

AGENCY FOR INTERNATIONAL DEVELOPMENT WASHINGTON, D. C. 20523 <b>BIBLIOGRAPHIC INPUT SHEET</b>	<b>FOR AID USE ONLY</b> <i>Batch 87</i> ARDA
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1. SUBJECT CLASSIFICATION	A. PRIMARY Science and technology	TC00-0000-G732
	B. SECONDARY Applications--Philippines	

2. TITLE AND SUBTITLE  
 Environmental assessment of the Small Farmer Systems Project, Philippines

3. AUTHOR(S)  
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4. DOCUMENT DATE 1978	5. NUMBER OF PAGES 840	6. ARC NUMBER ARC
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7. REFERENCE ORGANIZATION NAME AND ADDRESS  
 AID/ASIA/USAID/Philippines

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)

9. ABSTRACT

The Small-Scale Irrigation Project (SSI) is designed to increase the small farmer's income by the creation of irrigation systems and the development of farmer's organizations. Plans include the conversion of 190,000 hectares of agricultural land from single to double cropping from 1978 to 1982. Based on available data, field observations and the implementation of mitigation measures, it is concluded that there is no potential major adverse environmental impact warranting curtailment of the program. It is recommended that a training program be instituted in the use and proper application of appropriate pesticides in order to limit potential adverse ecological effects from that source. In areas endemic for schistosomiasis, a control program for snails should be developed and additional emphasis placed on good water management practices. A limited program of monitoring is recommended to document changes in pesticide use and their effects and in public health parameters.

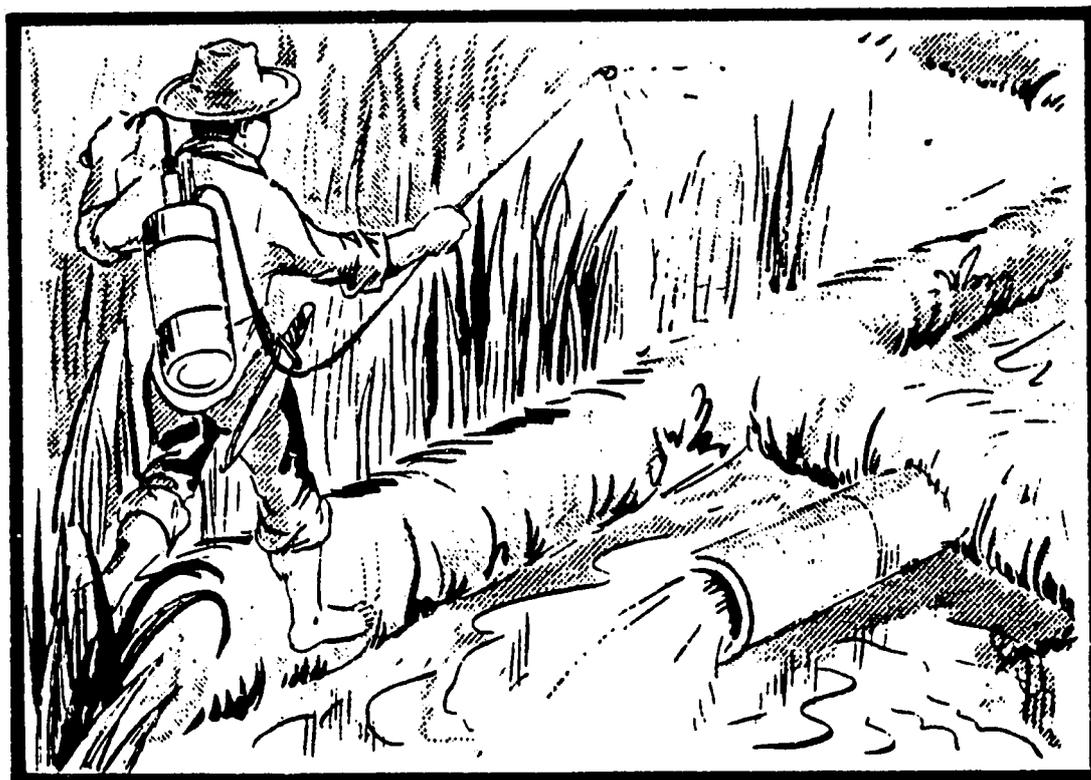
10. CONTROL NUMBER <i>PN-AAF-017</i>	11. PRICE OF DOCUMENT
12. DESCRIPTORS AID Assessments Environmental factors Farms, small Irrigation Philippines Projects Project planning	13. PROJECT NUMBER
	14. CONTRACT NUMBER AID/ASIA/USAID/Philippines
	15. TYPE OF DOCUMENT



AID/ASIA/USATU/

PNAAF-017 Philippines

**Supplement A**  
**ENVIRONMENTAL ASSESSMENT**  
**OF THE**  
**SMALL FARM SYSTEMS**  
**PHILIPPINES**



**United States Agency for International Development**

**Ralph A. Luken**

**and**

**Inter-Agency Committee for Ecological Studies**

**ENVIRONMENTAL ASSESSMENT**  
of the  
**SMALL FARMER SYSTEMS PROJECT\***  
**PHILIPPINES**

prepared for the  
**UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT**

Manila, Philippines  
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by

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**Inter-Agency Committee for Ecological Studies**

February, 1978

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\*Throughout the Environmental Assessment, the Small Farmer Systems Project is identified as the Small-Scale Irrigation Project, which was the name of the project at the time of the preparation of this report.

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SUMMARY

(X) Draft EA            ( ) Final EA  
( ) Draft EIS           ( ) Final EIS

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1. Name of Action: Small-Scale Irrigation Project (SSI)
2. Brief Description of the Action:

The SSI Project is designed to increase the small farmer's income by creating commercially viable farmer enterprises. The Farm Systems Development Corporation (FSDC), which is implementing the project, has targeted the conversion of 190,000 hectares from single to double cropping between 1978 and 1982. The FSDC will organize 130,000 small farmers into about 1,200 Irrigators' Service Associations (ISAs).

The main features of the project are:

- A. Irrigation Systems - The establishment of small-scale irrigation systems is the major feature of the project. This includes construction, installation and operation of pumps for irrigation and the expansion and/or rehabilitation of existing pump systems.
- B. Institutional Development - Corollary with the development of irrigation systems, the FSDC will organize farmers into ISAs. Throughout the year, the FSDC will regularly conduct training programs designed to equip farmers with entrepreneurial and management skills necessary in the development of rural leadership.
- C. Farm Support Systems - To strengthen the ISA organization and to further sustain agricultural productivity, farm support systems would be established to maximize labor, capital and land utilization. Commodity loans in the form of farm tools and equipment will be granted to ISA members to augment production capacities and post-harvest activities.

### 3. Summary of Environmental Impacts:

- A. Individual sub-projects because of their small size (100-300 hectares) will not have much of a measurable impact on natural and socio-economic conditions except in very unusual circumstances and only on a limited number of parameters.
- B. There will be normal short-term effects like the turbidity of water and slight disruption of the area during construction of pump and canal structures.
- C. There will be an increased risk of pesticide mishandling because the project will promote the use of agricultural chemicals. Careless disposal or application of some pesticides can result in adverse health effects.
- D. There will be more pesticide run-off due to the increased use of agricultural chemicals. Some of these pesticides would have an adverse effect on fishes, crabs and snails found in ricefields.
- E. In sub-project areas endemic for schistosomiasis, cases of poor water management might result in the establishment of breeding sites for snails, the intermediate host for schistosomiasis.
- F. While sub-projects will be constructed in provinces endemic for malaria, they will seldom be constructed in sites which would become suitable breeding places for anopheles mosquitoes. Sub-projects, for the most part, are constructed in the plains rather than foothills and mountainous areas.
- G. The sub-projects will improve social and economic conditions in the rural areas. Irrigation projects will be marked by a growth in per capita income and a higher standard of living.

### 4. Alternatives Considered:

- A. No project.
- B. Delay in project implementation.
- C. Different projects to achieve same goal.
- D. Functional or operational modifications.
- E. Different energy sources.
- F. Different locations.

## Chapter 1. PROJECT PURPOSE

### 1.1 Project Goals and Specific Objectives

The Small-Scale Irrigation Project (SSI) is a USAID-assisted project of the Farm Systems Development Corporation (FSDC). It is designed to increase small farmers' income through the creation of irrigation systems and the development of farmers' organizations. The FSDC has targeted the conversion of 190,000 hectares of agricultural land from single to double cropping from 1978 to 1982 (Table 1).

As of December 1976, the program had covered 29 provinces (Table 2). The FSDC had initiated 477 ISA's which served approximately 28,000 hectares.

### 1.2 Relationship to National Development Plan

The SSI Project is part of the government's program to increase agricultural production and reduce income disparities. The major thrust is directed towards small farmers who receive organizational training, irrigation systems and farm support services.

The SSI Project is related to and supportive of the government's self-sufficiency program for rice. Its goals and objectives are consistent with the national development plan as embodied in the current 5-Year Development Plan.

Inasmuch as this program involves existing agricultural land, it does not, in any way, conflict with the existing national land use policies.

**TABLE 1**  
**PROJECT MASTER PLAN**

<b>A. Irrigation System</b>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>TOTAL</u>
1. Hectares Irrigated	35,000	35,000	40,000	40,000	40,000	190,000
Pump	15,000	15,000	15,000	15,000	15,000	75,000
Gravity	20,000	20,000	25,000	25,000	25,000	115,000
2. ISA's Irrigated	270	270	220	220	220	1,200
<b>B. Farm Support System</b>						
1. Hectares Covered	---	5,400	12,100	24,500	22,500	64,500
2. ISA's Covered	---	50	130	250	230	660
3. Individual Farm Mechanic	---	4,000	8,000	16,000	15,000	43,000
<b>C. Institutional Development</b>						
1. No. of ISA's Organized	270	270	220	220	220	1,200
2. No. of Farmers	30,000	25,000	25,000	25,000	25,000	130,000
3. No. of Trainings	1,200	1,500	1,800	1,300	1,900	7,700

**SOURCE: FSDC**

TABLE 2

STATUS OF SSI PROJECT, AS OF DECEMBER 31, 1976

Province	No. of ISAs	No. of Farmers	Pumps Installed	Area Served (hectares)
1. Abra	12	1,408	15	1,695
2. Agusan del Sur	11	1,224	--	---
3. Aklan	8	402	5	398
4. Antique	13	696	16	1,116
5. Bataan	19	844	4	253
6. Benguet	7	182	--	---
7. Bohol	7	449	--	---
8. Bulacan	16	660	3	218
9. Cagayan	13	491	9	888
10. Camarines Sur	20	708	20	2,350
11. Capiz	72	2,836	73	3,420
12. Cavite	3	129	6	297
13. Davao del Norte	15	508	21	2,457
14. Davao Oriental	5	215	4	256
15. Ilocos Norte	7	370	7	477
16. Ilocos Sur	7	222	--	---
17. Iloilo	43	2,724	32	1,391
18. Isabela	35	3,867	30	2,870
19. La Union	11	415	16	1,005
20. Lanao del Sur	21	998	14	885
21. Leyte	22	761	18	1,382
22. Negros Occidental	15	545	14	869
23. North Cotabato	8	865	4	293
24. Pampanga	11	1,472	28	2,855
25. Pangasinan	15	926	7	464
26. Quezon	11	587	11	830
27. Sorsogon	7	238	2	69
28. Zambales	34	2,042	12	768
29. Zamboanga del Sur	9	1,015	2	96
<b>T O T A L</b>	<b>477</b>	<b>27,794</b>	<b>373</b>	<b>28,202</b>

SOURCE: FSDC

## Chapter 2. DESCRIPTION OF THE PROJECT

### 2.1 Selection of Sub-Projects Under the Program

Sub-projects selected under the project must be between 25 and 1,000 hectares in size and must be technically feasible and economically viable. The sub-projects, above all, must be supported by a group of farmers who are willing to form into effective farmers' organizations to eventually operate and maintain the irrigation systems.

### 2.2 Selection of Sub-Projects for Environmental Assessments

There would be about 1,200 individual sub-projects to cover the target area of 190,000 hectares. Given the number of sub-projects, an Environmental Assessment could not be completed on each one. Instead, Environmental Assessments are made on a "normal project" and three other projects which are representative of the potential major environmental problems associated with irrigation.

Four criteria were used in selecting the four sub-projects from among the more than 1,200 sub-projects:

1. Potential Problems - three sub-projects were representative of the three environmental problems identified in the Initial Environmental Examination: schistosomiasis, which is endemic in seven of the 29 provinces now covered under the Project; malaria, which infects 10 out of the 29 provinces now covered under the Project; and pesticide run-off which is expected to increase in all provinces due to the increased use of agricultural chemicals;
2. Geographical Distribution - sub-projects were selected from each island group;
3. Availability of Data - the sub-projects had completed feasibility studies based on adequate data;
4. Accessibility - sub-projects were accessible and relatively easy to visit.

On the basis of these four criteria, four sub-projects are evaluated in this study (Table 3). The general locations of these sub-projects are shown in Figure 1.

