PART-I
GENERAL BACKGROUND OF THE PROJECT

1. INTRODUCTION

1.1 Authority

This Final Report (the Report) is prepared in accordance with the "Implementing Arrangement on the Technical Cooperation for the Study on Jalaur Irrigation Systems and Rural Area Development Project (the Study)" agreed upon between the National Irrigation Administration (NIA) and Japan International Cooperation Agency (JICA) on August 8, 1996 (refer to Attachment I).

The Study was divided into two phases, Phase I and Phase II. The Phase I study was set to formulate a master plan for irrigation and rural development in the existing 5 national irrigation system areas and 6 potential irrigation areas and to evaluate and select the priority projects. The Phase II study dealt with the feasibility study on two (2) priority projects selected in the Phase I study. The Report presents the results of all works performed in both Philippines and Japan during the Phase I and Phase II studies.

1.2 Background of the Study

NIA presently operates 168 national irrigation systems (NISs) comprising 645,000 ha of the service area in the country. The systems are caught in a vicious circle, namely deterioration of system function → lowering of irrigation service fee collection rate → shortage of operation and maintenance budget → improper/poor operation and maintenance of systems → deterioration of system function. The major reasons for unsatisfactory performance of NIS include improper water management due to institutional and technical weaknesses of NIA and irrigators' associations (IAs), insufficient water control structures to ensure equitable and timely water supply to all sections of irrigation systems, inadequate funding for operation and maintenance, and siltation in canal systems caused by the absence of silt excluders, watershed degradation and severe erosion during typhoons. In light of the present NIS situation, proper operation and regular maintenance of irrigation facilities are needed to prevent system deterioration.

The study area is located southeast of Panay island and belongs to Iloilo province. In 1976, NIA formulated the Jalaur River Multipurpose Project (JRMP) with the additional functions of providing hydropower and municipal and industrial water. The implementation of JRMP was divided into two stages i.e., Stage I - rehabilitation and improvement of the five existing irrigation systems such as Jalaur proper RIS, Jalaur extension RIS, Suague RIS, Sta. Barbara RIS and Aganan RIS, and Stage II - construction of high dam, power plant and transbasin diversion channel.

Stage I was completed in 1983 with a financial assistance from the World Bank. As for Stage II, an evaluation and updating of the previous study carried out by NIA in 1988 found that the revised EIRR was a low 6.7 percent. The study concluded that Stage II could not be economically justified unless the plan is modified significantly.

Recognizing that the irrigation component of JRMP is very important for the region, NIA formulated an alternative development plan in which the multipurpose dam would be replaced by several small water impounding dams to be located in the upper catchment of the individual irrigation systems with the sole purpose of supplying irrigation water. The alternative plan, at the same time, intends to increase irrigation efficiency through rehabilitation and improvement of major irrigation facilities, and strengthening of farmer's organization, water management organization, and operation and maintenance organization.

Against this background, the Government of the Philippines (GOP) requested the Government of Japan (GOJ) in November 1995 to provide technical assistance for the execution of "The Study on Jalaur Irrigation Systems and Rural Area Development Project". In response to the request, GOJ dispatched a preliminary survey team through JICA and the Implementing Arrangement for the Study (I/A) was signed between NIA and JICA in August 1996.

1.3 Objectives of the Study

The Objectives of the Study are:

(a) To formulate a master plan for irrigation and rural area development in order to improve the regional and farm economy for increasing agricultural production in both the existing and potential irrigation areas of some 30,500 ha located in the basin of Jalaur and adjacent rivers, especially to enhance efficiency in the operation and maintenance of the irrigation facilities by rehabilitating/improving them to ensure irrigation water supply throughout the year through the construction of a series of small water impounding dams in the river basins and to select priority project(s),

(b) To conduct a feasibility study on the selected priority project(s) and formulate irrigation and rural development plan(s) to establish a pilot model project for rehabilitation/improvement of existing irrigation systems to be managed under NIA in the Philippines, and

(c) To transfer technology to the counterpart personnel by the On-the-Job Training method in the course of the Study.

1.4 Works Performed for Master Plan Study in Phase I

(1) Works in Philippines

The advisory team and the first group of the study team arrived in Manila on January 8, 1997, and had an inception meeting with NIA on January 10, 1997. During the period of the site visit from January 12 to 14, 1997, a meeting on the Inception Report was again held among NIA Central Office, NIA Region VI Office, regional offices of the national government agencies concerned, local government offices concerned, the advisory team and the study team on January 14, 1997. Through these meetings, the Inception Report was basically accepted by NIA and the Minutes of Meeting were signed between NIA and the study team in the presence of the advisory team on January 16, 1997 (refer to Attachment II).

After the above-mentioned meetings, all the experts of the study team commenced their respective field works including field reconnaissance, data collection and analysis, field investigation, preliminary study on present conditions of meteo-hydrology, socio-economy, agriculture, irrigation and drainage, water management, watershed management and environment in and around the study area, and establishment of the basic concepts for formulation of development plan. In addition, the aerial photograph shooting and preparation of photo-mosaic maps, hydro-geological investigation and water quality survey were also executed under sub-let contract basis. These survey and study results were compiled in the Progress Report (I) which was submitted to NIA on March 17, 1997. In order to discuss the contents of the Progress Report (I), meetings with NIA were held at Iloilo and Manila on March 17 and March 19, 1997, respectively. Through these meetings, the Progress Report (I) was basically accepted by NIA.

(2) Works in Japan

The office works of the Phase I study in Japan were carried out from May 9 to July 7, 1997. The works included: (i) review and analysis of the data and information collected in the field works; (ii) study on project development plan including the improvement plan of irrigation and drainage facilities, irrigated agriculture development plan, improvement plan of rural infrastructures, improvement plan of water management, improvement of agricultural support services, improvement plan of strengthening of farmers' organizations and NIA, improvement plan of post-harvest facilities and marketing, and development plan of watershed management; (iii) environmental consideration; (iv) preliminary estimate of project cost; (v) project evaluation; and (vi) study on priority of the development and project implementation. The results were compiled in the Interim Report.

1.5 Works Performed for Feasibility Study in Phase II

(1) Works in Philippines

The study team was dispatched to the Philippines on July 21, 1997 to August 1, 1997 primarily to explain and discuss the Interim Report. The team held separate discussions with the NIA Central and concerned regional and local government offices on July 23 and 25, 1997, respectively. Through these meetings, the Interim Report was basically accepted by the NIA and the Minutes of Meeting were signed between the NIA and the study team on July 31, 1997 (Attachment III).

The study team commenced the field works for the feasibility study on the priority projects from September 9, 1997. The field works involved additional data collection, interview survey with the relevant Municipal Agricultural Offices, inventory survey on the irrigation and drainage facilities, field tests on the irrigation water requirements, interview survey with the NIA field staff, household interview survey, consultation meetings with the officers of each IA, and establishment of development concept on the prospective plans for the priority projects. In addition, the survey works for preparation of topographic map, the canal route survey and the participatory rural appraisal (PRA) and public consultation seminars were also executed under sub-let contract basis.

These survey and study results were compiled in the contents of the Progress Report (II) which was submitted to NIA on December 8, 1997. The meetings on the Report were held at Iloilo and Manila on December 9 and December 11, 1997, respectively. Through the meetings, the Progress Report (II) was basically accepted by NIA.

(2) Works in Japan

The works of the Phase II study in Japan were executed from January 5, 1997 to February 18, 1997. The works included: (i) analysis of the collected data in the field works; (ii) study on the prospective plans such as irrigated agriculture development plan, improvement plan of irrigation and drainage facilities, improvement plan of water management and O&M practices, institutional development plan of IA and NIA, improvement plan of agricultural support services and watershed management plan ; (iii) environmental consideration; (iv) preliminary design of project facilities, project cost and benefit estimates and project evaluation; (v) preparation of implementation schedule; and (vi) strengthening plan of Aganan IA Federation. The results were compiled in the Final Report.

2. BACKGROUND OF THE PROJECT

2.1 National and Regional Economy

While service and manufacturing sectors have shown remarkable progress in recent years in the country, agricultural sector has been playing a very important role in the national economy sharing 21.5% of GDP, providing 43.4% of the total employment and contributing 14.4% of the total export value in 1995. In most rural areas, agriculture is the primary means for the livelihood of the people.

Recent Philippine economic progress has been significant. Annual GDP changes in 1991, 1992, 1993, 1994 and 1995 were respectively -0.6%, 0.3%, 2.1%, 4.4% and 4.8%. GNP per capita was, respectively, US$ 723, US$ 831, US$ 826, US$ 958 and US$ 1089. Export growth in 1995 was 29.4%, while that of import was 23.7%. Improvement in peace and order, deregulation in external trade, privatization in public sector, low inflation rates (8.1% in consumer prices change in 1995) and tax reform have been contributing for economic recovery. Business environments have been significantly improved in recent years.

Agriculture and service sectors are the two main industries in the Western Visayas occupying 33.7% and 43.5% of the Gross Regional Domestic Product (GRDP), respectively, in 1995. Considering that the major parts of the service sector consist of government services, which heavily rely on subsidies from the central government, agriculture is the most important sustainable source of livelihood for the region. Economic growth in the region has been sluggish in recent years, however. Annual growth in GRDP in the region in 1991, 1992, 1993, 1994 and 1995 was respectively -0.6%, 5.7%, 4.0%, 2.8%, and 2.0%. Growth in agriculture has stagnated in recent years with respective growth rates of 5.3%, 7.6%, 2.8%, 2.0% and -2.9%. The agricultural setbacks in 1995 were caused by lower rainfall than usual in the planting season and excessive rains and floods in the harvesting season.

Iloilo province is a surplus area in rice production and considered to be the rice bowl of the Visayas. However, agriculture production in the province has been sluggish in recent years. Production of palay in 1996, which is the most important agricultural produce in the province, was 609,000 tons, which was lower than in 1993 and 1994, in which 680,00 tons and 670,00 tons of paddy were produced. Paddy yields were only 3.2 tons/ha for irrigated palay and 2.3 tons /ha for rainfed palay in 1996. Rice industry is threatened by conversion of rice fields to residential and industrial areas, and by inefficient irrigation systems. Livestock population is decreasing. Livestock population in 1992 decreased by 12% for carabao, 2% for cattle, 9% for hogs and 14% for goat in comparison with the 1989 population.

2.2 Development Policies

2.2.1 Medium Term Philippine Development Plan

The Philippine Government formulated the Medium Term Philippine Development Plan 1993-1998 (MTPDP) in the context of 1991-92 recession during which the country experienced a negative GNP growth and high incidence of poverty. The MTPDP set development goals and action plans, which show the socio-economic dimensions of the country in the year 2000. Strategies of the MTPDP are human development, international competitiveness and sustainable development. The primary targets of the Plan are to get an average annual GDP growth rate of close 10%, per capita income of at least US$ 1,000, and reduction of poverty incidence to 30% by the end of 1998. The Plan recognizes the importance of reducing poverty in the rural areas, and stresses improvement in productivity, increased value added and diversification of rural economy to reduce poverty in the rural areas.

The Government of the Philippines (GOP) is decentralizing government administration by devolving functions of central government agencies such as the Department of Agriculture to the Local Government Units (LGUs). Actual implementation of the central government development policies are being carried out by the LGUs.

The province of Iloilo made the Medium Term Development Plan for 1994-1998 in reference to MTPDP. The vision of Iloilo in 2000 is to become a center for integrated agriculture and other viable industries with a balanced and sustainable ecological system and a premier tourist destination in the Visayas within the context of total human development, equity and social justice.

Provincial development goals and objectives are:

- Poverty alleviation,
- Protection, rehabilitation and enhancement of natural resources,
- Promotion of sustainable economic growth,
- Equity and social justice, maintenance of peace and order, and political stability for investment and increased economic activities, and
- Administrative and institutional reforms through greater people's participation such as NGOs, people's organizations and cooperatives.

2.2.2 NIA's Corporate Plan (1993-2002)

NIA's Corporate Plan (1993-2002) was formulated within the context of the MTPDP, planning nationwide to develop new service area of about 438,000 ha and rehabilitate existing service area of about 587,000 ha by 2002 for increasing food production and socio-economic development in rural areas. Under such a situation, the Plan seeks to:

- increase the average irrigated cropping intensity from a national average of 144% in 1993 to 162% by 2002,
- intensify income generation from ISF's and other sources by improving ISF collection through the restoration of irrigation systems and the provision of sustained improvement in the quality of services,
- develop a dynamic and viable NIA - IA partnership in system management for reducing O&M cost, and
- develop NIA's institution for improving efficiency and effectiveness.

2.3 Review of Projects related to the Study

(1) Jalaur River Multipurpose Project

The Jalaur River Multipurpose Project (JRMP) was a scheme aimed at a year-round water supply for irrigation, power generation and municipal and industrial use by utilizing the water of the Jalaur river. The feasibility study on JRMP was completed in 1976 with a financial assistance from the World Bank. The implementation of JRMP was divided into two (2) stages; Stage I-rehabilitation and improvement of the existing irrigation systems such as Aganan, Sta. Barbara, Suague and Jalaur (so called Jalaur proper) with a total area of some 22,000 ha and construction of new irrigation and drainage facilities for an extension area of about 2,700 ha to the Jalaur River Irrigation System (so called Jalaur extension), and Stage II-construction of high storage dam, power plant and transbasin diversion channel.

The project works for Stage I were completed in 1983 at a cost of 202.2 million peso with a financial assistance from the World Bank. In 1988, an evaluation and updating of the previous study was carried out and found that the revised EIRR was a low 6.7%. The study concluded that Stage II could not be economically justified unless the plan be modified significantly.

NIA formulated an alternative plan. Consequently, the said plan has replaced the proposed multipurpose dam by several small impounding dams to be located in the upper catchment of the existing NIS with the sole purpose of irrigation. The extension areas of 5,800 ha in total which would be irrigated by using water from a proposed transbasin diversion channel (so called low line canal) in the feasibility study were still included in the alternative plan. Thus, the possibility of irrigated agriculture development for the said extension areas was clarified in the Study.

(2) Agricultural Development Project for Aganan River Irrigation Area

The Agricultural Development Project for Aganan River Irrigation Area (the Project) was completed under Japan's Grant Aid Program and turned over to the Philippine Government from Japan Government at the end of March 1996. The project area is located on the right bank of the Aganan river adjacent to the western area of Iloilo city in Iloilo province.

The objectives of the Project were:

(i) improvement of agricultural productivities ;
(ii) improvement of farm income ;
(iii) activation of IAs ; and
(iv) efficient utilization of water and land resources.

The Project included the following components :

(a) Improvement of the existing irrigation facilities of the Aganan RIS: improvement of the diversion dam and rehabilitation of irrigation canal structures and service road ;
(b) Construction of the post-harvest facilities : multipurpose pavement, glass house, paddy warehouse, administration office and equipment shed ; and
(c) Procurement of the O&M equipment: equipment for O&M of the irrigation facilities and equipment for O&M of the post-harvest facilities.

The effects and impacts of the Project were preliminarily evaluated in the Paper prepared by NIA in January 1996, which are summarized as follows:

(a) Improvement of the existing diversion dam

Before the commencement of the Project, the right bank downstream of the diversion dam was very seriously eroded by floods and the erosion was about to destroy the existing main canal and dam itself. With the improvement of the diversion dam, the dam and main canal turned safe against floods and actually were saved from the extraordinary flood which occurred on October 28 and 29, 1995 (a 200-year probable flood).

(b) Concrete lining of the main canal

Before the commencement of the Project, the main canal was made of earth and irrigation water could hardly reach paddy field even in the wet season because of i) low velocity of the flow caused by rough and irregular canal sections and ii) seepage loss from the canal. With the concrete lining of the main canal, the irrigation water reached the field faster and smoothly. Before the Project, it took about 6 months to deliver the irrigation water and complete one cropping period for the whole service area of the system. Owing to the concrete lined canal, it took only 4 months.

(c) Post-harvest facilities

The following conditions of post-harvest facilities were clarified through the field survey :

Utilization of Post-harvest Facilities
(April 1996 to December 1996)

Paddy stored in Warehouse	:	4,087 sacks for 34 persons
Dry Yard	:	13,070 sacks for 100 persons
Transportation by Cargo Truck	:	20,000 sacks for 100 persons
Plowing by Farm Tractor with Rotavator	:	318 ha for 212 persons

Income by Post-harvest Facilities
(April 1996 to December 1996)

Paddy Warehouse	:	3,389 pesos (0.59%)
Dry yard	:	13,070 pesos (2.26%)
Cargo Truck	:	19,989 pesos (3.46%)
Farm Tractor with Rotavator	:	541,683 pesos (93.69%)

As shown in the above table, the paddy warehouse is not used effectively. The effective utilization plan of post-harvest facilities, especially paddy warehouse, shall be studied in the Study on the basis of constraints and problems found through the field survey.

