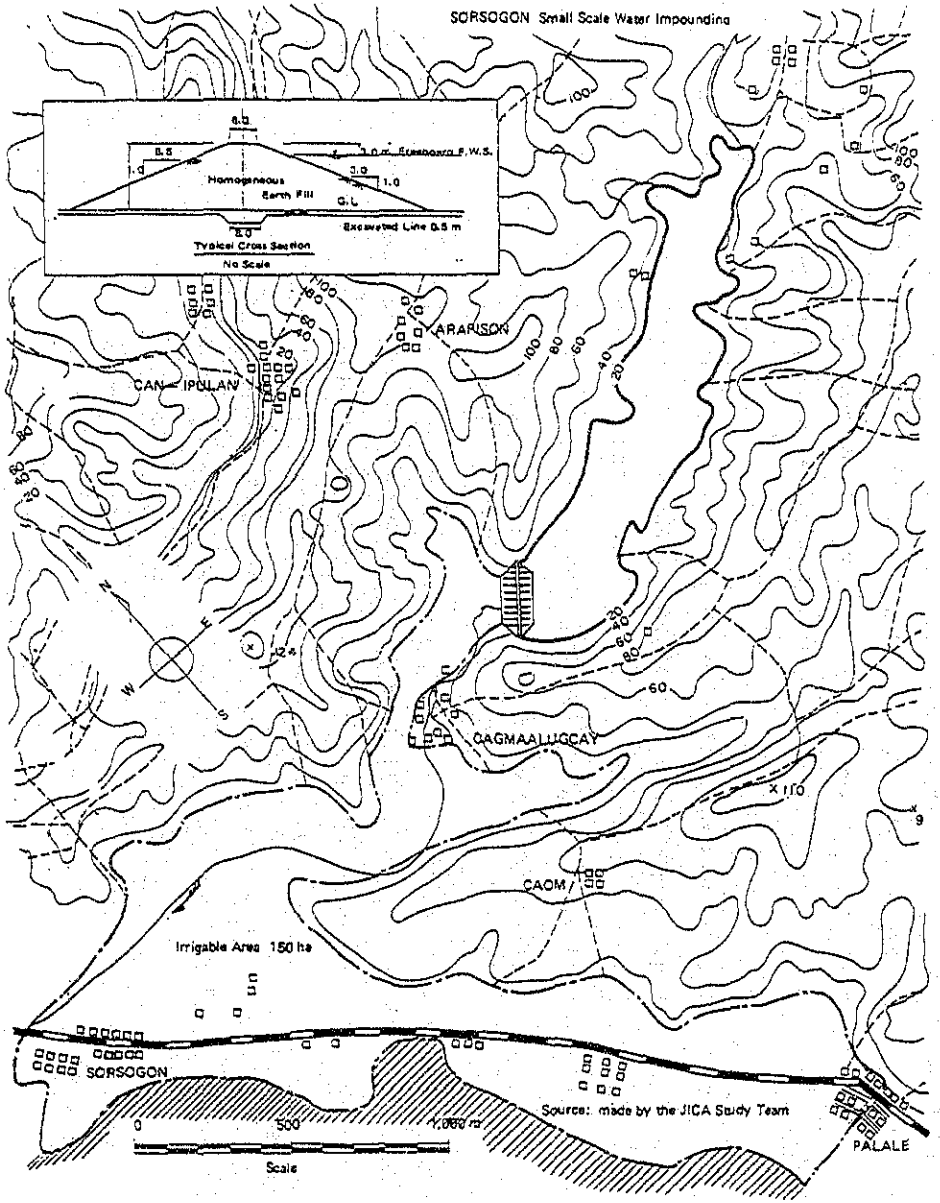


FIGURE F.5.2. LOCATION MAP