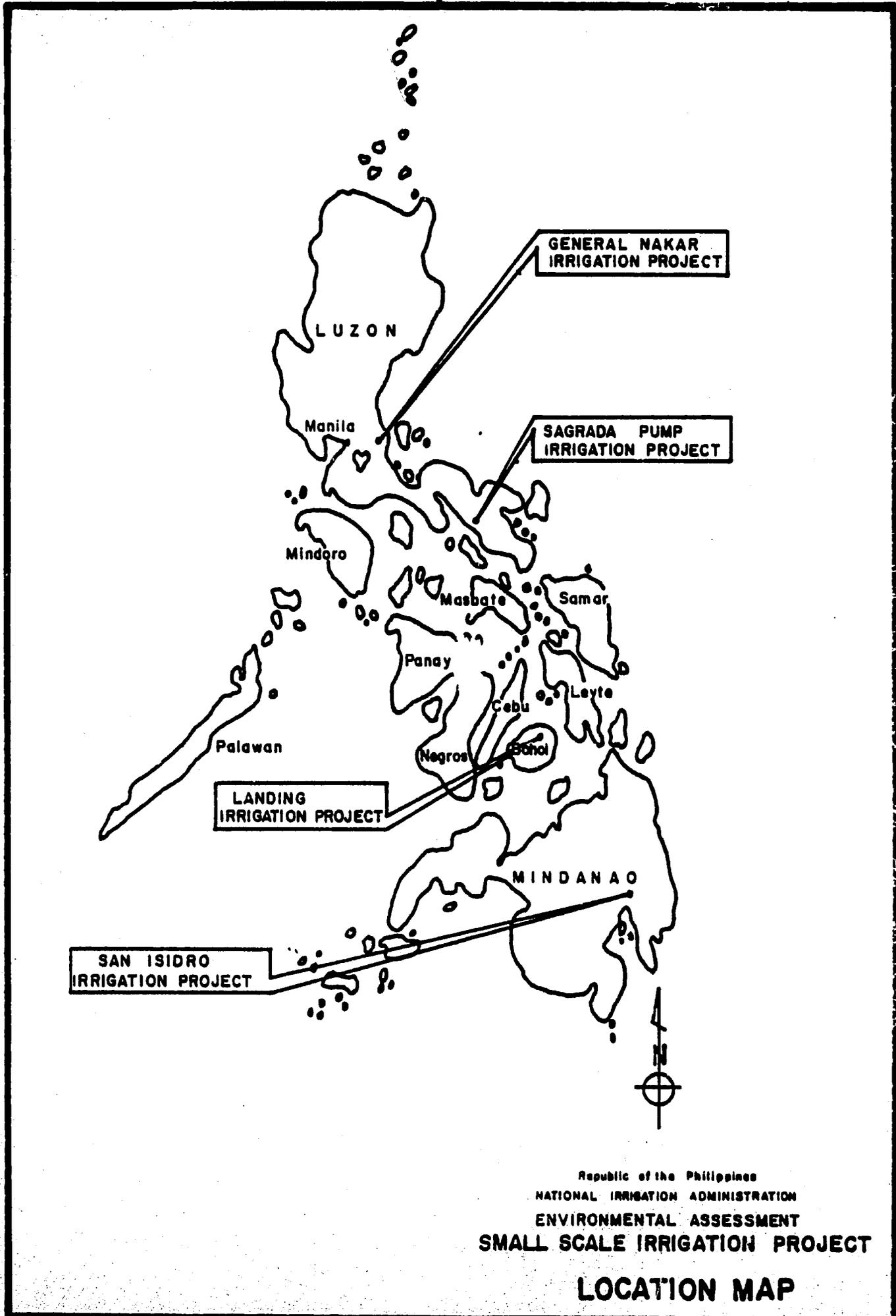
TABLE 3

SUB-PROJECTS EXAMINED AND THEIR ENVIRONMENTAL PROBLEMS

<u>Name of Project</u>	<u>Province</u>	<u>Significant Environmental Problems</u>	<u>Island Group</u>
Landing Irrigation Sub-Project	Bohol	None (as control)	Visayas
San Isidro Irrigation Sub-Project	Davao del Norte	Schistosomiasis	Mindanao
Gen. Nakar Irrigation Sub-Project	Quezon	Malaria	Luzon
Sagrada Irrigation Sub-Project	Camarines Sur	Pesticide Run-off	Luzon

SOURCE: FSDC

Figure 1



Republic of the Philippines  
NATIONAL IRRIGATION ADMINISTRATION  
ENVIRONMENTAL ASSESSMENT  
SMALL SCALE IRRIGATION PROJECT  
**LOCATION MAP**

### 2.3 Project Features

The first and most important feature of the project is an institutional system called Irrigators' Service Association (ISA). The function of an ISA is to serve as a conduit for technical and financial inputs and to provide centers for information and skill adoption.

The second important feature of the project is an irrigation system (Table 4). As can be seen, sub-project size ranges from 100 hectares to 300 hectares. All sub-projects are diesel-driven pump systems and require essentially the same concrete structures.

The third important feature of the project is a farm support system, which is established to maximize labor, capital and land utilization. Commodity loans will be available to purchase farm tools and other equipment necessary to augment production capacities and post-harvest activities.

### 2.4 Project Activities

Most project activities are common to the four sub-projects. They are usually divided into two categories: construction and operation.

Construction activities include the construction of pump sump, pump foundation, pump house, stilling pool, canal structures and the excavation of soil for the canals. Construction activities are carried on throughout the year. Construction of the pump sump and excavation of soils can be done efficiently because river flow is at a minimum and fields are dry.

Project activities during operation are limited to only running the engine and normal farm activities such as preparing the land, planting and caring of the crop, harvesting of the crop and maintaining the canals.

Another important activity that will be started even prior to construction is organization of an ISA. An ISA would be used for, among other things, training and teaching farmers how to effectively operate and maintain an irrigation system.

### 2.5 Other Related Activities

There are now several ongoing government projects designed specifically for the development of rural areas. One of them is the World Bank-assisted Philippine Rural Infrastructure Project initially covering

TABLE 4

SUB-PROJECT FEATURES

I T E M S	Landing Sub-Project	San Isidro Sub-Project	Gen. Nakar Sub-Project	Sagrada Sub-Project
1. Location	Dagohoy, Bohol	Carmen, Davao del Norte	General Nakar, Quezon	Bula, Camarines Sur
2. Sub-project Area	103 hectares	257 hectares	270 hectares	142 hectares
3. Type of Irrigation	Diesel driven pump	Diesel driven pump	Diesel driven pump	Diesel driven pump
4. Pump Specification	2 units of 20 centimeter diameter, 22.6 KW	*1 unit of 25 cen- timeter diameter, 30.2 KW *1 unit of 20 cen- timeter diameter, 22.6 KW	*1 unit of 10 cen- timeter diameter, 22.6 KW. *2 units of 10 centimeter diameter, 41.2 KW	2 units of 10-centimeter diameter, 34.0 KW
5. Canals	1,700 meters	4,300 meters	5,900 meters	1,300 meters
6. Concrete structures	Canal structures, stilling pool, pump sump, pump house, engine foundation	Canal structures, stilling pool, pump sump, pump house, engine foundation	Canal structures, stilling pool, pump sump, pump house, engine foundation	Canal structures, stilling pool, pump sump, pump house, engine foundation

SOURCE: FSDC

the provinces of Abra, Kalinga-Apayao, Antique, Aklan, Capiz, and Bohol. Another 10 provinces would be covered under Part II of the project of which small-scale irrigation is a major component.

Other projects involving small-scale irrigation are the Mindoro Integrated Rural Development Project, the Samar Rural Development Project and the Land Settlement Project of Agrarian Reform.

## Chapter 3. DESCRIPTION OF THE ENVIRONMENT

The sub-projects under the SSI Project are located in 29 different provinces. Although each sub-project setting is admittedly unique in itself, most of the significant parameters of the over-all SSI Project are covered by describing the environmental setting of the four selected sub-projects.

### 3.1 Landing Irrigation Sub-Project

#### 3.1.1 Land

The Landing Sub-Project is located in Dagohoy, Bohol which is about 600 kilometers south of Manila (Figure 2). The municipality of Dagohoy has a land area of 8,750 hectares of which 2,000 hectares are considered arable.

The general topography of the sub-project area varies from level to gently rolling landscape. The drainage area at the pump-site is 280 square kilometers, of which 25 percent are mountainous.

The sub-project area is covered with alluvial soils with medium to fine texture. Some of the soils are low in fertility although a test made by the Bureau of Soils indicates that they will respond to fertilizer amendments.

Land use data for farming activities in Dagohoy are shown in Table 5. Slightly less than 50 percent of the land is planted to temporary crops, primarily rice.

#### 3.1.2 Water

The Wahig River is the major source of water in the vicinity for irrigation, laundering and bathing. For drinking purposes, shallow wells and springs are utilized by the inhabitants.

The river has an average discharge of 1.5 cubic meters per second at the pumpsite. The water is turbid during the rainy season and clear during the dry season.

The proposed Wahig-Pamacsalan Project with its storage reservoirs would further assure this project of adequate water supply through its reservoir releases and return flows. Initial studies undertaken by the National Irrigation Administration indicate that the reservoir

Figure 2

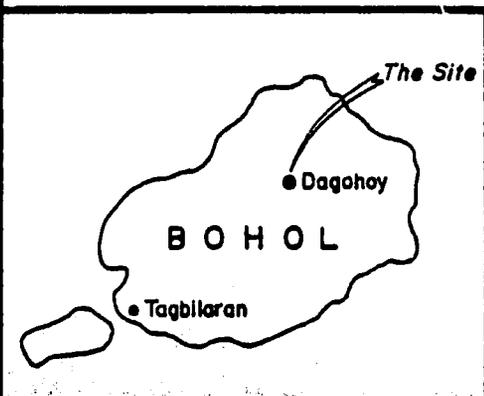
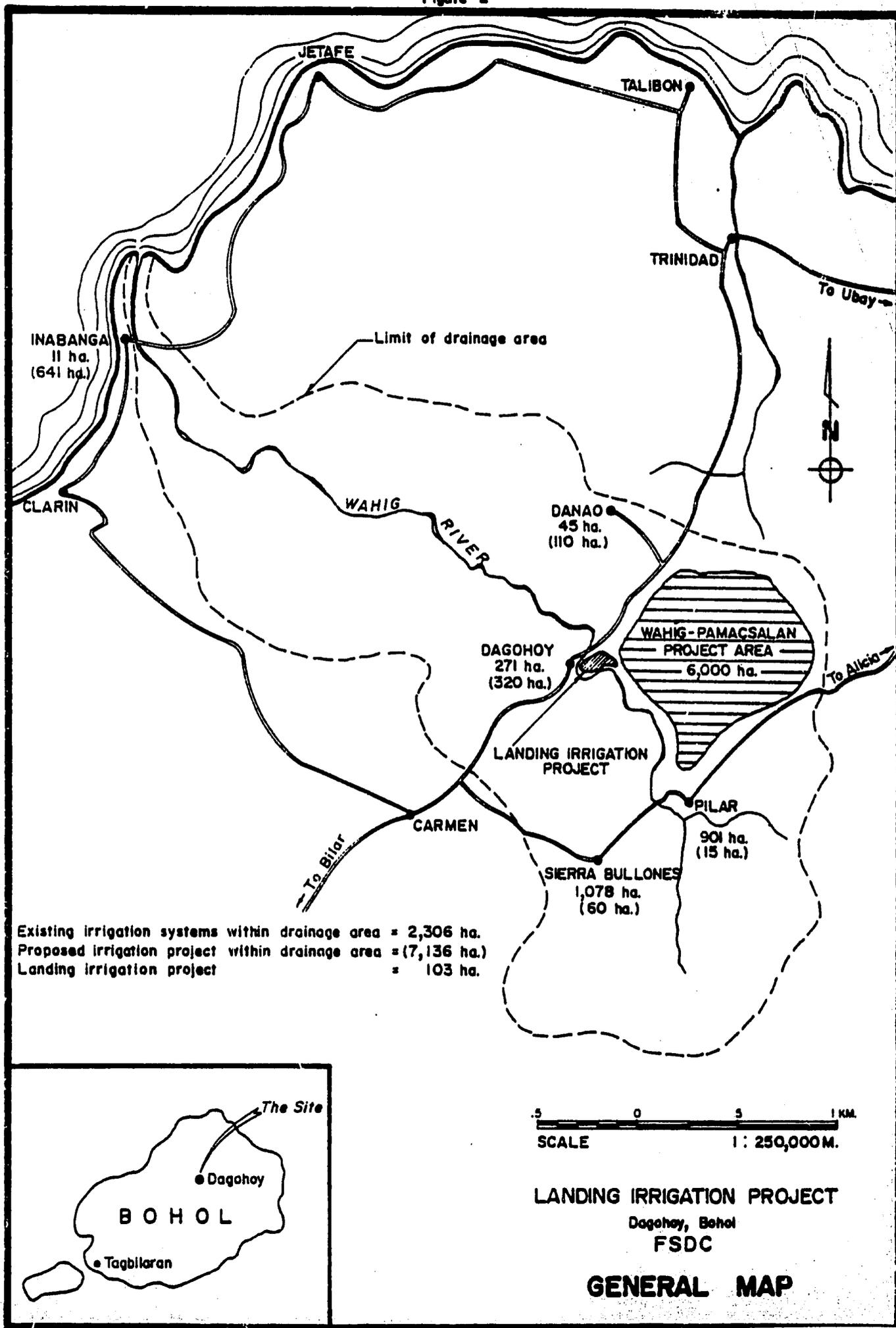


TABLE 5

AREA OF FARMS BY LAND USE: DAGOHoy/BOHOL, 1971

Land Use	Dagohoy		Bohol	
	Hectares	%	Hectares	%
1. Planted to temp. crops* <sup>1</sup>	1,600	47	57,400	40
2. Lying idle* <sup>1</sup>	400	12	15,900	11
3. Planted to perm. crops*	900	26	47,300	33
4. Under perm. meadows and pastures	400	12	14,900	11
5. Covered with forest growth	100	3	2,800	2
6. All other lands	-	-	3,800	3
<b>T O T A L</b>	<b>3,400</b>	<b>100</b>	<b>142,100</b>	<b>100</b>

\*Includes the 103 hectares of the Landing Sub-Project.