(3) The Study on the Flood Control for Rivers in the Selected Urban Centers

The objectives of the Flood Control Study were :

(i) to collect and compile the existing data on representative medium and small-scale rivers in thirteen (13) urban centers and prepare a river inventory based on the aforementioned data ;
(ii) to formulate a master plan on flood control for rivers located in the four (4) cities considered as priority areas for the Master Plan Study ;
(iii) to conduct a feasibility study on the most urgent flood control project identified in the Master Plan ; and
(iv) to carry out transfer of technical knowledge to Philippines counterpart personnel concerned through the foregoing series of studies and project formulation in the Philippines and in Japan.

The flood control project works proposed in the urgent plan are summarized as follows :

City	Project Works	Work Quantity		Major Structure
Iloilo	river improvement	Jaro	: 7.22 km	revetment, 2 bridges
		Iloilo	: 6.50 km	revetment, 4 bridges
	construction of floodway	Jaro	: 4.80 km	diversion channel
	drainage improvement	3 channels	: 9.65 km	
Ormoc	river improvement	Anilao	: 1.80 km	revetment,3drop,2bridge,2slit dam
		Malbasag	: 1.90 km	retaining wall,4drop,2bridge,1slit dam
	drainage improvement	1 channel	: 1.20 km	

In the Urgent Flood Control Plan, the following project works were proposed :

(i) construction of Jaro Floodway;
(ii) partial improvement of the Jaro river; and
(iii) improvement of the Tigum and Aganan rivers.

The proposed Jaro Floodway with a flow capacity of 850 m^3 was planned to run across the irrigation service area of Sta. Barbara RIS divided into two areas, such as northern area and southern area. However, the southern service area has been mostly converted into subdivisions or residential areas. The area of only 20 ha would remain as irrigation service area if the said floodway would be constructed. Under such a situation, the above construction plan of Jaro floodway would have no great influence on the development/improvement plan in the Study. If the improvement plans of the Jaro, Tigum and Aganan rivers would be implemented, the present drainage and flooding conditions in the Aganan and Sta. Barbara RIS areas would be drastically improved. According to the information from DPWH Regional Office at Iloilo, it is scheduled that the detailed design on the flood control works at the Iloilo city would be started from August 1998 under a financial assistance from OECF Japan.

(4) First Irrigation Operations Support Project (IOSP I)

The First Irrigation Operations Support Project(IOSP I) financed the first phase of NIA's nine-year Irrigation O&M Improvement Program, which commenced in July 1988, and was the first-financed project in the Philippines primarily to address O&M of irrigation systems.

The main objectives of IOSP I were:

(i) to strengthen the institutional and technical capability of NIA and cooperating IAs in order to improve and maintain the efficiency of existing NIA infrastructure, and
(ii) to improve the operating performance of the 127 existing NISs through minor repair works and through increase in the annual funding for O&M services and levels of O&M services.

The following works were executed under IOSP I for NIS in the study area.

(a) Restoration works

The restoration works were desilting, weeding and clearing, repairs of service road, and repairs of canal structures including gates. The allocated budget for the restoration works is shown below. Most of the budget was used for desilting works on the irrigation canals.

(Unit : peso)

Year	Aganan & Sta. Barbara RIS	Jalaur & Suague RIS
1989	2,105,700	3,288,000
1990	3,532,030	3,580,163
1991	2,420,300	529,600
Total	8,058,030	7,397,763

(b) Recurrent works

The recurrent works were also the same as the restoration works, mainly of irrigation canal systems including service road damaged by typhoons and floods. The allocated budget for the recurrent works is as follows :

(Unit : peso)

Year	Aganan & Sta. Barbara RIS	Jalaur & Suague RIS
1989	747,700	1,594,600
1990	250,000	3,062,656
1991	592,000	500,000
Total	1,589,700	5,157,256

(5) Second Irrigation Operations Support Project (IOSP II)

The project aims to improve and sustain the operational efficiency of the NIS, thereby helping increase agricultural production (mainly rice), expanding small farmer incomes and rural employment opportunities, and contributing to rural poverty alleviation. The project would finance the second phase of the program launched under IOSP I on the national irrigation systems.

The project would be implemented over a five and a half year period (mid-1993 to end-1998). It would be nationwide in scope and cover all 165 of the existing NIS serving about 620,000 ha.

The following works were executed under IOSP II for NIS in the study area.

(a) Repair works

The works included repairs of canal systems and service roads.

(b) Canal maintenance works

The canal maintenance works were executed for incremental O&M of canal system. The works were desilting, raising of embankment, improvement of canal structures including repair of control gates, and support for salaries and allowances of Institutional Development Officer (IDO).

(c) Urgent repair works

The urgent repair works were executed for the diversion dams of the Sta. Barbara RIS and Suague RIS which had been damaged mainly by floods. These urgent repair works were done on contract basis. These involved river training works upstream of the dams, and improvement and repair works of retaining wall, apron and concrete blocks downstream of the dams including repair of steel gates.

The allocated budget for the above works is shown below.

(Unit : peso)

Year	Aganan & Sta. Barbara RIS			Jalaur & Suague RIS		
	Repair	Canal M.	Urgent R.	Repair	Canal M.	Urgent R.
1993	1,652,236	1,215,350	-	1,705,089	1,412,800	-
1994	320,300	645,040	-	-	1,130,940	-
1995	727,060	1,635,317	14,110,000	2,145,024	1,910,000	-
1996	n.a.	n.a.	n.a.	n.a.	n.a.	12,363,000
Total	2,699,596	3,495,707	14,110,000	3,850,113	4,453,740	12,363,000

(6) Water Resources Development Project

The Water Resources Development Project (the Project) is a follow-up project to IOSP II to continue the program approach to irrigation systems improvement and repair. The Project would assist the Government in developing an appropriate policy and institutional framework to improve water resources planning, development and management in the country through the following:

(i) to initiate an integrated and comprehensive approach to watershed management to sustain water sources,
(ii) to improve efficiency of existing systems, thereby increase agricultural production (mainly rice) and finally alleviate rural poverty,
(iii) to improve irrigation services in the long term by accelerating management turnover of irrigation systems to water users and by increasing NIA's institutional effectiveness, and
(iv) to improve the environment in irrigated area, mainly by controlling schistosomiasis, a water-borne disease.

The Project would be implemented for five years from 1997 to 2001.

In the project component on improvement and repair of NIS, the following works are proposed for improvement and repair of Jalaur proper RIS.

Work Item	Main	Laterals
Service Road	2.1km	46.18km
Replacement of Steel Gate	33unit	77unit
Desilting	14.25km	63.09km
Embankment Raising	2.37km	23.78km
Structure Repair	4unit	40unit
Grouted Riprap	390m3	1,624m3

Total cost of the above works is estimated at 29,462.6 thousand pesos (US$ 1,031.8 thousand).

The above works should be excluded in the improvement plan of the canal systems of the Jalaur proper RIS in the Study.

PART-II
MASTER PLAN FOR THE JALAUR IRRIGATION SYSTEMS AND RURAL AREA DEVELOPMENT PROJECT

3. EVALUATION AND SELECTION OF PRIORITY PROJECTS

3.1 The Study Area

3.1.1 Location and Topography

(1) Location

The study area is located in Iloilo province in the island of Panay. It lies within the coordinates 10°37'50" and 11°00" east longitude and 122°38' to 122°45' north latitude, and its borders are defined by Jalaur damsite and the municipalities of Dueñas and Lambunao on the north, the municipalities of Leon and Maasin on the west, the city of Iloilo and Guimaras island on the south, and the municipality of Barotac Viejo on the east. It is situated north and northeast of Iloilo city, the provincial capital of Iloilo and the regional center of Region VI (Western Visayas). It covers 13 municipalities, namely; Leganes, Oton, Pavia, San Miguel, Sta. Barbara, Anilao, Barotac Nuevo, Dingle, Dumangas, Mina, New Lucena, Pototan, and Zarraga, and the northeastern part of Iloilo city comprising 10 barangays.

(2) Topography

The study area is located in the alluvial plains of the two (2) rivers, namely Jalaur and Jaro rivers. Majority of the study area are covered by the irrigated paddy field and rainfed paddy field. The upland areas with small undulation and slopes are found around the northern and western boundaries of the study area. The undulation areas are not so much expanded in the alluvial plain areas.

The Jalaur river has two (2) big tributaries, namely, Suague and Jagdong rivers, and the Jaro river has also two (2) tributaries, namely Tigum and Aganan rivers. All the rivers originate near the mountain chain which includes the peaks as Mt. Baloy, Mt. Singit, Mt. Inaman and Mt. Tambara. The mountain chain has an altitude of more than 1,000 m, and is laid down towards north - south direction. All the rivers flow down the eastern coast with the steep gradient, and flow out in the central area of the flat plain.

The elevation of the study area ranges from approximately 25 to 50 m nd into the lowland located near the fish pond, the towns and build-up areas.

3.1.2 Demography and Socio-economic Situation

(1) Demography

The study area encompasses 217 barangays belonging to 13 municipalities and the city of Iloilo with a combined population of about 392.2 thousands in 1995. The population density is estimated at about 4 persons per ha, or roughly 20 percent higher than the provincial average. This situation partly accounts for the large population in the barangays of Iloilo City and Pavia covered by the Study which have an estimated population density of 59.7 and 7.6 persons per ha, respectively. The small average size of land (about 1.5 ha) distributed to farmers under the Comprehensive Agrarian Reform Program (CARP) also partly explains for the present population density in the study area.

The demographic characteristics of the study area are summarized in the following table, with comparative data at the provincial, regional and national levels:

Parameters		Study Area	Iloilo Province	Region VI	Philippines
Area	('000ha)	42.9	532.4	2,022.3	30,000.0
Population	('000, 1995)	392.2	1,,876.0	5,777.0	68,614.2
Population density	(Persons/ha, 1995)	4.2	3.5	2.8	2.3
Average family size	(Number)	5.2	5.5	5.5	5.3
Population growth	(%/year, 90'-95')	2.0	2.1	1.8	2.3

Source: National Statistical Coordination Board, 1996 Philippine Statistical Yearbook and 1995 Regional Social and Economic Trends: Region VI (Western Visayas). The population density for the Study Area was computed by dividing its estimated population of 392,244 by the total land area of the 15 municipalities and Iloilo City served by five RIS (92,870 ha).

(2) Socio-economic situation

The economy of the study area is generally dominated by agriculture with paddy rice as the main crop produced. Its economic condition is typical of most parts of Iloilo Province, except those municipalities adjacent to Iloilo City such as Pavia and Leganes where urbanization due to expansion of the city has reduced gradually the irrigated agricultural land every year. As a result, a shift in cropping system towards diversified, high-valued crops has occurred in Aganan-Sta. Barbara RIS service area. The economic indicators for the study area are summarized below, with comparative data for provincial, regional and national levels.

Indicators		Study Area*	Iloilo Province	Region VI	Philippines
Labor force	('000)	239	1,200	2,551	28,057
Employed population	('000)	104	666	2,324	25,700
Share of agriculture sector	(%)	64	43	53	44
Employment rate	(%)	83	78	91	92
Unemployment rate	(%)	17	22	9	8
Average income	(Pesos)	32,400	43,104**	47,724**	65,186**
Average expenditures	(Pesos)	30,800	37,633**	42,671**	51,991**

Source: National Statistical Coordination Board, 1996 Philippine Statistical Yearbook for regional and national data; and NSCB, 1995 Regional Social and Economic Trends: Region VI (Western Visayas) for provincial data.
* Municipal-level data. ** 1991; others are in 1995.

Available data at the municipal level indicate that the average per capita income was about 2,000 pesos in 1994, compared to the per capita poverty threshold of 3,300 pesos for the same year. For the municipalities concerned, except the city of Iloilo, the poverty incidence has ranged from 71.4% to 83 % in 1994.

3.1.3 Climate and Hydrology

(1) Climate

Climatological normals at Iloilo (1961-1995, PAGASA) show the general climatological conditions in the study area.

Month	Rainfall (mm)	Rain Days (nos.)	Temperature (Deg. C) Max.	Min.	Mean	Relative Humidity (%)	Wind Direction	Wind Speed (m/sec)	Cloud (0ktas)
JAN.	39.4	8	29.8	22.7	26.2	82.0	NNE	5.0	5
FEB.	23.9	5	30.4	22.8	26.6	80.0	NNE	5.0	5
MAR.	29.6	5	31.7	23.4	27.6	75.0	NNE	5.0	4
APR.	50.9	5	33.1	24.6	28.9	73.0	NNE	4.0	4
MAY	118.2	10	33.2	25.1	29.1	76.0	SW	3.0	5
JUN.	303.8	19	31.6	24.7	28.2	82.0	SW	3.0	6
JUL.	340.4	20	30.7	24.4	27.6	84.0	SW	3.0	7
AUG.	383.6	20	30.5	24.5	27.5	84.0	SW	4.0	7
SEP.	285.6	19	30.8	24.3	27.6	84.0	SW	3.0	7
OCT.	268.3	18	31.1	24.2	27.6	84.0	N	3.0	6
NOV.	176.2	14	30.9	24.0	27.5	84.0	NNE	3.0	6
DEC.	84.6	11	30.2	23.3	26.8	83.0	NNE	4.0	5
Annual	2,104.5	154	31.2	24.0	27.6	81.0	NNE	4.0	6

Source: PAGASA, Iloilo

During wet season (May to November), south-westerly monsoon wind prevails bringing 90 % of annual rainfall, while north-easterly monsoon wind during dry season (December to April) blows stronger and brings little rainfall. It is notable that annual rain days total to over 150 days, i.e., more than 40 % of the year. Even during the driest month, the study area receives a few days of rainfall which facilitates crop cultivation to a large extent.

(2) Hydrology

(a) Rainfall

In Panay island, there are 16 authorized raingauge stations, of which only four (4) stations are active at present. They are Miagao (PAGASA), Iloilo Airport (PAGASA), Roxas City (PAGASA) and Dongsol, Pototan (NIA).

Rainfall distribution in the study area shows that precipitation is more in north-western part (over 3,000 mm) and less in south-eastern part (less than 1,500 mm). Since there is no rainfall data available on the western mountain side

of Iloilo province, the study team installed an automatic raingauge recorder at Lambunao.

Rainfall at Dongsol which is situated in the service area of the Jalaur proper is summarized below:

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Mean	51.0	27.2	36.6	60.4	72.3	259.5	300.2	310.8	240.4	269.0	189.6	88.0	1905.3
80% reliable	19.1	2.7	0.9	4.6	16.7	151.5	184.6	160.3	127.8	177.0	82.1	41.3	968.6

Source: NIA Region VI office
Note: Period 1977 - 1996

The rainfall in the service area is comparatively abundant and gives higher effective rainfall. Even during the dry season, rainfall of five(5) days or more is observed, which mitigates risk of damages to dry season's crops.

(b) River discharge

Runoff at the diversion site for each RIS is summarized below:

(Unit: m^3/sec)

River for RIS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Jalaur	42.3	28.2	21.1	20.8	28.4	43.9	65.5	58.6	53.7	79.3	79.5	71.2
Suague	6.0	4.2	2.7	2.0	4.6	4.8	8.4	8.0	7.6	11.1	9.6	7.9
Tigum	4.4	2.8	2.2	1.9	2.8	4.0	8.6	6.8	8.3	11.0	10.9	7.0
Aganan	0.98	0.22	0.37	0.59	0.77	1.60	3.56	2.96	2.33	3.98	2.04	1.27

The Jalaur river basin is considered to be the best water source, having a large catchment area (1,065 km^2) at the diversion dam and higher retaining capacity. The Aganan river has the worst watershed condition in the study area, considering runoff at the diversion dam (104 km^2). The Suague and Tigum river basins have almost similar catchment conditions, considering runoff at the diversion dams (181 km^2 and 193 km^2, respectively).

The watershed area of each river had been destroyed due to the disordered timber logging and fuelwood logging (for sugarcane factory). In addition, shifting cultivation and upland farming without conservation measures had accelerated the degradation of watershed. The degree of degradation of the watershed area corresponds with the above runoff condition.

There are irrigation areas to some extent by brush dams or pumps in the upper river basins of the existing RISs without obtaining water right (Jalaur river: 1,420 ha, Suague river: 1,035 ha, Tigum river: 259 ha, and Aganan river 274 ha). Water allocation should be made to the said areas for the basin-wide water management.