OF NAPURO DAM

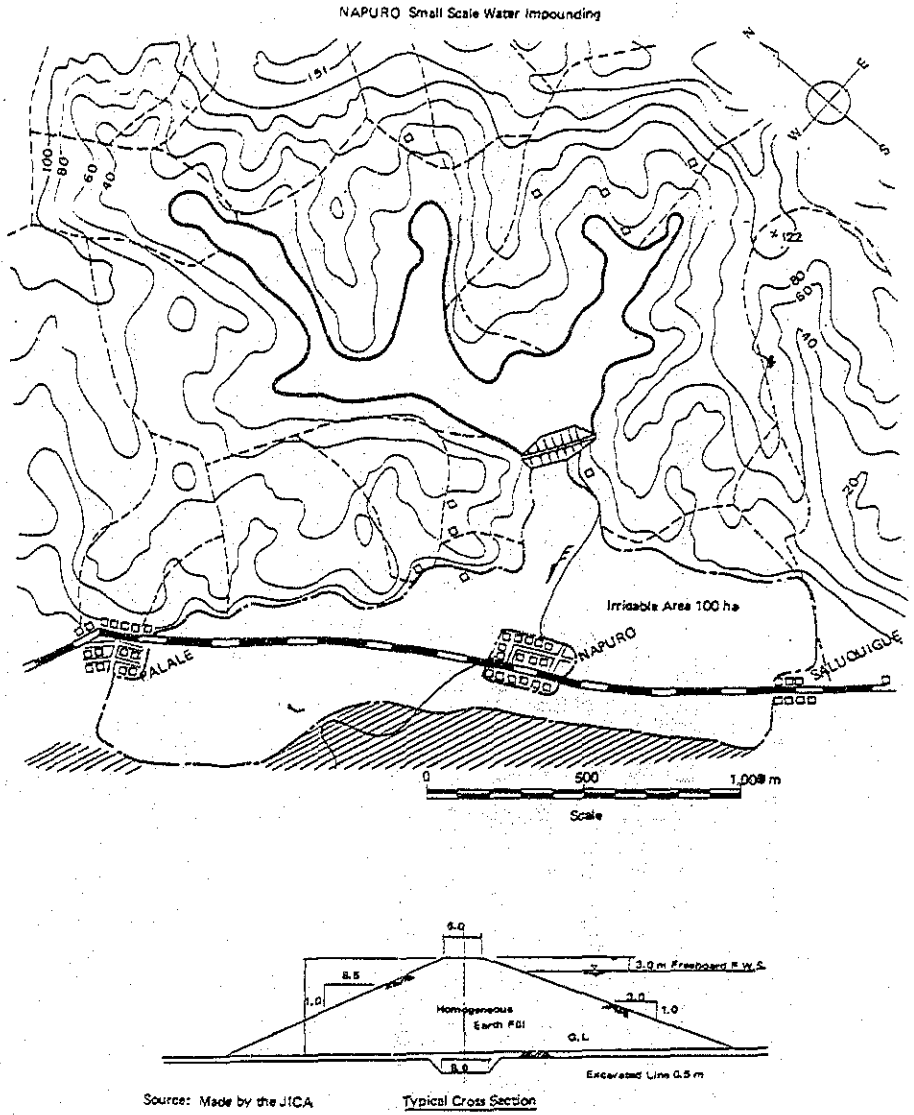