<sup>1</sup>/ Considered as arable lands.

SOURCE: FSDC

would have an average discharge of 12 cubic meters per second.

The results of the pesticide analysis of the Wahig River show no concentrations at the minimum detectable limit of 0.02 ppb. The results are based on only one sample at three stations near the project area.

### 3.1.3 Atmosphere

The sub-project area falls under the Type IV Climate Classification of the Philippines which is characterized by a more or less evenly distributed rainfall throughout the year. The average monthly and annual rainfall at Ubay station are listed in Table 6.

Average temperature fluctuates at around 27.5 °C while average relative humidity is about 80 percent.

No air pollution was observed in the area.

### 3.1.4 Aquatic Life and Terrestrial Life

Wildlife are found only in the upper reaches of the drainage basin where there is still forest cover and along the river banks. Wildlife common in the area are bats, swifts, orioles and crows. The quail (Turnix sp.) and ricebird are occasionally seen in the ricefields.

The aquatic resources of the river are mud fish (Ophicephalus striatus), carp (Cyprinus carpio), tilapia (Tilapia mossambica) and eel (Anguilla sp.). Due to overfishing, they are already very scarce.

There are no known rare or endangered species of fish and wildlife in the sub-project area.

### 3.1.5 Demography

There are about 8,600 people in the town of Dagohoy, of which about 1,400 live in the political subdivision containing the sub-project. The town had a population growth rate of only 1.4 percent between 1970 and 1975 due to out-migration. The population is relatively young with about 57 percent of the total population below 25 years of age.

The sub-project would be operated by the 35 registered members of the ISA of which about 75 percent live in the sub-project area.

TABLE 6

AVERAGE MONTHLY AND ANNUAL RAINFALL, UBAY STATION, 1960-1970

Month	Average (mm)	Month	Average (mm)
January	96	July	233
February	131	August	131
March	84	September	478
April	45	October	218
May	201	November	238
June	198	December	133
<b>AVERAGE ANNUAL</b>			<b>2,187</b>

SOURCE: Philippine Atmospheric, Geophysical and Astronomical Services Administration

### 3. 1. 6. Lifestyle and Amenities

The people are generally agricultural workers and farming occupies most of their time. During the dry season, when there is very little agricultural activity in their area, some farmers temporarily move to nearby areas as hired agricultural workers on irrigated farms.

The most common form of recreation is cock-fighting which usually occurs on Sundays and holidays.

There is no electricity available within the sub-project area. Farmers use firewood for cooking and kerosene for lighting.

Most of the farmers are members of the Samahang Nayan, an organization at the Barangay level that promotes farmers' cooperatives. They are quite aware of the government's programs through barangay meetings and extension workers.

### 3. 1. 7. Cultural Minorities and Historical Sites

There are no cultural minorities in the sub-project area nor as members of the ISA. There are no historical or archaeological sites within the sub-project boundaries.

### 3. 1. 8. Health

The ten most frequent causes of morbidity and mortality in Dagohoy and Bohol are partially listed in Table 7. General health problems in the area are the high birth rate, untreated drinking water supply and malnutrition.

Schistosomiasis, a snail-borne infection, is endemic in Trinidad and Talibon, some 25 kilometers from the sub-project area. The area, however, is highly localized being located among pockets of catchment ponds utilized by farmers. The total snail-infected area is only about three hectares. No cases of schistosomiasis has been reported in any other towns including Dagohoy.

Malaria is not endemic in the sub-project area nor in any town in Bohol.

The health and medical care services are made available to the people by the Department of Health through its Rural Health Units

TABLE 7.

TEN LEADING CAUSES OF MORBIDITY AND MORTALITY IN THE  
MUNICIPALITY OF DAGOHYOY AND THE PROVINCE OF BOHOL

<u>DAGOHYOY</u>		<u>BOHOL</u>	
<u>Causes of Morbidity*</u>	<u>Cases (/100,000)</u>	<u>Causes of Morbidity</u>	<u>Cases (/100,000)</u>
		1. Gastro-enteritis and colitis	480
		2. Influenza	475
		3. Tuberculosis	240
		4. Pneumonia	203
		5. Measles	40
		6. Dysentery	40
		7. Malignant Neoplasm	35
		8. Whooping Cough	32
		9. Infectious Hepatitis	15
		10. Tetanus	7

<u>DAGOHYOY</u>		<u>BOHOL</u>	
<u>Causes of Mortality*</u>	<u>Cases (/100,000)</u>	<u>Causes of Mortality</u>	<u>Cases (/100,000)</u>
		1. Pneumonia	135
		2. Tuberculosis	105
		3. Gastro-enteritis and colitis	57
		4. Malignant Neoplasm	35
		5. Influenza	13
		6. Tetanus	7
		7. Measles	5
		8. Dysentery	1
		9. Cholera El Tor	1
		10. Diphtheria	1

\*Not available at this time.

SOURCE: Disease Intelligence Center, Department of Health, 1974  
Philippine Health Statistics Report

(RHU) which are organized in every town. They are supposed to be staffed by a physician, a nurse, midwife and sanitary inspector. Due to lack of funds, however, most of these Units are not staffed with the necessary personnel to attend to the needs of the people.

### 3.1.9. Economics

Economic well-being in the province lags behind other provinces. The people are generally poor with an average family income of ₱2,465 (\$340) in 1971 compared to the national average of ₱3,740 (\$510). Their income is derived from the sale of palay (rough rice), their main crop, some coconuts and rootcrops. Palay is planted only during the rainy months of May and June. With lack of irrigation water, the land is either planted to corn or rootcrops or just remains idle during the rest of the year.

This condition is partly due to a relative neglect of the infrastructure and agricultural and industrial investments which are needed for economic development.

Most of the farms are owned by the operators themselves.

### 3.1.10. Related Activities in the Area

The Wahig-Pamacsalan Irrigation Project is scheduled for construction in early 1979. The Wahig-Pamacsalan Project utilizes the Wahig River and its tributary, the Pamacsalan River, to irrigate some 6,000 hectares in Dagohoy, Pilar and Sierra Bullones (Figure 2). The Landing Sub-Project is located on the outer southwestern fringe of the service area of the Wahig-Pamacsalan Project.

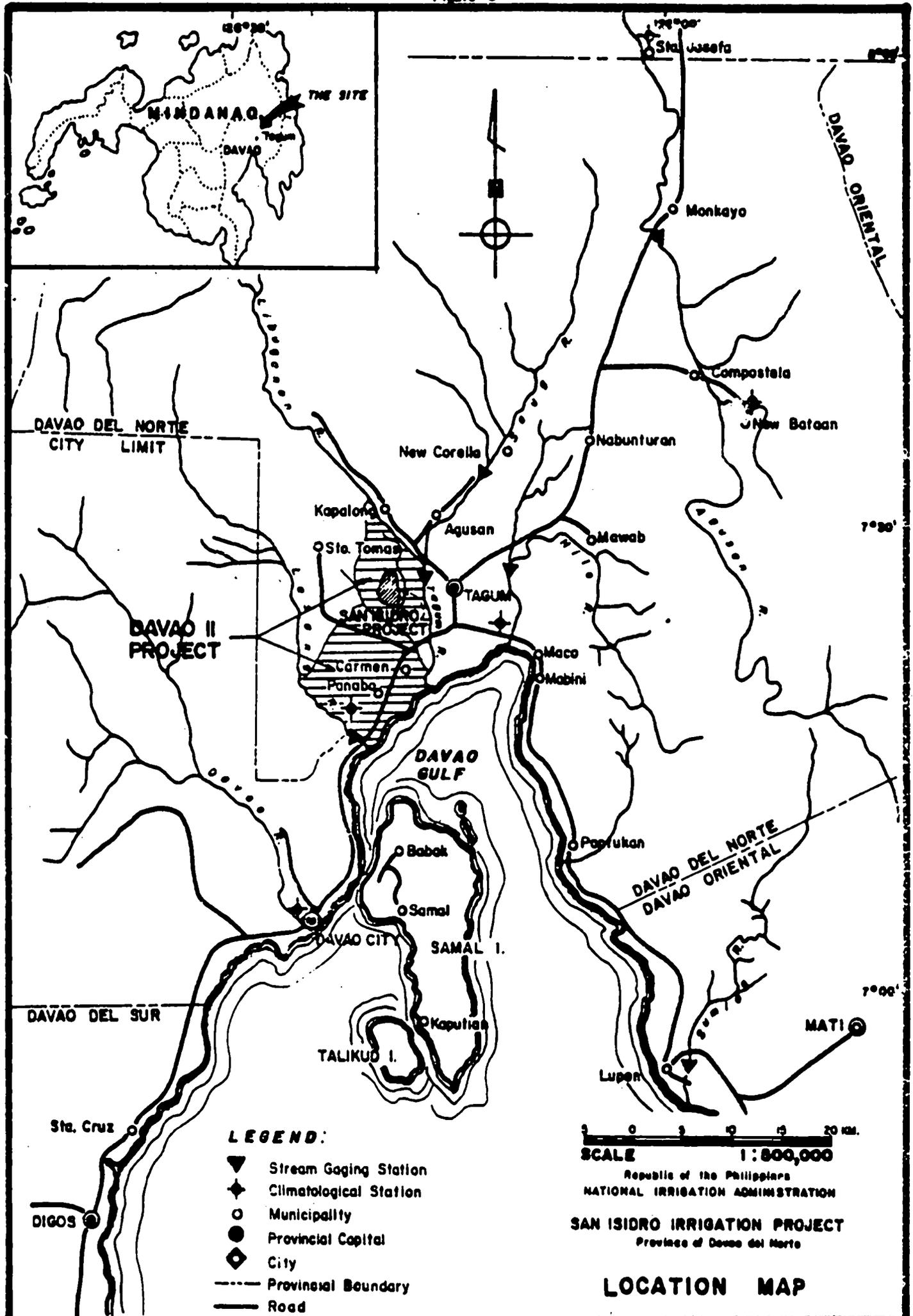
The Landing Sub-Project is the second of its kind in Dagohoy and the third for the Bohol Province.

## 3.2 San Isidro Irrigation Sub-Project

### 3.2.1. Land

The San Isidro Sub-Project is located in Carmen, Davao del Norte, which is about 930 kilometers south of Manila (Figure 3). The municipality of Carmen has a land area of 51,000 hectares of which 4,300 hectares are considered arable.

Figure 3



The general topography of the sub-project area is flat with a slight downward slope from the pumpsite. It has a drainage area of 25 square kilometers at the pumpsite.

The soil belongs to the Carmen series which are deep soils (100-200 cm. clay profile). The drainage conditions within the first 100-150 cm. are poor. This makes most of the sub-project area economically suited only to lowland rice.

Soil fertility is high except for some deficiencies in phosphorous and zinc. These deficiencies could, however, be corrected by fertilizer amendments.

Land use data for farming activities in Carmen are shown in Table 8. Rice is the main crop but is planted only during the wet season. During the dry season, the land is left idle due to lack of water supply.

### 3.2.2. Water

The Cabayanan creek is the source of water for irrigation. It is a tributary of the Tuganay River which drains into the Davao Gulf.

The dependable discharge of the creek has been estimated to irrigate 128 hectares even during the period of low flow.

Water quality analyses were undertaken on nearby rivers and the results showed that the water is suitable for irrigation (Table 9). It poses no salinity nor alkalinity hazards and has permissible levels of residual sodium carbonates, boron and other toxic elements.

The results of the pesticide analysis of the Cabayanan Creek indicate that there are only traces or insignificant concentrations of pesticides (Table 10). These are considerably below permissible levels in drinking water.

### 3.2.3. Atmosphere

The sub-project area falls under Type III Climate Classification of the Philippines which is characterized by a relatively dry season from November to April and a wet season during the remainder of the year. The average monthly and annual rainfall at Panabo Station are listed in Table 11.

TABLE 8

AREA OF FARMS BY LAND USE, CARMEN/DAVAO DEL NORTE 1971

Land Use	Carmen		Davao del Norte	
	Hectarage	% Distribution	Hectarage	% Distribution
1. Planted to temporary crops* <sup>1/</sup>	3,000	41	63,600	29
2. Lying idle* <sup>1/</sup>	1,300	18	29,000	13
3. Planted to permanent crops	2,100	28	76,700	35
4. Under permanent meadows and pastures	600	8	10,600	5
5. Covered with forest growth	400	5	29,400	14
6. All Other Lands	0	--	8,400	4
TOTAL	7,400	100	217,000	100

<sup>1/</sup> Considered as arable lands.

\* Includes the 257 hectares of the San Isidro Sub-Project.

SOURCE: National Census and Statistics Office, 1971 Census of Agriculture.

TABLE 9

CHEMICAL ANALYSIS OF WATER SAMPLES, LASANG AND LIBUGANON RIVERS, APRIL 27-28, 1976

Parameters	Lasang River		Libuganon River	
	April 27	April 28	April 27	April 28
pH	8.0	8.0	7.7	7.7
Conductivity, mmho/cm	0.488	0.488	0.339	0.339
Total soluble salts, ppm	341	341	233	237
Residual sodium carbonate, ppm	0.42	0.16	Trace	Trace
Chloride, ppm	9.2	9.1	11.2	12.1
Sulfate, ppm	2.8	4.8	Trace	Trace
Boron, ppm	0.27	Trace	Trace	Trace
Sodium, percent	21.1	20.5	40.5	30.7

SOURCE: National Irrigation Administration, "Second Davao del Norte Irrigation Project Feasibility Report" December 1976.