According to the investigation results of sedimentation for the Jalaur Multipurpose Dam Project, the sediment yield of the Jalaur river is 1.5 mm/km^2/year. No other observed data being available on the sediment transport, the study team conducted sampling and laboratory analysis for the river bed materials in the vicinity of the proposed small reservoir sites. These data have also been used as supporting information. In addition, the maximum specific rate was estimated at 1.2 mm/km^2/year based on an index for estimation of specific sediment rate for dams with catchment area of less than 100 km^2. Taking into consideration the proximity of catchment conditions and safety factor, the yield rate of 1.5 mm/km^2/year was assumed to be the specific sediment rate at the proposed small impounding dam sites.

3.1.4 Geohydrology

A geohydrological investigation was conducted to evaluate the recharge storage and the development potential of groundwater in the Aganan RIS area.

The following works were executed in the geohydrological investigation:

- Drilling of a test well with 300 mm in diameter and 100 m in depth,
- Pumping test, and
- Water level observation of existing wells at 25 places including the said test well.

The following three kinds of wells exist in the survey area.

Deep tube wells with 0.15 to 0.45 m in diameter and 30 to 120 m in depth are dug by cable tool method and installed with iron pipe and long screens. They are pumped up by submersible or suction pump at a large discharge rate. These type wells are distributed only in narrow mid-plain area for public water supply, large factories or offices.

Shallow artesian wells with 0.05 to 0.15 m in diameter and 10 to 30 m in depth are dug by hand auger or simple driving machine. DPWH has made several hundred wells at barangay halls or elementary schools from 1950, but about half of them are not functioning due to the damage of hand-pump. Based on the report of JICA (1982, Basic Survey Report of Kyousui-sei-gas Development Project in Iloilo city, Panay Island, Philippines), it is supposed that many flowing wells remained all over the Iloilo basin before the completion of MIWD's deep wells. In the present survey, these flowing wells are found only at Sta. Barbara and Oton. Some personal wells with 10 to 30 m deep are dug by hand auger method for irrigation to paddy field. They are installed with engine pump. Some factories have the same wells installed with electric suction pump.

Shallow open wells with 0.6 to 1.2 m in diameter and 3 to 8 m in depth are dug by hand with shovel and lined by brick, rock, or concrete. These wells are used for domestic water supply by households, offices, factories, schools, etc. Many private

wells are dug for irrigation to grow watermelon in paddy field at dry season. These wells are not lined and pumped only by hand.

From the pumping test records of deep tube wells under MIDP collected in the survey period, the following are clarified:

- The static water levels are periodically lowering from GL-5 to -8 m at initial stage to GL-35 to -50 m at present stage for the last 10 years,
- The dynamic water levels are recovered soon at coming a stop of pump but their recovery ranges are very limited, and
- The dynamic water levels are lowered to GL-35 to -50 m immediately after starting in pumping up.

MIWD endeavors to maintain the dynamic water level of each well at GL -50 m by some discharge rate; however, it could not sustain its water level. The sign of land subsidence appears evident with the damage of basement concrete at pumping station or the frequent rehabilitation of well. This means the overpumping of groundwater and that the hydraulic condition is not suitable to develop groundwater more than this rate.

A test well with 100 m deep was bored for fourteen (14) days from February 6 to 24, 1997 at the center of the Aganan RIS area considering the locations of existing deep tube wells. Using the test well, the following pumping tests were conducted;

- step draw-down test with 5 steps for 10 hours, and
- continuous constant discharge test for 48 hours.

The critical pumping rate could not be determined because the stable pumping amount could not be measured through the step draw-down test. Through the continuous constant discharge test, the following were observed:

- within an hour after start of the constant discharge test with a rate of 2.15 l/sec, the pumped groundwater has changed to red-brown color water with gas indication, and
- the water amount has been reduced to 1.64 l/sec and the water level has been lowered to GL-40 m.

The hydraulic coefficient was calculated using the data obtained for two (2) hours after starting the constant discharge test. The result is shown in the following table in comparison with the hydraulic coefficients of MIWD' deep well collected through the field survey.

WELL	SWL GL-m	DWL GL-m	Draw Down m	Duration hrs	Q l/sec	SC l/sec/m	T m^2/sec
Test Well	9.45	38.00	28.55	2	2.00	0.07	$4.60x10^{-5}$
No.8	5.81	28.69	22.88	24	40.13	1.75	$1.40x10^{-3}$
No.9	8.44	27.30	18.86	78	38.46	2.04	$2.50x10^{-3}$
No.10	4.87	22.75	17.88	80	40.15	2.25	$1.73x10^{-3}$

Note : SWL: Static Water Level
DWL : Dynamic Water Level
SC : Specific Capacity (Q/ Draw Down)
T : Transmissibility
$k = T/b = 4.60x10^{-5}/20 = 2.30x10^{-6}$ (m/sec) = $2.30x10^{-4}$ (cm/sec)

From the geological structure in the Iloilo plain, it is said that the sandstone layer is the thickest at the center of the plain. This stratum forms the hilly area in the northern part of the plain and gradually inclines towards the south-east direction. In the river beds of Aganan and Suague River, the alternation of sandstone and mudstone layers is exposed. It is considered that a fairly large amount of river water infiltrates and forms deep groundwater here.

As stated above, although a relatively large amount of deep groundwater exists at the center of the Iloilo plain, its development has already exceeded the sustainable level. It would be very difficult to develop the deep groundwater in the other area because of its low potential as investigated by the test well in the field survey.

3.1.5 Soils and Land Suitability

(1) Soil classification

There are two (2) types of soils of different landforms found in the study area such as the alluvial soils of the lowland and the residual soils of the upland. The alluvial lowland is divided into four (4) soil mapping units. Except the unit with fine soil material in the recent flood plain, all the other three (3) soil mapping units of the alluvial lowland are potential for paddy irrigation having fine-clayey and deep profile feature. On the other hand, only two (2) soil mapping units are recognized in residual upland which are generally found from Barotac Nuevo municipality extending northwest towards Dingle municipality, and cultivated to sugarcane. The residual upland soils are also very deep, fine clayey and have fairly good surface drainage with materials originating from limestone and basic sedimentary associated with its formation.

Santa Rita soil series is a member of the very fine-clayey family, montmorillionitic, isohyperthermic Typic Epiaquerts. The soils occur in the broad alluvial plain, poorly drained, that developed from recent alluvial deposits consisting of fine soil materials from the surrounding uplands. It has slopes ranging from flat to very gently sloping. The soils exhibit cracks that are wide and deep at least in the dry season, and close when wet. The soils have very dark surface when wet. The surface soils are fine clay, but very coarse and hard when dry. The soil fertility is moderate to high.

Umingan soil series is a member of the fine-loamy family, mixed, isohyperthermic Fluventic Eutropepts. These are well drained soils found along the recent flood plain of Jalaur river which are seasonally subjected to moderate river flooding. The soils are moderately deep, which developed from river sedimentation. The surface soils are silt loam in texture. The soil fertility is moderately high.

Faraon soil series is a member of the fine-clayey family, montmorillionitic, isohyperthermic Typic Hapludalfs. These soils are very deep and well drained, found in the northeast of the study area with gentle to undulating slopes. The soils are developed from old marine and limestone sediments. The surface soils have textures ranging from medium clay to heavy clay.

The extent of each soil series and mapping unit by RIS and potential extension area is summarized below.

(Unit: ha)

Soil Series	Sta. Rita			Umingan	Faraon		Miscellaneous	
Mapping Unit	10A	10Af3	10B	20Af1	30A	30B1	land	Total
Existing RIS								
Jalaur Proper	10,770	990	-	90	140	-	940	12,930
Jalaur Extension	1,520	-	-	460	2,570	50	1,070	5,670
Suague	3,430	-	160	-	-	-	690	4,280
Aganan	5,030	-	-	-	-	-	1,490	6,520
Sta. Barbara	3,410	-	-	-	-	-	1,410	4,820
Potential Extension Area								
1.Pototan	490	-	-	-	-	-	10	500
2.New Lucena	400	-	-	-	-	-	10	410
3.Sta. Barbara	-	-	990	-	-	-	40	1,030
4.San Miguel	2,470	-	-	-	-	-	40	2,510
5.Oton	1,350	-	-	-	-	-	80	1,430
6.Barotac Nuevo	-	-	-	-	2,720	70	40	2,830

(2) Land suitability

Land suitability of the study area has been assessed using the FAO Framework for Land Evaluation (1976). The extent of land suitability of the RISs and extension areas is summarized below.

(Unit: ha)

Land Use Type	For Wet Land Rice				For Diversified Crops				Miscellaneous	
Suitability Class	S1	S2f	S3s	N	S1	S2f	S3d	N	Land	Total
Existing RIS										
Jalaur Proper	10,910	990	90	-	230	-	10,770	990	940	12,930
Jalaur Extension	4,140	-	460	-	3,080	-	1,520	-	1,070	5,670
Suague	3,590	-	-	-	-	-	3,590	-	690	4,280
Aganan	5,030	-	-	-	-	-	5,030	-	1,490	6,520
Sta. Barbara	3,410	-	-	-	-	-	3,410	-	1,410	4,820
Potential Extension Area										
1. Pototan	490	-	-	-	-	-	490	-	10	500
2. New Lucena	400	-	-	-	-	-	400	-	10	410
3. Sta. Barbara	990	-	-	-	-	-	990	-	40	1,030
4. San Miguel	2,470	-	-	-	-	-	2,470	-	40	2,510
5. Oton	1,350	-	-	-	-	-	1,350	-	80	1,430
6. Barotac Nuevo	2,790	-	-	-	2,790	-	0	-	40	2,830

Limitation : s - texture, t - slope, d - drainage, f - flooding
Suitability class : S1 - Highly suitable, S2 - Moderately suitable, S3 - Marginally suitable, N - Not suitable

3.1.6 Rural Infrastructure

Rural infrastructures such as road networks, potable water supply, village electrification, public health care, communication facilities. etc. are generally maintained well in the study area by local governments. However, major constraints of rural infrastructure are found in the current road networks especially farm-to-market road and potable water supply.

(1) Road networks

Rural road network in the study area consists of national, provincial, municipal and barangay roads. Furthermore, the NIA service roads are being considered as part of the rural road network. Except for the NIA service road and some barangay roads, majority of the national, provincial and municipal roads are paved by concrete and/or asphalt, and maintained well.

The road networks in the 5 river irrigation systems (RIS) are summarized as follows:

Municipality	Road Networks (km) National	Provincial	Municipal	Barangay	NIA
Jalaur RIS area	93.7	114.4	59.1	174.6	238.6
4 municipalities (Dumangas, Zarraga, Barotac Nuevo & Dingle)					
Suague RIS area	57.8	36.6	11.5	175.3	35.4
3 municipalities (Mina, New Lucena & Pototan))					
Sta. Barbara RIS area	19.9	48.1	16.5	101.3	35.2
3 municipalities (Leganes, Pavia & Santa Barbaa))					
Aganan RIS area	42.3	39.1	15.4	46.6	39.0
2 municipalities (Oton & San Miguel)					
Total	213.7	238.2	112.5	497.8	348.2

Majority of the rural roads are annually maintained to sustain passable condition, and there are no remote areas even during the rainy season.

One of the biggest constraints to the rural road development is non-establishment of link road system in the municipal area due to lack of bridge and farm-to-market road. The lack of link road system affects considerably the rural economy, the public services to the inhabitants, agriculture activities in the RIS areas such as transportation of agriculture input and output, post-harvest activities and market activities. The main reason for the lack of the bridge and the farm to market road is the LGU's financial shortage.

Some LGUs have an intention to provide additional farm - to - market road to strengthen the rural economy development, utilizing the NIA service road. However, majority of NIA services roads are not maintained well and the road system can not be linked smoothly.

(2) Water supply

Potable water supply development is implemented in the study area by the local governments, DPWH and LWUA. The potable water supply comprises Level I, II and III water systems. The status of the potable water supply in the study area is that Level I water supply system is generally extended widely with an extension ratio of more than 50 % . Some municipalities which have water districts such as Dumangas, Dingle and Pavia have a little extension of the Level III water supply system.

The Metro Iloilo Water District (MIWD), which provides potable water to Iloilo city, has its source in the upper stream of the Tigum river from Maasin municipality and the deep ground water in the Aganan RIS area. The rehabilitation of existing pipeline and the extension of the beneficiary area are currently being undertaken by the MIWD and LWUA. Furthermore, LWUA started a study on the rural potable water supply development in the Aganan and Tigum river basins to sustain sufficient potable water supply to Iloilo city under the technical assistance of the Swedish International Development Administration (SIDA).

Municipality	Total	Level 1		Level 2		Level 3		Doubtful Sources	
	household	Household	%	Household	%	Household	%	Household	%
Jalaur RIS area	26,684	11,915	45	79	0	4,629	17	10,061	38
4 municipalities (Dumangas, Zarraga, Barotac Nuevo & Dingle)									
Suague RIS area	15,812	11,757	74	0	0	1,111	7	2,944	19
3 municipalities (Mina, New Lucena & Pototan)									
Sta. Barbara RIS area	14,539	8,621	59	212	1	2,074	14	3,632	25
3municipalities (Leganes, Pavia & Sabta Barbara)									
Aganan RIS area	11,357	4,573	40	110	1	16	0	6,658	59
2 municipalities (Oton & San Mguel)									
Total	68,392	36,866	54	401	1	7,830	11	23,295	34

Constraint to potable water supply in the study area is the LGUs' financial shortage for the upgrading of the distribution system in the barangay areas from level I to level II or from level II to level III. The LGUs needing the urgent water supply development have already made the plan in consultation with DPWH and LWUA.

(3) Electric power supply

Electric power supply system is sustained in and around the study area by two (2) electric cooperatives, namely Iloilo I Electric Cooperative Incorporated (ILECO I) and Iloilo II Electric Cooperative Incorporated (ILECO II). The energized lateral line networks are expanded in the 22 municipality areas concerned with the study area and each river basin, excluding Iloilo city area.

The status of electric power supply in the study area is that regional power supply capacity is sufficient, and village electrification will be able to expand, subject to the LGU's financial capacity. The 2 RIS areas near the Iloilo city such as Sta. Barbara and Aganan RIS areas have more village electrification than the other RIS areas as shown below.

Municipality	Beneficiary (household)		
	Potential Consumer	House Connection	%
<u>IELCO I</u>			
Sta. Barbara RIS area	13,341	9,004	67
3municipalities (Leganes, Pavia & Sabta Barbara)			
Aganan RIS area	11,622	8,300	71
2 municipalities (Oton & San Mguel)			
<u>IELCO II</u>			
Jalaur RIS area	28,463	9,927	35
4 municipalities (Dumangas, Zarraga,Barotac Nuevo & Dingle)			
Suague RIS area	12,801	5,161	40
3 municipalities (Mina, New Lucena & Pototan)			
Total	66,227	32,392	49

The electric cooperatives have also prepared the long term implementation program of village electrification by the year 2010.

3.1.7 Agriculture

(1) Land use

The land use in the study area is principally classified into two categories: agricultural land and non-agricultural land. The agricultural land is subdivided into paddy land, sugarcane land, pasture land, and other areas planted to tree crops such as mango and coconut. The non-agricultural land is also subdivided into built-up land

(residential, commercial and industrial lands), and other lands occupied by open forest lands (wood/bamboo land of hill/hillock and along river/creek) and rivers/creeks.

Recent survey indicates that the commercial and residential zones of Iloilo City and neighboring towns are rapidly encroaching into agricultural land. A part of service area of Aganan and Sta. Barbara RISs has already been encroached by land developers for residential or commercial use due to urbanization. According to the land use survey, 500 ha of paddy field in Aganan RIS, and 400 ha in Sta. Barbara RIS have been converted into urban land use including illegally converted lands.

About 64 % of the total land in the existing RISs are occupied by paddy land. Land planted to sugarcane covers 440 ha and 850 ha in Jalaur proper RIS and Jalaur extension RIS respectively. In other RISs, sugarcane is not or rarely cultivated. Almost all sugarcane area cultivated is under the hacienda estate of large landowners.