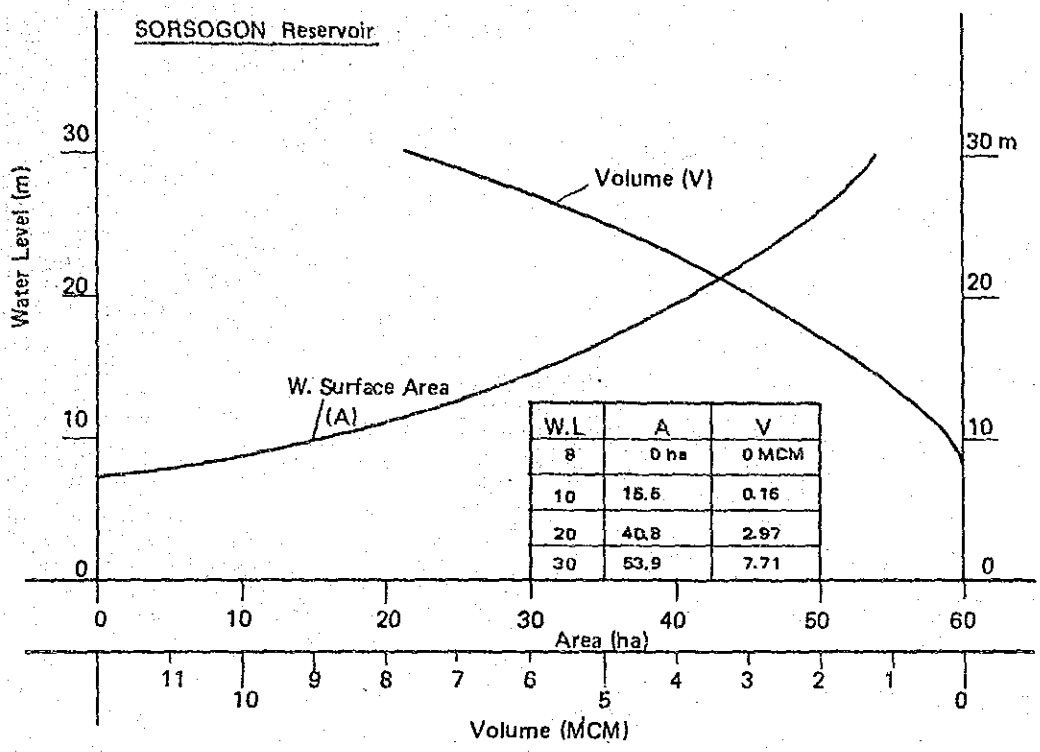
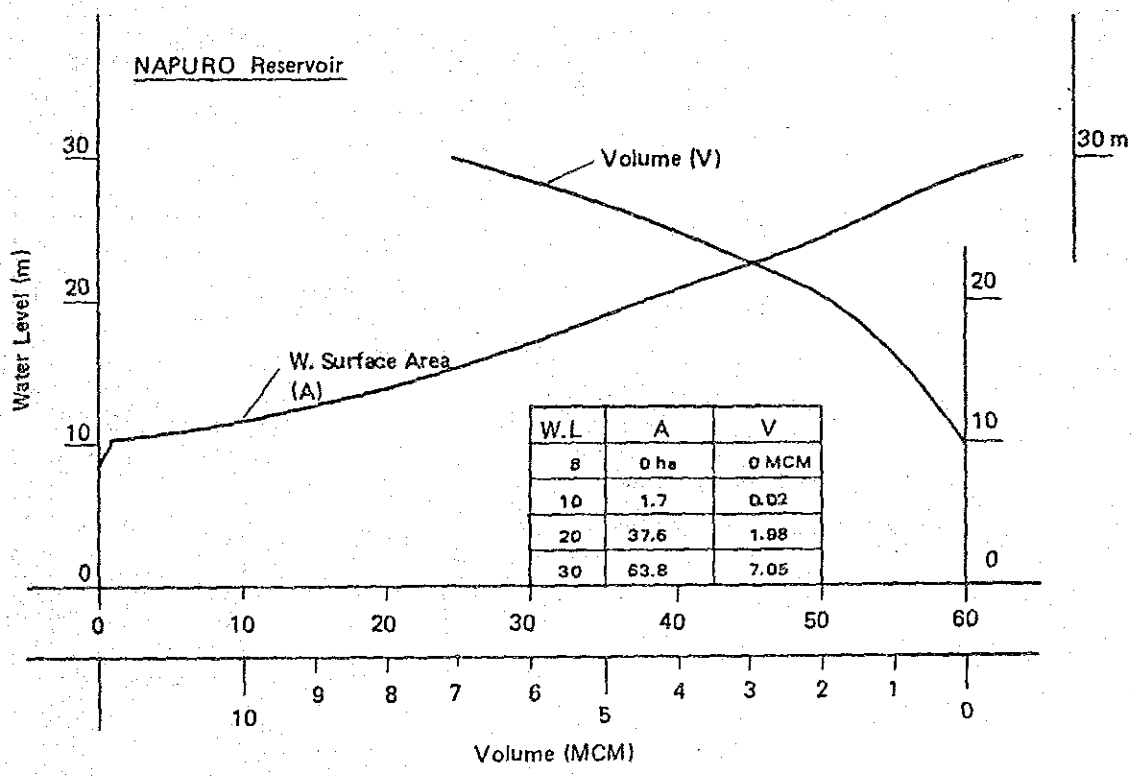