TABLE 10

PESTICIDE ANALYSIS OF WATER SAMPLES, CABAYANGAN CREEK

Pesticides Detected	Sample 1 (ppm)	Sample 2 (ppm)
Pentachlorbenzol	0.002	0.001
$\alpha$ - HCH	---	Traces
Lindane	---	0.001
<b>TOTAL LINDANE</b>	<b>0.002</b>	<b>0.001</b>
Endosulfan	0.001	Traces
$\beta$ - Endosulfan	Traces	Traces
<b>TOTAL ENDOSULFAN</b>	<b>0.001</b>	<b>Traces</b>
Methyl Parathion	0.002	0.002

Sample 1: Pumpsite (San Isidro, Carmen, Davao del Norte)  
July 21, 1977

Sample 2: Downstream service area (San Isidro, Carmen, Davao  
del Norte) July 21, 1977

SOURCE: Analyzed by Bureau of Plant Industry, Department of  
Agriculture.

TABLE 11

AVERAGE MONTHLY AND ANNUAL RAINFALL, PANABO, 1972-75

<u>Month</u>	<u>Average (mm)</u>	<u>Month</u>	<u>Average (mm)</u>
January	121	July	148
February	181	August	152
March	212	September	197
April	182	October	193
May	284	November	174
June	198	December	155
<u>T O T A L</u>			<u>2,206</u>

SOURCE: Tagum Agricultural Development Company  
Panabo, Davao del Norte

The mean temperature and humidity are 27°C and 80 percent respectively.

No air pollution was observed in the area.

#### 3.2.4. Aquatic and Terrestrial Life

The aquatic life and wildlife in the area are very limited. Of the fishes found in nearby creeks, the most common are mudfish (Ophicephalus striatus) and carp (Cyprinus carpio). Rats also abound in nearby forested and marshy areas. The rats usually destroy standing crops and could be transmitters of diseases.

No rare or endangered species have been reported in the sub-project area.

#### 3.2.5. Ecological Balance

There is an excessive loss of crops in the area due to rice infestation from rats, pests and insects (Figure 4).

#### 3.2.6. Demography

There are about 23,200 people in the town of Carmen, of which 400 live in the political subdivision containing the sub-project. Population is increasing at a rate of 2.95 percent which is slightly higher than the national growth rate of 2.86 percent. The average family has about six members.

The project would be operated by the 29 registered members of the ISA, of which 80 percent live within the project boundaries.

#### 3.2.7. Lifestyle and Amenities

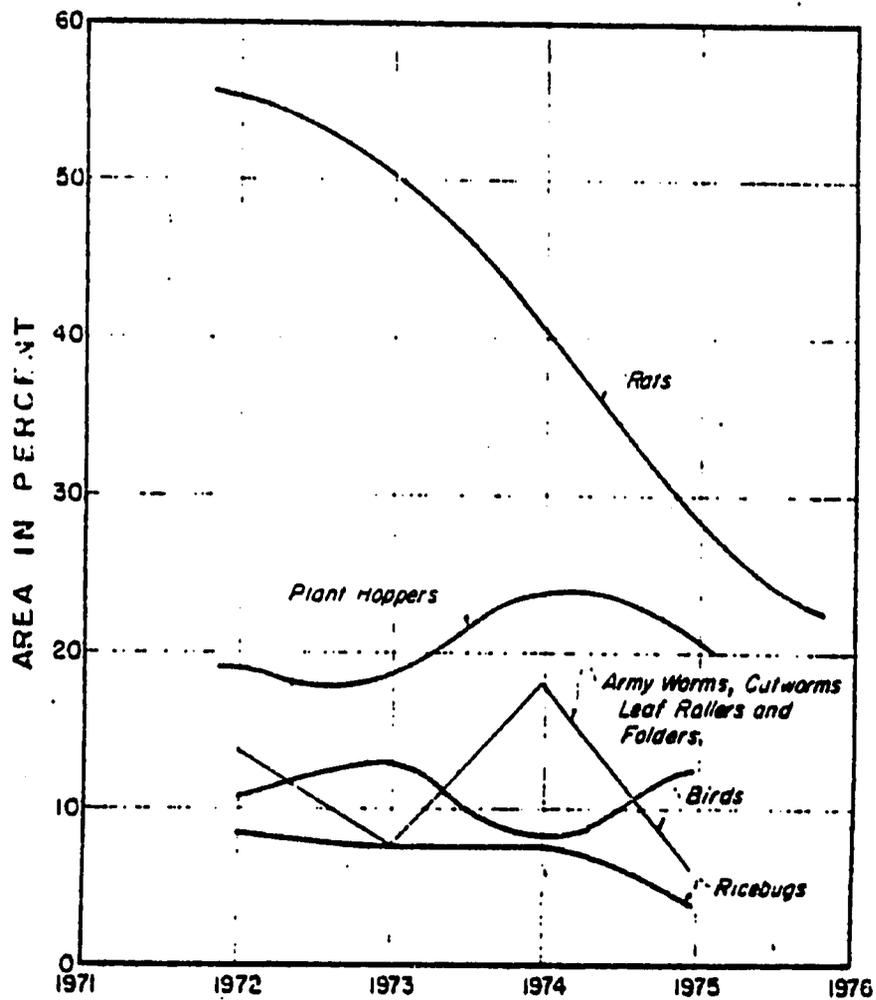
Farming is the main occupation of the family heads. Within a family, at least one member usually works as a hired laborer in the various banana plantations in the adjacent barrios and towns.

The most common form of recreation is cockfighting, which usually occurs on Sundays and holidays.

There is no electricity available in the sub-project area. Farmers use firewood for cooking and kerosene for lighting.

FIGURE 4

AREA INFESTED BY PESTS IN THE DAVAO II PROJECT



SOURCE: National Irrigation Administration, "Second Davao del Norte Irrigation Project Feasibility Report, Dec. 1976

### 3.2.8 Cultural Minorities and Historical Sites

There are no cultural minorities in the sub-project area nor as members of the ISA. There are no historical or archaeological sites within the sub-project boundaries.

### 3.2.9 Health

The ten most frequent causes of morbidity and mortality are listed in Table 12.

Davao del Norte is one of the 22 provinces in the Philippines which is endemic for schistosomiasis. Records on routine stool examination show that most municipalities of Davao del Norte have schistosomiasis cases (Table 13).

Table 14 shows the results of stool examinations among Grades 1, 2 and 3 schoolchildren in Carmen.

Schistosomiasis is a chronic, debilitating disease caused by a blood fluke, Schistosoma japonicum, and transmitted by a tiny fresh-water snail, Oncomelania quadrasi.

It is contracted through skin penetration by the infective stage of the parasite, the cercaria, when a person is in snail-infected water. Common among farmers and their families, by virtue of their occupation, the disease is characterized by dysenteric attacks in the early stage and enlargement of the abdomen and emaciation in the latter stage.

The intermediate host is a tiny operculate snail about half the size of a palay grain which inhabits areas characterized by the continuous presence of water or moisture the year round, ample vegetation that provides cover or shade and a relatively undisturbed situation. They are usually found in defined areas called colonies where water flows slowly. They do not thrive in rapidly flowing or stagnant waters. The snails are purely aquatic during the first two weeks of life and are amphibians the rest of their lives.

In Carmen, the usual snail habitats are the flood-plain forests, swamps, creeks, road ditches and certain poorly cultivated ricefields.

TABLE 12

TEN LEADING CAUSES FOR MORBIDITY AND MORTALITY IN THE MUNICIPALITY OF CARMEN AND THE PROVINCE OF DAVAO DEL NORTE

<u>CARMEN</u>		<u>DAVAO DEL NORTE</u>	
<u>Causes of Morbidity</u>	<u>Cases (/100,000)</u>	<u>Causes of Morbidity</u>	<u>Cases (/100,000)</u>
1. Schistosomiasis	157	1. Influenza	896
2. Tuberculosis	83	2. Gastro-enteritis and colitis	587
3. Gastro-enteritis and colitis	66	3. Dysentery	292
4. Pneumonia	35	4. Tuberculosis	280
5. Bronchitis	17	5. Pneumonia	271
6. Influenza	17	6. Whooping cough	173
7. Measles	17	7. Schistosomiasis	142
8. -	-	8. Measles	95
9. -	-	9. Infectious Hepatitis	48
10. -	-	10. Malignant Neoplasm	16

<u>CARMEN</u>		<u>DAVAO DEL NORTE</u>	
<u>Causes of Mortality</u>	<u>Cases (/100,000)</u>	<u>Causes of Mortality</u>	<u>Cases (/100,000)</u>
1. Pneumonia	48	1. Pneumonia	67
2. Heart Disease	35	2. Tuberculosis	37
3. Unknown	31	3. Gastro-enteritis and colitis	25
4. Tuberculosis	17	4. Malignant Neoplasm	16
5. Gastro-enteritis	9	5. Measles	7
6. Nephritis	9	6. Dysentery	5
7. Accidents	4	7. Schistosomiasis	3
8. -	-	8. Influenza	1
9. -	-	9. Infectious Hepatitis	1
10. -	-	10. Whooping cough	1

SOURCE: Disease Intelligence Center, Department of Health, 1974 Philippine Health Statistics Report.

TABLE 13

RESULTS OF STOOL EXAMINATION AMONG OUT-PATIENTS FROM DIFFERENT  
TOWNS OF DAVAO DEL NORTE, 1975

City/Town	Number Examined	Schistosomiasis	
		Number	Percent
1. Agusan	38	16	42
2. Asuncion	552	168	30
3. Carmen	383	145	38
4. Compostela	5	5	100
5. Davao City	33	1	3
6. Kapalong	38	12	32
7. Mabini	9	4	42
8. Maco	52	9	17
9. Mawab	315	120	38
10. Monkayo	12	7	58
11. Montevista	8	3	38
12. Nabunturan	18	3	17
13. New Babar	2	1	50
14. New Corolla	238	85	36
15. Panabo	537 <sup>1</sup>	13	2
16. Sto. Tomas	34	15	44
17. Tagum	292	48	16
T O T A L	2,566	655	26

1/ 537 specimens were examined by the Rural Health Unit of Panabo

SOURCE: Regional Schistosomiasis Control Office  
Tagum, Davao del Norte

TABLE 14

RESULTS OF STOOL EXAMINATIONS AMONG GRADES 1, 2 and 3 SCHOOL CHILDREN  
IN CARMEN, DAVAO DEL NORTE, 1975

S c h o o l	No. Exa- mined	Found Positive in Percent			Hook worm
		Schisto- somi- asis	Ascaris	Trichuris	
1. Central School	189	14	40	37	10
2. Alejal Elem. School	167	14	53	52	24
3. Camiling Elem. School	73	26	41	52	23
4. Tuganay Elem. School	98	18	62	55	17

SOURCE: Regional Schistosomiasis Control Office  
 Tagum, Davao del Norte

Malaria is not endemic in Carmen. However, Davao del Norte in general is considered an endemic province. In June, 1977, 1,096 cases of malaria were reported. Most of the infected persons are in the forested and mountainous areas.

### 3.2.10 Economics

Economic well-being in the province is somewhat higher than in other provinces. The people in the area had an above-average family income of ₱4,042 (\$550) in 1971 compared to the national average of ₱3,740 (\$510). The primary reasons for the higher incomes are the larger land holdings (3.7 hectares) and the growing of bananas for export. The net income per hectare from bananas for export is twice that from rice.

A low level of income from rice is partially the result of low yield of palay (35 cavans of palay per hectare) due to the limited use of fertilizers (15 kg. per hectare per crop). This limitation results from the high degree of risk faced by farmers in the absence of an assured water supply. Another reason for the low income is the excessive loss of crops due to rice infestation from rats, pests and insects.

About 50 percent of the farmers in the area are share tenants.

### 3.2.11 Related Activities in the Area

The San Isidro Sub-Project is within the project area of the Asian Development Bank-assisted Davao II Irrigation Project of the NIA (Figure 3). The Davao II Irrigation Project comprises the Libuganon River Irrigation Project with a service area of 10,500 hectares and the Lasang River Irrigation Project with a service area of 4,560 hectares. Both projects are presently under construction. By 1982, the San Isidro Sub-Project area would be served by the Libuganon Irrigation Project through extension of its irrigation facilities. By then the pumps and engines (after 4 years of operation assuming that the San Isidro Sub-Project will start operation in 1978) will no longer be necessary as water would be available (by gravity) from the irrigation facilities of the Libuganon Project. Although the farmers are aware of this, they still are interested in pushing through with the project as they do not want to wait four years for the Libuganon Project benefits. Besides, the pump and engine could still be used for other agricultural purposes even after four years of service.

The Libuganon Project incorporates a flood control scheme which could also benefit the San Isidro Sub-Project area in terms of flood protection and elimination of water-logging.

### 3.3 General Nakar Irrigation Sub-Project

#### 3.3.1 Land

The General Nakar Sub-Project is located in General Nakar, Quezon which is about 140 kilometers east of Manila (Figure 5). The municipality of General Nakar has a land area of 134,300 hectares of which 500 are considered arable.