(Unit: ha)

Name of RIS	Total Area	Paddy Field	Sugar-cane	Other Crops*	Non-agri. Land
Jalaur proper	12,930	8,820	440	40	3,630
Jalaur extension	5,670	2,620	850	80	2,120
Suague	4,280	2,960	50	0	1,270
Aganan	6,520	4,360	0	0	2,160
Sta. Barbara	4,820	3,000	0	0	1,830
Total	34,220	21,760	1,340	120	11,000

Note * : Major tree crops are mango and coconut

In the extension areas, about 69 % or 6,030 ha of the total land area of 8,710 ha are occupied by paddy field. Paddy field of the extension areas is mostly cultivated under rainfed condition, except the partially irrigated areas by pumps using shallow tube well or creek water. Sugarcane is cultivated widely in the extension area of Barotac Nuevo by estate farming, and is the dominant crop in the area.

(Unit: ha)

Name of Extension Area	Total Land	Paddy Field	Sugar-cane	Other Crops*	Non-agri. Lands
(1) Pototan	500	480	0	0	20
(2) New Lucena	410	390	0	0	20
(3) Sta. Barbara	1,030	800	0	160	70
(4) San Miguel	2,510	2,430	0	0	80
(5) Oton	1,430	1,250	0	0	180
(6) Barotac Nuevo	2,830	680	2,030	0	120
Total	8,710	6,030	2,030	160	490

Note * Mainly pasture for grazing

(2) Land tenure and operating farm size

The socio-economic survey conducted by the study team indicates that tenant farmer is dominant in the study area: about 50 % of the irrigation beneficiaries are tenant farmers, and only 30% of them are owner cultivator as shown below.

RIS	% of farms				Average cropping area (ha)				
	OC	OT	TE	O	OC	OT	TE	O	Overall
Jalaur proper	30	18	51	1	2.43	4.94	2.34	1.50	2.83
Jalaur extension	28	26	46	-	1.50	4.11	2.22	-	2.22
Suague	35	27	38	-	2.56	5.00	1.99	-	3.01
Aganan	25	19	55	1	2.15	2.59	2.67	4.00	2.55
Sta. Barbara	30	18	52	-	1.53	4.58	2.56	-	2.62
Average	29	21	50	-	2.20	4.60	2.30	2.50	2.68

Note: OC-owner cultivator, OT-owner-cum-tenant, TE-tenant, O-others

The average operating farm size is ranging between 2.22 and 3.01 ha. The socio-economic survey also indicates that 33 % of respondents are cultivating with farm size ranging from 1.00 to 1.99 ha, and that 15 % of them are operating with paddy land of 5.0 ha and more.

RIS *	JP	JE	SU	AG	SB	Total
No. of total respondents	149	55	48	74	50	376
Ratio of respondents by cropping area (%)						
Under 0.5 ha	7	11	2	7	12	8
0.5 to 0.99 ha	10	15	8	8	8	10
1.00 to 1.99 ha	32	38	35	35	24	33
2.00 to 2.99 ha	16	15	13	16	24	16
3.00 to 4.99 ha	19	11	21	22	22	19
5.00 to 7.99 ha	12	9	17	12	8	12
8.00 to 9.99 ha	1	0	4	0	2	1
10.0 ha and more	3	2	0	0	0	2

Note * JP: Jalaur proper, JE: Jalaur extension, SU: Suague,
AG: Aganan, SB: Sta. Barbara

(3) Cropping pattern and farming practices

(a) Cropping pattern

The cropping system in the study area indicates that paddy rice is dominantly cultivated, and farmers wish to increase their cropping intensity. Various cropping patterns are adopted in the study area. The cropping pattern is significantly dependent on the availability of irrigation water. The farmers in the irrigated area by RIS are applying the following cropping patterns:

(i) Paddy (wet season) - Paddy (dry season),
(ii) Paddy (wet season) - Paddy (dry season) - Mungbean,
(iii) Paddy (wet season) - Paddy (dry season) - Watermelon, and
(iv) Paddy (wet season) - Paddy (dry season) - Paddy (third paddy).

The cropping patterns are illustrated in Figure 3.1.1 in comparison with cropping calendar provided by NIA.

(b) Cropped area

NIA reports every cropping season the irrigated/planted area (actually irrigated area), benefited area (the crop areas where paddy yields are 2,000 kg and more per ha per crop), and average unit yield against benefited area. The

average irrigated and benefited areas in the last 5 years (1992 to 1996) by RIS are shown below.

	(a) Irrigated Area (ha)		(b) Benefited Area (ha)		(b)/(a) (%)	
	Dry	Wet	Dry	Wet	Dry	Wet
Jalaur proper	6,453	6,867	4,909	6,122	76.1	89.2
Jalaur extension	2,010	2,310	1,628	2,213	81.0	95.8
Suague	2,465	2,600	1,874	2,582	76.0	99.3
Aganan	1,186	4,585	876	4,551	73.9	99.3
Sta. Barbara	1,993	3,038	1,830	3,037	91.8	100.0
Total	14,107	19,400	11,117	18,505	78.8	95.4

Average of 5 years (1992 - 1996)
Source : NIA Aganan-Sta. Barbara and Jalaur-Suague offices

The above table indicates that 5 % and 21 % of irrigated area have not been benefited in the wet season and dry season respectively in the last 5 years.

The cropped areas of irrigated and rainfed paddy rice and their respective cropping intensity are shown below.

(Unit: ha)

	Wet Paddy		Dry Paddy		3rd Paddy	Total	Cropping Intensity (%)		
	Irrigated	Rainfed	Irrigated	Rainfed	Rainfed		Irr.	Rain.	Total
RIS									
Jalaur proper	6,120	2,600	4,910	1,940	1,200	16,770	125	65	190
Jalaur ext.	2,210	410	1,630	580	250	5,080	147	47	194
Suague	2,580	380	1,870	610	50	5,490	150	35	185
Aganan	4,050	300	1,230	900	200	6,680	121	32	153
Sta. Barbara	2,710	250	2,110	100	200	5,370	161	18	179
Subtotal	17,670	3,940	11,750	4,130	1,900	39,390	135	46	181
Extension Area									
Pototan	-	480	-	50	-	530	-	110	110
New Lucena	-	390	-	40	-	430	-	110	110
Sta. Barbara	-	800	-	80	-	880	-	110	110
San Miguel	-	2,430	-	240	-	2,670	-	110	110
Oton	-	1,250	-	120	-	1,370	-	110	110
Barotac Nuevo	-	680	-	70	-	750	-	110	110
Subtotal	0	6,030	0	600	0	6,630	0	110	110
Total	17,670	9,480	11,750	4,680	1,900	46,020	106	58	166

Note 1: Cropping intensities in the extension area are estimated at 110%
Note 2: A part of rainfed paddy has supplemental irrigation facilities.

Furthermore, planted areas to diversified crops after paddy harvest in the service area were estimated for each RIS on the basis of the municipal level production statistics. Mungbean and watermelon are the major diversified crops in dry season after second paddy.

RIS	Mungbean	Watermelon	Total	C.I. (%) *
Jalaur Proper	600	100	700	8
Jalaur Extn.	100	10	110	4
Suague	150	20	170	6
Aganan	400	500	900	21
Sta Barbara	200	150	350	12
Total	1,450	780	2,230	10

C.I* : Cropping Intensity (% of planted area against service area)

Cropped area and cropping intensity for each RIS are summarized in Table 3.1.1.

(c) Farming practices

Generally, the farming practices for the type of crops mentioned are similar in all the RISs. The common farming practices for major crops; paddy, mungbean and watermelon in the study area are summarized as follows:

(i) Paddy

Cultivation period: First paddy - from May/Jun to Aug/Sep, second paddy - from Sep/Oct to Dec/Jan, third paddy - from Dec/Jan to May/Apr. Growth period in paddy field is 95 to 110 days. Farmers in the upstream areas move rice planting forward as soon as possible in order to plant third paddy. This manner disorders the standard cropping season.

Land preparation: Generally plowing is done by hand-tractor, leveling done by carabao or hand tractor. It seems that land preparation will be fully done by hand-tractors in the near future.

Major variety: IR 64, RC 14, RC 18, RC 20, RC 10, and IR 72. Almost 100% of area have been planted with high yielding varieties.

Seeding: Direct seeding is dominant, 85 to 90% of farmers adopt direct seeding. Seeding rate of direct seeding and transplanting are 120 to 200 kg/ha and 80 to 120 kg/ha, respectively. The seeding rates are very high compared to reasonable amount of 60 kg for transplanting and 100 kg/ha for direct seeding. Application of certified seed from seed grower has not been common. Only 15 to 25 % of farmers use certified seed due to shortage of the supply and high price of certified seed for farmers' present financial situation.

Fertilizer: Fertilization rate is N: 93 kg/ha, P: 28 kg/ha, K: 13 kg/ha on average. The amount of fertilizer application is rather high, particularly on nitrogen compared with present unit yield. 70 % of farmers do not apply basal fertilizer. Usually farmers apply fertilization twice per cropping, 15 to 20 days and 45 to 50 days after

seeding, side-dressing for vegetative stage and top-dressing for reproductive stage, respectively. Organic manure are seldom used.

Weed control: Herbicides are generally applied twice per cropping . Manual weeding is not common.

Insect/pest control: Tungro, Grassy stunt, Bacterial leaf blight, Stem borer, Brown plant-hopper and Green rice leaf-hopper are major insects and pest. Generally, agro-chemicals, insecticide and fungicide are applied 2 to 3 times per cropping. Spraying is done using knap-sack sprayer. Dosing amount of agro-chemicals and timing of application are often not proper due to farmers' financial situation and low knowledge of application method.

Snail and rat control: Damage by golden snail and rat appears seriously in recent years. Molloscide for snail is not commonly used due to high price for farmers financial condition.

Harvesting: Harvesting is done by hand, and threshing by engine thresher. Harvesting and threshing are usually done by crop-share-labors which are given 1/8 or 1/7 of the production. Straw after threshing is generally burned in the paddy field. Usually farmers sell wet paddy without drying except for family consumption.

It seems that proper and appropriate farming technology has not become common among the farmers for production increase, maximization of profit through minimization of production cost, and upgrading the quality of produced paddy. Especially, present seeding rate, low using ratio of certified seed, fertilization, weeding and plant protection should be improved through appropriate farming technology.

(ii) Mungbean

Seeding: Seeds are broadcasted immediately after harvest of paddy using residual soil moisture without plowing.

Crop management: Mungbean is cultivated under rainfed condition, and fertilizer and agro-chemicals are not generally applied.

(iii) Watermelon

Land preparation: watermelon is usually planted in seed plots and plowed by hand at the extent of one meter diameter circle from December to early February after second paddy rice, after typhoon season to avoid water logging damage.

Crop management: Field planted is irrigated every day by hand and bucket using dug well water in the paddy field. Application of fertilizer and agro-chemicals is a common practice.

(d) Farm machinery

Plowing/harrowing during land preparation and threshing are carried out by engine farm machinery. Irrigation pumps with 2 - 3 horse-power engine are also common among farmers for supplemental irrigation from creeks and tube well when canal water is in shortage .

Based on the socio-economic survey, the number of farm machinery owned by farmers is shown below.

	Jalaur-Suague	Aganan- Sta. Barbara	Average	
	unit/100farmer	unit/100farmer	unit/100farmer	unit/100ha*
Tractor	3	5	4	1.3
Hand-tractor/Power tiller	53	58	55	20
Sprayer (knapsack)	99	112	103	38
Engine Thresher	23	37	27	10
Irrigation Pump	43	39	42	16

Note *: Computed by average farm size of 2.68 ha.

(4) Agricultural production

The unit yield of major crops is estimated below.

Irrigated paddy				
Wet season (1st paddy)	:	3.40 ~ 3.86	ton/ha	(average yield of benefited area)
Dry season (2nd paddy)	:	3.30 ~ 3.56	ton/ha	(average yield of benefited area)
3rd paddy	:	0.7 ~ 3.0	ton/ha	
Rainfed paddy	:	1.5 ~ 2.5	ton/ha	(included partially irrigated area)
Mungbean	:	0.4 ~ 0.7	ton/ha	
Watermelon	:	3.0 ~ 6.0	ton/ha	
Tomatoes	:	3.0 ~ 5.0	ton/ha	
Sugarcane	:	45 ~ 50	ton/ha	

The following table shows the average unit yield of paddy rice in benefited area by RIS and cropping season. The unit yield of paddy has been low inspite of rather high fertilization as mentioned above. Furthermore, the figures indicate that unit yield in the dry season paddy is lower than of the wet season due to the shortage of irrigation water during the dry season inspite of favorable solar radiation. Shortage of irrigation water is most important cause of low productivity. Average yield of Iloilo Province by BAS is similar to or higher than of RISs in wet season paddy, however, the yield of dry season paddy is lower compared with the yields of RISs. It is supposed that CIS and private irrigation areas are more difficult in water resources in the dry season than RIS areas.

RIS	Wet Season (1st paddy)	Dry season (2nd paddy)
Jalaur proper	3.40	3.30
Jalaur extension	3.70	3.43
Suague	3.64	3.41
Aganan	3.56	3.40
Sta. Barbara	3.86	3.56
Iloilo Province * (average of irrigated)	3.97	3.19

Average in recent 5 years (1992 - 1996)
Note * : Refer Table 3.1.2

Based on the estimated unit yield mentioned above, the present crop production in the study area is given in Table 3.1.3 and summarized below.

(unit: ton)

	Paddy Rice			Mungbean	Watermelon	Sugarcane
	Irrigated	Rainfed	Total			
RIS						
Jalaur Proper	37,010	12,570	49,580	240	400	-
Jalaur Extn.	13,770	2,720	16,490	40	40	-
Suague	15,770	2,320	18,090	60	80	-
Aganan	18,600	3,090	21,690	160	2,000	-
Sta. Barbara	17,970	1,180	19,150	80	600	-
Subtotal	103,120	21,880	125,000	580	3,120	-
Extension Areas	0	14,850	14,850	-	-	91,400
Total	103,120	36,730	139,850	580	3,120	91,400

(5) Livestock

Livestock sub-sector is a minor economic activity in the study area. However many farm households are raising livestock or poultry for supplementary family income and nutrition supply for the family.

	Jalaur-Suague		Aganan-Sta. Barbara		Total	
	A (%)	B (head/farm)	A (%)	B (head/farm)	A (%)	B (head/farm)
Carabao	27	1.3	16	1.5	20	1.4
Cattle	26	2.1	4	2.7	11	2.6
Hog	46	2.5	43	2.9	44	2.7
Goat	10	3.0	6	2.9	8	3.0
Poultry	67	21.9	73	24.4	71	22.7

A: Ratio of livestock raising farm
B: Average head of livestock per farm

Cattle are raised only by 11 % of the farmers. The cattle feeds are grass and rice straw after harvesting of paddy field. The average number of cattle raised per farmer is 2.6 heads. Cattle for dairy purpose is seldom, and there is no statistics for milk production.

Hogs and poultry are popular livestock in the study area. The ratio of farmers raising hog and chicken is 44 % and 71 % respectively based on the results of the socio-

economic survey. Middle/large scale poultry and hog farms have been established in the study area in recent years by enterprise or cooperative type.

Farm compost preparation using livestock manure is recommended by agricultural technicians of the Municipal Agricultural Offices (MAO), however it has not become common.

(6) Summary of constraints of agricultural production

(a) Shortage of irrigation water

Due to the limited water resources for irrigation and deterioration of irrigation facilities as well as inadequate water management, shortage of irrigation water is most serious cause of low productivity of paddy rice. Consequently, the benefited areas in the RIS service area are 69 to 93 % in the wet season, 28 to 70 % in the dry season. Remaining paddy field in the RIS is cultivated under rainfed conditions or fallow. The Jalaur proper RIS is functioning to only 69 % of service area even wet season.

RIS	Wet season	Dry season
Jalaur proper	69%	56%
Jalaur extension	84%	62%
Suague	87%	63%
Aganan	93%	28%
Sta. Barbara	90%	70%

Unified cropping calendar has been disordered by farmers' eagerness for early harvest to avoid water shortage in the late stage of second paddy cropping, or for cultivation of third paddy. Farmers in the upper stream have higher water availability than those in the downstream area. This makes unstable water distribution in downstream area.

(b) Insufficiency of proper farming technology

As mentioned in present farming practices, proper farming technology has not been common in the study area on dosing rate and method of seeding, composition of N : P : K and timing of fertilization, amount and timing of chemical application for weed and pest control etc. Damage by snail and rat also is a serious problem on paddy cultivation. Direct seeding is common in the study area. The seeding method may be one of the causes of low yield due to the difficulty of manual weeding and too high density of paddy planting.