FIGURE F.5.3. H–A AND H–Q CURVE





Source: made by the JICA Study Team

FIGURE F.5.4. RESERVOIR OPERATION OF SORSOGON RESERVOIR

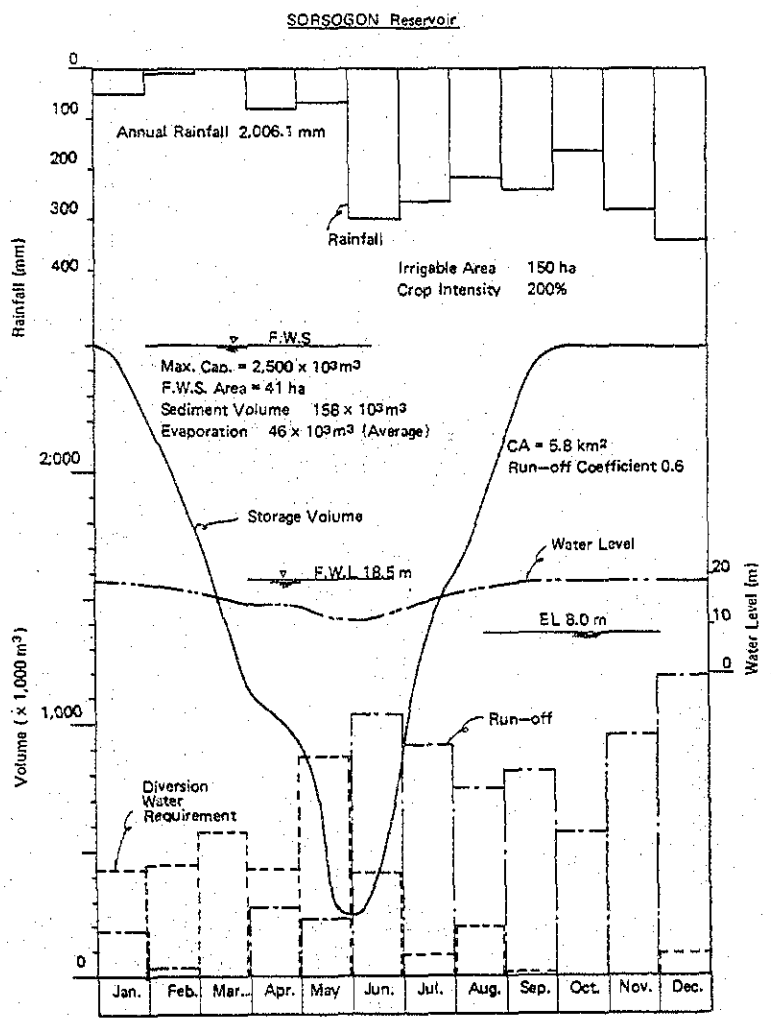
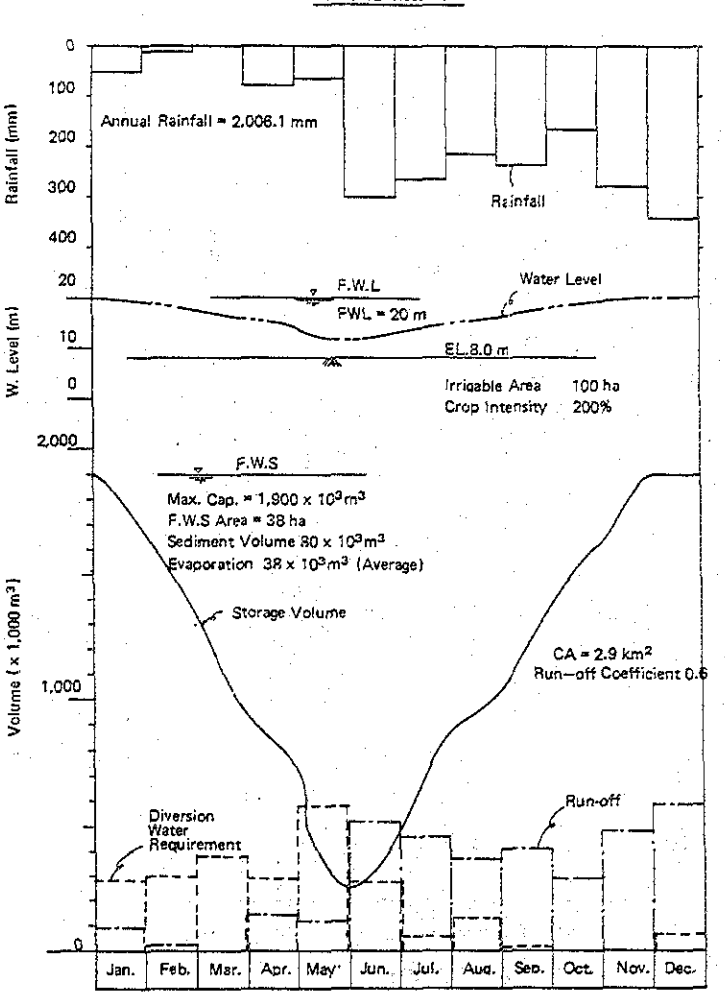