The sub-project area is gently sloping from the hillsides on its western edge and level on its eastern edge as it approaches the coastline. The drainage area at the pumpsite is a little more than 900 square kilometers.

The soil type is generally silt loam with a portion having an overburden of sandy soil. Strips along the riverbank have this characteristic due to flooding.

Analyses of soil samples from some parts of the sub-project area show that it is low in nitrogen and phosphorous content and quite high in potassium. Improvement of the soil will depend on fertilizer application and adoption of good soil management practices.

Land use data for farming activities in General Nakar are shown in Table 15. The land use in the sub-project site itself is rainfed riceland and coconut groves.

#### 3.3.2 Water

The Agos River is the main source of water in the area for irrigation, laundering and bathing. For domestic water supply, the inhabitants utilize shallow wells.

Reliable discharge records are available at the NIA gaging station located a few hundred meters upstream of the pumping site. Streamflow data indicate a mean annual total of 3,797 million cubic meters (MCM) with a mean monthly minimum of 136 MCM in May to a mean monthly maximum of 683 MCM recorded in December (Table 16). The discharge of Agos River is sufficient to serve the water needs of the sub-project area. At times, it overflows its banks, damaging a substantial portion of the sub-project area.

No water samples were taken from the Agos River for physical, chemical or pesticide analyses.

Figure 5

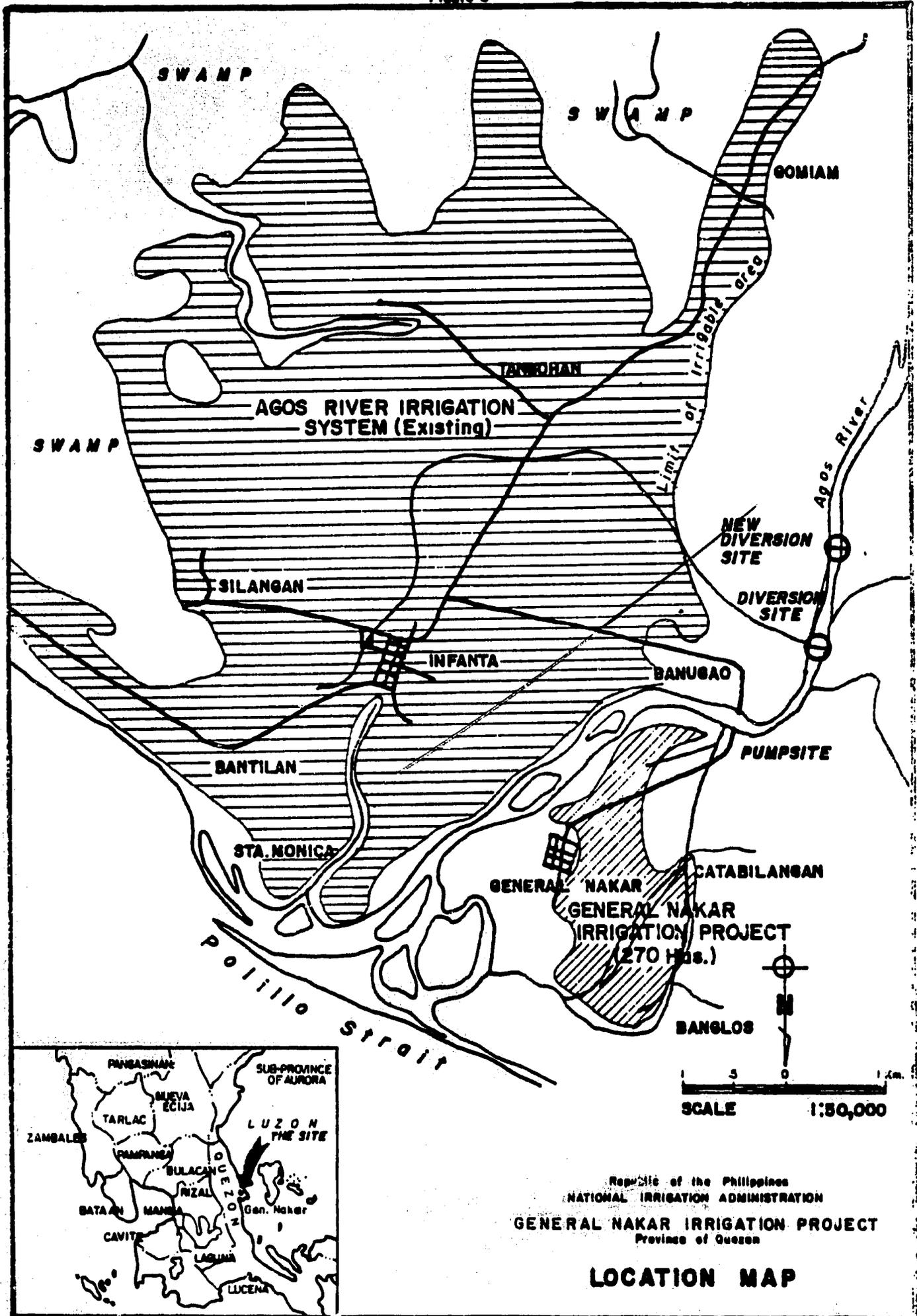


TABLE 15

AREA OF FARMS BY LAND USE: GEN. NAKAR/QUEZON PROVINCE

Land Use	Gen. Nakar		Quezon	
	Hectarage	% Distribution	Hectarage	% Distribution
1. Planted to temp. crops* <sup>1/</sup>	400	16	59,700	19
2. Lying idle <sup>1/</sup>	100	4	22,100	7
3. Planted to perm. crops*	1,400	56	192,100	61
4. Under perm. meadows and pastures	300	12	13,400	4
5. Covered with forest growth	300	12	21,200	7
6. All other lands	-	-	5,000	2
<b>T O T A L</b>	<b>2,500</b>	<b>100</b>	<b>313,500</b>	<b>100</b>

<sup>1/</sup> Considered as arable lands.

\* Includes the 270 hectares of the Gen. Nakar Sub-Project.

SOURCE: National Census and Statistics Office,  
1971 Census of Agriculture

TABLE 16

RECORD OF MEAN MONTHLY RUN-OFF, 1949-1972 OF AGOS RIVER AT  
AGOS IRRIGATION PROJECT (Million Cubic Meters)

<u>Month</u>	<u>Average</u>	<u>Month</u>	<u>Average</u>
January	471	July	206
February	281	August	243
March	233	September	243
April	152	October	426
May	136	November	576
June	142	December	683
		-----	
		T O T A L	3,797

Source: Bureau of Public Works, "Surface Water Supply Bulletin"

### 3.3.3 Atmosphere

The sub-project area falls under Type II Climate Classification which is characterized by the absence of a dry season and a pronounced maximum rain period from November to January. The average monthly and annual rainfall at the Infanta station are listed in Table 17.

The average annual temperature at Infanta is 26.8°C and average annual relative humidity is recorded as 83 percent.

### 3.3.4 Aquatic and Terrestrial Life

Freshwater fishes are abundant in the Agos River according to local fishermen. The most common are carp (Cyprinus carpio) and mudfish (Ophicephalus striatus). These fishes are relatively unexploited because of the proximity of the area to the sea, which is a bountiful source of marine fish.

No rare or endangered species have been recorded in the sub-project area.

### 3.3.5 Demography

In the 1975 population count, General Nakar had an estimated population of 11,800 of which 680 lived in the political subdivision containing the sub-project. The annual growth rate is 4.08 percent which is higher than the national average of 2.86 percent. The population is relatively young with about 60 percent of the total population below 25 years of age.

The project would be operated by the registered 100 members of the ISA of which 40 percent live within the sub-project boundaries.

### 3.3.6 Lifestyle and Amenities

The mode of living is basically rural. Except for the presence of a few motorized tricycles and worn-out logging trucks, the area does not have any signs of modern conveniences. Electricity is not available and only a few houses boast of transistorized radio receiving sets. The common form of recreation

TABLE 17

RECORD OF MEAN MONTHLY RAINFALL AT INFANTA, 1949 to 1975

<u>Month</u>	<u>Average (mm)</u>	<u>Month</u>	<u>Average (mm)</u>
January	375	July	255
February	238	August	210
March	199	September	303
April	171	October	517
May	221	November	589
June	222	December	590
<hr/>			
AVERAGE ANNUAL 3,891			

SOURCE: Philippine Atmospheric, Geophysical and Astronomical Services Administration

among men is cockfighting.

A number of civic and religious organizations are operating in the area. Active among them is the local unit of the Coconut Federation. A number of families are members of this organization which aims to improve the standard of living of the inhabitants. The main focal point of most social activities is the public school building.

### 3. 3. 7 Cultural Minorities and Historical Sites

There are no cultural minorities in the sub-project area nor as members of the ISA. There are no historical or archaeological sites within the project boundaries.

### 3. 3. 8 Health

The ten most frequent causes for morbidity and mortality are listed in Table 18. The leading cause of morbidity was upper respiratory infection and of mortality was pneumonia. They were due to malnutrition, unsanitary ways of living and lack of health facilities.

The sub-project is in a province endemic for malaria. Examinations for malaria in General Nakar show very few cases in the last two years (Table 19). However, the disease is more prevalent in the surrounding municipalities of Infanta and Port Real.

Malaria is a disease caused by the presence in the red blood corpuscles of a unicellular parasite, a protozoan belonging to the genus Plasmodium. It is contracted through the bite of the infective female anopheles mosquito known as Anopheles minimus flavirostris. The anopheles mosquito is relatively small in size compared to other mosquitos and generally black in color. It inhabits clean, slow-moving and partly shaded streams and starts to attack its victims at about 6:30 P.M. to 2:00 A.M. It can survive from 21 to 30 days and can fly about 2.5 kilometers. It can easily be identified by its perpendicular position during resting or in the act of biting.

The common symptoms of malaria infection are chills, fever and sweating. However, not all of the symptoms are manifested by individuals at a time. It could be fever and chills alone. Others complain only of headaches.

Teams of the Malaria Eradication Unit have been stationed in the area for several years and only recently integrated with the Infanta Station.

TABLE 18

**TEN LEADING CAUSES OF MORBIDITY AND MORTALITY IN THE  
MUNICIPALITY OF GENERAL NAKAR AND THE PROVINCE OF QUEZON**

General Nakar		Quezon	
Causes of Morbidity	Cases (/100,000)	Causes of Morbidity	Cases (/100,000)
1. Upper Respiratory Infection	1,540	1. Influenza	1,146
2. Avitaminosis	630	2. Gastro-enteritis and colitis	726
3. Gastro-enteritis	530	3. Tuberculosis	429
4. Bronchitis	450	4. Whooping cough	141
5. Parasitism	280	5. Measles	63
6. Allergy	110	6. Malaria	60
7. Tuberculosis resp.	100	7. Malignant Neoplasm	25
8. Hyperacidity	100	8. Dysentery	19
9. Dermatitis	70	9. Thyphoid/parathyphoid and other salmonella	17
10. Pertusis	50	10. Infectious Hepatitis	15

General Nakar		Quezon	
Causes of Mortality	Cases (/100,000)	Causes of Mortality	Cases (/100,000)
1. Pneumonia	130	1. Tuberculosis	88
2. Heart Disease	60	2. Gastro-enteritis and colitis	40
3. Unknown	60	3. Malignant Neoplasm	25
4. Bronchitis	50	4. Infectious Hepatitis	20
5. Malnutrition	50	5. Measles	8
6. Tuberculosis	40	6. Viral Encephalitis	2
7. Avitaminosis	20	7. Malaria	1
8. Gastro-enteritis	20	8. Cholera El Tor	1
9. Accidents	20	9. Dysentery	1
10. Peptic Ulcer	10		

SOURCE: Disease Intelligence Center, Department of Health, 1974  
Philippine Health Statistics Report

TABLE 19

CASE REGISTER OF MALARIA IN QUEZON PROVINCE WITH INTERVAL OF ONE MONTH SPRAYING

Municipalities	1 9 7 4				1 9 7 5			
	Total No. of Slides	Cases	% of Slides W/ + Cases	Sample Pop.	Total No. of Slides	+ Cases	% of Slides W/ + Cases	Sample Pop.
1. General Nakar	689	3	-*	28,054	2,088	-	-	9,267
2. Port Real	727	2	-*	18,007	764	9	1	9,322
3. Polillo	2,252	19	-*	27,393	-	-	-	-
4. Tayabas	-	-	-	-	5,826	45	1	34,434
5. Buenavista	6,768	2	-*	75,059	-	-	-	-
6. Pagbilao	-	-	-	-	4,087	68	2	23,936
7. Calauag	718	-	-	10,471	-	-	-	-
8. Mauban	-	-	-	-	3,682	27	1	30,443
9. Patnanongan	808	154	19	9,520	669	67	10	7,639
10. Panikula	662	5	1	9,740	789	28	4	18,774
11. Burdeous	829	37	4	17,570	1,140	26	2	13,206
12. Infanta	382	3	1	17,978	1,273	44	3	25,620
13. Dolores	-	-	-	-	560	-	-	9,298
14. Unisan	6,011	167	3	16,257	-	-	-	-
<b>T O T A L</b>	<b>19,846</b>	<b>392</b>	<b>2</b>	<b>230,049</b>	<b>20,878</b>	<b>314</b>	<b>2</b>	<b>181,939</b>

\* Less than one-half of one percent.

SOURCE: Annual Case Register Report of Malaria by Province, Malaria Eradication Center, Department of Health

### 3.3.9 Economics

Economic well-being in the province is somewhat lower than other provinces in the Philippines. The people had average family income of ₱2,970 (\$410) in 1971 compared to the national average of ₱3,740 (\$510).