(c) Low using rate of certified seed

Certified seed is produced by seed growers who have been accredited by BPI. There are 78 seed grower-farmers including the Western Visayas Integrated Agricultural Research Center (WESVIARC) in the relevant 13 municipalities and Iloilo city. DA and MAO (seed inspector) provide technical services and

inspection with seed growers. The seed growers have 720 ha of paddy field for seed production in total, but actual seed production area is less than 10% of 720 ha. Price of the certified seed is 600 to 650 pesos per 40 kg. The socio-economic survey by the study team reveals that the using rate of certified seed is only 12%. Usually farmers replace their seed stocks once in several cropping. It is not uncommon to observe an admixture of paddy varieties grown in the study area.

(d) Degradation of soil fertility

Rice straw is generally burned in the paddy field after threshing. Organic manure and compost such as rice straw and livestock manure are seldom applied. Although soils in the study area have a high inherent fertility for paddy cultivation, if the continuos paddy cropping would be done without application of organic manure the fertility would be decreased.

Lands for three cropping system of paddy rice are mostly under irrigation throughout the year. It is anticipated that the soil under full irrigation will decline in physical and chemical properties because of soil reduction affect.

(e) Problems of crop diversification

Diversified crops can be planted only in the dry season due to the low drainability of the soils in the study area. Mungbean can be grown under rainfed condition using residual soil moisture after harvest of paddy field, however, the yield is low. Watermelon which is presently a major valuable diversified crop in the study area, is irrigated by hand using dug-well in the paddy field due to stoppage of water distribution from canal in the late growth stage.

Since farming technology of valuable diversified crops such as vegetables has not been common among the farmers, the production is still little inspite of big market in Iloilo city. At present, the seed supply of vegetables also is not sufficient.

3.1.8 Irrigation and Drainage System

(1) Existing irrigation system

In and around the study areas, three (3) kinds of existing irrigation systems are found consisting of (i) the national (river) irrigation system (RIS), (ii) the communal irrigation system (CIS) and (iii) private irrigation system. The national (river) irrigation systems are the 5 river irrigation systems, namely, Jalaur proper, Jalaur extension, Suague, Sta. Barbara and Aganan RISs. The communal irrigation systems are scattered at 8 sites in and around the study area. The pump irrigation system has been constructed at the 2 sites and being constructed at the one (1) site in the Jalaur RIS areas. The private irrigation systems are mainly expanded in numerous spots of the upper reach of the respective big rivers concerned with the RIS as shown in Figure 3.7.1. The water resource of these private irrigation systems is river water, and the water is drawn up by brush dam, small potable pump and small permanent check structure.

(2) Irrigation extension area

The irrigation extension areas shown in Figure 3.1.2 were originally identified in the Jalaur River Multipurpose Project (JRMP) . In the feasibility study report on JRMP, it was planned that these extension areas except Extension Area No. 6 (2,830 ha) would be irrigated by using water to be delivered through a proposed transbasin diversion channel (so-called lowline canal) . The lowline canal would have a length of 53.7 km extending from the Jalaur River to the Aganan River. Irrigation water would be delivered to the canal from the Jalaur River pumping plant. The first 39 km of the canal would extend to the Sta. Barbara relift pumping plant where water would be lifted for delivery through the terminal portion of the canal. The principal purpose of the lowline canal and pumping plants would be to convey supplement irrigation water from the Jalaur River to the existing Suague RIS, Sta. Barbara RIS and Aganan RIS and the extension areas. Although the implementation of JRMP was stopped due to a low economic viability, these extension areas were still proposed in the Study.

The possibility of irrigated agriculture development for the extension area was examined and the following were found:

(a) Supplementary irrigation to the extension areas (No.1 to No.5) even in the wet season would be limited because of the exclusion of small impounding dam construction for new water resources development which has been found to have low economic and technical viability,

(b) Gravity irrigation to the extension areas (No.1 to No.5) would be difficult and/or limited due to the topographic conditions, which would result in low economic viability of the development plan, and

(c) As regards the extension area (No.6) located around the Jalaur extension RIS, most of the areas are occupied by large sugarcane fields which remained undistributed to small farmers due to slow progress of CARP implementation.

Considering the above findings, the proposed extension areas are excluded from the development plan.

(3) Diversion dam

Irrigation water is off-taken at each diversion dam of the RISs, and Jalaur proper and extension RISs own jointly the same diversion dam. All the diversion dams are Ogee type and have scouring sluice of the open channel type. The Jalaur diversion dam has scouring sluice of the under sluice type. Except for Sta. Barbara diversion dam, all the diversion dams have high and low water channel sections.

The salient features of the respective headwork are summarized below.

Description	unit	Jalaur	Suague	Sta. Barbara	Aganan
Diversion Weir		Ogee type with check gates	Ogee type	Ogee type	Ogee type
Check gate	nos./size	13/H 3.5 X W 5 ~ 6			
Scouring sluice		Undersluice type and Open channel type	Open channel type	Open channel type	Open channel type
Gate	nos./size	Under sluice 2/H 1.82 x W 4.26 Open channel	Open channel H 2.6 x W 5.2	Open channel H 2.5 x W 4.0	Open channel H 2.5 x W 4.6
Design flood water level	EL. m	27.07	?	?	?
High water level	EL. m	24.76	?	?	?
Elevation of weir crest	EL. m	-	-	25.6	-
High water channel section	EL. m	23.52	40.9	-	36.37
Low water channel section	EL. m	20.22	40.7	-	36.17
Length of weir	m	174	150	150	217
High water channel section	m	78	134	-	136
Low water channel section	m	96	16	-	82
Height of weir	m	-	-	2.5	-
High water channel section	m	5.15	1.8	-	2.8
Low water channel section	m	3.42	1.6	-	2.6
Intake method/structure		Orifice type			
Type of intake		Box conduit	Box conduit	Box conduit	Box conduit
Intake gate	nos./size	Both banks	2/H 1.8 x W 1.45	6/H 1.0 x W 1.95	2/H 1.0 x W 2.1
Intake discharge	m3/sec				
Right bank		13.5	4.5	-	7.3
Left bank		4.0	-	7.8	-
Water level at Sta. 0 of Head race					
Right bank	EL. m	23.22		-	35.38
Left bank	EL. m	23.27	-	25.03	-
Measuring devices		Staff gauge	Staff gauge	Staff gauge	Staff gauge
Settling basin		No installation	No installation	No installation	No installation

All the dams are still functional, but some portions of the dams have been damaged and deteriorated as summarized below.

(a) Jalaur diversion dam

Scouring sluice and intake gates have the technical trouble of gate lifting system during gate operation, and rubber seal of all gates is deteriorated. The downstream apron is deteriorated, and the steel iron of the apron is exposed. Trashrack for intake gates and communication facilities for monitoring and emergency are not provided.

(b) Suague diversion dam

Scouring sluice gates and intake gates have the technical trouble of gate lifting system during gate operation. Rubber seal of scouring sluice gates is deteriorated. The downstream apron, bottom floor of scouring sluice, retaining wall at the right bank and riverbed protection in the downstream are damaged due to flood. Trashrack for intake gates and communication facilities for monitoring and emergency are not provided.

(c) Aganan diversion dam

Intake gates have the technical trouble of gate lifting system during gate operation. Rubber seal of scouring sluice gates is deteriorated. Bottom floor of scouring sluice is abraded. Trashrack for intake gates and communication facilities for monitoring and emergency are not provided.

(d) Sta. Barbara

Intake structure has small damages, and the one (1) intake gate is not functional. Trashrack for intake gates and communication facilities for monitoring and emergency are not provided.

(4) Irrigation and drainage canal system of RISs

Present RISs comprise mainly of main irrigation canal system and service road system. Drainage canal systems are entrusted to natural rivers and creeks system in the RIS areas. Main canal system of the RISs ordinarily consists of a main canal and the lateral canals. Except for the main canal in the Aganan RIS, majority of the main and lateral canals are earth canals, and maintained annually for 2 months from March to April.

Proper hydraulic flow is not always sustained in canals due to the over excavation of canal sections and backwater caused by siltation and the accumulated debris at in - flow sections of related structures. No proper water management is found in the entire RIS areas because irrigation water is distributed without the metric volume measuring system of irrigation water discharge at head gate structure and turnout. Design water level of turn out is not sustained properly due to the deterioration of check structure and improper installation of gates at turnout structure. Siltation also occurred in the main canal system due to lack of settling basin at the head race section. Spill-out operation system of irrigation water in emergency case can not be expected to function in the canal networks due to the lack of spillway around siphon and aqueduct structure.

The distinguished status of deterioration of the structures is summarized as follows :

(i) Slide gates are of installation and severely damaged at majority of head gates and turnouts, and the number of head gates and turnouts without gate is nearly 50 %.

(ii) Measuring devices are not prepared at majority of head gates and turnouts.
(iii) A lot of riprap protections provided in inlet and outlet of the structures such as head gate, check structure, bridge, turnout, siphon and culvert are severely damaged.

Main drainage canal systems are natural rivers and creeks in the RIS areas and linked with secondary drainage canals which are being maintained by IAs.

The flood occurs at the middle reach of the Jalaur river near Barotac Nuevo municipality and flows into the Jalaur proper and extension RIS areas during the big typhoon. The flood water gives inundation in the tail portion of the Jalaur proper RIS area for 2 to 3 days , but does not result in the deterioration of agriculture land.

Furthermore, in the lowland of the tail portion of the Jalaur proper RIS, the inundation occurs only during heavy rainfall at high tide in the rainy season. Main reason of the inundation is backwater caused by the high tide. However, the inundation period is 2 to 3 days, and the heavy inundation damage does not occur in the paddy field. Another inundation also occurs in the irrigated paddy field along the highway Zarraga - Barotac Nuevo due to the lack of drainage culvert.

The inundation of the Suague RIS area is found in the topographic depression area along the highway Zarraga - Pototan. The inundation is caused by the poor drainage system of the highway.

The service road is incidentally provided along main and lateral canals for inspection of canals and for transportation of agriculture inputs and outputs. All the service roads have gravel pavement, but the pavement is poor and impassable in the rainy season. Some service roads also have bottleneck for jeepney passageway which are caused by the deterioration of canal embankment.

The service roads function as one of the rural road networks. The LGUs also expect the function of the farm - to - market road to the service road, but some service roads are not linked with rural roads. The function of the farm - to - market road is not realized at present. The salient features of the RISs are shown below.

Description	unit	Jalaur Proper	Jalaur Extension	Suague	Sta. Barbara	Aganan
Water resources		Jalaur	Jalaur	Suague	Tigum	Aganan
Proposed service area	ha	8,820	2,620	2,960	3,000	4,360
Approved water right	m3/sec		29.5	6.0	7.5	8.0
Design discharge at intake	m3/sec	13.5	4.0 (Max.12.3)	4.5	7.8	7.3
Length of headrace	km	2.1	6.3	1.5	4.9	2.8
No. of main and lateral canal	nos.	30	10	9	12	12
Total length of main and lateral canals	km	130.3	43.2	37.8	45.8	47.5
Total length of drainage canals	km	54.4	16.2	18.3	15.4	32.6
No. of turnout	nos.	261	93	76	136	271
Total length of services roads	km	47.4	32.4	20.5	42.7	45.0
No. of access roads	nos.	1	0	0	1	0
Total length of access roads	km	7.7	0.0	0.0	0.3	0.0
Average command area	ha	34.0	27.0	39.0	22.0	18.0
Municipalities served		Dingle	Barotac Nuevo	Mina	Pavia	Pavia
		Zarraga	Dumangas	Pototan	Sta. Barbara	Sta. Barbara
		Pototan	Dingle	New Lucena	Leganes	San Miguel
		New Lucena	Anilao		Iloilo city	Oton
		Barotac Nuevo				Iloilo city
		Dumangas				

(5) On-farm irrigation system of RISs

On-farm irrigation canal system consists of main farm ditches and supplementary farm ditches, and all the canals are earth canals which are seasonally maintained by the IAs.

At present, the farm ditches have usually double functions as irrigation canal in the upper stream of the canal, and drainage in the downstream of the canal.

The average command area of turnout in the Jalaur proper and extension and Suague RISs is bigger with more than 25 ha, and the ones of the Sta. Barbara and Aganan RISs are less than 22 ha. The average length of main farm ditches is estimated at approximately 700 m. Typical features of the on-farm irrigation system are shown below.

Description	unit	Jalaur proper	Jalaur extension	Suague	Sta. Barbara	Aganan
Service area	ha	8,820	2,620	2,960	3,000	4,360
No. of turnout	nos.	261	93	76	136	271
Average command area	ha	34.0	27.0	39.0	22.0	18.0
No. of Irrigation Division	nos.	11	4	4	4	6
No. of IA	nos.	14	6	5	3	6
Potential member of IA	household	3,991	1,782	1,770	1,445	2,279
No. of IA for O & M Contract	nos.	12	5	5	3	3
Type 1		11	5	5	0	0
Type 1 & 2		1	0	0	3	3
Contracted canal	km	73.6	27.8	32.9	26.4	18.5

(6) Overall irrigation efficiency

Overall irrigation efficiency of each RIS is roughly estimated to make a simple water balance based on the benefited area of paddy cultivation, seasonal net irrigation water requirement and runoff at each diversion dam. The water balance is made based on the reliability of the 80 % chance of the drought year. Since the discharge data of the irrigation water absorbed at intake gate is not reliable due to the affection of backwater to the measuring staff of the intake gate, it is assumed that all seasonal runoff at the diversion dam will be absorbed for irrigation, and then the overall irrigation efficiency in the dry season paddy is verified, based on the benefited area of each RIS.

The overall irrigation efficiency in the dry season is respectively estimated at about 30 % for the Sta. Barbara and Aganan RISs, approximately 25 % for Suague RIS and about 20 % for Jalaur proper and extension RISs.

Taking into consideration the present conditions of irrigation canal and related structures and on-farm irrigation system, main reasons of the low overall irrigation efficiency for the RISs are the improper water operation , the lack of control structures in canals and the lack of skills on operation of the NIA staff Therefore, necessary amount of irrigation water can not be sufficiently delivered into the irrigation area to be programmed, and some amount of the water is wasted in other canals and drains.

(7) Constraints to development

Constraints to irrigation and drainage development are generally summarized below.

1) Irrigation

(a) Proper and timely operation of the scouring sluice gates can not be conducted due to mechanical trouble of gates lifting system at the Jalaur and Suague diversion dams, and flushing out of sedimentation in upper stream from scouring sluice is not conducted well. Furthermore, the same mechanical trouble of gate lifting system

occurs at intake gates of the 2 dams and the Aganan diversion dam. The mechanical trouble of the gates and the difficulty of the gate operation accelerates the silt intrusion to the main canal.

(b) Sedimentation occurs in main and lateral canals due to the lack of settling basin and /or silt excluder and the insufficient and proper maintenance works. The present canal flow capacity is comparatively reduced to convey the design discharge due to sedimentation.

(c) Low irrigation efficiency is pointed out as one of the biggest problems. The low irrigation efficiency is caused by the following components.

- deterioration of the head gate and turnout,
- deterioration and lack of measuring devices at head gate and turnout,
- non-systematic and improper water operation by NIA and IAs,
- insufficient maintenance works of canal and related structures by NIA and IAs,
- lack or shortage of technical knowledge on water management of NIA and IA

In connection with these problems, the necessary water discharge can not be sufficiently delivered to the irrigation area which need the irrigation water, and some water discharge is wasted in the other canals and/or other irrigation areas.

(d) Lack of technical knowledge is found at the check structure and turnout in all the RIS areas. The maximum required water level to distribute irrigation water to the main farm ditches can not be realized at each turnout, because the lifting of water level at check structure is operated and controlled without the technical guidance. As the result of the operation, much water is absorbed to the specified main farm ditch only, and inefficient water use and disturbance of water operation system occur.

(e) There is almost no provision for the spillway in main and lateral canals to flush out the excess water during the water operation. The lack of the spillway causes over-flow at some canal sections during the full water supply and gives damage to the canal embankment and related structures.

(f) Slow water run is found due to the long length of main and some lateral canals and the complicate water distribution system at the on-farm. The complicate water distribution is due to the double

functions of some main farm ditches for water conveyance such as irrigation and drainage.

2) Drainage

The Jalaur proper and Suague RISs have flood and inundation problem in the tail portion of the RIS areas. The flood generally occurs at the middle reach of Jalaur river near the Barotac Nuevo municipality during the typhoon and heavy rain fall in the rainy season, and affects the tail portion of the Jalaur proper RIS area. In addition, the area also suffers from inundation caused by the high tide during heavy rain in the rainy season. The other inundation which is caused by the poor drainage system of highway occurs in the Zarraga area. In the Suague RIS area, the inundation also occurs along the highway near the Pototan area due to the poor drainage system of highway.