FIGURE F.5.5. RESERVOIR OPERATION OF NAPURO RESERVOIR



APPENDIX G. ROAD AND TRANSPORTATION

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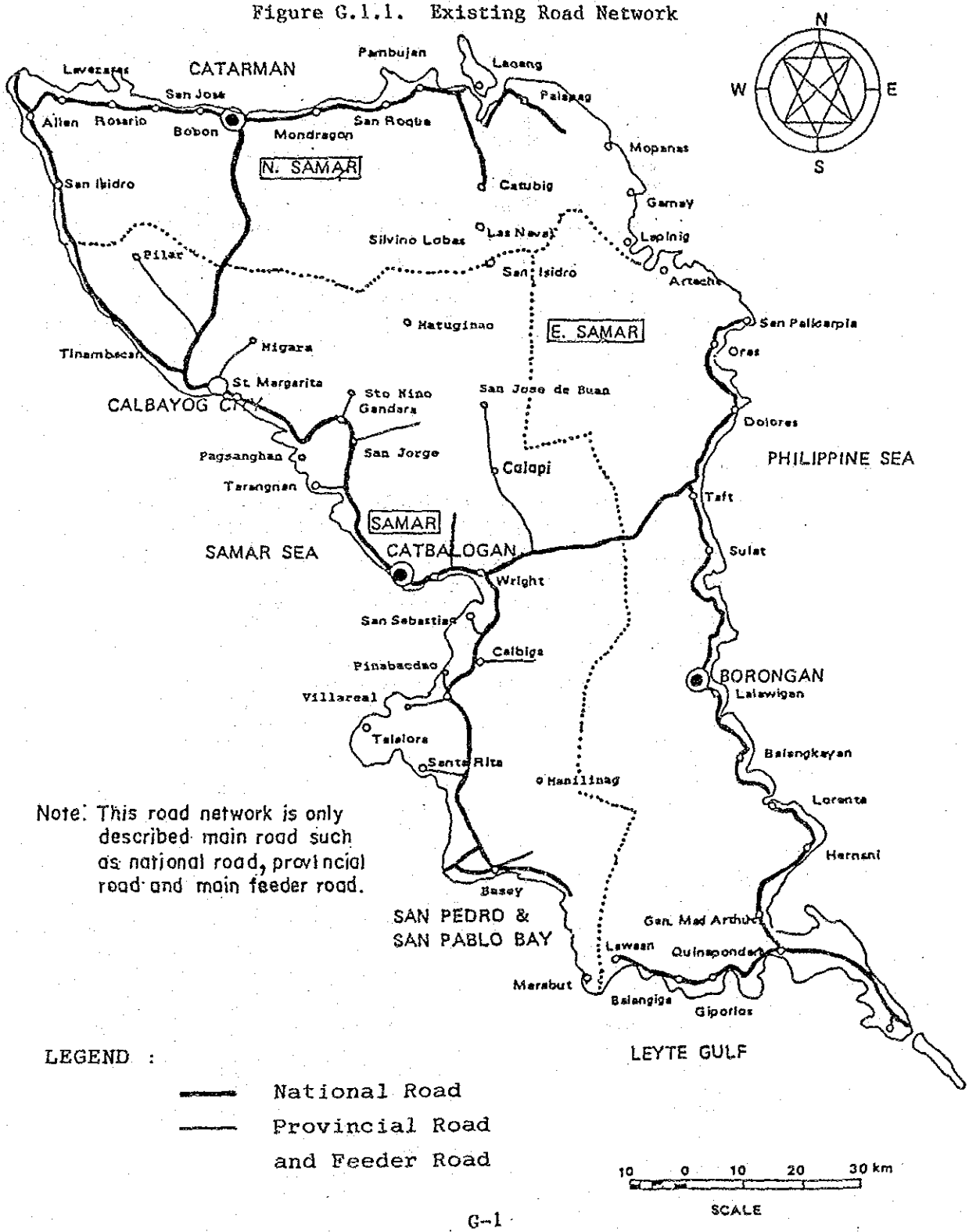
G.1. Road