About 40 percent of the farmers in the area are share tenants.

### 3.3.10 Related Activities in the Area

The General Nakar Sub-Project is adjacent to the existing Agos River Irrigation System with a potential service area of 1,200 hectares (Figure 5). The system is included in Package II of the World Bank-assisted National Irrigation System Improvement Project of the NIA. This larger project would rehabilitate and improve the present equipped area of about 1,000 hectares and would construct new distribution facilities for 200 hectares. The scheme would provide access roads, on-farm facilities and a drainage system. In addition, the diversion structure located about a kilometer upstream of the General Nakar pumpsite would be rehabilitated. It has not been able to divert a sufficient amount of water due to the low water level of the river and siltation of the intake conduit.

Although located downstream of the Agos System, the General Nakar Sub-Project would still be assured of sufficient water. The discharge of Agos River is more than enough to meet all water requirements.

The General Nakar Project is the first of its kind in General Nakar.

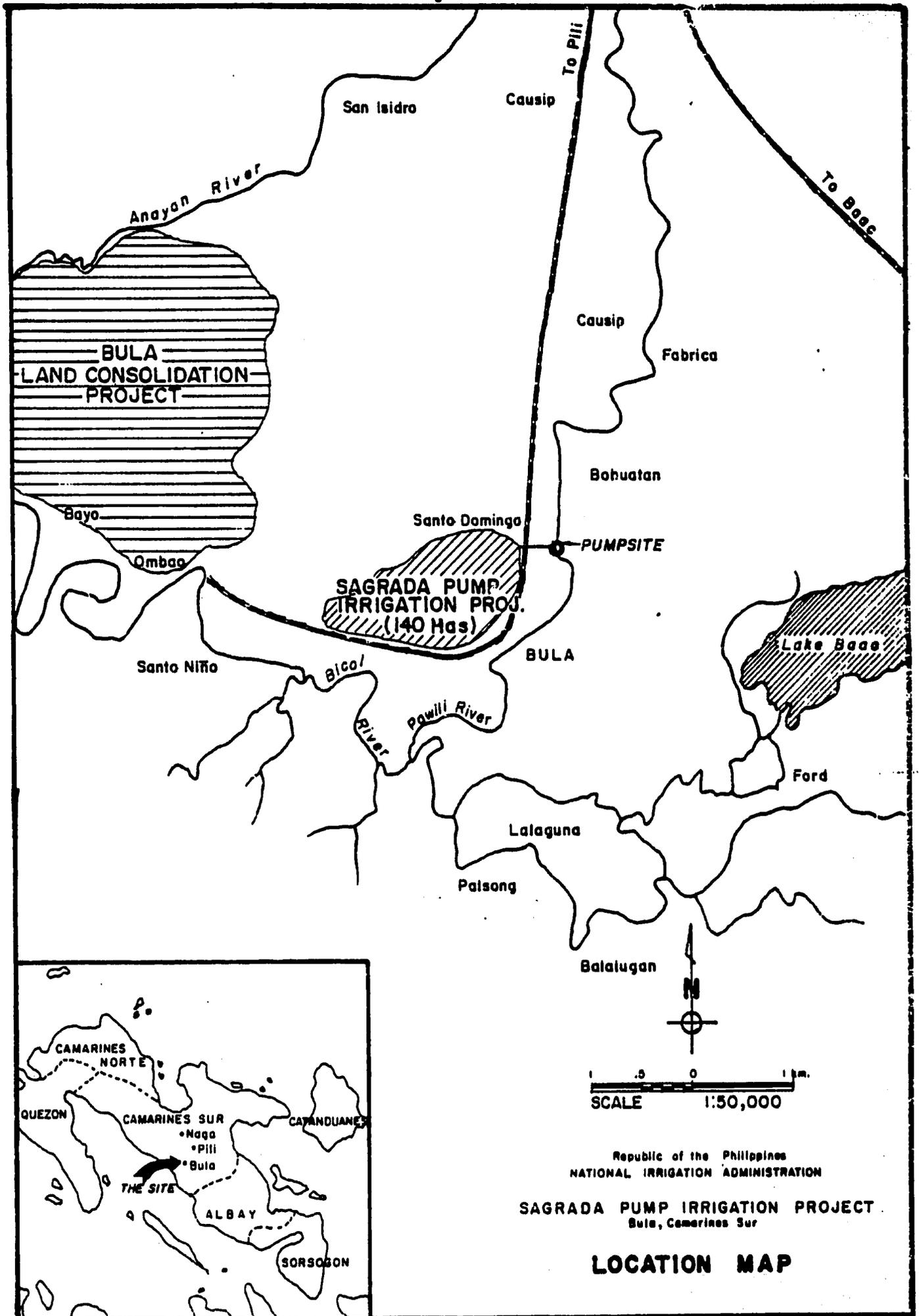
## 3.4 Sagrada Pump Irrigation Sub-Project

### 3.4.1 Land

The Sagrada Pump Irrigation Sub-Project is located in Bula, Camarines Sur which is about 175 kilometers south of Manila (Figure 6). The municipality has a land area of 10,270 hectares of which 7,500 are considered arable.

The terrain is generally level with slopes ranging from 0 to 3 percent. Some rolling portions and sloping areas are

Figure 6



found near the creeks and rivers. It also has some depressions which serve as drainage for run-off water. It has a drainage area of 240 square kilometers at the pumpsite.

The area soils have been classified as sandy clay loam types. These soils are considered to be very good for paddy rice and highly responsive to good management practices. They are highly to moderately fertile.

Land use data for farming activities in Bula are shown in Table 20. The land use in the project area is cultivation of rainfed rice.

#### 3.4.2 Water

The source of water for this sub-project is the Pawili River, one of the tributaries of the Bicol River. The water current is very strong and, as a result, large volumes of loose soil from the bank are carried with it. Also, there are discharges of waste materials from a sugar central upstream which occur during the dry season when milling operations are going on.

The river has an average discharge of 12.5 cubic meters per second at the pumpsite.

The results of water analysis for physical and chemical parameters at the Pawili River indicate that the water is suitable for irrigation (Table 21).

One water analysis for pesticides in the Pawili River showed only traces and insignificant concentrations of pesticides; the other water analyses at three later dates showed only traces of pesticides (Table 22). These amounts are considerably below permissible levels in drinking water.

The ability of pesticides, particularly the persistent organochlorines, to be concentrated as they are transferred through the ecological food chain is well-known. In order to check the possibility of "biological magnification", residue analysis on fish caught in the Bicol River Basin was done for this assessment (Table 23). While the residues were within tolerable limits, there were several pesticides present which were not detected in the water analysis for pesticides.

TABLE 20

AREA OF FARMS BY LAND USE: BULA /CAMARINES SUR: 1971

Land Use	Bula		Camarines Sur	
	Hectarage	% Distribution	Hectarage	% Distribution
1. Planted to temp. crops* <sup>1</sup>	7,000	68	110,400	38
2. Lying idle <sup>1</sup>	500	5	24,600	8
3. Planted to perm. crops	1,500	15	125,900	43
4. Under perm. meadows and pastures	900	9	13,000	4
5. Covered with forest growth	200	2	14,000	5
6. All other lands	100	1	4,500	2
<b>T O T A L</b>	<b>10,200</b>	<b>100</b>	<b>292,400</b>	<b>100</b>

\* Includes the 142 hectares of the Sagrada Sub-Project.

<sup>1</sup>/Considered as arable lands

Source: National Census & Statistics Office,  
1971 Census of Agriculture

TABLE 21

WATER ANALYSIS FOR PHYSICAL AND CHEMICAL PARAMETERS - PAWILI RIVER

Parameters	Volume
pH	7.4
Dissolved oxygen, mg/l	8.4
Turbidity, mg/l	300.0
Color	Turbid
Hardness (CaCO <sub>3</sub> ), mg/l	38.0
Suspended Residue, mg/l	210.0
Total solids, mg/l	390.0
Alkalinity, mg/l	38.0
Chlorides, mg/l	9.0
Copper, mg/l	0.02
Iron, mg/l	13.2
Zinc, mg/l	0.19
Nitrate (Nitrogen) mg/l	8.87
Sulfate, mg/l	7.0
Cadmium, mg/l	-
BOD, mg/l (5 days)	0.5
COD, mg/l	7.2

Sample 1: Pumpsite (Sagrada, Bula, Camarines Sur) July 20, 1977

SOURCE: Analyzed by the National Pollution Control Commission

TABLE 22

WATER ANALYSIS FOR PESTICIDES, PAWILI RIVER

<u>Pesticides Detected</u>	<u>Sample 1 (ppm)</u>
Pentachlorbenzol	0.001
$\alpha$ - HCH	-
Lindane	-
TOTAL LINDANE	0.001
Endosulfan	Traces
$\beta$ - Endosulfan	Traces
TOTAL ENDOSULFAN	-
Methyl Parathion	Traces

Sample 1: Pumpsite (Sagrada, Bula, Camarines Sur) July 20, 1977

SOURCE: Analyzed by Bureau of Plant Industry, Department of Agriculture

TABLE 23

PESTICIDE RESIDUES IN FISH SAMPLES,  
BICOL RIVER BASIN

Samples	Pesticide Residues Detected (ppm)				
	Lindane	Heptachlor	Aldrin	Endosulfan	DDT
1	0.01	0.04	-	0.01	-
2	0.01	0.04	0.06	0.01	-
3	0.01	0.04	-	0.01	0.08
4	0.01	0.03	0.01	0.01	-
5	0.02	0.01	-	0.01	0.03

Samples 1-5 - From Bicol River, November 1977

SOURCE: Analyzed by Bureau of Plant Industry, Department of  
Agriculture

### 3.4.3 Atmosphere

The sub-project falls under Type IV Climate Classification of the Philippines which is characterized by a more or less evenly distributed rainfall throughout the year. The average monthly and annual rainfall at the Pili Station are listed in Table 24.

In terms of temperature, the distribution is generally uniform with an average of 27°C. The average humidity is about 84 percent.

No air pollution was observed in the area.

### 3.4.4 Aquatic and Terrestrial Life

The Pawili River is naturally rich in fish species. The predominant species are carp (Cyprinus carpio), tilapia (Tilapia mossambica) and gourami (Osphronamus gourami). According to the fishermen, these species comprise about 80 percent of their catch.

Wildlife species fairly represented throughout the area include eleven species of reptiles, fourteen species of birds and six species of mammals.

No rare or endangered species has been recorded in the sub-project area although there are a few in the Bicol River Basin including the wild deer (Rura sp.).

TABLE 24

AVERAGE ANNUAL AND MONTHLY RAINFALL DISTRIBUTION  
PILI, CAMARINES SUR

Month	Distribution (mm)	Month	Distribution (mm)
January	163	July	236
February	66	August	281
March	78	September	288
April	73	October	345
May	125	November	376
June	192	December	306
		<b>T O T A L</b>	<b>2,530</b>

SOURCE: Philippine Atmospheric, Geophysical & Astronomical  
Services Administration

#### 3.4.5 Demography

There are about 36,900 people living in the town of Bula, of which about 800 live in the political subdivision containing the sub-project. It had a population growth rate of only 1.5 percent between 1970-1975 due to out-migration. The population is relatively young with about 60 percent of the total population below 25 years of age.

The sub-project would be operated by the 20 registered members of the ISA of which about 70 percent live within the sub-project boundaries.

#### 3.4.6 Lifestyle and Amenities

In the area most family members - husband, wife and older children - are employed in an effort aimed at making a living from the land. They are tillers of the soil, both wet and dry and upland types, with the use of carabao. Others work in cottage industries.

Generally, the pace of life is slow-moving and typical of rural areas. As the sub-project area is on the outskirts of Bula, the town proper is the focal point of social activities.

There are no recreation facilities within the sub-project area. Due to the presence of several streams and rivers, people enjoy hunting, fishing and swimming.

#### 3.4.7 Cultural Minorities and Historical Sites

There are no cultural minorities in the sub-project area nor as members of the ISA. However, 15 kilometers to the southeast, there is a population of approximately 400 Agtas, a semi-negroid hill tribe.

There are no historical or archaeological sites within the sub-project boundaries.

#### 3.4.8 Health

The ten most frequent causes of morbidity and mortality in Bula and Camarines Sur are partially listed in Table 25.

Schistosomiasis is virtually absent from the Bicol River Basin. The nearest reported area is in Sorsogon Province,

TABLE 25

TEN LEADING CAUSES OF MORBIDITY AND MORTALITY IN THE  
MUNICIPALITY OF BULA AND THE PROVINCE OF CAMARINES SUR

Bula		Camarines Sur	
Causes of Morbidity *	Cases (/100,000)	Causes of Morbidity <sup>1/</sup>	Cases (/100,000)
		1. Tuberculosis	112
		2. Malignant Neoplasm	21
		3. Gastro-enteritis and colitis	20
		4. Tetanus	14
		5. Whooping Cough	13
		6. Measles	9
		7. Influenza	8
		8. Infectious Hepatitis	1
		9. Diphtheria	1
		10. Dysentery	1

Bula		Camarines Sur	
Causes of Mortality *	Cases (/100,000)	Causes of Mortality <sup>1/</sup>	Cases (/100,000)
		1. Tuberculosis	112
		2. Malignant Neoplasm	21
		3. Gastro-enteritis and colitis	20
		4. Tetanus	14
		5. Measles	9
		6. Influenza	8
		7. Viral Encephalitis	1
		8. Diphtheria	1
		9. Rabies	1
		10. Whooping Cough	1
		11. Dysentery	1

SOURCE: Disease Intelligence Center, Department of Health, 1974  
Philippine Health Statistics Report

\*Not available at this time.