3) Service road and Farm road

(a) Maintenance work of the service road is poor. The narrow sections of the road for jeepney route caused by the deterioration of canal embankment are found out along some service roads. Gravel pavement and foundation of road are generally deteriorated, and no passable road sections are found along some service roads in the rainy season.

(b) The LGUs expect the service road to function as farm - to - market road, but all service roads are not linked with rural roads such as national, provincial and barangay roads in the study area. The function of the farm - to - market road is not realized at present.

3.1.9 Water Management and O & M Practices

(1) Organization and function

The national irrigation systems (NIS) are one of the main responsibility areas of the NIA where the available service areas are over 1,000 ha. All NISs are managed by Irrigation Superintendents (IS) with their respective staff, depending on the size of the areas being managed (IS II>4,000 ha and IS I<4,000 ha). These NISs are under the direct supervision of the Regional Systems Management Division.

The RIS office has its technical, administrative and financial sections to function exclusively for the particular office. At the field level of the NIS, the areas are normally divided into divisions of approximately 700-900 ha which are managed by the Water Resources Facilities (WRF) Technicians with two or three WRF Tenders to provide the basic functions of the office, depending on the size of the division and length of canals (WRF Tenders are normally assigned to a canal with 3.5 km length). Presently, the WRF Technicians are responsible for system operation activities, maintenance of canals, and also act as collectors of Irrigation Service Fee (ISF) in their respective areas or

division. The WRF Tenders are also deputized as assistant ISF bill collectors. In addition, the ISF collection is carried out by the irrigators' association through the Type II Contract between NIA and IA.

Operation and maintenance activities are undertaken at the field level by Field Engineers backstaffed by WRF Technicians (Water Masters), WRF Operators (Gatekeepers) and WRF Tenders (Ditch Tenders) in coordination with the IA Board of Directors and Officers. In keeping tract with the current trend of operation and maintenance activities, a monthly meeting between NIA and IA Officers is held regularly and supplemented by seasonal NIA-IA Operation and Maintenance Conference.

(2) Water management practices

(a) Water delivery schedule

The cropping calendar is prepared by the Irrigation Superintendent and staff of a system on the basis of the probable water supply and rainfall. This is discussed and presented to the IA for their guidance. However, in the present condition, the cropping calendar is not being followed by the farmers because water delivery is not sufficient and stable due to water management problem and shortage of water supply from the river, and water delivery is started regardless of farmers' preparedness to start their farming activities on time due to financial constraints.

The present schemes of water delivery and distribution schedule by system are as follows.

(i) Jalaur proper and Jalaur extension RIS

Continuous irrigation is adopted when water supply is available for all the system. However, rotational irrigation by laterals is implemented whenever intake discharge is very low and rainfall is inadequate. This schedule, except for the whole water delivery period, is not officially informed to the farmers and beneficiaries.

(ii) Suague RIS

Rotational irrigation is adopted in four RIS divisions with a duration of 3-day water delivery schedule for each area, and a 9-day interval before water returns to the first area. However, continuous irrigation is applied when water supply is available for all the divisions. This schedule, except for the whole water delivery period, is not officially informed to the farmers and beneficiaries.

(iii) Aganan RIS

There are 3 rotation areas with duration of 7 or 8 days irrigation in one area and an interval of 15 or 16 days/twice a month water delivery and distribution scheme adopted at this RIS. In effect, after a 7 or 8-day water application in a particular area, irrigation water resumption will be effected

after 15 or 16 days. This schedule is officially informed to the farmers and beneficiaries.

(iv) Sta. Barbara RIS

There are 4 rotation areas equivalent to irrigation divisions with a duration of 3 or 4 days irrigation in one area and an interval of 11 or 12 days/twice a month water delivery and distribution scheme adopted at this RIS. In effect, after a 3 or 4-day water application in a particular area, irrigation water resumption will be effected after 11 or 12 days. This schedule is officially informed to the farmers and beneficiaries.

However, such schedules are not followed due to insufficient water supply, and are not so accurate and effective due to the absence of proper measuring devices in the canals.

(b) Water management

Intake discharge from the river is being recorded through the staff gauges. Normally, an annual calibration of intake discharge must be done to come up with a reliable discharge in the main canal. However, due to the shortage of competent technical staff and calibration equipment, intake discharge are not calibrated regularly. With the rapid siltation in the main canal, erroneous readings are obtained. No record of river discharge is being done at present. Thus, it is very difficult to conduct an effective water management in the system.

IAs are the backbone in the implementation phase of the irrigation program. Water delivery schedule, cropping calendar and pattern of planting are determined jointly by Operation and Maintenance personnel, Institutional Development group and by the representatives of the Board of Directors of IA during the NIA-IA O&M conferences.

The system adopts a sequential start for land soaking during the initial release of irrigation water (usually during the months of April and May) until the system-wide area is totally land soaked.

(3) Operation and maintenance practices

(a) Current O&M method of existing facilities

Dam-site area and gates at the diversion dam are being maintained and operated by the WRF Operators assigned in the area. Additionally, their responsibility area also includes maintaining records of intake discharge, rainfall, water level elevation, and maximum and minimum flood elevations.

Control structures and gates along the main canal and laterals are being maintained and operated by the respective WRF Technicians and WRF Tenders assigned in the area. No such records as discharge and water elevations are being maintained.

Maintenance of main canal and laterals are being done by the existing WRF Tenders and the IA with Type I contracts. The WRF Tenders who are assigned to clean the canals are given 3.5 km as their section areas and likewise in charge of the water distribution in the area. Cutting of grasses along the main canal and laterals is governed by the Memorandum Circular of NIA and is to be done every 45 days. If there are no existing WRF Tenders in the area and no Type I contract, maintenance works are being done by the maintenance crew of the office.

Maintenance of on-farm facilities such as main farm ditch is being done by the farmers or beneficiaries of the concerned facilities in the area. However, the farmers or beneficiaries in some areas do not undertake such maintenance works because of unclear specification as to specific responsibilities among farmers.

The NIA prepared "General Operation and Maintenance Manual" for all RISs and "Specific Operation and Maintenance Manual" for the Jalaur-Suague RIS as guidelines for the operation and maintenance in 1991 under IOSP I. However, this manual is not being utilized by the O&M staff in the concerned system because this is not practical and easily comprehensible and also is not widely known in the systems.

(b) Budget planning and income & expenses

Every year, the IS prepares a budget for the next fiscal year. Budget preparation is normally based on the actual personnel salaries and wages plus other incentives and the plans to hire additional personnel for the next fiscal year as the case maybe. This also includes Maintenance and Other Operating Expenses such as power, mails, supplies, gasoline and fuel, etc. which are the routine needs of the office as well as the personnel. The desilting works and the rehabilitation and improvement works of the existing facilities in the main canal and laterals are not included in such expenses. The budget prepared by the IS is reviewed by the Regional Manager for eventual submission to the Central Office for approval and funding.

ISF collection as the income of RIS office and its efficiency are shown in Table 3.1.4. The collection efficiency of all the systems is lower than the national average (48% in 1995/refer to Table 3.1.5) of all RISs in the Philippines.

(4) Constraints to water management and O&M

Proper and effective water management and O&M in the systems are adversely affected by the following constraints:

(a) Water management

(i) <u>Absence of proper measuring devices for canal and river discharge</u>

No proper measuring devices are properly installed in the canals and rivers, making it very difficult for the RIS offices to prepare the cropping calendar on the basis of the probable water supply.

Water delivery and distribution schedules are not so accurate and effective due to the lack of measuring devices in the canals.

(ii) Insufficient water delivery and distribution schedule for the farmer-beneficiaries

Cropping calendar is not being followed by the farmers due to water delivery problems. In some systems, water delivery and distribution schedules are not officially informed to the farmer-beneficiaries.

(b) O&M

(i) Insufficient O&M works

O&M work is not properly done due to shortage of fund and technical staff, and no regular training program for O&M staff. As a result, it causes deterioration of irrigation and drainage facilities, and improper water management. Under such situation, irrigation water cannot be delivered and distributed properly.

(ii) Insufficient cost for O&M

Present ISF collection is lower than the actually required O&M cost, causing difficulty for the RIS offices to allocate enough funds for the operation and maintenance cost of the water control facilities

(iii) Absence of practical O&M manuals

There are no practical O&M manuals to be comprehended easily and utilized sufficiently by the field personnel in the systems. "General Operation and Maintenance Manual" and "Specific Operation and Maintenance Manual for Jalaur-Suague RIS" prepared by NIA are not utilized in the systems because these manual are not easy to comprehend.

3.1.10 Agricultural Support Services

(1) Agricultural research and extension

The Department Agriculture (DA) is the responsible agency for agricultural extension and research at the national level. Provincial Agricultural Office (PAO) coordinates local level agricultural extension activities, and Municipal Agricultural Office (MAO) is in-charge of undertaking rural level extension activities. The PAO and MAO belong the local government unit (LGU), and finance for activities and personal expenses depend on the budget of the local government concerned. Extension work at the municipality level is coordinated by MAO, and extension workers are technically supported by PAO personnel concerning crop and livestock. The transfer of agricultural extension function from DA to the LGUs in 1992 has encountered problems resulting in low level of extension activities to farmers due to budgetary constraints of most of the LGUs concerned and the lack of technical capabilities of municipal extension workers and agricultural technicians especially in diversified crop farming.

In 1995 DA started in 1995 the Grain Production Enhancement Program (GPEP, Gintong Ani Program) under the Medium-Term Agricultural Development Plan (MTADP). GPEP aims at improving farm productivity by addressing the low utilization of certified seeds, and the inadequate irrigation systems and post-harvest equipment and facilities in the initial phase. DA also implements the Integrated Pest Management (IPM) program which aims to provide a scientific control of insects and diseases in farmers field. However, since village level activities of these programs depend on the agricultural technicians of MAO, the results of programs have not been obtained effectively due to the low financial background.

The Western Visayas Integrated Agricultural Research Center (WESVIARC) is a regional research center under DA, located in Iloilo city. The center performs basic research and experiment for Western Visayas Region with three (3) sections: namely crop and soil system section, fishery system section, and animal system section. The center has established as an annex rice seed processing facilities by Japanese grant aid. This center has technically competent researchers, but its research activities could not be properly conducted due to limited budget support.

(2) Post-harvest facilities

(a) Rice mill

In the study area, the existing rice mills have a rated capacity of about 3,000 cavans (150 tons)/hr. The province of Iloilo has a total rated capacity of 7,300 cavans (365 tons) /hr.

The municipalities covering the study area have an estimated excess capacity of 86,000 tons of paddy. There are municipalities that have deficit capacity. As a whole, however, the total excess capacity in Iloilo province is about 250,000 tons. This excess capacity is more than enough to absorb the additional production of 71,300 tons projected for the study area.

Unit: Metric ton

Current	Production	Milling Capacity	Excess Capacity
Iloilo	614,873	865,505	253,632
Study area	234,134	320,445	86,312
Future With Project			
Study area	71,300	86,312	15,012

* Incremental Production

(b) Warehouse

The existing capacity of warehouses in the Study area is about 55,000 tons. The province of Iloilo has an existing capacity of 154,000 tons. Necessary storage spaces were calculated assuming the turnover rate of a warehouse to be 2 and the results were given in the next table. As shown in the table, registered storage space is not enough to accommodate the production. Shortage in storage

space is appeared to be filled with space in farm houses and bamboo bins because there is no observation of the open space storage of paddy. Additional storage space for the incremental production in the future is estimated at 35,650 ton.

(tons)

Area	Production	Storage Needs	Present Storage	Shortage
Iloilo province	614,873	307,000	154,000	153,000
Study area	71,300	35,650	-	35,650

* Incremental
Source: NFA, Iloilo

Enterprising rice millers in the study area are actually allowing farmers to use their warehouses for storage free of charge provided the farmers mill their palay in their rice mill. In so doing, the rice millers are assured of continuous supply of paddy. The minimum volume of paddy that a farmer can store is 50 cavans(2.5 tons).

(c) Dryers

The solar dryer is the common facility among the farmers. It is convenient and relatively trouble-free. Solar dryers are either concrete paved facility or improvised woven mat. It is also a common practice among farmers drying their palay along highways. While these facilities are convenient, they can hardly be used during rainy . There are also inherent disadvantages such as low recovery of milled rice, significant losses, broken grains, etc.

Mechanical dryers are normally owned by the rice millers. Some cooperatives have acquired this facility through the assistance of the Department of Agriculture (DA). The advantages of mechanical drying can normally compensate for its cost. The average cost of mechanical drying is about P0.40/kg. The available mechanical dryers in the Study area have an estimated capacity of 30,000 tons/yr.

(3) Agricultural credit

(a) Assessment on supply of agricultural credit

The sources of agricultural loans in the study area indicated an almost equal sharing between formal (51%) and non-formal institutions (49%). Among the formal sources were commercial and rural banks, credit cooperatives, and NGOs. Informal sources were input suppliers and traders and money lenders. Commercial bank was listed as a major source of agricultural loans. It is possible, however, that those who responded commercial bank were the big landowners who can provide adequate security and collateral to their loans. Among the non-formal sources, the moneylenders and input dealers and traders are the most preferred sources of the farmers in the study area.

(i) Formal sources

Land Bank of the Philippines

The LBP branch in Iloilo city has assisted a total of 137 farmers' cooperatives in the study area. Over the past 4 years, the total agricultural loans granted by the LBP in Iloilo province stood from P58 million in 1993 to about P21 million in 1996. Of the 137 cooperative borrowers only 30% were considered active. The sudden decrease in the amount of agricultural loans granted between the periods 1993 and 1996 can be attributed to the poor repayment of the farmers' cooperatives.

Rural bank

Rural bank is the second most important source of agricultural credit in the study area. The studied rural bank provides an average interest rate of 5%/annum for savings. Its loans are mostly agricultural and commercial. Commercial loans are mostly availed of by vendors and small businessmen within and adjacent municipalities. The effective interest rate on agricultural and commercial loans is pegged at 25%/annum.

Lending investor

Lending investors are like the rural banks. The only difference is that they do not take deposits. Lending investors are also regulated by the Central Bank. A typical lending investor in the study area charges an average interest rate of 5 %/month or 60 %/annum. This investor can provide practically all kinds of loans subject, however, to the fulfillment of a collateral.

Non-Government Organizations(NGOs)

The NGOs have become active in providing partly agricultural credit in the study area. A prominent NGO based in Iloilo city reported to have a total loan exposure of about P585,000 in the municipality of Pototan in the study area. However, this NGO reported that its main borrowers are the women. About 95% of the total loan exposures are given to the women. Production loans have a ceiling of P4,000/ha and the average interest rate being charged is 30 %/annum. The most important criterion being considered by this NGO in granting loans is that the borrowers should belong to the poorest of the poor.

(ii) Informal sources

Input suppliers and traders

The input suppliers and traders have become a dominant informal source of agricultural credit in the study area. The IA members have rated the input suppliers and traders as their first choice of credit mainly because of convenience and flexibility. They get the inputs on credit and in return a ready market for their produce. Traders and input dealers interviewed in

the study area provide loans at an average interest rate of 30 % to 100 %/annum depending on the credit needs.

Moneylenders

The moneylenders are individuals who are by far the most readily accessible but also the most exploitative among the informal sources. Effective interest rates being charged by them range from 90% to 1000%/annum. The common practice among these lenders is the so-called "five-six." For every P5.00 being borrowed, the borrower has to return P6.00 regardless of maturity.

(b) Assessment on the end-users

Farmers' cooperatives

The farmers' cooperatives have been the retailer of agricultural credit coming largely from the LBP. There are about 176 cooperatives listed as active by the CDA in the Study area. The CDA records indicate about 60% of these cooperatives as credit and 40% as multi-purpose. The data provided by the LBP on active cooperatives in the study area showed that only 20% of the cooperatives registered with the CDA are active with the LBP. This concern resulted in a number of cooperatives that can no longer renew their production loans with the LBP.

Farmer-borrowers

As end-users of credit, the farmer-borrowers have several needs for credit. The foremost, however, is for purchasing the inputs (80% of credit needs). Because of the non-payment of their loans with their cooperatives, they have turned to the input suppliers and traders and money lenders as their source of credit. The arrearages of the farmer-borrowers with their cooperatives have been the main reason for their non-access to the LBP lending window. Unless these farmers settle their outstanding loans with their cooperatives, they will remain to be at the mercy of the informal sources of credit.

(4) Marketing

(a) Paddy

(i) Production

The production of paddy in the study area is roughly 40% of the total production in Iloilo. Over the last 4 years, the annual average production stood at about 234,000 metric tons. Production increased by an average of 7%/annum between the periods 1992 and 1995. The production of paddy in the study area is indeed significant to the total paddy production of Iloilo. The paddy output in Iloilo stood at an average of 615,000 metric tons during the last 6 years.