G.1.1. Present Situation

1) Existing Road Network

Figure G.1.1. Existing Road Network



Note: This road network is only described main road such as national road, provincial road and main feeder road.

LEGEND :

——— National Road

—— Provincial Road and Feeder Road

Table G.1.1 Existing Road Length of Western Samar in 1987

(Unit : Km.)

Road Type	Length	PAVEMENT			
		Concrete	Asphalt	Gravel	Earth
National	313.38	234.22	0.62	78.54	-
Provincial	149.98	7.90	1.00	138.08	3.00
City	10.15	8.23	-	1.92	-
Municipal	51.30	33.01	2.35	6.91	9.03
Barangay	395.64	20.29	-	163.01	212.34
Total	920.45 (100.0%)	303.65 (33.0)	3.97 (0.4)	388.46 (42.2)	224.37 (24.4)

Source: Department of Public Works and Highways (DPWH), Region VIII

Table G.1.2 Road Density in 1985

Province	(a) Total Road Length (Km.)	(b) Total Land Area (Km^2)	(c) Arable Land (Km^2)	(d) Population (1,000 Persons)	Road Density (a)/(b)	(a)/(c)	(a)/(d)
Samar	915	5,591	1,871	523	0.16	0.49	1.75
Northern Samar	826	3,498	1,177	430	0.24	0.70	1.92
Eastern Samar	1,616	4,340	1,356	358	0.37	1.19	4.51
Leyte	4,164	5,745	3,611	1,305	0.72	1.15	3.19
Region VIII	9,321	21,432	9,620	3,013	0.43	0.97	3.03
Over all Philippines	161,709	300,000	133,258	54,669	0.54	1.21	2.96

Source: Infrastructure Atlas 1986 by DPWH.

2) Maintenance

Table G.1.3 Equipment in Operating Condition as of September, 1987

	Rate/day
1. One (1) unit Hydraulic Excavator	P1,445.00
2. Five (5) units Ford Fiera	110.00
3. One (1) unit Pick Up Nissan Patrol	275.00
4. Four (4) units Pick Up Toyota Hi-Lux	360.00
5. Four (4) units Dump Trucks	970.00
6. One (1) unit Shop Truck	-
7. Three (3) units Mighty Mite (Road Maintainer)	2,370.00
8. One (1) unit Loader	1,520.00
9. Three (3) units Road Grader	2,985.00
10. One (1) unit Road Roller	1,065.00
11. One (1) unit Pneumatic Roller	560.00
12. One (1) unit Bomag	1,705.00