<sup>1/</sup> This strange coincidence is due to the fact that statistics on morbidity and mortality are taken from two different sources, provincial reports and National Census respectively. When the cases of morbidity reported are less than the number of cases of mortality, the number of cases of morbidity is equalized with the number of cases of mortality. This discrepancy suggests that there is under-reporting of the number of cases of morbidity.

which is 200 kilometers to the east.

Cases of malaria have been reported in the Bicol River Basin, but none reaching epidemic proportions. Normally, exposure is confined to upland areas where clean, flowing streams exist and provide the necessary habitat for the anopheles vector.

#### 3.4.9 Economic

Farming is the most important occupation of the people. Rice, coconut, and abaca are the main crops while corn, sugarcane, banana, cassava, fruit trees and vegetables are the secondary crops.

The people in the province had a below average family income of ₱3,530 (\$480) in 1971 compared to the national average of ₱3,740 (\$510).

A sugar central started operations in the area in 1973. It employs 300 people during the three month operating season.

#### 3.4.10 Agricultural Practices

There is extensive use of agricultural chemicals in the general project area (Table 26). Survey results show that of the 477 farms surveyed, 421 or 88 percent used insecticides during the dry season and 405 or 85 percent used them during the wet season. The pesticides used were mainly organophosphates (Gusathione, Azodin, Parapest and Folidol) and one organochlorine (Thiodan). During both the wet and dry seasons, more insecticides were applied to irrigated rather than to non-irrigated ricelands.

Another indication of the type of pesticides which would be used in the area is the list of those recommended by the National Food and Agriculture Council. This list includes 124 insecticides, 64 herbicides and 29 fungicides. Quite a number of these are organochlorines (Thiodan, Lindane, Perthane, Ondosulfan and Chlordane) and are generally persistent.

#### 3.4.11 Related Activities in the Area

The Sagrada project is adjacent to the recently funded Bicol River Basin Integrated Area Development II [Pili-Bula] (Figure 6). There are two major components of the Pili-Bula Project.

TABLE 26

INSECTICIDE AND HERBICIDE USE IN THE BICOL RIVER BASIN  
MARCH-APRIL 1975. (Fluid oz. per hectare)

Type of Insecticide	I N S E C T I C I D E S			
	Dry Season		Wet Season	
	Irrigated	Non - Irrigated	Irrigated	Non-Irrigated
Combined Insecticides (No. of Farms)	25.8 (164)	19.6 (257)	28.9 (163)	19.2 (242)
Gusathion	27.9 (59)	24.9 (83)	28.4 (59)	27.0 (75)
Folidol	29.4 (49)	14.6 (84)	32.0 (48)	17.3 (90)
Thiodon	16.3 (19)	17.5 (42)	23.6 (18)	15.0 (46)
Azordrin	37.7 (7)	20.7 (17)	33.3 (9)	26.5 (16)
Parapest	22.8 (10)	11.4 (7)	28.9 (9)	14.0 (4)
Others	17.0 (20)	16.7 (24)	25.5 (20)	16.0 (16)

H E R B I C I D E S				
Combined Herbicides (No. of Farms)	39.5 (128)	32.1 (225)	39.3 (135)	30.4 (231)
2 - 4 - D	39.5 (115)	32.1 (189)	39.8 (117)	30.8 (197)
Hedonal	39.5 (15)	32.4 (36)	36.4 (18)	28.4 (34)

SOURCE: Social Science Research Unit, Ateneo de Naga

The first is the construction and installation of major physical facilities, namely irrigation and drainage canals, electric turbine pumps and pumphouses sufficient to irrigate 2,062 hectares, all-weather service roads and farm paths, multipurpose community buildings and an elementary schoolhouse. The pump will abstract water from the Bicol River downstream from where the Pawili River joins it. The second is the new community homesite development and relocation of farm houses and households from scattered field locations to planned community homesites.

The project is within the coverage of the Bicol River Basin Development Project (BRBDP). The BRBDP is designed to develop the area through a framework of eight integrated area developments, agricultural credit and rural bank expansion, water resources development, road development, rural electrification, livestock development and fisheries development. It is financially assisted by the USAID. Current major activities are Bicol River Basin Integrated Area Development I (Libmanan-Cabusao) and Bicol Integrated Area Development II (Pili-Bula).

The project is the first of its kind in Bula.

## Chapter 4. ENVIRONMENTAL EFFECTS OF THE PROJECT

Sub-projects, because of their small size, would not have much of a measurable impact on natural and socioeconomic conditions except in very unusual circumstances and only on a limited number of parameters. Irrigation sub-projects under this project are usually between 100 and 300 hectares in size and involve only between 30 to 70 farmers. In addition, precisely assessing many of the environmental effects of the SSI project is difficult for the same reason.

Even if the sub-projects had numerous measurable effects, changes would be overshadowed by the effects of larger irrigation projects. In almost every case, a SSI sub-project is included within, adjacent to or nearby a NIA project. Usually, NIA projects are an order of magnitude larger than SSI sub-projects. Thus, the environmental effects of the SSI sub-projects would be insignificant compared to similar environmental effects which would already be occurring in the same area.

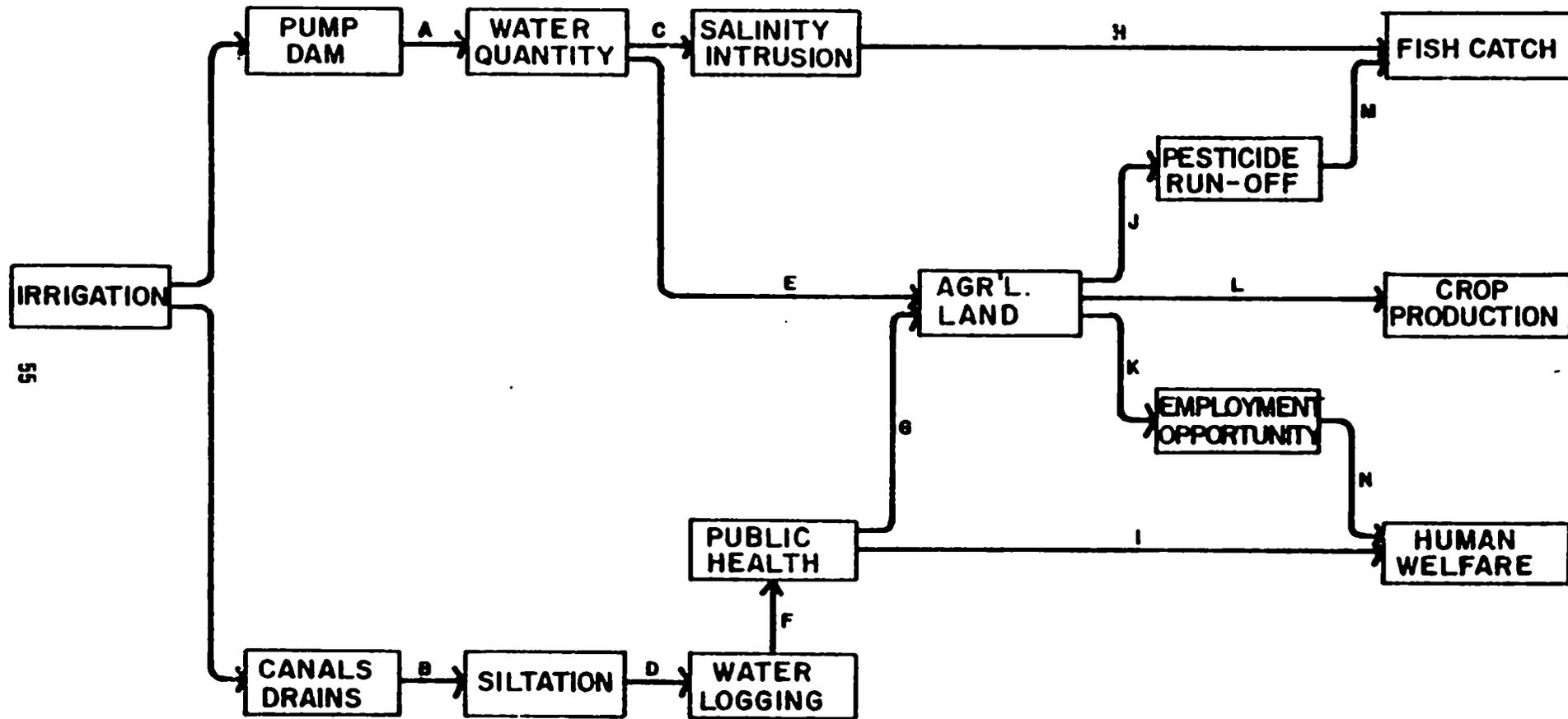
The significant environmental effects are illustrated in the network analysis (Figure 7). The network is a useful overview and summary of effects.

### 4.1 Land

Soil erosion and sedimentation would be minimal because the construction period for this type of sub-project is only a few months and occurs often during the dry season.

One particular adverse effect noticed at some sites is the inappropriate removal of soil for construction of canals and failure to fill borrow pits. At the Landing site, soil was excavated alongside the irrigation canal resulting in a deep ditch on either side of the canal. These two ditches will eventually become water-logged, i. e. pools of stagnant water, and will hinder the transfer of water to the fields. At sites in Leyte, unfilled borrow pits from already constructed projects were observed during the sub-project selection trip. These unfilled borrow pits were filled with pools of stagnant water.

Silt may accumulate in a canal because of sediment in the water source or from bank erosion. Silt deposition will clog canals, hinder the flow of water, enhance the growth of weeds and contribute to water-logging.



**NETWORK MODEL FOR ENVIRONMENTAL ASSESSMENT  
SMALL SCALE IRRIGATION PROJECT**

The implementation of an irrigation system will not result in a significant change in land use. Most of the land is already used for cultivation of rainfed rice or other agricultural activities.

#### 4.2 Water

The sub-projects will have only a temporary and probably very limited effect on sediment load in streams as mentioned above.

Salt water intrusion could be a problem in two areas where elevations above sea level are low and where tidal effects extend a considerable distance upstream. These two areas are the lowest reaches of the Bicol River Basin in Southern Luzon and the Pampanga River in Central Luzon. Salt water, if it reaches the irrigated lands, would obviously have a detrimental effect.

Actually, some projects will have a minor effect on the changes in the extent of salt water intrusion because they will withdraw fresh water. However, the effect will be very limited because the maximum water withdrawal for these projects would be between .15 to .40 cms. In the case of the Sagrada Sub-Project, which is in the upstream reaches of the Bicol River Basin, the maximum withdrawal would be .30 cms. This amount of withdrawal would result in a shift in the salinity gradient in the Bicol River by approximately 500 meters, which is insignificant compared to the daily variation.<sup>1</sup>

The one potential water quality effect analyzed in detail in this EA is an increase in pesticide concentration in the fields and streams. For the Sagrada site, the EA examined current pesticide use, concentration of pesticides in the streams and residues in the fish. Only one organochlorine (Thiodan) was noted in the survey and only traces of insignificant amounts of organochlorines were found in the water and fish samples. On the basis of these limited data, there is not much reason to be concerned.

However, these findings do not mean that all problems associated with pesticides are gone. First, the data collected for the study are not really a comprehensive assessment. Talking with suppliers of agricultural chemicals, reveals that they are selling in significant amounts, pesticides not reported in the survey. Also, a survey in another part of the Philippines revealed that both

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<sup>1/</sup> Agency for International Development, "Environmental Assessment - Bicol Integrated Area Development II-A (Bula-Minalabac)", September, 1977.

DDT and Endrin are still being used even though they have been banned by the government. <sup>2</sup> Nor is the limited analysis of water and fish samples adequate for an accurate picture of pesticide residue. More water and fish samples as well as sediment samples are needed for an accurate picture. Second, the National Food and Agricultural Council continues to recommend a number of organochlorine pesticides which are generally persistent (long lasting). Third, the actual amount of pesticides used and associated run-off will increase once an area is irrigated. The results of the pesticide use survey showed that approximately 30-40 percent more pesticides are used on irrigated than on non-irrigated rice crops.

#### 4.3 Atmosphere

There are no anticipated effects on air quality.

#### 4.4 Aquatic and Terrestrial Life

Excessive use of pesticides would probably eliminate fish, snails and crabs regularly caught in the rice fields. This would be unfortunate because they are a major source of protein for farm families. There are not sufficient data to assess the actual losses and the probability of occurrence.

In the long run, the use of persistent pesticides on both SSI and NIA projects could result in damage to the freshwater fishery. However, at this time, there is no danger because of the low input nature of agricultural practices.

There are no immediate adverse effects on wildlife because the implementation of the irrigation systems will not involve elimination of protective vegetative cover. Most land is already cleared for rainfed rice cultivation.

#### 4.5 Ecological Balance

Data are not available to estimate the extent to which these projects would disrupt the existing ecological balance. However, the introduction of irrigation reinforces the monoculture of rice, which means that certain pests, primarily rats, will increase in number. Also, the use of pesticides associated with irrigated rice culture would eliminate certain non-target organisms. Given the size of the SSI

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<sup>2/</sup> Based on an interview with Dr. Edwin Magalones of the University of the Philippines, Los Baños conducted by the National Environmental Protection Council, 1976.

sub-projects, these adverse effects would certainly be limited.