(ii) Current marketing practices

It is practically the private traders and millers(90%) that control the local trade of palay. They have agents, known as middlemen, stationed along major highways or right at the farms to purchase any available palay. The farmers in the study area have also considered these traders and millers as ready buyers of their palay. For one, the farmers get their credit from them and automatically their palay harvest serves as the payment. Second, the traders are so convenient. They buy the palay right at the farm regardless of the moisture content.

There are two compelling reasons why farmers sell their palay immediately after harvest. First is the very tight cash flow normally experienced by the farmers. With small farmholdings and low yields , the net reserves are simply not enough to satisfy even basic expenditures. Second, the farmers are heavily indebted due to virtual lack of savings. The cycle of borrowing during planting time and paying the loans during harvest time is the common practice.

(iii) Farmgate prices

The monthly farmgate prices of special paddy in current terms have been relatively stable over the past 21 months between January 1996 and September 1997. In Iloilo, the mean farmgate price ranged from a low of P8.11/kg to a high of P9.58/kg. In Region VI the mean farmgate price stood at a low of P8.30/kg to a high of P9.29/kg. For both areas, the average farmgate prices have been over and above the current support price of P8.00/kg.

Farmgate prices in the study area are expected in wet paddy and are lower by 10% to 25% of the farmgate prices posted in Iloilo market. This is largely due to the high moisture content(about 20%) of paddy harvested in the area. In addition, the practice of selling the paddy right after treshing does not allow any room for anticipation of higher prices, especially during lean months.

(iv) Wholesale and retail prices

Data on wholesale and retail prices of rice in Iloilo and Region VI have also been stable during the past 21 months. The mean wholesale price of rice in Iloilo ranged from a low of P15.11/kg to a high of P16.51/kg. The mean retail price, on the other hand, stood at a low of P18.12/kg to a high of P20.28. There was a price differential of P3.00 to P3.80/kg between the retail and wholesale prices. The same set of prices in Region VI fluctuated moderately. Regional prices were slightly higher than the prices in Iloilo by about 1% to 3%.

(b) Mungbean and watermelon

(i) Production

Production of mungbean in Iloilo stood at an average of about 800 tons during the periods 1993 and 1997. The production represents about 34% of the regional production of about 2,200 tons. The production of mungbean in Iloilo grew by about 26% between 1993 and 1997 with the bulk of production occurring during the first semester.

Production of watermelon in Iloilo averaged about 21,000 tons during the periods 1993 and 1997. The production represents roughly 96% of the regional production. Practically the available supply in the region comes from Iloilo.

(ii) Prices

Wholesale prices for mungbean at the Iloilo terminal vary for mongo yellow and mongo green. The former commands higher prices than the latter by about 30% to 50%. The wholesale prices of mongo yellow during the 12-month period in 1996 stood at P37.04/kg. In the 8-month period of 1997, the wholesale price dropped by about 4%. The wholesale price was registered at P35.65/kg.

Wholesale price for mongo green stood at P24.68/kg during the 12-month period of 1996. The 8-month period of 1997, however, showed a slight increase by about 7%.

For both varieties, the wholesale prices are largely influenced by the available production traded in the market.

(iii) Marketing practices

Harvested mungbean in the study area are directly brought to the Iloilo market for sale. The traders practically buy all the volume brought to the market. It is observed that most of the mungbean stocks in Iloilo come from Manila. Such stocks are imported from China. This implies that the local mungbean produce is really insufficient to meet the local demand.

In the case of watermelon, the local traders bring them to the Iloilo terminal market for wholesale and/or retail.

3.1.11 Farmers' Organizations and Other Rural Institutions

(1) Irrigators' Associations

Thirty-six IAs currently operate in the five river irrigation systems (RIS) in the study area, with a total of 7,254 registered members as summarized below. This number of IA members represents about 67% of all the farmer-beneficiaries in the five RIS.

(Unit: Number)

	Jalaur proper	Jalaur exten.	Suague	Sta. Barbara	Aganan	Total
1. IAs	15	6	5	4	6	36
2. IA members	2,545	916	1,061	1,004	1,728	7,254

Source: JICA Study Team

These IAs occupy 19,366 ha of irrigation service area, or 85 % of the total area served by the five RIS, which are distributed by RIS as follows:

(Unit: Hectare)

	Total	Average Area/HH
Jalaur proper RIS	8,125	3.20
Jalaur extension RIS	2,615	2.85
Suague RIS	2,856	2.70
Sta. Barbara RIS	2,633	2.60
Aganan RIS	3,137	1.80
Total/Average	19,366	2.70

Source: Results of survey with IA presidents conducted from 31 January to 26 February 1997.

As shown in the table, average irrigated farm area of IA members in the study area is 2.70 ha, ranging from 1.80 ha in Aganan RIS to 3.20 ha in Jalaur proper RIS.

(a) IAs' organization and management structure

Presently, the policy-making and plan-executing functions are performed by the same IA members who occupy the Board of Directors (BOD) and various positions (IA officers and committees) of the association. This arrangement, however, does not support the development of a management structure that ensures the greater participation of the association members. This is clearly evident in the existing decision-making processes gathered from the socio-economic survey result of the study team as shown below.

Decision-making processes	Jalaur proper		Jalaur exten.		Suague		Sta. Barbara		Aganan		Total	
	Case	%	Case	%	Case	%	Case	%	Case	%	Case	%
General assembly	26	18.3	19	29.2	8	15.7	9	18.0	10	13.0	72	18.7
Organization officers	95	66.9	35	53.9	36	70.6	36	72.0	47	61.0	249	64.7
Other Processes	21	14.8	11	16.9	7	13.7	5	10.0	20	26.0	64	16.6
TOTAL	142	100.0	65	100.0	51	100.0	50	100.0	77	100.0	385	100.0

Source: : JICA Study Team

(b) IA policies and activities on irrigation management and organizational development

Maintenance of irrigation canals

For the period 1991-1997, 32 of the 35 IAs have been engaged in Type I contract, as shown below.

(Unit: Number)

	Jalaur proper	Jalaur exten.	Suague	Sta. Barbara	Aganan	Total
IAs	14	6	5	3	4	32
% of total IAs	93	100	100	75	67	89

Source: JICA Study Team

This contract makes the IAs responsible for grass cutting and clearing in the inside and outside slopes for the entire length of the supply canal contracted every 45 days when the height of vegetation along the canal slopes is more than 15 cm. at a contractual cost of 1,400 pesos/3.5 km. Other non-contracted IAs are reportedly facing serious organizational problems due to inactive IAs or TSAGs.

ISF collection

Policy on ISF collection is largely defined by Type II (collection of ISF collection and system operation) contract of the NIA which obliges the contracted IA to promptly distribute ISF bills to each farmer-member, collect ISF and remit the collection to the NIA every Fridays within the contracted period. In addition, the IA assists in the verification assessment of farm lots requested for exemption from payment of ISF. In its absence, the IA members pay ISF to NIA-hired ISF collectors.

Twelve IAs have been involved in Type II contract implementation from 1991 to 1997 as shown in the next table.

(Unit: Number)

	Jalaur proper	Jalaur exten.	Suague	Sta. Barbara	Aganan	Total
IAs	3	0	1	4	5	13
% of total IAs	20	0	20	100	83	36

Source: JICA Study Team

Under Type II contract, the IAs are given incentives by the NIA based on five levels of collection which are as follows:

Percent ISF collection	Incentive to the IA (%)
Less 50	0
51 - 60	2
61 - 70	5
71 - 90	10
91 - 100	15

The IA incentive is given only when the IA collects more than 50% of current collection, and derived by multiplying current collections (exceeding 50% collection efficiency, CE) by the corresponding percentage share granted to the IA. This present level of incentives seems to be quite low to give the IA enough motivation to strive for higher CE, particularly when no incentive is granted for CE less than 50%.

System operation

IA policies on system operation focus mostly on cropping schedule, and water delivery and distribution which are drafted by and agreed upon with NIA, and normally embodied in Type II contract. The IA is obliged to formulate operations plan with the NIA support one month before the start of the next cropping season, disseminate information on cropping pattern and water delivery schedules to the members, and manage water allocation from main/lateral canals to different turn-out service area effectively and equitably. Many IA members, however, do not observe the established policies for the following reasons identified by the IA presidents:

(i) Inconsistency of actual water delivery with original schedule prompting farmers to compete with each other for early preparation of their paddy fields;
(ii) Diversion of water flow by some farmers caused by the presence of illegal checking, pumping and turn-outs; and
(iii) Absence of auxiliary canal connecting the lateral canal to individual farmers' fields.

Organizational development

Lack of discipline, unity and cooperation among members is identified as the most important organizational problem of IAs according to the result of the socio-economic survey:

	Cases	Distribution (%)
1. Lack of discipline/unity/cooperation	118	29
2. Nonpayment of membership fee	57	14
3. Leadership conflict/weak leader	53	13
4. Absenteeism	42	10
5. Decreasing membership	32	8
6. Nonfunctional IA	25	6
7. Corruption	21	5
8. Limited involvement in decision-making	12	3
9. Others	52	12
Total	412	100

Note: Double or multiple responses occurred in some cases.

(c) NIA organization and institutional development program for the IAs

The Institutional Development Division (IDD) of NIA Region VI Office assumes the overall responsibility for organizing, training and strengthening of the IAs in the study area. Its functions also include the formulation of policies and guidelines for planning and programming the provision of agricultural support services to the IAs, and the development of linkages with other government and non-government agencies for the delivery of such services.

Foreign-funded and priority national government projects implemented by NIA such as Irrigation Operations Support Project II (IOSP II) and Comprehensive Agrarian Reform Program-Irrigation Component (CARP-IC) have provided additional personal services funds for IDD to recruit IDOs and research assistants with casual employment status to augment or support its limited regular staff.

The temporary nature of their service contracts, however, could be a potential constraint to effective institutional development of the IAs because of the varying degrees of commitment normally associated with such job assignment.

Staffing

In the study area, six casual daily-paid staff perform the functions of IDOs, four of whom are assigned in Jalaur-Suague RIS (JSRIS) Office and the other two are in Aganan-Sta. Barbara RIS (ASBRIS) Office. Each IDO is responsible for 5-6 IAs on an estimated average area of 3,630 ha.

With the limited number of IDOs, the Water Masters (WRFTs) also assist to reactivate or reorganize 21 IAs (60 percent of total IAs) and strengthen the others in the study area. At present, there are 7 Water Masters in ABRIS and 10 in JSRIS.

Institutional development program (IDP)

Based on the types of training offered by NIA to IAs from 1991 to 1996 which have been financed from IOSP, Agri-Industrial Development Funds and other project sources, the IDP has focused on leadership development and technical capability building of IAs for improved and cost-effective O & M work, water delivery and distribution, cropping schedule, and ISF collection.

(2) Farmers' cooperatives

According to the information from the Cooperative Development Authority (CDA), there are some 256 duly registered farmers' cooperatives to date with the general status of "multi-purpose agricultural cooperative." Their formations have been largely facilitated by DA and LBP, with a few assisted by DAR and NGOs such as Visayas

Cooperative Development Center, Inc. (VICTO). The distribution of these cooperatives for JSRIS and ASBRIS is summarized below.

(Unit: Number)

Type of business	JSRIS	ASBRIS	Total
1. Consumer	21	48	69
2. Credit/relending	49	5	54
3. Marketing/trading*	7	13	20
4. Consumer, credit and marketing	13	5	18
5. Consumer and marketing	8	7	15
6. Producer	1	0	1
7. Others	55	12	67
TOTAL	166	90	256

Source: Cooperative Development Authority, Iloilo City.
* Usually paddy rice.

About half (or 48%) of the total farmers' cooperatives are presently engaged in consumer (69) and credit (54) types of business. They are followed by those cooperatives involved in marketing/trading of paddy rice in general (20), consumer, credit and marketing (18), and consumer and marketing (15). Producer cooperative is quite insignificant.

In terms of the geographical distribution, 166 farmers' cooperatives (65%) are located in the municipalities in the JSRIS and the other 90 are in the municipalities covered by ASBRIS area.

(3) Comprehensive Agrarian Reform Program

The coverage of the Comprehensive Agrarian Reform Program (CARP) in the 13 municipalities and Iloilo City covered by the study area is summarized below.

(Unit: Hectares)

Municipality	Total	Rice and Corn Lands			Other Agricultural Lands			Leasehold Operations		
	Scope	Scope	AD	%	Scope	AD	%	Scope	LH/A*	%
Anilao	4,796	171	130.4	76	4,625	1,329.0	29	211.8	30.9	15
Barotac Nuevo	4,839	410	201.3	49	4,429	229.7	5	495.0	131.5	27
Dingle	2,696	783	451.8	58	1,913	108.4	6	600.6	87.4	15
Dumangas	4,263	750	372.9	50	3,513	119.7	3	1,536.4	14.9	1
Leganes	554	300	173.2	58	254	1.7	1	419.9	12.2	3
Mina	782	577	428.9	74	205	29.4	14	437.7	17.3	4
New Lucena	378	294	185.8	63	84	35.3	42	482.9	28.6	6
Oton	850	796	400.3	50	88	3.9	4	2,029.2	44.9	2
Pavia	538	493	393.4	80	45	4.7	10	381.7	12.6	3
Pototan	2,244	1,680	940.2	56	564	16.4	3	725.2	7.7	1
San Miguel	290	190	148.8	78	100	30.2	30	823.6	15.0	2
Sta. Barbara	678	266	178.5	67	412	54.8	13	1,295.5	24.0	2
Zarraga	965	540	335.2	62	425	18.0	4	366.7	15.3	4
Iloilo City	1,390	945	24.2	3	445	9.0	2	177.4	10.4	6
TOTAL	25,258	8,161	4,365	54	17,097	1,990.2	12	9,983.6	452.7	5

Source: Iloilo Provincial Agrarian Reform Office, DAR

Notes: Scope represents the net area covered by CARP. Areas with slope 18% or more, and owner-cultivated land are not included. The initials in table columns mean as follows: AD = Area distributed; LH/A= Actual area covered by Leasehold Operations. *Data are accumulated accomplishment as of 31 December 1995.

The slow mode of ownership transfer of lands under rice and corn, including sugarcane, is affecting the farming operations and development projects of the farmers especially the tenants because of tenurial uncertainty over the lands they cultivate.

(4) Non-Government organizations

A network of 26 development NGOs (called Iloilo CODE NGOs) exists in the province, of which 12 NGOS presently provide a range of institutional and community development projects and services to farmers, women and youth in the 13 towns covered by the study.

Credit assistance for income-generating projects or enterprise development is provided by VICTO, one of the oldest NGOs in the Visayas that seeks to contribute towards cooperative development in the region. At present, VICTO is supporting 9 farmers' cooperatives in the study area, seven of which have a combined asset of about 2.3 million pesos in 1995 and 3.2 million pesos by mid-1996.

Other 7 NGOs assist farmers in the study area in cooperative and enterprise development which are potential support groups for the farmers' credit needs and the establishment or strengthening of cooperatives in the Project being prepared.

(5) Summary of constraints to development plans

(a) Irrigators' associations and farmers' cooperatives

Weak financial, managerial and technical capability is the major constraint of both IAs and farmers' cooperatives in the study area.

This constraint has been attributed to the following factors:

(i) Weak leadership, weak financial position and management, and low level of commitment among members;
(ii) Poor planning and management skills, particularly in the integration of O & M work, ISF collection, and the individual farmers' activities;
(iii) Lack of training on basic enterprise/cooperative development especially in management and control in the use of financial resources;
(iv) Inadequate extension services arising from weak coordination among the support agencies and the lack of ability of the farmers' organizations to establish linkage with those agencies;
(v) Lack of credit access to formal institutions;
(vi) Absence of permanent offices, resulting in generally loose operations and difficulty in maintaining documents and records;
(vii) Inadequate marketing system, particularly in post-harvest handling;
(viii) Weak policy on selection of officers to ensure mass-based decision-making; and
(ix) Heterogeneity of membership.

(b) National Irrigation Administration (NIA)

NIA's capacity to support the IA development in the study area is presently constrained by the following factors:

(i) Inadequate IDO staff

The 6 IDOs are faced with 60-70% inactive IAs due to non-functionality of the BOD, TSAGs and/or IA committees. Reactivation of these IAs would involve re-organization and re-election of new officers who may need intensive leadership/management training and guidance that the present manpower could not handle effectively.