Source : Area II Equipment Service, Catbalogan

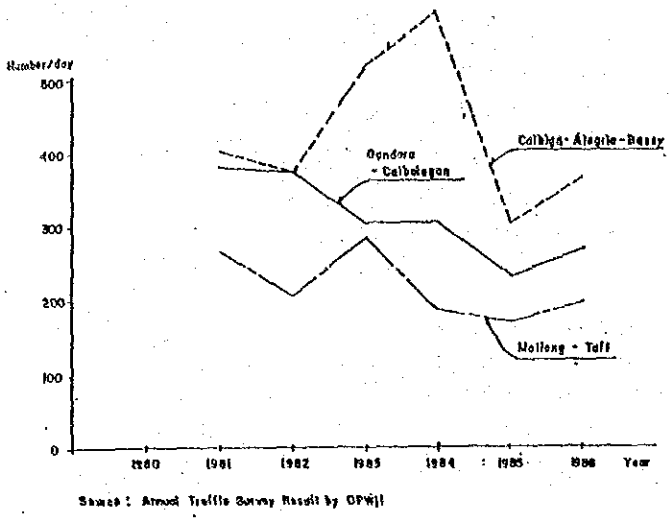
3) Traffic volume

Table G.1.4 Traffic Volume by DPWH

Road Section	1981	1982	1983	1984	1985	1986
Calbayog - Allen	-	278	531	-	261	108
Calbayog - Oquendo	-	367	896	110	148	251
Calbayog - Sta.Margarita	-	623	677	474	462	605
Sta.Margarita - Gandara	412	364	295	190	232	240
Gandara - Catbalogn	379	371	302	307	231	266
Catbalogan - Jiabong	-	-	-	-	381	383
Motiong - Taft	265	204	203	183	167	194
Motiong - Hinabangan	389	429	432	248	279	326
Hinabangan - Calbiga	316	438	447	275	326	395
Calbiga -Alegria- Basey	400	364	512	590	301	363

Source : Annual Traffic Survey Result by DPWH

Figure G.1.2 Traffic Volume



Source : Annual Traffic Survey Result by DPWH

Figure G.1.3 Evolution of Number of Motor Vehicles Registered in Western Samar

Source : Land Transportation Commission, Region VIII

4) Traffice survey

The traffic survey was conducted from 7:00 a.m. until 7:00 p.m. on September 1 and 2 by JICA Study Team at three points as follows:

a. Dolores, PNABACDAO : Junction of the national road (Tacloban - Catbalogan) and the provincial road for Villareal.

b. Loquilocon, WRIGHT : Junction of the national road (Wright - Taft) and the provincial road for San Jose de Buan.

c. Oquendo, CALBAYOG : Junction of the national road (Calbayog - Catarman) and Pilar feeder road.

According to the traffic volume based on the traffic survey, it is expected that the traffic volume of the national road and the provincial road is from 130 to 400 and from 40 to 120 vehicles per day, respectively, as shown in Table G.1.5, and the traffic volume at each points shows almost the same as the figures by DPWH traffic survey as shown in Table G.1.4.

Table G.1.5 Traffic Volume based on Traffic Survey

Road Section	Traffic Volume per day		Remarks
Dolores - Villareal	115	(96)	Provincial Road
Tacloban - Dolores	300	(251)	National Road
Dolores - Catbalogan	390	(325)	National Road
Loquilocon - Calapi	40	(35)	Provincial Road
Wright - Loquilocon	170	(142)	National Road
Loquilocon - Taft	135	(113)	National Road
Oquendo - Pilar	50	(42)	Barangay Road
Calbayog - Oquendo	260	(217)	National Road
Oquendo - Catarman	210	(177)	National Road

Source : JICA Study Team, 1987

Note : 1/ The figures in the parenthesis are shown traffic volume per 12 hours based on the traffic survey.
2/ Traffic volume per day is 1.2 times of traffic volume per 12 hours.

Table G.1.6 Traffic Count by Traffic Survey

Direction	Traffic Volume		Average
	Sept. 1 (Tuesday)	Sept. 2 (Wednesday)	
1. Survey Point: Dolores, PINABACDAO			
Villareal to Catbalogan	44	30	37
Catbalogan to Villareal	40	55	48
Villareal to Tacloban	2	1	2
Tacloban to Villareal	8	9	9
Catbalogan to Tacloban	126	118	122
Tacloban to Catbalogan	116	119	118
2. Survey Point: Loquilocon, WRIGHT			
Calapi to Taft	1	2	2
Taft to Calapi	1	1	1
Calapi to Wright	14	17	16
Wright to Calapi	15	17	16
Taft to Wright	41	51	46
Wright to Taft	61	67	64
3. Survey Point: Oquendo, CALBAYOG			
Pilar to Catarman	0	1	1
Catarman to Pilar	0	0	0
Pilar to Calbayog	16	21	19
Calbayog to Pilar	21	22	22
Catarman to Calbayog	72	102	87
Calbayog to Catarman	69	109	89

Source : JICA Study Team, 1987