#### 4.6 Demography

The SSI sub-projects are designed to serve existing farm communities, so they will not attract new settlers. However, there might be some demographic effects to the extent that increased economic activity will reduce the number of out-migrants. With the possibility of irrigation, farm families would produce enough income to sustain a few additional members of their families. The effect would be slight in the aggregate because the program will involve only 97,000 farm families.

#### 4.7 Lifestyle and Amenities

If the members of an ISA live in an energized barrio, then the additional income would allow them to purchase labor-saving devices and televisions which would change their lifestyle.

#### 4.8 Cultural Minorities and Historical Sites

None of the four sub-projects involve cultural minorities nor would they affect historical sites.

#### 4.9 Health

Preparation of this EA involved an analysis of how SSI sub-projects would affect the prevalence of schistosomiasis and malaria. It did not consider how SSI sub-projects would affect the prevalence of filariasis even though it is endemic in some areas in the Philippines. The problem in the Philippines is not yet well-enough defined to make an evaluation.

SSI sub-projects will certainly be constructed in areas endemic for schistosomiasis and with habitat suitable for the host snail. The San Isidro Sub-Project is one such site. The residents of the municipality of Carmen are infected with schistosomiasis and snail colonies with S. japonicum are also found in the barangay. (No sampling for snail colonies was carried out on the sub-project area.) The sub-project itself and the surrounding areas are suitable habitats for the host snail. Upstream from the sub-project site are flood-plain forests and swamps. The sub-project site itself is flat, low-lying land with poor drainage and adjacent to the Cabayanan Creek which is a meandering, sluggish stream.

The difficult question is whether the newly irrigated 270 hectares covered by the San Isidro Sub-Project will become a suitable habitat. There are conflicting opinions within the government and the WHO office

in Manila. The usual answer is no on the assumption that there is adequate drainage and that maintenance activities keep the canals free of vegetation.

However, there are two good reasons to think that the newly irrigated area could become a potential site. First, the Second Davao del Norte Irrigation Project under the supervision of NIA and funded by the Asian Development Bank has a schistosomiasis control component on the assumption (no data) that irrigation increases the possibility of establishing breeding sites for snails and thus the number of diseased persons. This project surrounds the San Isidro Sub-Project. (A World Bank-financed irrigation project in Leyte also includes a schistosomiasis control component on the same assumption.) Second, adequate drainage on the San Isidro Sub-Project would be difficult given the flat terrain and maintenance of canals, if similar to past practices, would not be satisfactory.

Just how much the San Isidro project or even the larger Davao II project would contribute to the incidence of schistosomiasis, if there is no control program, is unknown. There are no historical data on which to make an estimate.

While SSI sub-projects will be constructed in provinces endemic for malaria, they will seldom be constructed in sites which would become suitable breeding places for Anopheles minimus flavirostris. Most SSI sub-projects are in the plains which are not favorable for the breeding of the vector. The favorable breeding places are the mountainous and foothil areas where there are natural streams with slow running water and grass. The prevalence of malaria is usually high in these areas.

The General Nakar Sub-Project is such a site. (The San Isidro Sub-Project has the same features.) While Quezon Province is endemic for malaria, the prevalence is low in and around General Nakar. The General Nakar Sub-Project was constructed in the plains which are already devoted to rice culture.

The fact that the site of the General Nakar Sub-Project is not suitable was confirmed by talks with the field personnel of the Malaria Eradication Unit in the area. They said there had been no upward trend in positive cases in the past ten years even though the Agos River Irrigation System had been in existence for more than 15 years.

In addition, our field investigation showed that the adjacent Agos River Irrigation System had been built and operated so as to minimize habitat for the vector. Drainage is not a problem in the area and the canals are free of vegetation due to the effective work of the Malaria Eradication Unit.

Another potential adverse health effect may result from the mishandling of pesticides. Some pesticides in use (Phosdrin, for example) are very toxic to human beings. One could anticipate a few cases where the health of the applicator is adversely affected by mishandling.

There are no other anticipated adverse effects on morbidity and mortality.

#### 4.10 Economics

The SSI project will result in a significant improvement in the economic well-being of ISA members because of the improvement in output. The output without the SSI project is only one crop with a yield of 35 cavans/hectare. The output with the irrigation support system of the SSI project is two crops with a yield of 53 cavans/hectare/crop. And the output with the addition of the farm support system of the SSI project is two crops with a yield of 70 cavans/hectare/crop, which would also sell at a slightly higher price because the rice would be dried.

Assuming a farm size of 1.5 hectares, the average income before the SSI project is estimated to be ₱1,086 (\$150). The introduction of the irrigation support system would increase the average farm income to ₱2,947 (\$400) primarily because of the shift from single to double-cropping. The introduction of the farm support system (tractors and rice dryers) in the third year would increase the average farm income to ₱5,500 (\$750).

The SSI project would also result in some significant change in the employment pattern. With no program, the average farm labor is 28 man-days of hired labor and 78.5 man-days of family labor. With the introduction of irrigation farm support systems, the average farm labor would increase slightly to 31.5 days of hired labor and the average family labor would decrease to 67.3 man-days.

## **Chapter 5. MITIGATION OF ADVERSE ENVIRONMENTAL EFFECTS**

### **5.1 Siltation and Sedimentation**

The problem of siltation may occur during the construction of pump sump or diversion dam and soil excavation for canals and drains. This problem is minimized when construction is timed during the dry season. At that time the flow of the river is at the minimum and there is no rainfall to wash away loose soil.

The accumulation of silt in the canals caused by sediment carried together with the water from the stream and from bank erosion could be prevented by regular desilting of the canal. Canal desilting, realignment, reshaping and cleaning should be done at least once a year.

### **5.2 Salinity Intrusion**

The effects of salinity intrusion are minimized by FSDC technical review of the selection of pump sites. Wherever feasible, pump sites are not located at a point where saline water is present. In cases where saline encroachment is possible through tidal fluctuations, pumping of saline water could be avoided either by stopping pumping operation during hightides or by relocating the water intake through mechanical means.

### **5.3 Pesticides**

The intensified agricultural program will result in an increased use of pesticides, some of which are toxic to human health and to aquatic organisms.

One way to mitigate some of the adverse impacts of increased pesticide use is through the training given to the ISA members by the FSDC. The training component could instruct farmers in the difference between more persistent and less persistent pesticides and how the use of more persistent pesticides would kill the fish, snails and crabs in their rice fields. It would inform them about the appropriate amounts to be used. Equally important, the FSDC could instruct them to avoid the pesticides which are toxic to the applicator and to safely apply pesticides.

Both of these components should be incorporated into the FSDC training program.

The only really effective way to mitigate the adverse effects of persistent pesticides is to effectively ban their use in the country. At this time, there is a ban on the use of DDT and Endrin, but it does not prevent the use of these chemicals. Similarly, there is a regulation prohibiting farmers from using pesticides near streams and rivers, but it has little influence on the behavior of farmers.

Recently, the government created the Fertilizer and Pesticides Authority. It has authority to regulate the sale and use of pesticides. If it carries out its mandate, it could eliminate the use of the more persistent chemicals.

#### 5.4 Schistosomiasis

In the provinces where schistosomiasis is the greatest public health problem, there exists foreign-assisted control projects. The World Bank is now funding a schistosomiasis control component in Leyte and Mindoro and is considering funding for Mindanao and Samar.

In the case of the San Isidro Sub-Project, the Asian Development Bank is funding a schistosomiasis control component for Davao del Norte. The control program includes snail control by way of alteration of the environment, environmental sanitation (water supply and toilets), control of stray animals, treatment of cases and health education.

The actual mitigation measures adopted by FSDC should be those considered most effective and should be coordinated where possible, with the larger programs.

First, FSDC should encourage through the ISA farmers and their families in endemic areas to submit to screening and to accept treatment where necessary. Encouragement is needed due to the innate reluctance of the population to come forward because of the difficulty of treatment and the side effects of chemotherapy. However, recent advances in chemotherapy insure that the treatment will be effective and of shorter regimen. Second, the FSDC should include a plan for controlling the snail vector in sub-projects in endemic areas. The plan should include a survey for infected snails and, if present, use of methods including proper engineering measures

and molluscicides for their removal. Third, the FSDC should continually stress the importance of good water management practices particularly maintenance of water courses free of vegetation. It should encourage year-round cultivation of the fields to render the potential habitat unsuitable for the establishment of snails.

### 5.5 Malaria

The location of most SSI sub-projects in areas with unsuitable habitat for the vector and use of proper management measures means that the farmers will not be affected by malaria due to the sub-project. However, the farmers will still be in endemic areas, which means that the ISA should encourage farmers to seek adequate treatment in all cases, to kill adult mosquitoes with insecticidal sprays and where possible, to screen their homes. Given the existence of Malaria Eradication Units in most areas means that there will be adequate treatment available and a government-organized spraying program.

Mention should be made at this point that the malaria control program does not release DDT into the environment in a way which leaves residue on food crops or water sources. Malaria spraying is limited primarily to semiannual applications to the interior walls of houses. No observable adverse effects have been noted in controlled studies of inhabitants or spraymen.

## Chapter 6. ALTERNATIVES

### 6.1 No Project

Without the Small-Scale Irrigation Project, the goals and objectives mentioned in the preceding chapter would not be attained in the expected time frame. The economic and social benefits associated with this project would not occur.

### 6.2 Delay In Project Implementation

A delay in project implementation would mean a delay in the attainment of the project objectives. The project cost will also rise with time due to price escalation.

### 6.3 Different Projects to Achieve Same Goal

There is no general project alternative on a national scale. First, irrigation projects appear to be the only viable way to achieve economic development goals considering the land and water resources and the cultural and occupational backgrounds of the people. There is only limited potential for the development of cottage and small-scale industries to contribute to the same economic goals. Second, small-scale irrigation sub-projects are outside the scope of the NIA. The NIA promotes mostly large scale projects (as large as 40,000 hectares) which are usually diversion systems.

A few individual SSI sub-projects might be incorporated into NIA projects especially when there is a diversion rather than a pump system.

### 6.4 Functional or Operational Modification

There are two types of irrigation systems considered under this project -- the pump and the diversion type of irrigation. The use of each type depends upon the topography of the area and location of the source of water supply. About 70 percent of the target areas under the FSDC project would be served by pumps.

There are two types of pump systems used -- the electric and the diesel. Electric-powered pumps are used whenever electricity is available. Diesel-powered pumps are used in the absence of electricity. Wind powered pumps are rarely used in the Philippines.

Groundwater, as an alternative source, could be used but it is more expensive to abstract than surface water.

#### 6.5 Different Location

Sub-projects are selected based on the technical and economic attractiveness and farmers' willingness to form an ISA. A different location, therefore, would not benefit interested farmers.

## Chapter 7. SHORT-TERM GAIN VERSUS LONG-TERM LOSS

The only potentially significant short versus long-term trade-off is the increase in rice production gained by potentially disrupting aquatic life and affecting human health. On the positive side, installation of irrigation systems would increase annual rice production from 1.9 tons/hectare to 5.3 tons/hectare. On the negative side, the newly constructed canals, which are an integral part of an irrigation system, could become in a few areas a habitat for snails. Also, the increase in rice yield would be partially secured by application of pesticides, which would increase pesticide run-off and potential hazards to applications.

The SSI project will not contribute significantly to the use of persistent pesticides or the creation of habitat for snails for two reasons. First, the SSI sub-projects are small in scope -- 100 to 300 hectares. By their very size, they could have only a limited effect especially when they are usually an order of magnitude smaller than an adjacent NIA project. Second, the FSDC through the ISA training program, can encourage practices which would mitigate the potentially adverse effects. It can instruct farmers in the proper use of pesticides and encourage farmers in practical farm management. Third, FSDC can insure that projects are properly designed where necessary to account for potential health problems.

## Chapter 8. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irretrievable commitment would be a small quantity of sand, gravel, steel and other materials used in the construction of the irrigation systems.

The lands to be irrigated are already committed to agricultural activities.

## Chapter 9. BENEFITS AND CONSIDERATIONS WHICH OFFSET ADVERSE EFFECTS

The upliftment of the small farmers by raising their farm income through increased production is the primary goal of this project. This social consideration alone, for the 97,000 farmers directly affected, is more than enough to offset whatever adverse effect may result from project development.

As a whole, the internal rate of return for the project is estimated at 55% which is considered very attractive. The benefit calculation does not include secondary project benefits to suppliers and processors of agricultural inputs and outputs. Increased production will require increased agri-business which in turn could require increased employment. The value added and the foreign exchange savings that will accrue to the rice drying, milling, storage, transport and marketing sectors are also a substantial gain to the economy.

## Chapter 10. CONCLUSIONS AND RECOMMENDATIONS

1. There is no potential major adverse environmental impact warranting curtailment of the program. This conclusion is based on available data, field observations and the assumption that mitigation measures will be implemented by FSDC.
2. The FSDC should strengthen its training program in the use of appropriate (less persistent) pesticides in order to limit potential adverse ecological effects. Also, it should stress proper application of pesticides in order to protect the health of applicators.
3. The FSDC in areas endemic for schistosomiasis should encourage ISA members to accept treatment, should develop a control program for snails where necessary and should place additional emphasis on good water management practices.
4. A limited program of monitoring is recommended to be undertaken by FSDC. The program should document changes in pesticide use and their effects and in public health parameters.

Appendix A

CONSULTATION

CONSULTATION:

The following individuals contributed to the preparation of the EA:

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REVIEW:

This document has not been officially reviewed by the G.O.P.

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Appendix B

B I B L I O G R A P H Y

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