(ii) Lack of training on integrated and participatory development

The kinds of trainings and orientations received by the IDOs have been largely focused on developing IAs' capabilities to become effective "partners" of NIA in O&M work, water distribution, and ISF collection. The integration of these tasks with other existing and planned activities of the IAs such as crop diversification and operation of post-harvest facilities has not been successfully developed.

(iii) Poor database management system

The lack of systematic database management in the ASBRIS and JSRIS Offices hampers quick processing, retrieval and production of data in the desired format. The Institutional Development Section in these offices has no computer.

(c) Comprehensive Agrarian Reform Program

The slow progress of CARP implementation poses a major constraint to the development of irrigated agriculture and improvement of farmers' socio-economic conditions .

3.1.12 Watershed Area

(1) Physical conditions

(a) Present land use condition

The present land use and vegetative condition in the watershed areas are classified according to the land cover maps prepared by NAMRIA. The extent of each land cover is summarized below :

(Unit : km^2)

	Watershed							
	Aganan		Tigum		Suague		Jalaur	
Forest								
Open canopy, mature trees <50%	0	0%	4	2%	10	6%	76	7%
Extensive Land Use								
Cultivated area mixed with brush & grass	55	53%	140	73%	127	70%	644	60%
Grassland, glass covering >70%	0	0%	0	0%	0	0%	36	3%
Sub-total	55	53%	140	73%	127	70%	680	63%
Intensive Land Use								
Arable land, crops mainly paddy & sugar	17	16%	40	21%	44	24%	308	29%
Crop land mixed with plantations	32	31%	9	5%	0	0%	0	0%
Sub-total	49	47%	49	26%	44	24%	308	29%
Built-up Area	0	0%	0	0%	0	0%	100	0%
Total	104	100%	193	100%	181	100%	1,065	100%

Remark: Forest: cultivated land is less than 10% of the total area, Extensive land use: cultivated area is 10% to 70% of the total area, Intensive land use: cultivated land is more than 70% of the total area.

Source; Digital Data of Land Cover Maps (Iloilo City:2528, Roxas City:2523, Bogo:2524) NAMRIA.

The watershed areas are extensively or intensively utilized for cultivation, and the forest

cover is limited in a small area. In the Aganan watershed, the proportion of intensive use for cultivation is higher than the other areas.

(b) Slope condition

The slope condition of the watershed areas is as follows :

(Unit : km²)

Slope Class	Aganan	Tigum	Suague	Jalaur
0 - 3%: level to very gently sloping	8.3 8%	27.0 14%	32.6 18%	127.8 12%
3 - 8%: gently sloping to undulating	10.4 10%	29.0 15%	21.7 12%	63.9 6%
8 - 18%: moderately sloping to rolling	3.1 3%	40.5 21%	38.0 21%	298.2 28%
Sub-total	21.8 21%	96.5 50%	92.3 51%	489.9 46%
18 - 30%: rolling to moderately steep	35.4 34%	52.1 27%	30.8 17%	245.0 23%
> 30%: steep hills and mountains	46.8 45%	44.4 23%	57.9 32%	330.1 31%
Sub-total	82.2 79%	96.5 50%	88.7 49%	575.1 54%
Total	104.0 100%	193.0 100%	181.0 100%	1,065.0 100%

Source: Department of Environmental and Natural Resources (DENR), Region VI.

The steep slopes over 18% extends on more than half of the watershed. Taking into account the present land use condition mentioned in the above section, the steep slopes are extensively or intensively cultivated. In Aganan watershed, the proportion of the level to moderately sloping lands (0 to 18% slopes) is only 21%, and the intensively cultivated land is 47%. This indicates that more than half of the area utilized intensively are located in steep slopes over 19%.

(c) Soil erosion

According to the field reconnaissance and interviews with farmers, it is speculated that the upland fields located on sloping land are the most susceptible to soil erosion because of the non-application of soil conservation measures. Especially, Aganan and Suague watershed areas are assumed to be susceptible to severe soil erosion. Apart from soil erosion in sloping area, river bank erosion was observed throughout the field reconnaissance survey especially in the Suague watershed area. The river bank has also suffered serious erosion at flood.

(2) Socio-economic conditions

(a) Population intensity of the watershed areas

The population of the whole of province has been increasing at an annual rate of about 2% for the last three (3) decades. The population growth rates of the watershed areas for the last three decades ranged from 0. 2 to 2.4 %/annum. The data on population and number of households in 1995 in the watershed areas are shown below.

Watershed	Municipality	Population (1995)		Annual	Household (1995)	
		Number (1000person)	Density (P./km²)	Increase rate at '60 -'95	Number (1000H.H.)	Density (H.H./km²)
Aganan	Alimodian	29	201	1.4	5.4	37.1
Tigum	Maasin	29	187	0.9	5.0	31.8
Suague	Janiuay	50	280	0.2	9.4	52.3
Jalaur <1	4 municipalities	189	240	1.9	35.0	42.8

Source : Census on Population 1995, PPDO-Iloilo
Remark : <1 Data of Jalaur is represented by 4 municipalities of Lambuano, Calinog, San Enrique and Passi.

(b) Present problems and development needs

Present dominant problems of sampled households were roughly grasped through the interview survey. The dominant problems are summarized as follows:

Order	Aganan	Suague	Jalaur
1	- No electricity	- Poor road condition	- Shortage of food
2	- Poor road condition	- No electricity	- No irrigation water
3	- No school facility	- No school facility	- Poor drinking water
4	- No market facility	- Shortage of fertilizer	- Poor road condition
5	- No health facility	- No irrigation water	- No health facility

Remarks : The sampling number of each watershed is 3 H. H. in Aganan, 2 H. H. in Suague, and 1 H. H. in Jalaur, respectively.

The settlers are mainly concerned about the improvement of rural infrastructure such as electricity, road, school, etc. The ranking of forest rehabilitation was low in the list. It indicates that the settlers have no complaints on the present forest condition and less intention to improve the forest.

(3) Existing government activities

(a) Demarcation of governmental forest management area

For the rehabilitation and proper management of forest area, DENR has designated several reserve areas and forest management programs in public forest land. The areas are summarized as follows :

Watershed	Municipality	Forest Management *1		Designated as Reserve Area *2		Non-classified Area		Total Timber Land	
		(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Aganan	Alimodian	180	7	0	0	2,356	93	2,536	100
Tigum	Maasin	215	3	5,800	83	965	14	6,980	100
Suague	Janiuay	646	12	0	0	4,803	88	5,449	100
Jalaur *3	3 municipalities	5,084	20	12,578	49	8,152	32	25,814	100

Source : Provincial Environment & Natural Resource Office (PENRO), Iloilo

Remarks : *1 Forest Management program includes 1) Regular reforestation, 2) Contract reforestation, 3) ISFP, 4) ITP

*2 Reserve area includes 1) National park, 2) Watershed area, 3) Civil reserve, 4) Military reserved forest, 5) Communal forest

*3 Data of Jalaur is represented by 3 municipalities of Lambuano, Calinog and San Enrique.

(b) Watershed rehabilitation sub-project

In the watershed areas, parts of Tigum and Jalaur watershed areas are designated as Watershed Reservations with 5,800 ha in Tigum (Maasin municipality) and 9,230 ha in Jalaur (Calinog municipality), respectively. In addition, DENR is presently proposing to implement the rehabilitation sub-projects in both watershed areas. The outlines of the sub-projects are summarized as follows :

Watershed	Name of project	Total area	Components
Tigum (Maasin Mun.)	Maasin Watershed Sub-project	2,685 ha	- Reforestation : 1,065 ha - Agro-forestry : 1,164 ha - River bank stabilization : 60 ha - Rattan plantation : 111 ha - Bamboo plantation : 300 ha
Jalaur (Calinog Mun.)	Jalaur Watershed Rehabilitation Sub-Project	2,500 ha	- Establishment of nursery - Check dam construction - Reforestation/erosion control - Protection of forest - Institutionalization in ISFP areas

In addition to the above sub-projects, several reforestation activities are conducted in the Maasin Watershed Sub-project area by LGUs, NGOs, private companies.

(4) Evaluation of watershed condition

Based on the present land use condition, slope and elevation condition, land category and the present government activities, the degree of the degradation of the watershed area was evaluated, and the result of evaluation is summarized as follows :

Watershed	Land use	Slope	Land Category	Erosion	Gov. Activity	Overall
Aganan	3	3	3	3	3	3
Tigum	2	2	2	2	1	2
Suague	3	2	2	2-3	2 - 3	2-3
Jalaur	2	2	2	2	1 - 2	2

Note: Figures show the degree of condition of each aspect, i.e. 1=better, 2=moderate, 3=poor.

(5) Development constraints

The present constraints for watershed management are explained below.

(a) Physical aspects

(i) Increase of population pressure and limited available land - Aganan, Suague

(ii) Low accessibility of the watershed area-all watershed

(b) Social aspects

(i) Lack of settlers' intention for land conservation - Aganan, Suague, Jalaur

(ii) Shortage of income generating opportunities - all watershed

(c) Institutional aspects

(i) Insufficient amount of fund and number of appropriate staff - all watershed

(ii) Inefficient coordination among the different agencies - all watershed

3.1.13 Environmental Condition in the Study Area

(1) Present environmental condition

(a) Reserved area and environmental sensitive area in and around the study area

The following reserved areas issued by the DENR are found around the study area.

Reserved area	Name	Location	Area (ha)
National Park	Bulabog-Puti-An National Park	Dingle, Pototan, Duenas, San Enrique	845
Watershed Reserved Area	Maasin Watershed Area	Maasin	5,800
	Jalaur Watershed Area	Calinog	9,228
Reserved Forest	Military Reserved Forest	Calinog	20
	Primary Forest	Lambuano	758
Coastal Area	Mangrove Forest	Dumangas	3,964

Source: Department of Environment & Natural Resources, Region VI

Apart from these, many fish ponds were observed in the downstream area of each RIS. The total area and number of fish ponds which exist downstream are shown below.

Irri. Scheme	No.	Area (ha)	Remarks
Aganan	2	3	undeveloped
Sta. Barbara	-	-	-
Suague	-	-	-
Jalaur Proper	12	76	Milk fish/Prawn
Jalaur Extension	160	1,304	Milk fish/Prawn

Source: Department of Agriculture (DA), Region VI

(b) Water quality of irrigation and drainage water

To evaluate the suitability for irrigation use and to assess drainage water quality, a water quality test which consists of 28 items was carried out in Phase-I study. A total 30 of samples were taken at dam sites and upstreams of each river, and the drainage. The following table shows the results of main parameters concerned with water use among 28 items.

River Name	pH	TDS mg/l	DO mg/l	BOD mg/l	EC S/cm	TSS mg/l	Nitrogen mg/l	Or.- P mg/l	Cl mg/l	Boron mg/l	SAR
Irrigation water at Dam Site											
Aganan	8.0	180	2.6	2.0	0.8	173	0.0	NIL	20	<0.01	2.8
Sta. Barbara	7.5	210	2.7	1.3	0.5	520	0.2	2.7	14	<0.01	1.3
Suague	7.8	180	2.8	22.0	0.4	581	0.1	NIL	9	<0.01	1.1
Jalaur	7.0	190	1.5	128.0	0.3	39	0.0	NIL	12	<0.01	0.4
Irrigation water on Upstream											
Aganan	7.6	180	2.0	1.6	0.7	35	0.1	NIL	16	<0.01	1.9
Sta. Barbara	6.9	190	3.8	3.0	0.4	822	0.0	1.9	13	<0.01	1.0
Suague	7.7	170	3.0	17.5	0.3	3,084	0.3	2.9	11	<0.01	1.0
Jalaur	7.7	87	5.2	22.2	0.2	980	0.3	0.8	8	<0.01	0.4
Drainage water											
Aganan	7.5	180	1.1	4.8	0.7	86	0.6	2.2	22	<0.01	1.3
Sta. Barbara	7.2	410	3.7	5.3	0.9	41	0.3	NIL	10	<0.01	2.7
Suague	7.4	230	3.5	3.5	0.6	44	0.3	NIL	35	<0.01	1.0
Jalaur prop.	7.6	123	2.5	3.1	0.3	304	0.1	NIL	10	<0.01	0.8
Jalaur ext.	7.5	107	2.1	6.1	0.3	138	0.1	0.5	76	<0.01	0.6

Source: JICA Study Team (1997)

The following table shows the evaluation results based on the water quality criteria of the Philippines (Water Quality Criteria, DENR Order No. 34), FAO (I&D Paper 29) and Japan (Water quality criteria for irrigation, MAFF, 1970; Criteria for conservation of river surface water, Department of Environment, 1971).

Type		Comment
Irrigation water	1	The high BOD values at the intake dam sites of Suague and Jalaur RISs are caused by the waste water from the sugar mill factories in the upstream reaches, particularly in the late dry season. Those high BOD values result in low DO values by consumption of oxygen in water. No adverse effect is currently reported on rice cultivation caused by high BOD and low DO in irrigation water, and improvement of water quality is observed in the drainage from the RISs. It is also expected that no irrigation water will be applied in the most serious season of March to April due to canal maintenance. Therefore, the effect by high BOD and low DO at the intake dam sites are not serious in the future.
	2	The TSS (Total Suspended Solid) values are significantly high, although the values vary from 39 to 581 ppm at the dam sites. It indicates the high sedimentation loads at three (3) dam sites of Aganan, Sta. Barbara and Suague.
	3	Organic-phosphate was occasionally detected from the water sources. It should be analyzed to clarify the type of organic-phosphate. If its source is from agrochemical such as parathion, ENP, etc. and its contamination is stably continued, the water source may not be suitable for irrigation use.
Drainage Water	1	The quality is evaluated on the basis of the criteria of fishery water. Although DO in samples of all drainage is insufficient in comparison with the criteria, it will not occur a severe limitation for fish culture since the ponds are brackish type and the drainage water is therefore mixed with sea water by a tidal effect.
	2	Organic-phosphate was also detected from the drainage water. As mentioned above, it should be identified the type of organic-phosphate and its stability.

(2) Present environmental issues

Several environmental issues in and around the study area were found in the Phase - I survey. These issues are explained below.

(a) Siltation in scouring sluice and canals (in all schemes)

This is a major problem commonly observed not only in the study area but also in other national irrigation systems. Because of siltation, the scouring sluice and canals have substantially reduced their storage and flow capacities, and consequently resulted in unequal water distribution in the service area. Since the main cause of siltation in the service area is mass waste in the upstream area (watershed areas) due to land degradation, the watershed management such as reforestation and soil conservation is essential for avoiding it.

(b) Watershed degradation (in all schemes)

In addition to the logging activities, shifting cultivation and upland farming without conservation measures compounded by population increase had accelerated the degradation of land. It is considered that the watershed degradation has resulted in severe flood and lowering the base flow of river.

(c) Inequity of water distribution (in all schemes)

Inequitable water distribution is observed between water users in the upstream and downstream of canal systems, due to 1) deterioration of irrigation facilities, 2) overuse of water in the area upstream of canal systems, 3) out-of-schedule cropping in the upstream area, and 4) water use without obtaining water right for the irrigation areas in upper river basins. This causes social conflict among farmers.

(d) Seasonal inundation of service area (in Jalaur proper and Suague RIS areas)

Water logging and/or flooding in the service area during the typhoon season is an issue, though it is not a major one. It impairs farming operation and often results in lower crop yields. The flooding of the Jalaur proper RIS occurs along the middle reach of the Jalaur river near Barotac Nuevo municipality, and it is affecting the tail portion of the RIS.

(e) Deterioration of water quality (in Jalaur proper and extension RIS)

According to the results of water quality analysis conducted in Phase-I survey and the monitoring data of water quality conducted by DENR in 1996, the figures of BOD indicate quite a high level at the samples of Jalaur and Suague dam sites. It is considered that the effluent from the sugarcane factories on the upstream influences the water quality. The environmental complaints, however, are not found in the field survey. It is required to promote the oxidation through proper drainage management at the cropping season, since it may affect the root growth of paddy by deoxidization.

(f) Urbanization in the RIS area (in Aganan and Sta. Barbara RIS)

As described before, the service areas of Aganan and Sta. Barbara RISs have decreased due to expansion of Iloilo city. Considering the large amount of money to be spent to make the service area more productive by irrigation development, it is also assumed to be a serious issue. So far, about 500 ha of the area in Aganan and 400 ha in Sta. Barbara have been converted into residential or commercial areas. In order to reduce the progress of the urbanization, a certain incentives such as i) promoting modern and suburban type farming, ii) strengthening of agricultural supporting system, iii) strengthening of marketing system, etc. shall be considered and incorporated into the development plan.